4 ANNISTON ARMY DEPOT (ANAD), ALABAMA

4.1 INTRODUCTION

ANAD is located in a rural area of northeastern Alabama in Calhoun County, about 90 mi (144 km) west of Atlanta, Georgia; 49 mi (78 km) east of Birmingham, Alabama; and about 10 mi (19 km) west of Anniston (see Figure 4.1-1). ANAD covers 15,279 acres (6,190 ha) of land, with more than 11,000 acres (4,430 ha) of woodlands, about 5 acres (2 ha) of lakes and streams, and about 1,700 acres (680 ha) of improved grounds containing buildings and structures.

ANAD is under the command and control of the U.S. Army Tank Automotive Command (TACOM) and is also host to a number of tenant organizations. ANAD performs depot-level maintenance for combat vehicles, artillery, and various weapons systems. It also provides storage and demilitarization of conventional munitions and storage of chemical surety materiels and munitions.

ANAD has been affected by three Base Realignment and Closure (BRAC) Committee actions, which, for the most part, have resulted in increased mission responsibilities at the depot. First, in 1988, the Coosa River Ammunition Storage Annex was closed, and materiel stored there was relocated to ANAD. Second, in 1993, the ANAD tactical missile maintenance mission was transferred to Letterkenny Army Depot, Pennsylvania. Third, realignments in 1995 resulted in eight missions being transferred to ANAD from four other Army depots between fiscal year (FY) 1994 and FY 1997 (U.S. Navy 1998; Operations Support Command 2000).

4.1.1 Potential Sites and Facility Locations

Site requirements for an ACWA pilot facility are likely to be similar to those for a baseline incinerator. About 25 acres (10 ha) would probably be required for the facility. During construction, part of this land would be required for a construction lay-down area, temporary offices, parking, holding basins for surface water, and temporary utility installations. Together, the facility requirements and other land area requirements of 5 to 52 acres (2 to 21 ha) for infrastructure could total 30 to 77 acres (12 to 31 ha).

Six possible sites were identified in the environmental impact statement (EIS) for the baseline incinerator at Anniston (U.S. Army 1991). Each of these sites was initially considered as a possible site for the ACWA demonstration technologies. Two of the candidate sites, Sites 2 and 6, were eliminated because of their proximity to the perimeter fence to the west of the depot and to potential human populations to the south and west of the depot. Site 3 was also eliminated because of its proximity to the ammunition maintenance facility, ammunition workshop, and

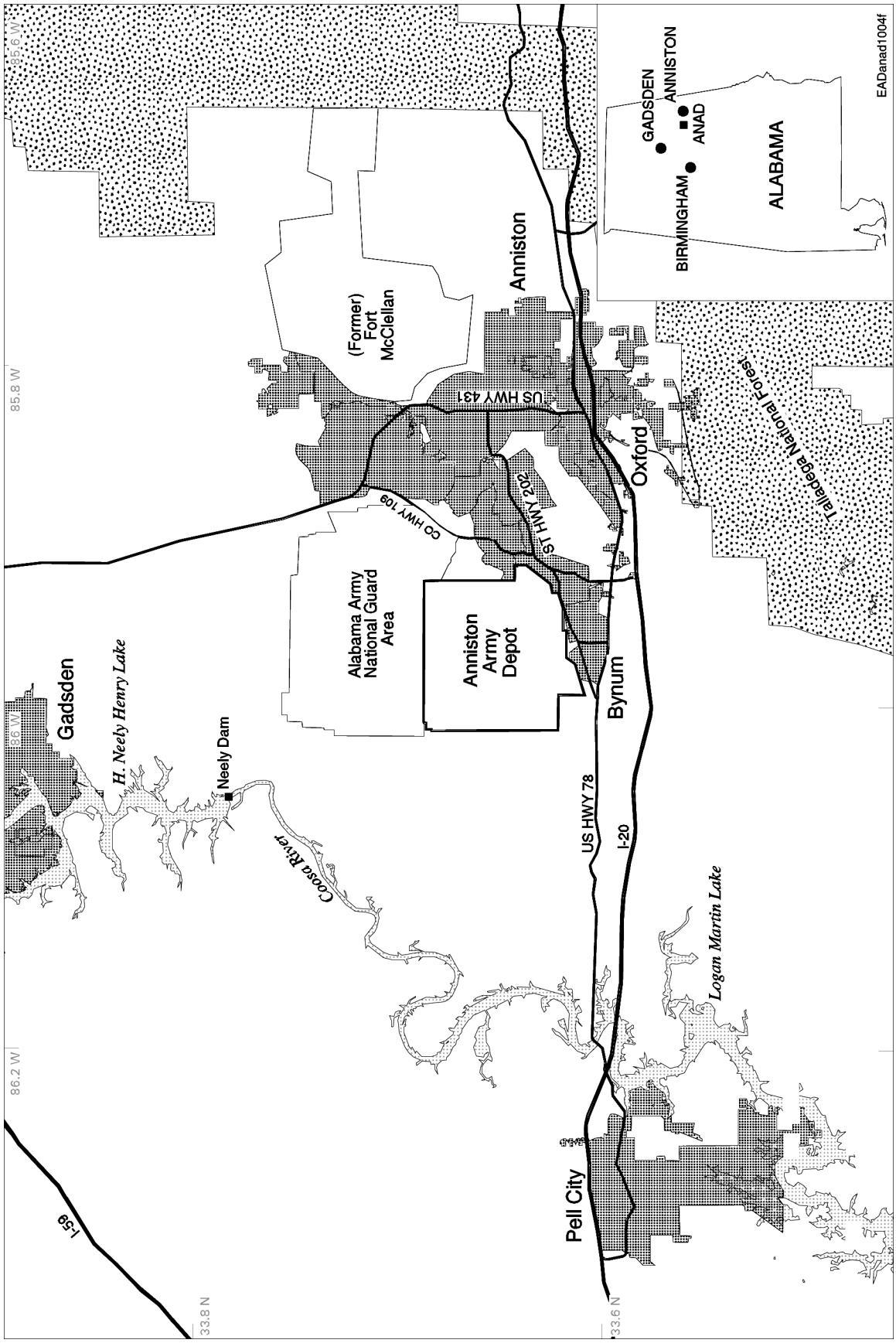

FIGURE 4.1-1 Location of ANAD

ammunition disassembly plant. The three remaining candidate sites are shown in Figure 4.1-2, together with the major facilities and areas at ANAD. Proposed Area A (Site 4 in the incinerator EIS) corresponds to the current location of Building 88 between Block C and G and is 33 acres (13.2 ha) in size. Proposed Area B (Site 1 in the incinerator EIS) is adjacent to and west of the incinerator presently under construction and is 149 acres (60 ha) in size. Proposed Area C (Site 3 in the incinerator EIS) is east of Elwood Road close to the center of the depot and is 32 acres (12.8 ha) in size.

- *Proposed Area A:* Area A is located in the northeast corner of the depot, between Blocks C and G of the chemical storage area, and corresponds to the location of existing Building 88. The area includes approximately 32.6 acres (13.2 ha) of land. Of this, about 12 acres (4.8 ha) lie in a 100-year floodplain along two creeks, leaving about 21 acres (8.4 ha) above the floodplain. Although this area would require substantial grading to provide a platform for a pilot facility, it has adequate land to accommodate a facility. Safety concerns at this location arise from the creek running through the site and from proximity to the road linking the incinerator facility with Gate 5 and Pelham Firing Range to the north. The facility might benefit from being close to utility lines constructed from Gate 5 to the incinerator, unless these lines are dedicated to the incinerator.

- *Proposed Area B:* Area B is situated on the northwest corner of the chemical agent storage area (Block G), close to the north perimeter of the facility and next to the incinerator that was recently constructed. The area includes approximately 149.1 acres (60.2 ha) of land. This area would be available if additional grading were done, and it would provide sufficient space for a demonstration facility. Potential safety concerns associated with this area arise from its proximity to the incinerator itself, the download facility to the south, Pelham Range to the north, demolition pits to the west, the 2,4,6-trinitrotoluene (TNT) burial trench, the road to Gate 5, and the solid waste management facility to the east. The facility might benefit from being next to existing utilities installed between Gate 5 and the incinerator.

- *Proposed Area C:* Area C is located south of Proposed Area A and southwest of the Chemical Limited Area (CLA, where chemical weapons are stored) and close to Elwood Road. The area includes approximately 36.4 acres (14.7 ha) of land. Although land is available at this location, it is unclear whether the 25 acres (12 ha) required for the demonstration facility could be accommodated at this location. Safety concerns associated with this area are its proximity to (1) Elwood Road; (2) the ammunition maintenance facility, ammunition workshop, and ammunition disassembly plant west of the site; and (3) the munitions storage igloos (Blocks E and F) east of the area. Use of this area would require a new dedicated road linking the facility with the CLA

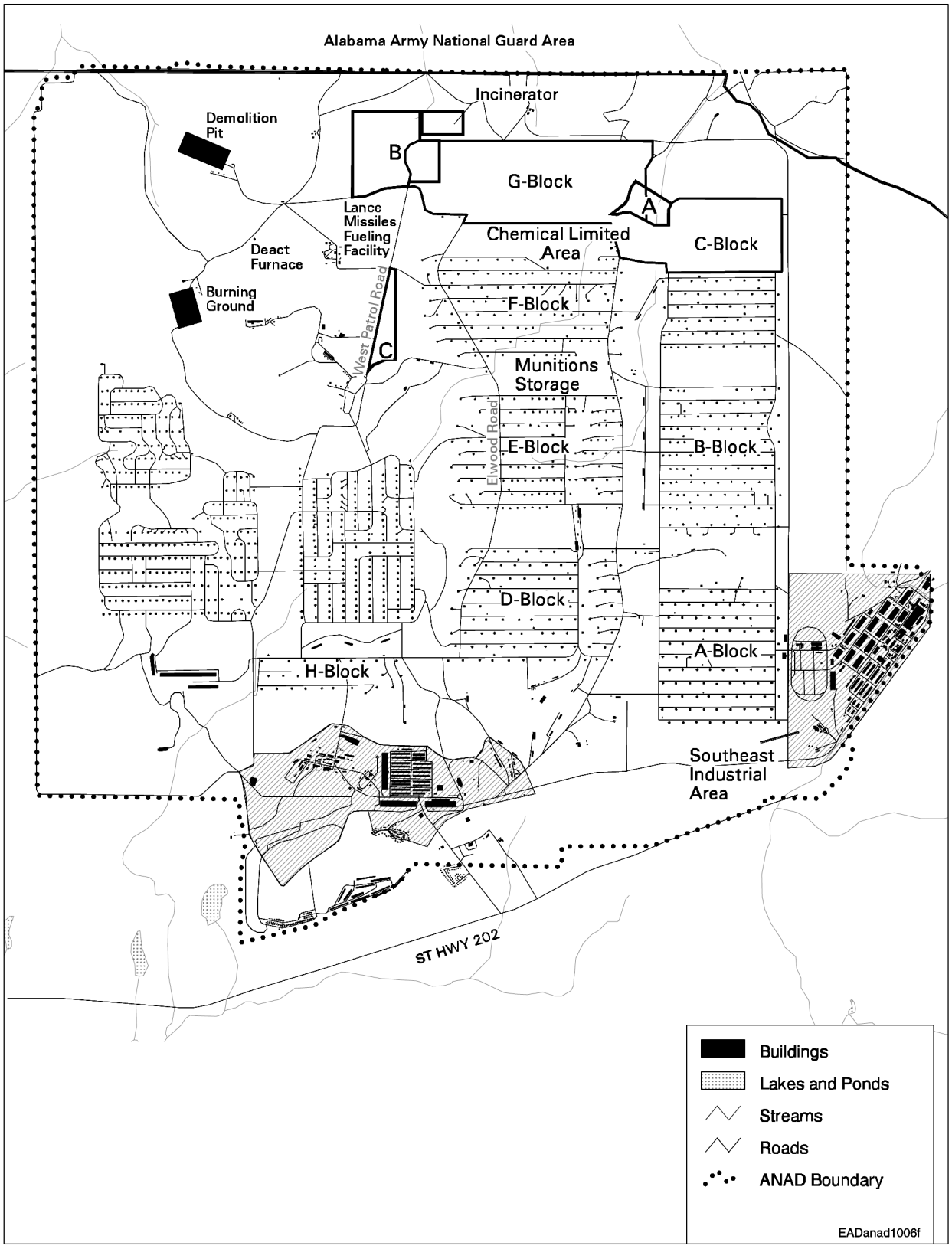

FIGURE 4.1-2 Facilities at ANAD

and an extension in the existing fence around the CLA to include the demonstration facility. The new road would increase the cost of the facility at this area (compared to the cost at the other areas) and would also increase safety concerns because of the need to transport munitions over the relatively long distance between the CLA and an ACWA facility. Another concern would be the increased traffic congestion along Elwood Road during construction and operation of the ACWA facility.

4.1.2 Munitions Inventory

The chemical agent inventory at ANAD currently includes rockets, mines, cartridges, projectiles, and ton containers, filled with mustard (designated as HD and HT) or nerve agent (designated as GB and VX) (see Table 4.1-1).

TABLE 4.1-1 Assembled Chemical Weapons Inventory at ANAD[a]

Type of Munition	Agent	Number in Inventory	Total Weight of Agent (lb)
4.2-in. cartridges	HT	183,552	1,064,600
4.2-in. cartridges	HD	75,360	452,160
105-mm cartridges	HD	23,064	68,500
155-mm projectiles	HD	17,643	206,420
105-mm cartridges	GB	74,014	120,640
105-mm projectiles	GB	26	40
155-mm projectiles	GB	9,600	62,400
8-in. projectiles	GB	16,026	232,380
M55 rockets	GB	42,738	457,300
M56 rocket warheads	GB	24	260
155-mm projectiles	VX	139,581	837,480
M55 rockets	VX	35,636	356,360
M56 rocket warheads	VX	26	260
Mines	VX	44,131	463,380
Ton containers	HD	108	185,080
Total		661,529	4,507,260

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

Source: Chemical and Biological Defense Command (CBDCOM) 1997.

4.2 LAND USE

4.2.1 Installation History and Uses

The U.S. Army began construction on a facility called Anniston Ordnance Depot in February 1941. It completed the first ammunition storage magazines on a wooded 18,133-acre (7,338-ha) tract in October of that same year (U.S. Army 1991, 2000). This installation was initially designed as a munitions storage depot, but during World War II, its role was expanded to include combat equipment storage, tank and artillery missions, and materiel handling. It had processed more than 1.2 million tons of military equipment by 1945. During the 1950s, activities at Anniston Ordnance Depot that were related to tank rebuilding and weapons and equipment storage increased, and facilities on the installation were enhanced accordingly to support these additional activities.

In 1962, the installation was renamed Anniston Army Depot (ANAD) and placed under the Army Materiel Command (U.S. Army 1991). In 1976, ANAD was placed under the U.S. Army Depot System Command, a major subordinate command of the U.S. Army Materiel Command (as are currently TACOM and U.S. Army Soldier and Biological Chemical Command [SBCCOM], the parent organizations of ANAD and Anniston Chemical Activity [ANCA], respectively). Throughout these changes, the mission of ANAD evolved. The installation's initial mission was expanded to include overhauling and repairing ordnance vehicles, rebuilding small arms, modifying M4SA1 tanks and M67 flame throwers, and providing logistics support for several missile systems (U.S. Army 2000). Presently, ANAD's mission includes the maintenance of combat vehicles, such as M-1 Abrams, M-60, and M-113 tanks, and a variety of artillery pieces. ANAD has substantial maintenance and manufacturing capabilities and is the only Army depot able to perform maintenance on both heavy- and light-tracked combat vehicles and their components. ANAD's mission also includes the storage of conventional munitions and chemical weapons. ANAD retains substantial ammunition storage capacity with 2.3 million ft^2 (214,000 m^2) of covered storage and 600,000 ft^2 (56,000 m^2) of open storage (U.S. Navy 1998). Supply storage capacity is approximately 3.1 million ft^2 (288,000 m^2) of covered space and 1.8 million ft^2 (167,000 m^2) of open storage (Operations Support Command 2000).

The Army began to store chemical weapons on 762 acres (308 ha) in the northeastern part of ANAD in 1961 (U.S. Army 2000). Currently, the portion of the depot where chemical weapons are stored is called the Chemical Limited Area (CLA) of the Anniston Chemical Activity. Chemical storage facilities in the CLA contain chemical weapons in a series of earth-covered, steel-reinforced concrete bunkers called igloos.

ANAD currently is under the command and control of the U.S. Army TACOM. Key tenant organizations located on the depot include:

- Defense Distribution Depot, Anniston;
- Anniston Munitions Center;
- Anniston Chemical Activity;
- Program Manager for Chemical Demilitarization (PMCD);
- Center of Military History Clearing House;
- 722nd Ordnance Company (Explosive Ordnance Disposal); and
- Defense Reutilization and Marketing Office (DRMO).

4.2.2 Current and Planned On-Post Land Use

Current land use on ANAD primarily includes industrial and related activities associated with the maintenance of combat vehicles. The huge installation includes buildings and structures linked by roads as well as a railroad (U.S. Army 2000). However, the most dominant feature of the installation is the more than 11,000 acres (4,400 ha) of woodland and 5 acres (2 ha) of lakes and streams.

Because of ANAD's size and the complexity of its multifaceted mission, one of the best ways to present current land use on ANAD is to divide the installation into major activity areas (Figure 4.2-1). Characteristics of these areas may be summarized as follows (U.S. Army 1991):

- The administrative area is located east of the warehouse area in the south-central portion of the depot. It consists of a series of permanent structures and the installation headquarters.
- The utility area contains engineering shops; motor pool, vehicle, and equipment repair shops; and property disposal facilities.
- The storage area consists of a processing facility and an area to store vehicles.

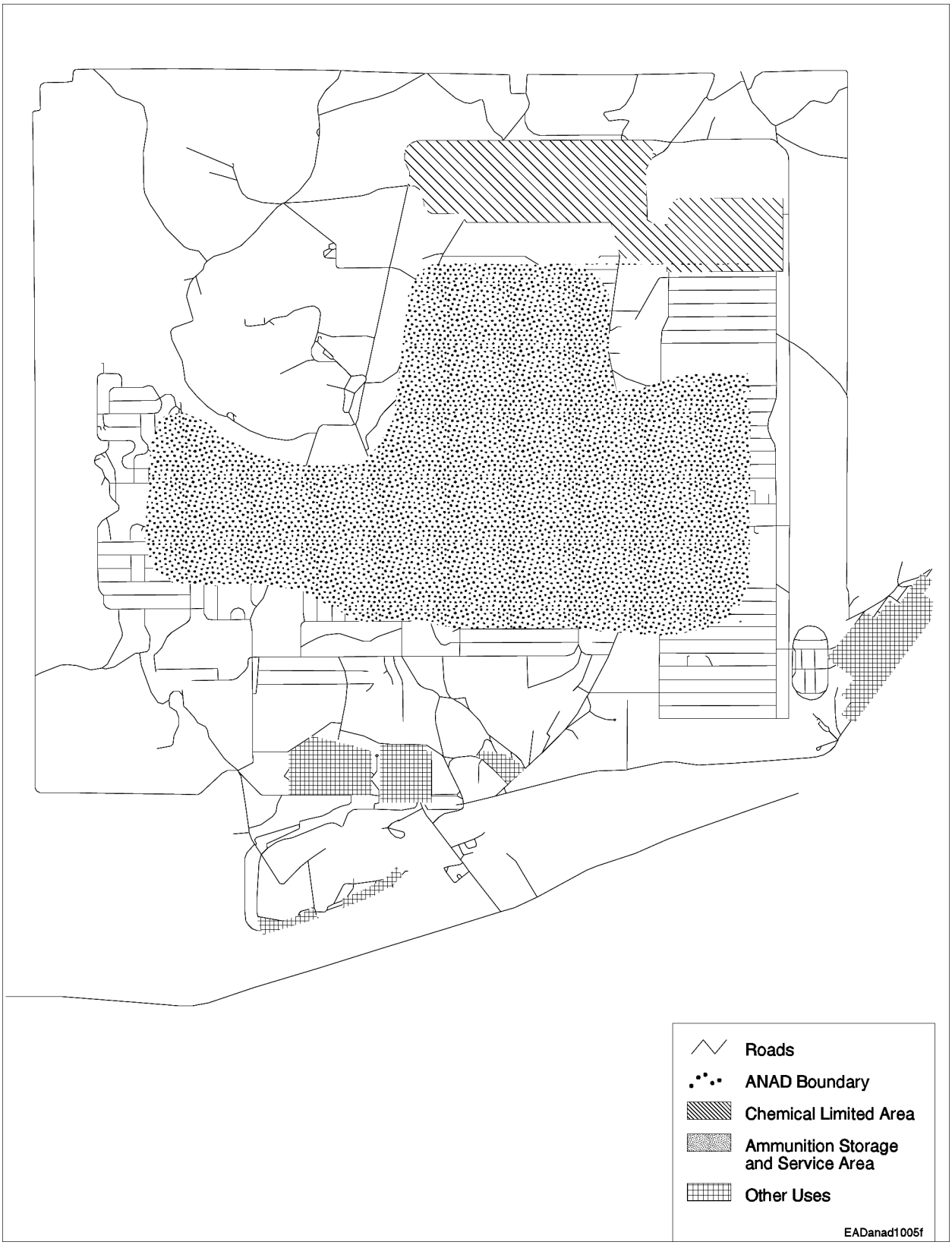

FIGURE 4.2-1 Land Use at ANAD

- The warehouse area in the south-central portion of ANAD contains a general supply, a shipping and receiving building, three large warehouses, and several smaller warehouses.

- The recreation area consists of the installation PX and gymnasium.

- The Nichols Industrial Complex (also called the Southeast Industrial Area [SIA]) in the southeast portion of ANAD contains 1.5 million ft^2 (140,000 m^2) of industrial facilities, including warehouses; depot maintenance, rebuild, and support shops; general supply processing facilities; loading facilities; and vehicle test facilities.

- The Ammunition Storage Area (ASA) occupies the majority of the depot and is located in the controlled-access central portion of ANAD. The ASA contains ammunition storage bunkers, providing 73,000 ft^2 (6,800 m^2) of storage. In the center of the area is an ammunition maintenance workshop complex that consists of the facilities needed for maintenance, demilitarization, and inspection of all types of ammunition and ammunition components. The Lance Missile Fueling Facility and the ammunition disposal areas are also located within this storage and service area.

- The chemical agent storage area is located in the CLA in the northern portion of ANAD.

Chemical weapons are stored in earth-covered bunkers, called igloos. They are constructed of steel-reinforced concrete and capped with soil. The igloos are designed specifically to protect chemical weapons from external factors, such as storms, lightning, and other weather-related events.

