ENVIRONMENTAL ASSESSMENT and (FONSI) OF THE PROPOSED 7-GeV ADVANCED PHOTON SOURCE

Table of Contents

LIST OF FIGURES

LIST OF TABLES

ENVIRONMENTAL ASSESSMENT and (FONSI) OF THE PROPOSED 7-GeV ADVANCED PHOTON SOURCE

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LIST OF ABBREVIATIONS AND ACRONYMS

ACHP	Advisory Council on Historic Preservation
ANL	Argonne National Laboratory
APS	(7-GeV) Advanced Photon Source
BNL	Brookhaven National Laboratory
BOD	biological oxygen demand
BP	before present (in archaeology)
CE	Commonwealth Edison (Company)
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act (Superfund)
COE	(U.S. Army) Corps of Engineers
DOE	(U.S.) Department of Energy
DOE/BES	(U.S.) Department of Energy, Office of Basic Energy Sciences
DOE-CH	DOE, Chicago Operations Office
DOT	(U.S.) Department of Transportation
EA	environmental assessment
EIS	environmental impact statement

EPA	(U.S.) Environmental Protection Agency
ESAAB	Energy Systems Acquisition Advisory Board
ESHD	Environment Safety and Health Department (at ANL)
FWS	(U.S.) Fish and Wildlife Service
GeV	gigaelectron volt (10E9 electron volts)
ID	insertion device: wiggler or undulator in a storage ring
IDC	Illinois Department of Conservation
IEPA	Illinois Environmental Protection Agency
IHPA	Illinois Historic Preservation Agency
KeV	kiloelectron volt (10E3 electron volts)
mA	milliampere (10E-3 A)
Mgd	Million gallons per day
MIT	Massachusetts Institute of Technology
NEPA	National Environmental Policy Act
NESHAP	National Emission Standards for Hazardous Air Pollutants

NIPDWS	National Interim Primary Drinking Water Standards
NOAA	National Oceanic and Atmospheric Administration
NOx	nitrogen oxides
NPDES	National Pollutant Discharge Elimination System
NRHP	National Register of Historic Places
NSLS	National Synchrotron Light Source (at BNL)
ORNL	Oak Ridge National Laboratory
R&D	research and development
RCRA	Resource Conservation and Recovery Act
SHPO	State Historic Preservation Officer
SMSA	Standard Metropolitan Statistical Area (Chicago, Ill.)
TDS	total dissolved solids
TLD	thermoluminescent dosimeter
TSP	total suspended particulates
TSS	total suspended solids
USDA	(U.S.) Department of Agriculture
ZGS	Zero Gradient Synchrotron

ABSTRACT

The potential environmental impacts of construction and operation of a 6- to 7-GeV synchrotron radiation source known as the 7-GeV Advanced Photon Source at Argonne National Laboratory were evaluated. Key elements considered include on- and off-site radiological effects; socioeconomic effects; and impacts to aquatic and terrestrial flora and fauna, wetlands, water and air quality, cultural resources, and threatened or endangered species. Also incorporated are the effects of decisions made as a result of the preliminary design (Title I) being prepared.

Mitigation plans to further reduce impacts are being developed. These plans include coordination with the U.S. Army Corps of Engineers (COE) and other responsible agencies to mitigate potential impacts to wetlands. This mitigation includes providing habitat of comparable ecological value to assure no net loss of wetlands. These mitigation actions would be permitted and monitored by COE. A data recovery plan to protect cultural resources has been developed and approved, pursuant to a Programmatic Agreement among the U.S. Department of Energy, the Advisory Council on Historic Preservation, and the Illinois State Historic Preservation Office. Applications for National Emission Standard for Hazardous Air Pollutants (NESHAP) and air emissions permits have been submitted to the U.S. Environmental Protection Agency (EPA) and the Illinois Environmental Protection Agency (IEPA), respectively.

CHAPTER 1 INTRODUCTION

This environmental assessment (EA) evaluates the potential consequences to the environment of the construction and operation of the proposed 7-GeV synchrotron radiation source known as the 7-GeV Advanced Photon Source (APS) at Argonne National Laboratory (ANL) in Argonne, Illinois. Decommissioning of this facility is also assessed, in general, in order to evaluate the potential magnitude of environmental concerns due to such an action.

1.1 PURPOSE

The purpose of the APS project is to construct and operate a major national user facility, providing high-brilliance X rays for users from industry, universities, and national laboratories. The APS project would use recently developed technology to produce beams of high-energy X rays 10,000 times brighter than is currently possible. The bright radiation beams are produced by accelerating positrons (particles like electrons, but positively charged) in a circular path at speeds near that of light. When the beam is bent by magnets, it emits energy in the form of X rays. Insertion devices (IDs) called undulators and wigglers would vibrate the positrons many times, resulting in brilliant beams of X rays (covering the range from 1 to 200 keV). As many as 70 X-ray beams would be available for research, of which 35 would be from insertion devices providing unprecedented capabilities for research in the nation. Operation of the APS would provide a needed national user facility for cutting-edge research in many fields of science and technology,

including physics, chemistry, biology, materials sciences, medicine, biotechnology, and the geosciences.

1.2 THE APS PROJECT AT ANL

Early in the planning process, the Energy Systems Acquisition Advisory Board (ESAAB) considered a number of DOE national laboratory sites and universities (ANL, Brookhaven National Laboratory (BNL), Stanford University, Stanford Linear Accelerator Center, etc.). On January 22, 1986, the Under Secretary of the U.S. Department of Energy (DOE) determined that planning for four proposed Energy Research projects should proceed at specific DOE laboratories. This senior management site decision was based on the need to maintain the technical viability of the various laboratories. As part of this decision, ANL was identified as DOE's preferred location for the proposed APS.

The ANL site has adequate vacant land to accommodate the 70 acre land requirement for the APS facility and further expansion. In addition, ANL has an extensive history in energy research and has an existing professional and scientific staff of approximately 1500 people with existing offices and laboratory buildings. Furthermore, ANL is located 25 miles southwest of Chicago (Fig. 1.2.1) and is near major transportation facilities (e.g., O'Hare International Airport), availability of electrical power, and major universities with materials research laboratories (e.g., University of Chicago and Northwestern).

A Biomedical X-Ray Complex which consists of three beam lines is a possible addition to the APS facility for future construction (1987b). Two beam lines would be used for basic research in determining the crystal structure of proteins, and one beamline would be used for basic research in medical imaging of soft tissue such as coronary structures. Further National

Figure (Page 3 Fig 1.2.1 Map of Chicago)

Environmental Policy Act (NEPA) documentation will be required if the Biomedical X-Ray Complex is proposed for construction in the future.

1.3 SUMMARY OF THE PROPOSED ACTION

The proposed action is the construction and subsequent operation of the APS. This project would occupy 28 ha (70 acres) of fields and forest in the southwest portion of the 516ha (1275-acre) ANL property (Fig. 1.3.1). The APS is a storage ring, where a 100-mA beam of positrons (i.e., positively charged electrons) circulates continuously at an energy of about 7 GeV (ANL 1987a). Figure 1.3.2 shows the storage ring, and the ANL area that surrounds APS. The biomedical beam line has been proposed as an optional addition to the APS facility (ANL 1987b).

1.4 NEED FOR ACTION

During the past two decades, synchrotron radiation from high-velocity electrons or positrons traveling in roughly circular paths has become the most important source of high-intensity photon beams useful for research. Such photon sources have emerged as powerful and versatile tools for examining the geometric and electronic structure of matter. The intensity, tunability, collimation, and high degree of polarization characteristic of such photon sources vastly exceed those of conventional sources. In the United States, there are seven synchrotron radiation facilities of different designs and characteristics now in operation, including recent additions at the National Synchrotron Light Source (NSLS) at BNL. Outside the United States, there are now 30 synchrotron sources operating or under construction.

Initially, high-energy physics accelerators provided synchrotron radiation from the bending magnets that function to keep the electron beam in

Figure (Page 5 Fig. 1.3.1 Vicinity map ...)

Figure (Page 6 Fig. 1.3.2 The APS project and surrounding areas.)

a circular path within the accelerator. As research with such sources progressed, it was recognized that the brilliance (i.e., the number of photons per specified wavelength bandwidth per second per unit solid angle per unit area of source) of the emerging radiation could be greatly increased by the use of specially designed magnets inserted into the straight sections of an accelerator or storage ring. Such devices, or IDs, composed of periodic arrays of magnets placed above and below the path of the electron beam, are now successfully used as high-intensity photon sources at several accelerators around the world.

Recognizing the scientific and technological implications of the extremely brilliant beams that could be obtained from IDs, the U.S. synchrotron radiation community began to consider construction of storage rings optimized for IDs. Interest increased, as demand began to exceed the availability of existing sources, prompting DOE to conclude that a detailed examination of U.S. synchrotron radiation research requirements was needed.

In October 1983, a committee was convened by the DOE Office of Basic Energy Sciences (DOE/BES) to evaluate future opportunities and technical needs for synchrotron-radiation based research. This 17-member committee concluded that the highest-priority major new facility should be a high-energy storage ring optimized for IDs capable of providing X rays of energy up to 20 keV and targeted for operation by the early 1990s. Such a storage ring requires a minimum electron or positron beam energy of about 6 GeV and a capability of accommodating a large number of IDs (Eisenberger and Knotek 1984).

Shortly after the Eisenberger-Knotek Committee report was issued, the National Academy of Sciences organized a comprehensive study of major facilities needed for materials science research. This committee, chaired by

Fredrick Seitz and Dean Eastman, concluded that the highest-priority major new facility should be a 6-GeV ID-based synchrotron source. Subsequently, DOE asked the Energy Research Advisory Board to evaluate the conclusions of the Seitz-Eastman report in terms of DOE programs and responsibilities. The board strongly endorsed the priorities established by the Seitz-Eastman report (Seitz-Eastman 1984) as being consistent with the needs of DOE and in the best interests of the nation (DOE 1985).

CHAPTER 2 THE PROPOSED ACTION AND ALTERNATIVES

2.1 DESCRIPTION OF APS AND CONSTRUCTION ACTIVITIES (PROPOSED ACTION)

2.1.1 APS Facility Description

The proposed action is the construction and operation of an Advanced Photon Source national user facility that provides high-brilliance X rays for users from industry, universities, and national laboratories.

APS would consist of a large storage ring containing as many as 34 IDs (wigglers and undulators) to give intense, hard X rays. The storage ring has a circumference of approximately 1104 m (0.7 miles) and is capable of accommodating 34 IDs and their associated photon beam lines. In addition, 35 photon beams can be provided from bending magnets (ANL 1987a). The experimental area, which houses the beam lines, is large enough to accommodate beam lengths up to 80 m (264 ft) within the Experiment Hall. Building design allows extension of the beam lines through the external wall of the Experiment Hall.

The principal building of the facility is an annular structure having an outer circumference of 1244 m (4083 ft) and a width of 27 m (88 ft). This building and its associated support and service buildings are all conventional metal structures. Figure 2.1.1 shows the APS site plan with the storage ring, the linear accelerator (linac), and the synchrotron. The linear accelerator injects the positrons into the synchrotron, which accelerates them to 7 GeV for injection into the storage ring. A current of approximately 100 mA of 6- to 7-GeV positrons circulates in the storage ring (ANL 1987a). Figure 2.1.1 also shows the central lab/office building, lab/office modules,

Figure (Page 10 Fig. 2.1.1 Advanced Photon Source Project site plan.)

Experiment Hall where X-ray beams would be used for research and development (R&D) experiments, site access roads, and miscellaneous site amenities. The APS facilities are designed to accommodate 600 permanent and temporary personnel.

Project Center (Central Laboratory/Office Building): a conventionally designed multistory building that would house 300 permanent staff scientists and support personnel. It would contain laboratories (for light use with nontoxic substances), offices, library, meeting facilities, control room for remote control of APS, technical area for assembly of experimental equipment, stock room, machine shop, truck airlock, clean rooms, and a mechanical room for air conditioning and service utility equipment.

Experiment Hall/Storage Ring Building: an annular steel-framed, metal-clad building. The interior area is dedicated to experimental beam lines. A concrete storage ring enclosure is located within the building near the inner wall. The X-ray beams are extracted from the storage ring into the experimental beam lines.

Synchrotron Buildings: four contiguous conventional metal buildings housing the synchrotron injection/extraction facilities and the synchrotron ring enclosure. The linear accelerator and the synchrotron ring are concrete tunnel structures covered with earth for radiation shielding.

Service Buildings: metal-framed buildings located within the infield of the Experiment Hall/Storage Ring Building that house storage-ring magnet power supplies, radio-frequency equipment, and electrical substations.

Laboratory/Office Modules: four metal-framed structures located around the outer wall of the Experiment Hall/Storage Ring Building. They contain offices, laboratories, a conference area, and service support space. A parking area for each module is also provided.

Utility Building: a single-story, metal-framed structure that contains the mechanical and electrical equipment support for APS. The cooling tower yard is located immediately adjacent to the building.

Site Improvement: several roads to provide access to all APS areas from the existing ANL road system. The site would be graded and landscaped with provisions for storm-water runoff (Pentecost 1987).

2.1.2 Utility Services

All service utilities exist at intercept points near the proposed APS complex. Table 2.1.1 lists the expected demands on utilities resulting from operation of APS relative to excess capacities (Kolzow 1988).

The operation of an APS requires a large amount of power (23 MVA average, with a peak demand of 34 MVA). Electrical service to ANL is provided by two independent 138-kV distribution circuits from Commonwealth Edison Company. Two 13-kV feeder circuits that originally serviced the ANL Zero Gradient Synchrotron (ZGS) accelerator facility (shut down in 1979) would provide power to APS from an existing substation. No new off-site power lines would be needed.

New mechanical-draft recirculating-type cooling towers would be constructed and located immediately east of the APS project site (Pentecost 1986). The towers are expected to supply between 2000 tons (winter) and 5000 tons (summer) of refrigeration. Cooling water demands are based on a usage of 3 gal/(min.ton) of refrigeration; therefore, APS peak usage is estimated at 56,800 L/min (15,000 gal/min). One percent would be lost to evaporation [568-L/min (150-gal/min) peak]. The blowdown rate is seasonally dependent, with 380-680 L/min (100-180 gal/min) or 2000 tons of refrigeration required during the winter months and 1140-1890 L/min (300-500 gal/min) or

Table 2.1.1 Site utility services and estimated APS usage (Pentecost 1987).

Utility	Units	Current lab-wide use	Estimated APS use	Projected lab-wide use	Projected APS use (relative to excess ANL capacity)a
Steam:					
Installed capacity	10E3 lb/h	360	50		
Peak demand	10E3 lb/h	224	40	264	29%
Average usage	10E3 lb/h	99	9	108	3%
Annual usage	10E6 lb	870	80	950	

Electricity:					
Installed capacity	MVA	136	47		
Peak demand	MVA	23	34	57	30%
Average usage	MVA	15	23	38	19%
Annual usage	MWH	132,000	198,000	330,000	
Domestic Water:b					
Installed capacity	Mg d	1.2	0.03		
Peak demand	Mg d	1.6c	0.03	1.63	3%
Average usage	Mg d	0.4	0.03	0.43	4%
Annual usage	Mg	152.4	10.95	163.35	
Canal Water:					
Installed capacity	Mg d	4.0	0.7		
Peak demand	Mg d	0.5	0.5	1.0	14%
Average usage	Mg d	0.3	0.4	0.7	11%
Annual usage	Mg	97.4	146	243.4	
Lab Water:b					
Installed capacity	Mg d	0.8	0.05		
Peak demand	Mg d	1.0d	0.05	1.05	25%
Average usage	Mg d	0.3	0.05	0.35	10%
Annual usage	Mg	92.8	18.25	111.05	
Lab Sewer:					
Installed capacity	Mg d	0.77	0.05		
Peak demand	Mg d	0.63	0.05	0.68	36%
Average usage	Mg d	0.4	0.05	0.45	14%
Annual usage	Mg	140	18.25	158.25	
Sanitary Sewer:					
Installed capacity	Mg d	1.26	0.03		
Peak demand	Mg d	0.70	0.03	0.73	5%
Average usage	Mg d	0.4	0.03	0.43	3%
Annual usage	Mg	130	10.95	140.95	

a Excess capacity Installed capacity - current lab-wide use.

b Domestic and lab water installed capacity and peak demand based upon treatment capacity. The FY 86 Schedule 44 addresses pumping capacity.

c Peak demand met by treated domestic water storage capacity of 1,275,000 gallons.

d Peak demand met by treated lab water storage capacity of 400,000 gallons.

5000 tons of refrigeration required during the summer months. The ANL cooling water is obtained from the Chicago Sanitary and Ship Canal (Fig. 1.2.1) and is treated by adding alum and a polymer to remove turbidity from the canal water. The treated water is chlorinated, and additional corrosion inhibitor (phosphate-based) and biocide (e.g., chlorine) may be added to the cooling towers. No withdrawal permit is required for water pumped from the canal.

The APS cooling water treatment process would generate 95-115 m3 (125-150 cubic yards) of sludge per year. The sludge would be disposed of in the ANL landfill an average of once every eight months. This increase (from the current 76 m3 (100 cubic yards) per year] represents a 0.5% increase in the ANL landfill permitted limit of 22,900 m3 (30,000 cubic yards) per year. All cooling water would be disposed of through the ANL sanitary sewer system.

Table 2.1.1 lists predicted APS utility demands compared with total ANL demands and excess capacities. The table shows that estimated average APS uses of electrical power and canal cooling water would result in laboratory-wide increases of 19 and 11%, respectively, of the excess capacities for these utilities-121 MVA and 14,000 m3/d (3.7 million gallons per day (Mgd)]. Table 2.1.1 shows that predicted demand increases for steam, sewer, and domestic and laboratory water attributable to APS range only from 3 to 36% of excess capacity.

2.1.3 Gaseous Emissions, Liquid Effluents, and Wastes

The operation of APS would generate some emissions, effluents, and wastes, such as normal plant/vehicular heat radiation, cooling-tower plumes, and storm-water runoff. APS construction plans include the use of holding ponds for storm-water runoff based on final contour configurations

(Pentecost 1987, ANL 1987a). There also would be potential contaminants from experimental sources which may include trace amounts of organic solvents, toxic proteins (48- to 72-h shelf life), microbiological products (treatable with micro-biocides), heavy metal compounds, and small amounts of carcinogenic waste. No radioactive waste is expected to be produced as a result of normal facility operations. The contaminant groups would be carefully controlled, and the wastes would be collected in special containers for disposal in accordance with waste management procedures developed to ensure compliance with DOE and ANL Resource Conservation and Recovery Act (RCRA) permits (Cheever 1986).

During operation of the APS, there would be normal positron beam losses within the aluminum vacuum chamber walls, producing energetic photons and some energetic secondary neutrons. These neutrons are capable of activating the air and some accelerator components (e.g., magnets) inside the accelerator shielding enclosure. Typical products in the air are carbon-11 (half-life = 20 min), nitrogen-13 (half-life = 10 min), and oxygen-15 (half-life = 122 s). These would be exhausted from the accelerator shielding enclosure at a rate of 1,835,000 L/min (64,000 cfm) under normal operations (an annual operating duration of 8,000 hours and 10% of this time for the Injector System). This would result in a production rate of activated air species of about 350 nCi/(m3d) (Cho 1989a). Similar activation products can also be produced in the water circulated in a closed system to cool the accelerator components. However, the production rate in water would be at least an order of magnitude lower than in air (Swanson 1979).

Small amounts of induced activity would also occur in the accelerator components distributed around the 1104 m (0.7 mile) circumference of the accelerator. Lead, concrete, and aluminum are least susceptible to

activation, while copper and iron are slightly more susceptible (Swanson 1979). Calculations indicate that most of this induced activity would be generated in the iron of the magnets. A saturation activity of about 13 pCi/cm3 would result (Huebner 1988b). These induced activities (i.e., Mn-56, Mn-52, Cr-51, V-48, Fe-59, etc.) have short half-lives that range from a few hours to less than one year and are fixed in the accelerator components.

