5 PINE BLUFF ARSENAL (PBA), ARKANSAS

5.1 INTRODUCTION

PBA is located in Jefferson County, Arkansas, approximately 30 mi (50 km) south and slightly east of the capital of Little Rock (Figure 5.1-1). PBA is about 15,000 acres (6,000 ha) (U.S. Army 1997) in size. The U.S. Food and Drug Administration (FDA), National Center for Toxicological Research (NCTR), which employs 670 workers, occupies an area located adjacent to the northern portion of PBA that is approximately 500 acres (200 ha) in size.

5.1.1 Potential Sites and Facility Locations

The three potential areas selected for the proposed ACWA pilot facility at PBA are located in the northern part of the arsenal, near the chemical storage area. They are shown in Figure 5.1-2. All three proposed areas are located in relatively flat terrain; the topography in these areas is flat to gently rolling hills. These areas were chosen on the basis of their suitability for construction, access to the chemical storage area, and nearness to other structures and boundaries, and the availability of required utilities.

Area A is located adjacent to the chemical storage area. This potential construction area is wooded and about 25 acres (10 ha) in size. It is about 0.8 mi (1.3 km) from the western boundary of PBA and about 2 mi (3 km) from the U.S. Army Program Manager for Chemical Demilitarization (PMCD) Pine Bluff Chemical Demilitarization Facility (PBCDF).

Area B is approximately halfway between the chemical storage area and the PBCDF. This potential construction area is not wooded and is about 34 acres (14 ha) in size. It is about 1.5 mi (2.5 km) from the western boundary of PBA and about 1.5 mi (2.5 km) from the PBCDF. It is about 0.7 mi (1 km) from the chemical storage area and approximately 0.4 mi (0.6 km) from the NCTR located on the northern boundary of PBA.

Area C was originally identified as a potential location for an ACWA facility because of its proximity to both the chemical storage area and existing utilities. However, Area C is no longer being considered in this document because it has been identified as a location for a potential nonstockpile demilitarization facility.

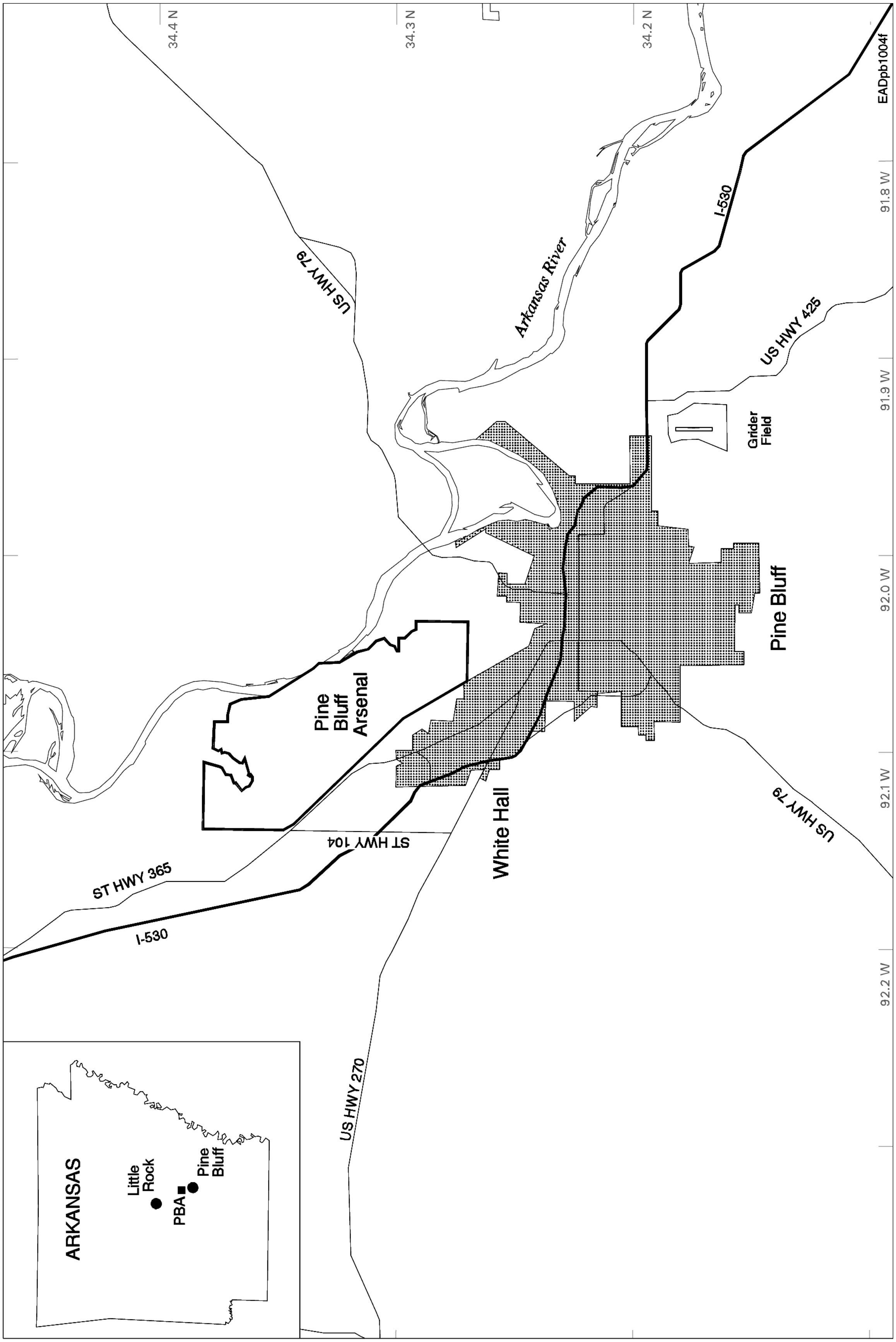

FIGURE 5.1-1 Location of PBA

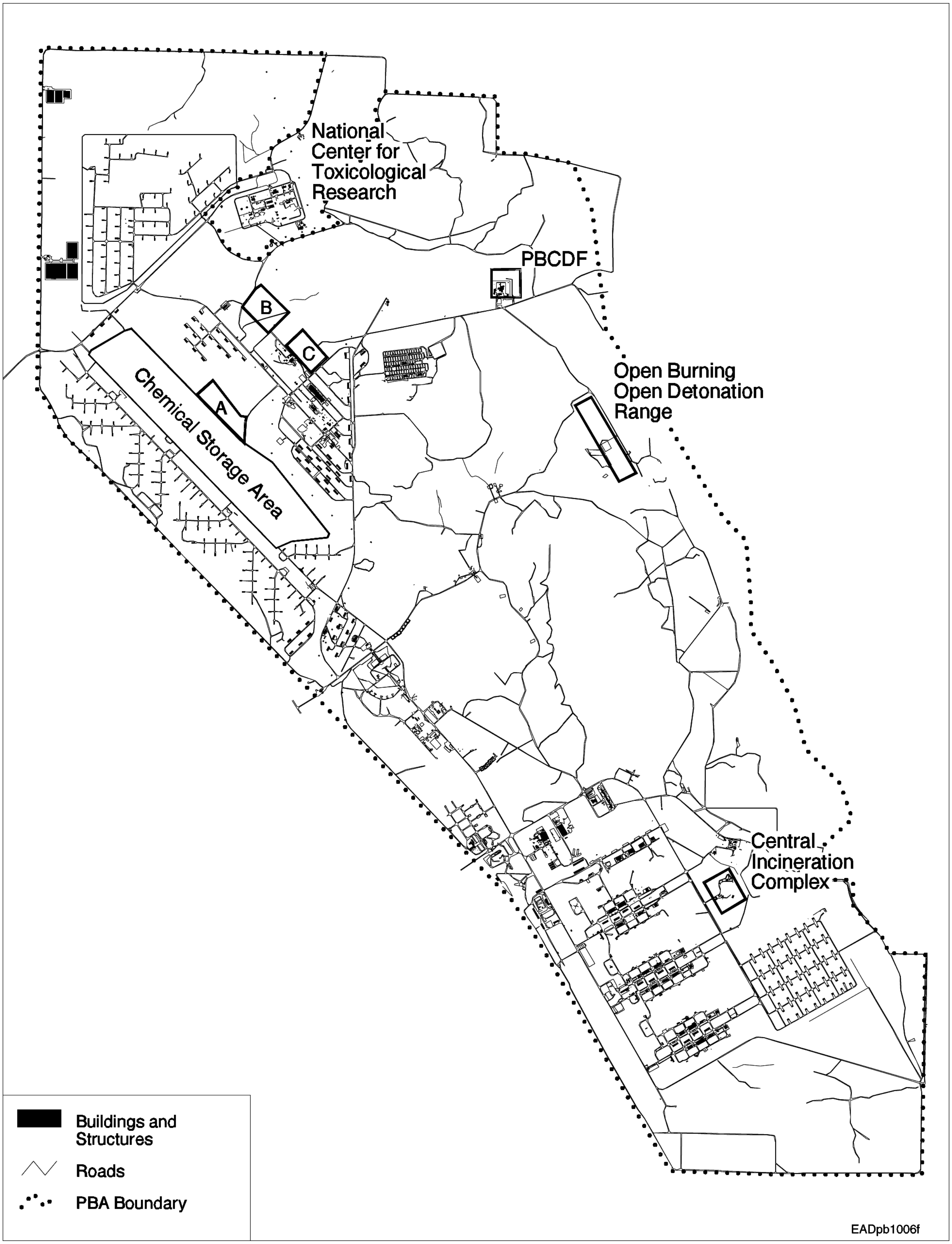

FIGURE 5.1-2 Existing Facilities and Potential Locations for the Proposed ACWA Pilot Test Facility at PBA

5.1.2 Munitions Inventory

Chemical agents stored at PBA include both nerve and blister agents; however, only nerve agent munitions are present as assembled chemical weapons (ACWs). Table 5.1-1 lists the current assembled chemical munitions inventory at PBA, which consists of the nerve agents GB (sarin) and VX. The stockpile is stored in two basic configurations, mines and rockets. Both configurations contain chemical agent and propellants and/or explosives. All munitions that contain propellant or explosives are stored inside earth-covered concrete igloos. Access is restricted by redundant systems, and each igloo has an intrusion detection system.

The chemical munitions undergo routine inspection and inventory in accordance with applicable Army regulations and guidelines. In addition to the Army regulated inspection and maintenance, igloos are monitored regularly in accordance with applicable U.S. Environmental Protection Agency (EPA) regulations. This monitoring may occur, depending on the item stored, quarterly, monthly, or weekly.

Small quantities of stored chemical munitions (mostly M55 rockets) have begun to leak. If a leaking munition is detected, it is identified and removed from the surrounding munitions; the surrounding munitions and area are then decontaminated. The leaking munition is placed into a munition-specific steel overpack and moved to an isolation igloo approved under the *Resource Conservation and Recovery Act* (RCRA). This procedure provides a high degree of assurance that agent will be contained, even if the munition continues to leak.

TABLE 5.1-1 Assembled Chemical Weapons Inventory at PBA[a]

Type of Munition	Total No. of Munitions	Agent	Total Weight (lb)
M55 rockets	90,231	GB	965,480
M55 rockets	19,582	VX	195,820
M56 rockets	178	GB	1,900
M56 rockets	26	VX	260
M23 land mines	9,378	VX	99,460

[a] Unit conversion: 1 lb = 0.45 kg.

Source: Modified from U.S. Army (1997).

5.2 LAND USE

5.2.1 Installation History and Uses

5.2.1.1 History

PBA was established in November of 1941 as the Chemical Warfare Arsenal, Pine Bluff, Arkansas. Construction of (1) facilities for the manufacture, loading, and assembly of incendiary and chemical munitions; (2) storage bunkers; (3) laboratories; and (4) associated administration and support facilities began in December. The arsenal was designated Pine Bluff Arsenal (PBA) in March of 1942, and the headquarters was moved from the city of Pine Bluff to PBA in April of the same year.

Initial production began in July 1942 with an incendiary grenade (AN M14). Production expanded during World War II to include bulk chemical agent production and filling of various chemical munitions (incendiary, smoke, and other types). Between 1945 and the Korean Conflict, PBA's main mission was maintenance of chemical supplies and equipment, industrial mobilization planning, and demilitarization. During the Korean Conflict, industrial operations at PBA expanded from the 24 different end items produced at the end of World War II to 38 different end items.

In 1953, biological warfare facilities were completed at PBA and designated as the Production Development Laboratories. In 1957, these facilities were added as a mission element of PBA under the designation Directorate of Biological Operations. PBA was also selected for BZ munition production, and the production facility was completed in 1962.

In November 1969, a Presidential Executive Order discontinued the U.S. biological warfare effort and production of biological warfare munitions. Demilitarization of all inventories of antipersonnel biological agents and munitions was completed at PBA in January 1972. The facilities used for the biological warfare mission were transferred to the FDA, which currently operates them as the NCTR.

In 1976, a program was initiated to dispose of the chemical agent BZ. Operation of this demilitarization facility began in 1988, and demilitarization of the chemical agent BZ at PBA was complete in 1990. An area adjacent to the BZ demilitarization site is currently being used for construction of the PBCDF for demilitarization of stockpiled chemical weapons stored at PBA.

PBA was selected as the sole site for the Binary Production Facilities in 1978, and the program was active until 1990.

5.2.1.2 Current Mission

PBA serves as the Group Technology Center for Illumination and Infrared Munitions, serves as the Specified Mission Facility for smoke munitions, and maintains the sole U.S. capability for white phosphorus fill. PBA produces and demilitarizes conventional ammunition, and Pine Bluff Chemical Activity (PBCA) supports the storage and destruction of the second largest stateside chemical weapons stockpile. PBA is currently the only installation east of the Rocky Mountains permitted for acceptance of nonstockpile chemical munitions (Industrial Operations Command [IOC] 2000).

PBA operates a Central Incinerator Complex (CIC) that includes a RCRA-permitted rotary deactivation furnace (RDF) and a fluidized-bed incinerator. It also includes a car-bottom furnace that is not RCRA-permitted for hazardous waste. The RDF is currently used to process nonhazardous munitions from the production facilities that do not meet specifications (e.g., smoke grenades, tear agent [CS]). The RDF and the car-bottom furnace share an afterburner and pollution abatement system. The fluidized-bed incinerator, which is used to process nonhazardous liquid and dry bulk wastes (e.g., solvents, smoke mixes, CS/tear agent), has its own pollution abatement system. The two pollution abatement systems use the same stack (U.S. Army 1997). The RDF and the fluidized-bed incinerator were permitted through RCRA in 1989; however, they have operated intermittently since that time to process only nonhazardous wastes.

PBCA supports the enforcement of international treaty efforts through compliance and education of worldwide inspectors. It is the Joint Services Center of Expertise for Chemical/Biological Defensive Equipment, where it supports production, maintenance, testing, certification, and training. It also offers design agencies support in development, engineering, prototype production, testing, and demonstration. PBA promotes environmental excellence through hazardous material and waste management programs.

The U.S. Army Soldier and Biological Chemical Command (SBCCOM) assumed operational control of PBA on October 1, 1999, and assumed full command and control on October 1, 2000 (IOC 2000).

5.2.2 Current and Planned On-Post Land Use

Table 5.2-1[1] lists the current land use classes and the approximate acreage devoted to their use at PBA. Land use at PBA consists of family and troop housing, recreation facilities,

[1] After this document was developed, PBA transferred two parcels of land with a total area of approximately 1,500 acres (607 ha) to The Alliance, a nonprofit corporation dedicated to economic development in the PBA area. These two parcels are located immediately to the west and east of the NCTR. The discussions in this chapter do not include this information.

TABLE 5.2-1 Land Use at PBA

Land Use	Approximate Area (acres)	Percentage of Total Area
Family and troop housing	127	1.0
Community facilities and recreation	499	3.8
Administration, operational facilities, and outleased land	154	1.2
Maintenance and production		
Nontoxic	878	6.8
Toxic	NA[a]	NA
Supply and storage		
Nontoxic	2,595	20.0
Toxic	514	4.0
Open space/clearance zones	7,673	59.1
Utilities and pollution abatement	302	2.3
Security	245	1.9

[a] Not applicable; currently, there are no toxic production areas.

Source: Adapted from U.S. Army (1997).

maintenance and production areas, supply and storage areas, open space, utilities, security, and the NCTR area. In general, production areas are located in the south, storage is in the north, and administration and housing are in the west-center portions of PBA. The PBCDF is currently under construction in the northeast portion of the installation, east of the chemical storage areas. Testing was scheduled for 2001, with operation beginning in 2003 and closure by 2007.

PBA is accessed by Interstate 530 (I 530) from the north or south. State Route (SR) 256 is a direct connector from I 530 to Plainview Gate, and SR 365 parallels the west boundary of PBA and provides access to Plainview, Dexter, and Stark Gates.

The majority of the installation's current total of 15,000 acres (6,000 ha) is designated as open space and clearance zones (Table 5.2-1; Figure 5.2-1). Other dominant uses include supply and storage (about 22% of the total area) and maintenance and production (roughly 6% of the total).

The chemical weapons stockpile is located on about 436 acres (175 ha) in the northwestern portion of PBA (see Figure 5.1-2) (U.S. Army 1997). About 3,850 tons of chemical weapons are stored at the installation (IOC 2000). The storage facilities consist of 66 igloos constructed of steel-reinforced concrete and are dedicated to storing chemical weapons.

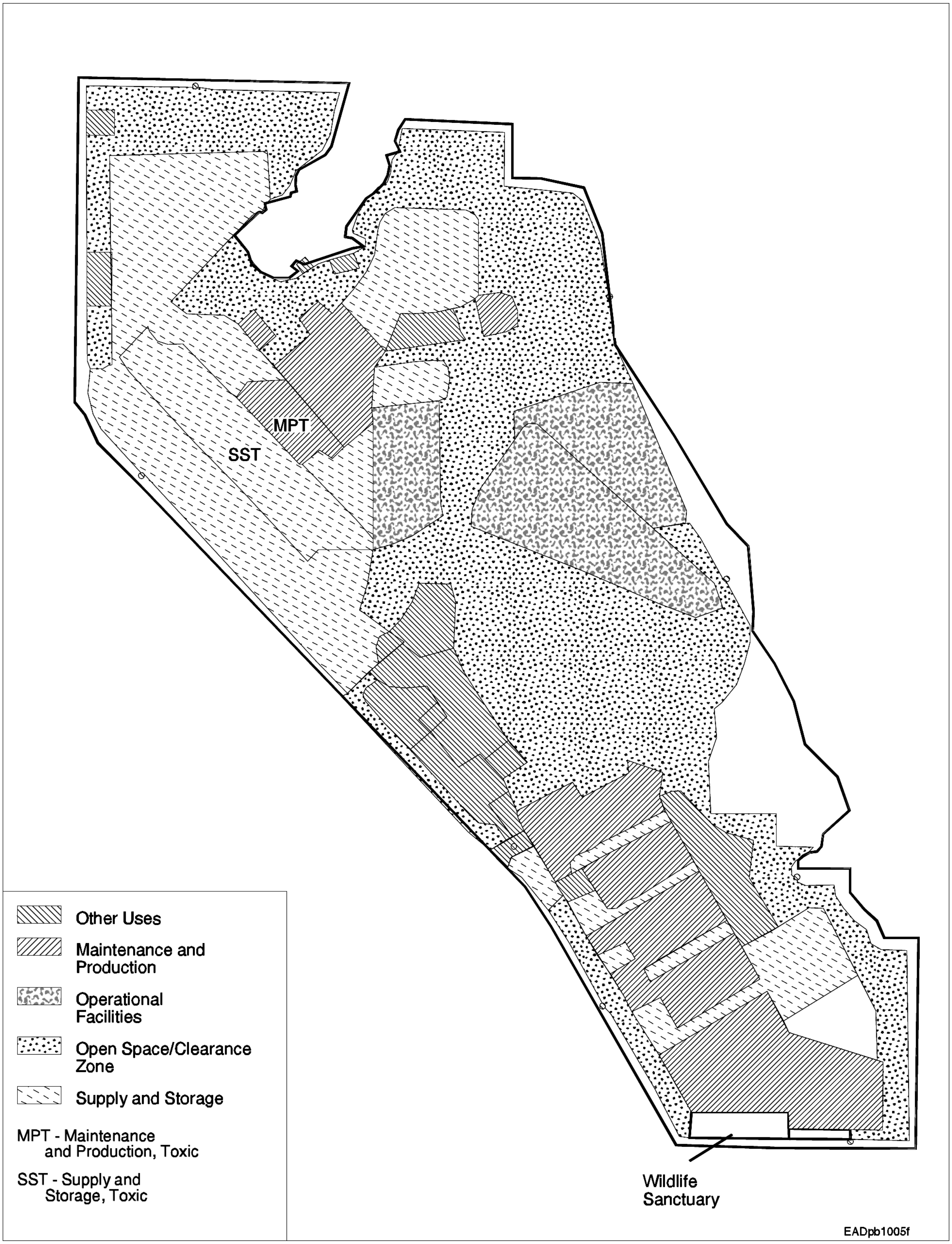

FIGURE 5.2-1 Land Use at PBA

Future land use at PBA is anticipated to remain generally the same as it is now. The land should provide a rural arsenal setting for the supply, storage, manufacturing, and maintenance of munitions and assorted administrative and operational facilities to support this general mission. The majority of the installation's land surface is expected to remain open space. The amount of PBA designated for chemical weapons storage is expected to decline as chemical demilitarization activities take place over the coming years.

5.2.3 Current and Planned Off-Post Land Use

PBA lies in Jefferson County, Arkansas, about 30 mi (48 km) southeast of Little Rock and roughly 8 mi (13 km) northwest of Pine Bluff, Arkansas. Communities closest to the installation include Pine Bluff, White Hall, Dexter, and Jefferson, Arkansas.

The northern boundary of PBA borders privately owned agricultural and timber lands with scattered residences. The town of Redfield, with a population of about 1,100, is located 5 mi (8 km) northwest of the PBA boundary. The NCTR is on the northeast boundary. The southern boundary borders developed and undeveloped industrial property. The University of Arkansas, Pine Bluff, is located 2 mi (3 km) to the southeast. The eastern boundary of PBA is the Arkansas River. The western boundary adjoins the Union-Pacific Railroad right-of-way, residential properties, and the town of Whitehall, with approximately 5,000 residents. Land use in these adjacent, off-post areas is expected to continue to follow current trends during the proposed period of operation of an ACWA pilot facility. No major construction activities or land use changes are anticipated; none were noted at the public meetings by PBA personnel, or by the Chemical Stockpile Emergency Preparedness and Planning (CSEPP) office.

Land use immediately to the east and north of PBA is primarily rural; the area is known for agricultural crops and livestock including soybeans, rice, wheat, hay, cotton, and beef cattle (SBCCOM 2000b). Agricultural area is interspersed with areas of residential use (communities and isolated residences) and mixed forest. To the west and south are built-up bedroom communities and a major urban area, the city of Pine Bluff. In 1997, Jefferson County contained 362 farms covering 288,635 acres (116,811 ha) (U.S. Department of Agriculture [USDA] 1999a). Cropland on these farms totaled 258,344 acres (104,552 ha), with the remaining 30,291 acres (12,259 ha) used mainly for grazing. Substantial changes in land use near the installation are not anticipated in the immediate future.

5.2.4 Impacts on Land Use

5.2.4.1 Impacts of the Proposed Action

The proposed ACWA testing facility at PBA would have negligible effects on both on- and off-post land use. Proposed ACWA pilot testing activities at PBA would be conducted within the portion of the installation that has been reserved for chemical weapon activities. Impacts on land use within the installation are expected to be negligible. Impacts from normal operations at the proposed ACWA pilot testing facility would be consistent with current and past installation use, and they would not significantly adversely affect those continuing installation operations.

Impacts on off-post land use as a result of normal construction and operations also are expected to be negligible. Any releases of chemical agents that could occur would be of such a small magnitude that they would cause no impacts off the installation. Impacts on more distant land use patterns in the community of Pine Bluff and other, closer communities would be reduced in correspondence to their distance from the installation.

5.2.4.2 Impacts of No Action

Under the no action alternative, storage of chemical stockpile components at PBA would continue. Land use in the immediate storage area, already identified for activities associated with chemical weapons, similarly would continue.

5.3 INFRASTRUCTURE

Utilities (electric power, water, sewer, and natural gas) are located within less than 1 mi (1.6 km) of either Area A or Area B. Figure 5.3-1 shows the corridors that would most likely be used to provide utilities for Areas A and B. Electric power transmission lines would be constructed from an existing substation, while water, sewer, and gas lines would be constructed from existing utilities located at the Binary Production Facilities. Utility corridors would generally follow existing roadways and, wherever possible, be constructed in previously disturbed areas. Table 5.3-1 lists an upper bound estimate of the area that would be disturbed during construction of these utility access corridors. For these estimates, it was assumed that (1) the water/sewer/gas/communications corridor would be 60 ft (20 m) wide and the entire corridor width would be disturbed during construction, (2) the power line corridor would be 30 ft (10 m) wide and the entire corridor width would be disturbed during vegetation clearing, and (3) the access road would be 50 ft (15 m) wide. The same amount of area would be disturbed by installation of the utility corridors for any of the ACWA technologies.

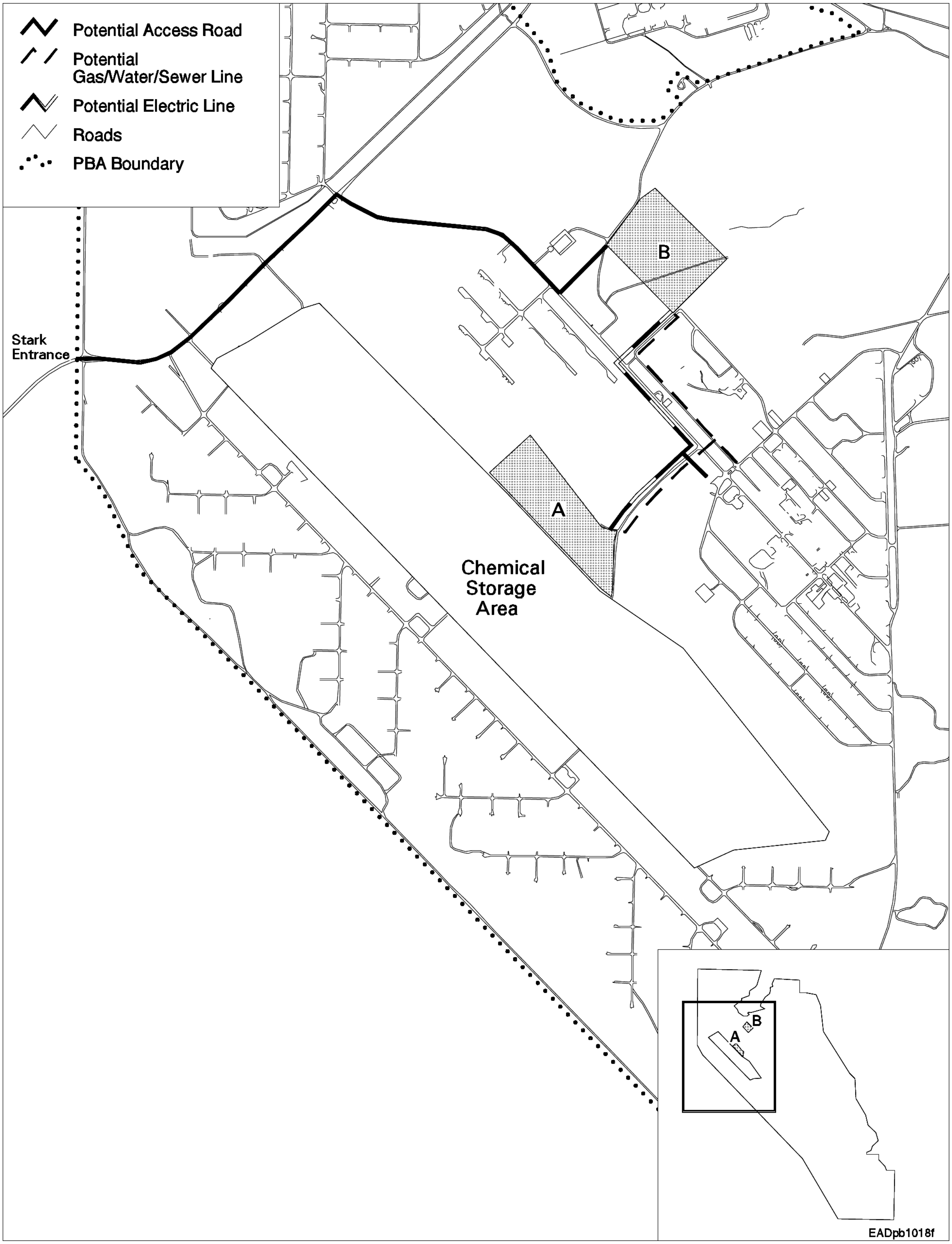

FIGURE 5.3-1 Proposed Utility and Road Access Corridors for the ACWA Pilot Facility at PBA

TABLE 5.3-1 Estimated Land Area Disturbed for Construction of an ACWA Pilot Test Facility and Associated Infrastructure at PBA[a]

	Area Disturbed (acres)	
Construction Activity	Area A	Area B
Pilot facility	25	25
Electric power	2.3	3.5
Water/sewer/gas/communications	2.5	7.0
Access road	0	1.3

[a] Unit conversion: 1 acre = 0.4 ha.

5.3.1 Electric Power

5.3.1.1 Current Supply and Use

The current electric power supplier is Entergy Systems. It has sufficient capacity to meet current and projected needs at PBA. Current electric power usage at PBA is 26,700 MWh/yr.

5.3.1.2 ACWA Pilot Facility Requirements

Table 5.3-2 lists the electric power requirements for each of the ACWA technologies. Electricity use would range up to 120 GWh/yr. The estimated power requirement for the PBCDF currently under construction is 36 GWh/yr.

5.3.1.3 Impacts of the Proposed Action

The electric power needs of the ACWA pilot test facility would be met by a power line from an existing substation located south of the chemical storage area. It is also possible that a new high-voltage line could be constructed from an Arkansas Power and Light transmission line. Any of the proposed technologies would require additional electric transmission lines to be constructed. Figure 5.3-1 shows the assumed utility corridors for both Areas A and B, and Table 5.3-1 lists the estimated areas that would be disturbed by this construction. Impacts on the existing electric power infrastructure would be negligible.

TABLE 5.3-2 Approximate Annual Utility Demands for Operation of an ACWA Pilot Test Facility at PBA[a]

	Annual Demand		
Utility	Neut/SCWO	Neut/GPCR/ TW-SCWO	Elchem Ox
Electric power (GWh)	60	26	120
Natural gas (scf)	52,000,000	140,000,000	48,000,000
Fuel oil (gal)	48,000	48,000	48,000
Process water (gal)	6,100,000	18,000,000	900,000
Potable water (gal)	5,500,000	6,400,000	6,400,000
Sewage (produced) (gal)	7,500,000	7,500,000	7,500,000

[a] Neut/Bio was not considered because it does not work with nerve agent, and because there is no mustard agent in ACWs at PBA. Unit conversions: 1 scf (standard cubic foot) = 0.028 Nm^3. 1 gal = 3.8 L.

5.3.1.4 Impacts of No Action

There would be no impact on the electric power infrastructure from the no action alternative.

5.3.2 Natural Gas

5.3.2.1 Current Supply and Use

The natural gas supplier for PBA is Reliant Energy. It has sufficient capacity to meet current and projected needs at PBA. Current natural gas usage at PBA is approximately 45 million scf.

5.3.2.2 ACWA System Natural Gas Requirements

Table 5.3-2 lists the natural gas requirements for each of the ACWA technologies. Annual natural gas use would range from 48 million scf for Elchem Ox to 140 million scf for Neut/GPCR/TW-SCWO.

5.3.2.3 Impacts of the Proposed Action

The natural gas power needs of the ACWA facility would be met by a gas line from the Binary Production Facilities located southeast of the chemical storage area. Natural gas consumption for a full-scale pilot ACWA facility would be similar to that for the PBCDF currently under construction. Current plans are for the PBCDF to cease operations before the proposed ACWA pilot plant is operational, which would make the natural gas resources it used available for the ACWA facility. However, even if the PBCDF and proposed ACWA facility operated concurrently, the existing infrastructure would be adequate to supply them as long as new supply lines were added.

The proposed ACWA facility would require additional natural gas pipelines to be built. Figure 5.3-1 shows the assumed utility corridors for both Areas A and B, and Table 5.3-1 lists the estimated areas that would be disturbed by this construction. Impacts from this construction on the existing natural gas infrastructure would be negligible.

5.3.2.4 Impacts of No Action

There would be no impacts on the natural gas infrastructure from the no action alternative.

5.3.3 Water

5.3.3.1 Current Supply and Use

Water at PBA is supplied by 12 on-post wells (U.S. Army 1997). These 12 wells have a combined maximum short-term production of 20.7 million gal/d (78,000 m^3/d) (U.S. Army 1997). Current water usage at PBA is approximately 900,000 gal/d (3,400 m^3/d) or 319 million gal/yr (1.2 million m^3/yr). The PBCDF currently under construction is estimated to require an additional average of 145,000 gal/d (53 million gal/yr) with peak usage of about 370,000 gal/d (1,400 m^3/d) or 135 million gal/yr (500,000 m^3/yr) (U.S. Army 1997).

5.3.3.2 ACWA Pilot Facility Requirements

The proposed ACWA facilities would require additional water supply lines to be built. Figure 5.3-1 shows the assumed utility corridors for both Areas A and B, and Table 5.3-1 lists the estimated areas that would be disturbed by this construction.

Table 5.3-2 lists the amounts of water (potable and process) that each of the proposed ACWA technologies would use during normal operations and the amounts of sewage each one would generate. Water use for the ACWA technologies would range from about 7 million gal/yr (2,000 m^3/yr) for Elchem Ox to 24 million gal/yr (91,000 m^3/yr) for Neut/GPCR/TW-SCWO. This usage represents an increase of 2.2 to 7.5% over existing water use, depending on the technology. The current water supply infrastructure at PBA would be sufficient to meet these needs.

Potable water lines and connections to the sewage treatment system would be available to both Areas A and B from existing lines and connections built to supply the Binary Production Facilities. Construction of additional pipelines would be required to provide these utilities to the proposed areas. The length of additional pipeline for Area A would be about 0.6 mi (1 km) and for Area B would be about 0.9 mi (1.5 km).

5.3.3.3 Impacts of the Proposed Action

The existing water supply systems would be sufficient to meet the needs of any of the proposed ACWA pilot facilities. The needs of an ACWA facility would represent only a small fraction of the current capacity of the system. Impacts from any of the ACWA technologies would be negligible. In addition, the PBCDF is currently scheduled to finish operating before an ACWA pilot plant would begin full-scale pilot testing. Thus, the additional water supply system currently being constructed for the PBCDF would be available to meet the needs of the ACWA pilot test facility.

Construction of an ACWA facility would require water for numerous uses including washing, dust control, preparation of concrete, and fire control. These needs have not been estimated quantitatively, but experience at PBA with construction activities of similar size has shown that the wells would be adequate and that impacts on the water supply would be negligible. Impacts on the sewage treatment infrastructure from construction activities would be negligible as well. Minor local disruptions in supply could occur when the ACWA facility was being connected to the existing infrastructure. However, this type of common disruption would be minor and short-lived.

Operations of the proposed ACWA pilot facility would have a negligible impact on the water supply systems. Even if the PBCDF was still in operation when full-scale ACWA pilot testing began, the water supply at PBA would be sufficient to meet both ACWA and PBCDF needs. Operations of the ACWA facility would have a negligible impact on water supply.

Sewage treatment facilities would be sufficient to meet the additional need of a proposed ACWA pilot facility. Construction and operation of the facility would have a negligible impact on the sewage treatment infrastructure.

The existing water supply system would not be able to provide enough water for fire fighting and other potential emergency response needs. To meet such emergency needs, the ACWA facility would be provided with a storage tank of sufficient capacity.

There would be no off-post impacts on the water supply or sewage treatment infrastructure from construction and operation of an ACWA pilot facility. PBA water and sewage infrastructure are self-contained.

5.3.3.4 Impacts of No Action

There would be no impacts on the water use and supply infrastructure from the no action alternative.

5.3.4 Communications

5.3.4.1 Current System

No information was available.

5.3.4.2 ACWA Pilot Test Facility Requirements

It is assumed that extension of the existing communications system to the proposed areas for a pilot facility would be required.

5.3.4.3 Impacts of Proposed Action

Extending the communications system would be unlikely to have any adverse impacts.

5.3.4.4 Impacts of No Action

No impacts on the communications system are likely from the no action alternative.

5.4 WASTE MANAGEMENT

This section presents the potential environmental consequences on waste management at PBA from siting, constructing, and operating an ACWA pilot test facility as well as the consequences from following the no action alternative. Included is a description of the environmental impacts at PBA from current waste management activities.

At PBA, an incinerator that will be used to destroy some or all of the chemical munitions held in inventory at the installation is currently under construction. For the purposes of this environmental impact statement (EIS), the discussion of the affected environment at PBA assumes that the incinerator is being built. Impacts from the ACWA pilot test facility discussed under the proposed action consider an operational incinerator as part of the environmental background.

5.4.1 Current Waste Generation and Management

5.4.1.1 Hazardous Wastes

PBA generates a variety of hazardous wastes associated with its missions for the Army. Most of these hazardous wastes are packaged and transported off post to appropriately permitted treatment and disposal facilities. The principal activities that are sources of these hazardous wastes at PBA include the following:

- Vehicle maintenance (used oil, batteries, coolant, degreaser, etc.),
- Facility maintenance (paints, solvents, water conditions, etc.),
- Chemical agent decontamination (field test materials, toxic chemical analysis agents, personal protective equipment [PPE], etc.),
- Conventional munitions management (spent and rejected munitions, contaminated filters, explosive residues, etc.), and
- Hazardous material management (organic and inorganic laboratory packs, other laboratory wastes, etc.).

Hazardous wastes accumulated at the generation points at PBA are transferred to the hazardous waste storage facility for further storage (up to 90 days) awaiting off-site transport. Various types of waste requiring some type of treatment (e.g., dewatering, shredding, incineration, etc.) can be stored in RCRA-permitted storage buildings (i.e., solid hazardous waste storage facility, liquid hazardous waste storage facility, phosphorus storage facility, waste container magazine, etc.) until such treatment is obtained. most of the wastes generated at PBA are collected and disposed of off post in accordance with the U.S. Army, state, and federal regulations. Any waste listed as hazardous in the RCRA regulations is stored, treated, and disposed of in appropriately permitted facilities as prescribed by the EPA and applicable state and local regulations.

PBA also maintains RCRA Subpart X interim status for a waste volume reduction unit (WVRU), used to reduce the volume of different types of waste and segregate them, and an open burning and open detonation area for treatment of reactive wastes, such as unserviceable and obsolete munitions and explosives that cannot be processed by any other means. PBA also maintains an Arkansas-permitted hazardous waste landfill (PBA 2000). This facility is used for disposal of remedial action waste from PBA's RCRA Corrective Action Program. It is also used for disposal of various pyrotechnic production wastes, demilitarization wastes, and industrial treatment plant sludge obtained from PBA. PBA also operates its Central Incinerator Complex, which includes a rotary deactivation furnace and a fluidized-bed incinerator (see Section 5.2.1.2). Although this unit was permitted to process RCRA hazardous wastes, it is currently used only intermittently to burn nonhazardous wastes.

PBA has a hazardous waste management plan that outlines the treatment and management of hazardous wastes at the site (PBA 1999). This plan describes the procedures, policies, and responsibilities for hazardous waste management activities, such as the waste identification, handling, storage, treatment, and disposal tasks performed at the installation. The plan is designed to ensure that the hazardous waste tasks performed at the installation comply with applicable federal, state, local, and Army regulations. An incinerator for the destruction of chemical agents and munitions stored in inventory at PBA is now being built at PBA. This treatment facility, upon completion, will generate many wastes for disposal at off-site permitted treatment, storage, and disposal facilities (TSDFs).

5.4.1.2 Nonhazardous Wastes

PBA generates a wide variety of nonhazardous solid wastes, such as office trash, scrap wood, industrial and demolition wastes, used equipment, and uncontaminated PPE. These wastes are collected and disposed off post in a RCRA Subtitle D landfill or recycled if possible. Sanitary wastes are treated in an on-post sewage treatment plant. Table 5.4-1 lists the hazardous and nonhazardous wastes generated at PBA during the year 1999.

TABLE 5.4-1 Hazardous and Nonhazardous Wastes Generated at PBA in 1999

Type of Waste	Amount (tons)
Hazardous wastes (total)	65.5
Liquids	18.4
Solids	46.1
Solids treated on site	1.0
Nonhazardous wastes	
Solids	1,730
Recyclable solids	1,780
Sanitary waste (solids after treatment)	400

Source: PBA (1999).

5.4.2 ACWA Pilot Test Facility Waste Generation and Treatment Requirements

The construction and operation of an ACWA pilot test facility would generate an array of solid and liquid wastes, both hazardous and nonhazardous. Estimates of waste generated during construction of the facility are based on waste generation from construction of comparable buildings and then scaling the values according to building size and number of construction workers (full-time equivalents [FTEs]). The types and amounts of waste expected to be generated from the operation of this facility were estimated by using the techniques of stoichiometric mass balance[2] for each unit process, coupled with the analytical results obtained from initial demonstration tests for the technologies. This technique relies on a number of assumptions that have not been fully verified (Kimmell et al. 2001). How sensitive these estimated results are to the various assumptions used in this procedure has not been determined.

The ACWA pilot facility would produce brine salts as solid waste. These salts could contain significant amounts of toxic heavy metals (e.g., lead [Pb]). Such solid waste would probably fail the RCRA Toxicity Characteristic Leaching Procedure (TCLP). If so, the hazardous salt waste would need to be stabilized by a procedure that would reduce the leaching of the heavy metal to a level that would allow it to be approved for land disposal as a hazardous solid waste. Salt wastes have proven somewhat difficult to stabilize, so additional studies might be required to identify an effective stabilization technology. If stabilization of the solid salt waste were required, either a waste management process for stabilizing the waste would be needed on site, or, alternatively, the waste would need to be shipped off post to an appropriately permitted waste treatment facility. Commercial facilities exist for managing this type of waste.

[2] Calculations are based on the principle of the conservation of mass in chemical reactions (i.e., the total mass in is equal to the total mass out).

Nerve agents are not listed hazardous wastes under Arkansas regulations. Therefore, if nerve agent residues did not demonstrate a hazardous characteristic, they would not be characterized as hazardous waste under Arkansas regulations. However, PBA has entered into a Consent Administrative Order with ADEQ concerning the management and storage of M55 rockets as hazardous waste, including the explosive charges and the GB and VX contained within them (Consent Administrative Order LIS 84-068).

It is assumed that most wastes generated by the proposed action would be collected and disposed of off post in accordance with U.S. Army, state, and federal regulations. Any wastes determined to be hazardous under RCRA regulations would be stored and disposed of as prescribed by the EPA and applicable state and local regulations.

5.4.3 Impacts of the Proposed Action

5.4.3.1 Impacts of Construction

Construction of an ACWA pilot facility would generate substantial amounts of nonhazardous wastes, such as building material debris and excavation spoils. Small amounts of hazardous wastes, such as solvents, paints, cleaning solutions, waste oils, contaminated rags, and pesticides, would also be generated. Construction activities would generate liquid nonhazardous wastes in the form of wastewater from wash-downs and sanitary wastes.

Estimates of the amounts of waste that would be generated during construction of an ACWA pilot test facility at PBA are shown in Table 5.4-2. This table includes waste estimates for Neut/SCWO, Neut/GRCR/TW-SCWO, and Elchem Ox.

No significant impacts are expected from the generation of hazardous wastes during construction of an ACWA facility. It is assumed that most wastes generated during construction would be collected and disposed of off post in accordance with U.S. Army, state, and federal regulations. Any wastes defined as hazardous in the RCRA regulations would be stored and disposed of in RCRA-permitted facilities as prescribed by the EPA and applicable state and local regulations. Existing on- and off-post facilities would be adequate to handle the increased wastes generated by construction of an ACWA facility, and no significant impacts on the internal, temporary storage facilities or the off-post treatment facilities would be expected.

No significant impacts are expected from the generation of nonhazardous wastes during construction of an ACWA facility. Nonhazardous solid wastes would be collected and disposed in a local landfill. Sanitary wastes would be treated in an on-post sewage treatment plant.

TABLE 5.4-2 Wastes Generated during Construction of an ACWA Pilot Test Facility at PBA

Waste	Neut/SCWO	Neut/GPCR/ TW-SCWO	Elchem Ox
Hazardous wastes			
Solids (yd^3)	90	90	90
Liquids (gal)	38,000	35,000	39,000
Nonhazardous wastes			
Solids			
Concrete (yd^3)	210	210	190
Steel (tons)	36	29	33
Other (yd^3)	1,700	1,700	1,500
Liquids			
Wastewater (gal)	2,500,000	2,300,000	2,500,000
Sanitary (gal)	5,500,000	5,100,000	5,600,000

Source: Kimmell et al. (2001).

5.4.3.2 Impacts of Operations

Munitions are not generally considered wastes while they are in storage. Typically, munitions are reclassified as wastes upon their removal from storage for treatment and disposal or if they are no longer usable. Upon the processing and destruction of a munition, however, the residuals become wastes. The Army has reclassified the M55 rockets stored at PBA as waste because of their obsolescence. PBA has entered into a Consent Administrative Order with ADEQ concerning the management and storage of M55 rockets as hazardous waste, including the explosive charges and the GB and VX contained within them (Consent Administrative Order LIS 84-068). Wastes resulting from the normal operations of an ACWA pilot test facility would include components from the treatment of metal parts and dunnage as well as process residues, such as the contaminated salts generated from treating chemical agents and energetics. Operations would also generate a number of nonprocess wastes (e.g., office trash, PPE, decontamination solutions, spent carbon filters). Current operating plans include recycling all process liquids obtained during operation back through the reaction vessel. Such recycling would eliminate these liquids from the waste streams. In summary, no activities or operations that would result in significant impacts on waste management systems or the environment were identified. If stabilization of the hazardous solids salt waste obtained during normal operations was required, either a waste management process for stabilizing the waste would be needed, or, alternatively, the waste would need to be shipped off post to an appropriately permitted treatment facility. Depending on the technology chosen for stabilization of the salt waste, a new off-post treatment facility might need to be built.

PBA has substantial amounts of nerve agent in its chemical munition inventory. The estimates of annual waste generation from the operation of an ACWA pilot test facility are based on 276 days of operation per year using the Neut/SCWO technology. For the Neut/GPCR/TW-SCWO and Elchem Ox technologies, the bases are 276 days of operation per year for GB and 108 days per year for VX.

Polychlorinated biphenyls (PCBs) have been identified as a constituent in the firing tubes of M55 rockets held in the inventory at PBA. The concentration of PCBs in the tubes can range from less than 50 parts per millions (ppm) to more than 2,000 ppm. Therefore, treating these munitions might involve treating PCB wastes. In addition, the treatment process might generate brine wastes containing more than 50 ppm of PCBs or unacceptable amounts of toxic PCB intermediate by-products such as dioxins or furans. PCB concentrations in wastes generated during the pilot-scale testing of ACWA technologies would need to be evaluated. Wastes containing PCBs in excess of 50 ppm are subject to regulation under the *Toxic Substances Control Act* (TSCA).

Hazardous Wastes. Waste generated from the operation of ACWA pilot test facilities are summarized in Table 5.4-3. The numbers in Table 5.4-3 account for only those waste streams that would be generated during processing of the nerve agent. The table does not include the wastes that would be generated during storage, which would include primarily contaminated solids such as PPE and pallets and a small quantity of contaminated liquids in the form of decontamination water. PBA would continue to generate wastes associated with storage at decreasing rates during the ACWA facility operation until the stockpile was completely destroyed.

Neutralization/SCWO. Process effluents from the SCWO units would be combined, and brine salts (mostly sodium sulfate, sodium fluoride, and sodium phosphate, see Table 5.4-3) would be extracted and dried for disposal as solid hazardous waste. No liquid wastes would be released from the process, since process liquids would be recycled back into the SCWO units.

Nonprocess operational wastes (e.g., dunnage, PPE, spent carbon filters, pallets, decontamination solution) were estimated by the technology provider (General Atomics 1999). All these wastes could potentially be contaminated by agent. Such contamination would require treatment. Current operating plans include recycling all nonprocess liquids obtained in the operations phase back through the reaction vessel. Such recycling would eliminate these liquids from the waste streams. Recycling of nonprocess wastes would result in approximately 44 tons of brine waste, which are included in the overall brine waste numbers shown in Table 5.4-3, and 13 tons of metals waste, which are included in Table 5.4-4 (Kimmell et al. 2001).

No significant impacts are expected from the generation of hazardous wastes during operation of an ACWA pilot test facility. It is assumed that most wastes generated during

TABLE 5.4-3 Hazardous Wastes Generated Annually from the Operation of an ACWA Pilot Test Facility at PBA[a]

	Amount of Waste Generated (tons/yr) per Technology and Agent Being Processed				
	Neut/SCWO	Neut/GPCR/ TW-SCWO		Elchem Ox	
Hazardous Waste	Nerve[b]	GB	VX	GB	VX
Brine salts (total)	2,900	3,170	970	120	50
Sodium phosphate	2,300	2,620	760	-[c]	-
Sodium fluoride	80	100	-	-	-
Sodium sulfate	43	-	76	-	-
Other salts	60	40	10	120	50
Water in salt cake	370	410	124	-	-
Aluminum oxide	1,300	760	230	-	-
Anolyte-catholyte waste	-	-	-	230	330
Hazardous liquids	-	-	-	10	4

[a] Values are based on 276 d/yr of operation for Neut/SCWO technology and also for Neut/GPCR/TW-SCWO and Elchem Ox Technologies processing GB. The latter two technologies would operate 108 d/yr when processing VX.

[b] The value for nerve agent includes GB and VX. Separate values were not provided for this technology from the results of demonstrations.

[c] A hyphen means that the waste stream is not generated by the specific technology.

Source: Kimmell et al. (2001).

operation would be collected and disposed of off post in accordance with U.S. Army, state, and federal regulations. Any wastes determined to be hazardous in the RCRA regulations would be stored and disposed of in RCRA-permitted facilities as prescribed by the EPA and applicable state and local regulations.

If the brine salts failed the RCRA TCLP tests, some type of stabilization of the salt would be necessary. Depending on the technology chosen and the amount of loading of the salt wastes in the stabilization matrix, the amount of stabilized salt waste could easily exceed the salt waste estimate given in Table 5.4-3 by a factor of approximately 2.5. If stabilization of the solid salt waste was required, either a waste management process for stabilizing the waste would be

TABLE 5.4-4 Nonhazardous Wastes Generated Annually from the Operation of an ACWA Pilot Test Facility at PBA

	Amount of Waste Generated per Technology		
Nonhazardous Waste	Neut/SCWO	Neut/GPCR/ TW-SCWO	Elchem Ox
Sanitary wastes (gal)	7,500,000	7,500,000	7,5000,00
Other solid wastes (yd^3)[a]	1,800	1,800	1,800
Recyclable wastes (yd^3)[b]	720	720	720
Metal waste (nerve) (tons)	1,030[c]	NA[d]	NA
Metal waste (GB) (tons)	NA	2,900[c]	1,800[c]
Metal waste (VX) (tons)	NA	660	650

[a] Domestic trash and office waste.

[b] Recyclable wastes include paper and aluminum.

[c] This waste includes glass fiber.

[d] NA = not applicable.

Source: Kimmell et al. (2001).

needed on post, or, alternatively, the waste would need to be shipped off post to an appropriately permitted treatment facility. Depending on the treatment chosen, a new facility might need to be constructed, or an existing off-post facility might need to handle the off-post shipment of solid salt waste.

Neut/GPCR/TW-SCWO. This technology would incorporate several sources of waste generation. Hydrolysates for both agent and energetics would be combined and sent to the TW-SCWO unit. This unit, operating at supercritical conditions, would rapidly oxidize all input materials. Upon completion, the liquid effluents from this unit would contain soluble and unsoluble salts and metal oxides. These would be sent to the evaporator/crystallizer unit. The resulting dried hazardous brine salts (primarily sodium phosphate, sodium sulfate, and sodium fluoride, see Table 5.4-3) would then be ready for disposal as hazardous wastes. The liquid effluent would be recycled back to the neutralizer unit as makeup water.