In addition to igloos, mustard is also stored in ton containers, which are large steel containers designed specifically to ensure that the agent is stored safely. Ton containers are cylindrical and approximately 6 ft (2 m) long and 3 ft (1 m) in diameter. Each sidewall of a ton container is about 1 in. (2.5 cm) thick. Specially designed valves located at one end of each container minimize the chance of leaks. When empty, ton containers weigh about 1,600 lb (725 kg) (SBCCOM 2000).

Future plans for ANAD are generally consistent with present uses. The main change in ANAD land use that would result from the ACWA Program would be the removal of chemical weapons storage from the north central portion of the depot. Construction of a baseline incinerator for chemical weapons destruction is complete.

4.2.3 Current and Planned Off-Post Land Use

Communities close to ANAD are primarily small towns south and east of the depot. These include the city of Anniston, which is the county seat of Calhoun County roughly 10 mi (16 km) east of ANAD. It has a population of about 30,000. The former Fort McClellan Military Reservation is also located in Calhoun County, about 10 mi (16 km) east of ANAD.

Land use in the vicinity of ANAD is primarily rural, with land cover dominated by forest (U.S. Army 1991). Interspersed among large forested tracts are areas of residential use (some are entire communities and others are isolated residences) and agriculture. In 1997, Calhoun County contained 629 farms covering 77,429 acres (31,336 ha) (U.S. Department of Agriculture [USDA] 1999). Cropland on these farms totaled 38,968 acres (15,770 ha); the remainder was used for grazing. Land ownership near ANAD is predominately private to the west, south, and east of the installation. The Pelham Range abuts ANAD to the north. Calhoun County also includes portions of the Talladega National Forest and Dugger Mountain Wilderness Area, approximately 20 mi (33 km) northeast of ANAD.

Substantial changes in land use in the vicinity of ANAD are not planned at this time. Fort McClellan was closed as an active U.S. Army facility in October 1999 and is slated for commercial development. The Alabama National Guard took over operational control of Pelham Range in December 1999, thus retaining it under military control.

4.2.4 Impacts on Land Use

4.2.4.1 Impacts of the Proposed Action

The proposed ACWA pilot facility at ANAD would have negligible effects on land use both on and off the installation. Proposed testing activities at ANAD would be conducted within the CLA. The CLA boundary would be revised to include the site selected for the pilot facility. Impacts on land reuse at ANAD are expected to be negligible. The locations and activities proposed for an ACWA pilot test facility are consistent with current installation use in the areas reserved for Chem Demil activities and with the historic and planned use of the installation.

Impacts on land use outside ANAD due to normal construction and operation are anticipated to be negligible as well. Normal construction and operation of an ACWA pilot test facility at ANAD would not interfere with activities in other areas of the installation or the surrounding communities. Any release of chemical agents or other chemical compounds as a result of occasional fluctuations in routine operations would be extremely small (see Section 4.6) and would not affect off-post activities.

4.2.4.2 Impacts of No Action

Under the no action alternative, storage of chemical stockpile components at ANAD would continue. Land use in the immediate storage area, already identified for activities associated with chemical weapons, would continue as described for the existing environment. As a result, under normal operating conditions, high and adverse impacts on land use are not anticipated, either on post or in the surrounding area.

4.3 INFRASTRUCTURE

Table 4.3-1 lists the annual utility requirements for an ACWA pilot test facility at ANAD, and Table 4.3-2 lists the approximate acreage needed for construction of an ACWA facility and associated utilities infrastructure. The following sections describe the requirements for an ACWA pilot test facility, current installation utility and infrastructure demands, and the impacts of construction and operation of an ACWA pilot test facility on utilities and infrastructure.

Estimates of infrastructure acreage requirements are based on a 120-ft (36-m) corridor for electricity and 30-ft (10-m) corridors for natural gas, potable water, and domestic sewage. It is assumed that any required additions to infrastructure capacity would occur in existing utility corridors, with corridor extensions to the proposed ACWA sites, as needed. The corridors to each of the proposed sites are shown in Figure 4.3-1. Estimates of existing corridor lengths and required extensions are summarized in Table 4.3-2. It is assumed that any extensions to the existing communications system that would be required for the proposed ACWA sites would not be likely to cause any land disturbance.

TABLE 4.3-1 Current Utility Usage and Approximate Annual Utility Demands for Operation of an ACWA Pilot Test Facility at ANAD

		Annual Demand			
Utility	2000 Usage	Neut/Bio	Neut/SCWO	Neut/GPCR/ TW-SCWO	Elchem Ox
Electric power (GWh)	62	36	60	26	105
Natural gas (scf)	310,000,000[a]	50,000,000	69,000,000	130,000,000	53,000,000
Process water (gal)	Not applicable	7,000,000	8,300,000	18,000,000	1,000,000
Potable water (gal)	260,000,000	6,400,000	6,400,000	6,400,000	6,400,000
Sewage (produced) (gal)	Not available	7,500,000	7,500,000	7,500,000	7,500,000

[a] Unit conversions: 1 scf (standard cubic foot) = 0.28 Nm^3. 1 gal = 3.8 L.

Sources: Freeman (2000) for annual usage; Kimmell et al. (2001) for demand for proposed facilities.

TABLE 4.3-2 Estimated Land Area Disturbed for Construction of an ACWA Pilot Test Facility and Associated Infrastructure at ANAD[a]

	Land Disturbance (acres)		
Construction Activity	Area A	Area B	Area C
Pilot facility and support structures	25	25	25
New utility corridors			
Electricity	9	4	33
Gas/sewer/water	2	1	7
Access road	0	0	12
Maximum area of disturbance	36	30	77

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

4.3.1 Electric Power

4.3.1.1 Current Supply and Use

ANAD purchases electric power from Alabama Power Company. The incinerator is served by a 44-kV transmission line and a substation that is located near Proposed Area B. The 44-kV line may provide sufficient capacity. Figure 4.3-1 identifies potential locations for the transmission line corridor to the proposed areas for an ACWA pilot facility.

4.3.1.2 ACWA Pilot Test Facility Requirements

Table 4.3-1 lists the estimated amounts of electricity that the four proposed ACWA pilot test technologies would use during normal operations. Electricity use estimates range up to 60 GWh/yr.

4.3.1.3 Impacts of the Proposed Action

The current on-site infrastructure would not be able to meet the needs for electric power supply to the pilot facility. While the 44-kV transmission line might be adequate, new service connections would have to be added, and a new substation would need to be constructed. The new power supply would supply the pilot facility and associated areas and would be independent

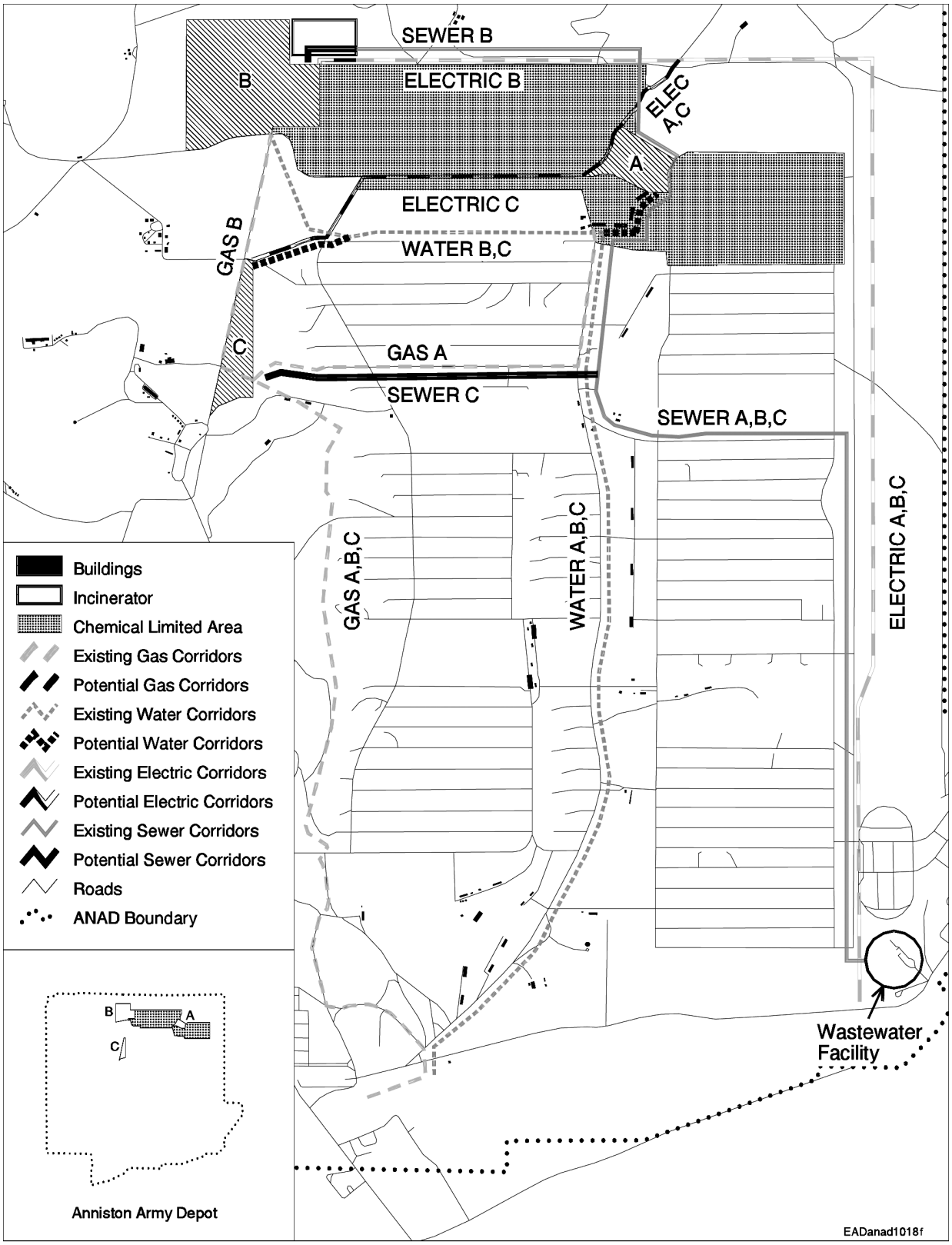

FIGURE 4.3-1 Proposed Utility and Road Access Corridors for an ACWA Pilot Test Facility at ANAD

of the other ANAD power supply infrastructure. Therefore, no impact on the existing electric power supply at ANAD or off site is anticipated.

4.3.1.4 Impacts of No Action

There would be no impacts on the electric power supply infrastructure from the no action alternative. The electric power supply for the installation would remain as described for the existing environment.

4.3.2 Natural Gas

4.3.2.1 Current Supply and Use

An 8-in. (20-cm) main gas pipeline supplies natural gas from Alabama Gas Company (Alagasco). The line runs from the Coosa Gate to the incinerator area through Proposed Areas B and C. A 2-in. (5-cm) branch line runs from the vicinity of Site C to within 0.3 mi (0.4 km) of Proposed Area A. The existing 8-in. (20-cm) gas line is capable of delivering 300,000 ft^3 of gas at an outlet pressure of 45 $lb/in.^2$ (psi).

4.3.2.2 ACWA Pilot Test Facility Requirements

Table 4.3-1 lists the amounts of natural gas the proposed ACWA technologies would use during normal operations. Natural gas use is estimated to range from 50 million to 130 million scf.

4.3.2.3 Impacts of the Proposed Action

The current infrastructure would be likely to meet the needs for natural gas supply to a pilot facility. New pipelines would have to be added to extend the system to the proposed areas for the pilot facility.

4.3.2.4 Impacts of No Action

There would be no impacts on the natural gas supply infrastructure from the no action alternative. The natural gas infrastructure would remain as described for the existing environment.

4.3.3 Water

4.3.3.1 Current Supply and Use

ANAD purchases its water supply from the city of Anniston (U.S. Army 1991). In FY 2000, average water usage at ANAD was 2.9 million ft^3/mo, or 260 million gal/yr (982,000 m^3/yr) (Freeman 2000). The Anniston Water Treatment Facility is located approximately 2 mi (3 km) south of the southeast corner of ANAD. The Anniston water distribution system draws its supply solely from the artesian Coldwater Spring, a groundwater source located between 1 and 2 mi (1.6 and 3.2 km) south of ANAD (Agency for Toxic Substances and Disease Registry [ATSDR] 1999). Coldwater Spring operates at a peak capacity of 24 million gal/d (91 million L/d), and a nearby reservoir can provide 19 million gal/d (72 million L/d). Additional capacity is planned in White Plains Reservoir, which will operate at a capacity of up to 9 million gal/d (34 million L/d) (U.S. Army 1991). The ANAD water distribution system is currently being upgraded to support the incinerator that is under construction. A water tower has been constructed near the incinerator site.

ANAD treats its domestic sewage on post in an existing sewage treatment facility located west of the SIA. Present sewer capacity is 20 million gal/d (75.7 million L/d). Normal use ranges from 10 million gal/d (37.9 million L/d) in summer to 14 million gal/d (53 million L/d) in winter. Wastewater is routed as needed through Choccolocco Creek and nearby tributaries (U.S. Army 1991). The sewage treatment facility is being upgraded to meet the demands of the incinerator currently under construction.

4.3.3.2 ACWA Pilot Test Facility Requirements

Table 4.3-1 lists the amounts of water and other utilities that the proposed ACWA technologies would use during normal operation and the amounts of sanitary sewage that each system would generate. Quantities of process water used range from 1 to 18 million gal/yr (3,700 to 68,000 m^3/yr or 3.1 to 55 acre-ft/yr). Estimates for potable water usage and sanitary sewage generation do not differ among the four potential ACWA technologies. Estimates are 6.4 million gal/yr (24,000 m^3/yr or 19 acre-ft/yr) for potable water usage and 7.5 million gal/yr (28,000 m^3/yr or 23 acre-ft/yr) for sanitary sewage generation. For the purposes of this

environmental impact statement (EIS), it is be assumed that potable water usage will be equal to the larger estimate of sanitary sewage generation (i.e., 7.5 million gal/yr).

The ACWA facility is expected to generate about 7.5 million gal/yr (34 million L/yr) of domestic sewage (Table 4.3-1). This sewage would only consist of effluent from bathrooms, showers, laundry facilities, and other common domestic uses. No process water or hazardous materials would be discharged to the ANAD sewage treatment plant. Process water would be decontaminated and reused within the pilot facility.

4.3.3.3 Impacts of the Proposed Action

The existing water supply system would be sufficient to supply the needs of an ACWA pilot facility if pipeline extensions were built. Impacts from any of the ACWA technologies on the water supply infrastructure would be negligible.

The current sewage treatment capacity would need to be expanded to meet the needs of an ACWA pilot facility. The sewage treatment plant would operate in accordance with all applicable regulations and permits. The impacts from the sewage treatment plant on the water supply and use infrastructure would be negligible.

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; however, the total estimated use would be small when compared with existing capacity. The existing water supply system would be adequate to meet these needs. Impacts on the water supply and sewage treatment infrastructure from construction activities would be negligible. Minor local disruptions in supply might occur when the ACWA facility was connected to the existing infrastructure, but these common types of disruption would be short-lived.

There would be no off-post impacts on the water supply or sewage treatment infrastructure during construction. ANAD sewage infrastructure is self-contained, and projected ACWA facility water requirements would be small when compared with the existing system capacity.

Accidents during construction could affect the personnel who operate the off-post infrastructure for water and sewage treatment. On-post accidents would not affect the off-post water supply or sewage treatment infrastructure.

During operation of an ACWA pilot test facility, the existing water supply system would not be sufficient to provide peak water demands for fire fighting and other potential emergency

response needs. To address such needs, the ACWA facility would have a storage tank of sufficient capacity to meet projected emergency needs.

A new or expanded sewage treatment facility would need to be constructed to meet the needs of the proposed ACWA pilot facility. Construction of the ACWA facility and sewage treatment facility would have a negligible impact on the existing sewage treatment infrastructure.

There would be no impacts to water use and supply infrastructure off post.

4.3.3.4 Impacts of No Action

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

4.3.4 Communications

4.3.4.1 Current System

No information was available.

4.3.4.2 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.

4.3.4.3 Impacts of the Proposed Action

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

4.3.4.4 Impacts of No Action

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

4.4 WASTE MANAGEMENT

ANAD currently generates a variety of solid and liquid hazardous and nonhazardous wastes, as described in Section 4.4.1. It also stores a large quantity of assembled chemical weapons (ACWs). While in storage, the ACWs are not generally considered wastes, but upon processing and destruction, the residuals become wastes. Wastes associated with operation of the ACWA facilities are primarily from the residuals of the ACW destruction.

4.4.1 Current Waste Generation and Management

4.4.1.1 Hazardous Wastes

ANAD generates a variety of hazardous wastes associated with three of its missions: (1) combat vehicle and equipment maintenance, (2) munitions management, and (3) hazardous material management. Most of these hazardous wastes are packaged and transported off site to appropriately permitted treatment and disposal facilities. The principal activities at ANAD that are sources of these hazardous wastes include:

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

Hazardous wastes accumulated at the initial generation points at ANAD are transferred to facilities for further storage (up to 90 days) while they await transport off post. The waste container storage areas are at Buildings 466, 512, and 527. Wastes generated at ANAD are collected and disposed of off post in accordance with U.S. Army, state, and federal regulations. Any waste listed as hazardous in the *Resource Conservation and Recovery Act* (RCRA) regulations is stored, treated, and disposed of off post as prescribed by the U.S. Environmental Protection Agency (EPA) and applicable state and local regulations.

A number of waste treatment units at ANAD also generate significant amounts of hazardous waste that need to be shipped off post to permitted treatment, storage, and disposal facilities (TSDFs). The Industrial Waste Treatment Plant (IWTP) processes various electroplating solutions and rinses; this activity generates hazardous sludges for off-post disposal. ANAD also has an active open burning area and an open detonation area for the treatment and disposal of unserviceable and obsolete munitions and explosives. The ashes and waste residues obtained from these areas are managed as hazardous wastes and shipped off post to permitted TSDFs. An incinerator for the destruction of chemical agents and munitions stored at ANAD is under construction. This treatment facility, upon completion, will generate many wastes for disposal at an off-post permitted TSDF.

ANAD has a hazardous waste management plan that outlines the treatment and management of hazardous wastes at the installation (ANAD 2000a). This plan describes the procedures, policies, and responsibilities associated with hazardous waste management activities — such as waste identification, handling, storage, treatment, and disposal — performed at the installation. This plan is also designed to ensure that the hazardous waste tasks performed at ANAD comply with applicable federal, state, local, and Army regulations.

4.4.1.2 Nonhazardous Wastes

ANAD 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 site in a RCRA Subtitle D landfill or recycled, if possible. Sanitary wastes are treated in an on-site sewage treatment plant. Table 4.4-1 lists the hazardous and nonhazardous wastes generated at ANAD during the year 1999.

TABLE 4.4-1 Wastes Generated at ANAD in 1999

Type of Waste	Amount Generated (tons)
Hazardous liquids	390
Hazardous solids	1,430
Nonhazardous solids	3,250
Recyclable solids	8,260
Sanitary waste	6,500

Sources: Phillips (2000); ANAD (1999).

4.4.2 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 the waste that would be generated during construction of an ACWA facility are based on data on waste generated during the construction of comparable buildings, scaled by building size and number of construction worker full-time equivalent (FTE) employees. The types and amounts of waste expected from the operation of this facility have been estimated by using the techniques of stoichiometric mass balance[1] for each unit process coupled with the analytical results obtained from initial demonstration tests for each technology. This technique relies on a number of assumptions that, as yet, 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 yet been determined.

An incinerator to be used to destroy some or all of the ACWs in inventory at ANAD has been constructed. For the purposes of this document, any discussions of the affected environment at the site assume that incinerator construction is complete but that operations have not started. Impacts of the ACWA pilot test facility discussed in the proposed action are determined on the basis of the assumption that an operational incinerator is part of the environmental background. The proposed no action alternative considers incineration of all ACWs in inventory at ANAD as presented in previous EISs.

The proposed ACW destruction system would produce brine salts as solid waste. These salts could contain significant amounts of toxic heavy metals (e.g., lead). 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 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 facility for stabilizing the waste would need to be constructed at ANAD, 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.

Mustard and nerve agents are not listed wastes in Alabama. If a waste does not demonstrate a hazardous characteristic, the residues are not characterized as hazardous wastes under Alabama Department of Environmental Management (ADEM) regulations. Information on the waste streams that could result from any of the ACWA technologies is not sufficient to determine if these wastes will be characterized as hazardous in Alabama.

It is assumed that most wastes generated by the proposed action would be collected and disposed of off site in accordance with U.S. Army, state, and federal regulations. Any wastes

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

determined to be hazardous under the RCRA regulations would be stored and disposed of off site as prescribed by the EPA and applicable state and local regulations.

4.4.3 Impacts of the Proposed Action

4.4.3.1 Impacts of Construction

Construction activities associated with the building of the ACWA pilot test facility would generate both solid and liquid nonhazardous wastes. The solid nonhazardous wastes would be primarily in the form of building material debris and excavation spoils. Liquid nonhazardous wastes would include wastewater from washdowns and sanitary wastes. Construction would also generate small amounts of both solid and liquid hazardous wastes such as solvents, paints, cleaning solutions, waste oils, contaminated rags, and pesticides. No changes in ANAD waste management systems would be expected to be needed for the management and disposal of solid and liquid construction wastes.

Estimates of the amounts of waste that would be generated during construction of a pilot test facility at ANAD are shown in Table 4.4-2. Data in this table cover the four technologies being considered: Neut/Bio, Neut/SCWO, Neut/GPCR/TW-SCWO, and Elchem Ox. These estimates are based on the proposed building size and an estimated total construction work force representing about 1,100 full-time-equivalent-years (FTE-yr) (Volume 1 of Kimmell et al. 2001). Sanitary wastes and wastewater would be the only significant liquid effluents that would be generated during construction. All of the construction wastes could be treated by existing systems, and no additional environmental impacts from managing these wastes are expected.

4.4.3.2 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 disassembly and destruction of an ACW, the remaining residuals become wastes. In the case of M55 rockets stored at ANAD, the Army has reclassified these munitions as waste due to obsolescence of the rocket. Wastes resulting from the normal operation of an ACWA pilot test facility would include components from the treatment of metal parts and dunnage as well as process residues (e.g., contaminated salts generated from treating chemical agents and energetics). An ACWA pilot test facility would also generate a number of nonprocess wastes (e.g., office trash, PPE, decontamination solution, spent carbon filters). ACWA pilot test facilities would recycle all process liquids obtained in the operation phase back through the reaction vessel. Such recycling would eliminate these liquids from the waste streams. If stabilization of the hazardous solid salt waste obtained in the normal processing of ACWs was

TABLE 4.4-2 Wastes Generated during Construction of an ACWA Pilot Test Facility at ANAD

Waste	Neut/Bio	Neut/SCWO	Neut/GPCR/ TW-SCWO	Elchem Ox
Hazardous wastes				
Solid (yd^3)	80	90	90	100
Liquid (gal)	33,000	38,000	36,000	39,000
Nonhazardous wastes				
Solids				
Concrete (yd^3)	210	210	220	190
Steel (tons)	32	36	29	33
Other (yd^3)	1,700	1,700	1,800	1,500
Liquids				
Wastewater (gal)	2,100,000	2,500,000	2,300,000	2,500,000
Sanitary (gal)	4,700,000	5,600,000	5,100,000	5,600,000

Source: Kimmell et al. (2001).

required, either a waste management facility for stabilizing the waste would need to be built at ANAD, or 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 treatment unit might be required.