The only other effluent would be blowdown water (expected to be 380-680 L/min (100-180 gal/min) in winter and 1140-1840 L/min (300-500 gal/min) in summer] discharged from the cooling system into the sanitary sewer system and discharged after treatment, through ANL's National Pollutant Discharge Elimination System (NPDES) Outfall 001. This water effluent would not contain any process liquids. It would contain phosphate-based corrosion inhibitors and biocide (e.g., chlorine) similar to those currently in use at other ANL cooling systems. The temperature of the cooling water discharged to the sanitary sewer system would range from 16 oC (60 oF) (winter) to 35 oC (95 oF) (summer).

2.1.4 Construction Activities

Construction of APS at the ANL site would require a number of different actions (ANL 1987a): (1) preparation of the site (i.e., grading, excavation, and provision of drainage, construction roads, walkways and parking areas); (2) extension of existing utilities (i.e, electrical power, water, sewage, gas, and communications); (3) construction of APS proper (linear accelerator, synchrotron, storage ring) and APS facilities; and (4) completion of the project (backfill and landscaping).

The proposed site is located on 28 ha (70 acres) of field and forest in the southwest portion of ANL (see Sect. 3.1). The site would be cleared and

stripped of about 51,200 m (66,900 cubic yards) of topsoil and 87,300 m3 (114,200 cubic yards) of unclassified soil. These excavations would be stockpiled for respreading and fill later in construction. Excess soil [about 27,200 m3 (35,600 cubic yards)] would be moved to disposal sites on ANL property (Title I 1989).

Because positron beam alignment is a basic concern for this facility, it is essential that its concrete foundation slab be set level, with only minimal settlement. Thus, the building excavation would extend to a depth adequate to allow most of the Experiment Hall floor slab to rest on undisturbed soil. The Experiment Hall would be constructed on concrete caissons, or spread footings, which would not penetrate the underlying aquifer. Any existing unstable areas under the Experiment Hall would be backfilled with engineered structural fill to prevent settlement. Where fill was required, the existing ground would be removed to a minimum depth of 0.6 m (2 ft) and replaced by cohesionless, well-compacted backfill. All of the construction associated with earthwork would use methods that minimize soil erosion (ANL 1987a).

Approximately 21,500 m3 (17.4 acre-ft) of storm-water storage would be provided in general locations around APS to meet local storm-water detention provisions (ANL 1987). The total allowable release from the site is approximately 221 L/s (7.8 ft3/s).

The proposed APS site is divided into a north and a south section by an east-to-west drainage divide. Therefore, a storage of 8,264 m3 (6.7 acre-ft) would be provided on either side of the site. The detention basins would be self draining and sized to drain in less than 72 hours.

Storm water collected on the APS site would be conveyed to the detention basins in properly sized storm sewers or ditches. Storm-water runoff from the buildings, roadways, parking areas, and the infield area would be conveyed to

the outlet sewers via ditches or small storm sewers. A drain system around building foundations would also drain to the outlet sewers (ANL 1987a).

No details are available at this time about construction schedule and equipment to be used in each construction phase. However, construction of APS would proceed in a routine fashion, following well established practices. A worst-day construction scenario involving the following activities and equipment is assumed:

a. The construction would disturb approximately 28 ha (70 acres) of land. Site clearing would take place over a period of 30 days, involving considerable amounts of excavating and grading.
b. The vehicles to be used in the construction would include two bulldozers, five 20-ton trucks capable of transporting 15 m3 (20 cubic yards) each, two one-half-ton pickup trucks for construction engineers, and one water truck to water the construction site and dusty roads to minimize fugitive dust.
c. About 138,500 m3 (181,100 cubic yards) would be sent to two locations. About 111,300 m3 (145,500 cubic yards) would be kept on the site for later landscaping. The remainder of the soil would be deposited in berms on the ANL site. Clay soil would be used as cover material on the 800 Area Sanitary Landfill.
d. There would be one drilling rig at the site to drill and place 240 caissons of 0.8-m (2.6-ft) diameter to a depth of 12 m (39 ft). The drilling rig probably would not be present during the preliminary site clearing.

In addition to this construction equipment, about 100 automobiles are expected to arrive daily with workers during the peak construction period.

The cars would arrive by 6:30 a.m. and would depart at about 3:30 p.m. each

day. Approximately one-half of these would be expected to leave and return during the lunch period. It is anticipated that most of the traffic would use Kearney Road and the Westgate entrance. Bluff Road would remain open during the first phase of the construction to permit easy access of cars and construction vehicles to the APS site (Pentecost 1986).

2.1.5 Decommissioning

It is difficult to estimate the useful lifetime of the APS before decommissioning because (1) the degree and duration of future user demand for continuing scientific-research use of the facility is unknown and (2) future development of accelerator and ID technology may enable this facility to evolve into a next-generation synchrotron radiation source, thereby extending its useful lifetime for research.

Nevertheless, it is worthwhile to consider decommissioning procedures that might be necessary for the APS facility some 20 to 30 years after first operation. During the past 20 years, four electron accelerators of energy greater than 1 GeV (Cornell, 1.5 GeV; California Institute of Technology, 1.0 GeV; Cornell, 2.5 GeV; and Harvard/Massachusetts Institute of Technology (MIT), 6 Gev) have been decommissioned. Decommissioning experience at these and at ANL's 12.5-GeV proton synchrotron provides a relevant experience base to draw upon in developing decommissioning plans for the APS.

Decommissioning of the APS and associated facilities (1) would be similar to other electron (or positron) accelerator/storage ring facilities of comparable energy and design, (2) would present no unique problems, and (3) could be performed using currently available technology. From a radiological perspective, electron accelerators and storage rings are appropriately classified as very low-level facilities and therefore do not

require unusual or particularly complicated decontamination procedures.

Equipment and facilities installed outside of the accelerator shielding enclosures have only a negligible possibility of being activated.

It is anticipated that decommissioning of the accelerator and storage ring facilities would proceed in three phases (Huebner 1988a):

1. Shutdown. After orderly shutdown and disconnection of operating systems, electrical power, and cooling water systems to the accelerator facilities, physical and administrative controls for limiting access to the facilities would be maintained.

2. Survey of residual activities. Every component in the accelerator enclosures would be surveyed by health physics personnel to identify and tag any radioactive components. Based on the documented radiation survey, an inventory of all activated materials and equipment would be made and kept under continued surveillance and maintenance. It is anticipated that all components, except for the positron production target and associated shielding, would be essentially radioactivity free. The volume of activated materials in the positron production target area is estimated to be about 0.5 m3 (0.7 cubic yards), composed primarily of steel. The level of activity would depend upon the length of operation, but dose rates are not expected to exceed a few tens of millirem per hour at an 8-cm (3-in.) distance. As a result of this phase, all excess accelerator equipment would be categorized by type and radioactivity level and would be ready for removal.

3. Removal of components and dismantling. It is anticipated that the inventory would include three general categories of components:

    (a) Contamination-free components would be removed to a temporary storage area, possibly a portion of the Experiment Hall. Experience at decommissioning of other accelerator facilities indicates that magnets, power supplies, and vacuum pumps belong to this category and are reusable at another accelerator facility.

    (b) Reusable items with some residual radioactivity would be removed under health physics supervision and stored in a separate radiologically controlled location for future shipment. Packaging and shipment of these items would follow U.S. Department of Transportation (DOT) specifications. For example, the decommissioned electron linac from the Harvard/MIT 6-GeV synchrotron was relocated and is currently used as the injector for the NSLS at BNL.

(c) Nonreusable items with some residual radioactivity would be packaged according to DOT specifications and shipped to a DOE-approved radioactive waste disposal site. For the proposed action, this might involve cutting of large pieces, under health physics supervision, into sizes suitable for shipment. In all cases, radioactive and nonradioactive components would be kept segregated.

Decommissioning of conventional facilities would follow after all activated components are identified and removed. No parts of the building structures or equipment are expected to be activated; therefore, they would be available for reuse. Hardware and equipment installed outside the accelerator enclosure

would be ward using standard ANL procedures for disposition of excess government properties.

2.2 ALTERNATIVES

2.2.1 No Action

Taking no action would mean not constructing a 7-GeV synchrotron radiation source and would result in no changes to the existing environment. However, as mentioned in Sect. 1.4, synchrotron radiation has emerged as a powerful tool for probing the structure of matter and studying important physical and chemical processes. Among the scientific advances that would be fostered by using radiation from this storage ring are the determination of bulk and surface structure and of catalytic activity of materials, microprobe impurity detection, inelastic X-ray scattering, and observation of the motion of atoms in protein systems.

2.2.2 Construction at Another ANL Site

Within ANL, four locations were identified as potentially suitable to meet the space requirements of the APS. These were the East Area, the 300 (ZGS) Area, and the North and South 800 Areas. Site selection is influenced by the following factors: (1) suitability of the site to meet technical requirements of design configuration and functional relationships; (2) suitability of topography and subsurface conditions; (3) minimal environmental resource impacts; (4) avoidance of external and traffic-generated sources of vibration; (5) provision of a buffer zone between APS and the ANL site boundary; (6) minimal interference of existing structures; (7) availability of existing utilities; and (8) flexibility of the site for future expansion. The East Area is unacceptable because of its proximity to traffic-

generated vibration along Cass Avenue, the lack of an adequate buffer zone, and topography and floodplain limitations to the west and south. Limitations of the 300 Area are the sources of vibration, the lack of an adequate buffer zone, and restricted expansion potential because of existing facilities. Therefore, the East Area and the 300 Area were eliminated on the basis of technical considerations.

The proposed location for the APS centered on Bluff Road in the South 800 Area provided the best overall resolution of these factors. Table 2.2.1 qualitatively summarizes these findings. Wetlands and topography limited the possible location of the APS in the North 800 Area. Additional studies justified moving the site south 82 m (270 ft) and west 30 m (100 ft), as well as rotating it 21 degrees clockwise. This location moves the facility from the floodplain and wetlands to the north. Site boundaries and the need for a buffer zone restrict moving the facility farther to the south or west.

Table 2.2.1. APS site-selection evaluation [a]

Site	East Area	300 Area	North 800 Area	South 800 Area
Design suitability	fair	good	fair	good
Topography	fair	good	fair	good

Environmental	poor	good	poor	fair
Vibration	poor	poor	good	good
Buffer zone	poor	poor	good	good
Existing structures	good	poor	good	good
Utility access	fair	good	good	good
Expansion potential	fair	poor	good	good

a good = acceptable in all aspects; fair = minimally acceptable, some mitigating action; poor = unacceptable in one or more nonmitigative aspects.

CHAPTER 3 THE AFFECTED ENVIRONMENT

3.1 SITE DESCRIPTION

The proposed 28-ha (70-acre) APS site lies on both sides of the existing Bluff Road, just east of Kearney Road on the southwest portion of ANL (Fig. 1.3.2). Figure 3.1.1 is a map of the APS proposed site with the wetlands and areas of cultural interest identified.

ANL occupies a 516-ha (1275-acre) site of gently rolling land in the Des Plaines River Valley of Dupage County, Illinois, about 35 km (22 miles) southwest of downtown Chicago and 40 km (25 miles) west of Lake Michigan. Laboratory facilities occupy about 81 ha (200 acres) of the total ANL site area. Surrounding the ANL site is the 826-ha (2040-acre) Waterfall Glen Forest Preserve, a greenbelt forest preserve of the DuPage County Forest Preserve District. Nearby highways are Interstate 55 to the north and Illinois Highway 83 to the east (Fig. 1.2.1). About 1.6 km (1 mile) south of ANL are the Des Plaines River, the Chicago Sanitary and Ship Canal, and the Illinois Waterway (Illinois and Michigan Canal). The principal stream on the site is Sawmill Creek, which drains southward to the Des Plaines River. The forest preserve and the area between the river and ANL are undeveloped, whereas urban developments predominate other surrounding areas.

3.2 CLIMATOLOGY AND AIR QUALITY

3.2.1 Climatology

The regional climate around the APS site is characterized as being continental, with relatively cold winters and hot summers (DOE 1982), and is slightly modified by Lake Michigan (Denmark 1974).

Figure (Page 26 Fig. 3.1.1. Historic and Wetland sites.)

Weather data for the ANL area are presented in detail in ANL's sitewide environmental assessment (DOE 1982). The average daily air temperature at ANL is 8.9 oC (48 oF). Average diurnal variations of temperature range from 7.6 oC (13.7 oF) in December to 11.4 oC (20.5 oF) in May.

The predominant wind direction is from the south, and wind from the southwest quadrant occurs almost 50% of the time (DOE 1982). The average wind speed at ANL at a height of 5.8 m (19 ft) is 3.4 m/s (7.6 mph), with calm periods occurring 3.1% of the time.

The average annual precipitation at ANL is 800 mm (31.5 in.) and is primarily associated with thunderstorm activity in the spring and summer. The annual average accumulation of snow and sleet at ANL is 818 mm (32.7 in) (DOE 1982). Snowstorms resulting in accumulations greater than 150 mm (5.9 in.) occur only once or twice each year on the average, and severe ice storms occur only once every 4 or 5 years (Denmark 1974).

The area experiences about 40 thunderstorms annually (NOAA 1980). Occasionally, these storms are accompanied by hail, damaging winds, or tornadoes. From 1951 to 1969 there were 371 tornadoes in the state, with more than 65% occurring during the spring months (NOAA 1970). The theoretical probability of a 67-m/s (150-mph) tornado strike at ANL is 3.0 x 10-5 each year, a recurrence interval of one tornado every 33,000 years (Coats 1984). The ANL site has been struck by milder tornadoes, however, with minor damage to power lines, roofs, and trees.

3.2.2 Air Quality

National and state ambient air quality standards are listed in Table 3.2.1. Ambient air quality in the general vicinity of ANL is monitored at several sites. The Environment Safety and Health Department (ESHD) of

Table (Page 28 Table 3.2.1 Summary of national and Illinois ambient...)

ANL monitors pollutants at five locations on the property, and the Illinois Environmental Protection Agency (IEPA) and Commonwealth Edison Company collect data from a number of sites around ANL. Ambient air quality monitoring station locations are shown in Fig. 3.2.1.

Total suspended particulates (TSP) data provide a baseline for the evaluation of environmental consequences of APS construction activities. Evidence has indicated that the TSP level near ANL is the result of fugitive emissions (Golchert, Duffy, and Sedlet 1980). Table 3.2.2 lists TSP data from monitoring sites operated by ANL, regulatory agencies, and Commonwealth Edison Company. Monitors within a 16-km (10-mile) radius were selected to represent the local air quality.

Aside from ANL's monitoring sites in Fig. 3.2.1 (8F, 12F, 12M, 14N, 18J), Darien and Lemont have the closest monitors. The highest TSP concentrations registered up to 1980 at these off-site monitors were 74 ug/m3 for an annual geometric mean and 208 ug/m3 for the second highest 24-h average; these values were barely in compliance with the primary air quality standards for TSP in effect prior to July 31, 1987. After this date, standards for particulate matter under 10 um in diameter (PM10) replaced national and state standards for TSP. The new primary and secondary PM10 standards were set at 150 mg/m3 for 24-h averages and 50 mg/m3 for annual averages (Table 3.2.1). PM concentrations would be lower than TSP concentrations. However, the compliance status of the ANL area with respect to the new PM10 standards has not yet been evaluated.

On the basis of the monitoring results of Table 3.2.2, the IEPA had classified Downers Grove township (the location of ANL) as nonattainment for secondary TSP standards, and adjacent Lemont and DuPage townships as

Figure (Page 30 Fig. 3.2.1 Air monitoring locations at and surrounding ANL (ANL 1982))

Table 3.2.2. Total suspended particles (TSP), in ug/m3, from monitors located within an approximate 16-km radius of ANL (ANL 1980)

Monitor	Geometric mean 1977	1978	1979	24-hour maximum 1977 1st	1977 2nd	1978 1st	1978 2nd	1979 1st	1979 2nd
Cook County and Chicago									
Bedford Park a	64	61	69	133	126	136	125	235	154
Lemont b	c	74	d	134	126	489	195	211	208
McCook (1)a	110	87	74	209	187	212	145	148	147
McCook (2)a	101	81	70	219	217	171	151	140	131
Orland Park a	52	56	66	177	142	189	176	138	127
Summit a	18	80	84	196	186	225	209	194	193
Du Page County									
Darien a	-	69	69	-	-	195	188	143	135
Naperville a	58	53	60	165	135	135	131	122	119
8Fe	47	48	45	-	-	-	-	-	-
12F e	58	58	55	-	-	-	-	-	-
12M e	43	48	45	-	-	-	-	107	71
14N e	-	38	43	-	-	-	-	-	-
18J e	52	61	-	-	-	-	-	-	-
Will County									
Lockport a	63	53	70	164	157	203	123	214	180
Romeoville (1)b	58	-	66	160	155	189	162	155	149
Romeoville (2)b	-	54	d	107	90	202	140	156	151

a Monitor operated by the Illinois Environmental Protection Agency.

b Monitor operated by Commonwealth Edison Company

c Hyphen means no data.

d The value given for 1978 is an average for 1 January 1978 to 31 December 1979.

e Monitor on the ANL site.

nonattainment for primary TSP standards (EPA 1980; DOE 1982). However, a significant improvement in air quality was observed in the succeeding 5 years.

As of February 1985, most of these townships had reached attainment status (IEPA 1985). The 1985 TSP concentrations (annual geometric mean) for Lemont, Darien, and Naperville were 67, 41, and 52 ug/m3, respectively (IEPA 1986).

3.3 DEMOGRAPHY AND SOCIOECONOMIC PROFILE

The proposed APS site is at ANL, located in Dupage County, Illinois, 40 km (25 miles) west of Lake Michigan, about 35 km (22 miles) southwest of downtown Chicago, and within the Chicago Standard Metropolitan Statistical Area (SMSA). This area comprises six Illinois and two Indiana counties around the southwest corner of Lake Michigan.

DuPage County's growth rate has been the highest of any metropolitan Illinois county. The nearby areas of Will and Cook counties have generally developed at a considerably lower rate, except along the Illinois waterway where industrial development has taken place. With its on-site work force of approximately 3760 people, ANL is one of the largest employers in DuPage County.

The estimated population by annular sector and radius within 80 km (50 miles) of ANL is shown in Table 3.3.1. More than 3.5 million people live within 32 km (20 miles) of ANL. About 8 million people live within the 80-km (50-mile) radius, which includes portions of Lake and Porter counties, Indiana; portions of Kankakee, Grundy, La Salle, DeKalb, McHenry, and Lake counties in Illinois; and all of Dupage, Will, Cook, Kendall, and Kane counties in Illinois.

Table (Page 33 Table 3.3.1 Incremental population data in the vicinity of ANL, 1981)

Beyond the forest preserve at ANL's perimeter, the population density increases rapidly, especially to the northeast. A high-density residential area (with several thousand residents) is 600 m (2000 ft) east of the perimeter.

The closest resident to APS is west southwest of the project site, approximately 1.4 km (0.9 mile) from the project centerline (Cho 1989a). The closest large populated subdivision is located northwest of the project site, west of the ANL West Gate entrance, on the west side of Lemont Road. The center of this development is approximately 2.1 km (1.3 miles) from the project centerline. Lemont (population 6080) to the southwest and Darien (population 16,390) to the north are the urban populations closest to the project site.

3.4 LAND USE

3.4.1 Site and Vicinity

Site. The APS site consists of undeveloped open fields and second-growth woodlands. The area was prairie and farmland before federal acquisition of the site in 1947. DuPage County land-use plans designate the area, including the site, as office, research, and development. This land-use commitment of the site to development precludes the land from being subject to the Farmland Protection Policy Act (7 USC 4201 et seq.).

An experiment involving five lysimeters is being conducted east of Kearney Road on the west edge of the APS site. The lysimeters are buried tanks and are being used to study radioactive leakage from solid ion-exchange resins. This program will not be impacted by the APS.