The GPCR unit consists of a thermal reduction batch processor (TRBP) and the GPCR reactor itself. In the TRBP, contaminated materials such as dunnage and metal parts contaminated with agent and energetics would be placed in a heated oven. The resulting volatile organics would be swept by heated hydrogen gas into the GPCR reactor, where they would be reduced to simple hydrocarbons (HCs) and acid gases. The gaseous effluent would pass through a caustic scrubber that would generate brine salts from the acid gases. These hazardous salts would be combined with the brine salts obtained from the TW-SCWO unit (amounts are listed in Table 5.4-3). All liquids would be recycled.

Nonprocess operational wastes (e.g., PPE, spent carbon filters, pallets, decontamination solution) were estimated by the technology provider (General Atomics 1999). All these wastes could potentially be contaminated by agent. Such contamination would require treatment. Current operating plans include recycling all nonprocess liquids obtained in the operations phase back through the reaction vessel. Such recycling would eliminate these liquids from the waste streams. Recycling of nonprocess wastes would result in approximately 190 tons of brine waste; this amount is included in the overall brine waste numbers shown in Table 5.4-3.

No significant impacts are expected from the generation of hazardous wastes during the operation of an ACWA pilot test facility. It is assumed that most wastes generated during operation would be collected and disposed of off post in accordance with U.S. Army, state, and federal regulations. Any wastes determined to be hazardous in the RCRA regulations would be stored and disposed of off post as prescribed by the EPA and applicable state and local regulations.

If the brine salts failed the RCRA TCLP tests, some type of stabilization of the salt would be necessary. Depending on the technology chosen and the amount of loading of the salt wastes in the stabilization matrix, the amount of stabilized salt waste could easily exceed the salt waste estimate given in Table 5.4-3 by a factor of approximately 2.5. If stabilization of the solid salt waste was required, either a waste management process for stabilizing the waste would be needed on post, or, alternatively, the waste would need to be shipped off post to an appropriately permitted treatment facility. Depending on the treatment chosen, a new facility might need to be constructed, or an existing facility might need to handle the off-post shipment of solid salt waste.

Electrochemical Oxidation. This system would incorporate several sources of waste generation. It would destroy both the agents and energetics by electrochemical oxidation in the SILVER II process. SILVER II employees an electrochemical oxidation reaction that generates Ag^{+2} ions in aqueous nitric acid that is circulated through stirred tank reactors (the anolyte and catholyte circuits). Agents and energetics would be oxidized in similar but separate systems. When the current was turned on, the generated Ag^{+2} ions would oxidize the organic feed. Silver chloride (AgCl) would be precipitated when organochlorine compounds, such as mustard, are treated. The AgCl salt cake containing various metal particulates would be collected, dried, and shipped off site for silver recovery. The remaining salts, solids, and metal impurities would be disposed of as hazardous salts. Amounts are listed in Table 5.4-3 as anolyte-catholyte waste. The anode-cathode reaction would also generate a number of off-gases, including gases such as nitrogen oxides (NO_X). Most of the NO_X would be recovered at the NO_X reformer unit (as concentrated nitric acid) and recycled. Small amounts of dilute nitric acid would be neutralized and disposed of as a hazardous liquid (see Table 5.4.3). The remaining off-gas would be swept to a caustic scrubber, where any remaining corrosive gases would be neutralized and dried for disposal as hazardous brine salts (see Table 5.4-3). All liquids from this unit would be recycled as makeup water.

Various types of nonprocess wastes would be generated from the operation of this technology. These would include dunnage, PPE, spent carbon filters, pallets, and decontamination solution. All these wastes could potentially be contaminated by agent. Such contamination would require treatment. Nonprocess wastes would be treated by the MPT. Treatment of nonprocess wastes would result in approximately 130 tons of residual brine waste; this amount is listed in the overall brine waste numbers shown in Table 5.4-3. Nonprocess waste would generate about 60 tons of metal wastes; this total is included in Table 5.4-4.

No significant impacts are expected from the generation of hazardous waste during operation of an ACWA pilot test facility. It is assumed that most wastes generated during operation would be collected and disposed of off post in accordance with U.S. Army, state, and federal regulations. Any wastes defined as hazardous in the RCRA regulations would be stored and disposed of off post as prescribed by the EPA and applicable state and local regulations.

If the salts and the anolyte-catholyte wastes failed the RCRA TCLP tests, some type of stabilization of these wastes would be necessary. Depending on the technology chosen and the amount of loading of the wastes in the stabilization matrix, the amount of stabilized waste could easily exceed the hazardous waste estimates given in Table 5.4-3 by a factor of approximately 2.5. If stabilization of the solid salt waste was required, either a waste management process for stabilizing the waste would be needed on post, or, alternatively, the waste would need to be shipped off post to an appropriately permitted treatment facility. Depending on the treatment chosen, a new facility might need to be constructed, or an existing off-post facility might need to handle the off-post shipment of solid salt waste.

Nonhazardous Wastes. Estimates of nonhazardous solid wastes associated with facility operations were made by scaling data on comparable buildings according to the size of the operating work force (Kimmell et al. 2001) (Table 5.4-2).

No significant impacts are expected from the generation of nonhazardous solid wastes during operation of an ACWA pilot test facility. Nonhazardous solid wastes would be collected and disposed of in a local landfill by a licensed waste hauler. In each technology, recyclable metals would be generated from the decontamination of various munition parts. These are listed in Table 5.4-4. Nonprocess waste would also generate a small amount of metal wastes, which are included in Table 5.4-4.

During normal operations, an estimated 7,500,000 gal/yr of sanitary sewage would be generated (Table 5.4-4) (Kimmell et al. 2001). Sanitary waste would be treated in an on-post sewage treatment plant. There would be no discharge of any wastewater from operations. Thus, no impacts are expected from the generation of wastewater during operation of an ACWA pilot test facility.

5.4.4 Impacts of No Action

5.4.4.1 Hazardous Wastes

No construction activities are anticipated under the continued storage alternative. Continued storage of munitions at PBA would generate relatively small quantities of hazardous wastes from leaks, spills, and contaminated solids, such as PPE, pallets, and dunnage. The estimated annual generation associated with storage is 5 tons of liquid wastes (decontamination water) and about 1 ton of hazardous solid waste from PPE and pallets. The continued degradation of agent containers over time would probably generate slowing increasing amounts of waste from leaks, but again, these quantities would be relatively small.

Continued storage of chemical weapons at PBA would not adversely affect waste management. Hazardous wastes are collected and disposed of off post in accordance with U.S. Army, state, and federal regulations. Any wastes determined to be hazardous in the RCRA regulations are stored and disposed of in RCRA permitted facilities as prescribed by the EPA and applicable state and local regulations.

The proposed no action alternative assumes that all chemical munitions held in inventory at PBA would be incinerated as presented in an earlier EIS (U.S. Army 1997). An estimate of waste generation from such an incinerator can be obtained by using data from the earlier PBA EIS coupled with the same methodology used to generate waste estimates for the ACWA technologies . Estimates of waste generation from operation of a chemical munitions incinerator are given in Table 5.4-5.

5.4.4.2 Nonhazardous Wastes

No construction activities are anticipated under the continued storage alternative. A small amount of nonhazardous solid waste and nonhazardous sanitary waste would be generated during the storage of chemical weapons. However, these amounts would not be significant. Nonhazardous wastes associated with the operation of a chemical munitions incinerator at PBA are listed in Table 5.4-5. Process liquids from the incinerator would be recycled and not released

TABLE 5.4-5 Solid Process Wastes Generated from the Operation of an ACW Incinerator at PBA[a]

Type	Description	Peak-Hour[b] (lb/h)	Average-Day (lb/d)	Annual (tons/yr except as noted)
Hazardous waste				
Brine salt	From brine reduction[c]	3,100	3,100	10,300
Scrap/ash	From liquid incinerator	0	0	0
Scrap/ash	From dunnage furnace	100	2,100	80
Scrap/ash	From deactivation furnace	1,400	NA	NA
Nonhazardous waste				
Metal scrap	From metal parts treater	1,100	10,000	1,800
Sanitary waste	Liquid	-	-	7,500,000 gal
Other wastes[d]	Solids	-	-	1,800 yd^3
Recyclable wastes[e]	Solids	-	-	720 yd^3

[a] NA = not applicable. A hyphen means that the data were not available.

[b] Source for peak-hour generation rates: U.S. Army (1997).

[c] Contains 10–15% moisture.

[d] Nonhazardous (other) wastes include domestic trash and office waste.

[e] Recycle wastes include paper, aluminum, etc., generated by the facility.

to the environment. Continued storage of chemical weapons at PBA would not adversely affect waste management. Facilities exist to handle sanitary waste, and solid wastes would continue to be hauled off post by a licensed contractor.

5.5 AIR QUALITY — CRITERIA POLLUTANTS

This section describes existing meteorology, air emissions, and air quality at PBA and environmental consequences on air quality that might result from constructing and operating an ACWA pilot test facility at PBA. Data on potential air emissions and environmental consequences on air quality under the no action alternative are also presented. Potential impacts on human health as a result of air emissions during construction and normal operations are described in Sections 5.6 and 5.7. Potential impacts on air quality and human health as a result of air emissions from accidents involving explosives and chemical agents are described in Section 5.21.

The analysis of impacts on air quality from both construction and operations was conducted for Area A (see Figure 5.1-2), which is closest to the PBA installation boundary in the direction of the nearest off-site residence. The two potential locations for pilot test facilities are adjacent to one another and would require similar infrastructure. Therefore, the analysis for one location would provide an adequate representation of the potential impacts from construction and operations for the other facility location.

Because the facility size, number of construction workers, and infrastructure required for each of the ACW destruction systems proposed for pilot testing would be similar, only one model analysis of the impacts from construction on air quality was conducted. The technologies are expected to differ in the amount of fossil fuel they would combust to generate heat.

The analyses presented in the following sections conclude that the total (modeled plus background) concentrations associated with fugitive dust emissions during construction would be below applicable standards. However, total annual average $PM_{2.5}$ levels would be close to the standard because of their higher background levels, which were recorded at many statewide monitoring stations.[3] Accordingly, construction activities should be conducted so as to minimize further impacts on ambient air quality. Because of Neut/GPCR/TW-SCWO's higher process heat requirements, emission levels from fossil fuel combustion would be higher for that technology than for the other two technologies (Neut/SCWO and Elchem Ox). However, concentration increments of air pollutants due to these emissions, by themselves or added to background, would be similar for all three destruction technologies and within applicable standards.

5.5.1 Current Meteorology, Emissions, and Air Quality

5.5.1.1 Meteorology

Arkansas is geographically divided into two regions. The dividing line runs diagonally across the state from northeast to southwest. West and north of this line are the interior highlands; to the east and south are the flat lowlands, where PBA is located. The climate of the area surrounding PBA is modified continental, which includes exposure to all of the North American air mass types. However, because of the area's proximity to the Gulf of Mexico (about 310 mi [500 km]) away, the summer season is marked by prolonged periods of warm and humid weather. The following description of climate is based on data recorded at the Little Rock Airport (Adams Field) located about 30 mi (48 km) north-northwest of PBA (National Oceanic and Atmospheric Administration [NOAA] 1999). Wind data measured at the PBA on-post meteorological towers are also presented to evaluate how well the airport data used in the dispersion analysis represent installation conditions at PBA (Rhodes 2000).

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[3] PM = particulate matter. PM_{10} = coarse, inhalable PM with a mean aerodynamic diameter of 10 μm or less. $PM_{2.5}$ = fine, inhalable PM with a mean aerodynamic diameter of 2.5 μm or less.

The average wind speed measured at 20-ft (6.1-m) above ground level (agl) at the Little Rock Airport, Arkansas, is about 7.7 mi/h or mph (3.4 m/s). The average wind speed of 8.8 mph [3.9 m/s]) in winter months (January–March) is higher than that of 6.6 mph [2.9 m/s]) in summer months (July–September). Dominant wind directions are from the south-to-southwest sector throughout the year, except in September, when they are from the northeast.

Seven CSEPP towers, which are distributed around PBA, are currently in operation for emergency response purposes. Two towers (Towers 1 and 6) house instruments that monitor winds at 15-, 30-, and 60-m agl, while instruments at other towers monitor winds at 60-m agl only. Wind data collected at Tower 1, which is near the chemical weapons storage igloos and the proposed locations for a destruction facility, are presented to examine the general wind patterns around the installation. The wind roses at the three (15-, 30-, and 60-m) levels of Tower 1 for 1995 are shown in Figure 5.5-1(a–c). For comparison, the wind rose at the 20-ft (6.1-m) level of the Little Rock Airport for the period of 1984–1992 is also presented in Figure 5.5-1(d) (EPA 2000a). Wind patterns at the three levels of Tower 1 are quite similar in terms of dominant wind directions (north-northeast and south-southwest) but different in terms of wind speeds. The wind patterns at PBA are similar to those at Little Rock Airport, except that the predominant wind direction at the airport is shifted slightly.

Winds in the area appear to be influenced by regional topographical features, including the Ouachita Mountains and Ozark Mountains, which tend to align winds in a north-northeasterly or south-southeasterly direction. The Arkansas River Valley to the east of the facility influences local winds, but not enough to dominate, even in areas as close to the river as PBA is. Wind roses from all PBA towers indicate the north-northeasterly and south-southwesterly tendencies, even though the Arkansas River is within about 2 mi (3.2 km) from the farthest tower.

Because of the area's proximity to the Gulf of Mexico, maritime tropical air dominates the summer season, causing prolonged periods of warm and humid conditions. Winters are short and mild, but cold periods of short duration do occur. The average annual winter temperature at Little Rock Airport is 62°F (17°C). January is the coldest month, averaging 40°F (5°C), and July is the warmest month, averaging 82°F (28°C). Extreme temperatures have ranged from –5°F (–21°C) in February 1951 to 112°F (44°C) in July 1986. The number of freeze-free days per year (i.e., when the daily-minimum temperature is greater than 32°F [0°C]) is about 305 days, and no freeze days occur May through September. Daily maximum temperatures of 90°F (32°C) or higher occur about 72 days per year, most of which occur in June, July, and August.

The average annual precipitation at Little Rock Airport is about 51 in. (129 cm). Precipitation is relatively evenly distributed throughout the year, ranging from 3.3 in. (8.3 cm) in August to 5.5 in (14 cm) in April. The average number of days with measurable precipitation (0.01 in. [0.025 cm] or more) is about 105 days per year. The greatest amount of precipitation in a single month was about 16 in. (42 cm) in December 1987, and the greatest amount in a 24-hour period was about 8 in. (20 cm) in April 1974. Snowfall is generally light and remains on the

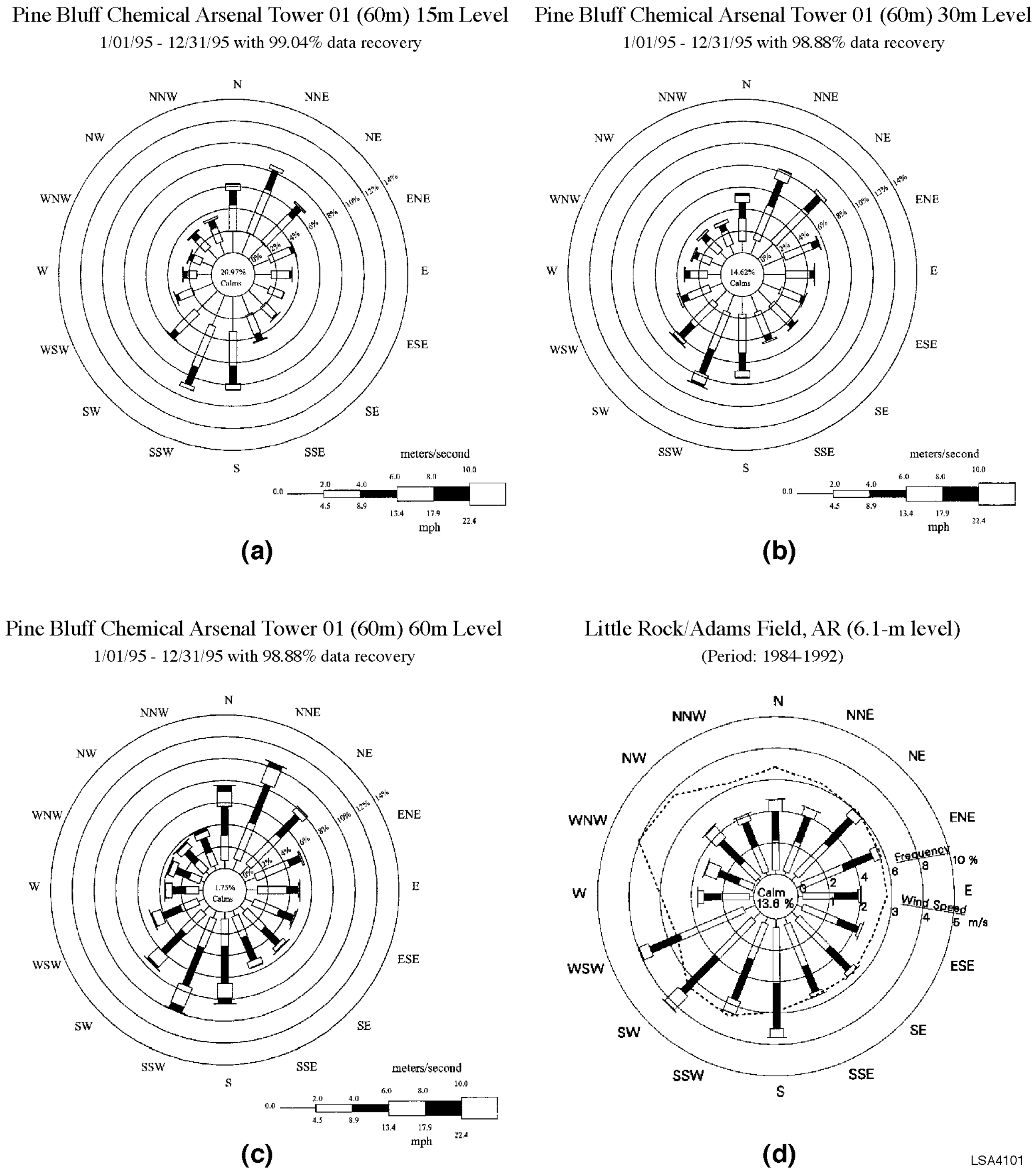

FIGURE 5.5-1 Annual Wind Roses for Three Heights Aboveground at Tower 1 at PBA in 1995 (a = 15 m, b = 30 m, c = 60 m) and for One Height at Little Rock Airport from 1984 through 1992 (d = 6.1 m) (Sources: Rhodes [2000] for a,b,c; EPA [2000a] for d)

ground only briefly. Annual average snowfall is about 6 in. (15 cm). The greatest amounts of snow reported in a single month and in a 24-hour period were about 14 in. (35 cm) and 12 in. (31 cm), respectively, in January 1988.

Average annual relative humidity at Little Rock Airport is 70%, ranging from 79 to 84% for the first half of the day, and from 57 to 60% for the second half. Heavy fogs in the area are rare. The average number of days with heavy fog (visibility of 0.25 mi [0.4 km] or less) is about 16 days per year, with higher frequencies in winter months. Thunderstorms can occur in any month, and about 57 thunderstorms are reported each year, with the greatest frequency in June and July.

Tornadoes are rare in the area surrounding PBA and are less frequent and destructive than those in the tornado alley, which stretches north from Texas to Nebraska and Iowa. For the 46-year period of 1950 through 1995, 878 tornadoes were reported in Arkansas, with a tornado event frequency of $3.7 \times 10^{-4}/mi^2$ per year and an average of 19 tornadoes per year (Storm Prediction Center 2000). For the same period, 15 tornadoes were reported in Jefferson County, with a tornado event frequency of $3.7 \times 10^{-4}/mi^2$ per year. During the 46-year period, most tornadoes that occurred in Jefferson County were relatively weak (F3 on the Fujita tornado scale was the highest level attained), with only one fatality.[4]

5.5.1.2 Emissions

PBA has a unique and varied mission. PBA is the Army's only chemical arsenal and the only installation with both manufacturing and depot functions. PBA's mission operations can be grouped into the following six categories:

- Ammunition operations;
- Chemical and biological defense operations;
- Product and process development;
- Demilitarization, waste treatment, and resource recovery;

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[4] The Fujita scale is used to classify tornadoes in terms of wind damage. F0 = light damage associated with winds traveling at speeds up to 72 mph. F3 = severe damage associated with winds traveling at 158 through 206 mph. F4 = devastating damage associated with winds traveling at 207 through 260 mph. F5 = incredible damage associated with winds traveling at 261 mph and faster.

- Base operations; and

- Chemical stockpile disposal.

These operations are emission sources and are thus being carried out in accordance with permits issued by the Arkansas Department of Environmental Quality (ADEQ). Table 5.5-1 presents the PBA emission summary information of existing sources from the Title V air permit application submitted to the state of Arkansas (Wachowiak 2000). On the basis of all categories of PBA sources with permits from the state, the annual total permitted emissions were 171.05 tons of volatile organic compounds (VOCs), 139.97 tons of nitrogen oxides (NO_x), 138.57 tons of PM_{10}, 52.33 tons of carbon monoxide (CO), 15.61 tons of sulfur dioxide (SO_2), and 0.4 ton of lead (Pb). PBA is classified as a major stationary source for Prevention of Significant Deterioration (PSD) purposes, for which actual or potential emissions are above the applicable source threshold.

For comparison, annual estimates of actual air pollutant emissions in 1996 from Jefferson County and the total permitted amounts from PBA are listed in Table 5.5-2. Actual PBA emissions were significantly less than the total permitted amounts. The significance of PBA emissions is shown by presenting them as a percentage of the total Jefferson County emissions. As the table indicates, PBA emissions account for very small fractions of the emissions released from the Jefferson County, that is, about 2.2%, 0.8%, 0.4%, 0.1%, and 0.03% of the total Jefferson County emissions for VOCs, PM_{10}, NO_x, CO, and SO_2, respectively. Jefferson County contains the White Bluff Electric Station, one of the largest emitters of air pollutants in the state, which accounts for about 71 and 93% of Jefferson County's total NO_x and SO_2 emissions, respectively.

5.5.1.3 Air Quality

The State Ambient Air Quality Standards (SAAQS) for six criteria pollutants — SO_2, PM (PM_{10} and $PM_{2.5}$), CO, ozone (O_3), nitrogen dioxide (NO_2), and Pb — are identical to the National Ambient Air Quality Standards (NAAQS), as shown in Table 5.5-3 (Arkansas Pollution Control and Ecology Commission 1999). In 1997, the EPA revised the NAAQS for O_3 and PM. The standards were challenged, and the lower court decision was appealed to the U.S. Supreme Court. On February 27, 2001, the U.S. Supreme Court unanimously upheld the constitutionality of the CAA as the EPA had interpreted it in setting the $PM_{2.5}$ and O_3 standards. However, the case was remanded back to the D.C. Circuit Court of Appeals to resolve the remaining issues, which include EPA's justification for the numerical levels. While the case is pending, the O_3 and fine particle standards remain in effect as a legal matter, because the D.C. Circuit Court decision did not vacate the standards. The EPA has not, however, started implementing the revised $PM_{2.5}$ and O_3 standards. The monitoring station nearest to PBA for SO_2, NO_2, CO, and O_3 is in Little Rock, while those for PM_{10} and $PM_{2.5}$ are in Pine Bluff (EPA 2000c). In Pine Bluff,

TABLE 5.5-1 Estimated Emissions of Air Pollutants from Existing PBA Sources

Source Category	Emissions (tons/yr)[a]					
	SO_2	NO_x	CO	VOCs	PM_{10}	Pb
Ammunition operations	-	-	-	132.69	17.5	-
Chemical and biological defense operations	-	-	-	0.78	-	-
Product and process development	2.9	0.21	0.04	2.8	0.08	-
Demilitarization, waste treatment, and resource recovery	11.56	42.45	28.17	12.53	107.63	0.4
Base operations	1.15	97.31	24.12	22.25	13.36	-
Total	15.61	139.97	52.33	171.05	138.57	0.4

[a] A hyphen means that there was no emission, the emission was negligible, or the emission was not estimated.

Source: Wachowiak (2000).

TABLE 5.5-2 Emissions of Air Pollutants from Jefferson County Sources in 1996 Compared to PBA Sources

Air Pollutant	Emissions (tons/yr)[a]	
	Jefferson County[b]	PBA[c]
SO_2	59,542	15.61 (0.03)
NO_x	31,465	139.97 (0.4)
CO	45,921	52.33 (0.1)
VOCs	7,856	171.05 (2.2)
PM_{10}	16,562	138.57 (0.8)
Pb	-	0.4

[a] A hyphen indicates that data are not available.

[b] Source: EPA (2000b).

[c] From Table 5.5-1. Numbers in parentheses are PBA emissions as a percentage of Jefferson County emissions.

$PM_{2.5}$ monitoring was started in 1999. As a direct result of the phase-out of leaded gasoline in automobiles, lead concentrations in urban areas decreased dramatically. Thus, the ambient lead concentration is no longer monitored in many parts of the country including the state of Arkansas. Highest background air-quality data measured at the monitoring station nearest to PBA for pollutants subject to the NAAQSs (EPA 2000c) are also presented in Table 5.5-3.

PBA is located in Jefferson County, which is located in the Central Arkansas Intrastate Air Quality Control Region (AQCR Code 016). This region covers the central and southeastern parts of the state of Arkansas (Figure 5.5-2). Currently, Jefferson County is designated as being in attainment for all NAAQS (40 CFR 81.304). Recent six-year monitoring data indicate that concentration levels for SO_2 and NO_2 around PBA are less than 21% of their respective NAAQS. In general, CO concentrations exhibit a downward trend, except for one exceedance for an 8-hour average in 1998 in Little Rock. The second highest value of 4.8 parts per million (ppm), used to determine the EPA's attainment, is well below the standard of 9 ppm. The highest 1-hour and 8-hour O_3 concentrations are higher than the applicable NAAQS. The 24-hour and annual average PM_{10} and 24-hour average $PM_{2.5}$ concentration levels are around 50% of their respective NAAQS. However, annual $PM_{2.5}$ concentrations are almost up to the standard level, about 94% of the standard.

PSD regulations (40 CFR 52.21) limit the maximum allowable incremental increases in ambient concentrations of SO_2, NO_2, and PM_{10} above established baseline levels, as shown in Table 5.5-3. The PSD regulations, which are designed to protect ambient air quality in attainment areas, apply to major new sources and major modifications to existing sources. Within the State of Arkansas, two wilderness areas are designated as Class I areas (40 CFR 81.404).[5] The PSD Class I area nearest to PBA is the Caney Creek Wilderness Area, which is located 115 mi (185 km) west of PBA. The other, is the Upper Buffalo Wilderness Area, located about 138 mi (222 km) northwest of PBA. These two wilderness areas are located upwind of prevailing winds at PBA, as shown in Figure 5.5-1.

5.5.2 ACWA Facility Emissions

5.5.2.1 Emissions from Construction

Emissions of criteria pollutants (such as SO_2, NO_x, CO, PM_{10}, and $PM_{2.5}$) and VOCs during the construction period would include fugitive dust emissions from earth-moving

[5] In 1975, the EPA developed a classification system to allow some economic development in clean air areas while still protecting air from significant deterioration. These classes are defined in the 1977 *Clean Air Act Amendments* (CAAA). Very little deterioration is allowed in Class I areas (e.g., larger national parks and wilderness area). Class II areas allow moderate deterioration. Class III areas allow deterioration up to the secondary standard.

TABLE 5.5-3 National Ambient Air Quality Standards (NAAQS), Maximum Allowable Increments for Prevention of Significant Deterioration (PSD), and Highest Background Levels Representative of PBA[a]

		NAAQS[b]		PSD Increments (μg/m^3)		Highest Background Level	
Pollutant	Averaging Time	Primary	Secondary	Class I	Class II	Concentration[c]	Location (Year)
SO_2	3 hours	-	0.50 ppm (1,300 μg/m^3)	25	512	0.030 ppm (6%)	N. Little Rock (1995)
	24 hours	0.14 ppm (365 μg/m^3)	-	5	91	0.011 ppm (8%)	N. Little Rock (1997)
	Annual	0.03 ppm (80 μg/m^3)	-	2	20	0.002 ppm (7%)	N. Little Rock (2000)
NO_2	Annual	0.053 ppm (100 μg/m^3)	0.053 ppm (100 μg/m^3)	2.5	25	0.011 ppm (21%)	N. Little Rock (1999)
CO	1 hour	35 ppm (40 mg/m^3)	-	-	-	17.0 ppm (49%)	Little Rock (1998)
	8 hours	9 ppm (10 mg/m^3)	-	-	-	13.5 ppm[d] (150%)	Little Rock (1998)
O_3	1 hour	0.12 ppm (235 μg/m^3)	0.12 ppm (235 μg/m^3)	-	-	0.125 ppm (104%)	N. Little Rock (2000)
	8 hours	0.08 ppm (157 μg/m^3)	0.08 ppm (157 μg/m^3)	-	-	0.098 ppm (123%)	N. Little Rock (1999)
PM_{10}	24 hours	150 μg/m^3	150 μg/m^3	8	30	78 μg/m^3 (52%)	Pine Bluff (1997)
	Annual	50 μg/m^3	50 μg/m^3	4	17	26.4 μg/m^3 (53%)	Pine Bluff (1995)
$PM_{2.5}$	24 hours	65 μg/m^3	65 μg/m^3	-	-	29.4 μg/m^3 (45%)	Pine Bluff (1999)
	Annual	15 μg/m^3	15 μg/m^3	-	-	14.03 μg/m^3 (94%)	Pine Bluff (2000)
Pb	Calendar quarter	1.5 μg/m^3	1.5 μg/m^3	-	-	-	-

[a] Hyphen indicates that no standards or monitoring data exist.

[b] Refer to 40 CFR 50 for detailed information on the implementation of the new $PM_{2.5}$ and O_3 standard and the interim treatment of the existing standards.

[c] Values in parentheses are monitored concentrations as a percentage of NAAQS.

[d] For the impact analysis, the second-highest maximum of 4.8 ppm was used as background concentration because the EPA evaluates exceedance of NAAQS on the basis of the second-highest values for short-term averages.

Sources: 40 CFR 50; 40 CFR 52.21; Arkansas Pollution Control and Ecology Commission (2000); EPA (2000c).

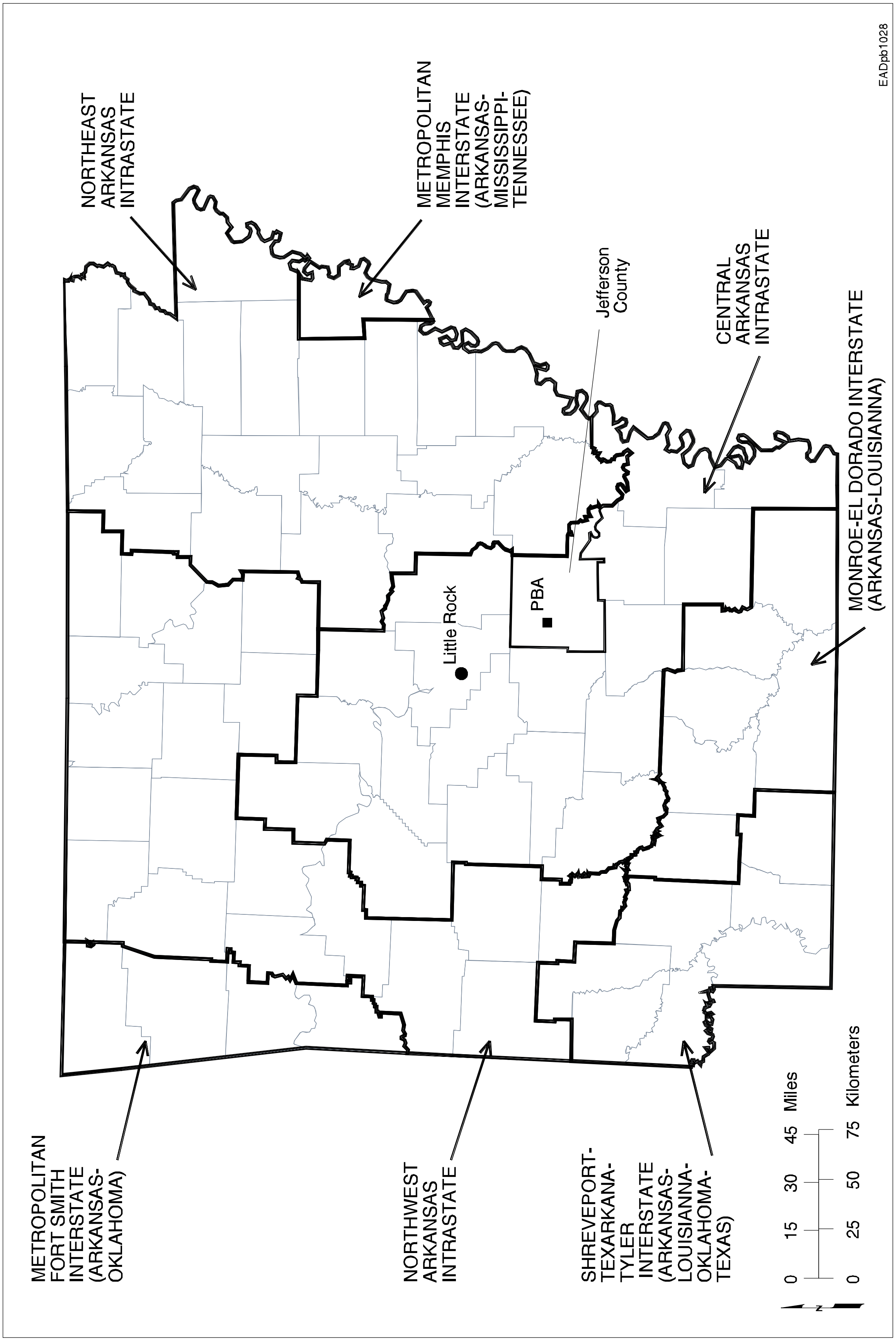

FIGURE 5.5-2 PBA and Air Quality Control Regions in Arkansas

activities and exhaust emissions from equipment and commuter and delivery vehicles. Exhaust emissions are expected to be relatively small when compared with fugitive dust emissions from earth-moving activities (Kimmell et al. 2001). Also, impacts from exhaust emissions would be smaller because of their elevated buoyant release, different from ground-level fugitive dust emissions. Accordingly, only the potential impacts on ambient air quality from fugitive emissions of PM_{10} and $PM_{2.5}$ from earth-moving activities were analyzed. Emission factors and other assumptions used in estimating emission rates of PM_{10} and $PM_{2.5}$ are described in Appendix B.

5.5.2.2 Emissions from Operations

The emission levels currently permitted to PBA are more than 100 tons per year of a regulated air pollutant. Therefore, PBA is classified as a major stationary source of air emissions. Emission factors and other assumptions used in estimating emission rates of criteria pollutants and VOCs during operations are described in Appendix B. Maximum short-term and annual total emission rates, along with stack parameters (i.e., heights, inside diameters, gas exit temperatures, and gas exit velocities) used in the dispersion modeling, are listed in Table 5.5-4 for the Neut/SCWO, Table 5.5-5 for Neut/GPCR/TW-SCWO, and Table 5.5-6 for Elchem Ox.

Neutralization/SCWO. In a Neut/SCWO pilot test facility, air pollutants would be emitted from four different types of stacks: (1) three stacks for natural-gas-burning boilers (two operating, one on standby) used to generate process steam and building heat, (2) two stacks for the diesel-powered generators used as a backup to provide emergency electricity, (3) a filter farm stack for building circulating air and non-SCWO air effluents (e.g., rotary hydrolyzer, metal parts treater [MPT]), and (4) a stack for exhaust from the SCWO process. The principal sources of criteria pollutant and VOC emissions would be boilers and emergency generators, while the primary sources of hazardous air pollutant (HAP) emissions would be the filter farm stack and the SCWO stack. (HAPs are discussed in Sections 5.6 and 5.7.)

Neutralization/GPCR/TW-SCWO. In a Neut/GPCR/TW-SCWO facility, air pollutants would be emitted from four different kinds of stacks, similar to those of the Neut/SCWO facility. The only difference is that a process gas burner stack would replace a SCWO stack. This stack would be used to discharge treated supplementary process fuel gas produced from the GPCR process (which consists of a central reactor for destroying organic waste streams). This stack would emit criteria pollutants, VOCs, and various HAPs. Its criteria pollutants and VOC emissions would amount to much less than those from boilers or diesel generators.

TABLE 5.5-4 Emission Rates of Criteria Pollutants and Volatile Organic Compounds and Stack Parameters Associated with Normal Operations of the Neutralization/SCWO Technology at PBA

Stack Parameters and Estimated Peak Emission Rates	Steam Boilers	Emergency Diesel Generators
Stack parameters[a]		
Height	70 ft (21.3 m)	47 ft (14.3 m)
Inside diameter	0.81 ft (0.25 m)	0.67 ft (0.20 m)
Gas exit temperature	325°F (436 K)	925°F (769 K)
Gas exit velocity	60 ft/s (18 m/s)	323 ft/s (98 m/s)
Estimated rates[b]		
SO_2	0.01 lb/h (0.02 ton/yr)	3.2 lb/h (0.95 ton/yr)
NO_x	2.2 lb/h (3.64 tons/yr)	48.4 lb/h (14.5 tons/yr)
CO	1.3 lb/h (2.18 tons/yr)	10.4 lb/h (3.12 tons/yr)
PM_{10}	0.12 lb/h (0.20 ton/yr)	3.4 lb/h (1.02 tons/yr)
$PM_{2.5}$[c]	0.12 lb/h (0.20 ton/yr)	3.4 lb/h (1.02 tons/yr)
VOCs	0.09 lb/h (0.14 ton/yr)	4.0 lb/h (1.18 tons/yr)

[a] For the modeling analysis, emissions from the three boilers were assumed to occur from one stack location. Similarly, emissions from the two emergency generators were assumed to occur from one stack location.

[b] Estimated peak emission rates are for the simultaneous operations of three steam boilers and two emergency generators at full load.

[c] $PM_{2.5}$ emissions were conservatively assumed to be 100% of PM_{10} emissions for natural-gas-fired boilers and diesel generators (EPA 2000e).

Source: Kimmell et al. (2001).

Electrochemical Oxidation. In an Elchem Ox facility, air pollutants would be emitted from three types of stacks. The major difference from a Neut/SCWO facility is the absence of a SCWO stack. Thus, the assumption is that all air effluents from all treatment processes would be emitted into the atmosphere via the filter farm stack.

Other Sources. Other sources of air pollution during operations would include vehicle traffic, such as cars, pickup trucks, and buses transporting personnel to and from the facility. Trucks and forklifts would be used to deliver supplies to the facility. Parking lots and access roads to the facility would be paved with asphalt concrete to minimize fugitive dust emissions. Other potential emissions would include VOCs from the aboveground and underground fuel storage tanks. However, these emissions would be negligible because diesel fuel has a low volatility and because facility operation would consume a low level of fuel and thus require infrequent refilling.

TABLE 5.5-5 Emission Rates of Criteria Pollutants and Volatile Organic Compounds and Stack Parameters Associated with Normal Operations of the Neutralization/GPCR/TW-SCWO Technology at PBA

Stack Parameters and Estimated Peak Emission Rates	Steam Boilers	Emergency Diesel Generators	Process Gas Burner
Stack parameters[a]			
Height	70 ft (21.3 m)	47 ft (14.3 m)	80 ft (24.4 m)
Inside diameter	1.1 ft (0.33 m)	0.67 ft (0.20 m)	0.42 ft (0.13 m)
Gas exit temperature	325°F (436 K)	925°F (769 K)	77°F (298 K)
Gas exit velocity	60 ft/s (18 m/s)	323 ft/s (98 m/s)	64 ft/s (19 m/s)
Estimated rates[b]			
SO_2	0.02 lb/h (0.03 ton/yr)	3.2 lb/h (0.95 ton/yr)	0.004 lb/h (0.007 ton/yr)
NO_x	4.2 lb/h (6.99 tons/yr)	48.4 lb/h (14.5 tons/yr)	0.10 lb/h (0.17 ton/yr)
CO	2.5 lb/h (4.20 tons/yr)	10.4 lb/h (3.12 tons/yr)	0.16 lb/h (0.27 ton/yr)
PM_{10}	0.23 lb/h (0.38 ton/yr)	3.4 lb/h (1.02 tons/yr)	0.03 lb/h (0.05 ton/yr)
$PM_{2.5}$[c]	0.23 lb/h (0.38 ton/yr)	3.4 lb/h (1.02 tons/yr)	0.03 lb/h (0.05 ton/yr)
VOCs	0.17 lb/h (0.27 ton/yr)	4.0 lb/h (1.18 tons/yr)	0.05 lb/h (0.08 ton/yr)

[a] For the modeling analysis, emissions from the three boilers were assumed to occur from one stack location. Similarly, emissions from the two emergency generators were assumed to occur from one stack location.

[b] Estimated peak emission rates are for the simultaneous operations of three steam boilers and two emergency generators at full load.

[c] $PM_{2.5}$ emissions were conservatively assumed to be 100% of PM_{10} emissions for natural-gas-fired boilers, diesel generators, and a process gas burner (EPA 2000e).

Source: Kimmell et al. (2001).

5.5.3 Impacts of the Proposed Action

Potential impacts of air pollutant emissions during pilot facility construction and operation were evaluated by estimating maximum ground-level concentration increments of criteria air pollutants resulting from construction and operations, adding these estimates to background concentrations, and comparing the results with applicable ambient air quality standards. As indicated in Table 5.5-3, the Arkansas SAAQS for criteria air pollutants are identical to the NAAQS (Arkansas Pollution Control and Ecology Commission 1999).

To evaluate air quality impacts from PBA operations with respect to PSD requirements, estimated maximum increments in ground-level concentrations that would result from the operation of the proposed facility were compared with allowable PSD increments above the baseline. Applicable PSD increments are also summarized in Table 5.5-3.

TABLE 5.5-6 Emission Rates of Criteria Pollutants and Volatile Organic Compounds and Stack Parameters Associated with Normal Operations of Electrochemical Oxidation Technology at PBA

Stack Parameters and Estimated Peak Emission Rates	Steam Boilers	Emergency Diesel Generators
Stack parameters[a]		
Height	70 ft (21.3 m)	47 ft (14.3 m)
Inside diameter	0.74 ft (0.23 m)	0.67 ft (0.20 m)
Gas exit temperature	325°F (436 K)	925°F (769 K)
Gas exit velocity	60 ft/s (18 m/s)	323 ft/s (98 m/s)
Estimated rates[b]		
SO_2	0.009 lb/h (0.014 ton/yr)	3.2 lb/h (0.95 ton/yr)
NO_x	2.0 lb/h (3.36 tons/yr)	48.4 lb/h (14.5 tons/yr)
CO	1.2 lb/h (2.02 tons/yr)	10.4 lb/h (3.12 tons/yr)
PM_{10}	0.11 lb/h (0.18 ton/yr)	3.4 lb/h (1.02 tons/yr)
$PM_{2.5}$[c]	0.11 lb/h (0.18 ton/yr)	3.4 lb/h (1.02 tons/yr)
VOCs	0.08 lb/h (0.13 ton/yr)	4.0 lb/h (1.18 tons/yr)

[a] For the modeling analysis, emissions from the three boilers were assumed to occur from one stack location. Similarly, emissions from the two emergency generators were assumed to occur from one stack location.

[b] Estimated peak emission rates are for the simultaneous operations of three steam boilers and two emergency generators at full load.

[c] $PM_{2.5}$ emissions were conservatively assumed to be 100% of PM_{10} emissions for natural-gas-fired boilers and diesel generators (EPA 2000e).

Source: Kimmell et al. (2001).

The air quality model, model input data (meteorological data, source and receptor locations, and elevation data), and other assumptions used in estimating potential construction and operational impacts on ambient air quality at the PBA boundaries and surrounding areas are described in Appendix B.

5.5.3.1 Impacts of Construction

The modeling results for both PM_{10} and $PM_{2.5}$ concentration increments that would result from construction-related fugitive emissions are summarized in Table 5.5-7. At the installation boundaries, for both PM_{10} and $PM_{2.5}$, the maximum 24-hour and annual average concentration increments above background would occur about 1.2 mi (2.0 km) and 0.9 mi

TABLE 5.5-7 Maximum Predicted Off-Post Concentration Increments and Total Concentrations of PM_{10} and $PM_{2.5}$ during Construction at PBA

		Concentration ($\mu g/m^3$)				
Pollutant	Averaging Time	Maximum Increment[a,b]	Background[c]	Total[d]	NAAQS	Percent of NAAQS[e]
PM_{10}	24 hours	44.7	78	122.7	150	82 (30)
	Annual	1.1	26.4	27.5	50	55 (2.2)
$PM_{2.5}$	24 hours	22.4	29.4	51.8	65	80 (34)
	Annual	0.53	14.0	14.5	15	97 (3.5)

[a] The maximum concentration increments were estimated by using the Industrial Source Complex Short-Term 3 (ISCST3) model (Version 00101; EPA 1995).

[b] Maximum modeled 24-hour and annual average concentrations occur at receptors about 1.2 mi (2.0 km) and 0.9 mi (1.4 km), respectively, to the north and southwest of the proposed facility.

[c] See Table 5.5-3.

[d] Total equals maximum modeled concentration plus background concentration.

[e] The values are total concentration as a percent of NAAQS. The values in parentheses are maximum concentration increments as a percent of NAAQS.

(1.4 km) north and southwest of the proposed facility, respectively. At these locations, for PM_{10}, the maximum 24-hour and annual concentration increments above background would be about 30% and 2.2% of the NAAQS, respectively. For $PM_{2.5}$, the maximum 24-hour and annual concentration increments above background would be about 34% and 3.5% of the NAAQS, respectively.

To obtain the overall concentrations for comparison with applicable NAAQS, the maximum PM_{10} and $PM_{2.5}$ concentration increments (Table 5.5-7) were added to background values (from Table 5.5-3). For PM_{10}, the maximum estimated 24-hour and annual average concentrations would be about 82% and 55% of the NAAQS, respectively. For $PM_{2.5}$, the maximum estimated 24-hour and annual average concentrations would be about 80% and 97% of the NAAQS, respectively. Maximum predicted concentrations would occur at the northern PBA boundaries adjoining the NCTR facility. Accordingly, concentration levels at the publicly accessible installation boundaries would be much lower. The annual average $PM_{2.5}$ background concentration of 14 μg/m^3 around the PBA area is already close to the standard of 15 μg/m^3. Accordingly, construction activities should be conducted so as to minimize further impacts on ambient air quality.

In summary, the maximum estimated 24-hour and annual concentration increments of PM_{10} and $PM_{2.5}$ that would result from construction-related fugitive emissions would be relatively small fractions of the applicable NAAQS. The total (maximum increments plus background) estimated 24-hour and annual concentrations of PM_{10} and 24-hour concentrations of $PM_{2.5}$ would be equal to or less than 82% of the applicable NAAQS. The total estimated annual concentration of $PM_{2.5}$ would be below but close to its applicable NAAQS, primarily because of high background concentration levels.

5.5.3.2 Impacts of Operations

In the air quality analysis for the operational period, air quality impacts were modeled for each of the three ACWA technologies. The results are presented in tabular format for each case. The modeling results for concentration increments of SO_2, NO_2, CO, PM_{10}, and $PM_{2.5}$ due to emissions from the proposed facility operations are summarized in Table 5.5-8 through 5.5-10 for the three technologies. The receptor locations where maximum concentration increments would occur are also listed in these tables.

The estimated maximum concentration increments due to operation of the proposed facility would contribute less than 6% of applicable NAAQS for all pollutants (Tables 5.5-8 through 5.5-10). Irrespective of the ACWA technology chosen, concentration increments would be almost the same. In most cases, maximum predicted concentrations would occur at the PBA boundaries southwest of the ACWA facilities. Accordingly, potential impacts from the proposed facility operations at nearby residences would be much lower.

The maximum 3-hour, 24-hour, and annual SO_2 concentration increments predicted to result from the proposed facility operations (Tables 5.5-8 through 5.5-10) would be less than 4% of the applicable PSD increments (Table 5.5-3). The maximum predicted increments in annual average NO_2 concentrations due to the proposed facility operations would be about 1% of the applicable PSD increments. The 24-hour and annual PM_{10} concentration increases predicted to result from the proposed operations would be less than about 12% of the applicable PSD increments. The predicted concentration increment at a receptor located 30 mi (50 km) away from the proposed facility (the maximum distance the Industrial Source Complex Short-Term 3 [ISCST3] model could reliably estimate concentrations) in the direction of the nearest Class I PSD area (the Caney Creek Wilderness Area) would be less than 0.7% of the applicable PSD increments. Therefore, concentration increments at the Caney Creek Wilderness Area, which is located about 115 mi (185 km) west of PBA, would be much lower.

TABLE 5.5-8 Maximum Predicted Off-Post Concentration Increments and Total Concentrations of Criteria Pollutants during Normal Operations of the Neutralization/SCWO Technology at PBA

		Concentration (µg/m³)					Receptor Location[e]	
Pollutant	Averaging Time	Maximum Increment[a]	Background[b]	Total[c]	NAAQS	Percent of NAAQS[d]	Distance [mi (km)]	Direction
SO_2	3 hours	9.9	78	88	1,300	6.8 (0.8)	1.0 (1.5)	WSW
	24 hours	3.2	29	32	365	8.8 (0.9)	0.9 (1.5)	SW
	Annual	0.02	5.3	5.3	80	6.7 (0.03)	0.9 (1.5)	SW
NO_2	Annual	0.31	21	21.3	100	21 (0.3)	0.9 (1.5)	SW
CO	1 hour	60	19,429	19,489	40,000	49 (0.2)	1.0 (1.7)	WSW
	8 hours	28	5,333	5,361	10,000	54 (0.3)	0.9 (1.5)	SW
PM_{10}	24 hours	3.6	78	82	150	54 (2.4)	0.9 (1.5)	SW
	Annual	0.02	26.4	26.4	50	53 (0.04)	0.9 (1.5)	SW
$PM_{2.5}$	24 hours	3.6	29.4	33	65	51 (5.5)	0.9 (1.5)	SW
	Annual	0.02	14.0	14.0	15	93 (0.1)	0.9 (1.5)	SW

[a] Maximum concentration increments were estimated by using the ISCST3 model (Version 00101; EPA 1995).

[b] See Table 5.5-3.

[c] Total equals maximum concentration increment plus background concentration.

[d] The values are total concentration as percent of NAAQS. The values in parentheses are maximum concentration increments as a percentage of NAAQS.

[e] Receptor locations (distance and directions) of maximum concentrations are from the approximate center of the Neut/SCWO facility.

Concentration increments for the two remaining criteria pollutants, lead and ozone, were not modeled. As a direct result of the phase-out of leaded gasoline in automobiles, average lead concentrations in urban areas throughout the country have decreased dramatically. It is expected that emissions of lead from the proposed facility operations would be negligible and therefore would have no adverse impacts on lead concentrations in surrounding areas. Contributions to the production of ozone, a secondary pollutant formed from complex photochemical reactions involving ozone precursors including NO_X and VOCs, cannot be accurately quantified. As discussed in Section 5.5.1.3, Jefferson County, including the PBA, is currently in attainment for ozone (40 CFR 81.304). Ozone precursor emissions from the proposed facility operations would be small, making up about 0.07% and 0.02% of the 1996 actual emissions of NO_X and VOCs, respectively, from Jefferson County. As a consequence, the cumulative impacts of potential releases from PBA facility operations on regional ozone concentrations would not be of any concern.