Demonstration I provided information for estimating waste generation rates from the processing of ACWs by the Neut/SCWO and Neut/Bio technologies. Demonstration II provided information for estimating waste generation rates from the processing of the ACW inventory by the Neut/GPCR/TW-SCWO and Elchem Ox. Estimates of wastes from processing agents by using the above technologies are presented in this section. The number of operating days for processing each agent was determined by choosing the smaller of the following two numbers: 276 days (the number of full operating days per year) or the number of days it would take to destroy the entire installation inventory of the agent.

Hazardous Wastes. Wastes that would result from the operation of an ACWA pilot test facility are summarized in Table 4.4-3. The numbers in Table 4.4-3 account for only those waste streams produced by the four technologies during the processing of mustard and both types of nerve agent (GB and VX). 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. ANAD would continue to generate wastes associated with storage at decreasing rates during the ACWA facility's operation until the stockpile was completely destroyed.

TABLE 4.4-3 Hazardous Wastes Generated Annually from the Operation of an ACWA Pilot Test Facility at ANAD[a]

	Amount of Hazardous Waste (tons/yr) per Technology and Agent Being Processed								
	Neut/Bio	Neut/SCWO		Neut/GPCR/TW-SCWO			Elchem Ox		
Hazardous Waste	Mustard	Mustard	Nerve[b]	Mustard	GB	VX	Mustard	GB	VX
Brine salts (total)	970	1,020	1,930	1,020	2,210	1,800	110	120	170
Sodium phosphate	-	18	1,380	14	1,800	1,260	-	-	-
Sodium fluoride	-		46	-	106	-	-	-	-
Sodium sulfate	345	500	170	500	-	280	-	-	-
Sodium chloride	360	360	-	360	-	-	-	-	-
Sodium bisulfate	72	-	-	-	-	-	-	-	-
Other salts	48	7.0	43	150	22	19	110	120	170
Water in salt cake	124	130	250	130	280	230	-	-	-
Aluminum oxide	-	-	1,200	-	430	280	-	-	-
Anolyte-catholyte waste	-	-	-	-	-	-	720	250	1,200
Biomass (total)	550	-	-	-	-	-	-	-	-
Biomass solids	360	-	-	-	-	-	-	-	-
Water in biomass	190	-	-	-	-	-	-	-	-
Other solids	1	-	-	-	-	-	-	-	-
Hazardous liquids	-	-	-	-	-	-	5	11	14

[a] Values are based on 276 days of operation per year for all technologies. A hyphen means that the waste stream is not generated by the specific technology. Operational durations are 21 months (1.75 years) for Neut/Bio and up to 36 months (3 years) for other technologies.

[b] Value shown for nerve agent includes GB and VX. Separate values were not provided for this technology from the demonstration results.

Sources: Mitretek (2001a–d); Kimmell et al. (2001).

ANAD has substantial amounts of nerve agents GB and VX and mustard agent in its ACW inventory. The Neut/Bio technology has proven effective at treating only the mustard agent, whereas Neut/SCWO, Neut/GPCR/TW-SCWO, and Elchem Ox can be used on both nerve and mustard agents. The estimates for the annual waste generation from an ACWA pilot test facility are based on an assumption of 276 days of operation per year, with the last three technologies treating all three agents and the Neut/Bio treating mustard agent only.

Polychlorinated biphenyls (PCBs) have been identified as a constituent in the firing tubes of M55 rockets held in the ACW inventory at ANAD. The concentration of PCBs in these munitions can range from less than 50 to more than 2,000 parts per million (ppm). Therefore, treatment of these munitions with ACWA technologies would involve the treatment of PCB

wastes. In addition, the treatment process could 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 will need to be evaluated. Wastes containing PCBs in excess of 50 ppm are subject to regulation under the *Toxic Substances Control Act* (TSCA).

Neutralization/Biotreatment. A number of process-related waste streams would be generated from the Neut/Bio technology. Salts and biomass would be extracted from the bioreactor effluents, treated further, and dried to be disposed of as solid hazardous waste (Table 4.4-3). The liquids obtained from the further treatment of the bioreactor effluents would be recycled back through the bioreactor, thus eliminating the release of any process liquid wastes.

Various types of nonprocess wastes would be generated from Neut/Bio operation. These would include dunnage, PPE, spent carbon filters, pallets, and decontamination solution. All of these nonprocess operation wastes have the potential to be contaminated by an agent, and such contamination would require treatment. Under the Neut/Bio alternative, nonprocess wastes would be treated by the metal parts treater (MPT). Treatment of nonprocess wastes would result in approximately 80 tons of residual brine waste; this amount is included in the overall brine waste numbers shown in Table 4.4-3. Nonprocess waste would also generate about 35 tons of metals waste; this total is included in Table 4.4-4 (Kimmell et al. 2001).

No significant impacts are expected from the generation of hazardous waste during the operation of an ACWA facility. Most of these wastes 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 salts and biomass 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 4.4-3 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 at ANAD, 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 at ANAD or an existing off-post commercial facility might need to handle the off-post shipment of solid salt waste.

Neutralization/SCWO. Process effluents from the SCWO units would be combined. Brine salts (mostly sodium sulfate, sodium chloride, and sodium phosphate, see Table 4.4-3) 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.

TABLE 4.4-4 Nonhazardous Wastes Generated Annually from the Operation of an ACWA Pilot Test Facility at ANAD[a]

	Amount of Waste Generated Annually per Technology			
Nonhazardous Waste	Neut/Bio	Neut/SCWO	Neut/GPCR/ TW-SCWO	Elchem Ox
Sanitary wastes (gal)	7,500,000	7,500,000	7,500,000	7,500,000
Other solid wastes (yd^3)[b]	1,600	1,600	1,600	1,600
Recyclable wastes (yd^3)[c]	660	660	660	660
Metal wastes (mustard) (tons)	2,200	2,200	2,400	2,200
Metal wastes (nerve) (tons)	NA[d]	4,150	NA	NA
Metal wastes (GB) (tons)	NA	NA	3,700	3,600
Metal wastes (VX) (tons)	NA	NA	5,200	5,100

[a] Values are based on 276 d/yr of operation for all technologies. Operational durations are 21 mo (1.75 yr) for Neut/Bio and 57 mo (4.75 yr) for other technologies.

[b] Domestic trash and office waste.

[c] Recyclable wastes include paper and aluminum.

[d] NA = not applicable.

Sources: Mitretek (2001a–d); Kimmell et al. (2001).

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 110 tons of brine waste; this amount is included in the overall brine waste numbers shown in Table 4.4-3.

No significant impacts are expected from the generation of hazardous wastes during operation of an ACWA facility unless brine salts were to fail the RCRA TLCP test. It is assumed that most wastes generated during operations would be collected and disposed of off post in accordance with U.S. Army, state, and federal regulations. Any wastes listed 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 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 4.4-3 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 at ANAD, 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 commercial facility might need to handle the off-post shipment of solid salt waste.

Neutralization/GPCR/TW-SCWO. This technology would generate several sources of waste during its operation at ANAD. 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 of oxidation, the liquid effluents from this unit contain soluble and unsoluble salts and metal oxides. These effluents would be sent to the evaporator/crystallizer unit. The resulting dried brine salts (primarily sodium phosphate, sodium sulfate, and sodium chloride; see Table 4.4-3) would be disposed of as hazardous wastes. The liquid effluent would be recycled back to the neutralizer unit as make-up water.

The GPCR unit would consist of a thermal reduction batch processor (TRBP) and the reactor (GPCR) 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 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, listed in Table 4.4-3. 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 4.4-3.

No significant impacts are expected from the generation of hazardous wastes during the operation of an ACWA facility. It is assumed that most hazardous wastes generated during operation would be collected and disposed of off post in accordance with U.S. Army, state, and federal regulations. Any wastes listed 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 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 4.4-3 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 at ANAD, 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.

Electrochemical Oxidation. The operation of this technology would generate several sources of waste. Both agents and energetics would be destroyed by Elchem Ox in the SILVER II process. The SILVER II process would use electrochemical oxidation, which would generate Ag^{+2} ions in aqueous nitric acid. The acid would be circulated through stirred tank reactors (the anolyte and catholyte circuits). Agent and energetics would be oxidized in similar but separate systems. The generated Ag^{+2} ions would oxidize the organic feed when the current was turned on. Silver chloride would be precipitated when organochlorine compounds (such as mustard) are treated. The silver chloride salt cake containing various metal particulates would be collected, dried, and sent away for silver recovery. The remaining salts, solids, and metal impurities would be disposed of as hazardous salts (listed in Table 4.4-3 as anolyte-catholyte waste). The anode-cathode reaction would also generate a number of off-gases, including several acidic 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 4.4.3). The remaining corrosive gas would be swept to a caustic scrubber, where the remaining corrosive gases would be neutralized and dried for disposal as hazardous brine salts (see Table 4.4-3). All liquids from this unit would be recycled as make-up 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 of these nonprocess wastes could be contaminated by agent, and such contamination would require treatment. Under this alternative, 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 included in the overall brine waste numbers shown in Table 4.4-3.

No significant impacts are expected from the generation of hazardous waste during the operation of an ACWA pilot 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 listed 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 4.4-3 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 at ANAD, 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 estimated by scaling data on comparable buildings for the size of the operating work force (Kimmell et al. 2001) (Table 4.4-4). These numbers are expected to be nearly the same for the four technologies, since the facilities would be of similar size and have similar work force numbers. No impacts are expected from the generation of nonhazardous solid wastes during the operation of an ACWA 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 4.4-4. Nonprocess waste would also generate about 40–60 tons of metal waste, which is included in Table 4.4-4.

During normal operations, an estimated 7.5 million gal (29,000 L) of sanitary sewage would be generated per operating year (Table 4.4-4) (Kimmell et al. 2001). Sanitary waste would be treated in an on-post sewage treatment plant. Wastewater generation per operations day related to normal operations would most likely be essentially the same for all four ACWA technologies being considered, since the technologies do not require significant amounts of make-up process water and do not discharge any process water. Because of this, wastewater generation would be related to the number of workers, which is essentially the same for all the technologies being considered. No impacts significant are expected from the generation of wastewater during operation of an ACWA pilot test facility.

4.4.4 Impacts of No Action

4.4.4.1 Hazardous Wastes

No construction activities would be anticipated under the no action/continued storage alternative. Continued storage of munitions at ANAD 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 would be 2.5 tons of liquid wastes (decontamination water) and about 4 tons of hazardous solid waste from PPE and pallets (ANAD 2000a). The continued degradation of agent containers over time would probably generate slowly increasing amounts of waste from leaks, but these quantities would be relatively small.

Continued storage of chemical weapons at ANAD would not adversely affect waste management. Hazardous wastes 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 the RCRA regulations would be stored and disposed of off post as prescribed by the EPA and applicable state and local regulations.

The no action alternative considers incineration of all ACWs in the inventory at ANAD, as presented in the ANAD EIS (U.S. Army 1991). An estimate of the wastes generated from such an incinerator can be determined by obtaining information from the ANAD EIS and using the same methodology used to generate waste estimates for the ACWA technologies (Folga 2001a). Estimates of waste generation from operation of an ACW incinerator are given in Table 4.4-5.

4.4.4.2 Nonhazardous Wastes

No construction activities would be expected to occur under the continued storage alternative. Small amounts of nonhazardous solid waste and nonhazardous sanitary waste are generated during storage of chemical weapons. However, these amounts are not significant. Nonhazardous wastes associated with the operation of an ACW incinerator at ANAD are listed in Table 4.4-5. Process liquids from the incinerator are recycled and not released to the environment.

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

4.5 AIR QUALITY — CRITERIA POLLUTANTS

This section describes existing meteorology, air emissions, and air quality at ANAD and the air emissions and environmental consequences on air quality that might result from constructing and operating an ACWA pilot test facility at ANAD. Data on potential air emissions and impacts 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 4.6 and 4.7. 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 4.21.

The analysis of impacts on air quality from both construction and operations was conducted for Proposed Area A (see Figure 4.3-1), which is closest to the ANAD installation boundary in the direction of the nearest off-site residence. The three 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 any of the three facility locations.

TABLE 4.4-5 Solid Process Wastes Generated during the Operation of an ACW Incinerator at ANAD[a]

Waste Type	Description	Peak-Hour (lb/h)	Average-Day (lb/d)	Annual (tons/yr except as noted)
Hazardous waste				
Brine salt	From brine reduction[b]	4,300	17,300	3,200
Scrap/ash	From liquid incinerator	0	0	0
Scrap/ash	From dunnage furnace	180	1,800	330
Scrap/ash	From deactivation furnace	1,400	NA	NA
Nonhazardous waste				
Metal scrap	From MPT	12,200	25,000	4,600
Sanitary waste	Liquid	-	-	4,200,000 gal
Other wastes[c]	Solids	-	-	1,600 yd^3
Recyclable wastes[d]	Solids	-	-	660 yd^3

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

[b] Contains 10–15% moisture.

[c] Other wastes include domestic trash and office waste.

[d] Recyclable wastes include paper, aluminum, etc. generated by the facility.

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 facilities 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 most statewide monitoring stations.[2] 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 three technologies (Neut/SCWO, Neut/Biot, and Elchem Ox technologies). However, concentration increments of air pollutants due to these emissions, by themselves or

[2] 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.

added to background, would be similar for all four destruction technologies and within applicable standards.

4.5.1 Current Meteorology, Emissions, and Air Quality

4.5.1.1 Meteorology

The climate of the area surrounding ANAD is temperate and characterized as subtropical. The summers are long, warm, and humid, while the winters are relatively short and mild. In winter months, there are frequent shifts between mild air, which has been moistened and warmed by the Gulf of Mexico, and dry, cool continental air. Cold waves from Canada have usually been modified substantially by the time they reach the area. In the summer, extended periods of hot and humid weather occur as a result of moist air originating from the Gulf. The following detailed description of climate is based on the data recorded at the Birmingham Municipal Airport located about 42 mi (68 km) west of ANAD (National Oceanic and Atmospheric Administration [NOAA] 1999). Wind data measured at the ANAD meteorological tower (Demil tower[3]) are also presented (Rhodes 2000).

Since July 1998, wind data have been measured at two (33-ft and 100-ft [10-m and 30-m]) levels of the Demil tower, which is located near the northern boundary of ANAD site and is the tower closest to the location of the proposed disposal facilities. The wind roses for the Demil tower for a two-year period (July 1998 through June 2000) are shown in Figure 4.5-1. For comparison, the wind rose at the 22-ft (6.7-m) level of the Birmingham Municipal Airport for the period of 1984–1992 is also presented in Figure 4.5-1 (EPA 2000a). Wind patterns between the 10-m and 30-m levels at the Demil tower are quite different. At the 10-m level (Figure 4.5-1, top left), southeasterly winds were predominant, with a secondary peak from the east-southeast. At the 30-m level (top right), winds were common from the south and south-southeast and, to a lesser extent, from the east-southeast and north-northeast. During the two-year period of 1998 to 2000, the average wind speed was 3.6 miles per hour or mph (1.6 m/s) at the 10-m level and 5.4 mph (2.4 m/s) at the 30-m level. These wind patterns at the Demil tower are also quite different from those at Birmingham Municipal Airport (bottom center), which are characterized by the dominance of northeast winds. Although the terrain at ANAD is hilly, there is no dominant topographic feature that broadly influences the wind by channeling the flow. These wind patterns at ANAD suggest that winds are, to some extent, affected by both nearby vegetation and topographic features.

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[3] Currently, five meteorological towers (four CSEPP [Chemical Stockpile Emergency Preparedness Program] towers and one Demil tower) are operating at ANAD. Wind data from the Demil tower were selected to represent the conditions at ANAD because the tower meets the EPA's siting criteria and because the instrument and associated data were more comprehensively checked for quality assurance/quality control (QA/QC) than were the data from CSEPP towers (Rhodes 2000).

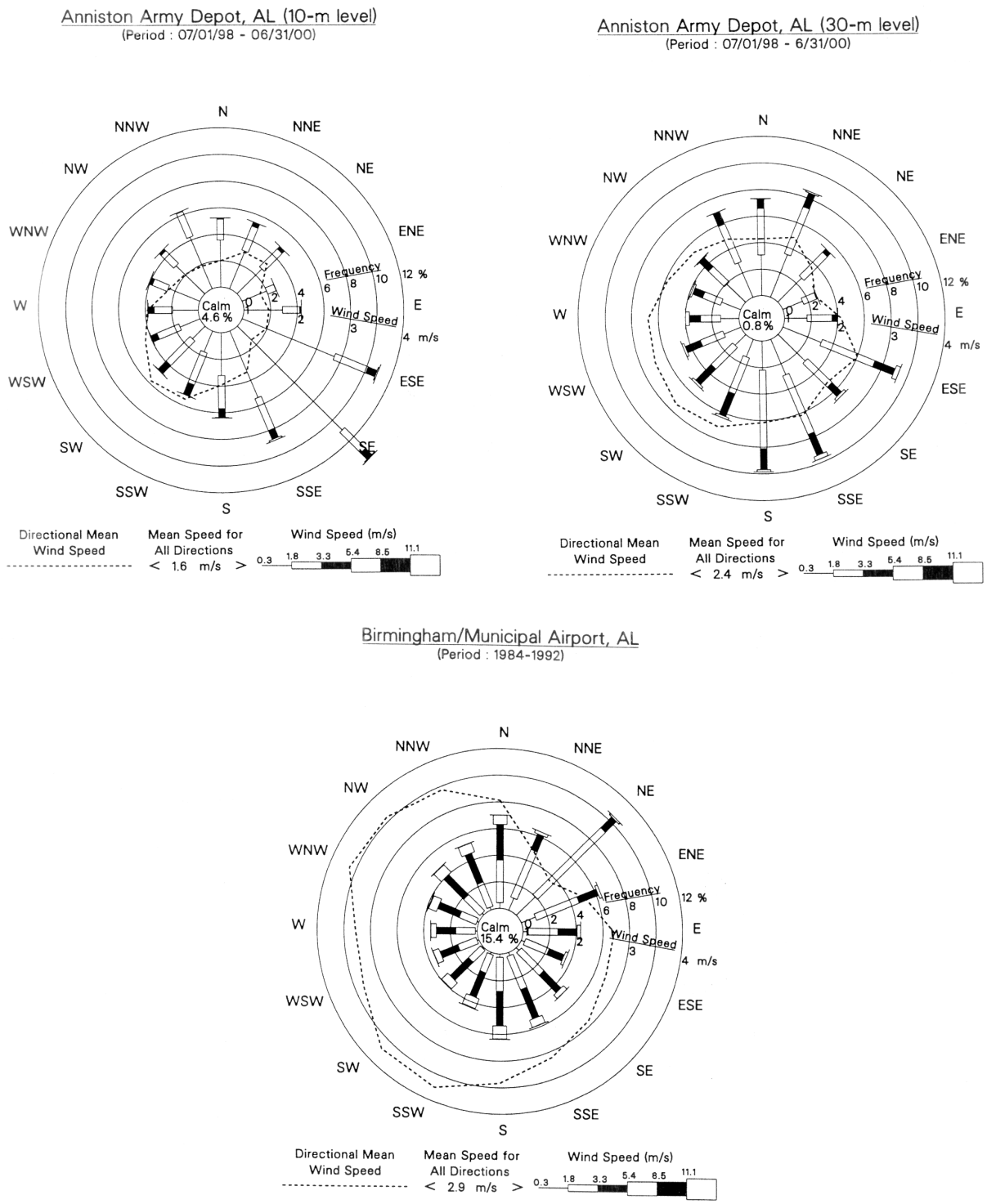

FIGURE 4.5-1 Annual Wind Roses for Two Heights Aboveground at the Demil Tower at ANAD from June 1998 through June 2000 (top left = 10 m, top right = 30 m) and for One Height at Birmingham Municipal Airport from 1984 through 1992 (bottom center = 6.7 m) (Sources: Rhodes 2000 for top left and right; EPA 2000a for bottom center)

The average annual temperature at Birmingham Municipal Airport is 62.4°F (16.9°C). January is the coldest month, averaging 43.3°F (6.3°C), and July is the warmest month, averaging 80.2°F (26.8°C). Extreme temperatures above 100°F (37.8°C) frequently occur, while those below 0°F (–17.8°C) are very rare. Extreme temperatures have ranged from –6°F (–21.1°C) in January 1985 to 106°F (41.1°C) in July 1980. The number of freeze-free days per year (i.e., when the daily minimum temperature is greater than 32°F [0°C]) is about 306 days, and no freeze days occur in May through September.

Annual precipitation is almost entirely in the form of rain. Average annual precipitation at Birmingham Municipal Airport is 54.6 in. (138.6 cm). Precipitation is relatively evenly distributed throughout the year, with a minimum of 2.8 in. (7.1 cm) in October and a maximum of 6.2 in. (15.7 cm) in March. The greatest amount of precipitation in a single month was 17.7 in. (44.9 cm) occurring in February 1961, and the greatest amount in a 24-hour period was 7.1 in. (17.9 cm) in March 1970. Annual snowfall averages about 1.4 in. (3.6 cm). The greatest amount of snow reported in a single month and during a 24-hour period was 13 in. (33 cm), which occurred in March 1993. On rare occasions, there may be a 2- to 4-in. (5.1- to 10.2-cm) snowstorm, but the snow usually melts quickly.

Average annual relative humidity at the Birmingham Municipal Airport is 70%, ranging from 80 to 84% in the first half of the day and from 56 to 62% in the second half. Heavy fogs are rather rare in the area. The annual average number of days with heavy fog (visibility of 0.25 mi [0.4 km] or less) is about eight days, which usually occurs in winter. Thunderstorms can occur in any month but are most frequent during the months of March through September. The mean number of days with thunderstorms at Birmingham Municipal Airport is about 58 per year. They are occasionally accompanied by damaging hail, but the area affected is nearly always small.

In the state of Alabama, the tornado season extends from November through early May, with the greatest frequency in March and April (Ruffner 1985). Frequently, a tropical storm moving inland will spawn several tornados. Tornadoes in the area surrounding ANAD 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, 923 tornadoes were reported in Alabama, with a tornado event frequency of $4.0 \times 10^{-4}/\text{mi}^2$ per year and an average of 20 tornadoes per year (Storm Prediction Center 2000). For the same period, 13 tornadoes were reported in Calhoun County, with a tornado event frequency of $4.6 \times 10^{-4}/\text{mi}^2$ per year. Most tornadoes occurring in Calhoun County are classified, at most, at a level of F3 on the Fujita tornado scale.[4] Only one was rated at F4, on March 27, 1994.