Vicinity. Land uses adjacent to the APS site consist of undeveloped ANL lands, laboratory facilities to northeast and east and the Waterfall Glen

Forest Preserve to the west and south. A portion of the south ANL boundary is built around Saint Patrick's Cemetery (Fig. 1.3.2), about 220 m (720 ft) from the proposed storage ring. The forest preserve is managed by DuPage County for public recreation, nature preservation, and ecological demonstration. Much of the preserve was formerly ANL property that was deeded to DuPage County in the early 1970s. The area adjacent to the southwest boundary of ANL is used by visitors to the cemetery, occasional hikers, and for access to a field used for flying model airplanes. However, no quantitative data on use are available (Pentecost 1981).

The surrounding area is varied in land use, including commercial, residential, and heavy industrial. For example, along the Illinois Waterway, about 8-11 km (5-7 miles) southwest of ANL, are large oil refineries and a large coal-fired electrical generating station. In addition, several large pipeline terminals for bulk storage of petroleum products and other chemicals are also present in the area.

3.4.2 Archaeological and Historic Sites

ANL is situated in an area known to have a long and complex cultural history. It is located in the Illinois and Michigan Canal National Heritage Corridor (Pub. L. 98-398, August 24, 1984).

3.4.2.1 Prehistoric cultural resources

All of the periods listed in the cultural chronology of Illinois (Curtis and Bebrich 1985), with the exception of the earliest period (Paleo-Indian), have been documented in the ANL area either by professional cultural resource investigation (e.g., Curtis and Berlin 1980) or by interviews of ANL staff with local collectors. A variety of site types, including mounds, quarries,

lithic workshops, and habitation sites have been reported by amateurs within a 16-km (10-mile) radius of ANL (Curtis and Bebrich 1985).

Three prehistoric sites, designated ANL-4, ANL-6, and ANL-23 (Fig. 3.4.1) and consisting of a surface scatter of lithic artifacts, were identified within the APS project area. Site archaeological efforts have revealed that ANL-4 and ANL-6 represent distinct concentrations of lithic artifact debris. The sites correspond to different periods of prehistoric use, although they vary slightly in the type of artifactual materials recovered. Site cultural resource studies (EES 1988) confirmed and amplified earlier work which had suggested the presence of two sites, ANL-4 and ANL-6 (Curtis and Berlin 1980). This earlier work also suggested the presence of two other sites which, as a result of the present survey work (EES 1988), are known to be part of the ANL-23 site.

3.4.2.2 Historic cultural resources

In the mid-seventeenth century, the ANL area was occupied by the so-called Illinois Confederacy, composed of 12 related tribes, which included the Potawatomi, the Ottawa, and the Chippewa (Curtis, Rosenthal, and Stanish 1985). During the eighteenth century, European and American governments laid claims to the land. Formal control of Indian lands was completed in 1816, when Illinois was purchased by the U.S. Government from the Potawatomi and their affiliates (Curtis, Rosenthal, and Stanish 1985). By 1834, early settlers had formed the community of Cass on what later became the ANL Reservation and now is Waterfall Glen Forest Preserve. The Cass post office, second oldest in DuPage County, was in operation from 1836 to 1885. During the early part of this period, construction of the Illinois and Michigan Canal took place.

Figure (Page 37 Fig. 3.4.1. Prehistoric and historic resources in the APS site...)

Two historic sites, designated ANL-28 and ANL-29, have been identified (EES 1988) within the APS project area (Fig. 3.4.1). Located near the Illinois and Michigan Canal Corridor, ANL-28 and ANL-29 may be helpful in revealing some information about the period of canal construction and use. These farmstead sites were constructed beginning in the 1840s. They appear to have been continually occupied for over 100 years before their purchase by the government beginning in 1946. Subsequently, the building structures were either removed or demolished as the ANL site was developed.

Archaeological work (EES 1988) recovered over 1000 historic artifacts from these two sites. Materials consisted of mainly glass and ceramic artifacts, reflecting a variety of container types. Most of the artifacts found at ANL-28 were recovered as surface finds. Because the dense undergrowth was a site constraint at ANL-29, shovel testing proved to be the most efficient method for recovering artifacts.

In addition to artifactual remains, partially excavated evidence of structural features, including cement and cobble foundations, rock alignments and scatters, and well retaining walls, were found at both ANL-28 and ANL-29. Evaluation confirms that both sites functioned as farmsteads (EES 1988).

3.5 GEOLOGY

3.5.1 Stratigraphy

According to Soil and Material Consultants, Inc. (1986), the APS site is underlain by 34-37 m (113-123 ft) of glacial till (Wisconsin stage of the Pleistocene series). Lineback (1979) mapped this unit as the Wadsworth Till Member of the Wedron Formation and described it as a clayey to silty-clayey till with few pebbles and cobbles. Sasman et al. (1981) observed, however, that the base of this unit is locally rich in gravel. Gravel deposits are

probably confined to valleys carved in the bedrock surface which now lies buried beneath the Pleistocene sediments (alluvium and glacial till). Lithologic logs of 12 exploratory holes are consistent with Lineback's description. The till is overlain by less than 0.3 - 0.6 m (1-2 ft) of loess and modern soil.

Strata immediately underlying the till are identified as probably belonging to the Kankakee Formation of the Alexandrian Series, lowermost Silurian System. The subcropping weathered zone is up to 10 m (35 ft) thick. This zone shows significant evidence of solution weathering and fracturing, below which rock is generally unfractured and unaltered.

Silurian aquifers (including the Kankakee Formation) are separated from deeper Cambro-Ordovician aquifers by an aquitard, the Maquoketa Group (Ordovician). This group consists primarily of shale units. The top of the Maquoketa Group lies 75 m (246 ft) beneath the surface, and it is about 45 m (148 ft) thick in the vicinity of the APS site (Sect. 3.7) according to maps published in Suter et al. (1959).

3.5.2 Soils

According to USDA (1979), the site consists mainly of upland soils belonging to the Morley Series. These soils formed in silty clay loam glacial till. Locally, a thin layer of overlying silty material is present. In the proposed construction area, surfaces on these soils generally range from nearly flat to about 15% slope. These upland soils are deep, well drained, and moderately slow to slowly permeable. Small marshlands, ponds, and moderate erosional features are on the vicinity of the construction site.

Other soil series in and adjacent to the construction site are the Sawmill silty clay loam (along a tributary to Sawmill Creek) and isolated

areas of Blount silt loam, Ashkum silty clay foam, and Peotone silty clay loam. These soils differ from the Morley Series in that they are all poorly or very poorly drained and are in localized low-lying areas within the upland till plain. Table 3.5.1 summarizes soil characteristics, and Fig. 3.5.1 is a map of soil types at ANL.

3.5.3 Seismicity

No tectonic features within 100 km (62 miles) of ANL are known to be seismically active. The longest of these features is the Sandwich Fault. Smaller local features are the Des Plaines disturbance, a few faults in the Chicago area, and a fault of apparently Cambrian age (DOE 1982).

Although a few minor earthquakes have occurred in northern Illinois, none has been positively associated with a particular tectonic feature. Most of the recent local seismic activity is believed to be caused by isostatic adjustments of the earth's crust in response to glacial loading and unloading, rather than by motion along crustal plate boundaries.

There are several areas of considerable seismic activity at moderate distances (hundreds of kilometers) from ANL (Hadley and Devine 1974) . These areas include the New Madrid Fault zone (southwestern Missouri), the St. Louis area, the Wabash Valley Fault zone along the southern Illinois-Indiana border, and the Anna region of western Ohio. Although high-intensity earthquakes have occurred along the New Madrid Fault zone, their relationship to plate motions remains speculative at this time.

According to estimates by Algermissen et al. (1982), ground motions induced by near and distant seismic sources in northern Illinois are expected to be minimal. However, peak accelerations in the ANL area may exceed 10% of

Table (Page 41 Table 3.5.1 Soil types in the vicinity of the APS site (USDA 1979))

Figure (Page 42 Fig. 3.5.1 Soil types of the ANL site (ANL 1980).)

gravity (approximate threshold of major damage) once in about 600 years, with an error range of -250 to +450 years (Coats and Murray 1984).

3.6 SURFACE WATER

3.6.1 Hydrology

Four drainages that may intermittently have flowing water are located on the proposed APS site (Fig. 3.6.1). One originates just west of the site, crosses Kearney Road, and drains north to Freund Brook, which flows near the northwest corner of the site. Freund Brook flows to the east-northeast and enters Sawmill Creek, which flows south to the Des Plaines River. Another drainage in the northeast part of the site also drains northward to Freund Brook. Flow data for Freund Brook are not available. However, field observations of the stream size and channel configuration suggest that the discharge averages less than 0.08 m3/s (3 ft3/s) and peaks at less than 0.6 m3/s (21 ft3/s) during the maximum flood stage (Golchert, Duffy, and Sedlet 1986; DOE 1982).

The remaining drainages originate in the south half of the site and drain southeast to a marsh along the Des Plaines River flood plain. The ANL site in general has a network of ditches and culverts that transport surface runoff without treatment toward the streams.

Sawmill Creek originates about 2.4 km (1.5 miles) north of ANL and flows southward through the eastern part of the ANL site. The ANL treated sewage discharge (50% sanitary wastewater and 50% laboratory wastewater) enters the creek about 1 km (0.6 mile) south of the ANL property boundary and about 305 m (1000 ft) upstream from the Des Plaines River. During rainstorms, much flow is contributed by surface runoff from built-up developments. ANL sewage

Figure (Page 44)

Fig. 3.6.1 Locations of the NPDES discharge monitoring point and water supply wells at ANL.

discharges averaged 0.044 m3/s (1.57 ft3/s) in 1987, while Sawmill Creek's flow above the discharge point averaged about 0.19 m3/s (6.6 ft3/s). Before its closure on October 27, 1986, the Marion Brook (DuPage County) sewage treatment plant, located a few kilometers north of ANL, contributed about 0.14 m3/s (5 ft3/s) to the flow in Sawmill Creek. Flow in the Des Plaines River ranges from 11 to 340 m3/s (400 to 12,000 ft3/s).

3.6.2 Quality

Sawmill Creek's flow through ANL decreased in 1986, when a trunkline sewer was placed into operation for sanitary treated wastewater which previously had been discharged to Sawmill Creek. The stream had been classified as water-quality limited with respect to the dissolved oxygen content (DOE 1982). Data obtained in 1987 are listed in Table 3.6.1. The smaller streams on the ANL site drain old fields, woodlands, lawns, and parking lots. Concentrations of chemical constituents found in Sawmill Creek, 15 m (50 ft) upstream and 60 m (200 ft) downstream from the wastewater outfall, are listed in Table 3.6.2.

ANL effluents at 13 discharge points (Fig. 3.6.1) are regulated by a National Pollutant Discharge Elimination System (NPDES) permit. Total suspended solids (TSS) occasionally have exceeded the permit levels at five of these locations, primarily when heavy rainfall occurred (Golchert and Duffy 1988). An average of 21% of the weekly or monthly TSS samples exceeded the permitted level by factors of 1.1 to 3.8.

3.6.3 Use

Water from the Chicago Sanitary and Ship Canal is used by ANL for process cooling, by local industries for various purposes in addition to

Table (Page 46)

Table 3.6.1. Sawmill Creek - effect of sanitary waste, 1987 (Golchert and Duffy 1988)

Table (Page 47)

Table 3.6.2. Chemical constituents in Sawmill Creek location 7m, 1987 a (Golchert and Duffy 1988)

process cooling, and by the state prison near Joliet for irrigation. ANL usage is about 380 m3/d (0.1 Mgd), some of which is returned to the Canal via Sawmill Creek and the Des Plaines River. The Canal, which receives Chicago Metropolitan Sanitary District effluent water, is used for industrial transportation and some recreational boating. The nearest downstream use of the canal or river water for drinking is reported to be at Alton, on the Mississippi River, over 644 river km (400 river miles) from ANL (Golchert and

Duffy 1988).

Sawmill Creek and the Des Plaines River above Joliet, about 21 km (13 miles) southwest (downstream) from ANL, exhibit very little recreation or industrial use. A few people fish in these waters downstream from ANL, and some duck hunting takes place on the Des Plaines River. Areas adjoining the creek and river, however, receive greater use. The Des Plaines River is a major focus for forest preserves and recreation activity in DuPage, Cook, and Lake counties. Sawmill Creek flows through Waterfall Glen Forest preserve, a major recreational area and the largest forest preserve in DuPage County.

3.7 GROUNDWATER

Two principal aquifers have been used as water supplies in the ANL area (DOE 1980). The shallow aquifer, about 35 to 75 m (115 to 246 ft) deep, is the Silurian age Niagara-Alexandrian Dolomite (locally in hydraulic connection with Pleistocene alluvium in bedrock valleys). The deep aquifer is the Cambrian age Galesville sandstone (in hydraulic connection with the Franconia and St. Peter sandstones), which lies between 240 and 450 m (790 and 1500 ft) beneath the surface. These aquifers are separated by the 45-m (148-ft)-thick Maquoketa Group aquitard, about 75 m (246 ft) below the surface (Suter et al. 1959).

3.7.1 Use

According to Sasman et al. (1981) public and industrial water use of the combined Niagara-Alexandrian dolomite and Pleistocene alluvium doubled in the interval between 1966 and 1978; yields of shallow wells have drastically declined as a result of excessive pumping (Sasman 1974).

During the period from October 1980 through December 1985, pumpage from deep wells in the Chicago region decreased from 666,000 to 600,000 m3/d (175.9 to 157.7 Mgd), a decrease of 10.3%. Changes in pumpage primarily reflect the transition from use of deep wells to water from Lake Michigan for public and industrial supplies, decreasing use of deep wells by self-supplied industries, and use of Fox River water to supplement the public water supply at Elgin in northeastern Kane County.

The four wells now in use at ANL (see Fig. 3.6.1) have yields of 1300 to 1900 L/min (350 to 500 gal/min) from the Niagara-Alexandrian aquifer, and they range in depth from 87 to 104 m (284 to 341 ft). The water level in these wells dropped about 3 m (10 ft) between 1960 and 1978 (Sasman et al. 1981).

3.7.2 Quality

According to Sasman et al. (1981), concentrations of total dissolved solids (TDS), hardness (as CaCO3), sulfate, chloride, sodium, and total iron in groundwater from DuPage and adjacent counties are high. For example, the median TDS in groundwater from DuPage County is 625 mg/L in comparison with EPA's secondary (suggested) standard of 500 mg/L for public drinking water. Table 3.7.1 lists concentrations of selected inorganic and radioactive constituents in water for 1948 and 1987 for the shallow ANL domestic water supply wells shown in Fig. 3.6.1. These data are consistent with those of Sasman et al. (1981). The table shows an increase of 40% in the concentration

of sulfate but indicates that only one parameter (turbidity) exceeds National Interim Primary Drinking Water Standards (NIPDWS). After treatment, turbidity is reduced by an order of magnitude. All volatile organics were below detection limits in 1987 for the four ANL domestic water supply wells (Golchert and Duffy 1988). All but one [bis(2-ethylhexyl)-phthalate] of the semivolatile organics were below detection limits. Samples were also analyzed for pesticides, herbicides, and PCBs, and none were found above detection limits.

3.8 ECOLOGY

3.8.1 Terrestrial Biota

ANL lies within the Prairie Peninsula of the Oak-Hickory Forest Region (Braun 1950). The Prairie Peninsula is a mosaic of oak forest, oak openings, land tall-grass prairie occurring in glaciated parts of Illinois, northwest Indiana, southern Wisconsin, and parts of other states. Much of the natural vegetation of this area has been modified by clearing and tillage. Forests in the ANL region, which are predominantly oak-hickory forests, are somewhat limited to slopes of shallow, ill-defined ravines or of low morainal ridges. Gently rolling to flat intervening areas between ridges and ravines, prior to their use for agriculture, were predominantly occupied by prairie. The predominant successional trend on these areas, in the absence of cultivation, is toward oak-hickory forest. Forests dominated by sugar maple, red oak, and basswood may occupy more pronounced slopes. Poorly drained areas, streamside communities, and floodplains may support forests dominated by silver maple, elm, and cottonwood (Braun 1950).

The APS site itself consists primarily of open fields (about 60% of

Table 3.7.1. Inorganic and radioactive constituents in domestic water, 1987, for ANL Wells 1-4 compared to NIPDWS (concentrations in mg/L and pCi/L, respectively)[a]

	Well Number					
Constituent	1	2	3	4	Treated water	NIPDWS[b]
Inorganic (mg/L)						
Aluminum	<0.06	<0.06	<0.06	<0.06	<0.06	
Antimony	<0.5	<0.5	<0.5	<0.5	<0.5	
Arsenic	<0.004	<0.004	<0.004	<0.004	<0.004	0.05
Barium	0.094	0.081	0.052	0.050	0.050	1.0
Beryllium	<0.001	<0.001	<0.001	<0.001	<0.001	
Cadmium	<0.004	<0.004	<0.004	<0.004	<0.004	0.01
Chromium	<0.02	<0.02	<0.02	<0.02	<0.02	0.05
Copper	0.083	<0.02	<0.022	<0.02	<0.02	
Lead	<0.01	<0.01	<0.01	<0.12	<0.004	0.05
Manganese	0.035	0.019	0.016	0.014	<0.01	
Mercury	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	0.002
Molybdenum	<0.5	<0.5	<0.5	<0.5	<0.5	
Nickel	<0.02	<0.02	<0.02	<0.02	<0.02	
Selenium	<0.002	<0.002	<0.002	<0.002	<0.002	0.01
Silver	<0.03	<0.03	<0.03	<0.03	<0.03	0.05
Sodium	36.9 (20)[c]	24.4 (15)[c]	22.4	21.1	21.7	
Thallium	<0.03	<0.03	<0.03	<0.3	<0.03	
Vanadium	<0.01	<0.01	<0.01	<0.01	<0.01	
Zinc	<0.02	0.027	0.016	0.011	0.011	

Chlorides	79 (4)c	55 (3)c	49	42	58	
Fluorides	0.24	0.29	0.30	0.33	0.3	1.4-2.4
Sulfates	140 (99)c	130 (92)c	100	140	150	
Turbidity (NTU)	11.4	6.4	7.2	7.1	1.9	1.0
Radioactive (pCi/L)						
Gross alpha	3.5	5.0	3.4	2.8	0.5	15.0
Gross beta	7.4	8.3	7.4	6.5	3.5	50
Tritium	217	141	122	110	<100	2 x 10 4
Strontium-90	-	<0.25	<0.25	<0.25	<0.25	8.0
Radium-226	-	0.94	0.64	0.72	0.15	5.0
Uranium (natural)	-	0.32	0.47	0.25	0.31	

a Golchert and Duffy 1988.

b From 40 CFR Pt. 265, Appendix III.

c Data for 1948 from Knowles et al. (1963)

site); lowland woods in early succession (approximately 20% of site); mature upland forest (approximately 10% of site); and developed or disturbed land (about 10% of site). The lowland woods, which are located along drainages and in several poorly drained depressions, have few mature trees and are dominated by box elder, white ash, and silver maple. The upland forest, in the northeast portion of the site, is dominated by white, bur, and black oaks and shagbark hickory. It represents the largest forested area on the site. Other tree species on the site are eastern cottonwood, black willow, basswood, American elm, slippery elm, black cherry, and red mulberry. The vegetation on the open fields was cleared to bare ground in the fall of 1986 for an archaeological survey (see Sect. 4.4 and Curtis et al. 1987). These fields had bluegrass, yarrow, Queen-Anne's lace, goldenrod, asters, bindweed, and cress.

Terrestrial vertebrates that are commonly observed or likely to occur on the site include about 5 species of amphibians, 7 species of reptiles, about 4O species of summer resident birds, and 25 species of mammals. More than a hundred other bird species occur in the area during migration or winter but do not nest on the site or in the surrounding region. An unusual species on the ANL site is the fallow deer, a European species that was introduced to the area by a private landowner prior to government acquisition of the property in 1947 and which subsequently increased to about 400 individuals. In November 1988, about 200 of the deer were removed for population control. Native white-tailed deer also occur on the ANL reservation. Lists of species that occur at ANL and that could be expected to occur on the proposed APS site are provided in DOE (1982). Invertebrate species, as well as plants and other animals, observed on the ANL site were reported by Messenger, Suter, and Wagner (1969).