TABLE 5.5-9 Maximum Predicted Off-Post Concentration Increments and Total Concentrations of Criteria Pollutants during Normal Operations of the Neutralization/GPCR/TW-SCWO Technology at PBA

		Concentration (µg/m³)					Receptor Location[e]	
Pollutant	Averaging Time	Maximum Increment[a]	Background[b]	Total[c]	NAAQS	Percent of NAAQS[d]	Distance [mi (km)]	Direction
SO_2	3 hours	9.9	78	88	1,300	6.8 (0.8)	1.0 (1.5)	WSW
	24 hours	3.2	29	32	365	8.8 (0.9)	0.9 (1.5)	SW
	Annual	0.02	5.3	5.3	80	6.7 (0.03)	0.9 (1.5)	SW
NO_2	Annual	0.37	21	21.4	100	21 (0.4)	0.9 (1.5)	SW
CO	1 hour	66	19,429	19,495	40,000	49 (0.2)	1.2 (2.0)	W
	8 hours	30	5,333	5,363	10,000	54 (0.3)	0.9 (1.5)	SW
PM_{10}	24 hours	3.7	78	82	150	54 (2.5)	0.9 (1.5)	WSW
	Annual	0.02	26.4	26.4	50	53 (0.04)	0.9 (1.5)	SW
$PM_{2.5}$	24 hours	3.7	29.4	33	65	51 (5.7)	0.9 (1.5)	WSW
	Annual	0.02	14.0	14.0	15	93 (0.1)	0.9 (1.5)	SW

[a] Maximum concentration increments were estimated by using the ISCST3 model (Version 00101; EPA 1995).

[b] See Table 5.5-3.

[c] Total equals maximum concentration increment plus background concentration.

[d] The values are total concentration as percent of NAAQS. The values in parentheses are maximum concentration increments as a percentage of NAAQS.

[e] Receptor locations (distance and directions) of maximum concentrations are from the approximate center of the GPCR/TW-SCWO facility.

The total concentrations of criteria pollutants obtained by adding the predicted maximum concentration increments to background values (from Table 5.5-3) are compared with applicable NAAQS (Tables 5.5-8 through 5.5-10). Except for annual $PM_{2.5}$, maximum estimated concentrations of criteria pollutants are less than or equal to 54% of the NAAQS. Total annual $PM_{2.5}$ concentrations would be close to, but still below, applicable standards, primarily because of high background levels.

5.5.3.3 Impacts of Fluctuating Operations

To assess potential impacts that could result from possible fluctuations in operations that could occur during pilot testing, it was assumed that levels of organic compounds emissions would be 10 times higher than the estimated annual average for 5% of the time and that levels of inorganic compound emissions would be 10 times higher than the estimated annual average for 20% of the time. These assumptions are based on EPA guidance (EPA 1994, as cited in National Research Council 1997a).

TABLE 5.5-10 Maximum Predicted Off-Post Concentration Increments and Total Concentrations of Criteria Pollutants during Normal Operations of the Electrochemical Oxidation Technology at PBA

		Concentration (µg/m³)					Receptor Location[e]	
Pollutant	Averaging Time	Maximum Increment[a]	Background[b]	Total[c]	NAAQS	Percent of NAAQS[d]	Distance [mi (km)]	Direction
SO_2	3 hours	9.4	78	87	1,300	6.7 (0.7)	1.0 (1.5)	WSW
	24 hours	3.2	29	32	365	8.8 (0.9)	0.9 (1.5)	SW
	Annual	0.02	5.3	5.3	80	6.7 (0.03)	0.9 (1.5)	SW
NO_2	Annual	0.31	21	21.3	100	21 (0.3)	0.9 (1.5)	SW
CO	1 hour	59	19,429	19,488	40,000	49 (0.1)	1.0 (1.7)	WSW
	8 hours	27	5,333	5,360	10,000	54 (0.3)	0.9 (1.5)	SW
PM_{10}	24 hours	3.5	78	82	150	54 (2.3)	0.9 (1.5)	SW
	Annual	0.02	26.4	26.4	50	53 (0.04)	0.9 (1.5)	SW
$PM_{2.5}$	24 hours	3.5	29.4	33	65	51 (5.4)	0.9 (1.5)	SW
	Annual	0.02	14.0	14.0	15	93 (0.1)	0.9 (1.5)	SW

[a] Maximum concentration increments were estimated by using the ISCST3 model (Version 00101; EPA 1995).

[b] See Table 5.5-3.

[c] Total equals maximum concentration increment plus background concentration.

[d] The values are total concentration as percent of NAAQS. The values in parentheses are maximum concentration increments as a percentage of NAAQS.

[e] Receptor locations (distance and directions) of maximum concentrations are from the approximate center of the Elchem Ox facility.

Over long time periods, such conditions would be assumed to increase organic emissions to 145% of their normal values and metal emissions to 280% of their normal values (EPA 1994, as cited in National Research Council 1997a). VOCs contribute to the formation of ozone, a criteria pollutant; multiplying VOC emissions from the proposed facility by 1.45 would result in about 2 tons per year, or less than 0.03% of the 1996 VOC emissions in Jefferson County (Table 5.5-2). Therefore, the potential increase in ozone concentration that could result from VOC emissions from the proposed facility operations under fluctuating operational conditions would be almost the same as that under normal operating conditions. Lead (Pb) is the only metal among criteria pollutants. Expected emissions of lead from the proposed facility are currently too small to quantify; therefore, increasing these emissions by 280% of their normal value would probably not lead to any appreciable increase in atmospheric Pb concentrations. Therefore, when fluctuating operational conditions are considered, the potential impacts of criteria pollutants involved would still be expected to be insignificant.

5.5.5 Impacts of No Action

The principal sources of air pollutant emissions associated with stockpile maintenance activities are exhaust emissions and road dust generated by vehicle operations. These emissions contribute to the background air quality at the installation. Emissions of air pollutants from these sources are minor both in absolute terms and in comparison with emissions from other natural and anthropogenic sources on and off PBA. Therefore, potential air quality impacts that would occur as a result of the continued storage of the stockpile are expected to be minimal.

5.6 AIR QUALITY — TOXIC AIR POLLUTANTS

5.6.1 Current Emissions and Air Quality

In 1999, the only reportable emission from PBA regulated under the EPA's Toxic Release Inventory (TRI) was 1,900 lb (862 kg) of hydrochloric acid generated as a by-product of incineration at the CIC (Vestal 2001). No other toxic air pollutant emissions exceeded TRI reporting limits. Other minor sources of VOC emissions at PBA include boilers, munitions manufacturing activities (e.g., M18 grenades and white phosphorus munitions), fuel oil and diesel storage, surface coating work, open burning/open detonation, and miscellaneous industrial processes. About 18 tons of VOCs were emitted in total from these sources in 2000 (Vestal 2001).

5.6.2 ACWA Facility Emissions

A summary of the estimated emissions of toxic air pollutants[6] that would result from operation of an ACWA pilot facility at PBA is given in Kimmell et al. (2001). Estimated emissions (including those from diesel generators and boilers) from a Neut/SCWO, a Neut/GPCR/TW-SCWO, and an Elchem Ox facility are provided in Tables 5.6-1 through 5.6-3. For the destruction facility stacks (SCWO vent, product gas burner vent, and catalytic oxidation unit [CatOx]/filter farm stack vent), emission estimates were based on demonstration test data and post-specific munitions inventories compiled by Mitretek Corp. (2001a–c). Estimates of emissions from diesel generators and boilers were based on standard algorithms that used fuel consumption estimates as input (Kimmell et al. 2001). For many substances (e.g., acetaldehyde, formaldehyde), the estimated emissions from boilers and diesel generators would exceed the emissions from destruction facility processes by many orders of magnitude (Tables 5.6-1 through 5.6-3).

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6 Many of the toxic air pollutants that would be emitted are HAPs as defined in Section 112, Title III, of the CAA. The term "toxic air pollutants" is broader in that it includes some pollutants that are not HAPs.

The estimates of air emissions from operating the pilot facilities were based on the assumption that organic substances from the filter farm stacks and the SCWO vent would be filtered from stack emissions by a series of six carbon filters, each having a removal efficiency of 95%. For PM (e.g., dioxins and furans on PM and metals), it was assumed that two high-efficiency particulate air (HEPA) filters, each with a removal efficiency of 99.97%, would be used for treatment. For the Neut/GPCR/TW-SCWO facility (Table 5.6-2), it was assumed that emissions from the product gas burner vent would not be further treated after release from the facility's scrubber system.

5.6.3 Impacts of the Proposed Action

5.6.3.1 Impacts of Construction

During construction, low-level emissions of potentially toxic air pollutants would result from the use of construction chemicals such as paints, thinners, and aerosols. These emissions would be expected to be minor and were not quantitatively estimated for this EIS. The main emissions from construction-related heavy equipment and from the commuter vehicles used by construction workers would consist of criteria pollutants (as summarized in Section 5.5); toxic air pollutant emissions were not quantified. The main emissions from construction-related heavy equipment and from the commuter vehicles used by construction workers would consist of criteria pollutants (Kimmell et al. 2001) and HAPs. HAP emissions were not quantified for this assessment because of insufficient data (e.g., whether the engine type is two-stroke, four-stroke, or diesel) (EPA 2000d). Although not quantified, the emission levels would be expected to be less than reportable quantities and similar across the technology systems evaluated.

5.6.3.2 Impacts of Operations

Estimates of emissions of toxic air pollutants that would result from the operation of pilot destruction facilities are provided in Tables 5.6-1 through 5.6-3. Many of the toxic air pollutants that would be emitted from the pilot test facility stacks are HAPs as defined in Title III, Section 112 of the *Clean Air Act* (CAA). However, a pilot test facility would not be a major source of HAP emissions and would not fall into any of the source categories regulated by EPA National Emission Standards for Hazardous Air Pollutants (NESHAP). Therefore, no regulatory action under NESHAPS would be necessary for the HAP emissions from a pilot test facility.

TABLE 5.6-1 Estimated Toxic Air Pollutant Emissions from Neutralization/SCWO Technology at PBA

	Emissions (μg/s)[b]			
			Nerve Agent Processing[c]	
Compound[a]	Diesel Generator	Boiler	SCWO Vent	Filter Farm Stack
1,3-Butadiene*	1.1	-	-	-
2-Methylnaphthalene	-	5.8×10^{-1}	-	-
3-Methylchloranthrene	-	4.3×10^{-2}	-	-
Acenaphthene	3.9×10^{-2}	4.3×10^{-2}	-	-
Acenaphthylene	1.4×10^{-1}	4.3×10^{-2}	-	-
Acetaldehyde*	2.1×10^{1}	-	1.0×10^{-6}	-
Acrolein*	2.6	-	-	-
Aldehydes	1.9×10^{3}	-	-	-
Anthracene	5.2×10^{-2}	5.8×10^{-2}	-	-
Antimony*	-	-	8.2×10^{-8}	-
Arsenic*	-	4.8	2.5×10^{-8}	-
Barium	-	1.1×10^{2}	-	-
Benz(a)anthracene	2.6×10^{1}	4.3×10^{-2}	-	-
Benzene*	4.7×10^{-2}	5.0×10^{1}	-	-
Benzo(a)pyrene	5.2×10^{-3}	2.9×10^{-2}	-	-
Benzo(b)fluoranthene	2.7×10^{-3}	4.3×10^{-2}	-	-
Benzo(g,h,i)perylene	1.4×10^{-2}	2.9×10^{-2}	-	-
Benzo(k)fluoranthene	4.3×10^{-3}	4.3×10^{-2}	-	-
Beryllium*	-	2.9×10^{-1}	4.9×10^{-9}	-
Butane	-	5.0×10^{4}	-	-
Cadmium*	-	2.6×10^{1}	1.3×10^{-7}	-
Chromium*	-	3.4×10^{1}	1.2×10^{-6}	-
Chrysene	9.8×10^{-3}	4.3×10^{-2}	-	-
Cobalt*	-	2.0	1.6×10^{-7}	-
Copper	-	2.0×10^{1}	-	-
Dibenzo(a,h)anthracene	1.6×10^{-2}	2.9×10^{-2}	-	-
Dichlorobenzene*	-	2.9×10^{1}	-	-
Dimethylbenz(a)anthracene	-	3.8×10^{-1}	-	-
Ethane	-	7.4×10^{4}	-	-
Fluoranthene	2.1×10^{-1}	7.2×10^{-2}	-	-
Fluorene	8.1×10^{-1}	6.7×10^{-2}	-	-
Formaldehyde*	3.3×10^{1}	1.8×10^{3}	1.3×10^{-7}	-
GB[d]	-	-	-	2.8
Hexane(n)*	-	4.3×10^{4}	-	-
Indeno(1,2,3-cd)pyrene	1.0×10^{-2}	4.3×10^{-2}	-	-
Lead*	-	1.2×10^{1}	1.3×10^{-6}	-
m,p-Xylene*	7.9	-	-	-
Manganese	-	9.1	1.2×10^{-6}	-

TABLE 5.6-1 (Cont.)

	Emissions (µg/s)[b]			
			Nerve Agent Processing[c]	
Compound[a]	Diesel Generator	Boiler	SCWO Vent	Filter Farm Stack
Mercury*	8.3×10^{-3}	6.2	1.0×10^{-7}	-
Methyl ethyl ketone/butyraldehydes*	-	-	2.6×10^{-8}	-
Molybdenum	-	2.6×10^{1}	-	-
Naphthalene*	2.3	1.5×10^{1}	8.4×10^{-10}	-
Nickel*	-	5.0×10^{1}	5.6×10^{-6}	-
Particulates	-	-	9.6×10^{-5}	-
Pentane(n)	-	6.2×10^{4}	-	-
Phenanthrene	8.1×10^{-1}	4.1×10^{-1}	-	-
Phosphorus*	-	-	2.9×10^{-5}	-
PCBs[e]	-	-	1.5×10^{-9}	-
PAHs*	4.7	-	-	-
Propane	-	3.8×10^{4}	-	-
Propylene	7.1×10^{1}	-	-	-
Pyrene	1.3×10^{-1}	1.2×10^{-1}	-	-
Selenium*	-	5.8×10^{-1}	2.0×10^{-7}	-
Toluene*	-	8.1×10^{1}	-	-
Vanadium	-	5.5×10^{1}	-	-
VX[d]	-	-		2.8

[a] Substances designated with an asterisk (*) are listed as HAPs under Title III, Section 112, of the CAA. PAHs = polycyclic aromatic hydrocarbons. PCBs = polychlorinated biphenyls.

[b] A hyphen indicates that the compound was not detected from this source during demonstration testing.

[c] For SCWO and filter farm stack emissions, organics are assumed to be treated by being passed through six carbon filters in series, each at 95% efficiency. PM is assumed to pass through two HEPA filters in series, each at 99.97% efficiency.

[d] The after-treatment emission rate from the filter farm stack for chemical agent (GB, VX) is a worst-case estimate; it assumes emissions at the detection limit (Kimmell et al. 2001). It is assumed that no agent would be emitted from the SCWO stack; none would be present after neutralization and SCWO treatment.

[e] Although PCB destruction was not included in demonstration testing, for these analyses, it is assumed that SCWO technology would have a destruction efficiency of 99.9999% and that further treatment, as described in footnote c, would be applied.

TABLE 5.6-2 Estimated Toxic Air Pollutant Emissions from Neutralization/GPCR/TW-SCWO Technology at PBA

	Emissions (µg/s)[b]					
			GB Processing[c]		VX Processing[c]	
Compound[a]	Diesel Generator	Boiler	Product Gas Burner	Filter Farm Stack	Product Gas Burner	Filter Farm Stack
1,1,1-Trichloroethane	-	-	8.7×10^{-2}	7.1×10^{-8}	6.6×10^{-2}	-
1,2,3,4,6,7,8-HpCDF	-	-	1.3×10^{-8}	-	1.0×10^{-5}	-
1,2,3,4,7,8-HxCDF	-	-	1.0×10^{-7}	-	8.0×10^{-5}	-
1,2,3,6,7,8-HxCDF	-	-	3.9×10^{-8}	-	3.0×10^{-5}	-
1,2,4-Trimethylbenzene	-	-	-	7.7×10^{-9}	-	2.0×10^{-6}
1,3-Butadiene*	1.1	-	-	-	-	-
1,4-Dichlorobenzene*	-	-	-	-	-	4.6×10^{-9}
1-Ethyl-2,2,6-trimethylcyclohexane	-	-	-	-	-	1.5×10^{-6}
1-Hexanol, 2-ethyl-	-	-	2.7×10^{1}	-	20	-
1H-Indene	-	-	6.6	-	5.1	-
1H-Indene, 2,3-dihydro-	-	-	-	4.6×10^{-8}	-	-
2-(2-Butoxyethoxy) ethanol	-	-	-	-	-	1.7×10^{-6}
2,3,7,8-TCDF	-	-	6.1×10^{-8}	-	4.7×10^{-5}	-
2,4-Dimethylphenol	-	-	2.6	-	2.0	-
2-Butanone (methyl ethyl ketone)*	-	-	9.2×10^{-1}	-	7.1×10^{-1}	-
2-Methylnaphthalene	-	9.1×10^{-2}	-	1.8×10^{-8}	-	7.4×10^{-7}
2-Nitrophenol	-	-	-	5.1×10^{-9}	-	-
3-Methylchloranthrene	-	6.8×10^{-3}	-	-	-	-
9H-Fluoren-9-one	-	-	-	2.7×10^{-6}	-	-
Acenaphthene	3.9×10^{-2}	6.8×10^{-3}	-	9.0×10^{-10}	-	-
Acenaphthylene	1.4×10^{-1}	6.8×10^{-3}	-	-	-	-
Acetaldehyde*	2.1×10^{1}	-	-	-	-	-
Acetic acid	-	-	-	-	-	5.6×10^{-7}
Acetone	-	-	2.4×10^{2}	-	1.8×10^{2}	-
Acrolein*	2.6	-	-	-	-	-
Aldehydes	1.9×10^{3}	-	-	-	-	-
Aluminum	-	-	8.9	-	6.8	-
Anthracene	5.2×10^{-2}	9.1×10^{-3}	-	1.0×10^{-8}	-	4.1×10^{-9}
Antimony*	-	-	3.0×10^{-2}	1.7×10^{-9}	2.3×10^{-2}	1.1×10^{-6}
Arsenic*	-	7.6×10^{-1}	4.2×10^{-1}	6.7×10^{-9}	3.2×10^{-1}	-
Barium	-	1.7×10^{1}	3.9×10^{-1}	-	3.0×10^{-1}	-
Benz(a)anthracene	4.7×10^{-2}	6.8×10^{-3}	7.0×10^{-2}	1.9×10^{-9}	5.4×10^{-2}	-
Benzaldehyde	-	-	9.3	2.8×10^{-8}	7.1	-
Benzaldehyde, 4-ethyl-	-	-	2.1	-	1.6	-
Benzaldehyde, ethyl-	-	-	1.3	-	9.8×10^{-1}	-
Benzaldehyde, ethyl- benzenemethanol, 4-(1-methylethyl)-	-	-	1.2	-	9.2×10^{-1}	-
Benzene*	2.6×10^{1}	8.0	6.5	1.2×10^{-6}	5.0	1.3×10^{-6}
Benzene, 1,2,3-trimethyl-	-	-	-	-	-	3.9×10^{-7}
Benzene, 1,2,4,5-tetramethyl-	-	-	-	-	-	1.8×10^{-6}
Benzene, 1-methyl-2-propyl-	-	-	-	-	-	1.8×10^{-6}
Benzene, 1-methyl-3-propyl-	-	-	-	-	-	4.4×10^{-7}
Benzo(a)pyrene	5.2×10^{-3}	4.6×10^{-3}	-	-	-	-
Benzo(b)fluoranthene	2.7×10^{-3}	6.8×10^{-3}	-	-	-	-
Benzo(g,h,i)perylene	1.4×10^{-2}	4.6×10^{-3}	-	-	-	-
Benzo(k)fluoranthene	4.3×10^{-3}	6.8×10^{-3}	-	-	-	-
Benzyl alcohol	-	-	1.6	-	1.3	1.7×10^{-6}
Beryllium*	-	4.6×10^{-2}	7.6×10^{-3}	7.2×10^{-10}	5.8×10^{-3}	-
Bis(2-ethylhexyl)phthalate*	-	-	1.9	6.6×10^{-9}	1.5	6.3×10^{-9}

TABLE 5.6-2 (Cont.)

	Emissions (µg/s)[b]					
			GB Processing[c]		VX Processing[c]	
Compound[a]	Diesel Generator	Boiler	Product Gas Burner	Filter Farm Stack	Product Gas Burner	Filter Farm Stack
Butanal	-	-	-	7.9×10^{-9}	-	2.9×10^{-8}
Butane	-	8.0×10^{3}	-	-	-	-
C3-Alkyl benzenes	-	-	-	4.8×10^{-7}	-	-
Cadmium*	-	4.2	1.2×10^{-1}	3.0×10^{-9}	9.2×10^{-2}	3.0×10^{-7}
Calcium	-	-	2.0×10^{1}	8.6×10^{-6}	15	6.9×10^{-5}
Carbon disulfide*	-	-	2.5×10^{-1}	-	2.0×10^{-1}	-
Chloroform*	-	-	3.9	-	3.0	-
Chromium*	-	5.3	1.1	-	8.3×10^{-1}	-
Chrysene	9.8×10^{-3}	6.8×10^{-3}	-	3.9×10^{-9}	-	-
Cobalt*	-	3.2×10^{-1}	3.5×10^{-2}	9.5×10^{-9}	2.7×10^{-2}	1.8×10^{-7}
Copper	-	3.2	2.0	-	1.5	-
Cyclododecane	-	-	2.8	-	2.2	-
Cyclohexane, 2-butyl-1,1,3-trimethyl-	-	-	-	-	-	3.5×10^{-7}
Cyclohexane, butyl-	-	-	-	5.7×10^{-9}	-	2.7×10^{-6}
Cyclohexane, hexyl-	-	-	-	-	-	4.0×10^{-7}
Cyclohexanol	-	-	-	-	-	8.8×10^{-7}
Cyclohexanone	-	-	-	3.8×10^{-8}	-	7.6×10^{-9}
Cyclotetrasiloxane, octamethyl-	-	-	2.8	-	2.2	-
Decane	-	-	-	6.2×10^{-8}	-	1.1×10^{-5}
Decane, 2,6,7-trimethyl-	-	-	-	5.2×10^{-9}	-	-
Decane, 2-methyl-	-	-	-	-	-	2.6×10^{-6}
Decane, 3-methyl-	-	-	-	-	-	1.9×10^{-6}
Decane, 4-methyl-	-	-	-	6.7×10^{-9}	-	1.4×10^{-6}
Decane, 5-methyl-	-	-	-	2.4×10^{-8}	-	-
Dibenzo(a,h)anthracene	1.6×10^{-2}	4.6×10^{-3}	-	-	-	-
Dibenzofuran*	-	-	1.0	5.9×10^{-8}	7.9×10^{-1}	6.8×10^{-8}
Dichlorobenzene*	-	4.6	-	-	-	-
Diethylene glycol	-	-	-	-	-	5.2×10^{-6}
Diethylphthalate	-	-	1.7	-	1.3	-
Dimethylbenz(a)anthracene	-	6.1×10^{-2}	-	-	-	-
Di-n-butylphthalate (bis-(2-ethylhexyl)phthalate)*	-	-	3.6	-	2.8	-
Diphenylmethane	-	-		5.0×10^{-9}	-	-
Dodecane	-	-	1.1	1.1×10^{-7}	8.6×10^{-1}	4.3×10^{-6}
Dodecane, 2,6,10-trimethyl-	-	-	-	7.2×10^{-9}	-	-
Dodecane, 4-methyl-	-	-	-	2.1×10^{-8}	-	-
Dodecane, 6-methyl-	-	-	-	1.3×10^{-8}	-	1.3×10^{-6}
Ethane	-	1.2×10^{4}	-	-	-	-
Ethanol, 2-(2-butoxyethoxy)-, acetate	-	-	-	2.4×10^{-8}	-	-
Ethanone, 1-(3-methylphenyl)-	-	-	-	7.6×10^{-9}	-	-
Ethanone, 1-phenyl-	-	-	-	5.5×10^{-8}	-	-
Ether	-	-	1.9×10^{2}	-	1.5×10^{2}	-
Ethylbenzene*	-	-	5.9	-	4.5	-
Ethylene glycol*	-	-	-	2.2×10^{-7}	-	1.8×10^{-6}
Fluoranthene	2.1×10^{-1}	1.1×10^{-2}	-	1.2×10^{-8}	-	8.3×10^{-9}
Fluorene	8.1×10^{-1}	1.1×10^{-2}	4.7×10^{-2}	2.2×10^{-8}	3.6×10^{-2}	2.4×10^{-8}
Formaldehyde*	3.3×10^{1}	2.9×10^{2}	-	-	-	-
GB[d]	-	-	-	3.7	-	-
Heptadecane	-	-	-	1.7×10^{-8}	-	-
Heptanal	-	-	-	2.8×10^{-7}	-	-

TABLE 5.6-2 (Cont.)

	Emissions (µg/s)[b]					
			GB Processing[c]		VX Processing[c]	
Compound[a]	Diesel Generator	Boiler	Product Gas Burner	Filter Farm Stack	Product Gas Burner	Filter Farm Stack
Heptane, 3-ethyl-2-methyl-	-	-	-	1.7×10^{-8}	-	8.5×10^{-7}
Hexadecane, 2,6,10,14-tetramethyl-	-	-	-	3.2×10^{-8}	-	-
Hexanal	-	-	-	1.0×10^{-7}	-	1.0×10^{-7}
Hexane(n)*	-	6.8×10^{3}	1.2×10^{2}	-	9.2×10^{1}	-
Hydrochloric acid*	-	-	7.6×10^{1}	4.5×10^{-6}	5.8×10^{1}	2.8×10^{1}
Hydrogen fluoride*	-	-	1.3	4.7×10^{1}	1.0	-
Hydrogen cyanide*	-	-	5.3	-	4.0	-
Hydrogen sulfide*	-	-	7.7×10^{3}	-	5.9×10^{3}	-
Indeno(1,2,3-cd)pyrene	1.0×10^{-2}	6.8×10^{-3}	-	-	-	-
Iron	-	-	1.3×10^{1}	8.4×10^{-7}	1.0×10^{1}	-
Isobutyl alcohol	-	-	-	8.9×10^{-8}	-	1.7×10^{-6}
Lead*	-	1.9	1.6×10^{-1}	3.7×10^{-8}	1.2×10^{-1}	1.1×10^{-5}
m,p-Xylene*	7.9	-	-	-	-	-
Magnesium	-	-	3.0	2.7×10^{-6}	2.3	1.9×10^{-5}
Malonic acid	-	-	-	2.1×10^{-5}	-	-
Manganese*	-	1.4	2.9×10^{1}	1.2×10^{-7}	22	6.1×10^{-5}
Mercury*	8.3×10^{-3}	9.9×10^{-1}	-	1.7×10^{-8}	-	-
Methylene chloride*	-	-	1.0×10^{1}	1.3×10^{-4}	8.0	7.0×10^{-7}
Molybdenum	-	4.2	8.5×10^{1}	4.4×10^{-8}	6.5×10^{1}	2.1×10^{-6}
m-Tolualdehyde	-	-	-	7.1×10^{-8}	-	4.9×10^{-8}
Naphthalene*	2.3	2.3	1.5×10^{-1}	1.2×10^{-7}	1.1×10^{-1}	5.9×10^{-7}
Naphthalene, 1,2,3,4-tetrahydro-	-	-	-	-	-	9.7×10^{-7}
Naphthalene, 1,2,3,4-tetrahydro-6-methyl-	-	-	-	-	-	5.1×10^{-7}
Naphthalene, 1,7-dimethyl-	-	-	-	-	-	5.5×10^{-7}
Naphthalene, 1-methyl-	-	-	-	1.9×10^{-8}	-	-
Nickel*	-	8.0	1.2	2.5×10^{-8}	9.5×10^{-1}	-
Nitrobenzene*	-	-	4.4×10^{-1}	6.3×10^{-8}	3.4×10^{-1}	-
Nonane, 2,6-dimethyl-	-	-	-	2.0×10^{-8}	-	4.7×10^{-6}
Nonane, 3,7-dimethyl-	-	-	-	-	-	6.9×10^{-7}
Nonane, 3-methyl-	-	-	-	-	-	3.6×10^{-7}
Octane, 3,6-dimethyl-	-	-	-	-	-	1.7×10^{-6}
Pentadecane	-	-	-	-	-	1.2×10^{-6}
Pentanal	-	-	-	1.3×10^{-7}	-	-
Pentane(n)	-	9.9×10^{3}	-	-	-	-
Phenanthrene	8.1×10^{-1}	6.5×10^{-2}	-	5.2×10^{-8}	-	5.5×10^{-8}
Phenol*	-	-	3.8	1.5×10^{-8}	2.9	-
Phosphorus*	-	-	5.7	1.3×10^{-5}	4.4	2.0×10^{-4}
PCBs[e]	-	-	9.6×10^{-2}	-	9.6×10^{-2}	-
PAHs*	4.7	-	-	-	-	-
Potassium	-	-	-	-	-	9.1×10^{-5}
Propanal (propionaldehyde)*	-	-	-	9.5×10^{-8}	-	9.2×10^{-8}
Propane	-	6.1×10^{3}	-	-	-	-
Propylene	7.1×10^{1}	-	-	-	-	-
Pyrene	1.3×10^{-1}	1.9×10^{-2}	-	6.5×10^{-9}	-	3.8×10^{-9}
Selenium*	-	9.1×10^{-2}	1.7×10^{-1}	-	1.3×10^{-1}	-
Silver	-	-	1.1×10^{-1}	8.6×10^{-9}	8.1×10^{-2}	6.5×10^{-8}
Sodium	-	-	2.6×10^{2}	-	2.0×10^{2}	6.7×10^{-5}
Styrene*	-	-	5.4×10^{-1}	-	4.1×10^{-1}	-
Tetrachloroethene*	-	-	7.8×10^{-2}	-	6.0×10^{-2}	-
Tetradecane	-	-	-	7.1×10^{-8}	-	5.4×10^{-6}

TABLE 5.6-2 (Cont.)

	Emissions (µg/s)[b]					
			GB Processing[c]		VX Processing[c]	
Compound[a]	Diesel Generator	Boiler	Product Gas Burner	Filter Farm Stack	Product Gas Burner	Filter Farm Stack
Thallium	-	-	3.8×10^{-2}	-	2.9×10^{-2}	-
Tin	-	-	1.5	-	1.2	-
Toluene*	1.1×10^{1}	1.3×10^{1}	8.7×10^{-1}	4.0×10^{-7}	6.6×10^{-4}	2.4×10^{-7}
Total HpCDF	-	-	1.5×10^{-9}	-	1.2×10^{-9}	-
Total HxCDD	-	-	7.7×10^{-7}	-	5.9×10^{-10}	-
Total HxCDF	-	-	1.6×10^{-6}	-	1.2×10^{-9}	-
Total PeCDD	-	-	4.4×10^{-7}	-	3.4×10^{-7}	-
Total PeCDF	-	-	5.5×10^{-7}	-	4.2×10^{-7}	-
Total TCDD	-	-	3.6×10^{-7}	-	2.8×10^{-7}	-
Total TCDF	-	-	7.8×10^{-7}	-	6.0×10^{-7}	-
Trichloroethene*	-	-	7.8×10^{-2}	-	6.0×10^{-2}	-
Tridecane	-	-	-	1.1×10^{-7}	-	2.4×10^{-6}
Tridecane, 2-methyl-	-	-	-	-	-	1.5×10^{-6}
Tridecane, 4-methyl-	-	-	-	-	-	6.9×10^{-7}
Tridecane, 6-propyl-	-	-	-	-	-	5.3×10^{-7}
Undecane	-	-	-	1.0×10^{-7}	-	7.1×10^{-6}
Undecane, 2,10-dimethyl-	-	-	-	3.2×10^{-8}	-	3.1×10^{-7}
Undecane, 2,6-dimethyl-	-	-	-	3.9×10^{-8}	-	-
Undecane, 2-methyl-	-	-	-	2.5×10^{-8}	-	-
Undecane, 3,6-dimethyl-	-	-	-	-	-	1.1×10^{-6}
Undecane, 4-methyl-	-	-	-	-	-	7.3×10^{-7}
VX[d]	-	-	-	-	-	3.7
Vanadium	-	8.8	1.1×10^{-1}	8.8×10^{-9}	8.8×10^{-2}	1.1×10^{-7}
Xylenes*	-	-	4.0×10^{-1}	3.1×10^{-1}	3.1×10^{-1}	-
Zinc	-	-	1.6	-	1.2	-

[a] Substances designated with an asterisk (*) are listed as HAPs under Title III, Section 112, of the CAA. PAHs = polycyclic aromatic hydrocarbons. PCBs = polychlorinated biphenyls. Polychlorinated dioxins/furans are as follows: HpCDF = heptachlorodibenzo-p-furan, HxCDD = hexachlorodibenzo-p-dioxin; HxCDF = hexachlorodibenzo-p-furan, PeCDD = pentachlorodibenzo-p-dioxin; PeCDF = pentachlorodibenzo-p-furan; TCDD = tetrachlorodibenzo-p-dioxin; TCDF = tetrachlorodibenzo-p-furan.

[b] A hyphen indicates that the compound was not detected from this source during demonstration testing.

[c] For the filter farm stack emissions, organics are assumed to be treated by being passed through six carbon filters in series, each at 95% efficiency. PM (metals, dioxins/furans) is assumed to pass through two HEPA filters in series, each at 99.97% efficiency. Product gas burner emissions are assumed not to receive further treatment after release from facility scrubbers.

[d] The after-treatment emission rate from the filter farm stack for chemical agent (GB, VX) is a worst-case estimate; it assumes emissions at the detection limit (Kimmell et al. 2001). It is assumed that no agent would be emitted from the product gas burner stack; none would be present after neutralization and SCWO treatment.

[e] Although PCB destruction was not included in demonstration testing, for these analyses, it is assumed that Neut/GPCR/TW-SCWO technology would have a destruction efficiency of 99.9999%.

TABLE 5.6-3 Estimated Toxic Air Pollutant Emissions from Electrochemical Oxidation Technology at PBA

	Emissions (µg/s)[b]			
			CatOx/Filter Farm Stack	
Compound[a]	Diesel Generator	Boiler	GB Processing[c]	VX Processing[c]
1,3-Butadiene*	1.1	-	-	-
1,5-Pentanediol, dinitrate	-	-	5.8×10^{-6}	4.4×10^{-6}
1-Butanol, 3-methyl-, nitrate	-	-	2.6×10^{-5}	2.0×10^{-5}
1-Hexanol, 2-ethyl-	-	-	3.3×10^{-7}	2.5×10^{-7}
2-Heptanone	-	-	6.0×10^{-7}	4.5×10^{-7}
2-Hexanone	-	-	5.4×10^{-6}	4.1×10^{-6}
2-Methylnaphthalene	-	4.4×10^{-2}	-	-
2-Octanone	-	-	9.7×10^{-7}	7.4×10^{-7}
2-Pentanol, nitrate	-	-	3.6×10^{-5}	2.7×10^{-5}
3-Methylchloranthrene	-	3.3×10^{-3}	-	-
4-Methyl-2-pentanone	-	-	2.0×10^{-7}	1.8×10^{-7}
4-Octene, (E)-	-	-	9.0×10^{-8}	7.8×10^{-8}
Acenaphthene	3.9×10^{-2}	3.3×10^{-3}	-	-
Acenaphthylene	1.4×10^{-1}	3.3×10^{-3}	-	-
Acetaldehyde*	2.1×10^{1}	-	-	-
Acetamide, N,N-dimethyl-	-	-	2.0×10^{-6}	1.5×10^{-6}
Acetic acid	-	-	2.6×10^{-6}	2.2×10^{-6}
Acetone	-	-	1.5×10^{-8}	1.3×10^{-8}
Acrolein*	2.6	-	-	-
Aldehydes	1.9×10^{3}	-	-	-
Anthracene	5.2×10^{-2}	4.4×10^{-3}	-	-
Arsenic*	-	3.7×10^{-1}	-	-
Barium	-	8.0	-	-
Benz(a)anthracene	4.7×10^{-2}	3.3×10^{-3}	-	-
Benzene*	2.6×10^{1}	3.8	2.1×10^{-6}	1.6×10^{-6}
Benzo(a)pyrene	5.2×10^{-3}	2.2×10^{-3}	-	-
Benzo(b)fluoranthene	2.7×10^{-3}	3.3×10^{-3}	-	-
Benzo(g,h,i)perylene	1.4×10^{-2}	2.2×10^{-3}	-	-
Benzo(k)fluoranthene	4.3×10^{-3}	3.3×10^{-3}	-	-
Beryllium*	-	2.2×10^{-2}	-	-
Bis(2-ethylhexyl)phthalate*	-	-	9.1×10^{-7}	6.9×10^{-7}
Butane	-	3.8×10^{3}	-	-
Cadmium*	-	2.0	-	-
Carbon disulfide*	-	-	7.7×10^{-5}	5.8×10^{-5}
Chromium*	-	2.6	-	-
Chrysene	9.8×10^{-3}	3.3×10^{-3}	-	-
Cobalt*	-	1.5×10^{-1}	-	-
Copper	-	1.6	-	-
Cyclohexane, 1,2,3-trimethyl-	-	-	3.1×10^{-7}	2.7×10^{-7}

TABLE 5.6-3 (Cont.)

	Emissions (µg/s)[b]			
			CatOx/Filter Farm Stack	
Compound[a]	Diesel Generator	Boiler	GB Processing[c]	VX Processing[c]
Decane	-	-	5.2×10^{-6}	4.0×10^{-6}
Decanenitrile	-	-	8.8×10^{-7}	6.7×10^{-7}
Dibenzo(a,h)anthracene	1.6×10^{-2}	2.2×10^{-3}	-	-
Dichlorobenzene*	-	2.2	-	-
Dimethylbenz(a)anthracene	-	2.9×10^{-2}	-	-
Dodecane	-	-	7.1×10^{-6}	5.4×10^{-6}
Ethane	-	5.7×10^{3}	-	
Ethylbenzene*	-	-	1.4×10^{-7}	1.1×10^{-7}
Fluoranthene	2.1×10^{-1}	5.5×10^{-3}	-	-
Fluorene	8.1×10^{-1}	5.1×10^{-3}	-	-
Formaldehyde*	3.3×10^{1}	1.4×10^{2}	-	-
GB[d]	-	-	3.4	-
Heptanal	-	-	1.3×10^{-6}	9.9×10^{-7}
Heptanenitrile	-	-	7.7×10^{-7}	5.9×10^{-7}
Hexadecane	-	-	1.3×10^{-6}	9.8×10^{-7}
Hexane(n)*	-	3.3×10^{3}	-	-
Hexanenitrile	-	-	6.9×10^{-7}	5.3×10^{-7}
Indeno(1,2,3-cd)pyrene	1.0×10^{-2}	3.3×10^{-3}	-	-
Isopropyl nitrate	-	-	1.6×10^{-4}	1.2×10^{-4}
Lead*	-	9.1×10^{-1}	-	-
m,p-Xylene*	7.9	-	-	-
Manganese*	-	6.9×10^{-1}	-	-
Mercury*	8.3×10^{-3}	4.8×10^{-1}	-	-
Molybdenum	-	2.0	-	-
Naphthalene*	2.3	1.1	3.0×10^{-5}	2.6×10^{-5}
Nickel*	-	3.8	-	-
Nitric acid esters	-	-	6.2×10^{-6}	4.7×10^{-6}
Nitric acid, butyl ester	-	-	2.9×10^{-5}	2.2×10^{-5}
Nitric acid, decyl ester	-	-	2.4×10^{-6}	1.8×10^{-6}
Nitric acid, ethyl ester	-	-	1.6×10^{-5}	1.2×10^{-5}
Nitric acid, hexyl ester	-	-	1.6×10^{-5}	1.2×10^{-5}
Nitric acid, nonyl ester	-	-	5.3×10^{-6}	4.1×10^{-6}
Nitric acid, pentyl ester	-	-	1.7×10^{-5}	1.3×10^{-5}
Nitric acid, propyl ester	-	-	1.7×10^{-5}	1.3×10^{-5}
Nonanal	-	-	8.4×10^{-7}	7.3×10^{-7}
Nonanenitrile	-	-	1.5×10^{-6}	1.1×10^{-6}
Octanal	-	-	1.5×10^{-6}	1.2×10^{-6}
Octanenitrile	-	-	1.7×10^{-6}	1.3×10^{-6}
Pentadecane	-	-	2.6×10^{-6}	1.9×10^{-6}
Pentane(n)	-	4.8×10^{3}	-	-

TABLE 5.6-3 (Cont.)

	Emissions (µg/s)[b]			
			CatOx/Filter Farm Stack	
Compound[a]	Diesel Generator	Boiler	GB Processing[c]	VX Processing[c]
Phenanthrene	8.1×10^{-1}	3.1×10^{-2}	-	-
PCBs[e]	-	-	1.5×10^{-9}	1.5×10^{-9}
PAHs*	4.7	-	-	-
Propane	-	2.9×10^{3}	-	-
Propylene	7.1×10^{1}	-	-	-
Pyrene	1.3×10^{-1}	9.1×10^{-3}	-	-
Selenium*	-	4.4×10^{-2}	-	-
Tetradecane	-	-	8.3×10^{-6}	6.3×10^{-6}
Toluene*	1.1×10^{1}	6.2	5.4×10^{-7}	4.1×10^{-7}
Tridecane	-	-	7.5×10^{-6}	5.7×10^{-6}
Undecane	-	-	6.3×10^{-6}	4.8×10^{-6}
VX[d]	-	-	-	3.4
Vanadium	-	4.2	-	-
Xylenes*	-	-	7.2×10^{-7}	5.7×10^{-7}

[a] Substances designated with an asterisk (*) are listed as HAPs under Title III, Section 112, of the CAA. PAHs = polycyclic aromatic hydrocarbons. PCBs = polychlorinated biphenyls.

[b] A hyphen indicates that the compound was not detected from this source during demonstration testing.

[c] For the CatOx/filter farm stack emissions, organics are assumed to be treated by being passed through six carbon filters in series, each at 95% efficiency. PM (metals, dioxins/furans) is assumed to pass through two HEPA filters in series, each at 99.97% efficiency.

[d] The after-treatment emission rate from the filter farm stack for chemical agent (GB, VX) is a worst-case estimate; it assumes emissions at the detection limit (Kimmell et al. 2001).

[e] Although PCB destruction was not included in demonstration testing, for these analyses, it was assumed that Elchem Ox technology would have a destruction efficiency of 99.9999% and that further treatment, as described in footnote c, would be applied.

Polychlorinated biphenyls (PCBs) have been identified as a constituent in the firing tubes of M55 rockets (see Section 5.4.2.2). PCBs were not tested as part of the ACWA demonstration project, since doing so would have triggered regulatory requirements under the TSCA that would have added considerably to the cost and difficulty of the demonstration. Demonstration tests were conducted by using wood spiked with pentachlorophenol (PCP, a chlorinated substance similar to PCBs). Results showed degradation of the PCP in the test systems, indicating that PCBs would also likely be destroyed. For pilot testing of M55 rocket destruction systems, appropriate TSCA regulations on monitoring PCBs and limiting them in effluents would be followed, and a permit with treatment standards would be obtained before rocket pilot testing. For the purposes of this assessment, it was assumed that the technology systems evaluated would achieve a PCB destruction efficiency of 99.9999. For filtered stacks, further removal by carbon filtration was also assumed.

In order to assess health risks associated with toxic air pollutant emissions (Section 5.7), the locations of maximum on-post and off-post concentrations of the emitted compounds listed in Tables 5.6-1 through 5.6-3 were identified through air modeling. The ISCST3 model (EPA 1995) was used in the same way as it was used for assessing criteria air pollutant emissions in Section 5.5. Details on the modeling conducted are presented in Appendix C.

The main emissions from commuter vehicles and delivery trucks are criteria pollutants (as summarized in Section 5.5); toxic air pollutant emissions have not been quantified.

5.6.3.3 Impacts of Fluctuating Operations

To account for possible fluctuations in operations that could occur during pilot testing, it was assumed that levels of organic compounds would be 10 times higher than the estimated annual average for 5% of the time and that levels of inorganic compounds would be 10 times higher than the estimated annual average for 20% of the time. These assumptions were based on EPA guidance (National Research Council 1997b) and were used to generate ambient annual concentrations for exposure estimates, as detailed in Appendix C.

During fluctuating operations, it is possible that agent could be released from the filter farm stack, which is the ventilation stack for the Munitions Demilitarization Building (MDB) process area. Regardless of the ACWA technology selected for implementation at PBA, the filter farm stack would be equipped with multiple carbon filter banks and with agent monitoring devices between banks. These devices would ensure that, in the unlikely event that some agent was not destroyed in the neutralization process and subsequent treatment, it would be detected and the causes mitigated immediately.

For the purpose of estimating the maximum potential emissions of chemical agent, only the MDB process area was assumed to be a potential source. The filter systems would be designed to remove agent from the ventilation air stream to a level below the detectable level

(Kimmell et al. 2001). Therefore, if any agent were detected in the exhaust stream, alarms would sound, the cause would be identified and mitigated, and the emission of agent (if any) would be short-term and at low levels. Since no estimates of potential chemical agent emission levels were made on the basis of demonstration test results, it was conservatively assumed for this assessment that an agent could hypothetically be emitted continuously from the stack at the detection limit level for that agent. Modeling dispersion from the source at these levels resulted in the maximum hypothetical on-post and off-post agent concentrations presented in Table 5.6-4. All these values are less than 1% of the allowable concentrations for general public exposure established by the Centers for Disease Control and Prevention (CDC 1988). In practice, the facility stacks would have continuous agent monitoring devices that would sound if any agent were detected in the stacks. The reasons for the presence of the agent would thus be identified, and the agent would be eliminated.

5.6.4 Impacts of No Action

Activities associated with continued storage at PBA would include inspecting, monitoring, and conducting an annual inventory of all munitions; overpacking any leaking munitions discovered during inspections; and transporting overpacked leakers to a separate RCRA-permitted storage igloo. All chemical munition storage igloos would continue to be routinely inspected and monitored in accordance with strict U.S. Army regulations. All of the permitted igloos containing the overpacked leakers would continue to be inspected and monitored in accordance with applicable State of Arkansas-issued RCRA permit conditions. Upon discovery of a leaker, a filter would be installed, and the entry door would be sealed. The amount of agent that might spill from a leaking munition would likely be small, and any vapor that might form as a result of the spill would likely be contained within the igloo. These statements are especially true for VX, which has a very low volatility (10 mg/m^3 at 25°C [77°F]). Liquid that could leak from a munition would tend to spill slowly over the munition(s) and onto the igloo floor. A VX liquid spill would evaporate very slowly because of the still air conditions inside the igloo and the low volatility of the agent. Because of GB’s greater volatility (21,000 mg/m^3), a liquid spill would more readily evaporate. However, because of the still air conditions inside igloos and the small spill areas that typically occur, spilled liquid and vapors coming from a GB munition leak would probably remain contained inside the igloo long enough for inspection crews to detect and remediate them. If the munition leak were from an M55 rocket, the shipping and handling containers for these munitions would contain any GB or VX liquid that might leak from the rocket. During Chemical Stockpile Emergency Preparedness Program (CSEPP) exercises, maximum credible events (MCEs) involving the spill of agent onto the igloo floor have been simulated with the D2PC model. These exercises have shown that the hazard zone from such an event would be contained within the PBCA at PBA.

TABLE 5.6-4 Maximum Annual Average Estimated On-Post and Off-Post Concentrations of Agent during ACWA Pilot Facility Operations at PBA[a]

Technology	Maximum Annual Average Off-Post Concentration (μg/m^3)	Maximum Annual Average On-Post Concentration (μg/m^3)	Percent of Limit Off Post[b]	Percent of Limit On Post[b]
Neut/SCWO	5.6×10^{-7}	7.2×10^{-7}	0.02	0.024
Neut/GPCR/TW-SCWO	7.0×10^{-7}	8.1×10^{-7}	0.02	0.03
Elchem Ox	6.4×10^{-7}	7.9×10^{-7}	0.01	0.03

[a] Estimated concentrations account for fluctuating operations. Agents considered are the nerve agents GB and VX.

[b] The general population exposure limits for 72-hour time-weighted average exposures, as estimated by CDC (1988), are as follows: GB and VX = 0.003 μg/m^3.

5.7 HUMAN HEALTH AND SAFETY — ROUTINE OPERATIONS

Impacts on human health from routine operations are generally assessed by estimating exposures to the toxic substances that are emitted from a facility on a routine basis and by estimating the potential for those exposures to cause adverse health effects. Because the degree of exposure is partially determined by where the human population is located with respect to the emission points, this section gives data on the locations of workers and the general public around the proposed facilities. Guidance for the estimation of exposure and risk from routine low-level exposures is available from the EPA. The assessment for this EIS generally followed the principlesals of the EPA’s Risk Assessment Guidance for Superfund, which includes the estimation of risk for a reasonably maximally exposed individual (MEI) (EPA 1989, 1997). For example, the risk for the off-site public would be assessed by assuming that the MEI resided in the area of off-site maximum contaminant concentrations (generally but not always the fence line). Other assumptions on intake levels and susceptibility are made to ensure that, whenever possible, that exposures and risks will be overestimated rather than underestimated. The reasoning is that if the MEI risk is found to be within acceptable limits, then the risk to the general public will be lower and also generally acceptable.

In addition to risks from exposures to facility emissions, occupational hazard risks of injury and fatality are presented for the facility workers. Some risk of on-the-job injury or fatality is associated with any industry, and a screening estimation of this risk is presented. The main determinanttion of this type of risk is the type of work (construction or facility operation) being done and the number of employees who are doing it.

5.7.1 Current Environment

5.7.1.1 Existing Environmental Contamination and Remediation Efforts

Contamination of groundwater in the near-surface aquifer has been detected at PBA as a result of past operations of the munitions facilities. Remedial action has been completed to remove or isolate areas that previously caused contamination. Environmental cleanup is being addressed in other environmental compliance documentation and is beyond the scope of this EIS. No past contamination has been identified at the sites being considered for an ACWA pilot test facility.

5.7.1.2 On-Post Workers and Residents

Employment at PBA currently stands at about 1,900, including 1,000 arsenal employees, 100 employees working at the CLA, approximately 30 military personnel, and about 800 employees for the PBCDF (Atkinson 2000). Next to the installation there are also a number of commercial and industrial tenants occupying land and buildings formerly used by the military. Employment in these activities is currently about 700 employees, including 600 employees at the NCTR.

The types of workers currently employed at PBA include industrial workers, environmental protection specialists, fire and emergency services specialists, facility management and maintenance workers, and administrative and office workers. The hazards associated with these jobs vary; workers receive training to address their specific job hazards. Although occupational hazards exist for all types of work (rates for various industry classifications are published, e.g., in National Safety Council 1999), hazards can be minimized when workers adhere to safety standards and use protective equipment as necessary.

On-post workers and residents at the PBA installation could be exposed to chemicals released to air, water, or soil. As discussed in Section 5.6.1, VOCs are emitted from various installation operations, but not at levels that require reporting of individual substance emissions. The only release at PBA that is reportable under TRI regulations is about 1,900 lb (862 kg) of hydrochloric acid released annually at the CIC. The CIC is located almost 2 mi (3.2 km) from the closest on-post residential area. On-post manufacturing facilities and workers are closer (about 0.5 mi [0.8 km]). Although health risks from ongoing operations at PBA have not been quantitatively estimated, the above information suggests that risks for PBA workers and on-post residents from toxic air emissions would be minimal.

Contaminant levels in PBA releases to water are subject to applicable NPDES regulations. Nonhazardous solid waste is sent to off-post landfills, and hazardous solid waste is stored in approved facilities (see Section 5.4), so that any contamination of water or soil at PBA from routine operations should be minor and should not result in increased health risk to workers or on-post residents.

5.7.1.3 Off-Post Public

Demographic information for the off-post public is contained in Section 5.18. No increased health risks to the off-post public are associated with normal PBA operations. Procedures are in place to minimize risks associated with accidents (see Section 5.7.1.4).

5.7.1.4 Emergency Response

Procedures for on-post emergency response actions involving toxic chemical munitions are contained in PBA's Chemical Accident or Incident Response and Assistance Plan (SBCCOM 2000a). This plan establishes policies and procedures that ensure adequately trained personnel and appropriate equipment are present on the installation at all times to respond to emergency situations.