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

4.5.1.2 Emissions

The existing sources of criteria pollutants and volatile organic compounds (VOCs) at ANAD include boilers, degreasing operations, paint booths, fuel storage and dispensing, open burning, open detonation, and other miscellaneous sources. Other emissions originate from numerous, very small, nonpoint sources that are associated with depot missions but are not included in any specific source categories (e.g., commuting vehicles, delivery operations). Major sources operate under permits from the ADEM. Data on total annual emissions under operating permits from ADEM in 1999 (Larkins 2000a) are included in Table 4.5-1. Estimated emissions from all categories of sources at ANAD were about 273 tons of PM_{10}; 245 tons of VOCs; 173 tons of sulfur dioxide (SO_2), 45 tons of NO_x, 19 tons of carbon monoxide (CO), and 0.7 ton of lead (Pb). The combined emissions from ANAD sources are large enough to result in ANAD being designated as a major stationary source. Therefore, emissions from the proposed destruction facility would be subject to comprehensive reviews during the air permitting process for the destruction facility.

For comparison, annual estimates of air pollutant emissions in 1996 from Calhoun County and ANAD (EPA 2000b) are listed in Table 4.5-2. The significance of ANAD emissions is expressed as a percentage of the total Calhoun County emissions. As the table indicates, except SO_2, ANAD emissions account for very small fractions of the emissions released from the

TABLE 4.5-1 Estimated Emissions of Air Pollutants from Existing ANAD Sources in 1999

	Emissions (tons/yr)[a]					
Source Category	SO_2	NO_x	CO	VOCs[b]	PM_{10}	Pb
Boilers	172.47	44.04	12.29	0.88	5.75	-
Degreaser/paint stripper/abrasive	-	-	-	63.91	43.72	-
Paint booths	-	-	-	72.5	1.24	0.03
Fuel storage and dispensing	-	-	-	5.19	-	-
Open burning/open detonation	0.19	0.48	6.49	0.43	58.8	0.67
Miscellaneous[c]	-	-	-	102	163	-
Total	172.66	44.52	18.78	244.91	272.51	0.70

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

[b] Includes organic hazardous air pollutants.

[c] Includes numerous, very small, nonpoint sources that are associated with depot missions but are not included in any specific source categories.

Source: Larkins (2000a).

TABLE 4.5-2 Estimated Emissions of Air Pollutants from Calhoun County and ANAD Sources in 1996

	Emissions (tons/yr)[a]	
Air Pollutant	Calhoun County	ANAD[b]
SO_2	3,057	346 (11)
NO_x	10,308	96 (0.9)
CO	58,888	51 (0.09)
VOC	10,804	161 (1.5)
PM_{10}	10,953	307 (2.8)
Pb	-	-

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

[b] Numbers in parentheses are ANAD emissions as a percentage of Calhoun County emissions.

Source: EPA (2000b).

Calhoun County, about 2.8%, 1.5%, 0.9%, and 0.09% of the total for PM_{10}, VOC, NO_x, and CO, respectively. SO_2 emissions account for about 11% of the total Calhoun County emissions due to coal-burning boilers at ANAD. Recently, these boilers were replaced with natural-gas boilers (backed up by diesel fuel); accordingly, SO_2 emissions from the ANAD site were significantly reduced (Larkins 2000b).

4.5.1.3 Air Quality

The Alabama State Ambient Air Quality Standards (SAAQS) for six criteria pollutants — SO_2, PM, CO, ozone (O_3), nitrogen dioxide (NO_2), and Pb — are identical to the National Ambient Air Quality Standards (NAAQS), as shown in Table 4.5-3 (ADEM 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 stations nearest to ANAD are Birmingham/Fairfield for SO_2 and CO, Helena in Shelby County for NO_2, and Ashland in Clay County for O_3 (EPA 2001). In Anniston, PM_{10} monitoring was

TABLE 4.5-3 National Ambient Air Quality Standards (NAAQS), Maximum Allowable Increments for Prevention of Significant Deterioration (PSD), and Highest Background Levels Representative of ANAD[a]

Pollutant	Averaging Time	NAAQS[b]		PSD Increment ($\mu g/m^3$)		Highest Background Level	
		Primary	Secondary	Class I	Class II	Concentration[c]	Location (Year)
SO_2	3 hours	-	0.50 ppm (1,300 $\mu g/m^3$)	25	512	0.133 ppm (27)	Fairfield (2000)
	24 hours	0.14 ppm (365 $\mu g/m^3$)	-	5	91	0.057 ppm (41)	Fairfield (2000)
	Annual	0.03 ppm (80 $\mu g/m^3$)	-	2	20	0.012 ppm (40)	Fairfield (2000)
NO_2	Annual	0.053 ppm (100 $\mu g/m^3$)	0.053 ppm (100 $\mu g/m^3$)	2.5	25	0.011 ppm (21)	Helena (2000)
CO	1 hour	35 ppm (40,000 $\mu g/m^3$)	-	-	-	12.4 ppm (35)	Birmingham (1995)
	8 hours	9 ppm (10,000 $\mu g/m^3$)	-	-	-	7.2 ppm (80)	Fairfield (1995)
O_3	1 hour	0.12 ppm) (235 $\mu g/m^3$)	0.12 ppm (235 $\mu g/m^3$)	-	-	0.126 ppm (105)	Ashland (1995)
	8 hours	0.08 ppm (157 $\mu g/m^3$)	0.08 ppm (157 $\mu g/m^3$)	-	-	0.099 ppm (124)	Ashland (19989)
PM_{10}	24 hours	150 $\mu g/m^3$	150 $\mu g/m^3$	8	30	68 $\mu g/m^3$ (45)	Anniston (1995)
	Annual	50 $\mu g/m^3$	50 $\mu g/m^3$	4	17	26.4 $\mu g/m^3$ (53)	Anniston (1998)
$PM_{2.5}$	24 hours	65 $\mu g/m^3$	65 $\mu g/m^3$	-	-	46.2 $\mu g/m^3$ (71)	Ashland (1999)
	Annual	15 $\mu g/m^3$	15 $\mu g/m^3$	-	-	14.41 $\mu g/m^3$ (96)[d]	Ashland (1999)
Pb	Calendar quarter	1.5 $\mu g/m^3$	1.5 $\mu g/m^3$	-	-	0.26 $\mu g/m^3$ (17)	Gadsden (1996)

[a] A hyphen indicates that no standards 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] The number of data are insufficient to determine the annual average, so the arithmetic average from available data is presented.

Sources: 40 CFR 50; 40 CFR 52.21; ADEM 1999; EPA 2000c.

discontinued after 1998. Currently, the monitoring stations nearest to ANAD are Talladega in Talladega County for PM_{10} and Ashland in Clay County for $PM_{2.5}$ (Figure 4.5-2). As a direct result of phase-out of leaded gasoline in automobiles, lead concentrations in urban areas decreased dramatically. Thus, ambient lead concentration is no longer monitored in many parts of the country. Until 1996, lead was monitored in Etowah, Jefferson (including Birmingham), and Pike Counties. In Alabama, lead is currently monitored only in Troy in Pike County. The values highest for background air quality data recorded at the monitoring station nearest to ANAD for criteria pollutants subject to the NAAQS (EPA 2001) are also presented in Table 4.5-3.

ANAD, situated near the southwest corner of Calhoun County, is located in the East Alabama Intrastate Air Quality Control Region (AQCR, Code 003), which covers the east central part of Alabama (Figure 4.5-2). Currently, Calhoun County is designated as being in attainment for all NAAQS (Title 40, Part 81, Section 301 of the *Code of Federal Regulations* [40 CFR 81.301]). On the basis of recent six-year monitoring data, concentration levels for SO_2, NO_2, and PM_{10} around ANAD are well below their respective NAAQS. The 8-hour CO levels are about 80% of the standard, but such levels are limited to urban centers. $PM_{2.5}$ levels are below but close to the standard. Note that annual average $PM_{2.5}$ levels tend to be close to or above the standard at most statewide monitoring stations. The highest O_3 concentrations of regional concern are somewhat higher than the applicable NAAQS, as they are in most cities in the Southeast.

Prevention of significant deterioration (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 4.5-3. 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.[5] Within the State of Alabama, the PSD Class I area nearest to ANAD is the Sipsey Wilderness Area, located 91 mi (146 km) northwest of ANAD. The next closest Class I area is the Cohutta Wilderness Area in Georgia, which is 105 mi (169 km) northeast of ANAD. On the basis of the assumption that wind data at Birmingham Municipal Airport (Figure 4.51c) are representative of the region, these wilderness areas are located upwind of ANAD.

[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 areas). Class II areas allow moderate deterioration. Class III areas allow deterioration up to the secondary standard.

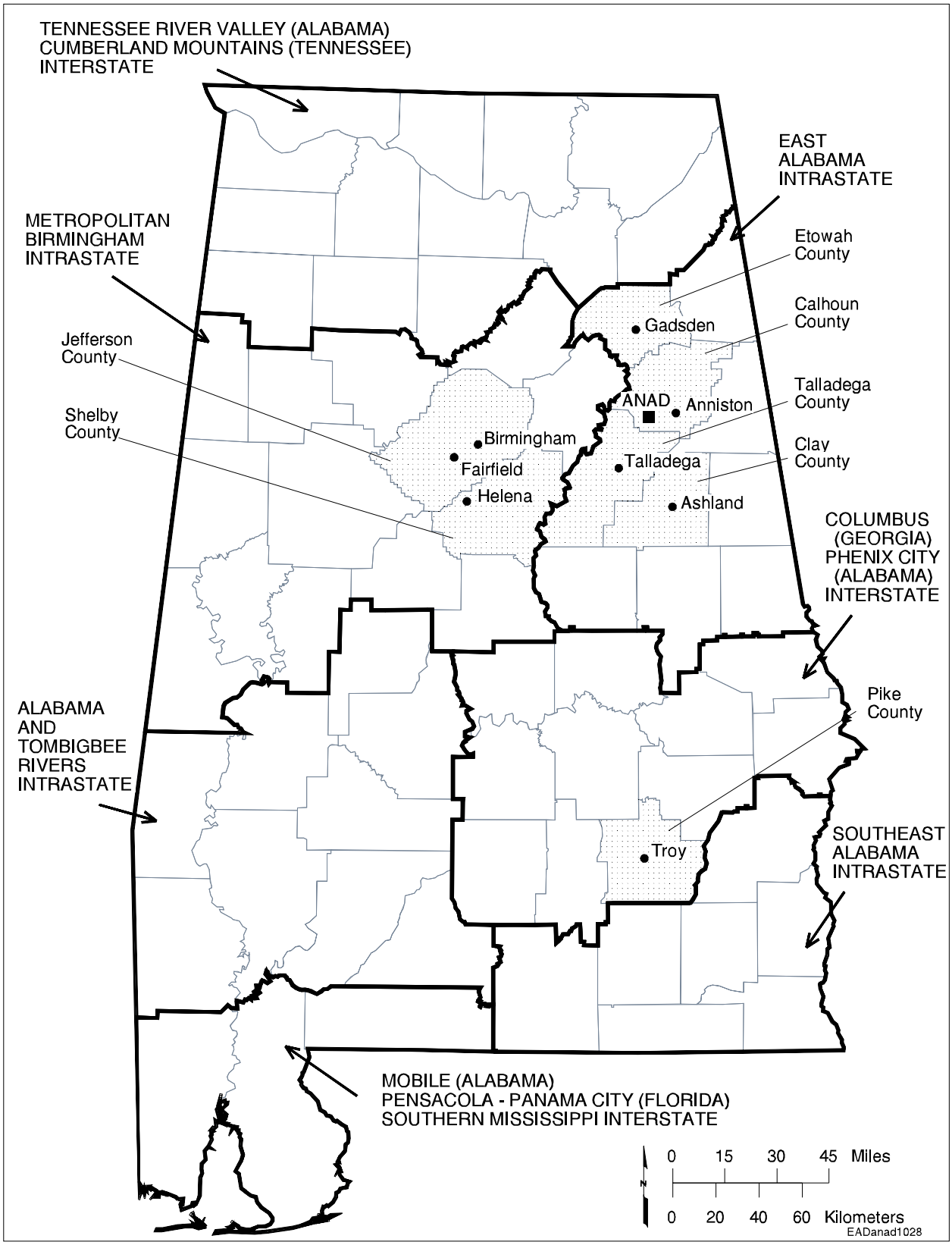

FIGURE 4.5-2 ANAD and Air Quality Control Regions in Alabama

4.5.2 ACWA Facility Emissions

4.5.2.1 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 earthmoving 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.

4.5.2.2 Emissions from Operations

The emission levels currently permitted to ANAD are more than 100 tons/yr of a regulated air pollutant. Therefore, ANAD is classified as a major stationary source of air emissions. Emission factors and other assumptions that were used to estimate 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, gas exit velocities) used in the dispersion modeling, are listed in Table 4.5-4 for Neut/Bio, Table 4.5-5 for Neut/SCWO, Table 4.5-6 for Neut/GPCR/TW-SCWO, and Table 4.5-7 for Elchem Ox.

Neutralization/Biotreatment. In a Neut/Bio pilot test facility, air pollutants would be emitted from five different types of stacks. Three would be similar to the first three types of stacks used in the Neut/SCWO facility described in the next paragraph. The fourth stack would be a biotreatment vent (waste gas) instead of a SCWO stack. The fifth stack would be a laboratory filter area stack. (In other systems, the laboratory effluents are combined with other emission streams.) No emissions from the laboratory filter area stack would be anticipated during normal (incident-free) operations.

Neutralization/SCWO. In a Neut/SCWO pilot test facility, air pollutants would be emitted from four 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 system to provide emergency electricity, (3) a filter farm stack for building circulating air and non-SCWO air effluents (e.g., rotary hydrolyzer, MPT), and

TABLE 4.5-4 Emission Rates of Criteria Air Pollutants and Volatile Organic Compounds and Stack Parameters Associated with Normal Operations of the Neutralization/Biotreatment Technology at ANAD

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	0.79 ft (0.24 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 (0.02 ton/yr)	3.2 lb/h (0.95 ton/yr)
NO_x	2.1 lb/h (3.50 tons/yr)	48.4 lb/h (14.5 tons/yr)
CO	1.3 lb/h (2.10 tons/yr)	10.4 lb/h (3.12 tons/yr)
PM_{10}	0.11 lb/h (0.19 ton/yr)	3.4 lb/h (1.02 tons/yr)
$PM_{2.5}$[c]	0.11 lb/h (0.19 ton/yr)	3.4 lb/h (1.02 tons/yr)
VOCs	0.08 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 2000c).

Source: Kimmell et al. (2001).

(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 4.6 and 4.7.)

Neutralization/GPCR/TW-SCWO. In a Neut/GPCR/TW-SCWO pilot test facility, air pollutants would be emitted from four types 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 4.5-5 Emission Rates of Criteria Air Pollutants and Volatile Organic Compounds and Stack Parameters Associated with Normal Operations of the Neutralization/SCWO Technology at ANAD

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	0.9 ft (0.27 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	2.9 lb/h (4.83 tons/yr)	48.4 lb/h (14.5 tons/yr)
CO	1.8 lb/h (2.90 tons/yr)	10.4 lb/h (3.12 tons/yr)
PM_{10}	0.16 lb/h (0.26 ton/yr)	3.4 lb/h (1.02 tons/yr)
$PM_{2.5}$[c]	0.16 lb/h (0.26 ton/yr)	3.4 lb/h (1.02 tons/yr)
VOCs	0.11 lb/h (0.19 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 2000c).

Source: Kimmell et al. (2001).

Electrochemical Oxidation. In an Elchem Ox pilot test 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 or 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

TABLE 4.5-6 Emission Rates of Criteria Air Pollutants and Volatile Organic Compounds and Stack Parameters Associated with Normal Operations of the Neutralization/GPCR/TW-SCWO Technology at ANAD

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	1.0 ft (0.30 m)	0.67 ft (0.20 m)	0.50 ft (0.15 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)	57 ft/s (17 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	3.7 lb/h (6.14 tons/yr)	48.4 lb/h (14.5 tons/yr)	0.11 lb/h (0.18 ton/yr)
CO	2.2 lb/h (3.69 tons/yr)	10.4 lb/h (3.12 tons/yr)	0.17 lb/h (0.28 ton/yr)
PM_{10}	0.2 lb/h (0.33 ton/yr)	3.4 lb/h (1.02 tons/yr)	0.03 lb/h (0.05 ton/yr)
$PM_{2.5}$[c]	0.2 lb/h (0.33 ton/yr)	3.4 lb/h (1.02 tons/yr)	0.03 lb/h (0.05 ton/yr)
VOCs	0.1 lb/h (0.24 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 2000c).

Source: Kimmell et al. (2001).

volatility and because facility operation would consume a low level of fuel and thus require infrequent refilling.

4.5.3 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 4.5-3, the Alabama SAAQS for criteria air pollutants are identical to the NAAQS (ADEM 1999).

TABLE 4.5-7 Emission Rates of Criteria Air Pollutants and Volatile Organic Compounds and Stack Parameters Associated with Normal Operations of the Electrochemical Oxidation Technology at ANAD

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	0.8 ft (0.24 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 (3.71 tons/yr)	48.4 lb/h (14.5 tons/yr)
CO	1.3 lb/h (2.23 tons/yr)	10.4 lb/h (3.12 tons/yr)
PM_{10}	0.12 lb/h (0.2 ton/yr)	3.4 lb/h (1.02 tons/yr)
$PM_{2.5}$[c]	0.12 lb/h (0.2 ton/yr)	3.4 lb/h (1.02 tons/yr)
VOCs	0.09 lb/h (0.15 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 2000c).

Source: Kimmell et al. (2001).

To evaluate air quality impacts from ANAD 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 4.5-3.

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

4.5.3.1 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 4.5-8. 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 1.0 mi (1.6 km) and 0.9 mi (1.5 km) north-northwest of the proposed facility, respectively. At these locations, for PM_{10}, the maximum 24-hour and annual concentration increments above background would be about 14 and 1.7% of the NAAQS, respectively. For $PM_{2.5}$, the maximum 24-hour and annual concentration increments above background would be about 16% and 2.8% 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 4.5-8) were added to background values (from Table 4.5-3). For PM_{10}, the maximum estimated 24-hour and annual average concentrations would be about 59 and 54% of the NAAQS, respectively. For $PM_{2.5}$, the maximum estimated 24-hour and annual average $PM_{2.5}$ concentrations would be about 87% and 99% of the NAAQS, respectively. Maximum predicted concentrations would occur at the northern ANAD boundaries adjoining the Pelham Range. Accordingly, concentration levels at the publicly accessible site boundaries (e.g., eastern boundaries) would be much lower. The annual average $PM_{2.5}$ background concentration of 14.4 $\mu g/m^3$ around the ANAD area is already close to the standard of 15 $\mu g/m^3$. 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} would be equal to or less than 59% of the applicable NAAQS. The total estimated 24-hour and annual concentrations of $PM_{2.5}$ would be below but close to their applicable NAAQS, primarily because of high background concentration levels.

4.5.3.2 Impacts of Operations

In the air quality analysis for the operational period, air quality impacts were modeled for each of the four 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 Tables 4.5-9 through 4.5-12 for the four technologies. The receptor locations where maximum concentration increments would occur are also listed in these tables.

TABLE 4.5-8 Maximum Predicted Off-Post Concentration Increments and Total Concentrations of PM_{10} and $PM_{2.5}$ during Construction at ANAD

		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	20.3	68	88.3	150	59 (14)
	Annual	0.84	26.4	27.2	50	54 (1.7)
$PM_{2.5}$	24 hours	10.1	46.2	56.3	65	87 (16)
	Annual	0.42	14.4	14.8	15	99 (2.8)

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

[b] Maximum modeled 24-hour and annual average concentrations occur at receptors about 1.0 mi (1.6 km) and 0.9 mi (1.5 km) to the north-northwest of the proposed facility, respectively.

[c] See Table 4.5-3.

[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.

The estimated maximum concentration increments due to operation of the proposed facility would contribute less than 9% of applicable NAAQS for all pollutants (Tables 4.5-9 through 4.5-12). Irrespective of the ACWA technology chosen, concentration increments would be almost the same. In most cases, maximum predicted concentrations would occur at the northern ANAD boundaries adjoining Pelham Range. Accordingly, potential impacts from the proposed facility operations at publicly accessible ANAD boundaries or nearby communities 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 4.5-9 through 4.5-12) would be less than 5% of the applicable PSD increments (Table 4.5-3). The maximum predicted increments in annual average NO_2 concentrations due to the proposed facility operations would be about 3% 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 18% 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 ISCST3 model

TABLE 4.5-9 Maximum Predicted Off-Post Concentration Increments and Total Concentrations of Criteria Pollutants during Normal Operations of the Neutralization/Biotreatment Technology at ANAD

		Concentration ($\mu g/m^3$)					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	13.5	346	360	1,300	28 (1.0)	1.4 (2.3)	NW
	24 hours	4.9	149	154	365	42 (1.3)	1.4 (2.3)	NW
	Annual	0.03	32	32	80	40 (0.04)	1.4 (2.3)	NW
NO_2	Annual	0.66	21	22	100	22 (0.7)	1.4 (2.3)	NW
CO	1 hour	63	14,171	14,234	40,000	36 (0.16)	1.4 (2.2)	ESE
	8 hours	31	8,000	8,031	10,000	80 (0.31)	1.4 (2.3)	NW
PM_{10}	24 hours	5.5	68	74	150	49 (3.7)	1.4 (2.3)	NW
	Annual	0.04	26.4	26.4	50	53 (0.1)	1.4 (2.3)	NW
$PM_{2.5}$	24 hours	5.5	46.2	51.7	65	80 (8.5)	1.4 (2.3)	NW
	Annual	0.04	14.4	14.4	15	96 (0.3)	1.4 (2.3)	NW

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

[b] See Table 4.5-3.

[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/Bio facility.

could reliably estimate concentrations) in the direction of the nearest Class I PSD area (the Sipsey Wilderness Area) would be less than 1.6% of the applicable PSD increments. Concentration increments at the Sipsey Wilderness Area, which is located about 91 mi (146 km) northwest of ANAD, would be much lower.