3.8.2 Floodplains and Wetlands

The l00-year floodplain of Fruend Brook and several wetlands exist at or in the vicinity of the APS site. These are designated by letters A through F in Fig. 3.8.1 and are described below. The location, size and characteristics of these areas were determined based on several sources including flood insurance maps (FEMA 1982), U.S. Fish and Wildlife Service (FWS) National Wetland Inventory maps, USGS and other topographical maps of the area, Northeastern Illinois Planning Commission aerial photograph (1985), and information collected during field surveys. The 100-year floodplain (Area F) is associated with the upper reaches of Freund Brook, a tributary to Sawmill Creek that traverses an area at the northwest edge of the APS site.

Area A, which is 0.16 ha (0.4 acre), is in a wooded area at the southeastern portion of the APS site. According to the FWS classification system, the area is palustrine, unconsolidated bottom/emergent, saturated, and semipermanent. Water is present in the pond except during exceptionally dry summers such as occurred in 1988. Because of its perennial nature and relatively undisturbed state, this wetland provides habitat for a variety of wildlife species.

Area B, which is 0.28 ha (0.7 acre), is palustrine, with emergent/scrub shrub, and is surrounded by a fringe of cottonwoods and willows. It is intermittently flooded during the fall, winter, and spring. During seasonally wet periods, it is frequented by a variety of wildlife species.

Area C is a small depression [0.45 ha (1.1 acres)] surrounded by open field. It is occasionally flooded during periods of heavy rain, but it has saturated soil conditions for sufficient periods to support a number of facultative and obligate hydrophytic species. Field survey of this area

Figure (Page 54)

Fig. 3.8.1 Floodplains and wetlands on the APS site.

identified the dominant species as leafybract beggar-ticks and the occurrence of the state-endangered hairy marsh yellow cress.

Area D was a partially filled excavation with standing water [0.40 ha (approximately 1.0 acre)] and steep slopes. It had no emergent vegetation and provided little if any wildlife habitat. As an action separate from APS, DOE obtained authorization from the U.S. Army Corps of Engineers (COE) to fill the excavation with the original excavated material stockpiled immediately southwest of the excavation (COE 1988). The filling operation has been completed.

Area E, which is 0.28 ha (0.7 acre), is described as a palustrine, emergent, saturated/semipermanent seasonal wetland. It is surrounded by a fringe of willows and box elders. Overflow from this area drains into a narrow (2-m wide) open water channel extending to Freund Brook.

Area F is a wetland complex associated with the 100-year floodplain of upper Freund Brook. Near Outer Circle Road, to the extreme north of the proposed APS site, a small concrete weir restricts water flow and impounds approximately 400 m (1320 ft) of the stream. This impoundment is approximately one-fourth open water, with the remaining lowland dominated by cattails and standing dead trees. Upstream from this impoundment, most of the 100-year floodplain was flooded by beaver activity in the fall of 1986. Patches of open water, a cattail marsh, and previously flooded stands of trees are located in this upstream area. This entire wetland complex is ecologically important because it is a permanent source of open water, relatively large in size [approximately 5.5 ha (13.6 acres)], generally undisturbed, and contains a variety of habitats. It supports a number of wildlife species and migrant waterfowl such as mallard, wood duck, green-back heron, and black-crowned night heron (the latter is listed as endangered by

the state of Illinois).

A summary of wetland type, size, and functional importance of wetland features at or in the vicinity of the proposed APS site is presented in Table 3.8.1. All wetland areas are classified as palustrine, but they vary in being dominated by open water, trees, or emergent vegetation. They differ in functional importance largely based on size and species associated with them. All wetlands at the project site are estimated to have a low importance for providing water supply, flood control, timber, food, and recreation, generally because of their relatively small size. All but the wetland complex (Area F) are ranked low in importance for water quality and water recharge and discharge functions. The artificial and natural dams in Area F provide catchment basins for sediment deposited within upper Freund Brook and serve to dampen fluctuations in water discharge rates. All but Area D are ranked moderate to high in importance for habitat.

3.8.3 Aquatic Biota

Freund Brook crosses the extreme north corner of the site but is impounded by a beaver dam in this area (Sect. 3.8.1). The gradient of the stream is relatively steep, and riffle habitat predominates. The substrate is coarse rock and gravel on a firm mud base. Primary production in the stream is limited by shading, but diatoms and some filamentous algae are common. Aquatic macrophytes include common arrowhead, pondweed, duckweed, and bulrush. Invertebrate fauna consist primarily of dipteran larvae, crayfish, caddisfly larvae, and midge larvae. Few fish are present because of low summer flows and high temperatures. Other aquatic habitats on the ANL site include

Table 3.8.1. Wetland type, size, and functional importance in the APS project area and vicinity.

Wetland a	A	B	C	D	E	F
Wetland Type b	PUB/EM/FO	PEM/FO	PEN	PUBr	PEM	PEM/FO/UBb
Size in hectares	0.16	0.28	0.45	0.40	0.28	5.5
(acres)	(0.4)	(0.7)	(1.1)	(1.0)	(0.7)	(13.6)

Importance: c

Water supply	L	L	L	L	L	L
Water quality	L	L	L	L	L	M
Recharge/discharge	L	L	L	L	L	M
Flood control	L	L	L	L	L	L
Habitat	M	M	H	L	M	H
Timber	L	L	L	L	L	L
Food	L	L	L	L	L	L
Recreation	L	L	L	L	L	L

a Wetlands correspond to those shown in Fig. 3.8.1.

b Wetland types were based on the classification scheme of Cowardin et al., 1979. P = palustrine, EM = emergent vegetation present, FO = trees present, UB = unconsolidated bottom (open water), b = modified by beaver, 5 = artificial.

c Importance ratings: L = Low, M = Moderate, H = High. Wetland functions are based on those identified in EO 11990.

additional beaver ponds, artificial ponds, ditches, and Sawmill Creek (DOE 1982).

The biotic community of Sawmill Creek is relatively depauperate, reflecting the creek's high silt load, steep gradient, and historic release of sewage effluent from the Marion Brook sewage-treatment plant, which closed in the winter of 1986-87. The fauna consists primarily of blackflies, midges, isopods, flatworms, segmented worms, and creek chubs. A few other species of minnows, sunfishes, and catfish are also present. Clean water invertebrates, such as mayflies and stoneflies, are rare or absent. The fish species that have been recorded in ANL aquatic habitats are the following: black bullhead, bluegill, creek chub, golden shiner, goldfish, green sunfish, largemouth bass, stoneroller, and orange-spotted sunfish (DOE 1982; Messenger, Suter, and Wagner 1969). The Des Plaines River system, including ANL streams, has been rated as "poor" in terms of the fish species present, a result of domestic and industrial pollution and stream modification (Smith 1971).

3.8.4 Threatened and Endangered Species

Although the geographic ranges of several federally listed animal species include the northern Illinois region (FWS 1986), no suitable habitat for these species is present on the proposed APS site, with the possible exception of the Indiana Bat (Myotis sodalis). An unconfirmed capture of an Indiana bat in nearby Waterfall Glen Forest Preserve indicates that the bat may occur in the ANL region. Consultation with the U.S. Fish and Wildlife Service (FWS) determined that suitable habitat for this species does not exist on the area that would be affected by APS construction (see Appendix C). The bald eagle, peregrine falcon, piping plover, interior least tern, and

Kirtland's warbler could occur in the ANL area as extremely rare nonbreeders during migration or winter.

Numerous species listed by the state of Illinois have been recorded in DuPage County, including one bird species and 26 plant species (IDC 1981). The black-crowned night heron (Nycticorax nycticorax) and hairy marsh yellow cress (Rorippa islandica var. hispida) are both listed as endangered (IDC 1981) and have been documented on the ANL site. The hairy marsh yellow cress occurs in Area C, and the black-crowned night heron occurs in Area F (Fig. 3.8.1). No other species on the state list are known to occur at ANL (Buhnerkempe 1988).

3.9 EXISTING ENVIRONMENTAL MONITORING PROGRAMS

3.9.1 Radiological

The basic occupational exposure limit for DOE contractors is 5 rem/year for whole-body exposure (DOE 1988b). However, it is DOE's and ANL's policy to keep radiation exposures as low as reasonably achievable (ALARA). The DOE, in keeping with the principles of ALARA, has set as a design objective for new facilities, a radiation exposure limit that is one-fifth of the 5 rem/year whole-body exposure limit. In addition, DOE has proposed that the predicted exposure to individual members of the public should not exceed 25 mrem/year

(DOE 1984). These guidelines for on-site and off-site locations would be used for operation of the facility in order to keep exposures as low as reasonably achievable.

The ANL radiological monitoring program has been in operation since 1948, and monitoring results have been published in a series of annual reports. These data provide a baseline for measuring impacts of present and future projects.

The radioactivity of the environment is routinely determined by monitoring ambient external penetrating radiation and radioactive nuclides in air, water, soil, and food. Sample collections and measurements are made at the ANL boundary and off-site for comparison purposes. Some on-site results are also reported when they are useful in interpreting perimeter and off-site results. Because radioactivity is usually spread by air and water, the sample collection program has concentrated on these media. In addition, soil, plants, foodstuffs, precipitation, and materials from the beds, lakes, and streams are also routinely collected and analyzed (Golchert, Duffy, and Sedlet 1986). The measured concentrations or radiation doses are compared with DOE radiation protection standards for uncontrolled areas (DOE 1988a).

The present DOE Radiation protection Standard for uncontrolled areas (i.e., for members of the public) is 100 mrem/year maximum for whole body (Vaughan 1985). This standard is being revised, and it is anticipated that the new standard would limit exposure to members of the public from DOE activities such that no individual shall receive in one year an effective dose equivalent greater than 100 mrem or a tissue dose equivalent greater than 5 rem (DOE 1988a). Any actual or potential individual dose equivalent exceeding 25 mrem/year must be reported to DOE. In addition, DOE facilities with airborne releases are subject to 40 CFR Pt. 61, Subpart H (EPA 1985), which requires the use of the EPA-AIRDOS/RADRISK code to demonstrate compliance with this regulation. The dose limits for the air pathway are 25 mrem/year to the whole body and 75 mrem/year to any organ.

Measurements of external penetrating radiation are routinely performed at ANL with calcium fluoride and lithium fluoride thermoluminescent dosimeter (TLD) chips. Dosimeters are exposed at a number of locations at the site boundary and on-site. Readings are also taken, for comparison purposes, at five off-site locations unaffected by ANL operations (Golchert and Duffy 1988).

Table 3.9.1 summarizes results for 1987 for these off-site locations. Measurements were made for the four successive exposure periods shown, and the results were calculated in terms of annual dose. The average 90 mrem/year, excluding radon, may be considered the normal background for the ANL area.

External penetrating radiation measurements at 14 ANL boundary and on-site locations (including the proposed APS site) show normal background near the proposed APS site and a dose range of from 78 to 112 mrem for most other locations. Four monitoring locations have high readings (Golchert and Duffy 1988). The location closest to the proposed APS site is near the old CP-5 reactor site, 200 m (656 ft) from the proposed APS site perimeter, with 608 mrem/year. The highest reading (7000 mrem/year) is found at the ANL Radioactive Waste Storage Facility, which is 830 m (2720 ft) from the proposed APS site perimeter. The calculated dose from these sources at the proposed APS site is less than 0.01 mrem/year.

The average background radiation level at ANL is near the national average, with a value of 28 mrem/year for both cosmic and terrestrial external radiation, and 39 mrem/year for internal (ingested and inhaled) radiation. An additional 200 mrem/year (the national average) come from radon and its short-lived daughters (NCRP 1987).

3.9.2 Nonradiological

Nonradiological air monitoring activities at ANL and surrounding areas are reviewed in connection with ANL air quality (Sect. 3.2.2). Emphasis is placed on total suspended particulates (TSP) data, because they provide a baseline for the evaluation of environmental consequences of the proposed APS

Table 3.9.1. Environmental penetrating radiation at off-site locations, 1987 (Golchert and Duffy 1988)

Dose rate (mrem/year)

Period of measurement

Location	1/5-4/9	4/9-7/16	7/16-10/15	10/15-1/17	Average
Lemont	85	90	98	88	90 +- 6
Lombard	87	92	101	92	93 +- 6
Oak Brook	88	95	99	90	93 +- 5
Oak Lawn	78	82	84	80	81 +- 3
Woodridge	87	93	95	89	91 +- 4
Average	85 +- 4	90 +- 5	95 +- 7	88 +- 5	90 +- 5

construction. Details of ANL air monitoring programs for SO2 and NOx are provided in the ANL environmental assessment (DOE 1982).

Surface water quality is monitored at numerous sampling stations to determine compliance with state regulations and the National Pollutant Discharge Elimination System (NPDES) permit (Fig. 3.6.1). The major discharge of wastewater from ANL is by way of the Wastewater Treatment Plant, which would also receive liquid effluents from the proposed APS facility. Water samples from ANL discharge are withdrawn continuously and analyzed daily for ammonia, nitrogen, total dissolved solids, pH, and the 15 elements for which state standards have been established.

Weekly and monthly surface water samples are collected at 13 sampling stations for the NPDES permit (Golchert and Duffy 1988). Although ten parameters are measured, an average of four is measured at each station. Parameters monitored include flow; total suspended solids (TSS); total dissolved solids (TDS); chlorides; pH; temperature; biological oxygen demand (BOD); chemical oxygen demand (COD); and fats, oils, and grease. The locations of sampling stations include the ANL Wastewater Treatment Plant, Freund Brook near its confluence with Sawmill Creek, and Sawmill Creek both upstream and downstream from the discharge of the Wastewater Treatment Plant.

In April 1987, ANL reviewed its laboratory-wide water monitoring program in connection with the proposed APS project; it is not considered likely that ANL permit modifications would be required for the proposed APS site (Pentecost 1987).

CHAPTER 4 ENVIRONMENTAL CONSEQUENCES OF THE PROPOSED ACTION

4.1 CONSTRUCTION IMPACTS

4.1.1 Land Use and Disturbance

The proposed 28-ha (70-acre) site would be converted from grasslands, fields, and woodlands to a predominantly built-up area including the APS facility and landscaped grounds. Because this property is currently part of the ANL site and has been intended to eventually support energy research facilities, this land conversion is in accord with long-range ANL planning and would have no significant direct effect on land use (ANL 1986). Development of the entire APS site would decrease the amount of undeveloped areas in the ANL property by approximately 15%. No prime farmland subject to protection under the Farmland Protection Policy Act is present on the site (Sect. 3.4.1).

Because of the relatively small size of the additional work force needed (see Sect. 4.3) and the fact that the ANL region is already highly urbanized, any land use effects from a small increase in the ANL work force would be insignificant. No construction would occur in the Waterfall Glen Forest Preserve (including Saint Patrick's Cemetery), which is adjacent to the site. The preserve would not be directly impacted by the proposed action other than by temporary, typical construction noise and insignificant changes in air quality due to the operation of construction equipment. Therefore, construction of APS should have no significant long-term effects on recreation, nature preservation, or other land uses of the preserve.

Excavation and earth moving during construction are discussed in detail in Sect. 2.1.4. Approximately 138,500 m3 (181,100 cubic yards) of material would be excavated during APS construction. The ANL on-site landfill is considered sufficient to accommodate all excess material

Construction could potentially increase erosion, sediment-laden surface runoff, and turbidity and sedimentation of local streams and rivers. An ANL policy for both the Laboratory and its contractors is to use standard soil conservation measures to minimize erosion and sedimentation (Reinsch 1986). The policy states that soil disturbance procedures must comply with EPA manuals, namely "Guidelines for Erosion and Sedimentation Control planning and Implementation" (EPA-R2-72-015) and "Processes, Procedures, and Methods to Control Pollution Resulting from All Construction Activity" (EPA-430/9-73-007). This policy also addresses the disposal of water from construction sites to ensure that surface water quality would not be adversely affected. In compliance with the requirements of the COE nationwide permit, reestablished and newly created wetlands would be protected. An erosion and sedimentation control plan is described in ANL (1987a). Various planned control measures include limiting exposed areas, surface water diversion, velocity control, slope stabilization, collection of runoff, water/solids separation, and postconstruction restoration (Sect. 2.1.4 and ANL 1987a).

4.1.2 Water Quality

4.1.2.1 Surface water

Surface water quality of the streams on the ANL site could be degraded by increased erosion of soils and turbid surface runoff from the construction site. Construction plans, including safe disposal of excess excavated material, and provision of stormwater runoff ponds, are discussed in Sect. 2.1.4 (also ANL 1987a).

Impacts of construction to surface waters would be minimized by adherence to ANL's policy on erosion and sediment control (see Sect. 4.1.1), as verified by monitoring required by ANL's NPDES permit. After construction is completed, unused disturbed areas on the site would be revegetated or restored to minimize the volume and turbidity of surface runoff. Stream turbidity (TSS), a measure of erosion and sedimentation, would be monitored at NPDES permit monitoring points on Freund Brook and Sawmill Creek. No sampling stations would be located on the drainages leading south to the Des Plaines River, which may receive some temporary construction runoff from the on-site stormwater retention basins. Adherence to the ANL erosion control policies (Sect. 4.1.1) should preclude adverse impacts on water quality.

4.1.2.2 Groundwater

There are no significant groundwater impacts resulting from either construction or operation of APS. Groundwater recharge follows an extensive pathway through clay-rich glacial till which adsorbs soluble cations. The pathway through till would not be short-circuited, because excavations do not extend to bedrock. Clay fill removed from the excavation would be disposed of at the ANL sanitary landfill, and topsoil would be made into berms on the APS site for future usage.

The ANL sanitary landfill is designated for disposal of construction wastes from the APS site, including excess excavated soil. This landfill is surrounded by monitor wells which are completed in the glacial till. It is currently operating under IEPA Permit 1981-20-OP (Golchert and Duffy 1988).

4.1.3 Air Quality and Noise

During the construction stages of APS, the principal adverse effects on air quality would result from dust and fugitive emissions of exhaust fumes. The dust would result from vehicular traffic on unpaved surfaces and from earth-moving operations. To the maximum practical extent, dust would be controlled by established engineering practices, chiefly by water sprinkling of all disturbed earth surfaces and earth stockpiles. Exhaust fumes from construction traffic and internal combustion equipment used at the construction site should be rapidly dispersed and, therefore, should not have any significant environmental effects. For both dust and exhaust fumes, any effects would be expected to be temporary and local in nature.

Sound emitted from construction equipment is also expected to be temporary and local in nature. This type of noise is specifically exempted from compliance with Illinois noise pollution control regulations (IPCB 1973, Rule 208-Exceptions). No unusual or significant noise impact is expected from construction of APS.

4.1.4 Ecology

4.1.4.1 Terrestrial biota

Construction of the APS facility would result in the loss of plant and animal communities of the fields, wetlands, and woodlands currently present on the proposed APS site. As noted in Sect. 4.1.1, the undeveloped area of the ANL site would decrease by approximately 15% after construction of APS. Wildlife population levels would be reduced over the long term by an amount generally proportional to the amount of habitat lost (Kroodsma 1985). Except for the fallow deer, the species that would be affected are typical of the

surrounding region and are not particularly rare or important as game animals. Impacts on terrestrial biota would not be significant.

4.1.4.2 Floodplains and wetlands

No impacts are expected on the 100-year floodplain of Freund Brook because construction would not occur in this area (Fig. 3.8.1).