The Chemical Stockpile Emergency Preparedness Program (CSEPP) has further enhanced PBA's ability to respond to a chemical accident by providing facilities and equipment and by supporting a framework for exchanging information and coordinating assistance with the state and county. As part of CSEPP, PBCA runs a 24 h/d, 7 d/wk operations center. This facility enables PBA to respond expeditiously to any accident that might occur. In the unlikely event of a chemical accident or incident, operations center staff can readily run plume projections by using the Emergency Management Information System (EMIS), determine the protective action recommendation (PAR), alert the off-post response community, signal PBA staff to respond, and activate the outdoor/indoor warning systems (made up of 58 warning sirens and 10,200 tone alert radios capable of emitting several tones and voice messages); many of these activities would occur simultaneously. The sirens and tone alert radios are part of the Jefferson County CSEPP warning system and can be activated by Jefferson County.

CSEPP has also encouraged cooperation among PBA, the county, and the state with regard to communications, event classification and notification, exercises, public affairs, and planning. Joint communication links include telephones, radios, e-mail, and microwave transmissions. A memorandum of agreement (MOA) for notification allows for the rapid exchange of information and sounding of warning devices. Jefferson County provides emergency information to employees, tenants, contractors, and on-post residents. Joint exercises have been held annually since 1989. Public affairs efforts are coordinated and include a joint information center (formalized by an MOA) and annual calendars. Finally, emergency response plans are currently being updated and synchronized.

PBA also has plans for responding to other potential spill hazards. Procedures for responding to spills of oil or a hazardous substance are contained in PBA's Installation Spill Contingency Plan. Controls designed to prevent spills of oil or hazardous substances and minimize the impact of spills on the environment are described in PBA's Oil and Hazardous Substance Spill Prevention, Control, and Countermeasure Plan (Appendix 1 to Annex G of the disaster control plan). Emergency response plans establish policies and procedures that ensure adequately trained personnel and appropriate equipment are present on the installation at all times to respond to emergency situations.

The PBA Fire and Emergency Services Department is staffed at all times. Equipment present on the installation for use in emergency situations includes fire-fighting equipment and vehicles, an emergency response vehicle, heavy equipment, and spill kits.

PBA has mutual aid agreements with local fire departments and medical facilities to augment its emergency services. These local fire departments have agreed to provide emergency response assistance to PBA, upon request, when it is possible to do so. In return, the PBA Fire Department has agreed to do the same for these local entities. PBA and PBCA also have memorandums of understanding (MOUs) and MOAs with the following organizations for the treatment of casualties, illness, and injuries requiring off-post assistance: Ambulance Transport Service of Arkansas, Ron Lusby's Paramedic Services, Baptist Medical Center, and Jefferson Regional Medical Center. They have an MOU with the U.S. Army Medical Department at Fort Sill, Oklahoma, to augment the on-post medical response force in the event of a major chemical incident.

5.7.2 Impacts of the Proposed Action

This section discusses the potential environmental consequences on human health and safety from constructing and operating a pilot test facility for the destruction of ACWs at PBA. Factors affecting human health and safety include occupational hazards to workers during continued storage and construction and operations and potential release of chemical agent or other hazardous materials during routine operations.

5.7.2.1 Impacts of Construction

Facility Workers. Impacts from construction would include occupational hazards to workers. While such hazards from can be minimized when workers adhere to safety standards and use protective equipment, as necessary, injuries associated with construction work can still occur.

The expected number of worker fatalities and injuries associated with the construction of an ACWA facility was calculated on the basis of estimates of total worker hours required for construction activities for each option as given in Kimmell et al. (2001) and rate data from the U.S. Bureau of Labor Statistics (BLS) as reported by the National Safety Council (1999). Construction of the Neut/SCWO, Neut/GPCR/TW-SCWO, or Elchem Ox facility is estimated to require approximately 511, 518, or 550 FTEs per year, respectively, and could require up to 34 months. Annual construction fatality and injury rates used were as follows: 13.9 fatalities per 100,000 full-time workers and 4.4 injuries per 100 full-time workers. Fatality and injury risks were calculated as the product of the appropriate incidence rate (given above) and the number of FTE employees.

The annual fatality and injury rates for construction of ACWA facilities are shown in Table 5.7-1. No distinctions were made among categories of workers (e.g., supervisors, laborers), because the available fatality and injury statistics by industry are not refined enough to warrant analysis of worker rates in separate categories. The estimated number of fatalities for all the ACWA technologies assessed is less than 1; the estimated annual number of injuries for construction of a Neut/SCWO facility is 22, a Neut/GPCR/TW-SCWO facility is 23, and an Elchem Ox facility is 24.

The calculation of risks of fatality and injury from industrial accidents was based solely on historical industrywide statistics and therefore did not consider a threshold (i.e., it was assumed that any activity would result in some estimated risk of fatality and injury). Whatever technology is implemented will be accompanied by best management practices, which should reduce fatality and injury incidence rates.

Other On-Post Workers and Residents. The main pollutant emissions associated with construction of an ACWA facility would be PM (see Section 5.5). The on-post administrative and residential areas are located more than 1 mi (1.6 km) from the proposed ACWA facility sites. PM_{10} and $PM_{2.5}$ levels associated with ACWA facility construction at the off-post boundaries nearest to the proposed areas for the ACWA facilities were estimated (see Table 5.5-9); these locations are 1.2 mi (2.0 km) north and 0.9 mi (1.4 km) west of the areas. PM concentrations at the on-post administrative and residential areas would presumably be lower because of the greater distance. The incremental PM levels estimated varied between 2% and 34% of the health-based 24-hour or annual NAAQS levels; therefore, adverse health impacts to on-post workers and residents would not be expected in association with inhalation of construction-related emissions. However, the background level for $PM_{2.5}$ is already at 93% of the annual NAAQS standard level, so that the $PM_{2.5}$ level would be very close to the standard during construction.

TABLE 5.7-1 Annual Occupational Hazard Rates Associated with Continued Munitions Maintenance (No Action) and ACWA Facility Construction and Operations at PBA

Impact to Workers[a]	Neut/SWCO	Neut/GPCR/ TW-SCWO	Elchem Ox	No Action
Fatalities				
Construction	0.07	0.07	0.08	NA[b]
Systemization	0.01	0.01	0.01	NA
Operations	0.02	0.02	0.02	0.003
Injuries				
Construction	22	23	24	NA
Systemization	14	14	14	NA
Operations	35	35	35	5

[a] Impacts are based on the projected work force over the lifetime of the project. Fatality estimates of less than one should be interpreted as “no expected fatalities.” For the ACWA technologies, construction is estimated to require up to 34 months, and operations are conservatively estimated to require a maximum of about 2 years. Under the terms of the CWC, the no action alternative could not extend beyond 2012, or about 11 years.

[b] NA = not applicable; i.e., construction and systemization phases are not associated with the no action alternative.

Off-Post Public. The main pollutant emissions associated with construction of an ACWA facility would be PM. PM_{10} and $PM_{2.5}$ levels associated with ACWA facility construction at the off-post boundaries nearest to the proposed areas for an ACWA facility were estimated (see Table 5.5-7; these locations are 1.2 mi (2.0 km) north and 0.9 mi (1.4 km) west of the areas). The incremental PM levels estimated varied between 2% and 34% of the health-based 24-hour or annual NAAQS levels; therefore, adverse health impacts to the off-post public would not be expected in association with the inhalation of construction-related emissions. However, the background level for $PM_{2.5}$ is already at 93% of the annual NAAQS standard level, so that the $PM_{2.5}$ level would be very close to the standard during construction.

5.7.2.2 Impacts of Operations

Facility Workers

Occupational Hazards. Occupational hazards associated with systemization and operation of an ACWA pilot test facility at PBA were estimated by using the same method as that discussed for construction (Section 5.7.2.1). The expected number of worker fatalities and injuries was calculated on the basis of rate data from the BLS as reported by the National Safety Council (1999) and estimates of total worker hours required for systemization and operational activities for each option as given in Kimmell et al. (2001). Operation of any of the ACWA technology systems is estimated to require approximately 720 FTE/yr, and systemization testing would require 12 months with a peak work force of 300 FTEs. Annual fatality and injury rates used were as follows: 3.2 fatalities per 100,000 full-time workers and 4.8 injuries per 100 full-time workers. Annual fatality and injury rates for the manufacturing sector were used because that sector was assumed to be the most representative for systemization and operational work at an ACWA facility. The annual fatality and injury rates for systemization and operation of ACWA facilities are shown in Table 5.7-1. The estimated number of injuries is the same for each technology: 14 per year for systemization and 35 per year for operations.

Inhalation Risks. For routine operations, inhalation exposures and risks for facility workers would depend in part on detailed facility designs that are not yet available. In this EIS, facility workers are generally excluded from health risk evaluation for occupational exposures because such exposures are covered by other guidance and regulations (EPA 1998b). Although quantitative estimates of risks to ACWA facility workers from inhalation of substances emitted during facility operations were not generated for this EIS, the workplace environment would be monitored to ensure that airborne chemical concentrations were below applicable occupational exposure limits. Health risks from occupational exposure through all pathways would be minimized because operations would be enclosed as much as possible and because protective equipment would be used if remote handling of munitions was not possible during processing.

Other On-Post Workers and Residents

Inhalation of Toxic Air Pollutants. Estimated maximum on-post and off-post concentrations of toxic air pollutants from the destruction technologies are discussed in Appendix C. The maximum on-post concentrations were found to occur close to the chemical storage area at PBA; therefore, people most likely to be exposed would be on-post workers. (The residential area at PBA is more than 1 mi (1.6 km) from the location of maximum modeled air concentrations). On-post exposures were modeled on the basis of exposure assumptions typical for the maximum exposed individual (MEI). This person would be a worker assumed to be present at the location of maximum on-post air concentration for 8 hours per day and 250 days per year, for the duration of the pilot test operations for each technology. Exposure estimates generated on the basis of these assumptions were compared with cancer and noncancer toxicity values to generate estimates of increased cancer risk and of the potential for noncancer health impacts. A summary of the results of this assessment is shown in Table 5.7-2. Details of the assessment are provided in Appendix C.

As shown in Table 5.7-2, estimated hazard indexes and carcinogenic risks from exposure to toxic air pollutants estimated for the on-post MEI were well below the benchmarks considered

TABLE 5.7-2 Toxic Air Pollutant Emissions and Impact on Human Health and Safety during Normal Operations at PBA[a]

Emissions and Impacts	Neut/SCWO	Neut/GPCR/ TW-SCWO	Elchem Oxidation
Hazardous air emissions			
Number of chemicals detected	56	172	93
Number of chemicals with quantitative data on toxic, noncarcinogenic effects[b]	32	77	35
Number of chemicals with quantitative data on carcinogenic effects[c]	20	36	22
Impacts[d]			
Hazard index (*hazard index of <1 means adverse health impacts are unlikely*)			
For MEI[e] in off-post general public	7×10^{-3}	5×10^{-3}	7×10^{-4}
For MEI in on-post population	6×10^{-4}	6×10^{-4}	5×10^{-5}
Increased lifetime carcinogenic risk *(risk of 10^{-6} is generally considered negligible)*			
For MEI in off-post general public	2×10^{-8}	4×10^{-9}	2×10^{-9}
For MEI in on-post population	2×10^{-9}	2×10^{-10}	2×10^{-10}

[a] Based on emission estimates from demonstration testing (Kimmell et al. 2001) and model estimates of maximum on-post and off-post concentrations and adjusted to account for fluctuating operations. ISCST3 model was used. Estimates for general public assumed 24-h/d exposures for the duration of operations. Estimates for the on-post population assumed 8-h/d exposures and 250-d/yr of the duration of operations. See Appendix C for details.

[b] Potential noncarcinogenic impacts from some detected chemicals could not be evaluated quantitatively because toxicity data were not available (see text discussion). For Neut/SCWO, Neut/GPCR/TW-SCWO, and Elchem Ox, 14, 92, and 48 chemicals, respectively, could not be quantitatively evaluated for either noncarcinogenic or carcinogenic effects (see text).

[c] All known carcinogens were evaluated for carcinogenic risk.

[d] Carcinogenic risks are less than 10^{-6} and hazard indexes are less than 0.01 for all technologies; thus, they are in the negligible range. Although calculated cancer risks range from approximately 10^{-10} to 10^{-7}, and calculated hazard indexes range from 10^{-4} to 10^{-2}, there is no significant difference in risk among the technologies. Thus, for all the technologies, increased cancer and noncancer risks from inhalation of emissions are in a range considered to be negligible.

[e] MEI = maximum exposed individual.

representative of negligible risk levels. The typical benchmark indicator for significant noncarcinogenic hazards is a hazard index of greater than 1, and for carcinogenic hazards, it is an increased lifetime carcinogenic risk level of greater than 1×10^{-6}. Hazards for the three technologies were very comparable, generally on the same order of magnitude. Almost all of the estimated noncarcinogenic and carcinogenic risks were associated with boiler emissions and not with destruction facility processes. Note that exposures and risks are slightly higher for the off-post MEI than for the on-post MEI because the annual exposure duration for the off-post MEI is assumed to be longer (see next subsection on off-post public).

There are some uncertainties in the demonstration test data used to estimate emissions of toxic air pollutants that should be considered in interpreting the results. Some unit operations were not characterized in demonstration testing, so trace effluents were not estimated for all unit operations that would make up the complete systems. Generally, data were available for unit operations that would be expected to generate the most gaseous emissions during actual operations (Mitretek 2001a–c). However, the emission levels and health risk estimates provided here should be considered only indicative of likely levels. They may need to be revised as technology designs near completion and as estimates of process efficiencies become more reliable (Kimmell et al. 2001). Nevertheless, the values used for the risks from operations presented in this EIS were designed to be very conservative (i.e., potentially resulting in overestimates of risk) and to bound minor variations in the way that the ACWA destruction systems would be engineered.

Many of the substances detected in demonstration testing do not have established (i.e., peer-reviewed) toxicity benchmark levels to allow quantitative risk of exposures to be evaluated. For Neut/SCWO operations, 14 of the detected chemicals (25%) did not have noncarcinogenic or carcinogenic toxicity benchmark levels (see Appendix C). For Neut/GPCR/TW-SCWO operations, 92 of the detected chemicals (53%) did not have established toxicity benchmark levels. For Elchem Ox operations, 48 of the detected chemicals (52%) did not have established toxicity benchmark levels. For most of the substances for which toxicity could not be quantitatively evaluated, emission levels were very low (e.g., less than 10 g/d). Although not quantitatively assessed, toxic effects would be highly unlikely in association with these very low emission levels. For several substances emitted from boilers and diesel generators (aldehydes, propane, butane, pentane, and ethane), emission levels were somewhat higher (up to about 1 kg/d). Although potential health effects from inhalation of these substances could not be quantitatively evaluated because of the lack of toxicity benchmark levels, such data would not distinguish among risks associated with the alternate technologies, because each of the technologies evaluated uses boilers and diesel generators.

Per Executive Order 13045 (1997), it is also necessary to consider whether sensitive subpopulations, such as children or the elderly, could be more affected by the estimated exposures to toxic air pollutants than could the general population. The reference concentrations used to evaluate the noncarcinogenic toxicity of the emitted substances already include factors to account for the possible added sensitivity of certain subpopulations. Chemical-specific potency estimates for carcinogens also include conservative uncertainty factors and so can be used to assess risks for sensitive subpopulations. However, the exposure parameters used to estimate intake (i.e., 154 lb [70 kg] body weight; 20 m^3/d inhalation rate) are typical for adults. To consider intake for young children (less than 1 year old), an inhalation rate of 4.5 m^3/d and a body weight of 20 lb (9 kg) (EPA 1997) could be assumed. Use of these assumptions would result in an estimate of inhalation dose (in mg/kg/d) for a young child that would be 1.7 times greater than the dose assumed for an adult, and overall hazard indices and cancer risks would also increase by a factor of 1.7. Since the hazard indices and cancer risks estimated for toxic air pollutant emissions during normal operations were low (Table 5.7-4), risk levels for children would still be far less than benchmark levels.

Inhalation of Chemical Agent. Maximum potential concentrations from emissions of agent (including consideration of fluctuating operations) were discussed in Section 5.6.3.3. For the nerve agents stored at PBA, modeling dispersion from the estimated maximum emissions resulted in a maximum estimated on-post concentration less than 1% of the allowable concentration for general public exposures. In practice, the facility stacks would have continuous agent monitoring devices that would sound if any agent were detected in the stacks, so that the source could be identified and eliminated quickly. Emissions would not be allowed to continue at the detection limit level, as was assumed in the modeling exercise.

Exposures from Other Pathways. Other potential exposure pathways to be considered are water (if effluent from the pilot facilities was released to nearby waterways) and soil and food (if soil became contaminated by releases to air and subsequent deposition). For pilot testing of each of the ACWA technologies, plans are to recycle all process water through the system. The facilities are not expected to generate any aqueous effluent except for the sanitary wastewater generated by employees. Also, exposure through soil and food chain pathways from deposition onto soil and/or water is expected to be very low, since the level of air emissions that would result from routine operations is expected to be very low and since the duration of operations would be short. All facility releases would be in conformance with applicable local and state permit requirements. Therefore, exposures through water, soil, or foodchain pathways would result in very minimal, if any, additional risk to on-post workers and residents.

Off-Post Public

Inhalation of Toxic Air Pollutants. Maximum off-post concentrations of toxic air pollutants that would result from the ACWA technologies are discussed in Appendix C. Off-post exposures were modeled by using exposure assumptions typical for the MEI in the off-post residential population. This hypothetical person is considered to be an individual who is present at the location of the maximum off-post concentration of a pollutant in air for 24 hours per day and 365 days per year, for the duration of the pilot test operations for each technology. Exposure estimates generated on the basis of these assumptions were compared with cancer and noncancer toxicity values to generate estimates of increased cancer risk and of the potential for noncancer health impacts. A summary of the results of this assessment is shown in Table 5.7-2. Details of the assessment are provided in Appendix C.

This assessment was limited to the estimation of risks associated with inhalation of emitted substances. For some of the emitted substances (e.g., PCBs, dioxins, and furans), exposure to the off-post public through the food-chain pathways could be as large or larger than exposure through inhalation, because these substances are bioaccumulative. Estimates of exposure through these alternate pathways can be highly uncertain and are beyond the scope of this EIS. However, for all the technologies, the emission rates for these substances are quite low (less than 0.00001 lb/yr for all forms of dioxins and furans and 0.005 lb/yr or less for PCBs). For the purpose of this assessment (i.e., to compare the risks associated with pilot testing the alternate ACWA technology systems), estimation of the risk associated with inhalation should be indicative of the risk from all pathways.

As shown in Table 5.7-2, estimated hazard indexes and carcinogenic risks from exposure to toxic air pollutants estimated for the off-post MEI were well below levels considered to be hazardous. The typical benchmark indicator for significant noncarcinogenic risks is a hazard index of greater than 1, and for carcinogenic hazards, it is an increased lifetime carcinogenic risk level of greater than 1×10^{-6}. Hazards for the three technologies were very comparable, generally on the same order of magnitude. Almost all of the estimated noncarcinogenic and carcinogenic risks were associated with boiler emissions and not with destruction facility processes. Note that exposures and risks were slightly higher for the off-post MEI than for the on-post MEI because the annual exposure duration was assumed to be longer for the off-post MEI (see previous subsection regarding on-post workers and residents). Even if it is assumed that sensitive subpopulations, such as children, have an exposure risk up to 1.7 times greater than that of adults, risks would still remain well below levels of concern. A more detailed discussion of assumptions and data limitations for this assessment is provided in Appendix C.

Inhalation of Chemical Agent. Maximum potential off-post concentrations from emissions of agent (including consideration of fluctuating operations) were discussed in Section 5.6.3.3. For the nerve agents stored at PBA, modeling dispersion from the estimated maximum emissions resulted in a maximum estimated off-post concentration of less than 1% of the allowable concentration for general public exposures (CDC 1988). In practice, the facility stacks would have continuous agent monitoring devices that would sound if any agent was detected in the stacks, so that the source would be identified and eliminated quickly. Emissions would not be allowed to continue at the detection limit level, as was assumed in the modeling exercise.

Exposures from Other Pathways. Exposures through water, soil, or food chain pathways would result in very minimal, if any, additional risk to off-post residents (see previous discussion for on-post workers and residents).

5.7.3 Impacts of No Action

Activities associated with continued storage (no action) at PBA would include inspecting and conducting an annual inventory of all munitions, overpacking any leaking munitions discovered during inspections, and transporting the overpacked leakers to a separate storage igloo. Before a worker can enter into any igloo, the air inside is monitored for the presence of agent. Workers are required to wear respiratory protection and protective clothing while in the storage igloos. Therefore, during normal operations under the no action alternative, no worker would be exposed to chemical agent. Routine use of other chemicals would not be required for continued storage operations, so exposure to other chemicals would be limited. A potential hazard would be heat stress associated with the heavy protective clothing and equipment required for the work. However, workers are trained to control this hazard. For the other on-post workers and residents and for the general public, no impacts on human health are expected in association with the no action alternative.

Risk calculations for occupational fatalities and injuries resulting from the no action alternative (i.e., continued storage and maintenance of the PBA stockpile) are presented in Table 5.7-1. The expected number of worker fatalities and injuries associated with continued maintenance of the munitions stockpile at PCD was calculated on the basis of rate data from the BLS as reported by the National Safety Council (1999) and an estimate of 100 FTE employees required for munitions maintenance activities each year (Atkinson 2000). Annual fatality and injury rates for the manufacturing sector were used because this sector was assumed to be the most representative for munitions maintenance work. The specific rates were as follows: fatality rate of 3.2 per 100,000 full-time workers and injury rate of 4.8 per 100 full-time workers. Annual fatality and injury risks were calculated as the product of the appropriate incidence rate (given above) and the number of FTE employees. No distinctions were made among categories of workers (e.g., supervisors, inspectors, security personnel), because the available fatality and injury statistics by industry are not refined enough to warrant analysis of worker rates in separate categories. The estimated number of fatalities was less than one; the estimated total number of injuries was five.

5.7.4 Impacts from Transportation

Chemical agent would not be transported on or off post for any of the alternative technologies evaluated. However, transportation can have adverse impacts on human health because of the associated emission of toxic air pollutants such as benzene, 1,3-butadiene, and formaldehyde. Emissions consist of engine exhaust from diesel- and gasoline-powered vehicles and fugitive dust raised from the road by transport vehicles. Increased incidence of lung cancer has been associated with prolonged occupational exposure to diesel exhaust (Dawson and Alexeeff 2001); toxic air pollutants are also emitted from gasoline-burning vehicles (EPA 2000e). Also, transportation results in some increased risk of injuries and fatalities from mechanical causes; that is, the transport vehicles may be involved in accidents. This type of risk is termed "vehicle-related." Both the chronic health hazard from inhalation of emissions from transport vehicles and the injury risk are directly proportional to the number of vehicle miles traveled.

For the transportation impacts in this EIS, the annual number of vehicle miles traveled by delivery vehicles (used for delivery of construction materials) and commuter vehicles (used to transport construction and operation workers) was compared for each of the alternative technologies and for the no action alternative. In addition, the annual number of shipments of raw materials and waste required for each alternative was tabulated. It was assumed that the distances for shipping raw materials and waste would be similar for each of the alternatives. This assumption was necessary because actual origination and destination locations had not been determined. Therefore, the data did not support risk calculations using diesel emission factors. The comparison of the number of vehicle miles traveled and the number of shipments by alternative is useful for an overall comparison of the potential transportation impacts to human health from each alternative.

The transportation impacts for PBA are summarized in Table 5.7-3. The number of miles traveled annually by construction and operations worker commuter vehicles is similar for each technology. The Neut/SCWO technology would require the greatest number of shipments annually; approximately 30% more than Neut/GPCR-TW-SCWO and more than twice the number required for Elchem Ox. The amount of transportation required for the no action alternative is very small.

5.8 NOISE

The Noise Control Act of 1972, along with its subsequent amendments (*Quiet Communities Act* of 1978, *United States Code*, Title 42, Parts 4901-4918 [42 USC 4901-4918]), delegates to the states the authority to regulate environmental noise and directs government agencies to comply with local community noise statues and regulations. The State of Arkansas and Jefferson County, where PBA is located, have no quantitative noise-limit regulations.

The EPA guideline recommends a day-night sound level (L_{dn}[7] or DNL) of 55 dBA,[8] which is sufficient to protect the public from the effect of broadband environmental noise in typically quiet outdoor and residential areas (EPA 1974). This levels is not a regulatory goal, but

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7 L_{dn} is the day-night A-weighted equivalent sound level, averaged over a 24-hour period, as defined in EPA (1974).

8 dBA is a unit of weighted sound-pressure level, measured by the use of the metering characteristics and the A-weighting specified in ANSI S1.4-1983 (the American National Standards Institute specification for sound level meters) and in ANSI S1.4A-1985, the amendment to S1.4-1983 (Acoustical Society of America 1983, 1985).

TABLE 5.7-3 Comparison of Annual Transportation Requirements for Construction and Routine Operations for Alternative Technology Systems at PBA[a]

Parameter	Neut/SCWO	Neut/GPCR/ TW-SCWO	Elchem Ox	No Action[b]
Number of vehicle miles traveled[c]				
Construction delivery vehicle	200,000	200,000	200,000	NA[d]
Construction worker commuter vehicle	4,900,000	5,000,000	5,300,000	NA
Operations worker commuter vehicle	8,000,000	7,900,000	8,000,000	1,100,000
Number of shipments[e]				
Mustard agent				
Raw materials	450	279	132	NA
Waste	388	362	188	NA
Total	838	641	320	<1

[a] Number of vehicle miles traveled and number of shipments are used as indicators of potential transportation-associated health impacts, since emissions and vehicle-related risks increase with increasing transportation.

[b] No action alternative assumes 100 employees would be required for continued storage maintenance.

[c] Annual miles are calculated as the number of workers × 276 work days per yr × 40 mi per round trip.

[d] NA = not applicable.

[e] Raw material and waste shipments for nerve agent are the maximum annual for either GB or VX.

Input data sources: Kimmell et al. (2001).

is "intentionally conservative to protect the most sensitive portion of the American population" with "an adequate margin of safety." For protection against hearing loss in the general population from nonimpulsive noise, the EPA guideline recommends an L_{eq}[9] of 70 dBA or less over a 40-year period.

5.8.1 Current Environment

PBA is located approximately 8 mi (12.9 km) northwest of Pine Bluff, Arkansas, in Jefferson County (Figure 5.1-1). U.S. Highway 79 (US 79) and Interstate 530 (I 530) run around the PBA installation. State Route 365 parallels PBA to the west. Immediately west of PBA lie the Missouri-Pacific Railroad right-of-way and a sparse number of residential properties. Along the northern boundary is a county road. Undeveloped industrial property and the Mid-Atlantic Packaging Facility are located south of PBA. The eastern boundary of the installation lies along the Arkansas River.

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[9] L_{eq} is the equivalent steady sound level that, if continuous during a specific time period, would represent the same total acoustic energy as the actual time-varying sound. For example, L_{eq}(1-h) is the 1-hour equivalent sound level.

Until the 1980s, the primary noise-producing activities within the PBA used to be open burning and open detonation (OB/OD) activities in the southeastern part of the installation (Neel 2000). However, these activities were discontinued, and, accordingly, no major noise-producing activities exist on post.

No sensitive noise receptors (e.g., hospital, schools) are located near the installation. The Red Cockaded Woodpecker Reserve is approximately 0.6 mi (1 km) from the installation. Ambient sound level measurements around the PBA installation are not currently available. The nearest off-post residence is located along the northern and western boundaries. In the general PBA area, the background environment is typical of rural areas, and residual sound levels are approximately 30 to 35 dBA (Liebich and Cristoforo 1988). Near the western boundary of the PBA installation, the background acoustic environment may be higher, about 40 to 45 dBA, because of the highway and railroad traffic.

5.8.2 Noise Sources from the ACWA Pilot Test Systems

Noise sources during construction of an ACWA pilot facility would include standard commercial and industrial activities for moving earth and erecting of concrete and steel structures. Noise levels generated from these activities would be comparable to those from any construction site of similar size.

Pilot facility operations would involve a variety of equipment that would generate noise. Some equipment, such as fans and pumps for conveying and handling treatment residues (e.g., pollution abatement systems), heating and air conditioning units, electrical transformers, and in-plant public address systems might be located outside the buildings. However, most of the equipment used in ACWA pilot testing operations would be housed inside buildings designed to prevent the release of chemical agents and to contain potential explosions. The walls, ceiling, and roofing materials used in these buildings would attenuate noise generated by the activities inside the buildings.

During both construction and operation, the commuter and delivery traffic in and around the ACWA facility would also generate noise. However, the contribution of noise from these intermittent sources would be minor in comparison to that from the continuous noise sources during construction or operation.

As it was in the air quality modeling presented in Section 5.5, Area A, which is located closer to the site boundary in the direction of neighboring residences, was selected as the receptor for the analysis of potential noise impacts. Regardless of the technology selected, it is assumed that noise levels from both construction and operations would be similar, since detailed information on noise from construction and operational activities associated with an ACWA facility was not available.

5.8.3 Impacts of the Proposed Action

5.8.3.1 Impacts of Construction

Operation of equipment and vehicles during construction and associated activities would typically generate noise levels in the 77–90 dBA range at a distance of about 50 ft (15 m) from the source (EPA 1979). Noise levels decrease about 6 dB for every doubling of distance from the source because sound spreads over an increasing area (geometrical divergence). Thus, construction activities at the pilot test facility location would result in maximum estimated noise levels of about 50 dBA at the PBA boundary closest to Area A, about 0.9 mi (1.2 km) southwest of the facility. The noise level would be lower than 50 dBA at residences located further away from the eastern site boundary.

This 50-dBA estimate is likely to be an upper bound because it does not account for other types of attenuation, such as air absorption and ground effects. This level is below the EPA guideline of 55 dBA for residential zones (see Section 5.8.1) and is in the range found within a typical residential community at night (Corbitt 1990). If other attenuation mechanisms were considered, noise levels at the nearest residence would decrease to near background levels typical of rural environments. In particular, tall vegetation between the proposed facility and the site boundary would contribute to additional attenuation. Thus, potential noise impacts from construction activities at the pilot test facility location are expected to be minor to negligible at the nearest residence. The resulting noise levels would be well within the EPA guidelines, which were established to prevent activity interference and annoyance or hearing impairment.

5.8.3.2 Impacts of Operations

At the baseline incinerator facility in Tooele, Utah, the highest sound levels during operations were measured in the vicinity of the pollution abatement system (Andersen 2000), which is similar in design to pollution abatement systems being considered for use in an ACWA pilot facility. These sound levels were less than 73 dBA within 100 ft (30 m) of the abatement equipment. When only the geometrical divergence discussed in Section 5.8.3.1 is applied, estimated noise levels would be less than 39 dBA at the nearest site boundary. This noise level at the site boundary is comparable to the ambient background level typical of a rural environment and would be hardly distinguishable from the background level, considering other attenuation effects. In conclusion, noise levels generated by plant operations should have negligible impacts on the residence located nearest to the proposed facility and would be well within the EPA guideline limits for residential areas.

5.8.4 Impacts of No Action

The levels of noise generated by current stockpile maintenance activities are part of the current background noise levels, which reflect the operations of the installation. These levels are not expected to change under the no action alternative; therefore, the conditions described in Section 5.8.1 (affected environment) will continue to exist.

5.9 VISUAL RESOURCES

5.9.1 Current Environment

PBA is located in a rural, wooded environment. Privately owned farms and timberland lie north of the installation. To the west is the Union-Pacific Railroad right-of-way and a sparse number of residential properties. The land south of PBA consists primarily of undeveloped industrial property and the Mid-Atlantic Packaging Facility. The Arkansas River runs along the eastern boundary of PBA. Viewing distances on PBA are short, restricted by heavy vegetation and gently rolling hills. The proposed areas for an ACWA facility are not visible from off post and only minimally visible on post because of the heavy vegetation and small hills. Within 5 mi (8 km) to the northwest of PBA is the town of Redfield. To the west, adjacent to the boundary, lies the town of Whitehall, and 2 mi (3 km) to the south is the city of Pine Bluff.

The industrial and other developed areas on the installation, including utility corridors, are generally consistent with a Visual Resources Management (VRM) Class IV designation (activities that lead to major modification of the existing character of the landscape). The remainder of the installation fits a VRM Class III or IV designation (hosting activities that, at most, only moderately change the existing character of the landscape) (U.S. Department of the Interior [DOI] 1986a,b).

5.9.2 Site-Specific Factors

Much of PBA is industrial and similar to the visual characteristics of the proposed ACWA facility. The general visual aesthetic character of PBA could be affected by these factors:

1. The appearance of the ACWA facility itself and its supporting components (other facilities, transmission lines, roads, parking areas),

2. The placement of the ACWA facility (its elevation, adjacent land use, resulting viewshed, etc.), and

3. Visibility impacts due to fugitive dust emissions from construction or due to steam emissions from the operating stacks.

5.9.3 Impacts of the Proposed Action

5.9.3.1 Impacts of Construction

During construction, the visual character of PBA could be affected as a result of the increased construction traffic. However, the current construction of the PBCDF is similar to the construction of an ACWA facility, so construction of the ACWA facility would not require any new access structures (such as roads, gates, parking lots, etc.) that would be visible from off post. During construction, utility access corridors and the construction area would be disturbed, but the line of sight to these areas is limited, and impacts would be short-lived. Utility construction would generally follow existing roadways to minimize impacts. Impacts on visual resources from construction of the proposed ACWA facility would be negligible.

5.9.3.2 Impacts of Operations

The visual elements of the ACWA facility would remain constant. Lines of sight to the facility would be limited, and the facility would not be visible from off post. None of the support utilities (e.g., power lines) would be visible from off post. On-post views would be limited to the immediate vicinity of the facility. During cold weather, steam from the facility might be visible both on- and off-post. However, PBA is an industrial area, as are many of the areas surrounding PBA, and steam plumes are not unusual. Impacts on visual resources from operation of the proposed ACWA facility would be negligible.

5.9.4 Impacts of No Action

Under the no action alternative, there would be no change to the current visual character of PBA.

5.10 GEOLOGY AND SOILS

5.10.1 Current Environment

5.10.1.1 Geology

PBA is located in the western part of Jefferson County near the Arkansas River in the Gulf Coastal Plain Physiographic Province (Haley et al. 1993). The topography is fairly flat, ranging in elevation from about 80 ft (24 m) above mean sea level (MSL) across most of the installation to about 70 ft (21 m) above MSL near the river (USGS 1985).

The installation stratigraphy is characterized by well-consolidated Cretaceous deposits dipping gently to the east that are unconformably overlain by nearly horizontal strata of unconsolidated Tertiary and Quaternary sediments. In the western part of Jefferson County, the thickness of the Tertiary and Quaternary sediments is approximately 2,000 ft (840 m) and increases to as much as 4,000 ft (1,680 m) toward the east (U.S. Army 1997).

Outcrops near PBA consist of Pleistocene terrace and Holocene alluvial deposits, as well as sediments of the Tertiary Jackson Group (Haley et al. 1993; U.S. Army 1997). The Quaternary deposits vary in thickness from approximately 3 ft (1 m) where they join the Jackson Group outcrop to 250 ft (76 m) near Pine Bluff. From a base of gravelly sands, the Quaternary deposits grade upward through a central section of sand overlain by silts and clays. The Jackson Group consists of a fairly even composition of marine sediments that include clays, silty clays, and clayey sands overlain by silts and sands of continental origin. The bluffs overlooking the Arkansas River floodplain are composed of Jackson Group sediments and are overlain by Pleistocene terrace deposits (U.S. Army 1997).

A survey of potential economic mineral resources at PBA has not been conducted. A general map of economic minerals in Arkansas indicates major producing areas of vermiculite, sand, and gravel in Jefferson County; however, this map is not detailed enough to determine whether these resources are present at PBA (Arkansas Geological Commission and USGS 1998).

5.10.1.2 Seismicity

PBA lies within the Ouachita Seismic Zone (U.S. Army 1997). There are no known faults at or near PBA (U.S. Army 1997). The nearest known fault is not active and is seen in Paleozoic rocks (2,300 to 570 million years old) near Little Rock, Arkansas.

The nearby New Madrid Seismic Zone is the dominant source of major earthquakes in the area. It is located about 120 mi (190 km) northeast of the installation. The largest known earthquakes in the region surrounding PBA were associated with this zone. These earthquakes occurred in southeast Missouri and northeast Arkansas in 1811 and 1812. They are generally known as the New Madrid Earthquake (Jackson 1979). Between December 16, 1811, and May 5, 1812, 1,874 separate seismic events were detected. The largest event occurred on February 7, 1812. It had a maximum Modified Mercalli Intensity of XI (magnitude 7.4) at its epicenter near New Madrid, Missouri (U.S. Army 1997). An earthquake of this intensity produces extreme damage to masonry with nearly total destruction of some buildings, broad fissures, earth slumps, and land slips. Approximately one million square miles were affected by this earthquake, which was felt at a distance of up to 564 mi (908 km) (Branner and Hansell 1932).

Although there have been no large earthquakes in the immediate vicinity of PBA, there have been clusters or swarms of small earthquakes in the area (J.R. Benjamin and Associates 1996). The largest of these occurred in January 1982 near the town of Enola, Arkansas, which is located about 50 mi (80 km) north of Little Rock. It had a magnitude of 4.5.

The maximum earthquake that could occur at PBA would be a repetition of the New Madrid Earthquake discussed above. It is estimated that this event would produce a Modified Mercalli Intensity of IX at the installation, with a peak ground acceleration of 0.34 G (U.S. Army 1997). Such an earthquake would produce heavy damage to masonry with some to partial collapse of buildings and conspicuous cracks in the ground. The same peak ground acceleration would be produced at PBA by the maximum earthquake predicted for the Wichita-Ouachita Seismic Province (magnitude = 6.2). The duration of the event is estimated to be 20 seconds.

A recent probabilistic analysis was performed for PBA (J.R. Benjamin and Associates 1996). According to this analysis, a seismic event resulting in a peak horizontal acceleration of more than 0.1 G would occur at PBA once in about 750 years. An event resulting in a peak horizontal acceleration of more than 0.18 G would occur once in 10,000 years, and an event resulting in a peak horizontal acceleration of more than 0.34 G would occur once in 100,000 years.

According to the nuclear power station seismic hazard curves for the eastern United States, the Pine Bluff installation is located in Seismic Probability Zone 1 (Staub 1991). Within this zone, minor earthquake damage may be expected to occur at least once in 500 years (or a 10% probability of occurring once in 50 years). The peak ground acceleration for this event is 0.075 G.

5.10.1.3 Soils

The soils at PBA consist predominantly of soils belonging to the Pheba-Savannah-Amy and Calloway-Grenada-Henry Associations; soils from the Crevasse-Oklared, Ouachita, Smithdale, Rilla-Herbert-McGehee, and Perry-Portland Associations also are present locally (U.S. Department of Agriculture [USDA] 1980) (see Table 5.10-1). Soils from the Pheba-Savannah-Amy and Calloway-Grenada-Henry Associations, which formed mainly on uplands, tend to be loamy, level to gently sloping, and poorly to moderately well drained. As shown in Figure 5.10-1, the soils present at Areas A and B are from the Pheba-Savannah-Amy Association. The engineering properties of these soils are variable and must be accounted for in the design of any facilities built in these areas. The soils within Areas A and B are largely undisturbed except along the courses of minor roadways.

5.10.2 Site-Specific Factors

Because the proposed action would entail only shallow excavation and require only standard building materials, it was concluded that there is no potential for impacts on the geologic resources at or near PBA. With respect to the soils at PBA, potential impacts might result from excavation, erosion, or accidental spills and releases of a variety of hazardous materials, including chemical agents. These potential impacts are discussed in the following sections on impacts from construction, operations, and no action. Potential impacts on soils associated with a major accident resulting in catastrophic releases of agent are discussed in Section 5.21.

5.10.3 Impacts of the Proposed Action

5.10.3.1 Impacts of Construction

Approximately 25 acres (10 ha) of ground could be affected to some degree from construction of the pilot facilities in either Area A or B (Table 5.3-1). Additional ground would also be disturbed during the development of the necessary site infrastructure (e.g., electric transmission line, gas pipeline, water pipeline, access road). For Area A, infrastructure-related construction is expected to disturb about 5 acres (2 ha); for Area B, it is expected to disturb about 12 acres (5 ha) (Table 5.3-1). Soil disturbance could increase the potential for erosion, which could affect surface water bodies and biological resources. Best management practices (e.g., use of soil fences, berms, and liners; revegetation of disturbed land following construction) would be employed to minimize the potential for soil erosion.

TABLE 5.10-1 Soil Associations at PBA

Association	Soil Type	Characteristics
Pheba-Savannah-Amy	Loamy soils on uplands and stream terraces	Poorly drained to moderately drained Level to gently sloping, mainly wooded Low to medium potential for urban uses Wetness and erosion are main limitations to use
Calloway-Granada-Henry	Loamy soils on uplands formed in predominantly wind-laid sediment	Moderately well-drained to poorly drained Level to gently sloping, mainly wooded Low to medium potential for urban uses Wetness and erosion are main limitations to use
Crevasse-Oklared	Loamy and sandy soils on bottom lands formed in alluvial sediment deposited by the Arkansas River	Well-drained and excessively well-drained Level to gently undulating Mainly used for pasture Flooding is a severe hazard Low potential for urban uses due to flooding
Ouachita	Undifferentiated soils on flood plains of local drainage ways; some areas predominantly silt loam	Well drained Level Inundated 2 to 3 times per year Moderate fertility High available water capacity Moderately slow permeability Runoff is slow Low potential for urban uses due to flooding
Smithdale	Line sandy loam (3 to 8% slope)	Well drained Gently sloping on uplands Moderate fertility Medium potential for farming High available water capacity Moderate permeability Runoff is medium High potential for urban uses
Rilla-Herbert-McGehee	Loamy soils on bottom lands formed in alluvial sediment deposited by the Arkansas River	Well drained and somewhat poorly drained Level to undulating Mainly used for cultivated crops Medium potential for urban uses Wetness is main limitation to use
Perry-Portland	Clayey soils on bottom lands formed in alluvial sediment deposited by the Arkansas River	Poorly drained and somewhat poorly drained Level High seasonal water table Mainly used for cultivated crops High potential for woodland Low potential for urban uses

Source: USDA (1980).

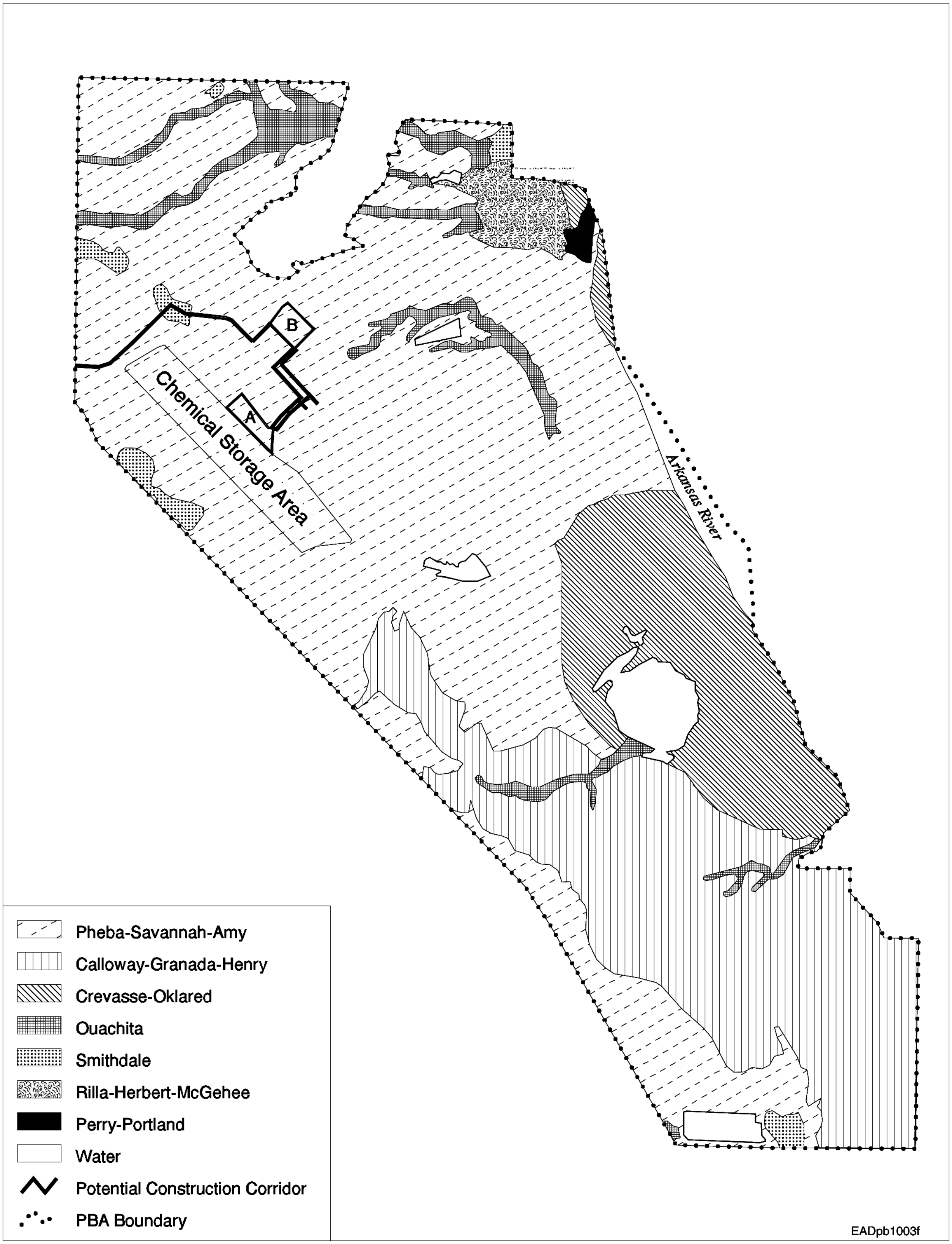

FIGURE 5.10-1 Soil Types at PBA

In addition, soils could be affected during the construction of a pilot facility if there was an accidental spill or release of a hazardous material. Effects would be primarily limited to those from spills of hazardous materials (e.g., paints, solvents) transported to the site and used during construction of the pilot facility and leaks of petroleum-based products (e.g., fuel, hydraulic fluid) from construction vehicles. In such an event, actions would be taken to contain and limit the migration of spilled materials, Any contaminated soils would be excavated and disposed of in accordance with applicable requirements.

5.10.3.2 Impacts of Operations

Impacts on soils from the operation of a pilot facility could occur if there was an accidental spill or release of a hazardous material. Such accidents could involve spills of any chemical transported to and used in the ACWA pilot facility, spills of chemical agent during the transport of chemical munitions from the storage bunker to the pilot facility, and leaks of petroleum-based products from vehicles. In such an event, actions would be taken to contain and limit the migration of spilled materials. Any contaminated soils would be excavated and disposed of in accordance with applicable requirements.

Although operations would result in air emissions of a variety of contaminants, the concentrations of these contaminants would be so low (see Sections 5.5 and 5.6) that they would not have a significant impact on surface soils.

5.10.4 Impacts of No Action

Under the no action alternative for PBA, which is defined as future incineration of the chemical munitions, potential impacts on soils would be equivalent to those assessed previously in the EIS prepared for the incineration activities (U.S. Army 1997).

5.11 GROUNDWATER

5.11.1 Current Environment

The principal aquifers in Jefferson County are the Quaternary alluvial deposits near the surface, the upper sands of the Cockfield/Jackson Formation, and the Sparta Sand Formation. Most water use in Jefferson County Arkansas is from groundwater sources. Table 5.11-1 summarizes water use from the three main aquifers (U.S. Army 1997). Other deeper aquifers exist but have not been developed because of low yield and poor quality (U.S. Army 1990). The

TABLE 5-11.1 Groundwater Resources of Jefferson County

Aquifer	Consumption (gal/d)	Quality	Principal Use	Approximate Depth (ft)
Quaternary	51,600,000	Variable	Agriculture	Surficial
Cockfield/Jackson	360,000	Good	Domestic	150 to 300
Sparta Sand	49,800,000	Excellent	Municipal	700 to 1,100

Source: Modified from U.S. Army (1997).

deep aquifers are not hydraulically connected with the developed surface aquifers because of an intervening thick clay formation called the Porters Creek Formation.

The Sparta Formation is the major groundwater source at and near PBA. The City of Pine Bluff General Water Works withdraws approximately 7.8 million gal/d (29,500 m^3/d) for the municipal water supply, while industry withdraws approximately 42 million gal/d (159,000 m^3/d) (U.S. Army 1988). The on-post water supply for PBA is also from the Sparta Aquifer. Water at PBA is supplied by 12 on-post wells (U.S. Army 1997). Average water use at PBA is about 980 acre-ft/yr (1,200,000 m^3/yr). These 12 wells have a combined maximum short-term production of 20.7 million gal/d (79,000 m^3/d) and withdraw water from a depth of between 700 and 1,100 ft (200 and 330 m) (U.S. Army 1997). Water table declines in the Pine Bluff area are large, up to 160 ft (50 m), and have been caused by the large withdrawals in the area (U.S. Army 1990).

Water quality in the surface Quaternary Aquifer is variable and, in some cases, low enough to be undesirable for most uses (U.S. Army 1997). In areas near the Arkansas River, where the aquifer is influenced by infiltration from the surface water features, dissolved solids are lower and water quality is better (U.S. Army 1997). Water quality in the Cockfield-Jackson Aquifer is moderately hard and mineralized (U.S. Army 1997), but water from this aquifer is suitable for most uses. Water quality in the Sparta Aquifer is excellent.

On post at PBA, groundwater of the surficial Quaternary Aquifer and possibly the underlying Cockfield-Jackson Aquifer has been contaminated as a result of past operations. Sources for this contamination have been removed (U.S. Army 1997), and monitoring continues at 11 inactive and 3 active areas. Contaminants of concern at these areas include metals and various organic compounds. Downgradient from PBA, these aquifers are not used, and the Cook Formation prevents contaminants from migrating to the Sparta Aquifer (U.S. Army 1997).

5.11.2 Site-Specific Factors

Annual water resource needs during construction would be essentially the same for all the ACWA technologies being considered and are estimated to be approximately 7 million gal/yr (26,000 m^3/yr) over approximately three years (see Chapter 3). Construction activities are estimated to generate 4.5 million gal (17,000 m^3) of sanitary waste over the same time period (Kimmell et al. 2001).

Annual water resource needs during operations (which include both process and potable water) range from 7.3 million gal/yr (28,000 m^3/yr) for Elchem Ox to 24 million gal/yr (91,000 m^3/yr) for Neut/GPCR/TW-SCWO. Neut/SCWO uses approximately 11.6 million gal/yr (44,000 m^3/yr) of water. Potable water needs are essentially the same for all the ACWA technologies being considered and are approximately 6 million gal/yr (23,000 m^3/yr). None of the ACWA technologies discharge any process wastewater. Domestic wastewater generation is related to the number of workers, which is essentially the same for the all technologies being considered at 4.6 million gal/yr (17,000 m^3/yr).

5.11.3 Impacts of the Proposed Action

5.11.3.1 Impacts of Construction

Construction-related impacts on groundwater would be none to negligible, and, if impacts did occur, they would exist for only a short period. During incident-free construction activities, no contamination of groundwater would be expected. Standard precautions during equipment fueling and maintenance and other activities should be followed to prevent spills or leaks.

Water use during construction is estimated to be 7 million gal (26,500 m^3 or 21.5 acre-ft) over approximately three years (approximately 7 acre-ft/yr). This use represents an increase of less than 0.05% of the on-post well capacity and an approximate 0.7% increase in water usage above the current average annual water usage of 980 acre-ft/yr. Existing water supply wells are capable of meeting this increase in demand. Impacts on the Sparta Aquifer from this additional withdrawal over a 36-month period would be negligible. Construction activities would be expected to generate 4.5 million gal (17,000 m^3) of sanitary waste over the same time period.

5.11.3.2 Impacts of Operations

The foreseeable impacts on water resources would result from the use of potable water, process water, and fire control water and from the generation of sanitary sewage. During normal operations, estimated water usage by the proposed ACWA technologies would range from

7.3 million gal/yr (28,000 m^3/yr) for Elchem Ox to 24 million gal/yr (91,000 m^3/yr) for Neut/GPCR/TW-SCWO. These amounts equal approximately 22 to 74 acre-ft per year.

Potable water use of 22 acre-ft/yr would be an increase of approximately 2% over the current average annual usage of 980 acre-ft/yr, while use of 74 acre-ft/yr would be an increase of approximately 7% over current average annual use. These are not significant increases in water use, and the existing water supply wells have the capacity to meet this additional need. This additional demand would not significantly increase the drawdown at the water supply wells and would not be permanent. Once ACWA facility operations ceased, groundwater levels would rebound. Impacts on groundwater resources from operating an ACWA facility would be negligible.