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 4.5.1, Calhoun County, including ANAD, is currently in attainment for ozone (40 CFR 81.301). Ozone precursor emissions from the proposed facility operations would

TABLE 4.5-10 Maximum Predicted Off-Post Concentration Increments and Total Concentrations of Criteria Pollutants during Normal Operations of the Neutralization/SCWO Technology at ANAD

		Concentration ($\mu g/m^3$)					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	13.4	346	359	1,300	28 (1.0)	1.4 (2.3)	NW
	24 hours	4.8	149	154	365	42 (1.3)	1.4 (2.3)	NW
	Annual	0.03	32	32	80	40 (0.04)	1.4 (2.3)	NW
NO_2	Annual	0.69	21	22	100	22 (0.7)	1.4 (2.3)	NW
CO	1 hour	69	14,171	14,240	40,000	36 (0.2)	1.2 (2.0)	E
	8 hours	32	8,000	8,032	10,000	80 (0.3)	1.4 (2.3)	NW
PM_{10}	24 hours	5.4	68	73	150	49 (3.6)	1.4 (2.3)	NW
	Annual	0.05	26.4	26.5	50	53 (0.1)	1.4 (2.3)	NW
$PM_{2.5}$	24 hours	5.4	46.2	51.6	65	79 (8.3)	1.4 (2.3)	NW
	Annual	0.05	14.4	14.5	15	96 (0.3)	1.4 (2.3)	NW

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

[b] See Table 4.5-3.

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

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

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

be small, making up about 0.2 and 0.01% of the 1996 actual emissions of NO_x and VOCs, respectively, from Calhoun County. As a consequence, the cumulative impacts of potential releases from ANAD facility operations on regional ozone concentrations would not be of any concern.

The total concentrations of criteria pollutants obtained by adding the predicted maximum concentration increments to background values (from Table 4.5-3) are compared with applicable NAAQS (Tables 4.5-9 through 4.5-12). Except for 8-hour CO and $PM_{2.5}$, maximum estimated concentrations of criteria pollutants are less than or equal to 53% of the NAAQS. Total 8-hour CO and $PM_{2.5}$ concentrations would be close to, but still below their applicable standards, primarily due to high background levels.

TABLE 4.5-11 Maximum Predicted Off-Post Concentration Increments and Total Concentrations of Criteria Pollutants during Normal Operations of the Neutralization/GPCR/TW-SCWO Technology at ANAD

		Concentration ($\mu g/m^3$)					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	13.5	346	360	1,300	28 (1.0)	1.4 (2.3)	NW
	24 hours	4.8	149	154	365	42 (1.3)	1.4 (2.3)	NW
	Annual	0.04	32	32	80	40 (0.05)	1.4 (2.3)	NW
NO_2	Annual	0.78	21	22	100	22 (0.8)	1.0 (1.6)	NNW
CO	1 hour	75	14,171	14,246	40,000	36 (0.2)	1.2 (2.0)	E
	8 hours	35	8,000	8,035	10,000	80 (0.4)	1.4 (2.3)	NW
PM_{10}	24 hours	5.5	68	74	150	49 (3.7)	1.4 (2.3)	NW
	Annual	0.05	26.4	26.5	50	53 (0.1)	1.0 (1.6)	NNW
$PM_{2.5}$	24 hours	5.5	46.2	51.7	65	80 (8.5)	1.4 (2.3)	NW
	Annual	0.05	14.4	14.5	15	96 (0.3)	1.0 (1.6)	NNW

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

[b] See Table 4.5-3.

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

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

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

4.5.3.3 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 compound 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 were based on EPA guidance (EPA 1994, as cited in National Research Council 1997a).

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 VOCs emissions from the proposed facility by 1.45 would result in about 2 tons per year, or less than 0.02% of the 1996 VOCs emissions in Calhoun County

TABLE 4.5-12 Maximum Predicted Off-Post Concentration Increments and Total Concentrations of Criteria Pollutants during Normal Operations of the Electrochemical Oxidation Technology at ANAD

		Concentration ($\mu g/m^3$)					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	13.5	346	360	1,300	28 (1.0)	1.4 (2.3)	NW
	24 hours	4.9	149	154	365	42 (1.3)	1.4 (2.3)	NW
	Annual	0.03	32	32	80	40 (0.04)	1.4 (2.3)	NW
NO_2	Annual	0.66	21	22	100	22 (0.7)	1.4 (2.3)	NW
CO	1 hour	63	14,171	14,234	40,000	36 (0.2)	1.4 (2.2)	ESE
	8 hours	31	8,000	8,031	10,000	80 (0.3)	1.4 (2.3)	NW
PM_{10}	24 hours	5.5	68	74	150	49 (3.7)	1.4 (2.3)	NW
	Annual	0.04	26.4	26.4	50	53 (0.1)	1.4 (2.3)	NW
$PM_{2.5}$	24 hours	5.5	46.2	51.7	65	80 (8.5)	1.4 (2.3)	NW
	Annual	0.04	14.4	14.4	15	96 (0.3)	1.4 (2.3)	NW

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

[b] See Table 4.5-3.

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

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

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

(Table 4.5-2). Therefore, the potential increase in ozone concentration that could result from VOC emissions from proposed facility operations under fluctuating conditions would be almost the same as that under normal operating conditions. Lead (Pb) is the only metal among criteria pollutants. 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 cause any appreciable increase in atmospheric lead concentrations. Therefore, when fluctuating operations are considered, the potential impacts of criteria pollutants involved would still be expected to be insignificant.

4.5.4 Impacts of No Action

The principal sources of air pollutant emissions associated with stockpile maintenance activities are exhaust emissions and road dust generated by vehicles. 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 ANAD. Therefore, impacts on air quality that would occur as a result of the continued storage of the stockpile are expected to be minimal.

4.6 AIR QUALITY — TOXIC AIR POLLUTANTS

4.6.1 Current Emissions and Air Quality

Under its Title V *Clean Air Act* (CAA) permit application, ANAD is classified as a major source emitter for VOCs, methylene chloride, methyl ethyl ketone, toluene, xylene, and trichloroethylene (ANAD 1997). Any new equipment installed that could release substances classified as HAPs, as defined in Section 112, Title III, of the CAA, must demonstrate compliance with EPA National Emission Standards for Hazardous Air Pollutants (NESHAP) prior to issuance of a permit to operate.

Permitted sources of emissions at ANAD in 1999 included open burning and open detonation, paint booths, degreaser units, boilers, and fuel storage and dispensing (Larkins 2000a). A summary of the compounds and quantities released is given in Table 4.6-1. Methyl ethyl ketone, methylene chloride, and trichloroethylene from paint booths and degreasing were the compounds released in the highest quantities. (The organic HAP emissions are also included in reported VOC emissions addressed in Section 4.5 and tabulated in Table 4.5-1).

4.6.2 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 ANAD is given in Kimmell et al. (2001). Estimated emissions (including those from diesel generators and boilers) from a Neut/Bio, a Neut/SCWO, a Neut/GPCR/TW-SCWO, and an Elchem Ox facility are provided in Tables 4.6-2 through 4.6-5. For the destruction facility stacks (SCWO vent, biotreatment vent, product gas burner vent, catalytic oxidation unit [CatOx]/filter farm stack vent), emission estimates were based on demonstration test data and site-specific munitions inventories compiled by Mitretek Corp. (2001a–d). 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

[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.

TABLE 4.6-1 Emissions from ANAD in 1999

Substance	Quantity (lb)	Source[a]
Antimony compounds	40	Paint booths
Benzene	200	OB/OD, fuel storage and dispensing
Chromium	700	OB/OD, degreasing, paint booths
Dibenzofurans	20	OB/OD
Ethyl benzene	560	OB/OD, paint booths, fuel storage and dispensing
Hexamethylene-1,6-diisocyanate	260	Paint booths
Hexane	160	OB/OD, fuel storage and dispensing
Hydrogen cyanide	1,380	OB/OD
Methyl ethyl ketone	33,940	Paint booths
Methyl isobutyl ketone	1,300	Paint booths
Methylene chloride	106,940	Degreasing, paint booths
Nickel compounds	120	Degreasing
Styrene	480	OB/OD
Toluene	12,500	OB/OD, paint booths, fuel storage and dispensing
Trichloroethylene	20,880	Degreasing
Xylenes (isomers and mixtures)	6,060	OB/OD, paint booths, fuel storage and dispensing
Total	185,540	

[a] OB/OD = open burning and open detonation.

Source: Larkins (2000a).

substances (e.g., acetaldehyde, formaldehyde), the estimated emissions from boilers and diesel generators would exceed the after-treatment emissions from destruction facility processes by many orders of magnitude (Tables 4.6-2 through 4.6-5).

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 particulate matter (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/Bio facility (Table 4.6-2), it is not known whether the emissions from the biotreatment vent would require further treatment. The provider of the equipment used during the ACWA technology demonstrations has stated that further treatment would not be necessary. In this assessment, both treatment and no treatment of biotreatment vent stack emissions are assessed. For the Neut/GPCR/TW-SCWO facility (Table 4.6-4), it was assumed that emissions from the product gas burner vent would not be further treated after release from the facility's scrubber system.

TABLE 4.6-2 Estimated Toxic Air Pollutant Emissions from Neutralization/Biotreatment Technology at ANAD

	Emissions (μg/s)[b]				
Compound[a]	Diesel Generator	Boiler	Biotreatment Vent, Treated[c]	Biotreatment Vent, Untreated[c]	Filter Farm Stack[d]
1,1,1-Trichloroethane	-	-	-	-	2.1×10^{-10}
1,2,3,4,6,7,8,9-OCDD	-	-	4.1×10^{-10}	4.7×10^{-3}	4.2×10^{-13}
1,2,3,4,6,7,8,9-OCDF	-	-	8.8×10^{-11}	1.1×10^{-3}	1.1×10^{-12}
1,2,3,4,6,7,8-HpCDD	-	-	8.8×10^{-11}	1.1×10^{-3}	8.4×10^{-13}
1,2,3,4,6,7,8-HpCDF	-	-	9.7×10^{-11}	1.1×10^{-3}	8.4×10^{-13}
1,2,3,4,7,8,9-HpCDF	-	-	2.5×10^{-11}	2.6×10^{-4}	9.5×10^{-14}
1,2,3,4,7,8-HxCDD	-	-	4.2×10^{-12}	4.7×10^{-5}	9.5×10^{-14}
1,2,3,4,7,8-HxCDF	-	-	2.9×10^{-11}	3.2×10^{-4}	8.4×10^{-13}
1,2,3,6,7,8-HxCDD	-	-	8.4×10^{-12}	1.1×10^{-4}	3.2×10^{-13}
1,2,3,6,7,8-HxCDF	-	-	1.3×10^{-11}	1.6×10^{-4}	4.2×10^{-13}
1,2,3,7,8,9-HxCDD	-	-	1.7×10^{-11}	2.1×10^{-4}	3.2×10^{-13}
1,2,3,7,8,9-HxCDF	-	-	-	-	4.2×10^{-14}
1,2,3,7,8-PeCDD	-	-	4.7×10^{-13}	5.3×10^{-6}	9.5×10^{-14}
1,2,3,7,8-PeCDF	-	-	1.3×10^{-11}	1.6×10^{-4}	2.1×10^{-13}
1,2-Dichloroethane*	-	-	1.5×10^{-7}	1.1×10^{1}	2.1×10^{-5}
1,2-Dichloropropane*	-	-	-	-	4.2×10^{-10}
1,3-Butadiene*	1.1	-	-	-	-
1,4-Dichlorobenzene*	-	-	-	-	4.2×10^{-9}
2,3,4,6,7,8-HxCDF	-	-	1.3×10^{-11}	1.6×10^{-4}	4.2×10^{-13}
2,3,4,7,8-PeCDF	-	-	2.1×10^{-11}	2.1×10^{-4}	5.3×10^{-13}
2,3,7,8-TCDD*	-	-	6.5×10^{-13}	5.3×10^{-6}	-
2,3,7,8-TCDF	-	-	2.1×10^{-11}	2.1×10^{-4}	2.1×10^{-12}
2-Methylnaphthalene	-	4.5×10^{-2}	-	-	-
3/4-Methy phenol*	-	-	-	-	2.1×10^{-9}
3-Methylchloranthrene	-	3.4×10^{-3}	-	-	-
Acenaphthene	3.9×10^{-2}	3.4×10^{-3}	-	-	-
Acenaphthylene	1.4×10^{-1}	3.4×10^{-3}	-	-	-
Acetaldehyde*	2.1×10^{1}	-	4.2×10^{-7}	2.6×10^{1}	-
Acrolein*	2.6	-	-	-	-
Aldehydes	1.9×10^{3}	-	-	-	-
Anthracene	5.2×10^{-2}	4.5×10^{-3}	-	-	-
Arsenic*	-	3.8×10^{-1}	-	-	-
Barium	-	8.3	-	-	-
Benz(a)anthracene	2.6×10^{1}	3.4×10^{-3}	-	-	-
Benzene*	4.7×10^{-2}	4.0	-	-	1.1×10^{-8}
Benzo(a)pyrene	5.2×10^{-3}	2.3×10^{-3}	-	-	-
Benzo(b)fluoranthene	2.7×10^{-3}	3.4×10^{-3}	-	-	-
Benzo(g,h,i)perylene	1.4×10^{-2}	2.3×10^{-3}	-	-	-
Benzo(k)fluoranthene	4.3×10^{-3}	3.4×10^{-3}	-	-	-
Beryllium*	-	2.3×10^{-2}	-	-	-
Bis (2-chloroethyl) ether*	-	-	1.1×10^{-7}	5.3×10^{1}	-
Bis (2-ethylhexyl) phthalate*	-	-	1.6×10^{-7}	1.1×10^{1}	1.1×10^{-8}

TABLE 4.6-2 (Cont.)

	Emissions (μg/s)[b]				
Compound[a]	Diesel Generator	Boiler	Biotreatment Vent, Treated[c]	Biotreatment Vent, Untreated[c]	Filter Farm Stack[d]
Bromomethane*	-	-	4.3×10^{-7}	2.6×10^{1}	3.2×10^{-7}
Butane	-	4.0×10^{3}	-	-	-
Cadmium*	-	2.1	-	-	-
Carbon disulfide*	-	-	-	-	3.2×10^{-7}
Carbon tetrachloride*	-	-	-	-	4.2×10^{-9}
Chlorobenzene*	-	-	-	-	4.2×10^{-7}
Chloroethane*	-	-	-	-	5.3×10^{-9}
Chloroform*	-	-	-	-	7.4×10^{-7}
Chloromethane*	-	-	3.9×10^{-7}	2.6×10^{1}	4.2×10^{-6}
Chromium*	-	2.6	-	-	2.1×10^{-7}
Chrysene	9.8×10^{-3}	3.4×10^{-3}	-	-	-
Cobalt*	-	1.6×10^{-1}	-	-	2.1×10^{-7}
Copper	-	1.6	-	-	-
Dibenzo(a,h)anthracene	1.6×10^{-2}	2.3×10^{-3}	-	-	-
Dibenzofuran*	-	-	-	-	4.2×10^{-9}
Dichlorobenzene*	-	2.3	-	-	-
Diethylphthalate	-	-	1.7×10^{-7}	1.1×10^{1}	-
Dimethylbenz(a)anthracene	-	3.0×10^{-2}	-	-	-
Dimethylphthalate*	-	-	-	-	2.1×10^{-8}
Ethane	-	5.9×10^{3}	-	-	
Ethyl benzene*	-	-	1.3×10^{-6}	1.1×10^{2}	1.1×10^{-9}
Fluoranthene	2.1×10^{-1}	5.7×10^{-3}	-	-	-
Fluorene	8.1×10^{-1}	5.3×10^{-3}	-	-	-
Formaldehyde*	3.3×10^{1}	1.4×10^{2}	3.5×10^{-6}	2.1×10^{2}	-
Glycol ethers (2-butoxy ethanol)	-	-	1.1×10^{-6}	5.3×10^{1}	-
H (mustard)[e]	-	-	-	-	2.8×10^{2}
Hexane(n)*	-	3.4×10^{3}	-	-	-
Indeno(1,2,3-cd)pyrene	1.0×10^{-2}	3.4×10^{-3}	-	-	-
Lead*	-	9.5×10^{-1}	-	-	1.1×10^{-8}
m,p-Xylene*	7.9	-	1.1×10^{-5}	5.3×10^{2}	5.3×10^{-8}
Manganese*	-	7.2×10^{-1}	-	-	8.4×10^{-8}
Mercury*	8.3×10^{-3}	4.9×10^{-1}	4.7×10^{-5}	5.3	2.1×10^{-8}
Methyl ethyl ketone*	-	-	-	-	2.1×10^{-5}
Methyl ethyl ketone/butyraldehydes*	-	-	1.3×10^{-7}	1.1×10^{1}	-
Methylene chloride*	-	-	3.4×10^{-6}	2.1×10^{2}	3.2×10^{-8}
Molybdenum	-	2.1	-	-	-
Naphthalene*	2.3	1.2	1.0×10^{-7}	5.3	6.3×10^{-8}
Nickel*	-	4.0	-	-	2.1×10^{-7}
OCDD	-	-	7.9×10^{-11}	1.1×10^{-3}	-
OCDF	-	-	3.2×10^{-11}	3.7×10^{-4}	-
o-Xylene*	-	-	-	-	3.2×10^{-9}
Particulates	-	-	-	-	6.3×10^{-4}

TABLE 4.6-2 (Cont.)

	Emissions (μg/s)[b]				
Compound[a]	Diesel Generator	Boiler	Biotreatment Vent, Treated[c]	Biotreatment Vent, Untreated[c]	Filter Farm Stack[d]
Pentane(n)	-	4.9×10^{3}	-	-	-
Phenanthrene	8.1×10^{-1}	3.2×10^{-2}	-	-	-
Phenol*	-	-	4.7×10^{-8}	3.2	7.4×10^{-9}
Phosphorus*	-	-	-	-	2.1×10^{-8}
PAHs*	4.7	-	-	-	-
POM (fluorene)	-	-	-	-	4.2×10^{-8}
Propanal (propionaldehyde)*	-	-	1.7×10^{-7}	1.1×10^{1}	-
Propane	-	3.0×10^{3}	-	-	-
Propylene	7.1×10^{1}	-	-	-	-
Pyrene	1.3×10^{-1}	9.5×10^{-3}	-	-	-
Selenium*	-	4.5×10^{-2}	-	-	2.1×10^{-9}
Styrene*	-	-	-	-	1.1×10^{-12}
Tetrachloroethene*	-	-	-	-	3.2×10^{-10}
Toluene*	1.1×10^{1}	6.4	2.3×10^{-7}	1.6×10^{1}	6.3×10^{-8}
Total HpCDD	-	-	1.6×10^{-10}	1.6×10^{-3}	2.1×10^{-12}
Total HpCDF	-	-	1.6×10^{-10}	1.6×10^{-3}	1.1×10^{-12}
Total HxCDD	-	-	1.0×10^{-10}	1.1×10^{-3}	3.2×10^{-12}
Total HxCDF	-	-	1.6×10^{-10}	1.1×10^{-3}	3.2×10^{-12}
Total PeCDD	-	-	-	-	3.2×10^{-12}
Total PeCDF	-	-	1.4×10^{-10}	1.6×10^{-3}	6.3×10^{-12}
Total TCDD*	-	-	3.6×10^{-12}	4.2×10^{-5}	2.1×10^{-12}
Total TCDF	-	-	6.5×10^{-11}	5.3×10^{-4}	2.1×10^{-8}
Vanadium	-	4.4	-	-	-

[a] Substances designated with an asterisk (*) are listed as HAPs under Title III, Section 112 of the CAA. PAHs = polycyclic aromatic hydrocarbons. POM = polycyclic organic matter. Polychlorinated dioxins/ furans are as follows: HpCDD = heptachlorodibenzo-p-dioxin, HpCDF = heptachlorodibenzo-p-furan, HxCDD = hexachlorodibenzo-p-dioxin; HxCDF = hexachlorodibenzo-p-furan, OCDD = octachlorodibenzo-p-dioxin, OCDF = octachlorodibenzo-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] The untreated values assume direct release to the stack after processing through the catalytic oxidation unit (CatOx). The treated values for organics assume that after passing through the CatOx, emissions are passed through six carbon filters in series, each at 95% efficiency. It is assumed that PM passes through two HEPA filters in series, each at 99.97% efficiency.

[d] Filter farm stack emissions are assumed to be treated by using carbon filters to capture organics and by using HEPA filters to capture PM, as in footnote c above.

[e] The after-treatment emission rate from the filter farm stack for mustard agent is a worst-case estimate; it assumes emissions at the detection limit of 0.006 $\mu g/m^3$ (Kimmell et al. 2001). It is assumed that no mustard would be emitted from the biotreatment vent; none would be present after neutralization and treatment in the immobilized cell bioreactor (ICB).

TABLE 4.6-3 Estimated Toxic Air Pollutant Emissions from Neutralization/SCWO Technology at ANAD

	Emissions (μg/s)[b]					
			Mustard Agent Processing[c]		Nerve Agent Processing[c]	
Compound[a]	Diesel Generator	Boiler	SCWO Vent	Filter Farm Stack	SCWO Vent	Filter Farm Stack
	-	-	-	-	-	-
1,3-Butadiene*	1.1	-	-	-	-	-
2-Methylnaphthalene	-	6.3×10^{-2}	-	-	-	-
3-Methylchloranthrene	-	4.7×10^{-3}	-	-	-	-
Acenaphthene	3.9×10^{-2}	4.7×10^{-3}	-	-	-	-
Acenaphthylene	1.4×10^{-1}	4.7×10^{-3}	-	-	-	-
Acetaldehyde*	2.1×10^{1}	-	1.2×10^{-7}	-	6.1×10^{-8}	-
Acrolein*	2.6	-	-	-	-	-
Aldehydes	1.9×10^{3}	-	-	-	-	-
Anthracene	5.2×10^{-2}	6.3×10^{-3}	-	-	-	-
Antimony*	-	-	1.9×10^{-7}	-	1.6×10^{-8}	-
Arsenic*	-	5.3×10^{-1}	5.4×10^{-8}	-	2.2×10^{-9}	-
Barium	-	1.2×10^{1}	-	-	-	-
Benz(a)anthracene	2.6×10^{1}	4.7×10^{-3}	-	-	-	-
Benzene*	4.7×10^{-2}	5.5	-	-	-	-
Benzo(a)pyrene	5.2×10^{-3}	3.2×10^{-3}	-	-	-	-
Benzo(b)fluoranthene	2.7×10^{-3}	4.7×10^{-3}	-	-	-	-
Benzo(g,h,i)perylene	1.4×10^{-2}	3.2×10^{-3}	-	-	-	-
Benzo(k)fluoranthene	4.3×10^{-3}	4.7×10^{-3}	-	-	-	-
Beryllium*	-	3.2×10^{-2}	1.2×10^{-8}	-	4.5×10^{-10}	-
Butane	-	5.5×10^{3}	-	-	-	-
Cadmium*	-	2.9	1.2×10^{-8}	-	8.0×10^{-9}	-
Chromium*	-	3.7	3.6×10^{-7}	-	8.0×10^{-8}	-
Chrysene	9.8×10^{-3}	4.7×10^{-3}	-	-	-	-
Cobalt*	-	2.2×10^{-1}	9.5×10^{-8}	-	9.5×10^{-9}	-
Copper	-	2.2	-	-	-	-
Dibenzo(a,h)anthracene	1.6×10^{-2}	3.2×10^{-3}	-	-	-	-
Dichlorobenzene*	-	3.2	-	-	-	-
Dimethylbenz(a)anthracene	-	4.2×10^{-2}	-	-	-	-
Ethane	-	8.1×10^{3}	-	-	-	-
Ethyl benzene*	-	-	1.4×10^{-6}	-	1.4×10^{-7}	-
Fluoranthene	2.1×10^{-1}	7.9×10^{-3}	-	-	-	-
Fluorene	8.1×10^{-1}	7.4×10^{-3}	-	-	-	-
Formaldehyde*	3.3×10^{1}	2.0×10^{2}	1.5×10^{-7}	-	9.5×10^{-9}	-
GB[d]	-	-	-	-		2.8
H (mustard)[d]	-	-	-	2.8×10^{2}	-	-
Hexane(n)*	-	4.7×10^{3}	-	-	-	-
Indeno(1,2,3-cd)pyrene	1.0×10^{-2}	4.7×10^{-3}	-	-	-	-
Lead*	-	1.3	2.2×10^{-7}	-	7.6×10^{-8}	-

TABLE 4.6-3 (Cont.)