APS construction would, however, result in the filling of three small wetlands that total 0.73 ha (1.8 acres) (Areas A, B, and E, Fig. 3.8.1). These wetlands provide some wildlife habitat but are of relatively low hydrological importance (Table 3.8.1). Other, more important wetlands in the area (Areas C and F) have been avoided in siting the ring, associated structures, roads, and parking lots (See Sect. 3.8.2). ANL erosion control techniques and construction fencing would protect wetlands Areas C and F from indirect impacts such as sedimentation. Any impacts that might occur to these wetlands would be temporary and would cease once construction was completed. Area D has been filled pursuant to U.S. Army Corps of Engineers' permit (Sect. 3.8.2).

There is no practical alternative site on ANL where impacts on wetlands could be avoided. Of four sites considered, two are unacceptable for the APS due to vibration effects and lack of buffer zones (Table 2.2.1). A third site has considerably more wetland that would be impacted and is thus environmentally less desirable than the proposed site.

The COE has issued a permit (permit number 26) for construction in wetlands in accordance with Section 404 of the Clean Water Act. As part of this permit, DOE would consult with the COE on the implementation of plans to mitigate wetland loss. Conceptual design for DOE's proposed mitigation plans focus on the replacement of lost wetlands, with an equivalent amount [0.73 ha

(1.8 acres)] of wetland habitat created in the vicinity of the APS facility within the same watershed of the impacted wetlands. These wetlands would be designed to normally contain saturated soils to support wetland vegetation similar to that in the lost habitats (Appendix B). Soil taken from impacted wetlands would be used for the littoral zones in the new wetlands. This would provide a viable and natural seed source for most plant species currently present. Plants germinating from this seed bank would be adapted to local conditions and should speed the establishment of wetland vegetation within the created wetlands. Detailed engineering specifications for the created wetlands would be provided to the COE before implementation. Included in this design would be consideration for ensuring rain water reaching the wetlands would be of similar quality to that which have reached the wetlands prior to the construction of the APS. Water directed to existing wetland "F" from the parking lot area north of the APS facility would be drained into the storm water system. This contains a four foot deep by four foot in diameter catch basin. This basin collects larger gravel and sediment. The water is then directed through an eight inch ceramic half trap to a 22 inch square water trap within the basin, similar to a baffle in a septic system, which prevents oil from leaving the basin with the water. The water then flows into detention basin "C". The flow of the water over the grass in the detention basin would filter out fines resulting in a reduced amount of suspended particles reaching wetland "F". The catch basin will be designed to meet the Dupage County Ordinance. This is sized to meet a 100 year, 24 hour storm having an intensity of 5.75 inches per 24 hours. To prevent flushing of the catch basin, a sand filter has been added to retard the flow of water. This desirable mitigation has been added to prevent impacts to the nearby wetland "F". Annual reports on vegetation and fauna would be provided to the COE for

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5 years following construction of the new wetlands. With mitigation in place, significant impacts to wetlands are not expected.

4.1.4.3 Aquatic biota

Because permanent streams are lacking on the site and the fish and invertebrate communities of Freund Brook and Sawmill Creek are relatively depauperate, there is little potential for construction impact on significant aquatic resources. Since earth-moving procedures would conform with ANL policy (Sects 2.1.4 and 4.1.1; and ANL 1987a), impacts would be minimized, although some temporary increases in stream turbidity from construction site runoff could be expected during storm events. Populations of some species of aquatic biota might be temporarily reduced as a result of the increased turbidity but should subsequently recover and suffer no long-term impacts.

4.1.4.4 Threatened and endangered species

No federally listed threatened or endangered species are known to occur on the APS site (Sect. 3.8.4). An unconfirmed capture of an Indiana bat in nearby Waterfall Glen Forest Preserve indicates that this bat species may occur on ANL. A principal concern regarding the Indiana bat is the loss of streamside habitat that has a well-developed riparian forest. Because this type of habitat would not be affected by the project, the FWS has determined that the Indiana bat would not be adversely impacted (Appendix C). A question arose about the potential occurrence on the site of the Indiana bat (Myotis sodalis), but consultation with FWS determined that suitable habitat for this species does not exist at the APS site (Appendix C). Locations that support the black-crowned night heron and hairy marsh yellow cress (Areas F and C, respectively; see Fig. 3.8.1), both state-listed species, would be avoided by

APS construction activities. Consequently, no significant impacts to threatened or endangered species are expected to result from construction or operation of the APS facility.

4.2 NORMAL OPERATION IMPACTS

4.2.1 Surface Water Use and Quality

Water for drinking, cooling, and other uses at the APS would be obtained from the existing ANL water supply system. Water for domestic and laboratory use at ANL is obtained from wells on the site, whereas water for process cooling is withdrawn from the Chicago Sanitary and Ship Canal (Fig. 1.2.1). Canal water usage would be limited to noncontact cooling water, free from process and other wastewater discharges. Discharge of cooling water blowdown would be via the sanitary sewer system through ANL's NPDES water effluent outfall 001. The estimated water usage for APS is compared in Table 2.1.1 with that of ANL as a whole and with the excess system capacity.

The predicted APS demand for cooling water would change total ANL cooling water usage from 1125 to 2625 m3/d (0.3 to 0.7 Mgd) (Sect. 2.1.2). Cooling water blowdown would be discharged to the ANL sanitary treatment plant at a predicted rate of 380 to 1900 L/min (100 to 500 gal/min) depending on the season. The increased demand on the ANL sanitary sewer system from APS activity, including cooling water and sanitary waste, is estimated at an additional 113,600 L/d (30,000 gal/d). This represents an increase of only 3% of the excess capacity. Sludge generation at the sewage treatment plant from APS activity is expected to increase only an additional 3 m3/year (4 cubic yards per year), which represents an additional demand of only 0.01% of the permitted disposal limit at the ANL solid-waste landfill.

ANL currently uses 1500 m3/d (0.4 Mgd) of domestic water for a population - of 3760 (Table 2.1.1). The water treatment facility has a capacity of 4540 m3/d (1.2 Mgd), and the anticipated APS domestic water usage represents an increase of only 4% of the Laboratory excess capacity.

APS water consumption would have no significant effects on public communities surrounding ANL. The pumpage rates of these communities declined 10.3% from 1980 to 1985 (Sasman et al. 1986) and are expected to continue declining as they convert from well water to Lake Michigan water usage (Pentecost 1987).

No liquid effluents from APS are anticipated other than stormwater runoff, cooling tower blowdown, laboratory drains, and sanitary wastes. Wastes such as trace amounts of organic solvents, toxic proteins, microbiological products, heavy metals, and radioactive and carcinogenic waste products would be handled in accordance with regulations and ANL waste management procedures and are not expected to pose any environmental problem. Effective restoration and landscaping of the site after construction and planned storm water runoff detention basins (Sect. 2.1.4 and ANL 1987a) should minimize the amount of sediment-laden runoff to the extent that streams would not be significantly affected during or after the plant construction phase.

Conformance with the NPDES permit would also ensure that construction of the proposed APS would have little impact on water quality in Freund Brook and Sawmill Creek.

The design capacity of 4770 m3/d (1.26 Mgd) for the sewage treatment plant (Table 2.1.1) is based upon an estimated ANL population of 7000 (Pentecost 1987). Current ANL population is 3760, however, and the plant treats 1500 to 1900 m3/d (0.4 to 0.5 Mgd) of sewage. The projected ANL population, after full APS operation is attained, is about 4060 full time-

equivalent workers (300 temporary personnel and 300 new employees). Therefore, adequate capacity is available for sewage treatment. The additional 113,600-L/d (30,000-gal/d) sanitary sewage discharge, which includes treated cooling water blowdown from APS activities, should have no significant effect on surface water quality.

Cooling tower blowdown and sanitary wastes would be discharged to ANL's Wastewater Treatment Plant via the sanitary sewer system for treatment along with other ANL wastes before release to Sawmill Creek through NPDES outfall 001. All cooling water additives (phosphate-based inhibitors, microbiocides, and chlorinating compounds) are biodegradable and can be treated at the Wastewater Treatment Plant. No zinc or chromate corrosion inhibitors would be used. Discharges from this plant, which has sufficient excess capacity (Table 2.1.1) to handle the APS-generated wastes, are monitored for criteria elements and other parameters to meet state of Illinois water quality criteria and specifications of the Laboratory's NPDES permit (Golchert and Duffy 1988). Flow, pH, temperature, and TSS would be monitored at NPDES location 001. APS cooling water discharged to the sanitary sewer system would range in temperature from 16oC (60oF) (winter) to 35oC (95oF) (summer). The maximum temperature rise above the natural temperature of the receiving stream below the NPDES outfall location 001 would not exceed permit requirements [2.8oC (5oF)].

4.2.2. Sludge Impacts

The current average usage of canal cooling water [1135 m3/d (0.3 Mgd)] generates approximately 76 m3 (100 cubic yards) of sludge per year. The sludge is removed from holding ponds once a year and is disposed of in the ANL landfill. An additional demand of 1513 m3/d (0.4 Mgd) cooling water for APS would increase the total ANL sludge generation to a maximum of 192 m3 (250 cubic yards) per year. Sludge would be removed from the holding ponds once every 8 months. The additional increase of 115 m3 (150 cubic yards) of disposal in the ANL landfill represents only a 0.5% increase in the permitted limit [22,900 m3/year (30,000 cubic yards per year)]. Sludge generated from the APS sanitary waste would increase the demand an additional 4 cubic yards per year. This represents an increase of only 0.01% in the permitted limit of the ANL landfill. The impact on ANL sludge management operations and disposal would be minimal.

4.3 Power Demand

The projected need of electric power for the proposed APS is relatively large. It amounts to 23-MVA average, with a peak demand of 34 MVA. This would represent an increase in average power demand for ANL from 15 to 38 MVA [i.e., a 153% increase (Table 2.1.1)]. However, this represents only a 19% decrease in excess power capacity available at ANL. Thus, the APS power demand is not expected to significantly affect the availability of electricity in the area of Chicago and its suburbs.

Because power for APS would be obtained from an existing substation (Sect. 2.1.2), no new power lines would need to be built (i.e., no additional land would need to be disturbed).

4.2.4 Air and Noise Impacts

Air impacts due to APS operation may result from car exhaust emissions and from the APS mechanical recirculating-type cooling towers. About 300 to 600 people are expected to be involved with the operation and use of APS on a continuous basis (Sect. 4.3), and they would arrive at and leave the area by

car. Car exhaust fumes at APS would, however, constitute fugitive emissions occurring mainly at the start and closing of business. The increase in emissions from APS-related traffic would constitute only about 10% of car exhaust emissions at ANL. These emissions would occur over a short period of time and would rapidly disperse with insignificant additional environmental effects.

Based on experiences of similar facilities, operation of APS is not expected to generate significant amounts of gaseous or particulate emissions. During certain atmospheric conditions, moisture from APS cooling towers could cause temporary reduction of visibility in nearby (mainly on-site) roads. However, a cemetery road near the APS site is not heavily traveled, and this temporary off-site impact is not expected to be significant.

Operation of APS would generate some noise, caused particularly by site traffic and by compressors and cooling towers. However, these facilities would be designed to the Illinois State Noise Standards and DOE criteria for occupational safety and health. The effect of such noise, typical of accelerator facilities, is not considered unusual or particularly significant to raise an environmental issue.

4.2.5 Radiological Impacts

The primary exposure of an individual in the vicinity of APS during operation would be to (gamma-ray and neutron) penetrating radiation. shielding planned for the facility would ensure that during normal operation the occupational external radiation dose to a worker at the highest exposure point, against the ratchet wall, on the experimental floor for 2000 hours per year would be less than 120 mrem/year. This is less than 2.4% of the standard (DOE 1988b) for exposure to radiation workers. This and exposures to other

individuals are based on information provided in Moe 1989b. For example, the maximum possible annual dose equivalent to an individual working within the APS Laboratory/Office Module, 12 m (40 ft) from the storage ring, would be less than 6 mrem/year. These are conservative estimates in that they do not include reductions for shielding by building structures that house such workers and are based on the APS running at the maximum design conditions. The above calculations are based upon 0.3 A circulating current, a energy of 7 GeV and a person experiencing operation of the machine at 2000 hours per year. Typical operating conditions would result in much lower exposures.

The annual dose equivalent to a hypothetical member of the public at the closest approach, the site boundary 140 m (462 ft) from the APS, would be approximately 6 mrem/year based on an 8000 h/year operation. About 2 mrem/year would be due to direct external radiation, and 4 mrem/year would be due to skyshine (Cho 1989b). Skyshine is radiation which is emitted upward to the sky and is scattered back to the earth by the air molecules. The nearest resident (Sect. 3.3) is 1.4 km (0.9 mile) west southwest of the APS site and could be expected to receive less than 0.05 mrem/year. Individuals in the closest subdivision, 2.1 km (1.3 miles) due northwest, could be expected to receive less than 0.02 mrem/year. All off-site estimated doses are low compared with the DOE standard of 100 mrem/year. Also, the dose rates estimated for the boundary, nearest resident, and closest populated subdivision are conservative in that they do not include reductions due to shielding by residential structures or absence from the residence.

The Biomedical X-ray Complex (ANL 1987b) is not expected to emit any more radiation than that resulting from X-ray facilities currently in use in hospitals. Thus, no additional dose to the public is expected from the proposed APS facility.

Because there would be normal positron losses around the 1.104 km (0.7 mile) circumference of the accelerator, there would be some activation of components of the vacuum chamber, magnets, and other materials within the accelerator shielding enclosure. The residual radioactivity is expected to be fixed within the accelerator components inside the shielding enclosure. The activated materials would be controlled in accordance with routine ANL health physics practice to protect workers and the public.

The production rate of activated air products such as carbon-11, nitrogen-13, and oxygen-15 is estimated to be about 350 nCi/(m3.d) (see Sect. 2.1.3). Application of the AIRDOS-EPA atmospheric dispersion computer code gives a maximum fence-line dose of 6.0 xl0-2 mrem/year. This annual dose is extremely small compared with applicable standards for exposure and that received from natural radiation background (NCRP 1987).

Short-lived activation products can also be produced in the cooling water but at rates about an order of magnitude lower than in air. The primary activation product in water is oxygen-15, which has about a 2-min half-life. These products would result in a dose to the worker less than 1 mrem because the cooling water is in a closed system. In the event of a leak, the short half-life of this product precludes exposures to the public by all pathways.

It is planned to use gamma monitors for the entire APS system: 8 monitors for the linear accelerator, 4 for the transport line from this accelerator to the synchrotron, 16 for the synchrotron, 4 for the transport line from the synchrotron to the storage ring, and 64 for the storage ring (Pentecost 1986). Monitoring of air and water would be performed routinely at APS to ensure protection of the public.

4.2.6 Ecological Effects

Operation of the proposed APS would have little potential for impact on ecological resources beyond those occurring during the construction phase. Although APS operation would cause some disturbance of wildlife in its vicinity, little additional loss of wildlife habitats is expected. The cooling towers would be relatively small and would not emit sufficient drift to affect vegetation in the area. Effective site restoration and wastewater treatment would minimize impacts on water quality (Sect. 4.2.1), thus preventing significant impact on aquatic biota. The small increase in cooling water consumption from the Chicago Sanitary and Ship Canal would not have significant entrainment/impingement effects on aquatic biota.

4.3 SOCIOECONOMIC EFFECTS

Socioeconomic impacts of construction and operation are evaluated. Although the construction schedule for APS is not firm, construction probably would involve up to 250 workers. As this number decreases during the last 3 years of construction, the APS technical-administrative staff would gradually increase to a stable-operation work force of about 300 persons. The total number of personnel connected with APS is not expected to exceed 600 people at any time.

Considering that a number of APS workers would transfer from existing ANL activities to APS, the actual number of staff added to the current ANL work force of 3760 persons by APS would be relatively small (8-16%). Most of the ANL work force lives within a 32-km (20-mile) radius of ANL, with about 50% of these people living at distances greater than 16 km (10 miles) (ANL 1986). It is assumed that the additional APS work force would have the same residence pattern as existing employees. Since housing and services are not limited within the ANL commuting area, no significant socioeconomic impacts are expected from the additional work force to an area that has 3.5 million people within the 32-km (20-mile) radius of ANL.

4.4 EFFECTS ON CULTURAL, HISTORICAL, AND ARCHAEOLOGICAL RESOURCES

Under 36 CFR Pt. 800, DOE initiated consultation in 1986 with the State Historic Preservation Officer (SHPO) concerning APS construction activities that may affect cultural resources. SHPO provided technical guidelines for the cultural resource compliance work carried out in the project area. Investigation of prehistoric and historic resources located at the proposed APS site was undertaken by ANL staff archaeologists. Survey work was conducted in 1986 and 1987 field seasons to identify and determine the location of cultural resources in the APS project area. Shovel testing in wooded areas and systematic surface collecting in open areas were the survey methods used. The open areas were shallow-plowed and disked for this sampling. The study area and survey methods used are depicted in Fig. 3.4.1. Evaluation of these cultural resource sites involved additional surface collecting, mapping, limited test excavations, top soil stripping, and laboratory analysis. A three-volume set of reports (EES 1988) was completed and presented for DOE and SHPO review in October 1988.

Based on their evaluation of the report (Cultural Resources at ANL's Advanced Photon Source Project Area: Volumes 1-3) (EES 1988), SHPO and DOE agreed that sites ANL-28, ANL-29, and Feature 270 associated with ANL-6 contained sufficient information to be considered eligible for the National Register of Historic Places (NRHP). DOE determined that the APS project would potentially affect the eligible sites and consulted with the Advisory Council

on Historic Preservation (ACHP) and SHPO pursuant to the regulations (36 CFR Pt. 800) implementing Section 106 of the National Preservation Act (16 U.S.C 470). Consequently, DOE, ACHP, and SHPO negotiated a Programmatic Agreement (see Appendix A). The agreement stipulated that DOE would develop and implement a data recovery plan in compliance with federal regulations and laws subject to SHPO review and monitoring. This data recovery plan has been developed and approved by both ACHP and SHPO. An area east of E 31850 to E 32805 (Fig. 3.4.1) has also been fully evaluated for the Utility Building. This was handled under the archaeological reconnaissance survey work stipulated by the Programmatic Agreement, item 1. Further, DOE will also continue archaeological reconnaissance surveys in consultation with the SHPO of all areas of project impact not previously surveyed.

4.5 ABNORMAL EVENTS

In any facility, the potential always exists for the occurrence of unusual or abnormal events that may have harmful consequences on-site or off-site. In a high-voltage radiation facility such as APS, fire, lethal electric shock, and/or a radiation burst could conceivably occur.

Although the ANL site is fenced and regulated by a security force, the possibility for sabotage by dissident individuals or groups cannot be overlooked. However, ANL is engaged in R&D and continues to maintain an open posture with respect to its endeavors. For this reason, the likelihood of sabotage on the site, and particularly at the proposed APS facility, is not considered high. In any case, any potential act of sabotage that could be sustained by APS would appear to involve only the disruption of operations but no detrimental effects to the off-site environment.

Standard fire protection systems would be provided for APS in accordance with DOE standards except the Experiment Hall. A separate property damage limitation exemption request has been submitted that will provide the same level of protection from fire and smoke damage and will not negatively impact the programmatic capability of the facility. The proposed fire protection system for the Experiment Hall does not in any way compromise the safety of the inhabitants and meets life safety codes. These features bring the proposed facility within the intent of DOE Order 5480.7 and ensure that all reasonable efforts have been made to reduce loss. The APS facilities pose no unusual threat, and no off-site consequences can be foreseen from typical industrial accidents and natural events such as tornadoes and earthquakes.

From the radiation standpoint, the maximum credible incident for the APS is based upon a scenario in which the positron beam with a circulating current at the maximum design capability of 0.3 A begins to wander as the result of erratic magnet behavior and strikes the walls of an insertion device creating

Bremsstrahlung radiation (probability of this event is once in 16,000 years or less than 10-4). The radiation then proceeds down the optical beam line striking the lead stop in the optical beam enclosure. The resulting radiation could shower an individual standing just beside the enclosure. The largest accidental radiation dose an occupational worker could receive from the APS facility given this condition is 1.17 rem. This dose is 23% of the applicable exposure limit of 5000 mrem/year for workers in controlled areas (DOE 1988b). This radiation will have attenuated at 20 m (66 ft) to 7.5 mrem. At the site boundary, 140 m (462 ft) from the APS, the dose would be reduced to less than 1 mrem (i.e., less than 1% of the revised applicable standard of 100 mrem/year) (Sect. 4.2.4, DOE 1984 and Moe 1989b). Thus, no significant off-site (or on-site) impact from a radiation accident may be expected at APS.