5.11.4 Impacts of No Action

Continued storage of chemical weapons at PBA would not adversely affect groundwater. Procedures exist to preclude chemical spills and to address them if they do occur to prevent contamination of groundwater resources. Facilities exist to handle generated sanitary waste.

5.12 SURFACE WATER

5.12.1 Current Environment

Surface water flow at PBA is typified by sluggish, meandering streams, abandoned meanders, and oxbow lakes (U.S. Army 1997). The gentle topography and slow stream flow result in numerous wetland areas or bayous. A large number of wetlands have been designated at PBA (see Section 5.16).

PBA is located within the Caney Bayou-Arkansas River watershed that surrounds the arsenal. Caney Bayou and the Arkansas River form the southwestern and northeastern boundaries of PBA, respectively (U.S. Army 1997). Lock and Dam Numbers 4 and 5 are located east and northwest of PBA, respectively, on the Arkansas River. These locks and dams provide for transportation on the river and regulate the river flow near PBA. Flow in the Arkansas River equals or exceeds 20,000 ft^3/s (570 m^3/s) 50% of the time (U.S. Army 1997).

PBA drains generally in a southeast direction toward and into the Arkansas River (U.S. Army 1988). Drainage occurs in several major creeks and several smaller creeks that cross PBA. Eastwood Bayou, Triplett, and Tully Creeks drain the majority of the arsenal (see Figure 5.12-1). Production and White Creeks drain the production areas in the southern portion

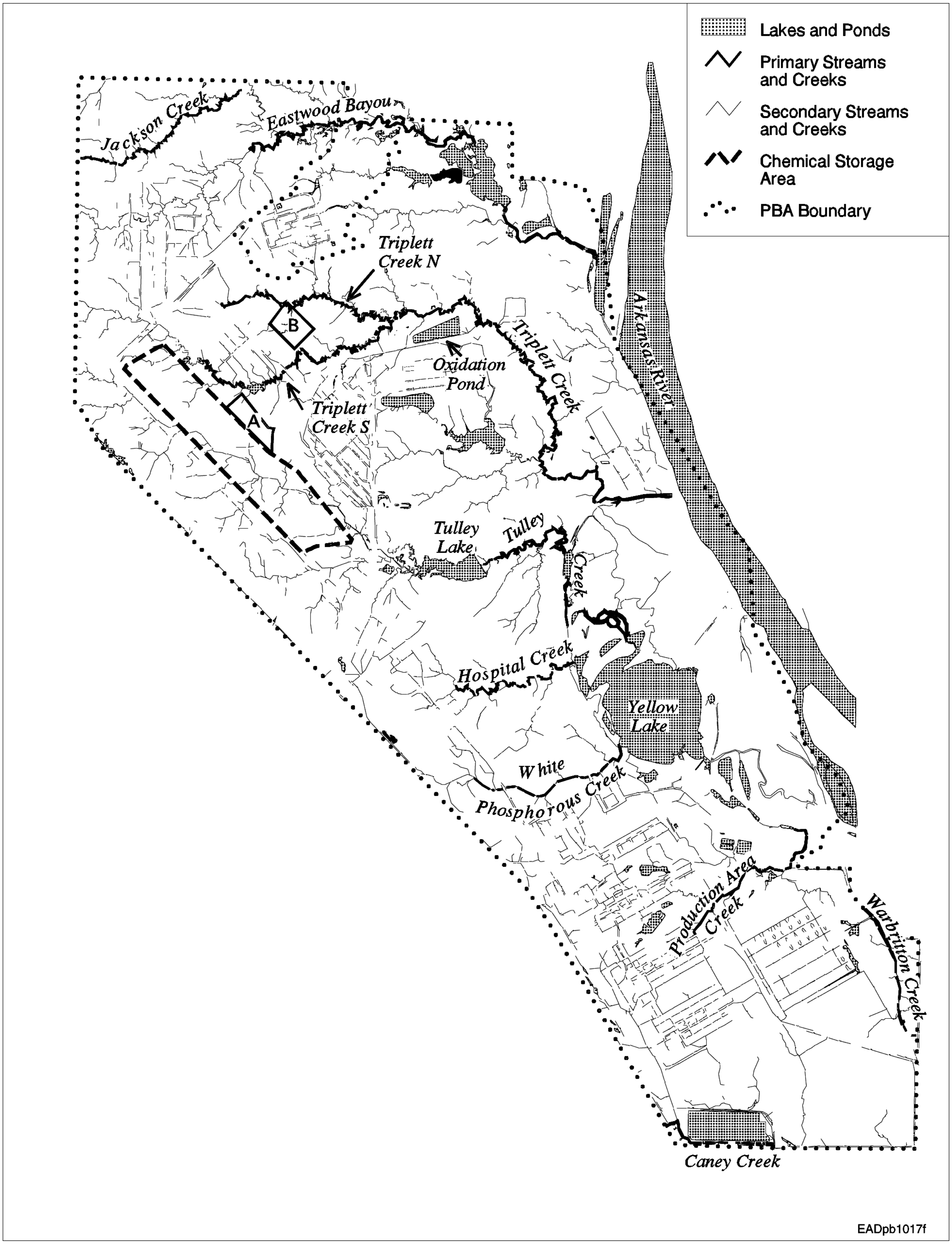

FIGURE 5.12-1 Surface Water Features at PBA

of PBA, and Warbritton Creek and Caney Bayou drain the southern tip of PBA. Eastwood Bayou is located north of PBA and drains some of the north and northeastern areas.

The chemical storage areas and proposed ACWA facility construction areas are located within the area drained by Triplett Creek.

Tulley, Hospital, and White Phosphorous Creeks empty into Yellow Lake, located in the southeast portion of PBA on an abandoned meander of the Arkansas River that was created by the U.S. Army Corps of Engineers [COE] in the 1930s (U.S. Army 1997). Discharge from Yellow Lake flows through swampy lowlands to the Arkansas River. Tulley Creek and Tulley Lake are human-made impoundments immediately upstream from Yellow Lake and drain part of the old manufacturing and storage areas. Hospital Creek drains the headquarters, administration, and hospital areas. Drainage from the maintenance shop and white phosphorous production area enters Yellow Lake through White Phosphorous Creek.

The bomb storage area and pyrotechnic production area are drained by Production Area Creek (U.S. Army 1997). Production Area Creek also receives treated sanitary and industrial wastewater discharge. Production Area Creek meanders through swampy wetlands and joins the discharge from Yellow Lake before entering the Arkansas River along McGregor's Reach (U.S. Army 1997).

PBA contains a large number of small lakes and ponds (Table 5.12-1). South of PBA are the Pine Bluff city sewage oxidation lagoons, Black Dog Lake, and Lake Pine Bluff Lake, a 500-acre (200-ha) impoundment (U.S. Army 1997).

No known springs on PBA discharge groundwater to the surface water regime (U.S. Army 1997).

The water quality of the streams on PBA is generally fair, and the quality of the surface waters is generally good. Some of the surface water areas were contaminated by historic production activities before pollution control technology was installed in the early 1980s (U.S. Army 1988). However, long-term monitoring of the surface water system shows that water quality is improving, and impacts from contamination have not been noted (U.S. Army 1997). The major contaminants included the pesticide DDT and its degradation products, elemental phosphorous, phosphates, and metals (U.S. Army 1997).

At Caney Bayou, Bayou Bartholomew, Brumps Bayou, and Black Dog Lake, the water quality is generally poor, with low dissolved oxygen. In addition, phosphorous, total nitrogen, biochemical oxygen demand, and fecal bacteria are high. Contact recreation in these waters could be unsafe (U.S. Army 1997).

TABLE 5.12-1 Ponds and Lakes at PBA

Pond or Lake	Surface Area (acres [ha])
Yellow Lake	200 (80.9)
Tulley Lake	35 (14.2)
Duck Reservoirs (2)	20 (8.1) total
Clear Pond	2 (0.8)
Dilly Pond	3 (1.2)
Gibson Pond	2 (0.8)
Big Transportation Pond	2 (0.8)
Big Area 3 Pond	4 (1.6)
Grassy Pond	3 (1.2)
Arkla Pond	2 (0.8)
Bomb Storage Pond	1 (0.4)
Little Transportation Pond	1 (0.4)
Horseshoe Pond	1 (0.4)
Dexter Pond	1 (0.4)
Bunker Pond	1 (0.4)
King Pond	1 (0.4)
Thompson Pond	1 (0.4)
Staff Pond	2 (0.8)
Total	282 (114)

Source: U.S. Army (1997).

No developed areas on PBA are subject to flooding (U.S. Army 1997). However, undeveloped areas, such as Yellow Lake and the lowlands adjacent to the Arkansas River, are subject to periodic flooding. Historically, minor flooding has occurred in developed areas during high rainfall events (U.S. Army 1997). The proposed locations for an ACWA facility are above historically flooded areas.

There are a number of public water intakes located on the Mississippi River downstream from PBA, but none on the Arkansas River. In Jefferson County, no surface water sources are used for the public water supply. The water supply for both Pine Bluff and PBA is from groundwater sources (U.S. Army 1997).

5.12.2 Site-Specific Factors

Impacts on surface water resources would be essentially the same for all the ACWA technologies being considered, because the source of both the process and potable water supply is groundwater resources. None of the technologies would discharge any process wastewater.

The only outfall to surface waters would be treated domestic sewage. As a result, wastewater generation would be related to the number of workers, which would be essentially the same for all the technologies being considered.

Annual surface water discharges during construction would range from 7.4 million gal (28,000 m^3) to 8.1 million gal (31,000 m^3) over approximately three years (see Table 5.4-2). This water would be treated to applicable standards and released to the surface water environment.

Annual surface water discharge during operations would be essentially the same for all the technologies being considered, with an estimated range of 7.4 to 8.1 million gal (28,000 to 31,000 m^3) over the entire construction period.

5.12.3 Impacts of the Proposed Action

5.12.3.1 Impacts of Construction

Construction-related impacts on overland water flow would be none to negligible, and, if impacts did occur, they would exist only for a short period. During incident-free construction activities, no contamination of surface water would be expected. Standard precautions during equipment fueling and maintenance and other activities should be followed to prevent spills or leaks. Berms and other devices should be placed to restrict surface runoff from the construction site. If spills or leaks did occur, procedures should exist to quickly remove contaminants before they could be transported to existing surface or groundwater resources.

There would be no impacts on off-post surface water from construction.

5.12.3.2 Impacts of Operations

Impacts on surface water would be negligible. Sewage would be treated to regulatory required limits and discharged. The estimated sewage discharge of 4.6 million gal/yr (0.002 ft^3/s) would be small when compared with surface water flows and would not significantly change flow conditions.

There would be no impacts on off-post surface water from normal operations. The estimated sewage discharge of 4.6 million gal/yr (0.002 ft^3/s) would be small when compared with surface water flows and would not significantly change flow conditions.

5.12.4 Impacts of No Action

Continued storage of chemical weapons at PBA would not adversely affect surface waters. Controls are in place to minimize soil erosion, although some erosion is expected to occur in areas kept clear of vegetation for security purposes and in dirt roadways within the storage block. Facilities exist to handle sanitary waste, and procedures are in place to preclude chemical spills and to address them if they do occur.

5.13 TERRESTRIAL HABITATS AND VEGETATION

5.13.1 Current Environment

Vegetation on PBA is representative of native plant communities found within the West Gulf Coastal Plain Physiographic Province. Some community types of the Mississippi Alluvial Plain Province occur in low elevation areas near the Arkansas River on PBA. PBA covers about 15,000 acres (6,000 ha), of which more than 9,000 acres (3,500 ha) is classified as forest (Campbell et al. 1997). Other vegetated areas on PBA include lawns, other mowed areas, wildlife food plots, and grasslands, some with isolated pine trees. Determinations made by using a geographic information system (GIS) indicated that cover types for PBA are as follows:

Open/other areas	6,000 acres	(2,500 ha)
Hardwood/pine	3,000 acres	(1,000 ha)
Pine/hardwood	2,500 acres	(1,000 ha)
Hardwood forest	1,000 acres	(500 ha)
Bottomland forest	1,000 acres	(500 ha)
Pine forest	800 acres	(300 ha)

Natural plant communities were classified into one of 15 vegetation types based on topographic and soil moisture conditions at PBA (Campbell et al. 1997) from forested communities in the Arkansas River floodplain to upland, drier forest and grassland areas. Plant communities have been described at six representative locations on PBA (Campbell et al. 1997) and are summarized in the Integrated Natural Resources Management Plan (PBA 1998).

Both the alternative areas for an ACWA pilot test facility are located on upland areas (see Figure 5.1-2). No quantitative data on vegetative communities at the areas being evaluated exist. Area A is covered with a dense hardwood/pine forest community that is typical of upland forest areas at PBA. The Campbell et al. (1997) survey identifies the following common trees on upland areas at PBA that support mixed hardwood/pine forest stands: loblolly pine (*Pinus taeda*), red maple (*Acer rubrum*), mockernut hickory (*Carya tomentosa*), sweetgum (*Liquidambar styraciflua*), black cherry (*Prunus serotina*), water oak (*Quercus nigra*), post oak (*Q. stellata*), and sassafras (*Sassafras albidum*). Area B is located in a grassland savanna community and mixed hardwood area. The grassland savanna community consists mostly of isolated loblolly pine trees generally less than 20 ft (6.1 m) tall. This area shows signs of previous surface disturbance. The mixed hardwood portion of Area B supports the following common tree species: loblolly pine, white oak (*Q. alba*), southern red oak (*Q. fulcata*), and sweetgum.

5.13.2 Site-Specific Factors

The disturbance of land for both the ACWA pilot test facility and the new infrastructure needed to operate the facility was considered in the scope of the construction impact analysis. The impacts from routine operations on ecological resources were considered for the three proposed ACWA technologies. Impacts addressed included those from traffic, atmospheric releases, and exposure to elements and compounds and were based on concentrations predicted by the D2PC model.

5.13.3 Impacts of the Proposed Action

5.13.3.1 Impacts of Construction

The construction of an ACWA pilot test facility would disturb up to 25 acres (14 ha) for the complex and another 5–12 acres (2–5 ha) for the infrastructure. The total area likely to be disturbed for utility requirements during construction is shown in Table 5.3-l. If Area A is chosen for the facility, up to 25 acres (10 ha) of dense hardwood/pine forest community would be disturbed during construction. An additional 5 acres (2 ha) would be disturbed to construct water, sewer, and gas lines, and the 69-kV transmission line. The area disturbed for the water, sewer, and gas pipeline assumes that all three lines would be placed in the same 66-ft (20-m) wide right-of-way. If Area B is selected, up to 25 acres (10 ha) of grassland savanna community composed of loblolly pine trees and grasses would be disturbed by construction. An additional area of up to 12 acres (5 ha) would be disturbed for infrastructure construction, including a 0.2-mi (0.3-km) long access road.

Some clearing or trimming of trees would be required to install the 69-kV transmission line along a right-of-way to either Area A or B. Disturbance for installation of gas and water supply lines and sewer lines would likely occur along road rights-of-way, affecting vegetation that was previously disturbed during roadway construction.

5.13.3.2 Impacts of Operations

Because routine operations would not involve the release of significant quantities of typical air pollutants (Kimmell et al. 2001), impacts on vegetation are expected to be negligible. Vegetation at PBA would not be affected from air concentrations downwind from an ACWA facility. Deposition levels on soils and vegetation downwind of the ACWA facility from such low stack release levels would be negligible. A soil screening-level ecological risk assessment was conducted to evaluate the potential impacts from air emissions expected from each of the three ACWA technologies. This analysis showed that impacts to ecological receptors would be unlikely (Section 5.14.3.2).

5.13.4 Impacts of No Action

Continued storage of chemical agent at PBA would not adversely affect plant communities or wildlife habitats under normal maintenance and monitoring of the storage bunkers, vegetated areas, and cleared areas. Periodic mowing of vegetation between the bunkers has precluded establishment of shrub and tree species. This type of vegetation control would likely continue into the future.

5.14 WILDLIFE

5.14.1 Current Environment

5.14.1.1 Mammals

Wildlife species at PBA are typical of eastern deciduous forest communities. Recent mammal surveys recorded 20 species from representative habitats on PBA (Phelps 1997). Surveys were conducted in the same areas where plant communities were described. The areas included the Eastern Bayou area located north of Areas A and B; Triplett Creek, Yellow Lake, and Triplett Bluff located east and southeast of Areas A and B; Refuge Woods located on the southwest corner of PBA; and railroad grasslands along the western perimeter of PBA. The most common small mammalian species recorded from trapping surveys was the cotton mouse (*Peromyscus gossypinus*). The cotton mouse was recorded in five of six study areas surveyed. Other small mammals recorded in two or more study areas included the white-footed mouse

(*Peromyscus leucopus*), deer mouse (*P. maniculatus*), cotton rat (*Sigmodon hispidus*), fulvous harvest mouse (*Reithrodontomys fulvescens*), golden mouse (*Ochrotomys nuttalli*), and short-tailed shrew (*Blarina carolinensis*). Common carnivores observed included the armadillo (*Dasypus novemcinctus*), raccoon (*Procyon lotor*), and coyote *(Canis latrans*). The river otter (*Lutra canadensis*) and beaver (*Castor canadensis*) were observed in aquatic habitats on PBA.

Bat surveys conducted in 1997 at PBA yielded five species totaling 58 captures in mist nets. Surveys were conducted at all areas of PBA except the chemical storage area (Saugey 1997) The most commonly captured species included the red bat (*Lasiurus borealis*), eastern pipistrelle (*Pipistrellus subflavus*), and evening bat (*Nycticeius humeralis*).

A more detailed discussion of the mammals documented from field observations at PBA and suggested management practices to support mammal populations is presented in the Integrated Natural Resources Management Plan and in a report on field surveys at PBA (PBA 1998; Phelps 1997).

5.14.1.2 Birds

Bird species at PBA are typical of eastern deciduous forest and open grassland habitats of the south-central United States. Peacock and Zollner (1998) conducted avian surveys at PBA during 1996 and 1997, classifying species occurrences into one of seven habitat types. A total of 155 species were observed either as permanent residents, migrants, or summer residents (i.e., breeding species). The upland forest matrix, together with bottomland hardwood forest, riparian areas, and water bodies on PBA, provide a diversity of habitats for resident and migratory species. Upland forests are considered the most important habitat for breeding birds at PBA (Peacock and Zollner 1998).

Forty-five of the 155 species observed at PBA are breeding species. Common breeding birds of upland forest habitats include the red-bellied woodpecker (*Melanerpes erythrocephalus*), downy woodpecker (*Picoides pubescens*), northern cardinal (*Cardinalis cardinalis*), indigo bunting (*Passerina amoena*), red-eyed vireo (*Vireo olivaceous*), song sparrow (*Melospiza melodia*), and blue jay (*Cyanocitta cristata*). Six warbler species are confirmed breeding species of upland forests, although none are classified as common. The pine warbler (*Dendroica pinus*) and black-and-white warbler (*Mniotilta varia*) were frequently observed during the 1996–1997 surveys. The great blue heron (*Ardea herodias*) is the most common of four wading bird species that inhabit wetland habitats at PBA. Seventeen waterfowl species have been observed at PBA (Peacock and Zollner 1998**)**. Only the Canada goose (*Branta canadensis)* and mallard (*Anas paltyrhynchos*) are permanent residents at PBA. Raptors known to breed at PBA include the red-tailed hawk (*Buteo jamaciensis)*, broad-winged hawk (*Buteo platypterus*), and red-shouldered hawk (*Buteo lineatus*). The red-tailed hawk and the kestrel (*Flaco sparverius*) are relatively common at PBA.

5.14.1.3 Reptiles and Amphibians

The herpetofauna of PBA are representative of southern deciduous forested ecosystems with a diverse landscape of aquatic and terrestrial habitats. Field surveys conducted in 1997 documented the presence of 45 species of amphibians and reptiles on PBA (Robison 1997). Twenty-four species were observed in hardwood/pine forests typical of Areas A and B. Fourteen amphibian species were observed at PBA. The most commonly observed amphibians included the cricket frog (*Acris crepitans blanchardi*), Fowler's toad (*Bufo woodhousei fowleri*), and leopard frog (*Rana utricularia*). The most abundant lizard species of the five species recorded at PBA is the fence lizard (*Sceloporus undulatus*), occurring in three of the seven habitat types delineated during the herpetofaunal surveys. Seventeen snake species have been observed at PBA. The most common species documented during the surveys in 1997 (Robison 1997) included three species of water snake (*Nerodia spp.*), the eastern hognose snake (*Heterodon platirhinos*), black rat snake (*Elaphe obsoleta*), speckled kingsnake (*Lampropeltis getula*), cottonmouth (*Agkistrodon piscivorus*), and midland brown snake (*Storeria dekayi*). The three water snakes and cottonmouth were typically observed in aquatic and riparian habitats, while the black rat snake, eastern hognose, and midland brown snake occurred in open fields and forested habitats. Ten turtle species were documented in the herpetofaunal surveys. The most common species was the three-toed box turtle (*Terrapene carolina*), observed only in terrestrial habitats. Other common turtle species included the Ouachita map turtle (*Graptemys pesudogeographica*), red-eared slider (*Trachemys scripta*), common musk turtle (*Sternotherus odoratus*), and common snapping turtle *(Chelydra serpentina*).

5.14.2 Site-Specific Factors

The disturbance of land for both the ACWA pilot test facility and the new infrastructure needed to operate the facility was included in the scope of the construction impact analysis. The impacts of routine operations on ecological resources were considered. Impacts addressed included those from traffic, atmospheric releases, and exposure to elements and compounds and were based on concentrations predicted by the D2PC model.

5.14.3 Impacts of Proposed Action

5.14.3.1 Impacts of Construction

Loss of habitat, increased human activity during construction, increased traffic on local roads, and noise are the most important factors that would affect wildlife species. The presence of construction crews and increased traffic would cause some wildlife species to avoid areas adjacent to the construction site during the 30-month construction period. Wildlife species inhabiting the construction area rely on upland hardwood/pine forest habitat and pine savanna for food, cover, and nesting and would be affected by vegetation clearing. Less mobile and burrowing groups, such as amphibians, some reptiles, and small mammals, would be killed during vegetation clearing and other preparation activities. The loss of grassland habitat would displace small mammals and songbirds from the construction areas. The loss of about 25 acres (10 ha) of upland forest habitat at Area A and about 35 acres (14 ha) of pine savanna habitat at Area B during construction would not be expected to eliminate any wildlife species from PBA, since similar habitat is relatively common elsewhere on the installation. Mammalian species likely to be affected by loss of grassland and forest habitat include the white-footed mouse, short-tailed shrew, cotton rat, and golden mouse.

Clearing of upland hardwood/forest habitat at Area A would potentially affect a greater number of summer resident bird species than would vegetation clearing at Area B. Area A is part of a larger dense upland forest that would become partially fragmented by clearing of up to a 25-acre (10-ha) area for construction of an ACWA facility. Upland forests are the most important habitat for breeding birds at PBA (Peacock and Zollner 1998). Breeding birds of upland forest habitats that would be affected by loss of forest habitat include the red-bellied woodpecker, downy woodpecker, red-eyed vireo, indigo bunting, song sparrow, blue jay, and six warbler species. Observations during 1996-1997 surveys indicated that the pine warbler and black-and-white warbler are relatively common (Peacock and Zollner 1998).

Reptiles likely to experience loss of habitat or mortality during construction activities at Areas A and B include the fence lizard, three-toed box turtle, black rat snake, eastern hognose snake, and midland brown snake. Relatively common amphibian species inhabiting moist forested habitats adjacent to drainage ways that could be affected during construction include the cricket frog, Fowler's toad, and leopard frog.

Noise levels generated by construction equipment are expected to range from 85 to 90 dBA at the proposed ACWA facility (see Section 5.8). Noise would diminish to background levels at the northern and western boundaries of PBA. Published results in numerous studies indicate that small mammals can be adversely affected by the maximum noise levels produced by construction equipment (Manci et al. 1988; Luz and Smith 1976; Brattstrom and Bondello 1983); Manci et al. (1988), in a review of the effects of noise on wildlife and domestic animals, reported that sudden sonic booms of 80 to 90 dBA startled seabirds, causing them to temporarily abandon nest sites. The startle response of birds to abrupt noise and continuous noise and their ability to acclimate seems to vary with species (Manci et al. 1988). Some songbirds within about 330 ft (100 m) of construction equipment may abandon existing habitat because of noise levels. Also, white-tailed deer and other larger mammals would not use areas near the construction area because of noise and the presence of workers. Noise from construction vehicle traffic might adversely affect wildlife species in areas adjacent to access roads. No long-term impacts on the hearing ability of wildlife species would be expected from construction-generated noise.

Some unavoidable impacts on wildlife would occur from increased vehicle traffic. Approximately 4,500 truck shipments of construction materials are expected during the construction period (Kimmell et al. 2001). Construction traffic would increase the potential for roadkills to species such as the eastern cottontail, gray and eastern fox squirrels, opossum, and raccoon along the new access road and existing roads. Birds of prey at PBA would not likely be adversely affected by the loss of prey base that would be associated with the loss of up to 40 acres (16 ha) of vegetation from clearing, but they might avoid foraging in areas next to construction sites because of increased human activity. Species such as the red-tailed hawk and kestrel might benefit from the single wood poles constructed for the transmission line, by using them as perch sites.

Raptor electrocution from simultaneous wing contact with two conductors or a conductor and ground wire on the 69-kV transmission line would not be expected if appropriate design features were incorporated into the system. The red-tailed hawk, the largest raptor occurring at PBA, has a maximum wing span of 54 in. (132 cm). The wings of a red-tailed hawk could make simultaneous contact with two conductors or a conductor and ground wire when it attempted to land, and if the conductor(s) were not properly shielded, the hawk would be electrocuted. This situation could occur at the transmission pole regardless of whether a crossarm design or a single pole design without a crossarm was selected. Also, in cases where a single pole structure has been built to support 69-kV conductors, raptors have been electrocuted when landing on an insulator and making simultaneous contact with a conductor and ground wire (Avian Power Line Interaction Committee 1996). To avoid raptor electrocution, the 69-kV transmission line would have to be designed by following suggested practices for raptor protection (Avian Power Line Interaction Committee 1996).

5.14.3.2 Impacts of Operations

Operation of the test facility would increase human activity in the northern portion of PBA. An increase in traffic along access roads from worker vehicles and periodic delivery of chemicals and other supplies would increase the number of roadkills of rodents and reptiles.

The maximum noise next to facilities is expected to be 72 dBA and decrease to about 50 dBA at a distance of 1,000 ft (300 m). Anticipated noise levels of 55–60 dBA near the facility boundary would have only minor impacts on birds and mammals. Noise generated by vehicles traveling to an ACWA facility might affect wildlife inhabiting areas adjacent to roadways. Any abrupt noise levels would startle birds and might cause temporary nest abandonment. These levels would not likely interfere with the auditory function of birds and mammals next to an ACWA facility.

A soil screening-level ecological risk assessment was conducted for each of the three technologies considered for ACWA pilot testing at PBA to determine potential impacts to biota from routine emissions. The overall approach for the risk assessment was the same as that used at PCD (see Section 6.13.3.2). Details of the risk assessment are provided elsewhere (Tsao 2001c). Table 5.14-1 shows the number of chemicals evaluated from the air emissions for each ACWA technology. Chloroform in emissions from Neut/GPCR/TW-SCWO pilot testing was the

TABLE 5.14-1 Chemical Emissions of Potential Concern Based on a Screening-Level Ecological Risk Assessment of Air Emissions from Routine Operation of an ACWA Pilot Facility at PBA

Technology	No. of Chemicals Evaluated	Chemicals of Potential Concern from Stack Emissions[a]
Neut/SCWO	41	None
Neut/GPCR/TW-SCWO	782	Chloroform
Elchem Ox	45	None

[a] Chemical emitted from the destruction of GB and VX with an HQ of >1 based on 12-h/d, 6-d/wk operation.

only chemical that resulted in an HQ of >1 of the 73 chemicals evaluated that exceeded the soil screening benchmark value of 1×10^{-3} mg/kg (EPA 2001). The HQ for this compound is 7.2. The emission of chloroform occurs during the destruction of VX and GB. Chloroform would likely be dispersed over a large geographical region and would probably not be deposited on soil because of its volatility and low solubility in water. With a vapor pressure of 197 mm Hg and a melting point of −63°C, most of this volatile compound would remain in a gaseous state and ultimately be degraded by hydroxyl radicals in the atmosphere.

Because chloroform would be released as a gas from the emission stacks, the primary route of exposure to agricultural and ecological receptors would be via inhalation and, to a lesser extent, air deposition. Inhalation toxicity studies on rats during gestation indicated that, at air concentrations of 150, 500, and 1,500 mg/m^3 for 7 h/d, chloroform inhibited the development of fetuses and was fetotoxic. Another study found that exposure to chloroform by pregnant female mice caused an accumulation of chloroform in newborn mice (Hazardous Substances Data Bank 2001). The “no observed effect” atmospheric concentration for rats is unknown. It is important to note that the ground-level air concentration of chloroform from the emission stacks would be about 1.4×10^{-8} mg/m^3, which is a small fraction of the exposure concentrations for rats in the laboratory.

Although chloroform emitted during pilot testing would likely persist as a gas, some amount could be deposited onto soil by mixing with water droplets during precipitation. Tests showed that chloroform, even at the highest tested concentration of 1,000 mg/kg had no effect on the respiration of native soil microflora (Efroymson et al. 1997). During ACWA pilot testing, if it is assumed that all chlorofom would be deposited on site and that no loss would occur, the highest soil concentration of chloroform would be expected to occur in the northeast quadrant, at a maximum value of 7.2×10^{-8} mg/kg (Tsao 2001c).

Food-chain transfer via plants would be minimal. On the basis of the most recent uptake model developed by the EPA (EPA 2000), the potential for chloroform to bioaccumulate in terrestrial food chains from soil is low (log $BAF_{soil\text{-}to\text{-}plant}$ = 1.9). The potential for air-to-plant transfer has been determined to be moderate, given a log $K_{air\text{-}to\text{-}cuticle}$ of 0.26 (Welke et al. 1998). If chloroform were to be deposited onto soil, most of it would most likely volatilize and be dispersed into the atmosphere (Hazardous Substances Data Bank 2001). The half-life of chloroform in the air is about 151 days (Hazardous Substances Data Bank 2001), suggesting that it would be slowly degraded by photochemically produced hydroxyl radicals. No information is available on the toxicity of plants from exposure to gaseous chloroform.

In conclusion, it is unlikely that chloroform concentrations would reach levels that would be harmful to soil microorganisms or wildlife, on the basis of the results of this risk assessment and the results of toxicological studies. The risk assessment assumed that all emissions would be deposited on the PBA site, an assumption that is highly conservative, because prevailing winds would disperse and transport gaseous emissions such as chloroform over a large geographic area, extending well beyond the PBA boundaries.

5.14.4 Impacts of No Action

Continued storage of chemical agent at PBA would not adversely affect wildlife populations.

5.15 AQUATIC HABITATS AND FISH

5.15.1 Current Environment

Five aquatic habitat types have been identified at PBA (Robison 2000): small woodland streams, sluggish bayous, big river (Arkansas River), ponds, and lakes. The two largest lakes on PBA are Yellow Lake (260 acres [105 ha]) and Tulley Lake (30 acres [12 ha]). Yellow Lake is about 2.8 mi (4.5 km) southeast of Area A and 2 mi (3.2 km) southeast of Area B. These lakes, several small human-made ponds, and numerous streams provide habitat for many invertebrate and fish species. Perennial and intermittent streams of the Triplett Creek and Tulley Creek Watersheds occur within the vicinity of Area A and B. Small woodland streams at PBA typically are relatively clear, shallow, tannin-stained with mud and sand substrates, and lacking in vegetation along stream margins (Robison 2000). Eastwood Bayou, located north of Areas A and B, was categorized as having deeper water than woodland streams and is generally devoid of vegetation, with mud and sand substrates.

An inventory of fishes at PBA conducted in 1999 recorded 59 native species from 81 sampling locations (Robison 2000). The most common species recorded are categorized by habitat type in Table 5.15-1. Yellow Lake supported the largest number fish species (34) of any aquatic habitat on PBA. Ponds on PBA supported only eight species. Eastwood and Chaney Bayous provided deeper water bodies than woodland streams that supported 23 fish species. Nineteen species were collected from small, woodland streams. Surveys of the Arkansas River

TABLE 5.15-1 Common Fish Species Occurring at PBA[a]

	Habitat Type				
Species	Streams	Bayous	Lakes	Ponds	Arkansas River
Gizzard shad (*Dorosoma cepedianum*)	-	x	x	-	x
Threadfin shad (*Dorosoma petenense*)	-	x	x	-	x
Red shiner (*Cyprinella lutrensis*)	-	-	-	-	x
Blacktail shiner (*Cyprinella venusta*)	-	x	-	-	x
Golden shiner (*Notomigonus crysoleucas*)	x	x	x	x	-
Emerald shiner (*Notropis atherinoides*)	-	-	-	-	x
Redfin shiner (*Lythrurus umbratilis*)	x	x	-	-	-
Fathead minnow (*Pimephales promelas*)	-	-	x	x	x
Bullhead minnow (*Pimephales vigilax*)	-	-	x	-	x
Yellow bullhead (*Ameiurus natalis*)	x	x	x	x	-
Blue catfish (*Ictalurus furcatus*)	-	-	-	-	x
Channel catfish (*Ictalurus punctatus*)	-	x	x	x	x
Tadpole madtom (*Noturus gyrinus*)	-	-	-	x	-
Pirate perch (*Aphredoderus sayanus*)	x	x	-	-	-
Blackspotted topminnow (*Fundulus notatus*)	x	x	x	-	-
Mosquitofish (*Gambusia affinis*)	x	x	x	x	x
Brook silverside (*Labidesthes sicculus*)	x	x	x	-	-
Inland silverside (*Menidia beryllina*)	-	-	-	-	x
Green sunfish (*Lepomis cyanellus*)	x	x	-	x	x
Orangespotted sunfish (*Lepomis humilis*)	-	-	x	-	x
Bluegill (*Lepomis macrochirus*)	x	x	x	x	-
Dollar sunfish (*Lepomis marginatus*)	x	x	x	-	x
Redear sunfish (*Lepomis microlophus*)	-	-	x	-	-
Largemouth bass (*Micropterus salmoides*)	x	x	x	x	x
White crappie (*Pomoxis annularis*)	-	-	x	-	-
Cypress darter (*Etheostoma proeliare*)	x	x	x	-	-

[a] Based on 81 samples during surveys on 16 dates during 1999 (Robison 2000). Species were categorized as common if more than 11 individuals were collected during the surveys.

along the PBA eastern boundary recorded 24 species. The most common species collected at PBA, in order of decreasing abundance, were the threadfin shad (*Ddorsoma* petenense), western mosquitofish (*Gambusia affinis*), brook silverside (*Labidesthes sicculus*), golden shiner (*Notemigonus crysoleucas*), and dollar sunfish (*Lepomis marginatus*). The western mosquitofish and largemouth bass were found in all habitat types. Four sampling locations in streams near Areas A and B yielded six species: black bullhead (*Ameiurus melas*), bluegill (*Lepomis macrochirus*), green sunfish (*Lepomis cyanellus*), brook silverside, black-spotted topminnow (*Fundulus olivaceus*), and western mosquitofish.

Recreational fishing occurs at several locations on PBA. Two of the most important are Tulley Lake and Yellow Lake. Tulley Lake has been stocked with largemouth bass, bluegill, and channel catfish (U.S. Army 1997). Yellow Lake typically receives floodwaters from the Arkansas River two to three times each year and exhibits naturally occurring eutrophication. Yellow Lake and the creek outfall receive heavy fishing pressure for white crappie (*Pomoxis annularis*), largemouth bass, bluegill, channel catfish (*Ictalurus punctatus*), and redear sunfish (*Lepomis microlophus*).

5.15.2 Site-Specific Factors

It is expected that impacts on aquatic habitats and fish resulting from construction would be the same regardless of the technology evaluated, given the similarity in space requirements, construction activities, and time requirements for constructing the pilot test facilities. Construction activities that would release sediments to on-post tributaries of streams could affect stream water quality and fish species. Any impacts from routine operations would be a result of emissions deposited in water bodies downwind of the pilot test facility.

5.15.3 Impacts of the Proposed Action

5.15.3.1 Impacts of Construction

Aquatic habitats and fish species would not likely be affected by construction activities. During construction of an ACWA facility and water, sewer, and gas pipelines, siltation fences or other mechanical erosion control measures would be used to control runoff where surface disturbance could potentially affect aquatic habitats in drainage areas downslope of Area B or along on-post roadways. Avoiding construction along a tributary of Triplett Creek (see Figure 5.17-1 in Sections 5.17 on wetlands) that runs through the middle portion of Area B would lessen the potential impacts on aquatic biota located downstream.

5.15.3.2 Impacts of Operations

Aquatic habitats and fish species would not be affected by releases of trace metals and organic compounds from an ACWA pilot test facility. During routine operations, emission rates of all trace constituents (Kimmell et al. 2001) and particulates from an ACWA facility would be well below levels that would affect ecosystems through biouptake and biomagnification in the food chain. A screening-level ecological risk assessment of aquatic species at PBA was not warranted on the basis of such low emissions. Releases of organic compounds during the processing of nerve agents would also be very low and would not result in any adverse impacts on aquatic ecosystems located downwind of the facilities.

5.15.4 Impacts of No Action

Continued storage of chemical agent at PBA would not adversely affect aquatic habitats and fish.

5.16 PROTECTED SPECIES

5.16.1 Current Environment

The Arkansas Natural Heritage Commission identified 97 species of concern within a 30-mi (50-km) radius of the proposed areas for an ACWA pilot test facility at PBA (Osborne 2000). Table 5.16-1 lists species of concern that are categorized as state endangered or threatened and federal listed threatened and endangered species and that the Arkansas Natural Heritage Commission believes could occur in the project area. The U.S. Fish and Wildlife Service (USFWS), however, reported that no federal listed species are known to occur at PBA (Tobin 2000). Records on the Florida panther (*Felis concolor coryi*) for Jefferson County are likely based on the historic distribution of the species in Arkansas (Becker 2000), because no recent sightings have occurred in the project area. Since the early 1980s, the federal threatened bald eagle (*Haliaeetus lecuocephala*) has been a transient species every year at PBA. Eagles attempted to nest at a snag near Yellow Lake in 1994, 1996, and 1997, but no young were fledged. In 1997, the nest fell from the snag tree, and no new nests have been observed since that time (PBA 1998).

TABLE 5.16-1 Species of Concern and Federal Protected Species within 30 Miles (50 Kilometers) of PBA

	Status[a]		Rank[b]	
Species	Federal	State	State	Counties[c]
Arkansas fatmucket *(Lampsilis powellii)*	LT	-	S2	Saline
Florida panther *(Felis concolor coryi)*	LE	-	S1	Jefferson
Bald eagle *(Haliaeetus lecuocephala)*	LT	-	S2B,S3N	Grant, Cleveland, Jefferson, Lonoke, Pulaski, Saline
Red-cockaded woodpecker *(Picoides borealis)*	LE	-	S2	Grant, Pulaski, Saline
Geocarpon *(Geocarpon minimum)*	LT	SE	S2	Cleveland
Winterberry holly *(Ilex verticillata)*	-	ST	S2	Saline
Prairie evening primrose *(Oenothera pilosella sessilis)*	-	ST	S2	Arkansas, Prairie
Aster *(Aster pratensis)*	-	ST	S2	Cleveland
Southern rein-orchid *(Platanthera flava)*	-	ST	S1,S2	Uncertain distribution
Purple fringeless orchid *(Platanthera peramoena)*	-	ST	S2	Pulaski
Rose pogonia *(Pogonia ophioglossoides)*	-	ST	S2	Jefferson, Saline
White-top sedge *(Rhynchospora colorata)*	-	SE	S1	Uncertain distribution
Slender marsh pink *(Sabatia campanulata)*	-	SE	S1	Lonoke, Pulaski
Texas sunnybell *(Schoenolirion wrightii)*	-	ST	S2,S3	Cleveland
Pineywoods dropseed *(Sporobolus junceus)*	-	ST	S1,S2	Arkansas
Small-headed pipewort *(Eriocaulon loernickianum)*	-	SE	S2	Pulaski, Saline

[a] Federal status: LE = endangered, LT = threatened. State status: SE = state endangered, native taxa in danger of extirpation; ST = state threatened, native taxa likely to become endangered in Arkansas in the near future as determined by the Arkansas Natural Heritage Commission (Osborne 2000).

[b] S1= extremely rare; typically five or fewer estimated occurrences in the state, especially vulnerable to extirpation. S2 = very rare; typically 5–20 estimated occurrences or many individuals in fewer occurrences; often susceptible to extirpation. S3 = Rare to uncommon; typically 20–100 estimated occurrences in the state, may be susceptible to extirpation. B = breeding status. N = nonbreeding status.

[c] Counties where sensitive species are known to occur or were present in recent historic periods. Source for counties: U.S. Army (1997).

The federal endangered red-cockaded woodpecker (*Picoides borealis*) is known to occupy old-growth pine forests in Grant, Pulaski, and Saline Counties located northwest of PBA and within the 30-mi (50-km) radius of Areas A and B. The federal threatened Arkansas fatmucket (*Lampsilis powelii)* is known to exist in Saline County about 13 mi (20 km) from PBA (U.S. Army 1997). A federal listed threatened plant species with no common name (*Geocarpon minimum*) occurs in Cleveland County, about 19 mi (30 km) south of PBA.

5.16.2 Site-Specific Factors

It is expected that impacts on protected species resulting from construction would be the same regardless of the technology evaluated, given the similarity in space requirements, construction activities, and time requirements for constructing the pilot test facilities. Impacts on protected species might result from the clearing of vegetation during construction of an ACWA pilot test facility and associated infrastructure. Increased human activity from the presence of the on-post work force during both construction and operations and increases in vehicle traffic might also affect federal- and state-protected or sensitive species.

5.16.3 Impacts of the Proposed Action

5.16.3.1 Impacts of Construction

No impacts on protected species are anticipated from the construction of an ACWA facility at PBA. No federal endangered or threatened species are known to occur at PBA. Species determined by the Arkansas Natural Heritage Commission as state threatened or endangered have not been documented from wildlife and plant surveys of PBA.

5.16.3.2 Impacts of Operations

No impacts on protected species are anticipated from the operation of an ACWA pilot test facility at PBA. No federal endangered or threatened species are known to occur at PBA. Species determined by the Arkansas Natural Heritage Commission as state threatened or endangered have not been documented from wildlife and plant surveys of PBA.

5.16.4 Impacts of No Action

Continued storage of chemical agent at PBA would not adversely affect threatened, endangered, or sensitive species.

5.17 WETLANDS

5.17.1 Current Environment

Palustrine forested wetlands (hardwood bottomland forests) occur extensively along streams near PBA, such as Caney Bayou, Bayou Bartholomew, and Derrieusseaux Creek, along tributaries to the west of the installation, and along Barnes Creek and Eastwood Bayou to the north (USFWS 1990, 1995, 1998b). The predominant hydrologic regimes in these wetland communities are seasonally flooded and temporarily flooded. The dominant species of the forest canopy along Eastwood Bayou include southern red oak, cow oak, Shumard oak, water oak, and willow oak. Palustrine scrub/shrub, palustrine forested, and lacustrine littoral unconsolidated shore wetlands (unvegetated sandy shore) occur along the perennial Arkansas River to the east of the installation (USFWS 1990, 1998b). Numerous palustrine forested and palustrine emergent (shallow marsh) wetlands occur within old ox-bow stream channels near tributaries of the Arkansas River, such as Plum Bayou to the east (USFWS 1990, 1998b).

Approximately 2,500 acres (1,000 ha) of wetland occur on the PBA installation (USFWS 1998a). In addition, approximately 600 acres (240 ha) of deep-water habitat (lakes more than 6.6-ft [2-m] deep) occur on the installation. Wetland types range from permanently flooded ponds to intermittent streams. Forested wetlands supporting broad-leaved deciduous trees (palustrine forested broad-leaved deciduous) total 1,500 acres (600 ha); forested wetlands predominantly composed of evergreen trees total 150 acres (60 ha); and mixed (deciduous and evergreen) forested wetlands total 460 acres (180 ha). Forested wetlands make up nearly 84% of all wetlands on PBA. Unvegetated ponds (palustrine unconsolidated bottom) cover 160 acres (60 ha); wetlands with predominantly herbaceous vegetation (palustrine emergent) total 120 acres (50 ha); and wetlands supporting shrubby vegetation communities total 85 acres (34 ha). About 17 mi (27 km) and 13 acres (5 ha) of perennial streams (riverine upper and lower perennial) and about 10 mi (16 km) of intermittent streams (riverine intermittent, that are seasonally flooded) occur on PBA.

Yellow Lake is the largest body of water on the PBA installation. Yellow Lake is a shallow, natural oxbow lake, modified into a 260-acre (105-ha) impoundment that typically is flooded several times a year by the Arkansas River (PBA 1998). A large area of tree and shrub swamp (palustrine forested and palustrine scrub/shrub wetlands) occurs along the north and northwest sides of the lake. Common species include black willow, cottonwood, and American lotus. Tulley Lake is a 30-acre (12-ha) human-made reservoir (lacustrine littoral wetland) located on Tulley Creek.

Area A contains one small palustrine emergent wetland that is temporarily flooded. This wetland is located along the southwest margin of Area A, next to the road bordering the Chemical Demilitarization Area. The dominant species of this wetland type on PBA is soft rush. Downstream of this wetland, to the southwest, is a broadleaf deciduous forested wetland within a tributary of Tulley Creek, a perennial stream. To the north and downgradient of Area A lie broadleaf deciduous forest wetlands and scrub/shrub wetlands along Triplett Creek, a perennial stream. These wetlands are temporarily flooded, with portions flooded seasonally as a result of beaver activity. Several small isolated wetlands occur within the Tulley Creek and Triplett Creek watersheds near Area A. They include palustrine unconsolidated bottom, scrub/shrub, and forested wetlands. They range from permanently and semipermanently flooded to temporarily flooded.

The northern and western portions of Area B contain broadleaf deciduous forested wetlands that are temporarily flooded. The dominant species associated with this type of wetland on PBA are red maple/southern red oak, willow oak/cottonwood, box elder/sugarberry, sassafras, willow oak/southern red oak, box elder/cottonwood, sweet gum/water oak, black willow, and ironwood. Both wetlands are part of larger wetland areas associated with a tributary of Triplett Creek, which intersects Area B. The northern wetland is part of a larger forested wetland area along Triplett Creek. Small areas of emergent wetland, both temporarily flooded and seasonally flooded, also occur along nearby portions of Triplett Creek. Most of the wetlands along Triplett Creek near Area B are temporarily flooded broadleaf deciduous forested wetlands, with a small area of seasonally flooded forested wetland. The southern portion of Area B lies within the watershed of the southern branch of Triplett Creek, which supports large areas of palustrine forested (and a smaller area of scrub/shrub) wetlands. An excavated, permanently flooded, palustrine unconsolidated bottom wetland is located near the southeast boundary of Area B. A temporarily flooded scrub/shrub wetland lies along the tributary, near the southwest boundary of Area B. Several small, isolated wetlands occur within the Triplett Creek watershed near Site B. These include palustrine unconsolidated bottom and emergent wetlands. They range from permanently to temporarily flooded.

5.17.2 Site-Specific Factors

Various factors associated with siting, constructing, and operating an ACWA pilot test facility and also with no action might result in environmental impacts on wetlands. Impacts on wetlands might result from land disturbances due to construction-related activities or other modifications of the landscape. Landscape modifications generally involve large-scale soil disturbances due to facility construction. Such disturbances may eliminate particular wetlands or cause one type to replace another. Landscape modifications may displace or eliminate wildlife that use the area as breeding or foraging habitat or for protection from predators. Landscape modifications might also increase the amount of impervious surface within a watershed or alter drainage patterns, resulting in indirect impacts on wetlands. Impacts could include mortality of individual organisms, habitat loss, or changes in biotic communities resulting from changes in surface water or groundwater quality or flow rates. Erosion of exposed soil at construction areas could reduce the effectiveness of restoration efforts and create downgradient sedimentation. The implementation of standard erosion control measures, installation of storm-water retention ponds, and immediate replanting of disturbed areas with native species would help minimize impacts on wetlands.

Impacts on wetlands might result from the release to the environment of substances known to cause toxic effects in biota. Construction or operation of a pilot facility might result in the release of organic or inorganic compounds, including agent or processing by-products. Releases might occur as a single event (a spill, for example) or as continual low-level releases. Exposure of biota might result from the airborne transmission and deposition of materials, surface water contamination, groundwater contamination (which can affect seeps or springs), or contaminants released to soils. Atmospheric releases of contaminants might result in the widespread deposition of contaminants on surface waters, including wetlands. Exposure routes might include dermal contact with contaminants in sediment or water, ingestion (including ingestion of contaminated sediments, water, or food), plant root uptake, or foliar exposure. Exposures may result in lethal effects, reduced growth or other limiting effects, or no observable effect.

5.17.3 Impacts of the Proposed Action

5.17.3.1 Impacts of Construction

Impacts on wetlands from construction were considered to be the same for all of the technologies evaluated, given their similarity in space requirements, construction activities, and construction durations. The following discussion of construction-related impacts identifies the potential impacts from building a facility within Areas A and B (Figure 5.17-1) and those from developing the associated infrastructure (e.g., electric power supply, gas and water pipelines, access roads). It also identifies mitigation measures that could minimize or prevent impacts on ecologically sensitive areas.

The pilot facility would disturb up to 25 acres (10 ha) of land at Area A or Area B. Approximately 200 tons/yr (178,000 kg/yr) of PM would be dispersed atmospherically during construction. The implementation of best management practices for erosion and sedimentation control, installation of storm-water retention ponds, and immediate replanting of disturbed areas with native species would help minimize impacts on wetlands.

Wetlands could be affected by filling or draining during construction. Impacts could include the elimination of entire wetlands or portions of wetlands or the reduction of wetland functions. Impacts on wetlands from soil compaction or alteration of surface water runoff patterns or groundwater flow could occur if the facility were located immediately next to wetland areas. Maintaining a buffer area around wetlands during construction of the facility could minimize impacts on wetlands.