	Emissions (μg/s)[b]					
			Mustard Agent Processing[c]		Nerve Agent Processing[c]	
Compound[a]	Diesel Generator	Boiler	SCWO Vent	Filter Farm Stack	SCWO Vent	Filter Farm Stack
m,p-Xylene*	7.9	-	-	-	-	-
Manganese	-	1.0	3.4×10^{-7}	-	7.0×10^{-8}	-
Mercury*	8.3×10^{-3}	6.8×10^{-1}	-	-	9.1×10^{-9}	-
Methyl ethyl ketone/butyraldehydes*	-	-	3.6×10^{-8}	-	1.9×10^{-9}	-
Molybdenum	-	2.9	-	-	-	-
m-Xylene*	-	-	1.3×10^{-6}	-	1.3×10^{-7}	-
Naphthalene*	2.3	1.6	-	-	7.7×10^{-11}	-
Nickel*	-	5.5	1.3×10^{-6}	-	3.6×10^{-7}	-
Particulates	-	-	5.8×10^{-5}	-	8.6×10^{-6}	-
p-Cresol (4-methylphenol)*	-	-	1.1×10^{-7}	-	1.1×10^{-8}	-
Pentane(n)	-	6.8×10^{3}	-	-		-
Phenanthrene	8.1×10^{-1}	4.5×10^{-2}	-	-		-
Phosphorus*	-	-	1.7×10^{-5}	-	2.7×10^{-6}	-
PCBs[e]	-	-	-	-	1.5×10^{-9}	-
PAHs*	4.7	-	-	-	-	-
Propane	-	4.2×10^{3}	-	-	-	-
Propylene	7.1×10^{1}	-	-	-	-	-
Pyrene	1.3×10^{-1}	1.3×10^{-2}	-	-	-	-
Selenium*	-	6.3×10^{-2}	5.6×10^{-8}	-	1.3×10^{-8}	-
Toluene*	1.1×10^{1}	8.9	-	-	-	-
Total HpCDF	-	-	1.6×10^{-16}	-	-	-
Total TCDD	-	-	1.5×10^{-12}	-	1.5×10^{-13}	-
Vanadium	-	6.0	-	-	-	-
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. HpCDF = heptachlorodibenzo-p-furan. TCDD = tetrachlorodibenzo-p-dioxin.

[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, mustard) 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 was assumed that SCWO technology would have a destruction efficiency of 99.9999%, and that further treatment as in footnote c would be applied.

TABLE 4.6-4 Estimated Toxic Air Pollutant Emissions from Neutralization/GPCR/TW-SCWO Technology at ANAD

	Emissions (µg/s)[b]							
			Mustard Processing[c]		GB Processing[c]		VX Processing[c]	
Compound[a]	Diesel Generator	Boiler	Product Gas Burner	Filter Farm Stack	Product Gas Burner	Filter Farm Stack	Product Gas Burner	Filter Farm Stack
(R)-(-)-2,2-Dimethyl-1,3-dioxolane-4-methanol	-	-	-	3.1×10^{-8}	-	-	-	-
1,1,1-Trichloroethane	-	-	1.1×10^{-1}	-	6.8×10^{-2}	7.6×10^{-8}	6.1×10^{-2}	-
1,2,3,4,6,7,8-HpCDF	-	-	1.7×10^{-8}	-	1.1×10^{-8}	-	9.4×10^{-6}	-
1,2,3,4,7,8-HxCDF	-	-	1.3×10^{-7}		8.2×10^{-8}		7.3×10^{-5}	-
1,2,3,6,7,8-HxCDF	-	-	5.0×10^{-8}		3.1×10^{-8}		2.5×10^{-5}	-
1,2,4-Trimethylbenzene	-	-	-		-	8.3×10^{-9}	-	2.9×10^{-6}
1,3-Butadiene*	1.1	-	-	-	-	-	-	-
1,4-Dichlorobenzene*	-	-	-	-	-	-	-	6.7×10^{-9}
1-Ethyl-2,2,6-trimethylcyclohexane	-	-	-	-	-	-	-	2.2×10^{-6}
1-Hexanol, 2-ethyl-	-	-	3.4×10^{1}	-	2.1×10^{1}	-	1.9×10^{1}	-
1H-Indene	-	-	8.5	-	5.2	-	4.6	-
1H-Indene, 2,3-dihydro-	-	-	-	-	-	4.9×10^{-8}	-	-
1-Propene, 3,3,3-trichloro-	-	-	-	5.3×10^{-9}	-	-	-	-
2-(2-Butoxyethoxy) ethanol	-	-		-	-	-	-	2.5×10^{-6}
2,3,7,8-TCDF	-	-	7.9×10^{-8}	-	4.8×10^{-8}	-	4.3×10^{-5}	-
2,4-Dimethylphenol	-	-	3.4		2.1	-	1.8	-
2-Butanone (methyl ethyl ketone)*	-	-	1.2	-	7.2×10^{-1}	-	6.4×10^{-1}	-
2-Methylnaphthalene	-	8.0×10^{-2}	-	8.4×10^{-8}	-	1.9×10^{-8}	-	1.1×10^{-6}
2-Nitrophenol	-	-	-	-	-	5.4×10^{-9}	-	-
3-Methylchloranthrene	-	6.0×10^{-3}	-	-	-	-	-	-
9H-Fluoren-9-one	-	-	-	-	-	2.9×10^{-6}	-	-
Acenaphthene	3.9×10^{-2}	6.0×10^{-3}	-	-	-	9.7×10^{-10}	-	-
Acenaphthylene	1.4×10^{-1}	6.0×10^{-3}	-	-	-	-	-	-
Acetaldehyde*	2.1×10^{1}	-	-	6.8×10^{-9}	-	-	-	-
Acetic acid	-	-	-	-	-	-	-	8.1×10^{-7}
Acetone	-	-	3.2×10^{1}	4.3×10^{-7}	1.8×10^{2}	-	1.6×10^{2}	-
Acrolein*	2.6	-	-	-	-	-	-	-
Aldehydes	1.9×10^{3}	-	-	-	-	-	-	-
Aluminum	-	-	1.1×10^{1}	-	7.0	-	6.2	-
Anthracene	5.2×10^{-2}	8.0×10^{-3}	-	-	-	1.1×10^{-8}	-	6.0×10^{-9}
Antimony*	-	-	-	-	2.3×10^{-2}	1.8×10^{-9}	2.1×10^{-2}	1.5×10^{-6}
Arsenic*	-	6.7×10^{-1}	8.5×10^{-2}	2.4×10^{-9}	3.3×10^{-1}	7.2×10^{-9}	2.9×10^{-1}	-
Barium	-	1.5×10^{1}	5.0×10^{-1}	-	3.1×10^{-1}	-	2.7×10^{-1}	-
Benz(a)anthracene	4.7×10^{-2}	6.0×10^{-3}	-	-	-	2.1×10^{-9}	4.9×10^{-2}	-
Benzaldehyde	-	-	-	3.0×10^{-8}	7.3	3.0×10^{-8}	6.5	-
Benzaldehyde, 4-ethyl-	-	-	2.7	-	1.6	-	1.5	-
Benzaldehyde, ethyl-	-	-	1.7	-	1.0	-	9.0×10^{-1}	-
Benzaldehyde, ethyl-benzenemethanol, 4-(1-methylethyl)-	-	-	1.5	-	9.4×10^{-1}	-	8.3×10^{-1}	-
Benzene*	2.6×10^{1}	7.0	7.9	1.2×10^{-7}	5.1	1.3×10^{-6}	4.5	1.9×10^{-6}
Benzene, 1,2,3-trimethyl-	-	-	-	-	-	-	-	5.6×10^{-7}
Benzene, 1,2,4,5-tetramethyl-	-	-	-	-	-	-	-	2.7×10^{-6}
Benzene, 1-methyl-2-propyl-	-	-	-	-	-	-	-	2.6×10^{-6}
Benzene, 1-methyl-3-propyl-	-	-	-	-	-	-	-	6.4×10^{-7}

TABLE 4.6-4 (Cont.)

	Emissions (µg/s)[b]							
			Mustard Processing[c]		GB Processing[c]		VX Processing[c]	
Compound[a]	Diesel Generator	Boiler	Product Gas Burner	Filter Farm Stack	Product Gas Burner	Filter Farm Stack	Product Gas Burner	Filter Farm Stack
Benzo(a)pyrene	5.2×10^{-3}	4.0×10^{-3}	-	-	-	-	-	-
Benzo(b)fluoranthene	2.7×10^{-3}	6.0×10^{-3}	-	-	-	-	-	-
Benzo(g,h,i)perylene	1.4×10^{-2}	4.0×10^{-3}	-	-	-	-	-	-
Benzo(k)fluoranthene	4.3×10^{-3}	6.0×10^{-3}	-	-	-	-	-	-
Benzyl alcohol	-	-	1.6	1.4×10^{-8}	1.3	-	1.2	2.5×10^{-6}
Beryllium*	-	4.0×10^{-2}	-	-	6.0×10^{-3}	7.7×10^{-10}	5.3×10^{-3}	-
Bis(2-ethylhexyl)phthalate*	-	-	6.3×10^{-1}	5.8×10^{-9}	1.5	7.1×10^{-9}	1.3	9.2×10^{-9}
Butanal	-	-	-	5.0×10^{-8}	-	8.4×10^{-9}	-	4.2×10^{-8}
Butane	-	7.0×10^{3}	-	-	-	-	-	-
C3-Alkyl benzenes	-	-	-	2.6×10^{-6}	-	5.2×10^{-7}	-	-
Cadmium*	-	3.7	1.7×10^{-2}	1.9×10^{-9}	9.5×10^{-2}	3.2×10^{-9}	8.4×10^{-2}	4.4×10^{-7}
Calcium	-	-	2.3×10^{1}	5.9×10^{-6}	1.6×10^{1}	9.2×10^{-6}	14	1.0×10^{-4}
Carbon disulfide*	-	-	3.3×10^{-1}	-	2.0×10^{-1}	-	1.8×10^{-1}	-
Chloroform*	-	-	5.0	-	3.1	-	2.7	-
Chromium*	-	4.7	1.4	3.7×10^{-9}	8.5×10^{-1}	-	7.5×10^{-1}	-
Chrysene	9.8×10^{-3}	6.0×10^{-3}	-	-	-	4.2×10^{-9}	-	-
Cobalt*	-	2.8×10^{-1}	4.4×10^{-2}	3.5×10^{-8}	2.8×10^{-2}	1.0×10^{-8}	2.5×10^{-2}	2.6×10^{-7}
Copper	-	2.8	9.4×10^{-1}	-	1.6	-	1.4	-
Cyclododecane	-	-	-	-	2.2	-	2.0	-
Cyclohexane, 2-butyl-1,1,3-trimethyl-	-	-	-	-	-	-	-	5.0×10^{-7}
Cyclohexane, butyl-	-	-	-	2.3×10^{-7}	-	6.1×10^{-9}	-	4.0×10^{-6}
Cyclohexane, hexyl-	-	-	-	-	-	-	-	5.8×10^{-7}
Cyclohexane, propyl-	-	-	-	2.6×10^{-7}	-	-	-	-
Cyclohexanol	-	-	-	-	-	-	-	1.3×10^{-6}
Cyclohexanone	-	-	-	1.9×10^{-8}	-	4.1×10^{-8}	-	1.1×10^{-8}
Cyclohexasiloxane, dodecamethyl-	-	-	-	1.0×10^{-8}	-	-	-	-
Cyclotetrasiloxane, octamethyl-	-	-	3.7	-	2.2	-	2.0	-
Decane	-	-	-	1.1×10^{-6}	-	6.7×10^{-8}	-	1.6×10^{-5}
Decane, 2,6,7-trimethyl-	-	-	-	-	-	5.5×10^{-9}	-	-
Decane, 2-methyl-	-	-	-	-	-	-	-	3.7×10^{-6}
Decane, 3-methyl-	-	-	-	2.7×10^{-7}	-	-	-	2.8×10^{-6}
Decane, 4-methyl-	-	-	-	3.6×10^{-9}	-	7.2×10^{-9}	-	2.0×10^{-6}
Decane, 5-methyl-	-	-	-	-	-	2.6×10^{-8}	-	-
Dibenzo(a,h)anthracene	1.6×10^{-2}	4.0×10^{-3}	-	-	-	-	-	-
Dibenzofuran*	-	-	-	-	8.1×10^{-1}	6.4×10^{-8}	7.2×10^{-1}	9.9×10^{-8}
Dichlorobenzene*	-	4.0	-	-	-	-	-	-
Diethylene glycol	-	-	-	-	-	-	-	7.5×10^{-6}
Diethylphthalate	-	-	2.2	-	1.4	-	1.2	-
Dimethylbenz(a)anthracene	-	5.3×10^{-2}	-	-	-	-	-	-
Di-n-butylphthalate (bis-(2-ethylhexyl)phthalate)*	-	-	4.7	-	2.8	-	2.5	-
Diphenylmethane	-	-	-	-		5.4×10^{-9}	-	-
Dodecane	-	-	1.5	4.3×10^{-7}	8.9×10^{-1}	1.2×10^{-7}	7.9×10^{-1}	6.3×10^{-6}
Dodecane, 2,6,10-trimethyl-	-	-	-	-	-	7.7×10^{-9}	-	-
Dodecane, 4-methyl-	-	-	-	-	-	2.2×10^{-8}	-	-
Dodecane, 6-methyl-	-	-	-	4.1×10^{-9}	-	1.4×10^{-8}	-	2.0×10^{-6}
Ethane	-	1.0×10^{4}	-	–	-	-	-	-
Ethanol, 2-(2-butoxyethoxy)-, acetate	-	-	-	1.7×10^{-8}	-	2.6×10^{-8}	-	-
Ethanone, 1-(3-methylphenyl)-	-	-	-	-	-	8.2×10^{-9}	-	-

TABLE 4.6-4 (Cont.)

	Emissions (µg/s)[b]							
			Mustard Processing[c]		GB Processing[c]		VX Processing[c]	
Compound[a]	Diesel Generator	Boiler	Product Gas Burner	Filter Farm Stack	Product Gas Burner	Filter Farm Stack	Product Gas Burner	Filter Farm Stack
Ethanone, 1-phenyl-	-	-	-	-	-	5.9×10^{-8}	-	-
Ether	-	-	-	-	1.5×10^{2}	-	1.4×10^{2}	-
Ethylbenzene*	-	-	1.1×10^{-1}	-	4.7	-	4.1	-
Ethylene glycol*	-	-	-	1.7×10^{-7}	-	2.3×10^{-7}	-	2.6×10^{-6}
Fluoranthene	2.1×10^{-1}	1.0×10^{-2}	-	-	-	1.3×10^{-8}	-	1.2×10^{-8}
Fluorene	8.1×10^{-1}	9.4×10^{-3}	-	-	3.7×10^{-2}	2.3×10^{-8}	3.3×10^{-2}	3.4×10^{-8}
Formaldehyde*	3.3×10^{1}	2.5×10^{2}	-	-	-	-	-	-
GB[d]	-	-	-	-	-	3.7	-	-
H (mustard)[d]	-	-	-	3.7×10^{2}	-	-	-	-
Heptdecane	-	-	-	-	-	1.8×10^{-8}	-	-
Heptanal	-	-	-	1.3×10^{-7}	-	3.0×10^{-7}	-	-
Heptane, 3-ethyl-2-methyl-	-	-	-	-	-	1.8×10^{-8}	-	1.2×10^{-6}
Hexadecane, 2,6,10,14-tetramethyl-	-	-	-	-	-	3.4×10^{-8}	-	-
Hexanal	-	-	-	3.2×10^{-8}	-	1.1×10^{-7}	-	1.5×10^{-7}
Hexane(n)*	-	6.0×10^{3}	-	-	-	-	-	-
Hydrochloric acid*	-	-	3.7×10^{1}	3.8×10^{2}	6.0×10^{1}	4.8×10^{-6}	53	4.1×10^{1}
Hydrogen fluoride*	-	-	1.7	-	1.0	5.0×10^{1}	9.3×10^{-1}	-
Hydrogen cyanide*	-	-	6.8	-	4.1	-	3.7	-
Hydrogen sulfide*	-	-	1.7×10^{1}	-	6.1×10^{3}	-	5.4×10^{3}	-
Indeno(1,2,3-cd)pyrene	1.0×10^{-2}	6.0×10^{-3}	-	-	-	-	-	-
Iron	-	-	1.7×10^{1}	5.1×10^{-7}	1.0×10^{1}	9.0×10^{-7}	9.1	-
Isobutyl alcohol	-	-	-	-	-	9.6×10^{-8}	-	2.5×10^{-6}
Lead*	-	1.7	9.9×10^{-2}	1.9×10^{-8}	1.2×10^{-1}	4.0×10^{-8}	1.1×10^{-1}	1.6×10^{-5}
m,p-Xylene*	7.9	-	-	-	-	-	-	-
Magnesium	-	-	3.2	1.7×10^{-6}	2.4	2.9×10^{-6}	2.1	2.7×10^{-5}
Malonic acid	-	-	-	7.8×10^{-6}	-	2.2×10^{-5}	-	-
Manganese*	-	1.3	1.2×10^{1}	2.3×10^{-7}	2.3×10^{1}	1.3×10^{-7}	2.0×10^{1}	8.8×10^{-5}
Mercury*	8.3×10^{-3}	8.7×10^{-1}	-	-	-	1.8×10^{-8}	-	-
Methylene chloride*	-	-	9.1×10^{-1}	3.4×10^{-7}	8.2	1.3×10^{-4}	7.3	1.0×10^{-6}
Molybdenum	-	3.7	8.1×10^{-1}	1.4×10^{-8}	6.7×10^{1}	4.7×10^{-8}	6.0×10^{1}	3.1×10^{-6}
m-Tolualdehyde	-	-	-	-	-	7.6×10^{-8}	-	7.2×10^{-8}
Naphthalene*	2.3	2.0	-	1.1×10^{-7}	1.2×10^{-1}	1.3×10^{-7}	1.0×10^{-1}	8.5×10^{-7}
Naphthalene, 1,2,3,4-tetrahydro-	-	-	-	-	-	-	-	1.4×10^{-6}
Naphthalene, 1,2,3,4-tetrahydro-6-methyl-	-	-	-	-	-	-	-	7.4×10^{-7}
Naphthalene, 1,7-dimethyl	-	-	-	-	-	-	-	8.0×10^{-7}
Naphthalene, 1-methyl	-	-	-	-	-	2.0×10^{-8}	-	-
Nickel*	-	7.0	1.6	2.1×10^{-8}	9.8×10^{-1}	2.7×10^{-8}	8.7×10^{-1}	-
Nitrobenzene*	-	-	-	-	3.5×10^{-1}	6.8×10^{-8}	3.1×10^{-1}	-
Nonane, 2,6-dimethyl-	-	-	-	-	-	2.1×10^{-8}	-	6.8×10^{-6}
Nonane, 3,7-dimethyl-	-	-	-	-	-	-	-	1.0×10^{-6}
Nonane, 3-methyl-	-	-	-	-	-	-	-	5.2×10^{-7}
n-Propylbenzene	-	-	-	1.6×10^{-7}	-	-	-	-
Octane, 2,6-dimethyl-	-	-	-	4.1×10^{-7}	-	-	-	-
Octane, 3,6-dimethyl-	-	-	-	-	-	-	-	2.4×10^{-6}
Octane, 3-methyl-	-	-	-	1.5×10^{-7}	-	-	-	-
Pentadecane	-	-	-	4.1×10^{-9}	-	1.1×10^{-8}	-	1.7×10^{-6}
Pentanal	-	-	-	1.0×10^{-7}	-	1.4×10^{-7}	-	-
Pentane(n)	-	8.7×10^{3}	-	-	-	-	-	-

TABLE 4.6-4 (Cont.)