4.6 IMPACTS OF DECOMMISSIONING

It is difficult to predict with any certainty the date for decommissioning the APS facility because of the conditions described in Sect. 2.1.5. Given this uncertainty, a detailed decommissioning plan for the APS would be developed at an appropriate time in the future. Thus, potential environmental impacts associated with APS decommissioning are discussed only generally in this EA. The potential APS decommissioning impacts will be fully evaluated as necessary in subsequent documentation. Generally, the potential radiological and nonradiological impacts presented in this section are derived from actual experience in the decommissioning of similar accelerators at ANL and elsewhere (Huebner 1988a).

4.6.1 Nonradiological Effects

Nonradiological effects associated with decommissioning work would be similar to installation of technical components during the construction phase (i.e., noise, dust, and exhaust emissions from carrier-transporting equipment, etc.) (see Sect. 4.1.3). Environmental impacts from these activities would be temporary and would have no short- or long-term effects on the site or neighboring area. No special or hazardous liquids would be required for this process. Nonradioactive solid materials would be salvaged or disposed of in a permitted sanitary landfill.

No significant impacts on site land commitment are expected. Interim space for temporary storage of excess materials could be allocated in the APS experiment hall and other support buildings. Staging areas for the preparation, packaging, and carrier-loading activities could also be accommodated within the APS facilities.

The work force for decommissioning would be small compared with that required for construction or operation. Similarly, traffic associated with decommissioning would be no greater than for construction. Therefore, there would be no significant socioeconomic impact to the metropolitan Chicago area.

4.6.2 Radiological Effects

Estimates of the levels of induced radioactivity in the components of the APS facility have been made (Huebner 1988b). The dominant radioactivities would occur from activation of the iron in the magnets (Sects. 2.1.3 and 4.2.4). Most of the products would be short-lived and would decay in place during the life of the facility. At the end of a 30-year life of the project the estimated level of intermediate- and longer-lived radionuclides would be millicurie amounts. These would be fixed within the accelerator components and would decay. The production of radionuclides in other components, such a aluminum, concrete, and lead, would be at least an order of magnitude lower.

Decommissioning of the APS accelerator facility can be divided into two categories for radiological consideration: accelerator and shielding components that can be reused at another accelerator facility and accelerator components that cannot be reused.

Most of the decommissioned accelerator components would belong to the reusable category. Reusable components would have either nondetectable or very low activation levels. It is expected that any activation products would be fixed within the materials and, thus, that only minor surface decontamination procedures would be required. Consequently, conventional health physics control procedures for the handling of low-level radiation during storage, shipping, and reinstallation at another location are adequate to ensure no significant environmental impact.

Nonreusable accelerator components are radiologically similar to those that can be reused but, for technical or economic reasons, disposal is the preferred option. The positron production target and shield are expected to be in this category, but they present no unique decontamination and decommissioning problems or potential for significant environmental impact. Conventional health physics surveillance and control during storage and packaging operations and shipment under DOT specifications to a DOE-approved low-level radioactive waste disposal site are adequate to limit the potential for radiation dose to the public to below permissible levels. Total radiological wastes are estimated to be less than 1.0 m3 (1.3 cubic yards).

Based on experience gained from the decommissioning of comparable electron accelerators at other locations in the past and of the 12-GeV Zero Gradient Synchrotron at ANL in the early 1980s, no significant environmental impact is anticipated from decommissioning operations for the APS.

4.7 SUMMARY

While potential impacts to wetlands and to cultural resources exist at the proposed APS site, effects of construction and operation of APS on land and water quality are not expected to be significant. Standard soil conservation measures would be used to minimize land erosion, sedimentation, dust generation, and water turbidity (Sects. 2.1.4, 4.1.1, 4.1.2 and 4.1.3). The Area D pond site (Fig. 3.8.1) would be avoided during APS construction (Sect. 3.4.1).

Operation of APS would pose a sizable demand for electric power and for cooling water from the Chicago Sanitary and Ship Canal. However, the projected total ANL demand (including APS) is only 19% of electric power excess capacity and 11% of cooling water excess capacity (Sects. 4.2.1 and

4.2.2). Cooling tower drift is not expected to significantly affect vegetation because of the use of biodegradable additives and the relatively small size of the cooling towers.

No federally listed threatened or endangered plant or animal species are known to inhabit the ANL area (Sect. 4.1.4.4). Although there was an unconfirmed report of an Indiana bat near ANL, consultation with the FWS determined that no suitable habitat for the bat would be affected by the project (Appendix C). Locations that support state-listed species would be avoided by APS construction activities (Sect. 4.1.4.4).

Insignificant amounts of air emissions and limited noise would be expected from the APS operation. APS construction would generate fugitive exhaust emissions and noise from construction equipment, but these emissions would be limited to the construction period (Sect. 4.1.3).

Construction of APS would affect approximately 0.73 ha (1.8 acres) wetland habitat and would require a Section 404 (Clean Water Act) permit from the COE (Sect. 4.1.4.2). DOE has received a permit from the COE for construction in the wetlands. Contacts have been established with the COE to monitor mitigating actions. Mitigation plans include construction of two wetlands that would provide at least 0.73 ha (1.8 acres) of similar habitat to assure no net loss of wetlands at the site. These would be constructed at the beginning of the facility construction and would mimic both the physical and biological setting of the destroyed wetlands as closely as possible.

One major concern in a facility such as APS is stray penetrating (gamma or neutron) radiation. The design shielding for APS is appropriate for its staff and also for the off-site environment, where the calculated gamma radiation dose to the nearest resident is less than 0.05% of the applicable standard of 100 mrem/year (Sect. 4.2.5). A few short-lived radionuclides

would be generated in air, during APS operation, at the rate of 350 nCi/m3d (Sect. 4.2.5). However, air dispersion analysis shows that the dose at ANL's fence line would be insignificant (6.0 x 1O-2 mrem/year). Applications for a NESHAP permit and an air emissions permit have been submitted to the EPA and IEPA, respectively. In the event of any release of cooling water due to such events as an undetected leak, the short half-life (2 min) of oxygen-15 in the cooling water precludes a dose to the public from this pathway. APS operation plans include 96 gamma-ray monitoring stations for the accelerator system and storage ring.

No significant socioeconomic impacts are expected from the addition of a relatively insignificant work force (about 0.06%) to the population within a 32-km (20-mile) radius from ANL (Sect. 4.3). However, construction of APS could potentially disturb some historic and archaeological sites. A Programmatic Agreement was signed by DOE (Appendix A), the Illinois SHPO, and the ACHP, by which DOE is committed to develop and implement a data recovery plan to protect cultural resources at the APS site. This plan has been developed by DOE and has been approved by the Illinois SHPO and the ACHP.

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LIST OF PREPARERS

This environmental assessment was prepared for the U.S. Department of Energy by the Integrated Analysis and Assessment Section, Energy Division, Oak Ridge National Laboratory (operated by Martin Marietta Energy Systems, Inc., for the U.S. Department of Energy). The following members of the ORNL technical staff contributed to this task:

R. B. McLean; Ph.D., Marine Biology; Program Manager

E. Ricci; Ph.D., Chemistry; APS EA Project Leader

R. L. Kroodsma; Ph.D., Zoology

R. L. Miller; M.S., Meteorology

W. P. Staub; Ph.D., Geology/Soils Engineering

J. P. Witherspoon; Ph.D., Plant Ecology (radiological effects)

M. Swihart; M.S., Landscape Architecture

Appendix A
PROGRAMMATIC AGREEMENT REGARDING CULTURAL RESOURCES
AT ANL'S ADVANCED PROTON SOURCE SITE, AND ATTENDANT CORRESPONDENCE BETWEEN THE ILLINOIS HISTORIC

PRESERVATION AGENCY AND THE U.S. DEPARTMENT OF ENERGY

PROGRAMMATIC AGREEMENT
AMONG THE U.S. DEPARTMENT OF ENERGY,
THE ADVISORY COUNCIL ON HISTORIC PRESERVATION, AND
THE ILLINOIS STATE HISTORIC PRESERVATION OFFICER
FOR THE ADVANCED PHOTON SOURCE PROJECT
AT ARGONNE NATIONAL LABORATORY

WHEREAS, the Department of Energy (DOE) proposes to construct and operate the advanced Photon Source at the Argonne National Laboratory, DuPage County, Illinois, and

WHEREAS, the DOE has determined that this project will have an effect upon properties eligible for listing on the National Register of Historic Places and has consulted with the Advisory Council on Historic Preservation (Council) and the Illinois State Historic Preservation Officer (SHPO) pursuant to Section 800.13 of the regulations (36 CFR Part 800) implementing 106 of the National Historic Preservation Act (16 U.S.C. Section 470f);

NOW, THEREFORE, the DOE, the Illinois SHPO, and the Council agree that the project shall be implemented in accordance with the following stipulations to satisfy the DOE's Section 106 responsibilities for the project.

Stipulations

The DOE will ensure that the following measures are carried out.

I. ARCHAEOLOGICAL SURVEY

A) The DOE shall ensure that an archaeological reconnaissance survey (Phase I) will be performed in all project areas which have not already been surveyed. An archaeological intensive survey (Phase II) will be performed at all historic properties identified during the reconnaissance survey. These surveys will be conducted in a manner consistent with the Secretary of the Interior's Standards and Guidelines for Identification (48 FR 44720-23) and taking into account the National Park Service publication The Archaeological Survey: Methods and Uses (1978) and the Illinois State Historic Preservation Office Guidelines for Archaeological Reconnaissance Surveys/Reports. The survey shall be conducted in consultation with the Illinois SHPO, and a report of the survey, meeting the standards of the Illinois SHPO, shall be submitted to the Illinois SHPO for review and approval.

B) In consultation with the Illinois SHPO, the DOE shall evaluate properties identified through the survey against the National Register criteria (36 CFR Part 60.4). For those properties which the DOE and the Illinois SHPO agree are not eligible for inclusion in the National Register of Historic Places, no further archaeological investigations will be required, and the proposed project may proceed in those areas. If the survey results in the identification of properties that the DOE and the Illinois SHPO agree are eligible for the National Register, such properties shall be treated in accordance with Part II below. If the DOE and the Illinois SHPO do not agree on National Register eligibility, or if the Council or the National Park Service so request, the DOE shall request a formal determination of eligibility from the Keeper of the National Register, National Park Service whose determination shall be final.

II. ARCHAEOLOGICAL DATA RECOVERY (Phase III)

A) Archaeological sites which are considered eligible for the National Register, including sites ANL-28, ANL-29, and Feature 270 associated with site ANL-6, will be treated in the following manner:

1. The DOE shall ensure that a data recovery plan addressing substantive research questions is developed in consultation with the Illinois SHPO for the recovery of relevant archaeological data. The plan shall be consistent with the Secretary of the Interior's Standards and Guidelines for Archaeological Documentation (48 FR 44734-37) and take into account the Council's Publication, Treatment of Archaeological Properties. It shall specify, at a minimum, the following:

- o the property, properties, or portions of properties where data recovery is to be carried out;

o the research questions to be addressed through the data recovery, with an explanation of their relevance and importance;

o the methods to be used, with an explanation of their relevance to research questions;

o proposed methods for disseminating results of the work to the interested public; and

o a proposed schedule for the submission of progress reports to the DOE and the Illinois SHPO.

2. The data recovery plan shall be submitted by the DOE to the Illinois SHPO for fifteen (15) days review and approval. After approval, the DOE shall then ensure that the data recovery plan is implemented. The Illinois SHPO shall monitor this implementation. If within fifteen (15) days of receipt of the plan, the Illinois SHPO has not responded, the DOE shall implement the data recovery plan as submitted.

B) The DOE shall ensure that the data recovery plan is carried out by or under the direct supervision of an archaeologist(s) who meets, at minimum, the Secretary of the Interior's Professional Qualifications Standards (48 FR 44738-9).

C) The DOE shall ensure that adequate laboratory time and space are available for analysis of osteological, cultural, and biological materials recovered from the excavations.

D) The DOE shall ensure that an adequate program of site security from vandalism during data recovery is developed in consultation with the Illinois SHPO, and then implemented by the DOE.

III. CURATION AND DISSEMINATION OF INFORMATION

A) In consultation with the Illinois SHPO, the DOE shall ensure that all materials and records resulting from the data recovery conducted at Argonne National Laboratory are curated at a repository within the state of Illinois and in accordance with 36 CFR Part 79. If human remains are recovered, the signatories to this Agreement shall consult further to determine the appropriate disposition of the remains.

B) The DOE shall ensure that all final archaeological reports resulting from actions pursuant to this Agreement will be provided in a format acceptable to the Illinois SHPO, and to the National Park Service for possible peer review and submission to the National Technical Information Service (NTIS). The agency official shall ensure that all such reports are responsive to contemporary standards, and to the Department of the Interior's Format Standards for Final Reports of Data Recovery Programs (42 FR 5377-79). Precise locational data may be provided only in a separate appendix if it appears that its release could jeopardize archaeological sites.

IV. DISPUTE RESOLUTION

The DOE and the Illinois SHPO shall together attempt to resolve any disagreement arising from implementation of this Agreement. If the DOE determines that the disagreement cannot be resolved, the DOE shall request the further comments of the Council in accordance with 36 CFR Part 800.6(b). Any Council comment provided in response will be taken into account by the DOE in accordance with 36 CFR Part 800.6(c)(2), with reference only to the subject of the dispute. The DOE's responsibility to carry out all actions under this Agreement that are not the subjects of the dispute will remain unchanged.

Execution and implementation of this Programmatic Agreement evidences that the Department of Energy as satisfied its Section 106 responsibilities for all individual undertakings of the project.

ADVISORY COUNCIL ON HISTORIC PRESERVATION

Executive Director Date 2/17/89

ILLINOIS STATE HISTORIC PRESERVATION OFFICER

State Historic Preservation Officer Date 2-14-89

DEPARTMENT OF ENERGY

Title   Date   2/15/89

Ronald J. Lutha

7 Gev Project Manager

Illinois Historic

Preservation Agency

Old State Capitol * Springfield. Illinois 62701 (217) 782-4836

217/785-4512

November 1, 1988

Mr. Ronald J. Lutha

7 GeV Project Manager

Advanced Photon Source

Department of Energy

Argonne Area Office

9800 South Cass Avenue

Argonne, IL 60439

Dear Mr. Lutha:

Our staff has reviewed the cultural resources documentation presented in your report Cultural Resources at Argonne's Advanced Photos Source Project Area: Volumes 1-3 and in our meeting/field inspection at Argonne Lab on 7 October, 1986. Based upon that information it is our opinion that three of the investigated properties, i.e. ANL 23, ANL 29, and Feature 270 with associated area ANL 6, contain sufficient information to be considered eligible for the National Register of Historic Places.

l) Historic archaeological site ANL 28 represents an initial early 1540-1850 occupation by Irish laborers who, by the 1870's, were absorbed into the larger agrarian community. This site contains our first opportunity to examine the archaeological aspects, at the household-level, of the social and economic impact of the construction of the Illinois and Michigan Canal in northeastern Illinois. It provides a unique opportunity to examine the transformation of the material culture as the economic focus of the household changed from that of a laborer to that of a farmer. In our opinion, ANL 28 possesses sufficient archaeological significance for listing on the National Register of Historic Places under criterion d.

2) Historic archaeological site ANL 29 represents an early mid-nineteenth century farmstead whose high degree of integrity will provide important insights into the development of the agrarian economic pattern in the greater Chicago area during the heyday of the Illinois and Michigan Canal. This site is especially important as a comparative base for developing a perspective on the material culture of such agrarian household when considered in conjunction with ANL 28. In our opinion ANL 29 possesses sufficient archaeological significance for listing on the National Register of Historic Places under criterion d.

3) Feature 270 represents a late prehistoric or early protohistoric earthworks radiocarbon dated to the 16th century. Chronologically and culturally, this ditch feature would appear to be related to the late Upper Mississippian manifestations is the greater Chicago area. This unique feature can provide critical information on a poorly understood period in Illinois' archaeological record. In our opinion, Feature 270 and its associated area ANL 6 possesses sufficient archaeological significance for listing on the National Register of Historic Places under criterion d.

In our opinion, the level of documentation also demonstrates that prehistoric sites ANL 4 and ANL 23 do not possess sufficient integrity or contain adequate information to be considered eligible for the National Register of Historic Places. It is necessary, however, that analysis of the materials from these sites be completed as part of the Phase II report process.

If the Department of Energy agrees with our findings that ANL 28, ANL 29 and Feature 270 and associated area ANL 6 are eligible for the National Register of Historic Places, this concurrence should be stated in a letter to our office as soon as possible. Under 36 CFR Part 800.4 (c) in cases where the SHPO and the Federal Agency concur, "the properties shall be considered eligible for the National Register for Section 106 purposes."

Additionally, it is our opinion that the construction of the Advanced Photon Source Project at Argonne National Laboratory will have an adverse effect on these eligible cultural resources. To mitigate the project impact on the resources we suggest that the Department of Energy and the Illinois SHPO enter into a Memorandum of Agreement (MOA) detailing a procedure to take into account these effects pursuant to 36 CFR Part 800.5(e)(4). Please note that we have provided a space for the signature of a representative of the Argonne National Laboratory to sign as a concurring party. We have attached such a MOA for your perusal and signature.

If the Department of Energy finds the enclosed MOA suitable, a signed copy accompanied by the documentation specified in 36 CFR Part 800.8(b) and (c) should be forwarded to the Advisory Council on Historic Preservation (The Old Post Office Building, 110 Pennsylvania Avenue, NW, #809, Washington, D.C. 20004) for their review.

If you have questions on the process or require additional information, please contact Thomas E. Emerson, Chief Archaeologist at the above referenced number.

Sincerely,

Theodore W. Hild
Deputy State Historic
Preservation Officer

TWH:TEE

Enclosed: MOA

bc: Betsy Updike

Ted Hild

Appendix B
WETLANDS PERMIT AND ATTENDANT CORRESPONDENCE AMONG THE U.S. ARMY CORPS OF ENGINEERS, THE ILLINOIS ENVIRONMENTAL PROTECTION AGENCY, THE U.S. DEPARTMENT OF ENERGY, AND ARGONNE NATIONAL LABORATORY

DEPARTMENT OF THE ARMY

CHICAGO DISTRICT, CORPS OF ENGINEERS

111 NORTH CANAL STREET

CHICAGO, ILLINOIS 60606-7206

4 OCT 1989

REPLY TO

ATTENTION OF

Regulatory Functions Branch

1708901

Mr. Robert C. Wunderlich, Project Manager

7 GEV Advanced Photon Source

Department of Energy

Argonne Area Office

9800 South Cass Avenue

Argonne, Illinois 60439

Dear Mr. Wunderlich:

This is in response to your September 26, 1989 letter regarding the proposed wetland mitigation plan for the 7GEV Advanced Photon Source. The relocated mitigation wetland will bring the project into compliance with the conditions of Nationwide Permit number 26. We are still expecting to receive final design and 5-year monitoring and management plans for the mitigation area.

If you have any questions, please contact Ms. Constance Hunt of the Regulatory Functions Branch at 312/353-6491.