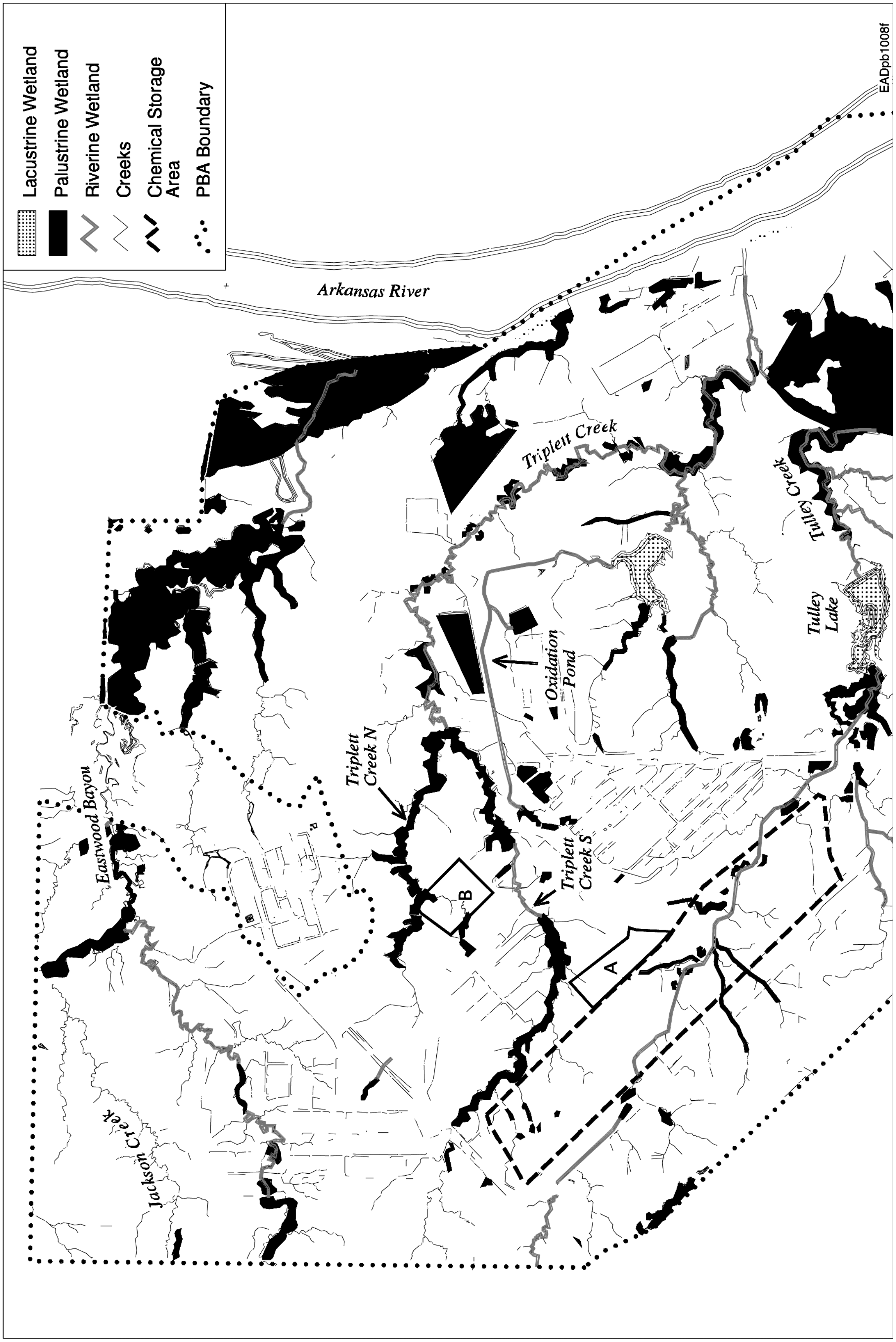

FIGURE 5.17-1 Wetlands at PBA

Construction of the pilot facility at Area A might eliminate the small palustrine wetland located on its southwest margin. The wetland could be affected directly by filling or excavation or indirectly by alteration of hydrology if the facility were located immediately next to the wetland. Activities that result in impacts on wetlands are regulated by the COE. A permit from COE would be required for discharges of fill material into the wetland. This temporarily flooded palustrine emergent wetland is approximately 0.4 acre (0.2 ha) in size, representing about 0.3 % of the emergent wetland type on PBA. Although this wetland type is not rare on PBA, emergent wetlands account for only about 5 % of the total wetland area on the PBA installation.

Sedimentation might occur in palustrine and riverine wetlands downstream from Area A as a result of grading for the facility. Construction activities might also result in accidental releases of contaminants into surface waters in downstream portions of the watershed. Forested wetlands downstream of Area A, such as along Triplett Creek immediately to the north and Tulley Creek to the south, would be adversely affected by uncontrolled runoff from the construction area. Such impacts could be minimized by the implementation of storm-water runoff control measures. Fugitive dust during construction might become dispersed by wind and deposited on wetlands in the vicinity, such as the forested wetlands, streams, or nearby ponds.

At Area B, grading during preparations for construction of a pilot facility could disturb wetlands and alter drainage patterns. Construction of the pilot facility at Area B could potentially eliminate the two wetlands located on Area B. These wetlands are palustrine forested wetlands that are temporarily flooded. The wetland associated with Triplett Creek, in the northern quadrant of Area B, is 1.2 acres (0.5 ha) in size, while the other, along a tributary on the southwest margin of Area B, is 1.0 acres (0.4 ha). These wetlands represent 0.15% of the forested wetlands and 0.09% of all wetlands on PBA. Facility construction may also require the alteration or re-routing of the stream on Area B and may subsequently alter flow patterns. A permit from COE would be required for discharges of fill material into wetlands.

In addition to impacts from facility construction, impacts might result from construction for infrastructure components. The proposed access road to Area B would cross a palustrine wetland and the intermittent stream associated with it. Approximately 0.04 acre (0.02 ha) of a 0.9 acre (0.4 ha) scrub/shrub temporarily flooded wetland would be directly eliminated by filling due to road construction. Additional indirect impacts from hydrological alteration of the wetland and immediate vicinity might also occur. The proposed gas, water, and sewer corridors to Area B would cross the south branch of Triplett Creek, a perennial stream, and its riparian wetland. This lower perennial riverine wetland has an unconsolidated bottom. Approximately 60 ft (18 m) of the stream and wetland would be included within the corridor. The implementation of best management practices for erosion control and immediate replanting of disturbed areas with native species would help minimize impacts on this wetland and wetlands in downstream areas. The corridors are also located immediately adjacent to a pond (palustrine unconsolidated bottom wetland), which could be indirectly affected by the installation of utility lines. The corridor for electric transmission lines to Area B also would cross the south branch of Triplett Creek and be located adjacent to a palustrine scrub/shrub wetland immediately upstream. Placement of the transmission towers could likely avoid the wetland areas. However, impacts on wetland vegetation might result from corridor preparation, conductor stringing, and maintenance activities.

Surface water quality in palustrine and riverine wetlands downstream of Area B might be adversely affected by construction. Forested wetlands downstream, such as along Triplett Creek immediately to the north, would be adversely affected by uncontrolled runoff from the construction area. Such impacts could be minimized by the implementation of storm-water runoff control measures. Fugitive dust from construction activities might be dispersed by wind and deposited on wetlands in the vicinity, such as the forested wetlands, streams, or nearby ponds.

5.17.3.2 Impacts of Operations

A portion of the materials released from the ACWA pilot facility stacks would be deposited on the vegetation, soils, and surface waters, including wetlands, surrounding the facility. The types of organic compounds and the quantities of trace metals released would be slightly different for the three technologies. Deposition from atmospheric emissions, for all the technologies included in this analysis, would result in very low concentrations of trace metals and organic compounds, well below levels known to be harmful to biota. Consequently, routine operations of a pilot test facility would cause only negligible impacts on wetlands.

5.17.4 Impacts of No Action

Under the no action alternative, an ACWA pilot test facility would not be constructed. Continued storage of chemical agents at PBA, including routine maintenance and monitoring operations, would not adversely affect wetlands.

5.18 CULTURAL RESOURCES

5.18.1 Current Environment

5.18.1.1 Archaeological Resources

A comprehensive cultural resources survey was conducted at PBA in 1990 (Bennett et al. 1993). Landscape analysis, remote sensing, cartographic analysis, and field sampling techniques were employed to identify areas with the greatest potential for containing archaeological resources. The collected data were used to generate a model for the distribution of prehistoric archaeological sites. Field testing was completed to validate the model and examine the locations of historic period sites identified by cartographic sources. A combination of pedestrian survey and subsurface testing was conducted in undisturbed areas of PBA at various intervals, depending on whether the area was predicted to contain clusters of prehistoric sites or a diffuse scatter of sites. Ninety locations were identified at PBA during the inventory; 18 locations contained prehistoric artifacts and 72 contained historic artifacts. Forty-six of the 90 locations were designated as archaeological sites by the Arkansas Archaeological Survey; seven sites were determined to be potentially significant. (Appendix F has additional details on the prehistoric and historic context of PBA.)

No archaeological resources have been identified within the proposed construction areas for an ACWA pilot test facility. Area B was surveyed, and no archaeological sites were recorded there (Bennett et al. 1993; Bennett and Stewart-Abernathy 1982). One prehistoric cultural artifact was recorded in the vicinity of Area B during subsurface testing and was designated Site 3JE331. However, no additional cultural material was located in the vicinity of that site, and no chronological indicators were present to gauge its age. Therefore, Site 3JE331 was considered not eligible for listing on the *National Register of Historic Places* (NRHP), and no further work was recommended (Bennett et al. 1993). Area A was reported as a location with evidence of prior disturbance and waste disposal and was consequently not surveyed for cultural resources (Bennett et al. 1993). An archaeological survey of Area A might be required if sufficient confirmation of the level of disturbance cannot be provided.

5.18.1.2 Traditional Cultural Properties

A traditional cultural property is defined as a property that is “eligible for inclusion in the National Register because of its association with the cultural practices or beliefs of a living community that (a) are rooted in that community’s history, and (b) are important in maintaining the continuing cultural identity of the community” (Parker 1995). No traditional cultural properties are known to occur within the proposed construction areas.

5.18.1.3 Historic Structures

Construction of PBA began in 1941. It was the first of three chemical munitions production plants to be designed and constructed since the Edgewood Arsenal during World War I. The principal function of PBA at that time was the manufacture of magnesium- and aluminum-based incendiary munitions, but the work was expanded for a short time during World War II to include war gases, smoke munitions, and napalm bombs. Because of PBA’s potential significance with regard to the U.S. arms buildup in preparation for World War II, an evaluation of PBA architecture was conducted in 1984. All facilities were surveyed except for those in high-security areas that could not be accessed. No PBA structures were found to meet Army criteria for designation as important historical structures or to meet eligibility criteria for the NRHP at that time (Hess 1984).

5.18.2 Site-Specific Factors

Factors that need to be considered with regard to significant archaeological sites, traditional cultural properties, and historic structures under the ACWA Program include these:

1. Destruction or disturbance of cultural resources could occur during construction activities.

2. Contamination of cultural resources could occur during an accidental chemical release or spill. This might lead to the establishment of temporary restrictions on access to the property or possibly to the destruction or disturbance of cultural resources if soils would need to be removed during cleanup.

3. Secondary impacts could be associated with the construction or operation of a proposed facility, such as these:

   a. Increased pedestrian or vehicle traffic in the area could increase the potential for inadvertent or intentional damage to cultural resources by casual passerbys or amateur collectors or

   b. Increased erosion potential as a result of construction activities could disturb archaeological sites next to the construction area.

5.18.3 Impacts of the Proposed Action

5.18.3.1 Impacts of Construction

Archaeological Resources. The probability of adverse effects on cultural resources as a result of the construction of any of the proposed facilities is small. Area A, northeast of and adjacent to the chemical demilitarization area, has not been surveyed; however, there appears to be considerable disturbance and waste disposal within that area (Bennett et al. 1993). The potential for finding intact cultural deposits that would meet significance criteria for listing on the NRHP in this location appears low. Area B was investigated as part of an arsenalwide survey in 1990; no archaeological sites were recorded within Area B boundaries (Bennett et al. 1993).

An isolated find[10] (Site 3JE331) was recorded within approximately 0.25 mi (0.4 km) of Area B during the inventory from subsurface testing, but the site is not considered eligible for listing on the NRHP, and no further work was recommended (Bennett et al. 1993). The potential utility and access road corridors, for the most part, follow existing rights-of-way; therefore, little impact on archaeological resources is expected. Although further intensive survey might be required, possibly at Area A and along potential corridors, before the Arkansas State Historic Preservation Officer (SHPO) concurs on a "no adverse effects" determination for this project, the chances of encountering additional significant archaeological resources in areas of possible construction appear small.

If cultural material was unexpectedly encountered during ground-disturbing activities at previously disturbed or surveyed areas of PBA, construction would cease immediately, and the Arkansas SHPO and a qualified archaeologist would be consulted to evaluate the significance of the cultural artifacts.

Traditional Cultural Properties. No traditional cultural properties are known to occur within the proposed construction areas for an ACWA facility; therefore, no impacts on traditional cultural properties are expected.

Historic Structures. No standing structures are located within Area A or Area B. The structures within the chemical storage area at PBA were recommended as not being eligible for the NRHP (Hess 1984). It is unclear whether the Arkansas SHPO has concurred with this recommendation. However, none of these structures would be demolished or modified during construction of an ACWA pilot test facility at PBA. Therefore, no adverse impacts on structures are anticipated.

5.18.3.2 Impacts of Operations

Archaeological Resources. Routine operation of an ACWA pilot facility would have no impact on eligible archaeological resources at PBA. No known significant resources that could be affected by increased use of the area are located near the proposed locations for an ACWA facility, and no ground-disturbing activities would be involved in operating the facility.

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[10] An isolated find is defined as one stone tool, five or fewer pieces of lithic debris, a single historic artifact type (e.g., glass, ceramic), or a scatter of glass or ceramics where all the sherds appear to be from the same vessel.

Traditional Cultural Properties. No traditional cultural properties are known to occur within the area for an ACWA facility; therefore, no impacts on traditional cultural properties are expected.

Historic Structures. The structures within the chemical storage area used to store the weapons stockpile from which munitions would be removed during operation of an ACWA pilot facility have been recommended as being not eligible. Regardless of their eligibility status, routine removal of the munitions from these structures would not affect their integrity; therefore, no adverse effect is expected.

5.18.4 Impacts of No Action

5.18.4.1 Archaeological Resources

The no action alternative (i.e., continued storage of chemical weapons that might otherwise be destroyed by pilot testing until destruction by other means) would not directly affect archaeological resources. No ground-disturbing activities are currently planned for the area should an ACWA pilot test facility not be constructed at PBA. Archaeological resources might be affected if there were an accident while munitions were in storage (see Section 5.21).

5.18.4.2 Traditional Cultural Properties

No known traditional cultural properties are known to occur within PBA; therefore, the no action alternative (i.e., continued storage of chemical weapons that might otherwise be destroyed by pilot testing until destruction by other means) would have no impact on properties of this type. Nearby resources might be affected if there were an accident while munitions were in storage (see Section 5.21).

5.18.4.3 Historic Structures

The no action alternative (i.e., continued storage of chemical weapons that might otherwise be destroyed by pilot testing) would not affect historic structures. Chemical munitions that might otherwise be removed and destroyed during pilot testing would continue to be stored in the designated chemical storage area structures. Such use is compatible with the history and the origin of the storage bunkers. If the SHPO has concurred with the recommendation that they are not eligible for listing on the NRHP, these structures would also not be affected if there were an accident while munitions were in storage (see Section 5.21).

5.19 SOCIOECONOMICS

5.19.1 Current Environment

Socioeconomic data for PBA describe a region of influence (ROI) surrounding the installation that is composed of four counties: Grant County, Jefferson County, Lincoln County, and Pulaski County (Figure 5.19-1). The ROI is based on the current residential locations of government workers at PBA and captures the area in which these workers spend their wages and salaries. Ninety percent of PBA workers currently reside in these counties (Atkinson 2000). The following sections present data on each of the counties in the ROI. However, since the majority of PBA government workers live in Jefferson County and in the city of Pine Bluff, and since the majority of impacts from an ACWA facility would be expected to occur in these locations, more emphasis is placed on describing the ROI in these two locations.

5.19.1.1 Population

The population of the ROI in 2000 stood at 476,708 (U.S. Bureau of the Census 2001b) and was expected to increase to 478,000 by 2001 (Table 5.19-1). In 2000, 84,278 people (18% of the ROI total) resided in Jefferson County, with 55,085 in the city of Pine Bluff itself (U.S. Bureau of the Census 2001b). During the 1980s, Jefferson County experienced a small decline in its annual average population growth rate of –0.5%, while the population in Grant, Lincoln, and Pulaski Counties grew slightly. Pine Bluff itself experienced a small average annual increase of 0.1%. The ROI average annual growth rate during this period was 0.1%. Over the period 1990–2000, population in Jefferson County and in Pine Bluff fell slightly, with small increases elsewhere in the ROI. The average annual growth rate for the ROI was 0.3%. Over the same period, population in the state grew at a rate of 1.3%. Other incorporated places in Jefferson County near PBA are Altheimer (population 1,192 in 2000), Redfield (1,157), Wabbaseka (323), and White Hall (4,732) (U.S. Bureau of the Census 2001b).

5.19.1.2 Employment

In 1999, total employment in Jefferson County stood at 28,384 (U.S. Bureau of the Census 2001a); it was expected to reach 29,100 by 2001 (Allison 2001). The economy of the county is dominated by the trade and service industries, with employment in these activities currently contributing almost 60% to total employment in the county in 1999 (Table 5.19-2). The manufacturing sector is also a significant employer in the county, representing 28% of total county employment in 1999. Average annual employment growth in the county was 1.3% during the 1990s (U.S. Bureau of the Census 1992c, 2001a).

FIGURE 5.19-1 PBA Region of Influence

TABLE 5.19-1 Population in the PBA Region of Influence in Selected Years

Location	1980[a]	1990[a]	Average Annual Growth Rate (%) 1980–1990	2000[b]	Average Annual Growth Rate (%) 1990–2000	2001[c] (Projected)
City of Pine Bluff	56,636	57,140	0.1	55,085	–0.4	54,900
Jefferson County	90,718	85,487	–0.5	84,278	–0.1	84,200
Grant County	13,008	13,948	0.6	16,464	1.7	16,700
Lincoln County	13,369	13,690	0.2	14,492	0.6	14,600
Pulaski County	340,597	349,660	0.2	361,474	0.3	363,000
ROI total	457,692	462,785	0.1	476,708	0.3	478,000
Arkansas	2,286,357	2,350,725	0.3	2,673,400	1.3	2,710,000

[a] U.S. Bureau of the Census (1994).

[b] U.S. Bureau of the Census (2001b).

[c] Allison (2001).

TABLE 5.19-2 Employment in Jefferson County by Industry in 1999

Employment Sector	Number Employed	% of County Total
Agriculture	1,011[a]	3.6
Mining	10	0.0
Construction	952	3.4
Manufacturing	7,832	27.6
Transportation and public utilities	664	2.3
Trade	5,666	20.0
Finance, insurance, and real estate	1,227	4.3
Services	10,962	38.6
Total	28,384	

[a] 1997 data.

Sources: U.S. Bureau of the Census (2001a); USDA (1999).

In 1999, total employment in the PBA ROI stood at 254,401 (U.S. Bureau of the Census 2001a). It was expected to reach 265,000 by 2001 (Allison 2001). The economy of the ROI is dominated by the trade and service industries, with employment in these activities currently contributing 69% to total employment in the ROI (Table 5.19-3). Annual average employment growth in the ROI was 2.0% during the 1990s (U.S. Bureau of the Census 1992c, 2001a).

Employment at PBA currently stands at about 1,900, including 1,000 arsenal employees, 100 employees working at the PBCA. Approximately 30 military personnel, and about 800 employees for the PBCDF (Atkinson 2000). A number of commercial and industrial tenants occupy land and buildings formerly used by the military, and employment in these activities is currently about 700 employees, including 600 employees at the NCTR.

Unemployment in Jefferson County steadily declined during the late 1990s from a peak rate of 11.4% in 1992 to the current rate of 7.9% (Table 5.19-4) (U.S. Bureau of Labor Statistics 2001). Unemployment in the ROI currently stands at 4.7%, compared with 4.5% for the state.

5.19.1.3 Personal Income

Personal income in Jefferson County stood at $1.6 billion in 1999 and was expected to reach $1.7 billion in 2001. The annual average rate of growth was 3.6% over the period 1990–1999 (Table 5.19-5). County per capita income also rose in the 1990s. It was expected to reach $20,800 in 2001, compared with $13,797 at the beginning of the period.

The annual average growth rate in personal income was higher in the ROI than in Jefferson County. Total personal income in the ROI grew at an annual average rate of 5.4% over the period 1990–1999 and was expected to reach $14.1 billion by 2001. ROI per capita income rose from $17,033 in 1990 to an expected $29,500 in 2001, an average annual rate of 5.1%.

5.19.1.4 Housing

Housing stock in Jefferson County grew at an annual average rate of 0.3% over the period 1990–2000 (Table 5.19-6). The total number of housing units was expected to reach 34,500 in 2001, despite a decline in county population. Housing growth in the city of Pine Bluff was negative over this period at –0.3%, with 22,400 total housing units expected in 2001. Vacancy rates currently stand at 11.2% in the city and 11.0% in the county as a whole for all types of housing. Based on annual average growth rates between 1990 and 2000, there would be 3,850 vacant housing units in the county in 2001, of which 970 would be rental units available to construction workers at the proposed facility.

TABLE 5.19-3 Employment in the PBA Region of Influence by Industry in 1999

Employment Sector	Number Employed	% of County Total
Agriculture	2,516[a]	1.0
Mining	578	0.2
Construction	12,396	4.9
Manufacturing	30,267	11.9
Transportation and public utilities	16,013	6.3
Trade	46,507	18.3
Finance, insurance, and real estate	16,773	6.6
Services	129,163	50.8
Total	254,401	

[a] 1997 data.

Sources: U.S. Bureau of the Census (2001a); USDA (1999).

TABLE 5.19-4 Unemployment Rates in Jefferson County, PBA Region of Influence, and Arkansas

Location and Period	Rate (%)
Jefferson County	
1990–2000 average	8.8
2001 (current rate)	7.9
ROI	
1990–2000 average	5.2
2001 (current rate)	4.7
Arkansas	
1990–2000 average	5.7
2001 (current rate)	4.5

Source: U.S. Bureau of Labor Statistics (2001).

TABLE 5.19-5 Personal Income in Jefferson County and PBA Region of Influence

Location and Personal Income	1990[a]	1999[b]	Average Annual Growth Rate (%) 1990–1999	2001[c] (Projected)
Jefferson County				
Total (millions of $)	1,180	1,627	3.6	1,750
Per capita ($)	13,797	19,278	3.8	20,800
Total ROI				
Total (millions of $)	7,882	12,684	5.4	14,100
Per capita ($)	17,033	26,688	5.1	29,500

[a] U.S. Bureau of the Census (1994).

[b] U.S. Department of Commerce (2001).

[c] Allison (2001).

TABLE 5.19-6 Housing Characteristics in Pine Bluff, Jefferson County, and PBA Region of Influence

Location and Type of Housing	1990[a]	2000[b]	2001[c] (Projected)
City of Pine Bluff			
Owner occupied	12,886	11,727	11,600
Rental	7,985	8,229	8,250
Total unoccupied units	2,316	2,528	2,550
Total units	23,189	22,484	22,400
Jefferson County			
Owner occupied	20,121	20,221	20,200
Rental	9,880	10,334	10,400
Total unoccupied units	3,310	3,795	3,850
Total units	33,311	34,350	34,500
ROI total			
Owner occupied	110,001	118,512	119,000
Rental	66,123	70,491	70,900
Total unoccupied units	18,560	18,397	18,400
Total units	194,684	207,400	209,000

[a] U.S. Bureau of the Census (1994).

[b] U.S. Bureau of the Census (2001b).

[c] Allison (2001).

In the ROI as a whole, housing grew slightly during the 1990s, with an annual growth rate of 0.6%. Total housing units are expected to reach 209,000 by 2001. The vacancy rate currently stands at 8.9%, which means that more than 7,250 rental units would be available to construction workers at the proposed facility.

5.19.1.5 Community Resources

Community Fiscal Conditions. Construction and operation of the proposed facility would result in increased revenues and expenditures for local government jurisdictions, including counties, cities, and school districts. Revenues would come primarily from state and local sales taxes associated with employee spending during construction and operation. The money would be used to support additional local community services currently provided by each jurisdiction. Appendix G presents information on revenues and expenditures by the various local government jurisdictions in the ROI.

Community Public Services. Construction and operation of the proposed facility would result in increased demand for community services in the counties, cities, and school districts likely to host relocating construction workers and operations employees. Additional demands would also be placed on local medical facilities and physician services. Table 5.19-7 presents data on employment and levels of service (number of employees per 1,000 population) for public safety and general local government services. Tables 5.19-8 and 5.19-9 provide staffing data for school districts and hospitals. Table 5.19-10 presents data on employment and levels of service for physicians.

5.19.1.6 Traffic

Vehicle access to PBA is afforded from SR 365, which runs northwest from Pine Bluff toward Redfield along the western perimeter of PBA. The main entrance to PBA is located approximately 8 mi (5 km) from downtown Pine Bluff and is connected to SR 365 by SR 256, which runs southwest toward White Hall. Other roads in the immediate vicinity of PBA used byemployees working on the installation include I 530 (formerly U.S. Highway 65), which connects Pine Bluff with Little Rock, and SR 104, which runs north and south to the west of White Hall.

Table 5.19-11 shows average annual daily traffic flows over these road segments, together with designations for the congestion levels (level-of-service designations) developed by the Transportation Research Board (1985). The designations range from A to F; A through C represent good traffic operating conditions with some minor delays experienced by motorists, and F represents jammed roadway conditions.

TABLE 5.19-7 Public Service Employment in Jefferson County, Various Cities near PBA, and Arkansas[a]

	Jefferson County[b]		Altheimer[b]		Pine Bluff[b]	
Employment Category	Number Employed	Level of Service	Number Employed	Level of Service	Number Employed	Level of Service
Police protection	27	1.2	4	3.6	145	2.6
Fire protection[c]	0	0	0	0	90	1.6
General services	298	13.7	2	1.8	162	2.9
Total	325	14.9	6	5.4	397	7.2

	Redfield[b]		Wabbaseka[b]		White Hall[b]	
Employment Category	Number Employed	Level of Service	Number Employed	Level of Service	Number Employed	Level of Service
Police protection	4	3.5	1	3.1	9	2.0
Fire protection[c]	0	0	0	0	0	0
General services	1	0.9	3	9.2	4	0.9
Total	5	4.4	4	12.3	13	2.8

	Arkansas[d]
Employment Category	Level of Service
Police protection	2.2
Fire protection[c]	0.9
General services	32.9
Total	36.0

[a] Level of service represents the number of employees per 1,000 persons in each jurisdiction. Data on the number of persons employed in the cities came from http://pinebluff.dina.org/general/qfacts.html; data for Jefferson County came from Holland (2000) and Skinner (2000).

[b] Source of population data was U.S. Bureau of the Census (2001b).

[c] Does not include volunteers.

[d] U.S. Bureau of the Census (2000).

TABLE 5.19-8 School District Data for Various Cities near PBA and Arkansas in 1999

Location	Number of Teachers Employed	Student to Teacher Ratio[a]
Altheimer	42	14.7
Dollarway	121	13.4
Pine Bluff	462	14.3
Watson-Chapel	194	17.1
White Hall	194	15.1
Arkansas[b]	-	15.0

[a] Student to teacher ratio represents the number of students per teacher in each school district.

[b] 1998 data.

Source: Arkansas School Information (2000).

TABLE 5.19-9 Medical Facility Data for Jefferson County in 1999

Hospital	Number of Staffed Beds	Occupancy Rate (%)[a]
Jefferson Regional Medical Center	324[b]	65[b]

[a] Percent of staffed beds occupied.

[b] Data source, by permission: SMG Marketing Group, Inc.,© copyright 2001.

TABLE 5.19-10 Physician Employment in Jefferson County and Arkansas in 1997[a]

	Jefferson County		Arkansas
Employment Category	Number Employed	Level of Service	Level of Service
Physicians	179	2.2	2.1

[a] Level of service represents the number of employees per 1,000 persons in each jurisdiction.

Source: American Medical Association (1999) for number employed; U.S. Bureau of the Census (2001b) for population data.

TABLE 5.19-11 Average Annual Daily Traffic (AADT) in the Vicinity of PBA

Road Segment	Traffic Volume (AADT)	Level of Service[a]
SR 365 at SR 104	4,500	A
SR 365 in White Hall	11,000	B
SR 104 south of SR 365	8,900	A
I 530 between White Hall and Pine Bluff	20,000	A
I 530 at SR 104	19,000	A
SR 256 between I 530 and SR 365	2,800	A
SR 256 between SR 365 and PBA	2,400	B

[a] Allison (2001).

Source: Boyles (2000).

5.19.2 Site-Specific Factors

This analysis covers the potential environmental consequences on socioeconomic factors from constructing and operating an ACWA pilot test facility. It considers effects on population, employment, income, regional growth, housing, community resources, and transportation.

5.19.3 Impacts of the Proposed Action

Impacts from construction and operations are summarized in Table 5.19-12. The impacts of no action are provided as well for comparison.

5.19.3.1 Impacts of Construction

Neutralization/SCWO. The potential socioeconomic impacts from constructing a neutralization/SCWO facility at PBA would be relatively small. Construction activities would create direct employment of approximately 730 people in the peak construction year and an additional 570 indirect jobs in the ROI. Construction activities would increase the annual average employment growth rate by less than 0.1% over the duration of construction. Neutralization/SCWO-related employment, wages, and salaries at PBA would also produce about $40 million of income in the peak year of construction.

In the peak year of construction, about 210 people would in-migrate to the ROI, both as a result of SCWO employment and as a result of the overall growth in the ROI economy through the local procurement of materials and services and through employee spending. However, in-migration would have only a marginal effect on population growth and would require only about 1% of vacant rental housing during the peak year. No significant impact on public finances would occur as a result of in-migration, and less than 10 local public service employees would be required to maintain existing levels of service in the various local public service jurisdictions in Jefferson County. In addition, on-post employee commuting patterns would have no impact on levels of service in the local transportation network surrounding PBA.

Neutralization/GPCR/TW-SCWO. The potential socioeconomic impacts from constructing a Neut/GPCR/TW-SCWO facility at PBA would be relatively small. Construction activities would create direct employment of approximately 740 people in the peak construction year and an additional 610 indirect jobs in the ROI. Construction activities would increase the annual average employment growth rate by less than 0.1% over the duration of construction. Neut/GPCR/TW-SCWO-related employment, wages, and salaries at PBA would also produce about $42 million of income in the peak year of construction.

TABLE 5.19-12 Effects of Construction, Operations, and No Action at PBA on Socioeconomics[a,b]

	Neut/SCWO		Neut/GPCR/TW-SCWO		Elchem Ox		
Impact Category	Construction	Operation	Construction	Operation	Construction	Operation	No Action
Employment (number of jobs in ROI)							
Direct	730	720	740	720	780	720	100
Indirect	570	760	610	760	660	850	80
Total	1,300	1,480	1,350	1,480	1,440	1,570	180
Income (millions of $ in ROI)							
Direct	24.9	34.9	25.2	34.9	26.9	34.9	5.8
Indirect	15.5	18.0	16.7	18.1	18.1	21.4	1.8
Total	40.4	52.9	41.9	53.0	45.0	56.3	7.6
Population (number of new residents in ROI)	210	580	220	580	250	640	0
Housing (number of units required in ROI)	80	210	80	210	90	230	0
Public finances (% impact on fiscal balance)							
Cities in Jefferson County[c]	<1	<1	<1	<1	<1	<1	0
Jefferson County	<1	<1	<1	<1	<1	<1	0
Schools in Jefferson County[d]	<1	<1	<1	<1	<1	<1	0
Public service employment (number of new employees in Jefferson County)[c]							
Police officers	0	1	0	1	0	1	0
Firefighters	0	1	0	1	0	1	0
General	1	1	1	1	1	2	0
Physicians	0	1	0	1	0	1	0
Teachers[d]	2	4	2	4	2	6	0
Number of new staffed hospital beds in Jefferson County	1	3	1	3	1	3	0
Traffic (impact on current levels of service in Jefferson County)	None	None	None	None	None	None	None

[a] Impacts are shown for the peak year of construction (2004) and the first year of operations (2009).

[b] The sum of individual row entries and column totals may not correspond because of independent rounding.

[c] Includes impacts that would occur in the cities of Altheimer, Pine Bluff, Redfield, Wabbaseka, and White Hall, and in Jefferson County.

[d] Includes impacts that would occur in Altheimer, Pine Bluff, and White Hall school districts.

In the peak year of construction, about 220 people would in-migrate to the ROI, both as a result of SCWO employment and as a result of the overall growth in the ROI economy through the local procurement of materials and services and through employee spending. However, in-migration would have only a marginal effect on population growth and would require only about 1% of vacant rental housing during the peak year. No significant impact on public finances would occur as a result of in-migration, and less than 10 local public service employees would be required to maintain existing levels of service in the various local public service jurisdictions in Jefferson County. In addition, on-post employee commuting patterns would have no impact on levels of service in the local transportation network surrounding PBA.

Electrochemical Oxidation. The potential socioeconomic impacts from constructing and operating an Elchem Ox facility at PBA would be relatively small. Construction activities would create direct employment of approximately 780 people in the peak construction year and an additional 660 indirect jobs in the ROI. Construction activities would increase the annual average employment growth rate by less than 0.1% over the duration of construction. Elchem Ox-related employment, wages, and salaries at PBA would also produce $45 million of income in the peak year of construction.

In the peak year of construction, about 250 people would in-migrate to the ROI, both as a result of Elchem Ox employment and as a result of the overall growth in the ROI economy through the local procurement of materials and services and through employee spending. However, in-migration would have only a marginal effect on population growth and would require only about 1% of vacant rental housing during the peak year. No significant impact on public finances would occur as a result of in-migration, and less than 10 local public service employees would be required to maintain existing levels of service in the various local public service jurisdictions in Jefferson County. In addition, on-post employee commuting patterns would have no impact on levels of service in the local transportation network surrounding PBA.

5.19.3.2 Impacts of Operation

Neutralization/SCWO. The potential socioeconomic impacts from constructing and operating a Neut/SCWO facility at PBA would be relatively small. Operational activities would create about 720 direct jobs annually and an additional 760 indirect jobs in the ROI. Direct Neut/SCWO-related employment, wages, and salaries at PBA would also produce about $53 million annually during operations.

About 580 people would move to the area at the beginning of Neut/SCWO facility operation. However, in-migration would have only a marginal effect on population growth and would require about 9% of vacant owner-occupied housing during facility operations. No significant impact on public finances would occur as a result of in-migration, and less than 10 new local public service employees would be required to maintain existing levels of service in the various local public service jurisdictions in Jefferson County. In addition, on-post employee commuting patterns would have no impact on levels of service in the local transportation network surrounding PBA.

Neutralization/GPCR/TW-SCWO. The potential socioeconomic impacts from constructing and operating a Neut/GPCR/TW-SCWO facility at PBA would be relatively small. Operational activities would create about 720 direct jobs annually and an additional 760 indirect jobs in the ROI. A Neut/GPCR/TW-SCWO facility would produce $53 million annually during operations.

About 580 people would move to the area at the beginning of operations. However, in-migration would have only a marginal effect on population growth and would require about 9% of vacant owner-occupied housing during facility operations. No significant impact on public finances would occur as a result of in-migration, and less than 10 new local public service employees would be required to maintain existing levels of service in the various local public service jurisdictions in Jefferson County. In addition, on-post employee commuting patterns would have no impact on levels of service in the local transportation network surrounding PBA.

Electrochemical Oxidation. The potential socioeconomic impacts from constructing and operating an Elchem Ox facility at PBA would be relatively small. Operational activities would create about 720 direct jobs annually and an additional 850 indirect jobs in the ROI. An Elchem Ox facility would produce about $56 million annually during operations.

About 640 people would move to the area at the beginning of operations. However, in-migration would have only a marginal effect on population growth and would require about 10% of vacant owner-occupied housing during facility operations. No significant impact on public finances would occur as a result of in-migration, and 11 new local public service employees would be required to maintain existing levels of service in the various local public service jurisdictions in Jefferson County. In addition, on-post employee commuting patterns would have no impact on levels of service in the local transportation network surrounding PBA.

5.19.4 Impacts of No Action

The socioeconomic impacts of continuing installation activities at PBA would be relatively small. PBCA currently employs 100 workers. Wage and salary expenditures by PBCA employees on goods and services have created an additional 80 indirect jobs in the ROI (Table 5.21-1) and increased the annual average employment growth rate in the ROI by less than 0.01% over the period 1990–2000. PBCA-related wage and salary expenditures have also created about $8 million in annual income in the ROI.

5.20 ENVIRONMENTAL JUSTICE

On February 11, 1994, President Clinton issued Executive Order 12898 (Volume 59, page 7629, in the *Federal Register* [59 FR 7629]). This order, along with its accompanying cover memo, calls on federal agencies to incorporate environmental justice as part of their missions. It directs them to address, as appropriate, disproportionately high and adverse human health or environmental effects of their actions, programs, or policies on minority and low-income populations.

This EIS used data from the two most recent decennial censuses (1990 and 2000) to evaluate environmental justice in the context of the ACWA Program at PBA. The 2000 census provides detailed data on race and ethnicity necessary for a systematic definition of minority populations. Although more than a decade old, the 1990 census nevertheless provides the most recent data available on income, which enabled the identification of low-income populations. To remain consistent with these data sources, the EIS employs the following definitions for minority and low-income:

- *Minority* — Individuals who classify themselves as belonging to any of the following racial groups: Black (including Black or Negro, African American, Afro-American, Black Puerto Rican, Jamaican, Nigerian, West Indian, or Haitian); American Indian, Eskimo, or Aleut; Asian or Pacific Islander; or “Other Race” (U.S. Bureau of the Census 1991). For present purposes, individuals characterizing themselves as belonging to two or more races also are counted as minorities. This study also includes individuals identifying themselves as Hispanic in origin, technically an ethnic category, under minority. To avoid double-counting, tabulations included only White Hispanics; the above racial groups already account for Non-white Hispanics.

- *Low-Income* — Individuals falling below the poverty line. For the 1990 census, the poverty line was defined by a statistical threshold based on a weighted average that considered both family size and the ages of individuals in a family. For example, the 1990 poverty threshold annual income for a family of five with two children younger than 18 years was $15,169, while the poverty threshold for a family of five with three children aged less than 18 years was $14,796 (U.S. Bureau of the Census 1992a). If a family fell below the poverty line for its particular composition, the census considered all individuals in that family to be below the poverty line. Low income figures in the 1990 census reflect incomes in 1989, the most recent year for which entire annual incomes were known at the time of the census.

For this EIS, an analysis of minority and low-income populations was done by using census data for two demographic units: counties and census block groups. A block group is a geographic unit consisting of a cluster of blocks that is used by the Census Bureau to present data (U.S. Bureau of the Census 1991). Block groups contain enough blocks to encompass about 250–550 housing units, with the ideal one containing about 400 housing units. Because housing density varies over space, the geographic sizes of block groups vary; smaller units tend to occur in denser areas, such as urban areas. This dual focus on counties and block groups enables the evaluation of environmental justice issues to remain consistent with the geographical focus of analyses in two issue areas where environmental justice is of particular concern: socioeconomics and human health. To maintain consistency with the socioeconomic analysis, the sections on current conditions and impacts under the environmental justice assessment consider Jefferson County to be the core county for PBA. To maintain consistency with the human health analysis, the environmental justice analysis considers population characteristics in census block groups within a 30-mi (50-km) radius of PBA. The block groups considered include all of Grant and Jefferson Counties and part of Arkansas, Cleveland, Dallas, Lincoln, Lonoke, Prairie, Pulaski, and Saline Counties.

To define disproportionate representations of either minority or low-income populations, this EIS uses values for the United States as a whole as reference points, thereby providing an identical comparison for all four installations considered in this EIS. This choice of a reference point, which is central to environmental justice analyses, reflects a desire to remain consistent with the environmental justice executive order and also with the need to select a meaningful reference point for any given impact assessment (see Council on Environmental Quality [CEQ] 1997; EPA 1998a). The 2000 census indicates the United States contains 30.9% minority persons (U.S. Bureau of the Census 2001c), while the 1990 census indicated that 13.1% of persons for whom poverty status was known were considered low-income population in 1989 (U.S. Bureau of the Census 1992b).

5.20.1 Current Environment

Of the Jefferson County residents recorded in the 1990 census, 52.0% were minority (U.S. Bureau of the Census 2001c). This percentage was well in excess of the minority representation for the United States as a whole and hence disproportionately high. The largest percentage of minority persons in Jefferson County (49.6% of the total population) was Black. The 1990 census recorded that 23.9% of the Jefferson County population was below the poverty level (U.S. Bureau of the Census 1992b); again, this percentage was greater than the figure for the United States as a whole and thus disproportionately high.

Of the 364 census block groups defined in the 2000 census partially or totally within a 30-mi (50-km) radius of PBA, 206 contained minority populations in excess of the percentage of minority representation in the United States (Figure 5.20-1). The 206 block groups contained a

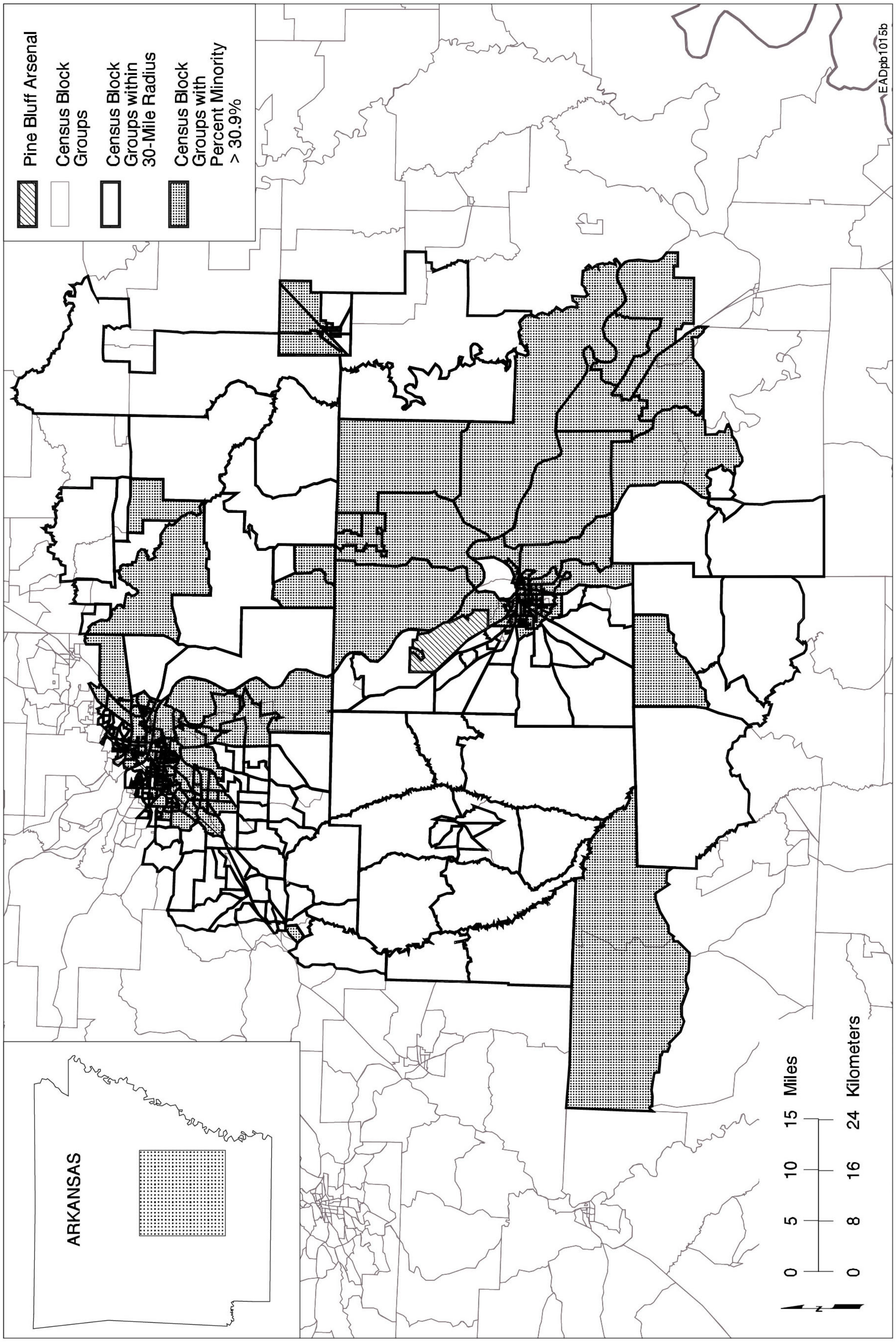

FIGURE 5.20-1 Census Block Groups within a 30-Mile (50-Kilometer) Radius of PBA with Minority Populations Greater than the National Average in 2000 (Source: U.S. Bureau of the Census 2001d)

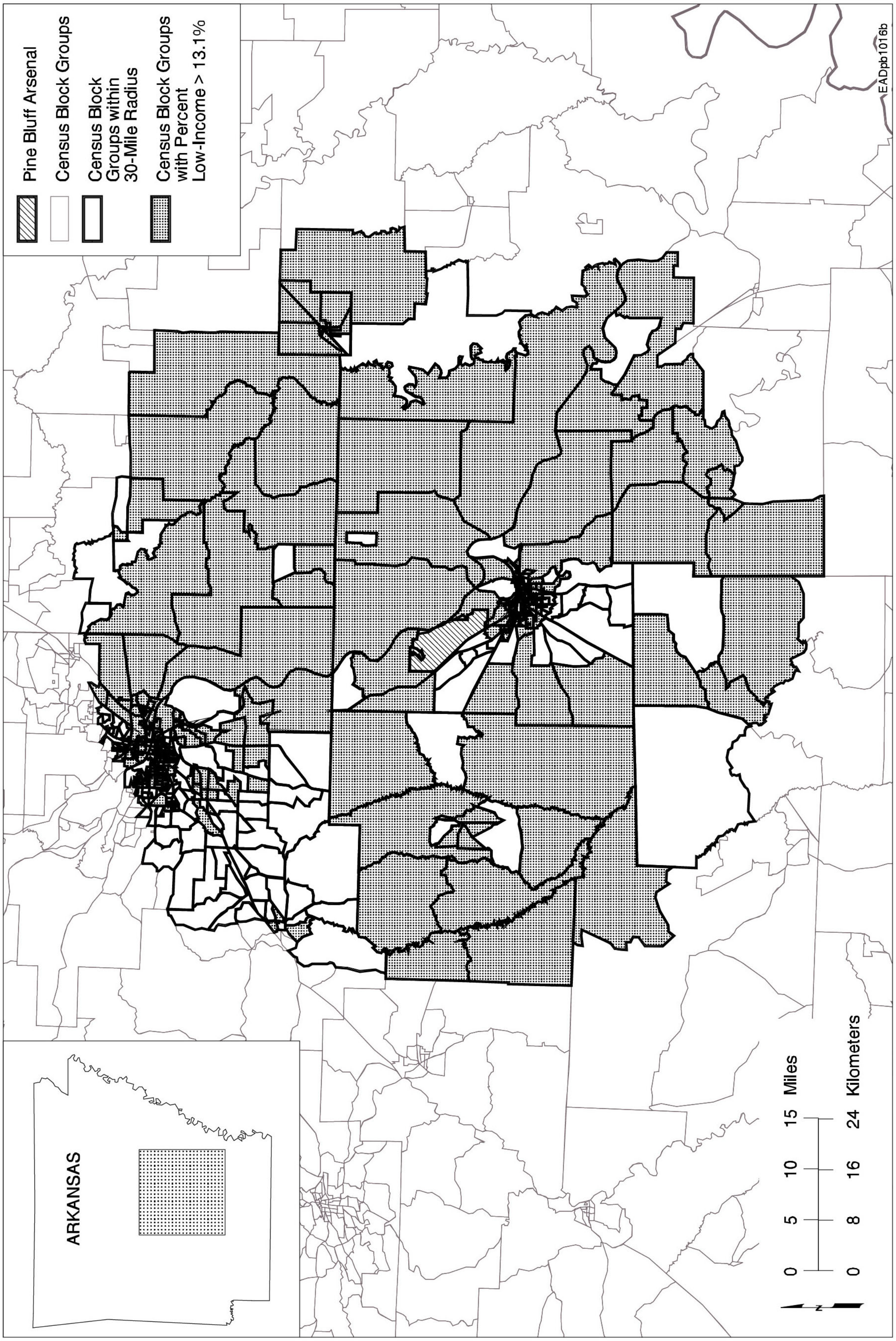

FIGURE 5.20-2 Census Block Groups within a 30-Mile (50-Kilometer) Radius of PBA with Low-Income Populations Greater than the National Average in 1989 (Source: U.S. Bureau of the Census 1992b)

total of 144,426 minority persons in 2000. Block groups with disproportionately high minority populations included the scattered farming communities of Altheimer, England, Grady, Sherrill, Wabbaseka, and Wrightsville as well as nearly all of the cities of Pine Bluff and Little Rock.

Two hundred seventy-three of the 450 census block groups defined in the 1990 census lying partially or totally within a 30-mi (50-km) radius of PBA contained low-income populations in excess of the 13.1% calculated for the United States as a whole (Figure 5.20-2). These block groups contained a total of 59,098 low-income persons in 1989. Block groups with disproportionately high representation of low-income populations included the same six farming communities as those noted in the preceding paragraph, other rural communities such as Allport, Coy, Humnoke, Humphrey, Keo, Parkers-Iron Springs, Prattville, Redfield, and Sheridan, and, once again, most of Pine Bluff and Little Rock.

5.20.2 Site-Specific Factors

Factors considered in this EIS with potential implications for environmental justice are any activities associated with the ACWA program at PBA. Included are impacts associated with construction, operations, and accidents. The evaluation of environmental justice consequences focuses on socioeconomic and human health impacts, two categories that directly affect all people, including minority and low-income populations.

To address Executive Order 12898, this analysis focuses on impacts that are both high and adverse and that disproportionately affect minority and low-income populations. Although it seems logical that certain characteristics of many environmental justice populations — such as having limited access to health care and reduced or inadequate nutrition — might make such populations disproportionately vulnerable to environmental impacts, there do not appear to be any scientific studies that support this contention for the types of impacts considered in this EIS. The absence of such information precludes any analysis that considers increased sensitivity of minority and low-income populations to impacts. To help compensate for this limitation, the analysis of human health impacts includes conservative assumptions and uncertainty factors to accommodate for potentially sensitive subpopulations (see Section 5.7.2.2). The present analysis considers that a disproportionate effect could occur only if the proportion of a population is in excess of the proportions in the United States as a whole, as discussed above under existing conditions. Therefore, significant environmental justice impacts are those that would have a high and adverse impact on the population as a whole and that would affect areas (Jefferson County or census block groups within 30-mi [50-km] of PBA) containing disproportionately high minority or low-income populations.

5.20.3 Impacts of the Proposed Action

5.20.3.1 Impacts of Construction

The primary socioeconomic impacts of construction under any alternative technology, discussed in Section 5.19.3.1, would be increases in short-term employment and income. They would also include small increases in the demand for local housing, schools, and public services. None of these impacts would be high and adverse; local governments and the existing housing stock should be able to accommodate increased demands, and the increased employment and income would be a positive consequence of construction. Human health and other impacts similarly are not expected to be high and adverse during construction. As a result, no environmental justice impacts are anticipated from construction.

5.20.3.2 Impacts of Operations

The primary socioeconomic impacts from operating an PBA facility, discussed in Section 5.19.2.2 for the three technologies, would be increases in employment and income. They would also include small increases in the demand for local housing, schools, and public services. None of these impacts would be high and adverse; local governments and the existing housing stock would probably be able to accommodate the increased demands, and the increased employment and income would be a positive consequence of operations. As a result, environmental justice impacts are not anticipated during operations.

Occupational hazards to workers and releases of agents or other hazardous materials represent the main impacts that could occur during routine operations of the alternative technologies. However, the risk of a noncancer health effect and the risk of cancer from hazardous chemicals released during normal operations would be very low for both workers and the public. These impacts would not be high and adverse; as a consequence, no environmental justice impacts are anticipated from normal operations.

5.20.4 Impacts of No Action

As discussed in Section 5.19.4, socioeconomic impacts of continued operations at PBA would be small: primarily a continuation of small, positive economic impacts and a slight increase in demand for housing, schooling, and public services. None of these impacts would be considered high and adverse. Similarly, high and adverse human health impacts on either workers at PBA or the general public are not anticipated (see Section 5.9.4). As a result, no environmental justice impacts are anticipated under the no action alternative.

5.21 ACCIDENTS INVOLVING ASSEMBLED CHEMICAL WEAPONS

5.21.1 Potential Accidental Releases

This analysis of accidents provides an estimate of the upper range of the potential impacts that might occur as a result of a hypothetical accident related to the proposed action (ACWA pilot testing) or no action (continued storage of chemical weapons). The accidents selected for analysis were the accidents that were shown to have the highest risk in previous Army analyses (Science Applications International Corporation [SAIC] 1997). The highest-risk accidents are defined as those with the highest combined consequences (in terms of human fatalities) and probability of occurrence. For existing continued storage conditions and for operations, the highest-risk accidents would involve the release of chemical agent; release of other materials would result in lower consequences and risks. In general, the accidents considered in this EIS have a fairly low frequency of occurrence. The accident considered for continued storage (lightning strike on a rocket storage igloo) has an estimated frequency on the order of 2×10^{-3} per year (i.e., one occurrence in 476 years). The accident considered for the pilot facility (handling accident in rocket storage igloo) has a somewhat lower estimated frequency of approximately 1×10^{-4} (i.e., one occurrence in 10,000 years).