	Emissions (µg/s)[b]							
			Mustard Processing[c]		GB Processing[c]		VX Processing[c]	
Compound[a]	Diesel Generator	Boiler	Product Gas Burner	Filter Farm Stack	Product Gas Burner	Filter Farm Stack	Product Gas Burner	Filter Farm Stack
Phenanthrene	8.1×10^{-1}	5.7×10^{-2}	-	7.6×10^{-10}	-	5.6×10^{-8}	-	8.1×10^{-8}
Phenol*	-	-	6.3×10^{-1}	-	3.0	1.6×10^{-8}	2.7	-
Phosphorus*	-	-	6.0	4.0×10^{-7}	4.5	1.4×10^{-5}	4.0	2.8×10^{-4}
PCBs[e]	-	-	-	-	9.6×10^{-2}	-	9.6×10^{-2}	-
PAHs*	4.7	-	-	-	-	-	-	-
Potassium	-	-	-	7.7×10^{-7}	-	-	-	1.3×10^{-4}
Propanal (propionaldehyde)*	-	-	-	-	-	1.0×10^{-7}	-	1.3×10^{-7}
Propane	-	5.3×10^{3}	-	-	-	-	-	-
Propylene	7.1×10^{1}	-	-	-	-	-	-	-
Pyrene	1.3×10^{-1}	1.7×10^{-2}	-	-	-	7.0×10^{-9}	-	5.6×10^{-9}
Selenium*	-	8.0×10^{-2}	2.1×10^{-1}	4.7×10^{-9}	1.3×10^{-1}	-	1.2×10^{-1}	-
Silver	-	-	2.0×10^{-2}	5.7×10^{-10}	8.3×10^{-2}	9.2×10^{-9}	7.4×10^{-2}	9.4×10^{-8}
Sodium	-	-	3.1×10^{2}	-	2.0×10^{2}	-	1.8×10^{2}	9.7×10^{-5}
Styrene*	-	-	7.0×10^{-1}	-	4.3×10^{-1}	-	3.8×10^{-1}	-
Sulfur, mol. (S8)	-	-	-	1.2×10^{-7}	-	-	-	-
Tetrachloroethene*	-	-	1.0×10^{-1}	-	6.1×10^{-2}	-	5.4×10^{-2}	-
Tetradecane	-	-	-	2.4×10^{-7}	-	7.6×10^{-8}	-	7.8×10^{-6}
Thallium	-	-	-	-	3.0×10^{-2}	-	2.7×10^{-2}	-
Tin	-	-	2.0	-	1.2	-	1.1	-
Toluene*	1.1×10^{1}	1.1×10^{1}	1.1	-	6.8×10^{-1}	4.3×10^{-7}	6.1×10^{-4}	3.5×10^{-7}
Total HpCDD	-	-	-	4.2×10^{-14}	-	-	-	-
Total HpCDF	-	-	1.9×10^{-6}	-	1.2×10^{-9}	-	1.1×10^{-9}	-
Total HxCDD	-	-	1.0×10^{-6}	1.9×10^{-14}	6.1×10^{-7}	-	5.4×10^{-10}	-
Total HxCDF	-	-	2.1×10^{-6}	-	1.3×10^{-6}	-	1.1×10^{-9}	-
Total PeCDD	-	-	5.7×10^{-7}	3.9×10^{-13}	3.5×10^{-7}	-	3.1×10^{-7}	-
Total PeCDF	-	-	7.1×10^{-7}	2.4×10^{-14}	4.3×10^{-7}	-	3.8×10^{-7}	-
Total TCDD*	-	-	4.7×10^{-7}	2.4×10^{-12}	2.8×10^{-7}	-	2.5×10^{-7}	-
Total TCDF	-	-	1.0×10^{-6}	2.2×10^{-13}	6.2×10^{-7}	-	5.5×10^{-7}	-
Trichloroethene*	-	-	1.0×10^{-1}	-	6.1×10^{-2}	-	5.4×10^{-2}	-
Tridecane	-	-	-	2.9×10^{-7}	-	1.2×10^{-7}	-	3.5×10^{-6}
Tridecane, 2-methyl	-	-	-	-	-	-	-	2.1×10^{-6}
Tridecane, 4-methyl-	-	-	-	-	-	-	-	1.0×10^{-6}
Tridecane, 6-propyl-	-	-	-	-	-	-	-	7.7×10^{-7}
Undecane	-	-	-	7.3×10^{-7}	-	1.1×10^{-7}	-	1.0×10^{-5}
Undecane, 2,10-dimethyl-	-	-	-	-	-	3.4×10^{-8}	-	4.6×10^{-7}
Undecane, 2,6-dimethyl-	-	-	-	-	-	4.2×10^{-8}	-	-
Undecane, 2-methyl-	-	-	-	-	-	2.7×10^{-8}	-	-
Undecane, 3,6-dimethyl-	-	-	-	-	-	-	-	1.6×10^{-6}
Undecane, 4-methyl-	-	-	-	-	-	-	-	1.1×10^{-6}
VX[d]	-	-	-	-	-	-	-	3.7
Vanadium	-	7.7	3.8×10^{-2}	4.2×10^{-10}	9.0×10^{-2}	1.7×10^{-9}	8.0×10^{-2}	1.6×10^{-7}
p-Xylene*	-	-	-	3.7×10^{-7}	-	2.5×10^{-8}	-	-
Xylenes*	-	-	5.2×10^{-1}	-	3.2×10^{-1}	-	2.8×10^{-1}	-
Zinc	-	-	2.0	4.7×10^{-8}	1.2	-	1.1	-

Footnotes appear on next page.

TABLE 4.6-4 (Cont.)

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[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: HpCDD = heptachlorodibenzo-p-dioxin, 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 passing through six carbon filters in series, each at 95% efficiency. Particulate matter (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, mustard) 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 was assumed that Neut/GPCR/TW-SCWO technology would have a destruction efficiency of 99.9999%.

4.6.3 Impacts of the Proposed Action

4.6.3.1 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 (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.

4.6.3.2 Impacts of Operations

Estimates of emissions of toxic air pollutants that would result from the operation of pilot destruction facilities are provided in Tables 4.6-2 through 4.6-5. 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*. 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 NESHAP. Therefore, no regulatory action under NESHAP would be necessary for the HAP emissions from a pilot test facility.

TABLE 4.6-5 Estimated Toxic Air Pollutant Emissions from Electrochemical Oxidation Technology at ANAD

	Emissions (μg/s)[b]				
			CatOx/Filter Farm Stack		
Compound[a]	Diesel Generator	Boiler	Mustard Processing[c]	GB Processing[c]	VX Processing[c]
1,1-Dichloroethene*	-	-	5.1×10^{-7}	-	-
1,3-Butadiene*	1.1	-	-	-	-
1,5-Pentanediol, dinitrate	-	-	-	3.3×10^{-6}	2.1×10^{-6}
1-Butanol, 3-methyl-, nitrate	-	-	-	1.5×10^{-5}	9.2×10^{-6}
1-Hexanol, 2-ethyl-	-	-	-	1.8×10^{-7}	1.2×10^{-7}
2-Heptanone	-	-	-	3.4×10^{-7}	2.1×10^{-7}
2-Hexanone	-	-	4.9×10^{-8}	3.3×10^{-6}	2.3×10^{-6}
2-Methylnaphthalene	-	4.8×10^{-2}	-	-	-
2-Octanone	-	-	1.1×10^{-8}	6.0×10^{-7}	4.3×10^{-7}
2-Pentanol, nitrate	-	-	-	2.0×10^{-5}	1.3×10^{-5}
3-Methylchloranthrene	-	3.6×10^{-3}	-	-	-
4-Methyl-2-pentanone	-	-	3.6×10^{-8}	3.0×10^{-7}	3.4×10^{-7}
4-Octene, (E)-	-	-	1.6×10^{-8}	1.4×10^{-7}	1.5×10^{-7}
Acenaphthene	3.9×10^{-2}	3.6×10^{-3}	-	-	-
Acenaphthylene	1.4×10^{-1}	3.6×10^{-3}	-	-	-
Acetaldehyde*	2.1×10^{1}	-	-	-	-
Acetamide, N,N-dimethyl-	-	-	-	1.1×10^{-6}	7.0×10^{-7}
Acetic acid	-	-	4.6×10^{-7}	3.9×10^{-6}	4.4×10^{-6}
Acetone	-	-	1.2×10^{-6}	2.3×10^{-8}	2.6×10^{-8}
Acrolein*	2.6	-	-	-	-
Aldehydes	1.9×10^{3}	-	-	-	-
Anthracene	5.2×10^{-2}	4.8×10^{-3}	-	-	-
Arsenic*	-	4.0×10^{-1}	-	-	-
Barium	-	8.9	-	-	-
Benz(a)anthracene	4.7×10^{-2}	3.6×10^{-3}	-	-	-
Benzene*	2.6×10^{1}	4.2	1.4×10^{-8}	1.2×10^{-6}	8.5×10^{-7}
Benzo(a)pyrene	5.2×10^{-3}	2.4×10^{-3}	-	-	-
Benzo(b)fluoranthene	2.7×10^{-3}	3.6×10^{-3}	-	-	-
Benzo(g,h,i)perylene	1.4×10^{-2}	2.4×10^{-3}	-	-	-
Benzo(k)fluoranthene	4.3×10^{-3}	3.6×10^{-3}	-	-	-
Beryllium*	-	2.4×10^{-2}	-	-	-
Bis(2-ethylhexyl)phthalate*	-	-	-	5.1×10^{-7}	3.2×10^{-7}
Butane	-	4.2×10^{3}	-	-	-
Cadmium*	-	2.2	-	-	-
Carbon disulfide*	-	-	3.6×10^{-6}	4.4×10^{-5}	2.8×10^{-5}
Chloroethane*	-	-	1.1×10^{-7}	-	-
Chloroform*	-	-	1.4×10^{-7}	-	-
Chloromethane	-	-	4.5×10^{-7}	-	-

TABLE 4.6-5 (Cont.)

	Emissions (μg/s)[b]				
			CatOx/Filter Farm Stack		
Compound[a]	Diesel Generator	Boiler	Mustard Processing[c]	GB Processing[c]	VX Processing[c]
Chromium*	-	2. 8	-	-	-
Chrysene	9.8×10^{-3}	3.6×10^{-3}	-	-	-
Cobalt*	-	1.7×10^{-1}	-	-	-
Copper	-	1.7	-	-	-
Cyclohexane, 1,2,3-trimethyl-	-	-	5.6×10^{-8}	4.7×10^{-7}	5.3×10^{-7}
Decane	-	-	6.4×10^{-8}	3.2×10^{-6}	2.3×10^{-6}
Decanenitrile	-	-	1.3×10^{-8}	5.6×10^{-7}	4.1×10^{-7}
Dibenzo(a,h)anthracene	1.6×10^{-2}	2.4×10^{-3}	-	-	-
Dichlorobenzene*	-	2.4	-	-	-
Dimethylbenz(a)anthracene	-	3.2×10^{-2}	-	-	-
Dodecane	-	-	7.7×10^{-8}	4.4×10^{-6}	3.1×10^{-6}
Ethane	-	6.3×10^{3}	-	-	
Ethylbenzene*	-	-	-	8.0×10^{-8}	5.1×10^{-8}
Fluoranthene	2.1×10^{-1}	6.1×10^{-3}	-	-	-
Fluorene	8.1×10^{-1}	5.6×10^{-3}	-	-	-
Formaldehyde*	3.3×10^{1}	1.5×10^{2}	-	-	-
GB[d]	-	-	-	3.4	-
H (mustard)[d]	-	-	3.4×10^{2}	-	-
Heptanal	-	-	1.8×10^{-8}	8.2×10^{-7}	6.0×10^{-7}
Heptanenitrile	-	-	-	4.3×10^{-7}	2.8×10^{-7}
Hexadecane	-	-	8.8×10^{-9}	7.7×10^{-7}	2.6×10^{-6}
Hexane(n)*	-	3.6×10^{3}	-	-	-
Hexanenitrile	-	-	-	3.9×10^{-7}	2.5×10^{-7}
Indeno(1,2,3-cd)pyrene	1.0×10^{-2}	3.6×10^{-3}	-	-	-
Isopropyl nitrate	-	-	2.6×10^{-7}	9.3×10^{-5}	6.0×10^{-5}
Lead*	-	1.0×10^{-1}	-	-	-
m,p-Xylene*	7.9	-	-	-	-
Manganese*	-	7.7×10^{-1}	-	-	-
Mercury*	8.3×10^{-3}	5.2×10^{-1}	-	-	-
Methylene chloride*	-	-	5.3×10^{-7}	-	-
Molybdenum		2.2	-	-	-
MPA	-	-	-	-	1.1×10^{-11}
Naphthalene*	2.3	1.2	5.4×10^{-6}	4.5×10^{-5}	5.1×10^{-5}
Nickel*	-	4.2	-	-	-
Nitric acid esters	-	-	-	3.5×10^{-6}	2.2×10^{-6}
Nitric acid, butyl ester	-	-	-	1.6×10^{-5}	1.0×10^{-5}
Nitric acid, decyl ester	-	-	1.9×10^{-8}	1.5×10^{-6}	1.0×10^{-6}
Nitric acid, ethyl ester	-	-	-	9.1×10^{-6}	5.8×10^{-6}
Nitric acid, hexyl ester	-	-	-	9.0×10^{-6}	5.7×10^{-6}
Nitric acid, nonyl ester	-	-	5.9×10^{-8}	3.3×10^{-6}	2.3×10^{-6}
Nitric acid, pentyl ester	-	-	-	9.4×10^{-6}	6.0×10^{-6}
Nitric acid, propyl ester	-	-	-	9.7×10^{-6}	6.2×10^{-6}

TABLE 4.6-5 (Cont.)

	Emissions (μg/s)[b]				
			CatOx/Filter Farm Stack		
Compound[a]	Diesel Generator	Boiler	Mustard Processing[c]	GB Processing[c]	VX Processing[c]
Nonanal	-	-	1.5×10^{-7}	1.3×10^{-6}	1.4×10^{-6}
Nonanenitrile	-	-	1.6×10^{-8}	9.3×10^{-7}	6.6×10^{-7}
Octanal	-	-	1.0×10^{-7}	1.4×10^{-6}	1.3×10^{-6}
Octanenitrile	-	-	-	9.7×10^{-7}	6.2×10^{-7}
Pentadecane	-	-	1.4×10^{-8}	1.5×10^{-6}	1.0×10^{-6}
Pentane(n)	-	5.2×10^{3}	-	-	-
Phenanthrene	8.1×10^{-1}	3.4×10^{-2}	-	-	-
PCBs[e]	-	-	-	1.5×10^{-9}	1.5×10^{-9}
PAHs*	4.7	-	-	-	-
Propane	-	3.2×10^{3}	-	-	-
Propylene	7.1×10^{1}	-	-	-	-
Pyrene	1.3×10^{-1}	1.0×10^{-2}	-	-	-
Selenium*	-	4.8×10^{-2}	-	-	-
Tetradecane	-	-	7.0×10^{-8}	5.0×10^{-6}	3.5×10^{-6}
Toluene*	1.1×10^{1}	6.9	-	3.0×10^{-7}	1.9×10^{-7}
Trichloroethene*	-	-	6.9×10^{-7}	-	-
Tridecane	-	-	-	-	4.4×10^{-6}
Undecane	-	-	7.2×10^{-8}	3.9×10^{-6}	2.8×10^{-6}
VX[d]	-	-	-	-	3.4
Vanadium	-	4.6	-	-	-
Vinyl chloride*	-	-	5.8×10^{-7}	-	4.6×10^{-7}
Xylenes*	-	-	2.7×10^{-8}	5.5×10^{-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. Particulate matter (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, mustard) 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 in footnote c, would be applied.

PCBs have been identified as a constituent in the firing tubes of M55 rockets (see Section 4.4.2.2). PCBs were not tested as part of the ACWA demonstration project, since doing so would have triggered regulatory requirements under 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 4.7), the locations of maximum on-post and off-post concentrations of the emitted compounds listed in Tables 4.6-2 through 4.6-5 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 4.5. 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 4.5); toxic air pollutant emissions have not been quantified.

4.6.3.3 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 (EPA 1994, as cited in National Research Council 1997a) and were used to generate ambient annual air 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 ANAD, 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 4.6-6. 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 then be identified, and the agent would be eliminated.

4.6.4 Impacts of No Action

Activities associated with continued storage at ANAD would include inspection, monitoring, and conducting an annual inventory of all munitions; overpacking any leaking munitions discovered during inspections; and transporting the overpacked leakers to a separate RCRA-permitted storage igloo. All chemical munition storage igloos are 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 the applicable State of Alabama-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 be likely to be small, and any vapor that might form as a result of the spill would be likely to be contained within the igloo. These statements are especially true for mustard agent and VX, which have very low volatilities (900 and 10 mg/m^3 at 25°C [77°F], respectively). Liquid that could leak from a munition would tend to spill slowly over the munition(s) and onto the igloo floor. Evaporation from a VX or HD liquid spill would occur at a very slow rate because of the still air conditions inside the igloo in combination with the low volatility of the agent. In addition, with igloo temperatures typically below 15.6°C [60°F], a mustard leak (liquid spill on igloo floor) would be much less likely considering the relatively high freezing point, 14.5°C (58°F), of mustard. 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 Chemical Limited Area for ANAD.

TABLE 4.6-6 Maximum Annual Average Estimated On-Post and Off-Post Concentrations of Agent during ACWA Pilot Facility Operations at ANAD[a]

	Maximum Annual Average Off-Post Concentration ($\mu g/m^3$)		Maximum Annual Average On-Post Concentration ($\mu g/m^3$)		Percent of Limit Off Post[b]		Percent of Limit On Post[b]	
Technology	Mustard	GB/VX	Mustard	GB/VX	Mustard	GB/VX	Mustard	GB/VX
Neut/SCWO	9.7×10^{-5}	9.7×10^{-7}	3.1×10^{-4}	3.1×10^{-6}	0.01	0.03	0.31	0.1
Neut/Bio	9.7×10^{-5}	NA[c]	3.2×10^{-4}	NA	0.01	NA	0.32	NA
Neut/GPCR/ TW-SCWO	1.1×10^{-4}	1.1×10^{-6}	3.4×10^{-4}	3.4×10^{-6}	0.01	0.04	0.34	0.11
Elchem Ox	1.1×10^{-4}	1.1×10^{-6}	2.6×10^{-4}	2.6×10^{-6}	0.01	0.04	0.26	0.09

[a] Estimated concentrations account for fluctuating operations.

[b] The general population exposure limits for 72-hour time-weighted average exposures, as estimated by CDC (1988), are as follows: mustard = 0.1 $\mu g/m^3$, GB and VX = 0.003 $\mu g/m^3$.

[c] NA = not applicable.

4.7 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 principles 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, 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 determinant 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.

4.7.1 Current Environment

4.7.1.1 Existing Environmental Contamination and Remediation Efforts

Forty-seven (47) solid waste management units (SWMUs) have been designated at ANAD. There are 29 in the SIA, 15 in the ASA, and three in other areas (ANAD 2000b). No past contamination has been identified at the areas being considered for an ACWA pilot test facility. Environmental cleanup of contamination from past operations at ANAD is being addressed in other environmental compliance documentation and is beyond the scope of this EIS.

4.7.1.2 On-Post Workers

Employment at ANAD currently stands at 3,838 (Burdell 2000c), including ANAD employees, tenant employees, and contractors. This includes 90 workers in the CLA (Burdell 2000d).

Types of workers currently employed at ANAD include 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 in various documents; see National Safety Council [1999] for an example), hazards can be minimized when workers adhere to safety standards and use protective equipment as necessary.

There is only one residence on post at ANAD, that of the post commander. Occupants of this residence and on-post workers at ANAD could be exposed to industrial chemicals released to air, water, or soil. As discussed in Section 4.6.2, toxic air pollutants released at ANAD are from open burning and open detonation, paint booths, degreaser units, and fuel storage and dispensing. VOCs (i.e., methylene chloride, methyl ethyl ketone) are released in the highest quantities. Industrial workers at ANAD may work extensively with paints and coating containing VOCs. Paint booths are used to minimize emissions and employee inhalation exposures. ANAD operations comply with Occupational Safety and Health Administration (OSHA) regulations on maximum contaminant levels (MCLs) in air.

Most VOC emissions occur in the SIA, more than 3 mi (5 km) from the single occupied house on the site (Figure 4.2-1). Potential health risks to ANAD residents from air emissions would be expected to be minimal because they are located relatively far from the emission points and ANAD releases to air are in compliance with regulatory standards under the CAA.

Contaminant levels in ANAD 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 4.4), so that any contamination of water or soil at ANAD from routine operations should be minor and should not result in increased health risk to workers or on-site residents.

4.7.1.3 Off-Post Public

The off-post public near the ANAD installation could be exposed to chemicals released to air, water, or soil. As discussed in Section 4.6.1, toxic pollutants released to air at ANAD are from open burning and open detonation, paint booths, degreaser units, and fuel storage and dispensing. VOCs (i.e., methylene chloride, methyl ethyl ketone) are released in the highest quantities. Most emissions occur in the SIA, which is about 1 mile (1.6 km) from an off-post residential area. Potential health risks to off-post residents from air emissions are not expected because the residences are located relatively far from the emission points and ANAD releases to air are in compliance with regulatory standards under the CAA. However, no measurements or modeling of ambient concentrations in the residential area are currently available.

Contaminant levels in ANAD 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 4.4), so that any contamination of water or soil at ANAD from existing operations should be minor and should not result in increased health risk to the off-post public. Procedures are in place to minimize risks associated with accidents (see Section 4.7.1).

4.7.1.4 Emergency Response

ANAD has procedures for on-post emergency response actions involving toxic chemical munitions, which are contained in its 2001 publication, *Chemical Accident/Incident Response and Assistance Plan*. This plan establishes policies and procedures that ensure adequately trained personnel and appropriate equipment are present on post at all times to respond to emergency situations; it is currently being revised.

The Chemical Stockpile Emergency Preparedness Program (CSEPP) has further enhanced the depot'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 six surrounding counties. As part of CSEPP, ANAD operates an emergency operations center (EOC) in Building 363 for 24 hours a day, seven days a week. This facility enables the depot to respond expeditiously to any accident that may occur. In the unlikely event of a chemical accident or incident, EOC 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 depot staff to respond, and activate the on-post outdoor warning system. The warning system consists of 17 on-post sirens capable of emitting several tones and voice messages. ANAD is also in the process of installing an enhanced visual/audio warning system (EVAWS) in the high-noise areas of the industrial portions of the depot. This system consists of indoor sirens and strobe lights.

CSEPP has also encouraged cooperation among ANAD, the six CSEPP counties, and the state with regard to communications, event classification and notification, exercises, public affairs, and planning. Joint communication links include a dedicated CSEPP hotline, commercial telephones, radios, e-mail, and the exchange of information on a CSEPP-Wide Area Network maintained by the Alabama Emergency Management Agency. A memorandum of agreement (MOA) for notification allows for the rapid exchange of information and sounding of outdoor warning devices. Calhoun and Talladega Counties are installing tone-alert radios off post. Joint exercises have been held annually since 1992. Public affairs efforts are coordinated and include a joint information center located on Fort McClellan, with an MOA among all participants.

ANAD also has plans for responding to other potential spill hazards. Procedures for responding to on-post spills of oil or a hazardous substance are contained in the *Anniston Army Depot Oil and Hazardous Substances Spill Contingency Plan*, which was published in 1997. This contingency plan describes controls designed to prevent spills of oil or hazardous substances and minimize the impact of spills on the environment. In addition, this contingency plan establishes policies and procedures that ensure adequately trained personnel and appropriate equipment are present on post at all times to respond to emergency situations.

The ANAD Fire and Emergency Services Division is staffed at all times with firefighter and emergency medical personnel. Equipment present on post for use in emergencies includes fire-fighting equipment and vehicles, ambulances with paramedic personnel, an emergency response vehicle, heavy equipment, and spill kits.

ANAD has medical mutual aid agreements with local fire departments and medical facilities to augment its emergency preparedness, as detailed in the 1991 U.S. Army Pamphlet 50-6, *Chemical Accident/Incident Response and Assistance Operations*, dated May 17. Current agreements for fire and rescue services are with Oxford EMS, City of Talladega, City of Anniston, and City of Oxford. Agreements for medical support are through U.S. Army Medical Department Activity, Fort Benning, Georgia, and are with:

- Northeast Alabama Regional Medical Center and Stringfellow Hospital, Anniston;
- Riverview Regional Medical Center and Gadsden Regional Medical, Gadsden;
- Citizens Baptist Medical Center, Talladega;

- Anniston Emergency and Rescue Squad, Anniston; and
- Oxford Emergency Medical Services, Inc., Oxford.

These local fire departments and medical facilities have agreed to provide emergency response assistance to ANAD upon request when it is possible to do so. In return, the ANAD Fire and Emergency Services Division and the Dear Occupational Health Clinic have agreed to do the same for these local entities, within their capabilities.