Sincerely,

James E. Evans, P.E.
Chief, Construction Operations
Division

ARGONNE AREA OFFICE

OCT -6 1989

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SEP 26 1989

Mr. James E. Evans, P.E.
Chief, Construction Operations Division
U.S. Army Corps of Engineers
111 N. Canal Street
Chicago, Illinois 60604

Dear Mr. Evans:

SUBJECT: ADVANCED PHOTON SOURCE WETLAND MITIGATION PLAN

In order to further coordinate efforts between the Department of Energy (DOE) and the Corps of Engineers (COE) on the Advance Photon Source (APS) Section 404 permit, I would like to advise you at this time of recent developments in the APS construction plans. As Constance Hunt of your staff is aware from recent telephone conversations with Ron Lutha of this Office, Title I Design, Preliminary Engineering, has been developed for the APS. The APS ring has shifted 270 feet to the south and 100 feet to the west in order to reduce the amount of excavations for the ring and to take advantage of a more stable subsurface condition. To reduce possible project impact on wooded areas at the north end of the site the structure was rotated 21 degrees clockwise. Because of this shifting of the ring, DOE has revisited the conceptual wetland mitigation plan incorporated in the Section 404 nationwide permit issued by COE to DOE on February 2, 1989.

Attachment 1 contains a Title I drawing of the site, and where the proposed wetland would be located, is highlighted in yellow. At the request of DOE and Argonne National Laboratory (ANL), Dr. Courtney Hackney, our wetlands consultant, reviewed the probable changes resulting from the Title I Design. Attachment 2, contains a copy of Dr. Courtney Hackney's letter to ANL, wherein he recommends and outlines the current plans for creating the proposed wetlands.

DOE believes that the results of the Title I Design effort are consistent with the Section 404 permit approved by your office. The same total acreage of wetlands will be replaced in the south central section of the APS site. However, instead of recreating two very small wetlands, one wetland of 1.8 acres will be created. DOE intends to honor all other commitments such as the protection of Wetland C, the early construction of the replacement wetland, and monitoring the newly created wetland for five years.

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Please confirm in writing that the DOE is still in compliance with the Section 404 permit approved by the COE on February 2, 1989. If you have any questions please feel free to give me a call on (312) 972-2366 or Ron Lutha on (312) 972-2432. As outlined in the permit, we will seek your approval of our Title II design (Definitive Design) of the proposed wetlands upon completion, prior to construction.

Sincerely,

Robert C. Wunderlich
Project Manager
7 GeV Advanced Photon Source

Enclosures:
As Stated

cc w/encls: Y. Cho, ANL
R. Hislop, ANL

bc w/encls: G. Walach, OCC
M. Grace, ESHD
B. White, ESHD

File: 4710.10.5.2

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Figure (Page B-x)

WETLANDS RELOCATION

COURTNEY T. HACKNEY, PH.D.
Coastal Ecologist - Wetland Consultant

ROUTE 1, BOX 382R
ROCKY POINT, NORTH CAROLINA 28457
(919)259-3348 OR (919)395-3759

11 September 1989

Mr. Richard D. Hislop
APS, Bld 360
Argonne National Lab

9700 South Cass Ave
Argonne, Il 60439-4814

Dear Mr. Hislop,

During my visit to the proposed APS site on 7 & 8 September 1989, I examined the impact of moving the planned structure on the 404 permit obtained from the Corps of Engineers. Since construction plans are further along now, I also discussed construction aspects of the wetland with Mr. John McKinnon from the Architecture and Engineering firm of Lester B. Knight and Associates. The prime question you asked me to examine was if moving the structure south altered the conditions or validity of the COE 404 permit.

The primary changes relative to the permit are 1) the construction of one 1.85 acre wetland instead of two equal to the same area, 2) a change in the manner through which water will enter the created wetland and 3) some potential change in the size of the buffer zone around the newly constructed wetland and wetland C. The numerous detention are another refinement in construction plans which were not a part of the permit, but need to be mentioned. These will retain heavy precipitation and release it slowly until they do not contain standing water. These are required by current county regulations.

The current plan is to fence wetland C before site preparation begins with a 30 foot buffer zone and appropriate erosion control measures. No fill will enter the natural area. There may be one part of this buffer zone, along the northern side, which may not be 30' wide. All other construction plans follow the original permit specifications.

Plans for the wetland to be constructed as mitigation for wetlands A & B can now be finalized. Since we had no final site plan when the original permit was granted this part of the plan must still be submitted to the COE. It was understood that there would be some changes from the original proposal. This wetland will be constructed in the south central portion of the construction area and will include 1.85 acres of the lowest

contour. Soil from wetlands A & B will be placed in this wetland as soon as it is removed from wetlands A & B. It will not be stockpiled. This is the most desired situation. The water necessary to produce and maintain this wetland will come from the southern half of the inside grassed perimeter of the APC structure. This portion of the APS site will be graded and planted with grass before construction of the APS facility begins. Water will fill a detention basin within the perimeter and be fed slowly into the constructed wetland. There should be little difference between the water quality of this water versus water from the watershed surrounding the APS structure. The mitigated wetland would be fenced and protected from siltation. A 30' buffer may not always be possible during construction, but the basin will be protected at all times from siltation.

Detention ponds build to control storm runoff, although not a part of any COE permit, will be engineered essentially as intermittent wetlands except for basin H. Detention basin H will contain a shallow pond. This aspect was added to provide breeding areas for amphibians.

Wetland E, for which the created wetland was partly mitigated will now be a retention basin. This is a very desirable plan as it will lessen the impact of storms on the wetland F. I understand that the basin will be constructed by excavation. This is acceptable, but if a dam is used instead of excavation the COE should be consulted.

A five year monitoring of the created wetland remains a part of the permit. Should the engineering design not meet COE criteria they retain the right to cancel the permit. I would also suggest that if construction of the APS facility takes more than five years the monitoring program should also be extended.

It is my opinion that the construction changes should not imperil the viability of the 404 permit as these changes actually lessen overall environmental impacts on the adjacent wetlands as compared to the original plan. I do not believe that these changes alter the conditions of the permit.

Sincerely Yours,

Courtney T. Hackney, Ph.D.

DEPARTMENT OF THE ARMY
CHICAGO DISTRICT, CORPS OF ENGINEERS
219 SOUTH DEARBORN STREET
CHICAGO, ILLINOIS 60504-1797

REPLY TO ATTENTION OF

2 FEB 1989

Regulatory Functions Branch
1708901

SUBJECT: Proposed Construction of the Advanced Photon Source at Argonne National Laboratory, DuPage County, Illinois

Mr. Ronald J. Lutha, Project Manager
Department of Energy
Argonne Area Office
9800 South Cass Avenue
Argonne, Illinois 60439

Dear Mr. Lutha:

This letter is in regards to the filling of wetlands at the site of the proposed Advanced Photon Source. We have determined that this project, including the mitigation plan submitted on January 26, 1989, qualifies for authorization under an existing nationwide permit. This determination is contingent upon review of the final engineering drawings and management and monitoring plan for the mitigation site by our office. We would like to have two weeks to review these documents before you commence work on the site.

We have received the November 22, 1988 Section 401 water quality certification issued by the Illinois Environmental Protection Agency (IEPA) for your project. A copy of the IEPA 401 certification and the nationwide permit conditions and management practices that you must comply with are enclosed.

This determination is applicable only to the permit program administered by the Corps of Engineers. It does not eliminate the need to obtain other federal, state or local approvals before beginning work. You are advised that this verification of the

ARGONNE AREA OFFICE

FEB -3 1989

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nationwide permit authorization is valid for two years from the date of this letter. If you have any questions, please contact Ms. Constance Hunt of the Regulatory Functions Branch, telephone number 312/353-6491.

Sincerely,

James E. Evans, P.E.
Chief, Construction Operations
Division

Enclosures (A, 26,401)

Copy Furnished

IDOT/DWR (Kabbes)
IEPA (Yurdin)

- -~

ATTACHMENT A

NATIONWIDE PERMIT MANAGEMENT PRACTICES (33 CFR 330.6)

1. Discharges of dredged or fill material into waters of the United States shall be avoided or minimized through the use of other practical alternatives.

2. Discharges into spawning areas during spawning seasons shall be avoided.

3. Discharges shall not restrict or impede the movement of aquatic species indigenous to the waters or the passage of normal or expected high flows or cause the relocation of the water unless the primary purpose of the fill is to impound waters.

4. If the discharge creates an impoundment of water, adverse impacts on the aquatic system caused by the accelerated passage of water and/or the restriction of its flow shall be minimized.

5. Discharges into wetland areas shall be avoided.

6. Heavy equipment working in wetlands shall be placed on mats.

7. Discharges into breeding areas for migratory waterfowl shall be avoided.

8. All temporary fills shall be removed in their entirety.

NATIONWIDE PERMIT 330.5(a)(26) CONDITIONS

DISCHARGES OF DREDGED OR FILL MATERIAL INTO: NON-TIDAL RIVERS, STREAMS, AND THEIR LAKES AND IMPOUNDMENTS, INCLUDING ADJACENT WETLANDS, THAT ARE LOCATED ABOVE THE HEADWATERS; AND OTHER NON-TIDAL WATERS OF THE UNITED STATES, INCLUDING ADJACENT WETLANDS, THAT ARE NOT PART OF A SURFACE TRIBUTARY SYSTEM TO INTERSTATE WATERS OR NAVIGABLE WATERS OF THE UNITED SlATES (i.e. ISOLATED WATERS)

1. That the Illinois Environmental Protection Agency has issued water quality certification for the discharge under Section 401 of the Clean Water Act.

2. That any discharge of dredged or fill material will not occur in the proximity of a public water supply intake.

3. That any discharge of dredged or fill material will not occur in areas of concentrated shellfish production.

4. That the activity will not jeopardize a threatened or endangered species as identified under the Endangered Species Act, or destroy or adversely modify the critical habitat of such species.

5. That the activity will not significantly disrupt the movement of those species of aquatic life indigenous to the waterbody.

6. That any discharge of dredged or fill material will consist of suitable material free from toxic pollutants in toxic amounts, pursuant to Section 307 of the Clean Water Act.

7. That any structure or fill authorized will be properly maintained.

8. That the activity will not occur in a component of the National Wild and Scenic River System.

9. That the activity will not cause an unacceptable interference with navigation.

10. That, if the activity may adversely affect historic properties which the National Park Service has listed on, or determined eligible for listing on, the National Register for Historic Places, the permittee will notify the district engineer.

11. That the best management practices listed on Attachment A shall be followed to the maximum extent practicable.

If the above conditions cannot be met an individual or regional permit will be required.

Illinois Environmental Protection Agency P.O. Box 19276. Springfield, IL 62794-9276

217/782-l696

D.O.E. Argonne National Laboratory (DuPage Co.)
Wetland Fill - Des Plaines River Watershed
Log #C - 945-88 [COE Appl. #1708901]

November 22, 1988

Department of the Army
Chicago District
Corps of Engineers
219 South Dearborn Street
Chicago, Illinois 60604

Gentlemen:

This Agency received a request on October 20, 1988, from the U.S. Department of Energy requesting necessary comments for environmental consideration concerning the construction of the 7-GeV Advanced Photon Source (APS) at Argonne National Laboratory in DuPage County. The construction of the APS will result in the filling of approximately 1.1 acres of wetland. We offer the following comments.

Based on the information included in this submittal, it is our engineering judgment that the proposed project may be completed without causing water pollution as defined in the Illinois Environmental Protection Act, provided the project is carefully planned and supervised.

These comments are directed at the effect on water quality of the construction procedures involved in the above described project and is not an approval of any discharge resulting from the completed facility, nor an approval of the design of the facility. These comments do not supplant any permit responsibilities of the applicant towards this Agency.

This Agency hereby issues certification under Section 401 of the Clean Water Act (PL 95-217); subject to the applicant's compliance with the following conditions:

l. The applicant shall not cause:

a. violation of applicable water quality standards of the Illinois Pollution Control Board, Title 35; Subtitle C: Water Pollution Rules and Regulations;

b. water pollution as defined and prohibited by the Illinois Environmental Protection Act; and

c. interference with water use practices near public recreation areas or water supply intakes.

2. The applicant shall provide adequate planning and supervision during the project construction period for implementing construction methods, processes and cleanup procedures necessary to prevent water pollution and control erosion.

3. Any spoil material excavated, dredged or otherwise produced must not be returned to the waterway but must be deposited in a self-contained area in compliance with all State statutes; regulations and permit requirements with no discharge to the waters of the State unless a permit has been issued by this Agency. Any back filling must be done with clean material and placed in a manner to prevent violation of applicable water quality standards.

4. All areas affected by construction shall be mulched and seeded as soon after construction as possible. The applicant shall undertake necessary measures and procedures to reduce erosion during construction. Interim measures to prevent erosion during construction shall be taken and may include the installation of staked straw bales; sedimentation basins and temporary mulching. All construction within the waterway shall be conducted during zero or low flow conditions.

5. This certification becomes effective when the Department of the Army, Corps of Engineers, includes the above conditions #1 through 4 as

conditions of the requested permit issued pursuant to Section 434 of PL. 95-217.

This certification does not grant immunity from any enforcement action found necessary by this Agency to meet its responsibilities in prevention, abatement; and control of water pollution.

Very truly yours,

Thomas G. McSwiggin, P.E.
Manager, Permit Section
Division of Water Pollution Control

TGM:JH:jab/3636j/21-22

cc: IEPA; DWPC; Records Unit
DWPC, Field Operations Section; Region 2
IDOT; Division of Water Resources, Schaumberg
USEPA, Region V
D.O.E. Chicago Operations Office/Argonne Area Office

Illinois Department of Transportation
Division of Water Resources
2300 South Dirksen Parkway / Springfield, Illinois 62764

November 2, 1988

U.S. Department of Energy
Chicago Operations Office
Argonne Area Office
9800 S. Cass Avenue
Argonne, IL 60439
Attn: Ronald Lutha

Dear Applicant:

Advanced Photon Source - Argonne - DuPage County

Thank you for your application for permit, submitted on your behalf by Ronald J. Lutha for the above referenced project in the Southwest 1/4 of Section 9, Township 37 North, Range ll East of the 3rd Principal Meridian in DuPage County.

An Illinois Department of Transportation, "Division of Water Resources' permit is not required for the project as both of the following conditions are met:

a). The project site is not located within a designated floodway.

b). The project site is not located within the flood plain of a watercourse that drains at least one square mile in an urban/urbanizing area or at least 10 square miles in a rural area.

This letter does not exempt the project from meeting the requirements of any other local, state, or federal agency.

If you have any questions, please call Gary Jereb of my Schaumburg office staff at 705-4341.

Sincerely,

David R. Boyce, P.E.
Chief Flood Plain Management
Engineer

cc: Chicago Corps of Engineers
IEPA
DuPage County

ARGONNE AREA OFFICE
NOV 4 1988
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DRB/KCK/GJ:tj

Mr. James E. Evans, P.E.
Chief, Construction-Operations Division
U.S. Army Corps of Engineers
219 S. Dearborn Street
Chicago, Illinois 60604

Dear Mr. Evans:

SUBJECT: ADDITIONAL INFORMATION FOR THE 404 PERMIT ON THE ADVANCED PHOTON SOURCE (APS) AT ARGONNE NATIONAL LABORATORY

As requested by Ms. Constance Hunt, attached is the Conceptual Wetlands Mitigation Plan and associated documentation to complete the COE Wetlands permit application. This permit was developed with consultation from a wetlands scientist (Dr. Courtney Hackney, University of North Carolina - resume attached) and was discussed with Ms. Hunt through a conference call. The conceptual mitigation plan represents the document by which DOE and Argonne National Laboratory will exert their best efforts to mitigate wetland impacts resulting from the construction of the proposed Advanced Photon Source Facility. Detailed engineering specifications for the wetlands created will be provided to the COE prior to construction.

We look forward to the COE determination on the permit application for the APS project. If there are any questions please do not hesitate to call me at (312) 972-2432.

Sincerely,

Ronald, J. Lutha, Project Manager
7 GeV Advanced Photon Source

Enclosure:
As Stated

cc: R. Huebner, ANL, w/encl.
Y. Cho, ANL, w/o encl.
G. Pewitt, ANL, w/o encl.

bc w/encl: G. Walach, OCC
B. White, ESHD

File: 4700.gl APS

Environmental

OFFICIAL FILE COPY

(1-23-89)

APS0138

WETLAND MITIGATION PLAN

1. Permit Application Number:________________
2. Date Permit Application Filed: October 17, 1987
3. Permit Applicant: U.S. Department of Energy
   Chicago Operations Office/Argonne Area Office
   9800 So. Cass Avenue
   Argonne, IL 60439
4. Authorized Agent: Mr. Ronald Lutha, 7 GeV APS Project Manager
   (312) 972-2432
5. Project Description: Advanced Photon Source Project
6. Location: Argonne National Laboratory
7. Wetland Mitigation Plan: The conceptual wetland mitigation plan will include the following points --
   a. Wetland C (1.1 acres) wilt be avoided during construction of the APS facility (Figure 1). The ecological integrity of wetland C will be maintained by fencing the wetland with about a 30 foot wide buffer and erosion control zone around it. In addition, culverts will be constructed under the road to allow sheet flow to enter or exit the wetland.

   b. Wetland areas A (0.4 acres) and B (0.7 acres) will be destroyed (total of 1.1 acres) during construction of the APS facility. In their place, we plan to construct two wetlands which total 1.8

acres in the general area (about 6 acres) in the southeast corner of the APS site as indicated by the colored region in Figure 1. These wetlands will be designed to have similar hydrologic and biotic characteristics to those wetlands destroyed.

c. Area E (Figure 1) has wetland characteristic. Old aerial photographs suggest that this area may have been a wetland prior to construction and subsequent partial filling of the A2R2 excavation (Area D). Today this area shows signs of human disturbance, but

there may still be some wetland function. To avoid loss of wetland function we plan to mitigate the entire basin of Area E, 0.7 acres. Loss of this wetland-like area will be mitigated as part of the isolated wetlands already discussed in item b and is included in the 1.8 acre total.

d. One wetland (Figure 2A) will be constructed immediately adjacent to the wooded area in the southeastern part of the APS site. This will provide similar conditions to that present in area A and will provide for the habitat requirements of species which depend on both wetland and forest to complete their life cycle, e.g. tiger salamander. The second wetland (Figure 2B) will be approximately the same size and located farther west in a relatively open area. This will provide similar conditions for development of wet meadow vegetation and habitat.

e. By design, constructed wetlands will not contain standing water at all times during all years, but they will normally contain saturated soils. Such systems can be termed vernal or intermittent ponds. Wetlands to be destroyed have a similar hydrologic regime.

f. Each constructed wetland will have profiles similar to those found in wetlands A and B with the primary goal of creating vegetative zones similar to Figure 2 (A and B).

g. We plan to construct wetlands at the beginning of the APS construction during the site preparation phase. Approximately 6 inches of surface soil will be removed from wetlands A and B and graded into each new wetland. Best efforts will be made to avoid soil stockpiling for more than one year. This will provide a viable and natural seed source for most plant species currently present in the wetlands. Plants germinating from the seed bank will be adapted to local conditions and should provide rapid colonization of the constructed wetlands. We also expect rapid invasion of aquatic insects and amphibians.

h. Newly created wetlands will have a buffer area of approximately 50 feet from which permanent human structures will be prohibited during and after construction. All construction associated with the APS project will use standard methods required by ANL policy that minimize soil erosion and sedimentation in accord with EPA guidelines.

i. Plant species composition will be determined in late spring and summer following construction of the wetlands. Cattails and any other plant species not considered natural or desirable will be removed. Local wetland seed stock and/or native herbaceous species found in other similar wetlands at ANL will be planted if needed to supplement natural recolonization of the constructed wetlands. Woody species such as black willow, silver maple, and rough-leaved dogwood will not be planted until after the second year. All vegetation will be surveyed thereafter through annual summer surveys for a period of 5 years.

j. Detailed engineering specifications for both created wetlands will be provided to the COE prior to construction. Annual reports on vegetation and fauna based on annual surveys will be provided to COE for 5 years after construction of the wetlands.

8. Summary: Two isolated wetlands which equal a total 1.1 acres and a third area (O.7) acres will be destroyed. Two wetlands which will total 1.8 acres will be created very near the original locations in the Des Plaines River Watershed. These will mimic both the physical and biological

setting of the destroyed wetlands as closely as possible. A five-year monitoring program will follow their development.