5.21.1.1 Scenarios

The hypothetical highest-risk accident for ACWA pilot testing of GB and VX is a handling accident in a rocket igloo, with a subsequent fire and release of agent from all the munitions in the igloo. The hypothetical highest-risk accident for continued storage is a lightning strike into a GB- or VX-rocket-containing igloo, with a subsequent fire and release of agent from all the munitions in the igloo. Therefore, the accident consequences from no action (continued storage) and would be the same as those from the proposed action (pilot facility).

Impacts from accidents occurring during the transport of agent from the storage igloos to the pilot testing facility were not assessed for this EIS, because the risks from these accidents would be less than those from the accidents already considered. Accident scenarios and probabilities from on-site transportation are discussed in a PEIS support document (GA Technologies 1987). As noted above, potential accidents from handling the munitions inside the igloos were considered and, in fact, were identified as being the highest-risk accidents during facility operations (SAIC 1997).

For the storage igloo accident scenario, it was assumed that a lightning strike could release the entire contents of a rocket-containing storage igloo. Similarly, a handling accident in a rocket-storage igloo scenario could result in an explosion and propagation by fire, also causing the entire igloo contents to be released. The probability of such an event occurring is fairly low (on the order of 2×10^{-3}), but it increases slightly with increasing length of continued storage. For these scenarios, the maximum amount of agent at risk was obtained from estimates of the maximum amount of VX or GB agent stored in any single PBA rocket-containing igloo (Harris 2000).

5.21.1.2 Methods of Analysis

Potential accidental releases of chemical agent to the atmosphere and the associated consequences of such releases were assessed by using the D2PC[11] Gaussian dispersion model (Whitacre et al. 1987). Two meteorological conditions were assumed in the modeling to assess accident impacts. E-1 conditions consist of a slightly stable atmosphere (stability class E) with light winds (1 m/s). D-3 conditions consist of a neutral atmosphere (stability class D) with moderate winds (3 m/s). E-1 conditions would produce conservative impacts for the assessed accident scenarios. They represent accidents that would occur during the night or during a relatively short period after sunrise. The D-3 conditions would result in more rapid dilution of an accidentally released agent than would E-1 conditions. D-3 conditions represent accidents that would occur during daytime. When D-3 meteorological conditions are assumed, the size of the estimated plume is smaller. In conducting D2PC modeling, it was assumed that no plume depletion by agent deposition would occur. This is a conservative assumption for estimating the area potentially affected by an accidental release, because assuming that more agent remains in the plume allows farther plume travel before concentrations are diluted below the toxicological endpoint levels. The D2PC model default mixing height assumptions were used for modeling D-3 meteorological conditions, and per EPA guidance (EPA 1995), an unlimited mixing height was assumed for modeling E-1 meteorological conditions. A mixing height of 5,000 m is used as a default in D2PC to represent unlimited mixing. The D2PC model limits its application to accident release scenarios that could produce impacts at distances of less than or equal to about 30 mi (50 km).

5.21.1.3 Exposures and Deposition

For each of the accident scenarios assessed, the impacts of agent release were modeled by using D2PC-generated plumes with dosages estimated to result in adverse impacts for a certain percentage of the human population exposed (i.e., LCt_{50} = dosage corresponding to 50% lethality; LCt_{01} = dosage corresponding to 1% lethality; no deaths = dosage below which no deaths are expected in the human population exposed; no effects = dosage below which no adverse impacts are expected in the human population exposed). The distances to which these various plumes were predicted to extend were used as the starting point for the analyses of impacts to the various resources of concern under the proposed action and no action alternatives, as detailed in Sections 5.21.2 and 5.21.3 below. These distances are summarized in Table 5.21-1. For reference, the minimum distance from the hypothetical accident locations (i.e., the Chemical

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[11] The Army has completed the development and validation of a new model (D2Puff). However, the new model is not accredited for use at all installations.

TABLE 5.21-1 Chemical Agent Plume Distances Resulting from Accidents at an ACWA Pilot Test Facility (Proposed Action) or in the Chemical Limited Area (No Action) at PBA[a]

Effect	Impact Distance, Mi (km)[b]	Exposure Dose (mg-min/m^3)[c]	Impact Area km^2	Impact Area Acres
GB Accidents				
Proposed action, D-3 (i.e., handling accident in rocket storage igloo)				
1% lethality	6.3 (10)	10	6.6	1,600
No deaths	8.5 (14)	6	11	2,700
No effects	>30 (>50)	0.5	180	44,000
Proposed action, E-1 (i.e., handling accident in rocket storage igloo)				
1% lethality	27 (43)	10	44	11,000
No deaths	>30 (>50)	6	70	17,000
No effects	>30 (>50)	0.5	130	32,000
No action, D-3 (lightning strike on rocket igloo)				
1% lethality	6.3 (10)	10	6.6	1,600
No deaths	8.5 (14)	6	11	2,700
No effects	>30 (>50)	0.5	180	44,000
No action, E-1 (lightning strike on rocket igloo)				
1% lethality	27 (43)	10	44	11,000
No deaths	>30 (>50)	6	70	17,000
No effects	>30 (>50)	0.5	130	32,000
VX Accidents				
Proposed action, D-3 (i.e., handling accident in rocket storage igloo)				
1% lethality	8.9 (14)	4.3	13	3,200
No deaths	12 (20)	2.5	23	5,700
No effects	>30 (>50)	0.4	180	44,000
Proposed action, E-1 (i.e., handling accident in rocket storage igloo)				
1% lethality	>30 (>50)	4.3	73	18,000
No deaths	>30 (>50)	2.5	90	22,000
No effects	>30 (>50)	0.4	130	32,000
No action, D-3 (lightning strike on rocket igloo)				
1% lethality	8.9 (14)	4.3	13	3,200
No deaths	12 (20)	2.5	23	5,700
No effects	>30 (>50)	0.4	180	44,000

TABLE 5.21-1 (Cont.)

Effect	Impact Distance, Mi (km)[b]	Exposure Dose (mg-min/m^3)[c]	Impact Area	
			km^2	acres
No action, E-1 (lightning strike on rocket igloo)				
1% lethality	>30 (>50)	4.3	73	18,000
No deaths	>30 (>50)	2.5	90	22,000
No effects	>30 (>50)	0.4	130	32,000

[a] Distances and plume areas in table are from D2PC output. Meteorological conditions are either D stability and 3-m/s wind speed or E stability and 1-m/s wind speed.

[b] Impact distances downwind of accident that would have 1% lethality, no deaths, or no effects on humans (see Table 5.21-2).

[c] Dosage for duration of accident at specific impact distance. The dosages correspond to default values used in the D2PC code (Whitacre et al. 1997).

Limited Area, or CLA) to the PBA installation boundary and other industrialized areas (e.g., the NCTR) is about 0.4 mi (0.7 km). For all the hypothetical accidents assessed, the no effects plume contour extends into off-post areas (i.e., extending to 30 mi [50 km]). The extent of the no deaths contour varies from 9 to 30 mi (15 to 50 km), depending on the assumed type of chemical agent release and meteorological conditions.

5.21.2 Impacts of Accidents during the Proposed Action

5.21.2.1 Land Use

An accidental agent release during operation of an ACWA pilot test facility could generate serious negative land use impacts outside the installation, including the death and quarantine of livestock, interruption of agricultural productivity, and disruption of local industrial activities (see Sections 5.21.2.9 and 5.23). Although such an accident would be capable of generating serious negative consequences, the likelihood of such an accident is extremely remote; consequently, the overall risk is very low.

5.21.2.2 Waste Management and Facilities

Hazardous Waste. The highest-risk accident scenario for ACWA pilot testing activities is a handling accident in a rocket-containing igloo. Waste generated under this scenario would be primarily contaminated soil and debris from dispersion of agent. An undeterminable amount of contaminated wastes could be produced by cleanup of a spill or accident involving dispersion of agent. Spill and emergency response plans and resources would be in place to contain, clean up, decontaminate, and dispose of wastes according to existing standards and regulations.

Chemical agents are not listed in the Arkansas hazardous waste regulations. In the case of an accident that involves the release of a chemical agent, any contaminated residue, soil, water, or other debris resulting from the cleanup of that agent must be characterized to determine if it is a hazardous waste (Arkansas Department of Environmental Quality [ADEQ] Regulation 23, Section 261). Debris and soil contaminated with agent could be considered hazardous waste if they demonstrated a hazardous characteristic. In this case, the hazardous waste could have a serious impact on hazardous waste management capabilities in the area.

Nonhazardous Waste. Depending on the particular accident conditions, if the cleanup material did not demonstrate a hazardous waste characteristic, the Army might be able to dispose of some or most of it as nonhazardous waste in a local landfill.

5.21.2.3 Air Quality

Depending on the amount, an accidental release of GB or VX at PBA during operation of an ACWA pilot test facility could have short-term but very significant adverse impacts on air quality, in terms of human injuries and fatalities (see Section 5.21.2.4). However, deposition of agent from air onto the ground surface and/or degradation in the environment would occur within a relatively short period of time. GB is considered nonpersistent because it is volatile, soluble in water, and subject to acid-base hydrolysis. Although data on the fate of GB in the atmosphere are lacking, GB is likely to be subject to photolysis, radical oxidation, or hydrolysis upon contact with water vapor (Munro et al. 1999). Therefore, it is unlikely to persist in air. VX is nonvolatile and persistent; however, after an accidental release, VX aerosols would be subject to rapid deposition onto ground surfaces. Therefore, long-term (e.g., more than a few days after release) adverse air quality impacts would not be expected from an accidental release of GB or VX.

5.21.2.4 Human Health and Safety

For each of the accident scenarios assessed, the impacts of agent release were modeled by using plumes with dosages estimated to result in death for a certain percentage of the population exposed (i.e., LCt_{50} = dosage corresponding to 50% lethality; LCt_{01} = dosage corresponding to 1% lethality; no deaths = dosage corresponding to 0% lethality. The assumption was made that for any accident, the wind direction would be toward the direction where the largest number of people live. By using site-specific population data, the potential numbers of fatalities for each accident were estimated. Further details on the methods used to estimate number of fatalities are given in Appendix H. This evaluation did not specifically estimate the numbers of nonfatal injuries that would occur for each accident scenario, because there would be great variation in the number and severity of nonfatal injuries, depending on the exposure concentration and duration and on variations in the populations exposed.

The population at risk at PBA (i.e., persons residing within a 30-mi [50-km] radius of the post) is about 440,000 people. The handling accident in a VX-rocket storage igloo scenario could result in an explosion and propagation by fire, causing the entire igloo contents to explode and/or burn (SAIC 1997). For this igloo scenario, the maximum amount of agent at risk was obtained from estimates of the maximum amount of VX stored in any single PBA igloo (Harris 2000). If this handling accident scenario occurred under E-1 meteorological conditions, 1% lethality distances and no deaths distances of more than 30 mi (50 km) would result (Table 5.21-2). The corresponding estimated number of fatalities among the general public would be about 6,000. The estimated number of fatalities for the on-post population would be about 440. If such an accident occurred under D-3 meteorological conditions, the 1% lethality distance would decrease to 9 mi (14 km). The corresponding estimated number of fatalities among the general public would be about 1,100. The estimated number of fatalities for the on-post population would be 350.

The above estimates are conservative with respect to several modeling assumptions, such as the number of munitions and amount of agent released, unvarying meteorology, no fire-induced plume buoyancy, and the size of the population exposed (e.g., wind assumed to be in direction of most populous area for an extended period of time). However, the toxicity levels used to estimate fatalities were originally developed for healthy adult males. If it is assumed that children and/or the elderly are substantially more susceptible to the effects of agent exposure than healthy adult males and all other conservative assumptions remain the same, then the estimated number of fatalities could increase. When a previously developed method for incorporating sensitive subpopulation risk assumptions is used (U.S. Army 1997) and when it is assumed that about 35% of the general population in the PBA ROI (see Section 4.19) falls into the sensitive subgroup, the fatality estimates for the accident scenarios addressed here for alternative technologies would increase by a factor of about 1.5. (Details of this assessment are provided in Appendix H.) For example, if children and the elderly are up to 10 times more

TABLE 5.21-2 Fatality Estimates for Potential Accidents Involving Agent Release at PBA[a]

Accident Scenario[b]	Distance (mi): To LCt_{50} Dose	Distance (mi): To LCt_{01} Dose	Distance (mi): To No Deaths Dose	On-Post Population at Risk (no. of persons)[c]: Source to LCt_{50}	On-Post Population at Risk (no. of persons)[c]: LCt_{50} to LCt_{01}	On-Post Population at Risk (no. of persons)[c]: LCt_{01} to No Deaths	Maximum Estimated Fatalities for On-Post Population[d]
Continued storage highest-risk accident (applicable to no action and proposed action, all ACWA technologies)							
Lightning strike on VX rocket storage area with fire: D-3	3.9	8.9	12	448	52	126	350
Lightning strike on VX rocket storage area with fire: E-1	16	>30	>30	487	296	20	439
Facility highest-risk accident (applicable to all ACWA technologies)							
Handling accident in VX rocket storage igloo: D-3	3.9	8.9	12	448	52	126	350
Handling accident in VX rocket storage igloo: E-1	16	>30	>30	487	296	20	439

Accident Scenario[b]	Off-Post Public Population at Risk (no. of persons)[c]: Source to LCt_{50}	Off-Post Public Population at Risk (no. of persons)[c]: LCT_{50} to LCt_{01}	Off-Post Public Population at Risk (no. of persons)[c]: LCT_{01} to No Deaths	Maximum Estimated Fatalities for Off-Post Population[d]
Continued storage highest-risk accident (applicable to no action and proposed action, all ACWA technologies)				
Lightning strike on VX rocket storage area with fire: D-3	240	3,367	7,770	1,061
Lightning strike on VX rocket storage area with fire: E-1	314	22,603	6,881	5,921
Facility highest-risk accident (applicable to all ACWA technologies)				
Lightening strike into VX rocket storage area with fire: D-3	240	3,367	7,770	1,061
Lightening strike into VX rocket storage area with fire: E-1	314	22,603	6,881	5,921

[a] Scenarios are highest-risk accidents for ACWA pilot facilities and for continued storage.

[b] D-3 corresponds to meteorological conditions of D stability with 3-m/s wind speed, and E-1 corresponds to conditions of E stability with 1-m/s wind speed. All accidents are assumed to occur with the wind blowing toward the location of maximum public or on-post population density.

Footnotes continue on next page.

TABLE 5.21-2 (Cont.)

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[c] Population at risk indicates the number of individuals working (for on-post populations) or residing (for off-post populations) within the area encompassed by the plume. LCt_{50} values used were 18 and 42 for VX and GB, respectively, assuming a 25-L/min breathing rate (SAIC 1997; Goodheer 1994; Burton 2001). LCt_{01} and no deaths values were defaults from D2PC code (Whitacre et al. 1987), as given in Table 7.21-1. LCt_{50} values proposed by National Research Council (1997b) of <15 and <35 for VX and GB, respectively (for 15-L/min breathing rate) were not used in this assessment; these values have not been formally approved for use by the Army.

[d] Total fatalities were calculated by assuming (1) a fatality rate of 75% in the area between the point of agent release and the 50% lethality dosage contour, (2) a fatality rate of 25% in the area between the 50% lethality dosage contour and 1% lethality dosage contour, and (3) a fatality rate of 0.5% in the area between the 1% lethality dosage contour and no deaths dosage contour.

sensitive to the lethal effects than are healthy male adults, and if a handling accident in a VX rocket storage igloo occurred under E-1 meteorological conditions, up to about 12,000 fatalities ($8{,}100 \times 1.5$) would be expected in the general population. It must be emphasized that this is a very conservative estimate of the maximum number of fatalities that would be expected from a highly improbable accident; sufficient data are not available to determine whether children or the elderly are actually more sensitive to the toxic effects of an acute chemical agent exposure than the rest of the population.

For the human health impacts assessment, an internally initiated accident was also modeled (i.e., an accident caused by equipment failure or human error at the pilot facility). The internally initiated accident that was modeled involved a rupture in the 500-gal (1,900-L) agent holding tank or the connecting piping in the MDB that could result in the release of the tank's entire contents. Such an accident could result in the release of a small quantity of GB from the filter farm stack. Air concentrations would be too low to cause fatalities.

Essentially, the assessment did not find any difference between the technology systems with respect to accident impacts during pilot facility operations. This finding is attributable to the fact that acute health risks are mainly determined by the quantity of agent released in an accident (the source term). Once neutralization has taken place inside the pilot facility, the acute health risks associated with an accidental release of process by-products (e.g., hydrolysate solution) would be negligible in comparison with the risks associated with the release of an agent. Because the alternative technologies would operate at similar throughput rates, with similar total amounts of agent present at the front end of the process (during munitions disassembly), the maximum amounts of agent released in the pilot facility would be similar for all technologies and less than the amount released in a rocket igloo handling accident.

The main potential differences in accidents involving releases of agent for the different technology systems being tested would be related to the method used to access agent and explosives in the munitions. Cryofracture would be used for separation of energetics in some processes, while a reverse assembly process with some modifications would be used for other processes. Assessments of the consequences of accidents involving these separation processes are not presented here because the impacts would be substantially smaller than those of the other externally and internally initiated events considered. Also, the currently available design data do not indicate any major differences in the disassembly processes with respect to potential amounts of agent released.

The Neut/SCWO process would use five major process chemicals: sodium hydroxide, phosphoric acid, kerosene, liquid oxygen, and liquid nitrogen (PMACWA 1999). The Neut/GPCR/TW-SCWO process would use several hazardous chemicals, including sodium hydroxide, liquid oxygen, hydrogen, and kerosene. Finally, the Elchem Ox process would use sodium hydroxide, nitric acid, sodium hypochlorite, hydrochloric acid, calcium oxide, silver nitrate, and liquid oxygen (PMACWA 2001). Several of these chemicals are flammable or reactive (e.g., sodium hydroxide, sulfuric acid, kerosene) and exhibit irritant properties when inhaled or touched. However, all are common industrial chemicals with well-established handling procedures and safety standards. According to PMACWA (1999), "the risk from gaseous emissions of these chemicals is minimal, but more work is needed to demonstrate the effectiveness of the containment design in the event of an accidental ignition of energetics during processing." The effectiveness of the containment design is being further addressed in engineering design studies.

5.21.2.5 Soils

Under the accident scenarios considered for ACWA pilot testing activities at PBA, contamination of surface soils could extend over an area beyond the installation boundaries. Given the nature of the accidents, it is assumed that chemical agent would be widely deposited downwind on surface soils as fine particles or droplets. Degradation rates for fine particles of agent typically are rapid (see Appendix A). Therefore, any impacts on soils resulting from the deposition of fine particles of agent would be of limited duration — on the order of several days to two weeks — depending on ambient temperatures.

Pools or larger pieces of chemical agent might be deposited near the location of the agent release. Although larger pieces of chemical agent would degrade more slowly than fine particles, any agent released during such an accident would be removed during cleanup operations and would not have a long-term impact on surface soils. Contaminated soils excavated during cleanup would be disposed of in accordance with applicable requirements.

5.21.2.6 Water Resources

Impacting Factors. The agent deposited on the soil after a rocket storage igloo handling accident would be deposited as fine particles, aerosols, or vapor. No large masses (drops, pools, etc.) of agent would be deposited downwind of the accident site. Near the accident site, large drops or pools of agent might occur on the ground surface. This agent near the accident would be removed during cleanup operations and would not pose a long-term threat or be a source of water contamination. However, any agent deposited on the soil downwind of the accident as fine particles could be a potential source of surface or groundwater contamination.

GB deposited on the soil surface would degrade rapidly. GB has a volatilization half-life of 7.7 hours and a hydrolysis half-life of 46 to 460 hours, depending on the soil's pH (Appendix A). Within two to three days, surface concentrations of GB would be negligible. Only 0.1% of the original deposition would remain after about 10 half-lives; thus, within about three days, surface concentrations of GB would be below 0.01%, and within 15 half-lives (about five days), only 0.003% would remain.

VX deposited on the soil surface would be moderately persistent and could remain in significant concentrations for 15 to 20 days (Appendix A). The degradation half-life of VX in soil is estimated to be about 4.5 days, while the hydrolysis half-life ranges from 17 to 42 days, depending on temperature and pH. Within approximately 1.5 months, less than 0.1% of the VX would remain, and within about two months, less than 0.001% of the deposited VX would remain.

Once agent reached either surface water or groundwater, it would dissolve and begin to hydrolyze and undergo dilution as it mixed with the water. None of the agents would be persistent in water resources; however, some of the agent breakdown products would be persistent in the environment.

GB has one breakdown product that is persistent in the environment: isopropyl methyl phosphonic acid (IMPA), (Appendix A). It is considered an eye and skin irritant with low to moderate toxicity. VX has two relatively stable degradation products: EA2192 and methyl phosphonic acid (MPA) (Appendix A). EA2192 retains some anticholinesterase properties and has the potential to affect human health through the oral pathway. However, at concentrations estimated in the environment, EA2192 would not be expected to pose a significant threat.

Groundwater. Transportation of agent by subsurface flow would be minimal. Surface sources would not last for significant periods, and degradation would occur as the agents moved through the vadose zone to the groundwater. Once in the groundwater, degradation would continue, and significant dilution would occur.

In addition to the fact that the agent source would be present on the surface to contaminate groundwater for only a relatively short length of time, once the agents were dissolved and mobile, they would hydrolyze. GB hydrolyzes rapidly and would break down before being transported any significant distance in the subsurface. VX hydrolization takes a slightly longer time but still occurs rapidly when compared with groundwater travel times.

It is very unlikely that after an accident, conditions that would allow significant impacts on groundwater resources would exist. Trace amounts of agent breakdown products might be detected, but these contaminants would be present at low concentrations and would not pose significant threats to the environment.

Surface Water. Small ponds and other nonmoving surface water features would be affected after an accident for a short time. Agent concentrations would rapidly decrease as a result of agent degradation and dilution as the agent mixed with the water column.

Surface runoff might mobilize the agent present on the soil surface. If mobilization occurred, the turbulent water would dissolve the agent rapidly. Once dissolved, GB would hydrolize rapidly and not persist in the water. VX would be present for a slightly longer period but would also break down rapidly.

It is unlikely that agent transported by runoff would reach surface water bodies in appreciable concentrations because of agent dilution and degradation. Even if it did, impacts would be short-lived. Surface runoff might contain some agent when it reached various surface water bodies, but within a short time, depending on the agent and environmental conditions, these concentrations would be negligible. Dilution from both the overland flow and mixing in the water body would also reduce the concentration of agent reaching the water bodies. In addition, in order for any appreciable amount of agent to reach surface water bodies from overland flow, a rainfall event large enough to produce surface runoff, but small enough to not significantly dilute the dissolved agent, would have to occur shortly after an accident.

Because of the relatively low toxicity of the breakdown products and the low agent concentrations (because of dilution and low initial concentrations of agent or breakdown products), the impacts from degradation products on surface water resources would be none to negligible.

5.21.2.7 Biological Resources

Accident analyses were conducted for a scenario that involved a handling accident in a VX or GB rocket storage igloo. Ecological impacts from a major accident associated with operation of an ACWA pilot test facility were assessed on the basis of atmospheric concentration estimates made by using the D2PC model (Whitacre et al. 1987). Model output was used to conduct impact analyses for vegetation, wildlife, aquatic habitats and fish, protected species, and wetlands.

Terrestrial Habitats and Vegetation. VX and GB mainly interfere with neurotransmission in animals and would not likely affect vegetation; however, VX is known to be phytotoxic to some plants at 10 ppm (soil and solution). The toxicity of GB to terrestrial plants is unknown but is probably similar in magnitude to the toxicity of VX, since both agents are organophosphates (Opresko et al. 1998). Hydrolysis of GB would probably occur quickly after deposition on plant surfaces and soils downwind from the accident location (see Appendix A). Model runs for a handling accident in a GB rocket storage igloo under E-1 (nighttime) meteorological conditions showed an average GB deposition area of 4,400 ha (11,000 acres) in the 1% human lethality area that extends to 27 mi (43 km) downwind from the accident location (see Table 5.21-1). The maximum deposition area after an accident would occur during nighttime conditions. The average VX deposition area would be 7,300 ha (18,000 acres) in the 1% human lethality area located out to 30 mi (50 km) downwind of the accident during nighttime (E-1) conditions.

Wildlife. The deposition plume areas projected by the D2PC model would be elliptical in shape and would occur mostly downwind of the accident. The location and geometry of the plume areas would vary, depending on the atmospheric stability and wind direction at the time of an accident. At PBA, the prevailing winds that would result in the greatest consequences from an accident would be from the southwest. A release of nerve agents would thus have a higher probability of affecting ecosystems located northeast of the CHB. However, the release could presumably affect ecosystems in any direction, depending on the direction and speed of the wind at the time of the accident. Because of the limitations of the D2PC model, the size of habitat potentially exposed to agents cannot be reasonably approximated.

A screening-level ecological risk assessment was conducted to determine impacts of the bounding accident on four common wildlife species observed in grassland and forest habitats at PBA: white-tailed deer (*Odocoileus virginianus*), red fox (*Vulpes fulva*), meadow vole (*Microtus pennsylvanicus*), and white-footed mouse (*Peromyscus leucopus*). No benchmark values were found for exposure of birds, reptiles, or amphibians to VX and GB. Risks to the four ecological receptors from the accident scenarios were characterized by using the hazard quotient (HQ) approach for exposure to VX and GB. The HQ is the ratio between the concentration of a contaminant (VX, GB) in a medium (air, water) and a contaminant-specific benchmark concentration representing a "no observed adverse effects level" (NOAEL) and a "lowest observed adverse effects level" (LOAEL) exposure concentration on the basis of results from laboratory studies. HQs were calculated on the basis of inhalation benchmark values developed for use in ecological risk assessments of wildlife from exposure to combustion products at ANAD (USACHPPM 1999a). The HQ values could vary from zero to infinity. HQ values greater than one show a potential risk to the ecological receptor from the exposure. It is important to note that HQ values greater than one indicate only the potential for adverse risks (or effects) to individual animals and not actual impacts on them. Actual impacts would depend on many factors, such as the length of exposure to the plume, concentration of the chemical agent in air, and species sensitivities to various atmospheric concentration levels. HQ values were based on air concentrations estimated by the D2PC model under the air stability expected during typical nighttime conditions (wind speed of 1 m/s) and during typical daytime conditions (wind speed of 3 m/s). Benchmark values were adjusted for differences in inhalation rates on the basis of the body mass of the four species examined. Distances that were affected by a handling accident at an igloo followed by a fire were determined for HQ values of less than one on the basis of D2PC model output for both NOAEL and LOAEL exposures. Details of the HQ calculations are provided in Tsao (2001a–b).

Exposure of the four mammalian species to GB would result in lethality at distances extending out to 30 mi (50 km) downwind from the accident location (see Table 5.21-3). Species with small home ranges, such as small mammals, reptiles, and amphibians, would remain in the exposure plume during the accident and would thus experience higher mortality rates than more mobile species. Exposures to VX would result in some mortality to wildlife out to 30 mi (50 km) downwind of the accident for all four species evaluated in the ecological risk assessment (see Table 5.21-3).

Exposure of wildlife to VX and GB following an accident might have effects similar to those known to occur to humans. VX and GB are strong inhibitors of enzymes and effect neurotransmission by interfering with the enzyme cholinesterase, in particular. Nausea, vomiting, skeletal muscle twitching, seizures, and death typify the normal progression of effects from brief human exposures to high concentrations (see Appendix A). VX is not expected to be harmful to plants because of their low sensitivity, but it might be harmful to herbivores that consume contaminated vegetation downwind of the accident location over an extended period of time (Appendix O in U.S. Army 1988).

VX is not very volatile, is moderately persistent in the environment, and may occur in the environment for about 15 to 20 days following deposition on soil. The half-life of VX is about 4.5 days, and an estimated 90% of VX applied to soils would be lost in less than 15 days (Appendix A). No data were available to model wildlife uptake of VX or GB through ingestion. The nerve agent GB is considered nonpersistent in the environment and quickly breaks down in water. Impacts of GB through bioaccumulation in the food chain would not be likely to occur, given its tendency to volatilize quickly. The degradation products of GB have low toxicities (see Appendix A) and also would not be likely to pose a threat to wildlife through biomagnification in the food chain.

Aquatic Habitats and Fish. Aquatic habitats and fish in all water bodies at PBA might be affected by a release of GB or VX following a handling accident at a rocket storage igloo. VX is more environmentally persistent than GB. VX is moderately to highly soluble in water, with a solubility of 30 g/L at 77°F (25°C) (Munro et al. 1999). Its half-life ranges from 17 to 42 days at a temperature of 25°F (77°C) and pH of 7 (Appendix A). Depending on the concentrations of VX reaching surface waters, fish, amphibians, and reptiles would be likely to die if their responses were similar to those of mammals under laboratory conditions (Munro et al. 1999). Analyses of the effects from potential accidental releases of VX on fish and other aquatic

TABLE 5.21-3 Distance from Accident Location That Would Result in No or Lowest Adverse Effects on Wildlife at PBA[a]

	Distance (mi) with Hazard Quotient of <1[b]							
	GB				VX			
	Daytime Conditions		Nighttime Conditions		Daytime Conditions		Nighttime Conditions	
Species	LOAEL[c]	NOAEL[d]	LOAEL[c]	NOAEL[d]	LOAEL[c]	NOAEL[d]	LOAEL[c]	NOAEL[d]
White-tailed deer	17	26	>30	>30	>30	>30	>30	>30
Red fox	26	>30	>30	>30	>30	>30	>30	>30
Meadow vole	<30	>30	>30	>30	>30	>30	>30	>30
White-footed mouse	<30	>30	>30	>30	>30	>30	>30	>30

[a] Scenario is a GB release or a VX release that results from a handling accident or lightning strike at a rocket storage igloo.

[b] Hazard quotient = (dose at a given distance from the source) divided by (benchmark value of agent for receptor species). The air concentration used to determine dose was obtained by using the D2PC model and assuming a wind speed of 3 m/s during daytime and 1 m/s during nighttime.

[c] LOAEL = lowest observed adverse effect level; the maximum distance from the site at which an adverse effect would be expected to occur.

[d] NOAEL = no observed adverse effect level; the distance from the site beyond which no adverse effects would be expected to occur.

organisms (U.S. Army 1998) indicate that the impacts at PBA could be severe. Aquatic organisms in Yellow Lake, Tulley Lake, small ponds, and intermittent and ephemeral streams at PBA would be killed from exposure to VX following a handling accident in a VX rocket storage igloo. Mortality to aquatic biota from VX exposure after the accident could occur in any of the surface water bodies at PBA, depending on the wind direction at the time of the accident. Aquatic species in surface waters located downwind of the accident to the northeast of PBA would have the greatest probability of exposure to accidental release concentrations projected by the D2PC model (based on the direction of the prevailing winds). The D2PC model uses very conservative input parameters and assumptions; it is described in detail in Appendix H of this EIS.

Yellow Lake and Tulley Lake provide habitat for a variety of fish species (34 species recorded in Yellow Lake) that are important as recreational species and forage species for game fish, birds, and mammals. Mortality to these species from an accidental release of VX would result in the greatest impact to aquatic ecosystems at PBA.

Protected Species. No federal listed threatened and endangered species are known to occur at PBA (Tobin 2000). The federal threatened bald eagle *(Haliaeetus leucocephalus)* and federal endangered red-cockaded woodpecker *(Picoides borealis)* occur within 30 mi (50 km) of PBA and could be killed or adversely affected by a release of VX or GB following a handling accident in a rocket storage igloo. The potential for lethal and adverse impacts on these species would depend on the direction of the wind and extent of the plume following the accident. Prevailing winds are mainly from the south and southwest of PBA during all months except September, when they come mostly from the northeast.

The likelihood of impacts on to the bald eagle and the red-cockaded woodpecker populations within 30 mi (50 km) of PBA is low. Known breeding populations in 1997 (U.S. Army 1997) were located northwest of PBA in Grant, Pulaski, and Saline Counties. These areas are typically not downwind of PBA because the prevailing winds are from the southwest. The bald eagle is considered a transient species during spring and fall migration (PBA 1998). Severe accidents involving VX that occurred during the migration periods could adversely affect bald eagles if they were exposed to the agent in areas downwind from the release in five counties that are within 30 mi (50 km) of PBA.

The geocarpon (*Geocarpon minimum*), a federal threatened plant species, occurs within a 30-mi (50-km) radius of PBA. Eleven other plant species considered as state endangered or threatened by the Arkansas Natural Heritage Commission (see Table 5.15-1) are also known to occur in counties within 30 mi (50 km) of PBA. No studies were found to suggest that VX and GB would adversely affect the geocarpon or other listed plant species.

The Arkansas fatmucket (*Lampsilis porvelii*), a federal threatened clam species, is known to occur in Saline County, located northwest of PBA and within the 30-mi (50-km) radius. The extent to which this species would be affected by VX releases from an accident would depend on the water volume and flow rate of the stream, both of which would affect VX water concentration and exposure levels. Clams in shallow perennial or intermittent streams downwind from the accident during daytime could be exposed to relatively high concentrations of VX within the 1% human lethality, no human deaths, and no human health effects contours, located 3.9 mi (14 km), 12 mi (20 km), and more than 30 mi (50 km), respectively, from the accident. VX is known to persist in water for 17–42 days at a temperature of 77°F (25°C) and a pH of 7 (Appendix A). Given the sedentary nature of clams, individuals would be exposed to the entire aliquot of water containing agent deposited from the vapor plume following the accident. Clams surviving exposure would likely bioaccumulate VX in soft tissues.

Wetlands. Wetlands near the location of a handling accident at a rocket storage igloo would be exposed to VX or GB. The limited amount of data available on known impacts on plants suggests that some absorption of VX would occur (U.S. Army 1988). VX and its breakdown products would be harmful and potentially lethal to animals ingesting contaminated plant material. Plant species exposed to GB downwind of the accident site would not be likely to become contaminated to a large extent because of the agent’s tendency to break down relatively quickly by hydrolysis.

5.21.2.8 Cultural Resources

The occurrence of an accident, either during the proposed action or no action, could result in impacts on cultural resources within the area exposed to agent. The building materials used in historic structures or the exposed surfaces of archaeological sites could become contaminated during an accident. At a minimum, public access to these historic properties would be temporarily denied until contamination was degraded by exposure to light and moisture or by active decontamination.

For the hypothetical accidents assessed here (i.e., handling accident at a GB or VX rocket storage igloo), only temporary impacts (i.e., access restrictions) on cultural resources located outside the maximum radial no effects distance of 30 mi (50 km) would be expected (see Table 5.21-1). Access restrictions could last for a few days or longer, depending on the degree of contamination and the length of time required to certify that access to these properties could again be permitted. It is expected that low levels of agent contamination would degrade in a few hours under certain conditions, while larger quantities might take several weeks to degrade (see Appendix A).

Significant historic properties located within 30 mi (50 km) of the accident (Appendix F) could be affected by temporary but extended restriction periods until the contaminant was degraded by light and moisture. If the contaminant was deposited as a liquid on these properties, the Army might require that the properties undergo various decontamination procedures before being released for access by the public. These decontamination procedures could potentially damage the property. However, deposition of liquid agent in quantities that would require decontamination procedures that could damage or destroy cultural resources would most likely be confined to the pilot test facility or storage area. Extended public access restrictions, lasting until the contaminant dissipated, would be the most likely measure for preserving significant properties.

5.21.2.9 Socioeconomics

The accidental release of chemical agent at PBA during ACWA pilot testing would have the potential to affect the socioeconomic environment in two ways. The demand for crops and livestock produced within the 30-mi (50-km) radius around the facility might change, and employees might need to be evacuated from work places.

Agriculture. The most significant impact of an accident on agriculture would be if all the crops and livestock produced in a single season were interdicted (either by federal or state authorities) and removed from the marketplace. Although the impacts from losses in agricultural output on the economy of the counties within the 30-mi (50-km) radius surrounding PBA would be significant (Table 5.21-4),it is unlikely that the severity of these losses would be any different for the no action and the proposed action alternatives.

TABLE 5.21-4 Socioeconomic Impacts of Accidents at PBA Associated with the Proposed Action and No Action[a]

Parameter	Neut/ SCWO	Neut/ GPCR/ TW-SCWO	Elchem Ox	No Action
Impacts from a one-year loss of agricultural output				
100% loss of agricultural output				
Employment (no. of jobs)	23,900	23,900	23,900	23,900
Income (millions of $)	1,030	1,030	1,030	1,030
75% loss of agricultural output				
Employment (no. of jobs)	17,900	17,900	17,900	17,900
Income (millions of $)	770	770	770	770
50% loss of agricultural output				
Employment (no. of jobs)	11,900	11,900	11,900	11,900
Income (millions of $)	510	510	510	510
Impacts from a single-day evacuation of businesses				
100% of economic activity affected				
Sales (millions of $)	150	150	150	150
Employment (no. of jobs)	360,000	360,000	360,000	360,000
Income (millions of $)	80	80	80	80
75% of economic activity affected				
Sales (millions of $)	110	110	110	110
Employment (no. of jobs)	270,000	270,000	270,000	270,000
Income (millions of $)	60	60	60	60
50% of economic activity affected				
Sales (millions of $)	74	74	74	74
Employment (no. of jobs)	180,000	180,000	180,000	180,000
Income (millions of $)	40	40	40	40

[a] Impacts for no action and the proposed action are presented for the first year of operation of an ACWA facility (2009).

Businesses and Housing. Although the evacuation of businesses as a result of an accident at PBA would likely be only on a temporary basis, disruption to the economy in the area likely to be evacuated (the CSEPP Protective Action Zone [PAZ]) surrounding PBA, consisting of Arkansas, Cleveland, Dallas, Grant, Jefferson, Lincoln, Lonoke, Pulaski, and Saline Counties) could be significant. In the worst-case scenario, all business sales and employee income in the PAZ would be lost as a result of the evacuation. An evacuation that might be required after an accident could last for many days. Since the exact duration of the evacuation cannot be determined, the consequent overall effect on local economic activity could not be determined. The impacts from a temporary, single-day evacuation of businesses in the PAZ are shown in Table 5.21-4. The data in the table may be used to estimate the impact of an evacuation over a multiple-day period.

Since it is likely that the presence of chemical agent and the risk of accidents at PBA are already captured in housing values nearby, an accident would probably not create significant additional impacts on the housing market, unless residents were prevented from quickly returning to their homes.

5.21.2.10 Environmental Justice

Within 30 mi (50 km) of PBA, the analysis of human health impacts anticipates that highly unlikely accident scenarios causing the widespread release of an agent would indeed result in high and adverse impacts (see Section 5.21.2.4). In such a situation, minority and low-income populations could suffer fatalities and serious injuries disproportional to their representation in the United States as a whole, if the wind direction at the time of the accident put the agent plume in the direction of census tracts with high numbers of minority or low-income populations (see Section 5.20.1 for identification of these census tracts). Such severe human health impacts would have similarly high and adverse socioeconomic consequences for the counties in the ROI, including the removal of some of the work force and the interruption of agricultural activity (see Section 5.21.2.9). However, such accidents have a low frequency of occurrence, on the order of 2×10^{-3} per year (i.e., one occurrence in 476 years), so the risk of the resultant disproportionate impacts would be low. Such impacts are not anticipated.

5.21.3 Impacts of Accidents during No Action (Continued Storage)

5.21.3.1 Land Use

Land use impacts from accidents under the no action alternative would be the same as those discussed under the proposed action (Section 5.21.2.1).

5.21.3.2 Waste Management and Facilities

Waste management impacts from accidents under the no action alternative would be the same as those discussed under the proposed action (Section 5.21.2.2).

5.21.3.3 Air Quality

After an accidental release of agent from a storage igloo at PBA, deposition of agent from air onto the ground surface and/or degradation in the environment would occur within a relatively short period of time (see Section 5.21.2.3). Therefore, long-term (e.g., more than a few days after release) adverse air quality impacts would not be expected from an accidental release of GB or VX.

5.21.3.4 Human Health and Safety

The U.S. Army and Federal Emergency Management Agency (FEMA) routinely conduct CSEPP exercises, in coordination with the communities surrounding PBA and with their participation. These exercises are required under a 1988 memorandum of understanding (MOU) between FEMA and the Army. Because chemical agent is currently stored at PBA, some risk from accidents is already present. For example, agent could be released if a pallet were accidentally dropped during daily operations (i.e., maintenance and inspection). The most probable event would be that the pallet would be dropped from 4 ft (1 m), the average height that a pallet could be dropped during normal operations. This event would involve three rounds of munitions spilling their contents on the igloo floor. Emergency response preparation for potential accidents of this type during normal PBA operations (e.g., maximum credible events [MCEs] for daily operations) is routinely evaluated under CSEPP (U.S. Army 1997).

For the EIS, the hypothetical accident for continued storage is assumed to be an event that could release the entire content of a storage igloo containing GB or VX rockets (e.g., a lightning strike). The probability of such an event occurring is low (on the order of 2×10^{-3}) but increases slightly with increasing length of continued storage. A lightning strike could result in an explosion and propagation by fire, causing the entire contents to explode and/or burn (SAIC 1997). Thus, the impacts of the lightning strike scenario are identical to those of the handling accident scenario (Section 5.21.2.4), because the estimated amount of nerve agent released is the same. The consequences from a lightning strike on a VX rocket storage igloo have been estimated in terms of the number of fatalities and are given in Table 5.21-2. A discussion of the impacts is provided in Section 5.21.2.4.

5.21.3.5 Soils

Potential impacts on soils associated with the accident scenarios considered under the no action alternative would be the same as those discussed under the proposed action (Section 5.21.2.5).

5.21.3.6 Water Resources

The factors that would affect water resources under the accident scenario would be the same for the no action and proposed action alternatives (Section 5.21.2.6). Impacts on surface water resources would be short-lived, although agent breakdown products might persist for some time. Impacts on groundwater resources would be unlikely and, if they did occur, would be negligible. Breakdown products might be detected, but their occurrence would be unlikely.

5.21.3.7 Biological Resources

The impact from an accident involving a lightning strike into a GB or VX rocket storage igloo in the CLA was evaluated for the no action alternative. The methodology used for assessing impacts to biological receptors under the no action accident scenario was the same as that used under the proposed action scenario (see Section 5.21.2.7). Table 5.21-1 presents the agent exposures and deposition areas that could result from this accident scenario for the 1% lethality, no deaths, and no effects distances to humans.

Terrestrial Habitats and Vegetation. Impacts on vegetation from GB deposited after the accident would be likely to be negligible. VX and its breakdown products could accumulate in plant tissues, but they would not be likely to cause adverse impacts because of the relatively low sensitivity of plants to nerve agents.

Wildlife. The impacts on wildlife under the no action accident scenario would be the same as those discussed under the proposed action scenario (see Section 5.21.2.7). Wildlife species with small home ranges, such as small mammals, reptiles, and amphibians, would remain in the exposure plume during the accident and would thus experience higher mortality rates than more mobile species. Mammals that did survive within this distance would suffer from blistering skin, respiratory system irritation, eye irritation, and other chronic effects known to occur to humans and laboratory animals (Appendix B in U.S. Army 1988).

Aquatic Habitats and Fish. The amount of GB or VX that would be deposited into aquatic habitats as the result of a lightning strike at a storage igloo would be the same as the deposition amounts that would result from a handling accident at a storage igloo (see Table 5.21-1). Aquatic habitats and fish would experience impacts the same as those discussed under the proposed action (Section 5.21.2.7).

Protected Species. The impacts on protected species from exposure to GB or VX released following an accident under the no action scenario (continued storage) would be the same as the impacts from an accident under the proposed action scenario (Section 5.21.2.7).

Wetlands. The impacts on wetland vegetation from a lightning strike at a storage igloo under no action (continued storage) would be the same as those from a handling accident at a storage igloo under the proposed action (Section 5.21.2.7).

5.21.3.8 Cultural Resources

Potential impacts on cultural resources associated with accident scenarios under the no action alternative would be the same as those discussed under the proposed action (Section 5.21.2.8). Appendix F discusses historic properties that could be affected by the modeled accidents under the no action alternative.

5.21.3.9 Socioeconomics

Potential impacts on socioeconomics associated with the accident scenarios under the no action alternative would be the same as those discussed under the proposed action (Section 5.21.2.9).

5.21.3.10 Environmental Justice

Potential impacts on environmental justice associated with the accident scenarios under the no action alternative would be the same as those discussed under the proposed action (Section 5.21.2.10).

5.22 CUMULATIVE IMPACTS

Cumulative impacts would result from adding the incremental impacts of the proposed action to other past, present, and reasonably foreseeable future actions. “Reasonably foreseeable future actions” are considered to be (1) actions that are covered in an environmental impact document that was either published or in preparation, (2) formal actions such as initiating an application for zoning approval or a permit, or (3) actions for which some funding has already been secured. Cumulative impacts could result from actions occurring at the same time or from actions occurring over a period of time.

Depending on the technology chosen, an ACWA pilot test facility would take up to 34 months to construct and would operate for up to about 36 months. This short operational time reduces the potential for cumulative impacts.

This cumulative impact analysis does not cover areas in which the proposed action and other reasonably foreseeable future actions would have no impacts or only localized impacts. Thus, the following areas were not analyzed for cumulative impacts:

- Geological resources,
- Cultural resources, and
- Communications infrastructure.

In addition, cumulative impacts were not assessed for accidents. Accidents are low-probability events whose exact nature and time of occurrence cannot reasonably be foreseen. Although their impacts may be large, these impacts cannot be added in a reasonably predictable manner to the impacts of other reasonably foreseeable future actions.

The analyses in this EIS were based on the assumption that a single, full-scale ACWA pilot test facility would be built. If two or more ACWA pilot test facilities would be built, they would share common facilities, and each one would be smaller than the full-scale pilot facility. Collectively, they would be similar in size to a full-scale pilot test facility, and their impacts together would reasonably be bounded by the impacts of the full-scale pilot and incinerator. The impacts of two ACWA pilot test facilities and/or an increase in weapons throughput would be reasonably bounded by the impacts of the full-scale pilot and incinerator. Thus, this cumulative impact analysis should represent the impacts from either one or two ACWA pilot test facilities.

Government and private organizations were contacted to identify reasonably foreseeable on-post and off-post actions for inclusion in this cumulative impact analysis. Organizations contacted included the following:

- Pine Bluff Arsenal;
- Southeast Arkansas Economic Development District;

- Entergy Arkansas;
- Reliant Energy;
- Arkansas Highway and Transportation Department;
- Arkansas Department of Environmental Quality, Air Quality Division, Permit Branch;
- Arkansas Department of Environmental Quality, Hazardous Waste Division, Active Site Branch;
- Southeast Arkansas Regional Planning;
- Economic Development Alliance of Jefferson County; and
- Arkansas Electric Cooperative.

5.22.1 Other Reasonably Foreseeable Future Actions

The impacts of past and present actions are included in the discussions of the affected environment. They are summarized here, when needed, in the corresponding discussions of cumulative impacts.

5.22.1.1 On-Post Actions

Some on-post actions have already been included in the proposed action as defined and analyzed in this document. These actions include building an access road to the ACWA pilot test facility. Actions included in the cumulative impact analysis include:

- Constructing and operating new facilities, including the conventional weapons SCWO and the new scrubber for the fluidized-bed incinerator, and
- Transferring land from PBA to another owner.

The impacts of these actions were assessed on the basis of information collected in discussions with post personnel (Smith 2001).

Other potential chemical demilitarization actions would be the operation of the PBCDF for demilitarization of stockpile munitions and the construction and operation of the nonstockpile SCWO. The PBCDF is under construction at PBA. A NEPA analysis has been completed for the PBCDF (U.S. Army 1997). Cumulative impacts for the ACWA proposed action are assessed on the basis of the assumption that there would be an operating PBCDF.

5.22.1.2 Off-Post Actions

The reasonably foreseeable off-post actions have been identified broadly as highway construction, housing development, and some light industrial expansion. Pine Bluff Energy has applied for a permit for a 250-MW electric turbine. This project was the only major industrial facility identified. Even though a permit has been applied for, future development of the project is unclear, and its impacts were not considered in this EIS (Smith 2001).

5.22.2 Land Use

PBA is in an area of interspersed agricultural land, woodland, industrial property, and built-up communities. Nearby federal lands are used by the Food and Drug Administration. Past and present land use on PBA itself has been primarily for industrial and related purposes associated with munitions production, storage, maintenance, testing, and disposal. Land use on the installation has also included administrative, residential, and recreational uses. The post covers about 15,000 acres (6,000 ha), of which about 8,700 acres (3,500 ha) is classified as forest. About 5,300 acres (2,200 ha) have been developed (Section 5.2).

About 1,500 acres (610 ha) of land at PBA has been transferred to another organization. Some temporary restrictions have been placed on the use of this land, since parts of it lie within the 1% lethality arcs and quantity-distance arcs of PBA facilities (Smith 2001).

An ACWA pilot test facility would have negligible effects on both on- and off-post land use (Section 5.2). The PBCDF is being constructed in a location consistent with current land use. The U.S. Army (1997) found no significant land use impacts from the PBCDF.

Depending on the site chosen, construction of an ACWA pilot test facility would disturb up to 37 acres (15 ha) of land — 25 acres (10 ha) for the site construction and 12 acres (5 ha) for utilities and access roads —in addition to the 45 acres (18 ha) of previously disturbed land affected by construction of the PBCDF. The two facilities together would disturb about 0.5% of the area of PBA. Use of Area A or Area B for an ACWA pilot test facility would be consistent with current and anticipated land use and would generate no significant impacts on on-post or off-post land use (Section 5.2). Construction of other on-post projects, including the nonstockpile SCWO and the conventional weapons SCWO, would disturb additional land and would follow current land use patterns. Cumulative land use impacts from an ACWA pilot test facility, the PBCDF, and other reasonably foreseeable on-post actions would not be significant.

Housing and commercial development is occurring near Whitehall (Smith 2001). These and other anticipated activities in the vicinity of PBA would not contribute cumulatively to significant adverse land use impacts when aggregated with impacts from on-post activities.

5.22.3 Infrastructure

Construction of the PBCDF should be completed before construction of the ACWA pilot test facility begins. This analysis assumes that construction and operation of the ACWA pilot test facility would overlap operation of the PBCDF.

Table 5.22-1 presents the expected utility demands for a baseline incinerator at PBA.

5.22.3.1 Electric Power Supply

Currently, PBA consumes about 27 GWh of electric power annually. Depending on the technology chosen, an ACWA pilot test facility could require up to 120 GWh of electric power annually (Table 5.3-2). The PBCDF would require another 33 GWh (Table 5.22-1). New power lines and service connections would be needed to supply the electric power needs of an ACWA pilot test facility. Other reasonably foreseeable on-post actions would require additional electric power and supply infrastructure. New off-post actions, including residential and commercial development, would add to the need for power from the utility. Discussions with local planners indicated no current or foreseen problems with electric supplies in the vicinity of PBA (Smith 2001).

TABLE 5.22-1 Estimated Annual Utility Demands for a Baseline Incinerator at PBA

Utility	Annual Demand
Electric power (GWh)	33
Natural gas (scf)	1,400,000,000
Process water (gal)	47,000,000
Potable water (gal)	5,500,000
Sewage produced (gal)	7,500,000

Source: Folga (2001).

5.22.3.2 Natural Gas Supply

The natural gas needs of an ACWA pilot test facility would be met by a gas line from the Binary Production Facilities as long as additional gas pipelines were added (Section 5.3.2). Additional new on-post facilities would require additional pipelines.

Reliant Energy has sufficient capacity to meet current and projected natural gas needs at PBA (Section 5.3.2). Current natural gas use at PBA is approximately 451 million scf (13 million m^3) annually. Depending on the technology chosen, an ACWA pilot test facility would require up to 140 million scf (4 million m^3) of natural gas annually (Table 5.3-2), and the PBCDF would require about an additional 1.4 billion scf (40 million m^3) annually (Table 5.22-1). Together, these two facilities would increase current natural gas consumption at PBA by about 340% during their temporary operating period while still supplying existing on-post use. Other reasonably foreseeable on-post actions would require additional natural gas. Overall, this use would represent a significant increase in the consumption of natural gas at PBA. New off-post actions, including residential and commercial development, would add to the gas required from the supplier. However, no problems are foreseen with natural gas supplies in the region around PBA (Smith 2001). Reliant Energy has reserves of around 710 billion scf (20 billion m^3) of natural gas, and discussions with local planners indicated no current or foreseen problems supplying natural gas in the vicinity of PBA (U.S. Army 1997; Smith 2001).