Figure (Page B-x)

Figure 1. Topographic map of the APS site showing wetland and floodplain areas.

Figure (Page B-x)

Figure 2 CONCEPTUAL WETLANDS SECTIONS

Appendix C
CORRESPONDENCE REGARDING THREATENED AND ENDANGERED SPECIES AMONG THE FISH AND WILDLIFE SERVICE, THE ILLINOIS DEPARTMENT OF CONSERVATION, AND THE U.S. DEPARTMENT OF ENERGY

United States Department of the Interior

IN REPLY REFER TO

FISH AND WILDLIFE SERVICE
ROCK ISLAND FIELD OFFICE (ES)
1830 Second Avenue, Second Floor COM: 309/793-5800
Rock Island, Illinois 61201 FTS: 386-5800

February 9, 1988

Mr. A.L. Taboas
Area Manager
Department of Energy
9800 South Cass Avenue
Argonne, Illinois 60439

Dear Mr. Taboas:

This responds to your letter dated November 20, 1987 requesting informal consultation pursuant to the Endangered Species Act of

1973 for a planned 7 GeV Advanced Photon Source Facility at the Argonne National Laboratory. In addition you requested consultation pursuant to the Fish and Wildlife Coordination Act because of potential modification of wetland habitat on the project site.

On February 2, 1988, Gerald Bade of my staff met with Ron Lutha (DOE) and others from Argonne and toured the site. The wetlands in question consisted of palustrine forested and/or emergent types with some value to wildlife such as waterfowl, deer, amphibians, herons and other species. Although the wetlands are rather small in size, we feel any losses should be mitigated.

Mitigation of environmental impacts generally follows a sequential consideration of avoidance, minimization and compensation of lost values. It is apparent that the placement and design of the facility has already resulted in avoidance and minimization of impacts as much as is practicable. The remaining unavoidable impacts can then be compensated by either creating new wetland habitat or enhancing existing low value habitat to raise its value.

Several possibilities were discussed for compensation which included l) extending the beaver pond northeast of the project site to replace the lost wetland acreage; 2) replacing the beaver dam with a permanent water control structure to insure its future existence; 3) creating or enhancing additional habitat in an area near Argonne Park on the east that could be donated to the DuPage County Forest Preserve District; 4) create or enhance habitat on lands belonging to the Forest Preserve District; 5)

establish food plots on unused lands that would be of benefit to wildlife such as deer, pheasant, waterfowl and others. These are merely suggestions and we will be happy to review any proposals your staff develops.

With regard to endangered species, the only Federally listed species in the area is the Indiana bat. We have seen an unconfirmed report of this species being captured in the Waterfall Glen Forest Preserve south of the project. While Indiana bats have been known to forage over upland forests, our main concern is with alteration of nursery habitat. This species generally roosts and rears its young under the loose bark of dead or dying trees that are greater than 16 inches in diameter. Generally, we have found this to occur along the corridor of small streams with a well developed riparian forest on both sides and an overhanging canopy. Since your project does not involve alteration of any such streams, we have determined that it will not affect the Indiana bat. This precludes the need for further action on this project as required under Section 7 of the Endangered Species Act of 1973, as amended. Should this project be modified or new information indicate endangered species may be affected, consultation should be initiated.

If you have any questions, please contact Gerry Bade or myself. This letter provides comment under the authority of and in accordance with provisions of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. et seq.); the National Environmental Policy Act of 1969, as amended; the Endangered Species Act of 1973, as amended; and in accordance with the Fish and Wildlife Service's Mitigation Policy.

Sincerely,

Richard C. Nelson
Field Supervisor

cc. Chicago District
IDOC (Schanzle)

Illinois Department of Conservation
life and land together

LINCOLN TOWER PLAZA * 524 SOUTH SECOND STREET * SPRINGFIELD 62701-1787

CHICAGO OFFICE * ROOM 4-300 * 100 WEST RANDOLPH 60601
MARK FRECH, DIRECTOR

March 7, 1988

Mr. A. L. Taboas
Department of Energy
Argonne Area Office
9800 South Cass Avenue
Argonne, IL 60439

Dear Mr. Taboas:

As per your request, I have checked our database system for occurrences of state listed threatened and endangered species associated with the proposed construction site at the Argonne National Laboratory. The search came up with no known threatened or endangered species occurrences. However, since the construction site appears to involve a marsh, a guild of birds associated with marshes should be considered. The guild includes the pied-billed grebe (proposed threatened), yellow-headed blackbird (endangered), common moorhen (threatened) and least bittern (proposed threatened)

Please note that the there is always the potential for additional significant features to occur at a site. This is especially the case with the Illinois Natural Heritage Database, since the database has only been in operation for just over a year and a half.

If I can be of further assistance, please feel free to call me at (217) 785-8774.

Sincerely,

John E. Guhnerkempe
Data Coordinator

Illinois Natural Heritage Database
Division of Natural Heritage

cc: Carl Becker

Appendix D
AGENCIES AND PERSONS CONSULTED

AGENCIES AND PERSONS CONSULTED

INDIVIDUAL	AGENCY/ElK
James Evans Constance Hunt	U.S. Department of the Army Chicago District, Corps of Engineers
Gerald Bade	U.S. Department of Interior Fish and Wildlife Service Rock Island Field Office
Tom Emerson Paula Cross	Illinois Historic Preservation Agency
Betsy Updike Tom McCallum	Advisory Council on Historic Preservation
John E. Buhnerkempe	Illinois Department of Conservation
Richard C. Nelson	U. S. Department of the Interior
Courtney Hackney	Wetlands Specialist University of North Carolina

United States Government Department of Energy memorandum

Date: May 9, 1990
REPLY To EH-25

Attn OF:

Subject: Finding of No Significant Impact (FONSI) for the 7-GeV Advanced Photon Source, Argonne National Laboratory, Argonne, Illinois

To: James F. Decker
Acting Director
Office of Energy Research

We have reviewed the proposed final FONSI as requested in your memorandum of April 16, 1990. This FONSI adequately responds to public comments received during the 30-day review period on the proposed FONSI, which was published in the Federal Register on March 1, 1990.

We have determined, after consultation with the Office of General Counsel, that the proposed action will not have a significant effect on the quality of the human environment within the meaning of the National Environmental Policy Act (NEPA). Therefore, an environmental impact statement (EIS) is not required.

The attached final FONSI with summary of comments and responses should be published in the Federal Register and distributed to persons who received copies of the Environmental Assessment and proposed FONSI.

If you have any questions, please contact Carol M. Borgstrom of my staff on 586-4600.

Peter N. Brush
Acting Assistant Secretary
Environment, Safety and Health

Attachment

[6450-01]

U.S. Department of Energy
Finding of No Significant Impact
7-GeV Advanced Photon Source
Argonne National Laboratory

AGENCY: U.S. Department Of Energy

ACTION: Finding of No Significant Impact

SUMMARY: The U.S. Department of Energy (DOE) has prepared an Environmental Assessment (EA) for the construction and operation of the proposed 6- to 7-GeV synchrotron radiation source, also known as the 7-GeV Advanced Photon Source (APS), at Argonne National Laboratory, Argonne, Illinois. The main APS building would be ring-shaped with a circumference of about 4,083 feet. The complex also would include offices, general and special purposes laboratories, clean room laboratories, and service operation areas. The proposed APS would provide a national facility for advancing research in physics, chemistry, biology, and the materials and health sciences.

The EA examined and compared the environmental impacts of the\
\
proposed APS Project and reasonable alternatives. Based on the analysis in the EA, and the comments received on the EA and the proposed FONSI during the 30 day public comment period, DOE has

determined that the Environmental Assessment is adequate for the proposed APS Project and that the proposed action does not constitute a major federal action significantly affecting the quality of the human environment within the meaning of the National Environmental Policy Act of 1969, 42 U.S.C. 4321 et seq. Therefore, an environmental impact statement is not required.

A proposed FONSI and the supporting EA were made available for public review for a period of 30 days, from March l through March 31, 1990. Following completion of the public review period, DOE analyzed the comments received on the proposed FONSI and the Environmental Assessment. Three comment letters were received. One comment was submitted from the Illinois State Historic Preservation Office stating that the EA adequately outlines the effect of the proposed project on cultural resources and the archaeological work conducted to mitigate this impact. The second comment letter was submitted by the Mayor of Woodridge, Illinois, who states that the Village of Woodridge, located approximately 5 miles from the site, fully supports the construction of the APS. The third comment letter was submitted by the U.S. Environmental Protection Agency (EPA), Region 5. EPA agrees that wetland losses would be mitigated by the "full wetland replacement" proposed by DOE in the EA. EPA Regional guidance recommends that for construction projects, consideration be given to additional mitigation for wetland losses at a ratio of at least 1.5:1. A summary of the comments

and the DOE response is presented as an attachment to this notice. No changes in the EA have been made.

PROPOSED ACTION: The proposed action is the construction and operation at Argonne National Laboratory (ANL) of the 7-GeV Advanced Photon Source and those associated facilities of the APS including the linear accelerator (linac), the synchrotron and the storage ring. The linac injects positrons into the synchrotron which accelerates them to 7-GeV before they are injected into the storage ring. The positrons circulate continuously in the storage ring with a current of approximately 100 milliampere. The storage ring is capable of accommodating 34 insertion devices specially designed to produce high brilliance x-ray beams for multi-discipline research. The experimental area, which houses the x-ray beam lines, would accommodate beam lines up to 80 meters long. The project would occupy 70 acres of fields and forest in the southwest portion of the 1275-acre ANL property.

A multi-story central laboratory/office building would provide a working environment for up to 300 permanent staff scientists and support personnel at the site. Laboratory modules would be located around the outer wall of the experiment hall/storage ring building. These modules would contain offices, laboratories, a conference area, and service support space. Other proposed construction activities include service and utility buildings, parking areas, and access roads.

ALTERNATIVES: Two alternatives to the proposed action were considered in the EA:

- no action (the 7-GeV Advanced Photon Source would not be built),

- construction at other sites within ANL.

Taking no action would mean not constructing a 7 GeV Advanced Photon Source and would result in no changes to the existing environment. However, synchrotron radiation has emerged as a powerful tool for probing the structure of matter and studying important physical and chemical processes. If the facility is not built a number of scientific advances such as the determination of bulk and surface structure, the determination of catalytic activity of materials, microprobe impurity detection, inelastic x-ray scattering, and observation of the motion of atoms in protein systems would not occur.

Within ANL, four locations were identified as potentially suitable to meet the space requirements of the APS. Site selection was influenced by the following factors: (1) suitability of the site to meet technical requirements of design configuration and functional relationships; (2) suitability of topography and subsurface conditions; (3) minimal environmental resource impacts; (4) avoidance of external and traffic-generated

sources of vibration; (5) provision of a buffer zone between APS and the ANL site boundary; (6) minimal interference of existing structures; (7) availability of existing utilities; and (8) flexibility of the site for future expansion. Consideration of these factors eliminated two areas on the basis of technical considerations and one area was eliminated because of wetland involvement and topography features. Construction of the APS facility in the so-called South 800 Area at ANL provides the best overall site based on these factors and is the preferred location for the facility.

FINDINGS: The EA includes an assessment of impacts of constructing and operating the APS on land use, employment levels, vegetation, threatened and endangered species, cultural and historic resources, parking and traffic, noise, worker and public health, air quality, and water and power consumption.

Construction Impacts

Initial activities at the proposed site include site grading, preparing and paving roadways and parking areas, and construction of various buildings and facilities. Erosion and sedimentation to surface waters would be controlled by limiting exposed areas, surface water diversion, water flow velocity control, slope stabilization, collection of runoff, water/solids separation, and post construction restoration. Because this property is

currently part of the ANL site and has been intended eventually to support energy research facilities, this land conversion is in accord with long-range ANL planning and would have no significant direct effect on land use. Development of the entire APS site would decrease the amount of undeveloped areas in the ANL property by approximately 15%. No groundwater impacts would result since excavations do not extend to bedrock and recharge follows an extensive pathway through clay-rich glacial till which absorbs cations. Dust and fugitive emissions from construction would be temporary and local in nature. Construction noise also is expected to be temporary and local. Thus, no unusual or significant air quality problems or noise impacts are expected. No significant impacts to threatened or endangered species nor critical habitat are expected, since no such species are present on the site.

APS construction would result in the filling of three small wetlands (1.8 acres total). These wetlands provide some wildlife habitat but are of relatively low hydrological importance. The U.S. Army Corps of Engineers (COE) has issued a permit for construction in wetlands in accordance with Section 404 of the Clean Water Act. As part of this permit, DOE is having consultations with the COE on the implementation of plans to mitigate wetland loss. A Floodplain and Wetland Involvement Notice was published in the FEDERAL REGISTER (54 FR 18326) on April 28, 1989. By terms of the permit, detailed engineering

specifications for the created wetlands must be provided to the COE before implementation. With mitigation in place, significant impacts to wetlands are not expected. Impacts to nearby streams and aquatic biota would be minimized by following good engineering practices. Stream turbidity from construction site runoff may temporarily increase but no long-term impacts to the aquatic biota would occur.

DOE has determined that the APS project potentially would affect sites eligible for the National Register of Historic places. Consequently, DOE, Advisory Council on Historic Preservation (ACHP), and the State Historic Preservation Office (SHPO) have negotiated a Programmatic Agreement which stipulates that the DOE will develop and implement a data recovery plan in compliance with federal regulation and laws subject to SHPO review and monitoring.

Operational Impacts

Water for drinking, cooling, and other uses at the APS would be obtained from the existing water supply system. The increased demand on the ANL sanitary sewer system from APS activity would be an increase of only 3% of the excess capacity. APS water consumption would have no significant effect on public communities surrounding ANL. The pumpage rates of these communities declined from 1980 to 1985 and are expected to

continue declining as they convert from well water to Lake Michigan water usage. The additional 30,000-gallons per day sanitary sewage discharge, which includes cooling water blowdown from APS activities, should have no significant effect on surface water quality. Sludge generated from the APS sanitary waste would be minimal since the increase in the demand of an additional 4 cubic yards per year is an increase of only 0.01% in the permitted limit of the ANL landfill.

The projected need for electric power represents a 19% decrease in excess power capacity available at ANL. Thus the APS power demand is not expected to affect significantly the availability of electricity in the area of Chicago and its suburbs. The operation of APS is not expected to generate significant amounts of gaseous or particulate emissions. The noise from site traffic, compressors, and cooling towers would be well within the Illinois State Noise Standard and DOE criteria for occupational safety and health. During normal operation, the dose to the nearest offsite resident (0.9 mile to the southwest of the APS) from penetrating radiation (gamma ray and neutron) is estimated to be 0.05 millirem per year which is well below the DOE standard of 100 millirem per year. The dose equivalent to workers, as the result of the maximum credible accident (probability of less than 10E-4), would be 1.17 rem (23% of the allowed exposure of workers). The dose equivalent at the site boundary would be less than 1 mrem. During normal operation, the dose due to airborne

emissions of activated products is calculated to be 6.0 x 10E-2 mrem per year at the fenceline which is well below the 10 mrem per year standard of 10 CFR 61 (National Emission Standards for Hazardous Air Pollutants).

Operation of the proposed APS would have little potential for impact on ecological resources beyond those occurring during the construction phase. Considering that a number of APS workers would transfer from existing ANL activities to APS, the actual number of staff added to the current ANL work force of 3760 persons by APS would be relatively small (8-16%). Since housing and services are not limited within the ANL community area, no significant socioeconomic impacts are expected from the additional work force to an area that has 3.5 million people within the 20-mile radius of ANL.

Determination

Based on the analysis in the EA and the comments received on the proposed FONSI during the 30 day public comment period, DOE has determined that the EA is adequate for the proposed APS project and that the proposed action does not constitute a major federal action significantly affecting the quality of the human environment within the meaning of the National Environmental Policy Act of 1969, 42 U.S.C. 4321 et seq. Therefore, an environmental impact statement is not required.

Single copies of the EA (DOE/EA-O389) are available from:

Robert C. Wunderlich, Project Manager

Advanced Photon Source
U.S. Department of Energy
Argonne Area Office
9800 South Cass Avenue
Argonne, IL. 60439
Phone: (708)972-2366

For further information regarding the NEPA process, contact:

Carol M. Borgstrom, Director
Office of NEPA Project Assistance
U.S. Department of Energy
1000 Independence Avenue, S.W.
Washington, DC 20585
Phone: (202) 586-4600

Signed in Washington, D.C., this 9th day of May, 1990

Raymond P. Berube
Acting Assistant Secretary
Environment, Safety and Health

Attachment Summary of Comments Received on the Proposed FONSI

Comment: The Environmental Protection Agency states in their letter, "For unavoidable wetland impacts, appropriate compensation is required to replace lost wetland functions, which you have proposed to do in the EA by full wetland restoration. However, the goal of our Regional guidance is that mitigation, such as wetland restoration, should be on a basis of at least a 1.5:1 ratio of mitigated wetlands to those lost. Your mitigation plans should reflect this guidance, as well as identify all affected wetlands in detail (including total acreage, vegetation present, functions, and values), according to the Federal Manual of Wetland Identification........As long as wetland mitigation is provided as outlined above we will have no objections to the construction of the Project."

Response: The U.S. Corps of Engineers (COE) has federal regulatory authority for compliance with Section 404 of the Clean Water Act. A wetland relocation permit for the APS Project, as outlined in the EA, has been granted to the U.S. Department of Energy by the U.S. COE (Nationwide Permit number 26) on February 2, 1989. The basis for this permit is the development of natural replacement wetlands, performing the same function as the

original wetlands, on a ratio of 1:1. The COE permit was reviewed by the Illinois EPA in November 1988 as part of their responsibilities under Section 401 of the Clean Water Act.

EPA states that the goal of their Regional guidance is mitigation and, as such, wetland restoration should be on a basis of at least 1.5:1 ratio of mitigated wetlands to those lost. EPA further states that this goal represents EPA regional policy and is not a regulatory requirement.

Both the EPA and the COE agree that the "functional replacement" of the wetlands is the primary objective of mitigation. The proposed mitigation will provide functional replacement of wetlands. DOE will provide final detailed designs of the mitigation, as well as the 5-year monitoring and management plans to the COE for approval. The DOE believes that the mitigation described in the EA provides "full wetland restoration" which results in "functional replacement" of the wetlands. The net effect will be "no net loss" of wetlands from the construction and operation of the APS. Additional "functional" contributions will not be needed.

Comment: The letter from the Mayor of Woodridge states that the "APS also holds the prospect of being a catalyst for local employment growth and business attraction."

Response: Section 4.3 of the EA states that the total number of personnel connected with the APS is not expected to exceed 600 people at any time. While this will increase the size of the ANL work force, it is expected that they will have the some off-site residence pattern as the existing ANL staff. Most ANL staff live within a 20-mile radius of the site. Since housing and services are not limited within the ANL commuting area, no significant socioeconomic impacts are expected from the additional work force to an area that has 3.5 million people within a 20-mile radius.

Comment: The letter from the Deputy State Historic Preservation Officer stated that the environmental assessment adequately outlines the affect of the proposed project on cultural resources and the archaeological work conducted to mitigate this impact.

Response: None required.

Finding of No Significant Impact (FONSI) for the 7-GeV Advanced Photon Source, Argonne National Laboratory, Argonne, Illinois

James F. Decker
Acting Director
Office of Energy Research

We have reviewed the proposed final FONSI as requested in your memorandum of April 16, 1990. This FONSI adequately responds to public comments received during the 30-day review period on the proposed FONSI, which was published in the Federal Register on March l, 1990.

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The attached final FONSI with summary of comments and responses should be published in the Federal Register and distributed to persons who received copies of the Environmental Assessment and proposed FONSI.

If you have any questions, please contact Carol M. Borgstrom of my staff on 586-4600.

Peter N. Brush
Acting Assistant Secretary
Environment, Safety and Health

Attachment

OFFICIAL FILE COPY

DOE F 1325.10

(11-89)