5.22.3.3 Water (Supply and Sewage Treatment)

No impacts on the water supply and infrastructure off post would occur, because these systems are self-contained at PBA.

Water for use at PBA is supplied by 12 on-post wells. Current water usage is approximately 320 million gal/yr (1.2 million m^3/yr). New water distribution pipelines and sewage pipelines, in addition to those supplying the PBCDF, would be needed for an ACWA pilot test facility. Part of this need could be supplied by existing lines built for the Binary Production Facilities. A new water storage tank for fire fighting and emergency needs would be needed for an ACWA pilot test facility. Additional new pipelines would also be needed for other reasonably foreseeable on-post facilities.

Water supply at PBA is sufficient to meet the needs of an ACWA pilot test facility and the PBCDF if they operated simultaneously (Section 5.3.3). Depending on the ACWA technology chosen, operation of an ACWA pilot test facility would require up to 24 million gal/yr (92,000 m^3/yr) of water, more than the amount that would be required during construction (Table 5.3-2). Operating the PBCDF, the new scrubber on the fluidized-bed incinerator, and the conventional weapons SCWO would require an additional 65 million gal/yr (246,000 m^3/yr) (Smith 2001; Table 5.22-1). Together with use by an ACWA pilot test facility, these actions would represent an increase of up to 28% over current water use at PBA and an increase of about 0.49% over current withdrawals in the vicinity of PBA. The nonstockpile

SCWO would process, at most, six weapons per day and would use only minor quantities of water. In view of the large PBA supply capacity, cumulative impacts on the water supply should not be significant.

Sewage treatment capacity would be sufficient to meet the needs of both an ACWA pilot test facility and the PBCDF. Currently, PBA discharges about 73 million gal/yr (280,000 m^3/yr) of sewage (Smith 2001). An ACWA pilot test facility and the PBCDF together would discharge about 15 million gal/yr (57,000 m^3/yr), less than 21% of the amount currently discharged (see Section 5.3) (Table 5.22-1). The total discharge would be less than the 430 million gal/yr (1.6 million m^3/yr) that PBA could treat. The conventional weapons SCWO and the new scrubber on the fluidized-bed incinerator have been included in existing plans. No adverse cumulative impacts to sewage treatment capacity should result from these and other reasonably foreseeable future actions at PBA.

5.22.4 Waste Management

Cumulative impact on waste management systems from construction and operation of an ACWA pilot test facility with concurrent operation of the PBCDF and other reasonably foreseeable actions would be minimal. Discussions with local planners indicated that current off-post hazardous and nonhazardous waste disposal capacities appear adequate (Smith 2001).

Hazardous wastes are transferred to the hazardous waste storage facility and shipped off post to permitted treatment and disposal facilities. PBA currently has a permitted hazardous waste landfill for disposal of remedial action wastes. In 1999, PBA generated 66 tons (59,000 kg) of hazardous wastes (Table 5.4-1). Nonhazardous wastes were disposed of off post or recycled. In 1999, PBA generated 7.8 million lb (3.6 million kg) of nonhazardous wastes. Sanitary wastes are treated in the on-post sewage treatment plant.

The quantities of construction wastes generated by an ACWA pilot test facility (Table 5.4-2) and other on-post actions would be small and would have minimal impacts on waste management systems. Depending on the ACWA technology chosen, operating an ACWA pilot test facility and the PBCDF could produce up to 6,500 tons (5,900,000 kg) of hazardous wastes annually, an increase of about 9,400% in the amount produced by PBA in 1999. Operating an ACWA pilot test facility and the PBCDF would produce amounts of hazardous and nonhazardous wastes that, while representing a substantial increase in amounts currently generated by PBA, would have a minimal impact in the vicinity of PBA (see Tables 5.4-3 and 5.4-4) (U.S. Army 1997). The U.S. Army (1997) found no significant impacts on waste management systems from operation of the PBCDF. The total stockpile of munitions to be demilitarized is fixed. If both an ACWA pilot test facility and the PBCDF were operated, fewer munitions would be demilitarized in each, and fewer wastes would be produced by each, than if a single facility was operated alone to process the entire stockpile. Either facility alone would produce a minimal amount of wastes. Together, they would produce wastes that, even when added to other reasonably foreseeable wastes, would have a minimal impact on waste management systems. The PBCDF would also produce brine salts, for which the ultimate disposal requirements are currently unclear (Section 5.4).

Sewage treatment capacity would be sufficient to meet the needs of both an ACWA pilot test facility and the PBCDF. Currently, PBA discharges about 73 million gal/yr (280,000 m^3/yr) of sewage (Smith 2001). An ACWA pilot test facility and the PBCDF together would discharge about 15 million gal/yr (57,000 m^3/yr), less than 21% of the amount currently discharged (see Section 5.3) (Table 5.22-1). The total discharge would be less than the 430 million gal/yr (1.6 million m^3/yr) that PBA could treat. The conventional weapons SCWO and the new scrubber on the fluidized-bed incinerator have been included in existing plans. No adverse cumulative impacts to sewage treatment capacity should result from these and other reasonably foreseeable future actions at PBA.

5.22.5 Air Quality

Emissions of toxic and hazardous air pollutants are of interest primarily with regard to their potential impacts on human health or biological resources. Sections 5.22.6 and 5.22.12 discuss potential cumulative impacts for these impact areas. This analysis assumes that the PBCDF would be operating during construction and operation of an ACWA pilot test facility.

5.22.5.1 Impacts of Construction

PM_{10} and $PM_{2.5}$ from fugitive emissions are the pollutants of principal concern during construction. Emissions of pollutants from worker and delivery vehicles, construction equipment, fuel storage, and refueling operations would be small, and off-post concentrations would not exceed NAAQS levels.

Table 5.22-2 summarizes the maximum ambient particulate concentrations, including the background concentration, from construction of an ACWA pilot test facility and operation of the PBCDF. Except for annual $PM_{2.5}$ concentrations, these concentrations are, at most, 84% of the NAAQS levels. The annual $PM_{2.5}$ level — when the particulate concentrations from the background level (93% of the NAAQS level), the operation of the PBCDF (2.7% of the NAAQS level), and the construction of an ACWA pilot test facility (3.5% of the NAAQS level) are accounted for — would exceed 99% of the NAAQS level. (Background levels in Arkansas tend to be near or above the annual $PM_{2.5}$ NAAQS level.) Other reasonably foreseeable on-post and off-post actions that emit particulates would contribute small or temporary concentrations to this level and would raise the cumulative annual $PM_{2.5}$ concentrations during the temporary period of ACWA pilot test facility construction activities.

TABLE 5.22-2 Air Quality Impacts from Construction of an ACWA Pilot Test Facility and Operation of the PBCDF at PBA[a]

		Concentration ($\mu g/m^3$)				
Pollutant	Averaging Time	Maximum Increment[b]	Background	Total	NAAQS	Percentage of NAAQS[c]
PM_{10}	24 hours	48	78	126	150	84 (32)
	Annual	1.5	26	28	50	56 (3.0)
$PM_{2.5}$	24 hours	25.4	29	55	65	84 (39)
	Annual	0.93	14.0	14.9	15	99.5 (6.2)

[a] See Section 5.5 for details on background and modeling.

[b] The maximum increment is the sum of the increment for the ACWA pilot test facility plus the increment for the PBCDF. The ACWA pilot test facility increment is based on Table 5.5-7. PBCDF PM_{10} impacts are based on U.S. Army (1997). PBCDF $PM_{2.5}$ impacts are assumed to be 100% of PM_{10} impacts during operation.

[c] Values are based on total concentration, including the background concentration and maximum increment, from simultaneous construction of an ACWA pilot test facility and operation of the PBCDF. Values in parentheses are based on the increment due to the two facilities alone without the background concentration.

5.22.5.2 Impacts of Operations

Table 5.22-3 summarizes the maximum ambient concentrations, including the background concentration, from concurrent operation of an ACWA pilot test facility and the PBCDF. Except for annual $PM_{2.5}$ concentrations, these concentrations are, at most, 56% of the NAAQS levels. The annual $PM_{2.5}$ level — when the background level (93% of the NAAQS level), operation of the PBCDF (2.7% of the NAAQS level), and operation of an ACWA pilot test facility (0.13% of the NAAQS level) are considered — would be more than 96% of the NAAQS level. (Background levels in Arkansas tend to be near or above the annual $PM_{2.5}$ NAAQS level.) Other reasonably foreseeable on-post and off-post actions that emit particulates would contribute small or temporary concentrations to this level and would raise the cumulative annual $PM_{2.5}$ concentrations during operation of an ACWA pilot test facility.

TABLE 5.22-3 Air Quality Impacts from Operation of an ACWA Pilot Test Facility and the PBCDF at PBA

		Concentration (μg/m^3)				
Pollutant	Averaging Time	Maximum Increment[a]	Background	Total	NAAQS	Percentage of NAAQS[b]
SO_2	3 hours	24	78	102	1300	7.8 (1.8)
	24 hours	7.2	29	36	365	9.9 (2.0)
	Annual	0.52	5.3	5.8	80	7.3 (0.65)
NO_2	Annual	3.4	21	24	100	24.3 (3.4)
CO	1 hour	91[c]	19,400	19,500	40,000	49 (0.23)
	8 hours	47[c]	5,300	5,380	10,000	54 (0.47)
PM_{10}	24 hours	6.7	78	85	150	56 (4.5)
	Annual	0.42	26	27	50	54 (0.84)
$PM_{2.5}$	24 hours	6.7	29	36	65	56 (10)
	Annual	0.42	14.0	14.4	15	96 (2.8)

[a] The maximum increment is the sum of the increment for an ACWA pilot test facility plus the increment for the PBCDF. The ACWA pilot test facility increment is based on the largest modeled values for any technology (Tables 5.5-8 through 5.5-10). PBCDF impacts are based on U.S. Army (1997). PBCDF $PM_{2.5}$ impacts assumed to be 100% of PM_{10} impacts during operation.

[b] Values are based on total concentration including background concentration and maximum increment, from simultaneous operation of an ACWA pilot test facility and the PBCDF. Values in parentheses are based on operation of the two facilities alone and ignore the background level.

[c] CO increment for PBCDF is from U.S. Army (1997).

5.22.6 Human Health and Safety — Routine Operations

5.22.6.1 Impacts of Construction

PM_{10} and $PM_{2.5}$ from fugitive emissions would be the pollutants of principal concern during construction. Emissions of pollutants from worker and delivery vehicles, construction equipment, fuel storage, and refueling operations would be small, and off-post concentrations would not exceed NAAQS levels.

Particulate NAAQS levels would not be exceeded off-post during construction of an ACWA pilot test facility with concurrent operation of the PBCDF (Section 5.22.5). However, even without any new actions, the current background annual $PM_{2.5}$ level is more than 93% of the NAAQS level. (Background levels in Arkansas tend to be near or above the annual $PM_{2.5}$ NAAQS level.) Concurrent construction of an ACWA pilot test facility and operation of the PBCDF would raise the maximum level to more than 99% of the NAAQS level (Table 5.22-2). Other reasonably foreseeable future actions would contribute small concentrations to this level and would temporarily raise the cumulative annual $PM_{2.5}$ concentrations during construction of an ACWA pilot test facility. Because of the preexisting high background level, the potential exists for cumulative adverse health impacts off post.

5.22.6.2 Impacts of Operations

A report by the Army's Center for Health Promotion and Preventive Medicine (USACHPPM 1997) presents the results of a human health risk analysis for the PBCDF and CIC. The fluidized-bed incinerator is in the CIC. The analysis included emission increases to account for startup, shutdown, and upsets.

Noncarcinogenic risks for operation of an ACWA pilot test facility are less than 0.7% of the levels considered to represent hazards (Table 5.7-2). USACHPPM (1997) concluded that stack emissions from the proposed PBCDF and emissions from the CIC should not adversely affect human health. All hazard indices were less than 20% of the level of 1 used in this EIS to indicate that adverse health impacts are unlikely. The new scrubber on the fluidized-bed incinerator would reduce emissions from that facility. No significant cumulative emissions impacts or health impacts are expected from the small nonstockpile SCWO or the conventional weapons SCWO. Cumulative adverse health impacts from an ACWA pilot test facility, the PBCDF, and other reasonably foreseeable on-post actions would be unlikely.

The maximum carcinogenic risk from agent processing to on-post and off-post populations associated with any ACWA pilot test facility would be 4×10^{-8}, or 2% of the 1×10^{-6} benchmark level generally considered representative of negligible risk. USACHPPM (1997) found a maximum excess cancer risk of 7×10^{-6}. If additivity for the carcinogens is assumed (a common assumption in risk assessments), the PBCDF and an ACWA pilot test facility, operating simultaneously, would represent an increased carcinogenic risk of approximately 7×10^{-6}. This total risk is in the lower end of the target range for residual carcinogenic risk of between 1×10^{-6} and 1×10^{-4} (one in 1 million to one in 10,000) used by the EPA to determine whether cleanup of hazardous waste sites is warranted (EPA 1990). This risk would still generally be considered negligible.

Risks from the maximum possible release of agent from an ACWA pilot test facility were estimated by assuming that agent could be emitted continuously from the filter farm stack at the agent detection limit of the in-stack monitor (Section 5.6). The detection limit is about 20% of the concentration allowed in the stack. Operations would be shut down if the detection limit were reached. Thus, the estimate of risk is conservative (i.e., it overestimates risk). The maximum estimated risk from ACWA pilot test facility emissions would be 0.03% of the maximum allowable level recommended by the CDC (Table 5.6-4). U.S. Army (1997) estimates the maximum risk from the PBCDF conservatively and assumes that emissions are at the allowable level. This EIS assumes lower emissions are at the detection limit. By adjusting the Army's results for lower emissions to put them at the detection limit, the maximum risk from the baseline incinerator would be 2.0% of the maximum allowable level recommended by the CDC. If an ACWA pilot test facility and a baseline incinerator were operating concurrently, the worst case would have agent levels equal to 2.03% of the allowable level. However, it is unlikely that such levels would be reached under routine operating conditions, because the two plant stacks would be at different locations, which would lead to lower maximum air concentrations than if all emissions were from one stack. Also, the assumption of continuous agent release at the detection limit (Section 5.6) is very conservative and results in overestimates of possible agent releases.

Only annual $PM_{2.5}$ concentrations would exceed 56% of the corresponding NAAQS levels during concurrent operation of an ACWA pilot test facility and the PBCDF (Table 5.22-3). Even without any new actions, the current background annual $PM_{2.5}$ level is at 93% of the NAAQS level. (Background levels in Arkansas tend to be near or above the annual $PM_{2.5}$ NAAQS level.) Concurrent operation of an ACWA pilot test facility and the PBCDF would raise the maximum level to about 96% of the NAAQS level. Other reasonably foreseeable future actions would contribute small concentrations to this level and raise the cumulative annual $PM_{2.5}$ concentrations during operation of the ACWA pilot test facility. Because of the preexisting high background level, the $PM_{2.5}$ level could be close to the standard during operation.

5.22.7 Noise

Measurements of noise levels around PBA were not available. Existing levels should be typical of rural areas, 30 to 35 dBA, except near the western boundary, where highway and traffic could raise background noise levels to the 40 to 45 dBA range. The maximum noise level from construction and routine operation of an ACWA pilot test facility would be less than 50 dBA at the nearest PBA boundary, to the southwest of Area A (Section 5.8). This level is less than EPA's guideline of 55 dBA for protection against annoyance and interference with outdoor activities. The U.S. Army (1997) found minimal impact from operation of the PBCDF at the nearest residence located east of the post. The PBCDF is located more than 1.5 mi (2.4 km) from the closest potential area for an ACWA facility. No perceptible cumulative noise impacts from these two facilities would be expected at off-post locations. Noise from a nonstockpile SCWO in Area C could add to noise from an ACWA pilot test facility. The increase would be far less than the barely perceptible level of 3 dBA, and the cumulative noise level would be less than EPA's 55-dBA guideline. Other reasonably foreseeable on-post actions would be sufficiently distant from the ACWA pilot test facility to preclude significant noise interactions. Thus, no significant off-post impacts on noise would be expected from an ACWA pilot test facility, the PBCDF, and other reasonably foreseeable on-post and off-post actions.

5.22.8 Visual Resources

PBA is located in an area of interspersed agricultural land, woodland, industrial properties, and built-up communities. Heavy vegetation and gently rolling hills restrict viewing distances on post. Much of PBA itself is of military and industrial character (Section 5.9).

Current actions and reasonably foreseeable on-post actions are in keeping with the existing visual environment of PBA. The areas proposed for an ACWA pilot test facility would not be visible from the perimeter fence. Traffic and dust during construction of an ACWA pilot test facility and other on-post facilities would affect the visual character of PBA but would be intermittent and temporary. During operations, a small steam plume from the ACWA pilot test facility would be visible. This plume would add to the visual impact of the large steam plume from the PBCDF. Any plumes associated with other reasonably foreseeable on-post facilities would also be small. The cumulative visual impact would remain in keeping with the visual character of PBA and would not be significant.

5.22.9 Soils

With the exception of the area of potential soil contamination resulting from deposition of air emissions released during operations, the analysis area for cumulative impacts on soils was limited to the immediate vicinity of the areas for the proposed ACWA facility. Activities disturbing soils have very localized impacts and hence little chance for cumulative impacts.

Construction of the PBCDF affected about 45 acres (18 ha) of previously disturbed soils. Construction of an ACWA pilot test facility in either Area A or Area B would disturb 25 acres (10 ha) of largely undisturbed soils and up to an additional 12 acres (4.8 ha) for development of the associated infrastructure.

Future construction actions not associated with an ACWA pilot test facility could contribute to soil erosion and accidental spills and releases. These impacts would be the same types of impacts as those associated with construction of an ACWA pilot test facility. The impacts would be temporary and minor if best management practices noted in Section 5.10.3 were followed. Overall, cumulative impacts from construction on soils should be negligible.

No significant cumulative impacts on surface soils would be expected from routine operation of an ACWA pilot test facility and other identified on-post and off-post actions, including routine operation of the PBCDF. Because of its low emissions, the ACWA pilot test facility should have no significant deposition impacts (Section 5.10.3). The emissions from the PBCDF would also be low (U.S. Army 1997). Other reasonably foreseeable on-post and off-post actions would be sufficiently far away or have sufficiently small emissions to preclude significant cumulative deposition at PBA. Thus, cumulative impacts on soils through deposition would be negligible.

5.22.10 Groundwater

All water used at PBA is withdrawn from the Sparta Aquifer. Past and current pumping of the aquifer has caused a water table decline of up to 160 ft (46 m) in the Pine Bluff area. Past operations at PBA have led to groundwater contamination in the Quaternary Aquifer and possibly the Cockfield-Jackson Aquifer. The contaminant sources have been removed, and a monitoring program is in place (Section 5.11.1).

To avoid contaminating groundwater, best management practices for avoiding leaks and spills during refueling and maintenance should be followed during construction of the ACWA pilot test facility and other on-post actions.

As indicated in Section 5.22.3.3, current water use at PBA is 320 million gal/yr (1.2 million m^3/yr). The city of Pine Bluff and local industry withdraw an additional 18 billion gal/yr (69 million m^3/yr) (Section 5.11.1). Depending on the ACWA technology chosen, operation of an ACWA pilot test facility would require up to 24 million gal/yr (92,000 m^3/yr) of water, more than the amount that would be required during construction (Table 5.3-2). Operating the PBCDF, the new scrubber on the fluidized-bed incinerator, and the conventional weapons SCWO would require an additional 65 million gal/yr (246,000 m^3/yr) (Smith 2001; Table 5.22-1). Together with an ACWA pilot test facility, these actions would represent an increase of up to 28% over current water use at PBA and an increase of about 0.49% over current withdrawals in the vicinity of PBA. The on-post wells could supply the increased need. Additional drawdown in the Sparta Aquifer during operation of an ACWA pilot test facility and the PBCDF would not be significant and would end when the facilities ceased operations. After that, groundwater levels would rebound. The nonstockpile SCWO would process, at most, six weapons per day and would use minor quantities of water. Other on-post and off-post actions would increase the total withdrawals and increase the decline in the water table. In view of the large groundwater supply capacity at PBA, cumulative impacts on groundwater supplies and flows should not be significant.

During routine operations of an ACWA pilot test facility and the PBCDF, all liquid process wastes would be recycled, and no process wastewater would be discharged (see Section 5.11) (U.S. Army 1997). Hence, no cumulative impacts involving discharges from these facilities would be expected on groundwater.

Although no data were available to account for the water supply needs for off-post actions, local planners indicated in discussions that water supplies in the vicinity of PBA are expected to be adequate to meet all needs (Smith 2001).

5.22.11 Surface Water

Some of the surface waters at PBA were contaminated by past production activities at the post. Pollution control equipment was installed in the 1980s, and long-term monitoring has indicated that surface water quality is improving. Surface water contamination from current activities has not been noted (Section 5.12). Groundwater, not surface water, is used for potable water supply by PBA and in Jefferson County.

To avoid contaminating surface waters, best management practices for avoiding leaks and spills during refueling and maintenance should be followed during construction of the ACWA pilot test facility and other on-post facilities. During routine operations of an ACWA pilot test facility and the PBCDF, all liquid process wastes would be recycled, and none would be discharged (see Section 5.12 and U.S. Army 1997). Hence, no cumulative impacts involving discharges from these facilities would be expected on surface waters. Process water from other reasonably foreseeable on-post actions would be treated before being discharged under the post's NPDES permit.

Sanitary sewage would be treated in the on-post treatment plant. An ACWA pilot test facility and the PBCDF together would discharge about 15 million gal/yr (57,000 m^3/yr), less than 21% of the amount currently discharged (see Section 5.3) (Table 5.22-1). Other reasonably foreseeable on-post facilities would discharge additional minor amounts of sewage. The cumulative additional discharge should not affect surface water flows on PBA or in the vicinity.

5.22.12 Biological Resources

5.22.12.1 Terrestrial Habitats and Vegetation

PBA covers about 15,000 acres (6,000 ha), of which more than 8,700 acres (3,500 ha) is classified as forest (Section 5.13.1). Both Area A and Area B are largely undisturbed and located in upland areas; the site of the PBCDF was previously disturbed. Area A is located in a dense hardwood/pine forest community. Area B is located in a grassland savanna community. Section 5.13 describes the potential impacts on vegetation and wildlife that might result from disturbing up to 37 acres (15 ha) of land, a small fraction of the 9,000 acres (3,500 ha) of forest at PBA, while constructing an ACWA pilot test facility and its associated infrastructure. Disturbance of this land would add to the 45 acres (18 ha) already disturbed during construction of the PBCDF (U.S. Army 1997). Construction of other on-post facilities would increase vegetation loss as sites were cleared. The conventional weapons SCWO would be located in the manufacturing area in the southern portion of the post, and constructing that facility would be unlikely to contribute to significant loss of vegetation. Building the nonstockpile SCWO in Area C would add to the overall vegetation loss. Use of standard erosion and runoff controls would mitigate impacts on vegetation due to sedimentation and erosion.

A screening-level ecological risk assessment for soils found that air emissions from routine operation of an ACWA pilot test facility would have negligible impacts on terrestrial habitats and vegetation (Section 5.13). The U.S. Army (1997) found that deposition from operation of the PBCDF would not affect significantly terrestrial biota in the vicinity of PBA. In addition, the total stockpile to be demilitarized is fixed; if both the ACWA pilot test facility and the PBCDF were operated, fewer munitions would be demilitarized in an ACWA pilot test facility, reducing its overall emissions and deposition. Given the small emissions potential of other reasonably foreseeable actions and their distance from the ACWA pilot test facility, cumulative impacts on terrestrial habitats and vegetation from an ACWA pilot test facility, the PBCDF, and other potential facilities should be negligible during routine operations.

Impacts on terrestrial habitats and vegetation associated with reasonably foreseeable off-post activities would be related to the size of the developments and the land occupied. These impacts could not be determined accurately but are expected to be minor.

5.22.12.2 Wildlife

Both Area A and Area B are largely undisturbed and located in upland areas; the site of the PBCDF was previously disturbed. Area A is located in a dense hardwood/pine forest community. Area B is located in a grassland savanna community. Section 5.14 describes the impacts on wildlife that might result from disturbing up to 37 acres (15 ha) of land, a small fraction of the 9,000 acres (3,500 ha) of forest at PBA, while constructing an ACWA pilot test facility and its associated infrastructure. Loss of this amount of potential habitat at Area A or

Area B should not eliminate any wildlife species from PBA (Section 5.14). Disturbance of this land would add to the 45 acres (18 ha) already disturbed during construction of the PBCDF (U.S. Army 1997). Construction of other on-post facilities would increase habitat loss as areas were cleared. The conventional weapons SCWO would be located in the manufacturing area in the southern portion of the post, and constructing it would be unlikely to cause significant loss of habitat. Building the nonstockpile SCWO in Area C would add to the overall habitat loss.

Each new, on-post construction activity would also affect wildlife by increasing human activity and construction traffic. Cumulatively, these increases would cause additional deaths among less mobile species and displace additional wildlife during the construction period. Increased noise would displace additional small mammals and potentially lead to increased habitat abandonment by songbirds.

A screening-level ecological risk assessment for soils found that air emissions from routine operation of an ACWA pilot test facility would have negligible impacts on wildlife (Section 5.14). The U.S. Army (1997) found that deposition from operation of the PBCDF would not affect terrestrial biota in the vicinity of PBA significantly and that inhalation would not be a significant exposure pathway. In addition, the total stockpile to be demilitarized is fixed; if both the ACWA pilot test facility and the PBCDF were operated, fewer munitions would be demilitarized in an ACWA pilot test facility, reducing its overall emissions and deposition. Given the small emissions potential of other reasonably foreseeable actions and their distance from the ACWA pilot test facility, cumulative impacts on wildlife from an ACWA pilot test facility, the PBCDF, and other potential facilities should be negligible during routine operations.

Operation of an ACWA pilot test facility, the PBCDF, and other possible on-post facilities would increase the number of workers worker and deliveries. Roadkills would increase as a result of the consequent increase in traffic.

Given the distance of other reasonably foreseeable on-post actions from the potential areas for an ACWA pilot test facility and the small size of these projects, additive noise impacts would be negligible. Overall noise impacts would be the same as those associated with each action considered by itself.

Impacts on wildlife associated with reasonably foreseeable off-post actions would depend on the size of the developments and the land occupied. These impacts could not be determined accurately but are expected to be minor.

5.22.12.3 Aquatic Habitats and Fish

Aquatic habitats and fish would not be likely to be affected during construction of an ACWA pilot test facility and other reasonably foreseeable on-post facilities if runoff and siltation control measures were employed. Any impacts would add to those already caused by construction of the PBCDF. Avoiding construction activities along the tributaries of Triplett Creek in Area B would lessen the potential for downstream impacts on aquatic biota (Section 5.15).

During routine operations, air emissions and deposition from an ACWA pilot test facility would be small and would not affect aquatic habitats and fish adversely (Section 5.15). The U.S. Army (1997) found that routine operation of the PBCDF would have little or no potential for negative impacts on aquatic biota in the vicinity of PBA. In addition, the total stockpile to be demilitarized is fixed; if both the ACWA facility and the PBCDF were operated, fewer munitions would be demilitarized in an ACWA pilot test facility, thus reducing its overall emissions and deposition. Given the small emissions potential of other reasonably foreseeable actions and their distance from potential sites for an ACWA pilot test facility, cumulative impacts on aquatic habitats and fish from an ACWA pilot test facility, the PBCDF, and other potential facilities would be negligible during routine operations.

5.22.12.4 Protected Species

No federally listed species are known to occur at PBA (Section 5.16). The U.S. Army (1997) found little or no potential for negative impacts on protected species from routine operation of the PBCDF. Off-post impacts on protected species from the low emissions and deposition from an ACWA pilot test facility, the PBCDF, and other reasonably foreseeable on-post actions would be negligible.

5.22.12.5 Wetlands

Both Area A and Area B contain wetlands that could be eliminated or otherwise adversely affected by construction of an ACWA pilot test facility (Section 5.17). Construction in Area A could eliminate a 0.4-acre (0.2-ha) palustrine emergent wetland that is temporarily flooded and represents about 0.3% of the emergent wetland type on PBA. Construction in Area B could eliminate two wetlands that make up 1.2 acres (0.5 ha) of palustrine forested wetlands that are temporarily flooded and represent about 0.15% of forested wetlands on PBA. There are no bodies of water or streams adjacent to the site of the PBCDF. Construction of utility corridors and uncontrolled runoff from the areas could adversely affect downstream wetlands, and about 0.04 acre (0.02 ha) of a 0.9-acre (0.4-ha) scrub/shrub temporarily flooded wetland could be eliminated by filling during construction of the access road to Area B. Wetlands are also located in Area C, in which the conventional weapons SCWO will be built, but the potential for impacts from that action was not assessed in this EIS. Avoidance of wetlands or the use of standard practices for controlling runoff, sedimentation, and erosion for all on-post construction projects would lessen the potential for wetland impacts.

Routine operation of an ACWA pilot test facility and the PBCDF would have negligible impacts on wetlands (Section 5.17 and U.S. Army 1997). In addition, the total stockpile to be demilitarized is fixed; if both an ACWA facility and the PBCDF were operated, fewer munitions would be demilitarized in an ACWA pilot test facility, thus reducing its overall emissions and deposition. Given the small emissions potential of other reasonably foreseeable actions, cumulative impacts on wetlands from an ACWA pilot test facility, the PBCDF, and other potential on-post facilities would be negligible during routine operations.

Reasonably foreseeable future off-post actions would be too far away to affect wetlands on PBA.

5.22.13 Socioeconomics

Construction and operation of any of the ACWA technologies could produce cumulative socioeconomic impacts if construction and operational activities occurred concurrently with other existing or future activities at PBA in the four-county ROI surrounding the post.

Other reasonably foreseeable on-post actions might create additional demands on on-post utility and transportation infrastructures if they occurred concurrently with construction and operation of an ACWA pilot test facility. However, other reasonably foreseeable on-post actions would be expected to require employment of far fewer people than would any ACWA pilot test facility. In the area surrounding the post, any industrial, commercial, and residential development that might occur could also lead to cumulative impacts on local socioeconomic resources if planning for impacts was not adequate.

The cumulative socioeconomic impacts from operation of any of the ACWA technologies, together with the operation of the PBCDF and existing or planned economic development activities, would be relatively small. Construction of an ACWA pilot test facility would be expected to generate approximately 1,400 direct and indirect jobs in the ROI during the peak year, with employment during the operation of both facilities likely to be about 3,000. Operations jobs for both facilities would be filled partially by workers moving into the ROI. However, in-migration of workers would have only a minor effect on the local housing market. Project-related demand for rental housing during the peak year of construction of an ACWA facility would require approximately 1% of the vacant rental housing stock, with about 14% of vacant owner-occupied housing required during operation of both an incinerator and an ACWA facility. If current vacancy rates and housing development continue, adverse cumulative impacts on housing would not be expected to occur.

A number of local road expansion projects, including a southern bypass of Pine Bluff that is to be built from 2004 until 2007, are planned for the next five years. Employment growth is expected to occur in the ROI in the near future as a result of the construction of a number of new industrial facilities, including a cogeneration plant in Wrightsville. More specific information on the size and precise timing of all of these projects is not available. However, judging from the size of the impact from similar activities on other rural communities, even if these projects were to occur during construction and operation of an ACWA pilot test facility and the PBCDF, the potential cumulative impact of these activities, together with other reasonably foreseeable on-post actions on the local economy, local labor markets, and public and community services, would be minor.

Local labor markets would probably not be adversely affected by the construction of an ACWA pilot test facility or the concurrent operation of an ACWA pilot test facility and the PBCDF and projected off-post activities. The PBA is located in the Little Rock Metropolitan Statistical Area (MSA), in which a variety of occupations are represented and in which the unemployment level is high enough to provide workers to meet the local labor demand created by both projects.

Concurrent operation of the PBCDF, an ACWA pilot test facility, and projected off-post activities might have moderate impacts on the local transportation network. Construction of an ACWA pilot test facility would result in an additional 1,200 daily trips on SR 365/SR 104, the local road segment most heavily used by existing post employees. These trips would represent a 26% increase in annual average daily traffic. Concurrent operation of both facilities would result in an additional 1,500 daily trips, or an increase of 33% in annual average daily traffic on SR 365/SR 104.

Additional local public service employees, medical services, and teachers would be needed if the ACWA pilot test facility and PBCDF operation, together with projected off-post activities, occurred concurrently. However, given sufficient planning, local public service providers should be able cope with the additional demands on public service through increases in city, county, and school district revenue collections.

5.22.14 Environmental Justice

Environmental justice impacts would be related to socioeconomic and human health impacts. No environmental justice impacts are anticipated from construction and routine operation of an ACWA pilot test facility (Section 5.20). During the construction and routine operations of any ACWA technology at PBA, high and adverse impacts are not anticipated on either socioeconomic-related activities or human health (Sections 5.7 and 5.19). The construction and operation of an ACWA pilot test facility would add to the environmental justice impacts of a PBCDF. However, the cumulative impacts associated with construction and routine operations are not anticipated to contribute to high and adverse impacts on populations (see Sections 5.22.6 and 5.22.13). As a result, significant cumulative environmental justice impacts from construction and routine operation of an ACWA pilot test facility, the PBCDF, and other reasonably foreseeable actions are not anticipated.

5.23 AGRICULTURE

This section was prepared in response to public comment on the draft of this EIS (see Volume 2, Section 2, Part DD of this final EIS). This assessment describes agriculture near PBA and evaluates whether toxic air pollutants from pilot facility operations would impact crops and livestock. It also assesses potential agricultural losses from an accident involving release of chemical agent.

5.23.1 Current Environment

5.23.1.1 Land Use

The region of influence (ROI) used to assess impacts on agriculture consists of 10 counties located entirely or partly within an area 30 mi (50 km) around the installation. This agricultural ROI contains 4.6 million acres (1.9 million ha) of land, of which 1.6 million acres (650,000 ha) (35%) were in farms in 1997 (USDA 1999). The ROI contained 3,800 farms in 1997, with more than half operated by full-time farmers (Table 5.23-1). In the ROI counties, average farm size ranged from 148 to 823 acres (60 to 333 ha).

TABLE 5.23-1 Farms and Crop Acreage in the Agricultural Region of Influence around PBA in 1997[a]

Farms and Land	Land (acres) and Farms (no.): ROI	Land (acres) and Farms (no.): State
Land in farms (acres)	1,614,886	14,364,955
Number of farms	3,796	45,142
Full-time farms	1,942	22,300
Average farm size (acres)	148 – 823	318
Total cropland (acres)	1,296,035	10,062,289
Harvested cropland (acres)	1,125,799	7,665,490

[a] The agricultural ROI is composed of the following counties: Arkansas, Cleveland, Dallas, Grant, Hot Spring, Jefferson, Lincoln, Lonoke, Pulaski, and Saline.

Source: USDA (1999).

5.23.1.2 Employment

Agriculture was historically only a moderately significant local source of employment in the 10-county ROI, and its importance declined during the 1990s. Farm workers and agricultural services employment totaled 7,158, contributing a little less than 3% to total employment in the region in 1999. In Jefferson County, agricultural employment accounted for about 4% of total employment (U.S. Bureau of the Census 2001a). Recent estimates of the number of migrant and seasonal farm workers indicate that about 1,700 are employed annually in the ROI. The total statewide is 16,100 (Larson 2000). Within the South Census Region in 1998, about half of such farm workers were White, 37% were Hispanic, and the remainder were Black and other racial/ethnic groups (Runyan 2000).

5.23.1.3 Production and Sales

Beans, rice, wheat, cotton, and hay are the primary crops harvested (Table 5.23-2). Cattle and poultry are the major types of livestock production. Farms in the region generated \$570 million in agricultural sales in 1997, representing 17% of total agricultural sales in the state as a whole. The majority of sales (69%) consisted of crops, with a smaller contribution made by livestock (Table 5.23-3) (USDA 1999).

5.23.2 Site-Specific Factors

The only aspect of pilot facility operations that could have an impact on agriculture is the release of substances that could cause toxic effects on crops or livestock. Routine or fluctuating operations of a pilot facility or an accident could release organic or inorganic compounds, including agent or processing by-products, to the environment (see Sections 5.5 and 5.6). Atmospheric releases could result in the widespread dispersal and deposition of contaminants. Exposures might result in lethal effects, reduced growth or other limiting effects, or no observable effect.

5.23.3 Impacts of the Proposed Action

Impacts from construction and operations are discussed below. This analysis considers effects on agricultural production, employment, and sales. The impacts of no action are provided for comparison.

TABLE 5.23-2 Agricultural Production in the Agricultural Region of Influence around PBA in 1997[a]

Crops and Livestock	Crops (acres) and Livestock (no.) ROI	State
Selected crops harvested		
Beans	573,107	3,571,342
Rice	284,620	1,384,969
Wheat	170,554	763,388
Cotton	118,452	962,272
Hay	80,802	1,232,771
Sorghum	9,705	130,948
Livestock inventory		
Cattle and calves	93,879	1,770,248
Hogs and pigs	1,432[b]	858,741
Sheep and lambs	160[b]	8,284
Layers and pullets	124,841[b]	20,213,603
Broilers sold	48,285,986[b]	1,003,161,769

[a] The agricultural ROI is composed of the following counties: Arkansas, Cleveland, Dallas, Grant, Hot Spring, Jefferson, Lincoln, Lonoke, Pulaski, and Saline.

[b] ROI inventory is an underestimate due to data unavailability for some counties.

Source: USDA (1999).

5.23.3.1 Impacts of Construction

Construction impacts would be confined to the installation; therefore, no significant impacts on agriculture would be likely from facility construction activities.

5.23.3.2 Impacts of Routine Operations

During routine operations, crops and livestock in the vicinity of the pilot test facility would be exposed to atmospheric emissions from the boiler stack and process stack. All such facility emissions, including emissions of criteria pollutants, organic compounds, and trace elements, would be within applicable air quality standards (see Sections 5.5 and 5.6).

TABLE 5.23-3 Sales by Farms in the Agricultural Region of Influence around PBA in 1992 and 1997[a]

	Sales (millions of $)	
Product	1992	1997
Livestock	104.5	178.3
Harvested crops	306.4	391.4
Agricultural ROI total	410.9	569.7
State total	4,159.5	5,479.7

[a] The agricultural ROI is composed of the following counties: Arkansas, Cleveland, Dallas, Grant, Hot Spring, Jefferson, Lincoln, Lonoke, Pulaski, and Saline.

Sources: USDA (1994, 1999).

A screening-level ecological/agricultural risk assessment was conducted to assess the risk to agricultural resources from deposition of air emissions during routine operations of each of the three pilot test technologies. For this evaluation, it was assumed that all emissions were deposited on the soils within a circle defined by the distance from the proposed pilot test site to the nearest PBA installation boundary. This assumption provides an upper limit on possible deposition at off-site locations. Actual deposition of pollutants would be less than this value and would tend to decline with distance from PBA. Within this area, the deposited emissions were assumed to be completely mixed into the top 1 cm (0.5 in.) of soil. The resulting pollutant concentration was compared with the lowest soil benchmark value available from the EPA and state sources. These benchmark concentrations for soil are based on conservative ecological endpoints and sensitive toxicological effects on plants, wildlife, and soil invertebrates. Soil chemical concentrations that fall below the benchmark are considered to have negligible risk. Those chemicals that exceed the benchmark values are considered to be contaminants of concern and would be evaluated in further detail. The only chemical emitted by a pilot test facility that, when deposited on soils, would exceed the soil benchmark values was chloroform from Neut/GPCR/TW-SCWO pilot testing, which exceeded its benchmark by a factor of seven. However, because of its volatility and low solubility in water, it is unlikely that chloroform would be deposited on soil to the extent assumed in the analysis. It would be more likely to volatilize and be dispersed. Potential inhalation exposures from chloroform gas would be at levels thousands of times lower than levels at which effects have been induced in laboratory animals. The analysis indicates that the risks of impacts on agriculture from maximum concentrations of emissions from operations would be negligible (Tsao 2001c). Off-site concentrations would be substantially lower due to the effect of emission dilution over a larger area.

Most of the toxic air pollutants emitted by a pilot test facility (Section 5.6) would be from the boiler stack, a source type commonly found in any combustion facility that requires fuel to heat up the system. Boiler emissions would be followed in quantity by the emissions from the emergency diesel generator, which would operate only in case of power failure. The technology-specific emissions would contribute very little to the overall deposition of metals and organics onto soil. There is no evidence that deposited residuals from agent emitted due to fluctuating operations would bioaccumulate through the food chain (USACHPPM 1999b).

5.23.3.3 Impacts of Accidents

Section 5.21 describes potential accidents for both the proposed action and no action, including a catastrophic event that would release agent to surrounding land areas. Although extremely unlikely, release of agent might affect a major portion of the ROI. The largest impact of an accident on agriculture would result if all of the crops and livestock produced in a single season in the ROI were interdicted (either by federal or state authorities) and removed from the marketplace. The impacts from such losses in agricultural output on the economy of the counties within the 30-mi (50-km) radius surrounding BGAD would be significant. Table 5.23-4 presents three scenarios of regional losses of employment and income associated with 50, 75, or 100% loss of agricultural production (see Appendix G). These scenarios are presented for each of the pilot test technologies and for no action. The estimated losses do not include the losses that would occur in the case of death of breeding stocks of animals. Because scenarios involving widespread agent release were identified for both the proposed action and no action, the magnitude of such losses is unlikely to differ between the proposed action and no action.

5.23.4 Impacts of No Action

5.23.4.1 Impacts of Routine Operations

The agricultural impacts of continuing routine operations at PBA would be negligible and as included in baseline conditions for the PBA region.

5.23.4.2 Impacts of Accidents

Potential impacts on agriculture associated with the accident scenarios under the no action alternative would be the same as those discussed under the proposed action alternatives (Section 5.23.3.3).

TABLE 5.23-4 Agricultural Impacts of Accidents at PBA Associated with the Proposed Action and No Action[a]

Parameter	Neut/ SCWO	Neut/ GPCR/ TW-SCWO	Elchem Ox	No Action
Impacts to the regional economy from a one-year loss of agricultural output				
100% loss of agricultural output				
Employment (no. of jobs)	23,900	23,900	23,900	23,900
Income (millions of $)	1,030	1,030	1,030	1,030
75% loss of agricultural output				
Employment (no. of jobs)	17,900	17,900	17,900	17,900
Income (millions of $)	770	770	770	770
50% loss of agricultural output				
Employment (no. of jobs)	11,900	11,900	11,900	11,900
Income (millions of $)	510	510	510	510

[a] Impacts for no action and the proposed action are presented for the first year of operation of an ACWA facility (2009).

5.24 OTHER IMPACTS

5.24.1 Unavoidable Adverse Impacts

Most potential adverse impacts identified in this EIS would either be negligible or could be avoided through careful facility siting and adherence to best management practices during the construction and operation of industrial facilities. However, some minor to moderate unavoidable adverse impacts could result from implementation of an ACWA technology. These are described in this section.

ACWA facility construction activities, including land clearing and moving of personnel and equipment in the construction staging area(s), would require disturbance of as much as 25 acres (10 ha) and could result in unavoidable adverse impacts comparable to those that would occur at any construction site of similar size. Depending on the construction area chosen, an additional 5 to 12 acres (2 to 5 ha) could be disturbed during utility and access road construction.

- As much as 37 acres (15 ha) of vegetative and terrestrial habitats could be disturbed. Cleared lands would include dense hardwood/pine forest community for Area A and grassland savanna community composed of loblolly pine trees and grasses for Area B. Most disturbances would be short-term (less than 34 months) and would be mitigated through revegetation and careful construction siting and planning.

- Wildlife would be affected by landscape modification, loss of habitat, increased human activity in the construction area, increased traffic on local roads, and noise. Less mobile and burrowing species (such as amphibians, some reptiles, and small mammals) could be killed during vegetation clearing and other site preparation activities. The increased traffic volume would likely increase roadkills to species such as the eastern cottontail, gray and eastern fox squirrels, opossum, and raccoon along the new access road and existing roads. Overall, most disturbances would be short-term (less than 34 months), and construction at either Area A or Area B would not be expected to permanently displace any mammals or birds.

- Air quality would be affected during construction as a result of increased fugitive dust emissions (PM_{10} and $PM_{2.5}$). Background concentrations of $PM_{2.5}$ are already near the maximum levels of applicable air quality standards. Emissions from construction of an ACWA pilot test facility, although they would be very low overall, would result in levels near the applicable NAAQS, primarily because of high background concentration levels. Similarly, emissions of $PM_{2.5}$ during operations would be very low, but would be near the maximum NAAQS because the background levels are already high.

- A small number of worker injuries would be expected during construction of an ACWA facility: 22 for Neut/SCWO, 23 for Neut/GPCR/TW SCWO, and 24 for Elchem Ox. Worker injuries were estimated on the basis of the number of workers and duration of construction. When workers follow established safety precautions, the risk of worker fatalities is very low, and no worker fatalities would be expected.

The normal operations of an ACWA facility would have minor unavoidable adverse impacts. Facility workers would be subject to some risks from operations, and an estimated 49 worker injuries would be expected for each of the technologies; no worker fatalities would be expected. Worker injuries were estimated on the basis of the number of workers and duration of operations. There would also be minor increases in emissions of air pollutants, but these emissions would be well below allowable levels and would not significantly affect human health, ecological resources, or wetlands. Impacts related to fluctuating operations are also expected to be minimal, given the safety features that would be built into the design of ACWA facilities, which would prevent migration of contaminants to the environment in the event of a spill or other operational accident. While there would be significant unavoidable adverse impacts related to a catastrophic accident, the probability of this scenario is extremely remote.

5.24.2 Irreversible and Irretrievable Commitment of Resources

Irreversible commitments are those that cannot be reversed (i.e., the resource is permanently lost or consumed). Irreversible commitments that would result from the construction and operation of a proposed ACWA pilot test facility include consumption of electricity, natural gas, and fuel oil, as described in Section 5.3. Materials such as the concrete and steel used to construct the pilot test facility would also generally be irreversible commitments because they would probably not be recyclable because of potential agent contamination. Data on the quantities of construction materials required for an ACWA pilot facility are provided in Kimmell et al. (2001).

Irretrievable commitments are those that are lost for a period of time. Irretrievable commitments that would result from the construction and operation of a proposed ACWA pilot test facility would include water and habitat. Implementation of an ACWA technology would consume both process and potable water for the period of construction and operations (i.e., less than six years total). (Amounts of water consumed are discussed in Section 5.3.) When proposed operations ended, the water used by the ACWA technology would be available for other uses. Habitat lost because of the construction of an ACWA pilot test facility would also represent an irretrievable commitment. Habitat in the footprint of an ACWA pilot facility would be lost during the period of construction and operations (i.e., less than seven years total). After decontamination and decommissioning, the land could be revegetated, and habitat could be restored. Depending on the methods chosen for decommissioning, habitat losses could also be considered irreversible.

5.24.3 Short-Term Uses of the Environment and Enhancement of Long-Term Productivity

Constructing and operating one or more pilot test facilities would be an action of limited duration — less than six years. Construction would disturb soils, wildlife, and other biota, and it would produce temporary air emissions. Operations would produce air emissions, liquid effluents, and liquid and solid wastes. Air emissions and liquid effluent releases would be temporary, ceasing at the end of the project life. Disposal of wastes on post and off post would be a long-term commitment of land with restricted use. Construction and operation of one or more pilot test facilities would have short-term socioeconomic impacts for the duration of construction and pilot testing by creating jobs, increasing tax revenues, and increasing demand for housing and public services.

After pilot testing, the ACWA facility might be used to destroy the remaining on-post ACW stockpile. At the end of stockpile destruction, the facilities would be decontaminated and demolished, and the land would be returned to long-term productivity.

The pilot testing of an ACWA technology system would not substantially reduce or increase the risks to the public from accidents involving chemical agent. This situation would occur because the accidents with the greatest consequences, although highly unlikely, are associated with ACW storage, and ACW storage would continue during pilot testing. The consequences from highly unlikely accidents involving agents at a pilot test facility would be less than the consequences from similar highly unlikely accidents, including ACW storage.

5.25 MITIGATION

For environmental resource areas where adverse impacts have been identified, mitigation measures have been developed to minimize or avoid potential impacts from constructing and operating an ACWA pilot facility. The mitigation measures are outlined below. Because no adverse impacts on land use, infrastructure, noise, visual resources, aquatic species, protected species, socioeconomics, or environmental justice were identified, no mitigation would be required for these resource areas.

5.25.1 Waste Management

Adequate facilities exist to handle hazardous and nonhazardous wastes that would be generated by construction activities. Large potentially hazardous waste streams would be produced from operating either of the neutralization pilot test facilities; Elchem Ox would generate a smaller volume of hazardous wastes. In addition, PCBs have been identified as a constituent in the firing tubes of M55 rockets held in the inventory at PBA. PCB concentrations in wastes generated during the pilot-scale testing of ACWA technologies would need to be evaluated and would probably be subject to regulation under TSCA. The Army would work with regulators to develop procedures for handling potentially hazardous wastes resulting from ACW destruction. These procedures might include conducting tests to determine the toxicity of wastes, developing a process to stabilize salt wastes, sending wastes to a permitted hazardous waste disposal facility, or others.

5.25.2 Air Quality — Criteria Pollutants

Fugitive dust emissions would be generated during construction of an ACWA pilot facility. To minimize dust emissions, access roads would be paved with asphaltic concrete, and standard dust suppression measures (i.e., watering) would be employed at the construction areas.

5.25.3 Air Quality — Toxic Air Pollutants

No significant emissions of hazardous air pollutants are expected during construction of an ACWA pilot facility. During operations, the ACWA facility would be equipped with multiple carbon filter banks and with agent monitoring devices between banks to ensure that, in the unlikely event that some agent was not destroyed in the neutralization process and subsequent treatment, it would be detected, and the causes would be mitigated immediately.

5.25.4 Human Health

Some risk to workers would result from constructing and operating an ACWA pilot facility. Workers would adhere to safety standards and use protective equipment as necessary to reduce these risks. Also, the ACWA facility would be designed and operated to contain potential agent emissions to air, water, or soils. Design components (e.g., recycling process effluents, surrounding the facility with a berm, installing automated agent detection devices) would be incorporated to minimize operational and accidental emissions. Emergency response procedures are in place to protect human health and safety, both on post and off post, in the unlikely event of a significant release to the environment from a catastrophic accident (see Section 5.21).

5.25.5 Geology and Soils

Best management practices (e.g., use of siltation fences, berms, and liners; revegetation of disturbed land following construction) would be employed to minimize the potential for soil erosion potentially caused by construction of an ACWA pilot facility. A berm would surround the facilities to contain any potential releases from spills or fluctuating operations. In addition, the facilities would be designed with many safety features (e.g., detection devices, automatic shutoff) that would prevent migration of spills from an operational accident.

5.25.6 Groundwater, Surface Water, and Wetlands

Best management practices would be implemented for erosion and sedimentation control to avoid impacts on groundwater, surface water, or wetlands, and disturbed areas would be immediately replanted with native species. A buffer area would be maintained around wetlands during construction, and construction would avoid the small palustrine wetland located on the southwest margin of Area A and the two wetlands located on Area B, including locating facilities immediately adjacent to wetlands.

A berm would surround the facilities to contain any potential releases from spills or fluctuating operations. The facilities would be designed with many safety features (e.g., detection devices, automatic shutoff) to prevent migration of spills from an operational accident.

5.25.7 Vegetation and Wildlife

Construction could affect as much as 37 acres (15 ha) of vegetative and terrestrial habitat. Construction areas would be immediately replanted with native vegetation, and no long-term impacts are expected.

5.25.8 Cultural Resources

The probability of adverse effects on cultural resources because of the construction of one or more or the proposed facilities appears to be small. Area A has not been surveyed for archaeological resources, but on the basis of past disturbance in the area, the potential for finding intact cultural deposits that would meet significance criteria for listing on the NRHP in this location appears small. Area B has been surveyed, and no culturally important sites were recorded. While it is not likely, it is possible that archaeological artifacts could be encountered during construction activities. If cultural material were unexpectedly encountered during ground-disturbing activities at previously disturbed or surveyed areas of PBA, construction would stop immediately, and the Arkansas SHPO and a qualified archaeologist would be consulted to evaluate the significance of the cultural artifacts.

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