The Alabama Emergency Management Agency, Alabama Department of Public Health, and the Regional Medical Center located in Anniston have implemented a system in which a medical EOC coordinates all aspects of the medical response to a CSEPP incident. This includes the transfer of medical calls from the county's 911 center for dispatch, coordination of all hospitals in the county, ambulance and first responder dispatch, distant and hospital triage of patients, control of drugs, and management of other medical equipment logistic issues. Talladega and Etowah Counties are developing similar coordinating systems.

4.7.2 Impacts of the Proposed Action

This section discusses the potential environmental consequences on human health and safety from constructing and operating an ACWA pilot test facility at ANAD. 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.

4.7.2.1 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/Bio, Neut/SCWO, Neut/GPCR/TW-SCWO, or Elchem Ox facility is estimated to require approximately 412, 515, 525, or 554 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. Annual 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 4.7-1. 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 one; the estimated annual number of injuries for construction of a Neut/Bio facility is 18, a Neut/SCWO facility is 23, 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.

TABLE 4.7-1 Annual Occupational Hazard Rates Associated with Continued Munitions Maintenance (No Action) and ACWA Facility Construction and Operations at ANAD

Impact to Workers[a]	Neut/Bio	Neut/SWCO	Neut/GPCR/ TW-SCWO	Elchem Ox	No Action
Fatalities					
Construction	0.07	0.06	0.07	0.08	NA[b]
Systemization	0.01	0.01	0.01	0.01	NA
Operations	0.02	0.02	0.02	0.02	0.003
Injuries					
Construction	18	23	23	24	NA
Systemization	14	14	14	14	NA
Operations	31	31	31	31	4

[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 3 years (except for Neut/Bio, which would require only 2 years for mustard-only processing). 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.

Other On-Post Workers and Residents. The main pollutant emissions associated with construction of an ACWA facility would be PM (see Section 4.5). Most of the on-post workers would be located 1 mi (1.6 km) or more from the proposed ACWA facility areas. PM_{10} and $PM_{2.5}$ levels associated with ACWA facility construction were modeled at off-post locations about 1.2 mi (2 km) east of proposed Area A (closest boundary where residences could potentially be located) (Section 4.5; Table 4.5-8). PM concentrations at the on-post locations of workers would presumably be similar because of the similar distance. The incremental PM levels estimated for the off-post area varied between 2% and 16% of the health-based 24-hour or annual NAAQS levels; therefore, adverse health impacts to on-post workers would not be expected from the inhalation of construction-related emissions. However, the background level for $PM_{2.5}$ is already almost equal to the annual NAAQS standard level, so there is a potential for adverse health impacts to workers from the existing environment**.**

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 were modeled at off-post locations about 1.2 mi (2 km) east of proposed Area A (closest boundary where residences could potentially be located) (Section 4.5; Table 4.5-8). The incremental PM levels estimated varied between 2% and 16% of the health-based 24-hour or annual NAAQS levels; therefore, adverse health impacts to the off-post public would not be expected from the inhalation of construction-related emissions. However, the background level for $PM_{2.5}$ is already almost equal to the annual NAAQS standard level, so there is a potential for adverse health impacts from the existing environment.

4.7.2.2 Impacts of Operations

Facility Workers

Occupational Hazards. Occupational hazards associated with systemization and operation of an ACWA pilot test facility at ANAD were estimated by using the same method as that discussed for construction (Section 4.7.2.1). 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 655 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 4.7-1. The estimated number of injuries is the same for each technology, 14 per year during systemization and 31 per year during 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 exposure 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

Inhalation of Toxic Air Pollutants. Estimated maximum on-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 CLA at ANAD. 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 eight 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 4.7-2. Details of the assessment are provided in Appendix C.

As shown in Table 4.7-2, for the four technology systems evaluated, estimated hazard indexes and carcinogenic risks from exposure to toxic air pollutants estimated for the on-post MEI were well below the benchmarks considered 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 all four technologies were very comparable, generally on the same order of magnitude. Almost all of the estimated noncarcinogenic and carcinogenic risks shown in Table 4.7-2 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).

TABLE 4.7-2 Toxic Air Pollutant Emissions and Impact on Human Health and Safety during Normal Operations at ANAD[a]

Emissions and Impacts	Neut/Bio[b]	Neut/SCWO	Neut/GPCR/ TW-SCWO	Elchem Oxidation
Hazardous air emissions				
Number of chemicals detected	107	63	183	103
Number of chemicals with quantitative data on toxic, noncarcinogenic effects[c]	79	38	73	42
Number of chemicals with quantitative data on carcinogenic effects[d]	57	23	39	28
Impacts[e]				
Hazard index (*hazard index of <1 means adverse health impacts are unlikely*)				
For MEI[e] in off-post general public, nerve agent processing	NA[f]	2×10^{-3}	3×10^{-3}	5×10^{-3}
For MEI in off-post general public, mustard agent processing	2×10^{-3} (3×10^{-3})	2×10^{-3}	5×10^{-4}	2×10^{-3}
For MEI in on-post population, nerve agent processing	NA	2×10^{-4}	2×10^{-3}	4×10^{-4}
For MEI in on-post population, mustard agent processing	2×10^{-4} (3×10^{-4})	2×10^{-4}	3×10^{-4}	2×10^{-4}
Increased lifetime carcinogenic risk *(risk of 10^{-6} is generally considered negligible)*				
For MEI in off-post general public, nerve agent processing	NA	3×10^{-8}	2.1×10^{-9}	5×10^{-8}
For MEI in off-post general public, mustard agent processing	5×10^{-9} (8×10^{-9})	7×10^{-9}	7×10^{-10}	6×10^{-9}
For MEI in on-post population, nerve agent processing	NA	2×10^{-9}	3×10^{-9}	5×10^{-9}
For MEI in on-post population, mustard agent processing	2×10^{-9} (2×10^{-9})	5×10^{-10}	7×10^{-10}	5×10^{-10}
Increased lifetime carcinogenic risk to population due to worst-case mustard emissions *(risk of 10^{-6} is generally considered negligible)*[g]				
Off post	2×10^{-7}	2×10^{-7}	2×10^{-7}	2×10^{-7}
On post	1×10^{-8}	1×10^{-8}	1×10^{-8}	1×10^{-8}

[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] For Neut/Bio, the value in parentheses assumes no further treatment of emissions from the biotreatment vent after they have been processed in the immobilized cell bioreactor (ICB) unit.

[c] Potential noncarcinogenic impacts from some detected chemicals could not be evaluated quantitatively because toxicity data were not available (see text discussion). For Neut/Bio, Neut/SCWO, Neut/GPCR/TW-SCWO, and Elchem Ox, 17, 14, 99, and 50 chemicals, respectively, could not be quantitatively evaluated for either noncarcinogenic or carcinogenic effects (see text).

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

[e] 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.

[f] NA = not applicable; MEI = maximum exposed individual.

[g] Although the facility would be designed to operate without mustard releases, these values were estimated as a worst case by assuming continuous emission at the detection limit (Kimmell et al. 2001). The estimated concentrations are all 1% or less of the allowable concentrations for general population exposures.

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 2000a–d). 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.

In general, toxicity benchmark levels were available to allow quantitative risk estimates for the majority of toxic air pollutants detected. For Neut/SCWO operations, 14 of the detected chemicals (22%) did not have established (i.e., peer-reviewed) noncarcinogenic or carcinogenic toxicity benchmark levels (see Appendix C). For Neut/GPCR/TW-SCWO operations, 99 of the detected chemicals (53%) did not have established toxicity benchmark levels. For Elchem Ox operations, 50 of the detected chemicals (49%) did not have established toxicity benchmark levels. For Neut/Bio operations, 17 of the detected chemicals (16%) 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.

Inhalation of Chemical Agent. Maximum potential concentrations from emissions of agent (including consideration of fluctuating operations) were discussed in Section 4.6.3.3. For all three chemical agent types stored at ANAD, modeling dispersion from the estimated maximum emissions resulted in a maximum estimated on-post concentration of 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. By this means, 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.

Mustard has been classified as a known carcinogen (see Appendix C). The maximum incremental cancer risk for the on-post MEI due to hypothetical mustard emissions was estimated to be 1×10^{-8} (Table 4.7-2). This risk level is 100 times lower than the benchmark risk value of 1×10^{-6}, and, as stated above, emission levels would not be allowed to continue at the detection

limit level for more than a short time, so the exposure estimate based on the entire duration of operations is a large overestimate. Therefore, even under hypothetical worst-case emission levels, carcinogenic risks from mustard emissions associated with a pilot facility would be very small.

Exposures from Other Pathways. Other potential exposure pathways to be considered are water (if effluent from the pilot facilities were to be released to nearby waterways) and soil and food (if soil were to become contaminated by releases to air and subsequent deposition). For pilot testing 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 food chain pathways would result in very minimal, if any, additional risk to on-post workers.

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 4.7-2. 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 less 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 4.7-2, for the four technology systems evaluated, estimated hazard indexes and carcinogenic risks from exposure to toxic air pollutants estimated for the off-post MEI were well below the benchmarks considered representative of negligible risk levels. 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 all four technologies were very comparable, generally on the same order of magnitude. Almost all of the estimated noncarcinogenic and carcinogenic risks shown in Table 4.7-2 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 previous discussion for on-post workers).

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 one 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 4.7-2), risk levels for sensitive subpopulations, such as children, would still be far less than benchmark levels.

Inhalation of Chemical Agent. Maximum potential off-post concentrations from emissions of agent (including consideration of fluctuating operations) were discussed in Section 4.6.3.3. For all three chemical agent types stored at ANAD, 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.

Mustard has been classified as a known carcinogen (see Appendix C). The maximum incremental cancer risk for the off-post MEI due to hypothetical mustard emissions was estimated to be 2×10^{-7} (Table 4.7-2). This risk level is about 10 times lower than the benchmark risk value of 1×10^{-6}, and, as stated above, emission levels would not be allowed to continue at the detection limit level for more than a short time, so the exposure estimate based on the entire duration of operations is a large overestimate. Therefore, even under hypothetical

worst-case emission levels, carcinogenic risks from mustard emissions associated with the destruction facilities would be very small.

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

4.7.3 Impacts of No Action

Activities associated with continued storage (no action) at ANAD 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 routine 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 ANAD stockpile) are presented in Table 4.7-1. The expected number of worker fatalities and injuries associated with continued maintenance of the munitions stockpile at ANAD was calculated on the basis of rate data from the BLS as reported by the National Safety Council (1999) and an estimate of 90 FTE employees required for munitions maintenance activities each year (Burdell 2000d). 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 number of injuries was four.

4.7.4 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 ANAD are summarized in Table 4.7-3. The number of miles traveled annually by construction and operations worker commuter vehicles is similar for each technology. For both mustard and nerve agent processing, the Neut/SCWO technology would require the greatest number of shipments annually; approximately 60% more than the other technologies for mustard processing and about 30% more for nerve agent processing. The amount of transportation required for the no action alternative is very small.

4.8 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 Alabama and Calhoun County, where ANAD is located, have no quantitative noise-limit regulations.

TABLE 4.7-3 Comparison of Annual Transportation Requirements for Construction and Routine Operations for Alternative Technology Systems at ANAD[a]

Parameter	Neut/Bio[b]	Neut/SCWO	Neut/GPCR/ TW-SCWO	Elchem Ox	No Action[c]
Number of vehicle miles traveled[d]					
Construction delivery vehicle	200,000	200,000	200,000	200,000	NA[e]
Construction worker commuter vehicle	4,000,000	4,900,000	5,000,000	5,300,000	NA
Operations worker commuter vehicle	6,300,000	7,200,000	7,200,000	7,200,000	1,000,000
Number of shipments[f]					
Mustard agent					
Raw materials	88	479	101	191	NA
Waste	384	263	281	258	NA
Total	472	742	382	449	NA
Nerve agent					
Raw materials	NA	479	229	137	NA
Waste	NA	560	590	562	NA
Total	NA	1,039	819	699	<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] Neut/Bio totals are for mustard agent processing only.

[c] No action alternative assumes 90 employees would be required for continued storage maintenance.

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

[e] NA = not applicable.

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

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

ANAD has developed environmental noise management assessments. Two different sound-level measures of day-night sound level (DNL or L_{dn})[7] are used by the U.S. Army for noise impact assessments in the Army's Environmental Noise Management Program (which incorporates and replaces the Installation Compatible Use Zone Program): A-weighted DNL (ADNL) and C-weighted DNL (CDNL). ADNL is a descriptor used for evaluation of environmental noise-impact on the general population, and CDNL is a descriptor used for evaluation of risk to hearing damage produced by impulsive noise. For the Army's regulatory purposes, these measures are both used to define three land-use classifications. Table 4.8-1 presents these ADNL and CDNL noise-limit criteria for each of three zone classifications

[7] L_{dn} is the time-weighted 24-hour average sound level with a 10 decibel (dB) penalty added to the nighttime levels (2200 to 0700 hours).

TABLE 4.8-1 Noise Criteria for Noise-Sensitive Land Use Classifications

	Noise Limits[b]		Population Highly Annoyed
Noise Zone[a]	ADNL (dBA)	CDNL (dBC)	(%)
Zone I	< 65	< 62	< 15
Zone II	65–75	62–70	15–39
Zone III	> 75	> 70	> 39

[a] Zone I noise levels are acceptable and there is no conflict with noise-sensitive land uses. Zone II noise levels are normally unacceptable for sensitive land uses, such as hospitals, housing, and schools, but are generally acceptable for offices and other work areas. Zone III levels are unacceptable for any residential uses. However, industrial, agricultural, and some commercial business may be compatible.

[b] ADNL and CDNL = A-weighted and C-weighted day-night sound levels. DBA and dBC = A-weighted and C-weighted decibels.

Source: U.S. Army (1997a); ANAD (undated).

(Zones I, II, and III) and corresponding percent of highly annoyed population (U.S. Army 1997a; ANAD undated). Noise-sensitive land uses, such as hospitals, housing, and schools, are considered incompatible with noise environment in Zone III, normally incompatible in Zone II, and compatible in Zone I.

The EPA has recommended a maximum noise level of 70 dB(A)[8] as DNL limit to protect against permanent hearing loss and a maximum noise level of 55 dB(A) as DNL to protect against outdoor activity interference and annoyance (EPA 1974). These levels are not regulatory goals, but are "intentionally conservative to protect the most sensitive portion of the American population" with "an additional margin of safety." For protection against hearing loss in the general population from nonimpulsive noise, the EPA guideline recommends an average L_{eq} limit of 70 dBA over a 40-year period.[9]

[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 S1.4-1985, the Amendment to ANSI S1.4-1983 (Acoustical Society of America 1983, 1985).

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

4.8.1 Current Environment

ANAD is situated in rural Calhoun County, about 10 mi (16 km) from the cities of Anniston and Oxford. The small community of Bynum lies on the depot's southern boundary. Land near the remaining three boundaries are sparsely settled. The north boundary is adjacent to Pelham Range, a wooded operational and training area. The east and west boundaries are bordered by sparsely populated rural lands. The major highways serving ANAD are Interstate 20 (I 20) and U.S. Highway 78 (US 78), running east and west, and US 431, running north and south (Figure 4.1-1). The main access to the ANAD is from State Highway 202.

The primary noise-producing activities within ANAD are associated with the operation of the tank firing range, burning ground, demolition pit, and recoilless rifle range, which are located in the depot's restricted area. Other noise sources outside ANAD, which affect the noise levels within, are firing activities from Pelham Range north of the site. The most recent noise assessment at ANAD in 1987 indicated that Zone III is limited to small areas in the northwest within ANAD and that Zone II (normally unacceptable for residential use) does not extend off federal lands, as shown in Figure 4.8-1. The Zone II areas extend onto Pelham Range over about 15 acres (6 ha). All other locations within the depot boundary are classified as Zone I. The location of the preferred site for the proposed facility is in the northern central section of the depot, in the Zone I area, about 0.5 mi (0.8 km) from the nearest part of the Zone II area (Figure 4.8-1).

Ambient sound level measurements at ANAD are not currently available. As indicated above, most areas surrounding ANAD are compatible with noise-sensitive land uses. No sensitive noise receptors (e.g., hospitals, schools) are located near the site. The nearest resident is located about 1.2 mi (2 km) east of the post. There is no off-post noise problem from operation of the ranges and the demolition pit at ANAD. Dense forests within and around the ANAD site are likely to decrease noise levels.

4.8.2 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 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

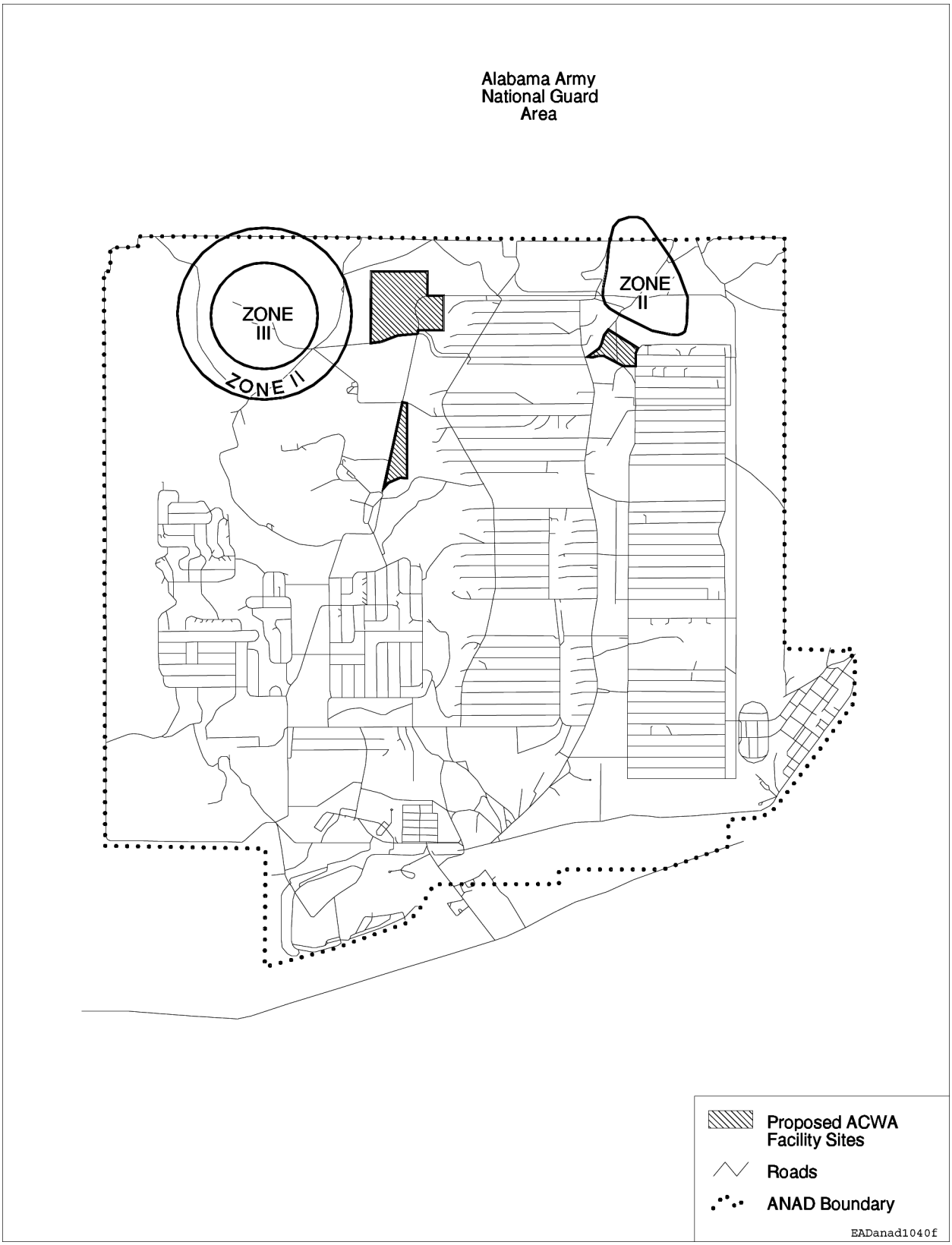

FIGURE 4.8-1 Noise-Sensitive Zones at ANAD

prevent the release of chemical agents and 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 vehicle 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 4.5, 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 is not available.

4.8.3 Impacts of the Proposed Action

4.8.3.1 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 by 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 48 dBA at the ANAD boundary closest to Area A, about 1.2 mi (2.0 km) east of the facility. The noise level would be lower than 48 dBA at residences located further away from the eastern site boundary.

This 48-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 due to terrain and vegetation. This level is below the EPA guideline of 55 dBA for residential zones (see Section 4.8.1) 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.

4.8.3.2 Impacts of Operations

At the baseline incinerator facility in Tooele, Utah, the highest sound levels during operation 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 the noise attenuation factors discussed in Section 4.8.3.1 are applied, estimated noise levels would be less than 37 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 operation 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.

4.8.4 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 4.8.1 (affected environment) would continue to exist.

4.9 VISUAL RESOURCES

Natural and human-made features give a particular landscape character and aesthetic quality. The character of a landscape is determined by its form, line, color, and texture; each element may influence the character to a varying degree. The stronger the influence of any one or all of these elements, and the more visual variety that can successfully coexist in the landscape, the more aesthetic quality is present in the landscape.

4.9.1 Current Environment

The viewshed within the vicinity of ANAD consists mainly of agricultural and forested land, with some residential and industrial development. The landscape is characterized mainly by woodland or forest on low mountains and hills, with intermittent open land. Vegetation consists of broadleaf deciduous forests in the low-lying areas, pine forests on higher ground, and mixed forests elsewhere.

At ANAD, industrial and administrative development is confined mostly to the southern and southeastern portion of the post. Smaller, more sporadic developments occur in the

northwestern parts and along the northern perimeter of the post. Munitions storage facilities are scattered throughout the southwestern, southeastern, and northeastern parts of the post. All of the industrial and administrative areas are brightly lit at night. The munitions storage areas are not visible from off post. The views are limited by the rolling terrain and the relatively dense forests. The industrial and administrative areas of the site can be seen from County Road 109 to the east of the Nichols Industrial Area and State Highway 202 to the south of the site.

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

Within the CLA, buildings and structures consist mainly of a small number of administrative and vacant buildings and about 155 storage igloos used to house chemical munitions. Buildings in the CLA are located primarily at the western end of the area, the site of the Reconfiguration Facility, and between Areas C and G, the site of Building 88 and other small buildings. Throughout the CLA, structures are generally less than 30 feet (9.1 m) in height, and only the buildings and surrounding parking lots are brightly lit at night. The CLA can be viewed only from the on-post access roads to the north and south and cannot be seen at all from off post. Visual resource conditions in the CLA are consistent with a VRM Class IV designation (DOI 1986a,b).

4.9.2 Site-Specific Factors

The general visual aesthetic character of ANAD could be affected by these factors:

1. 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.

4.9.3 Impacts of the Proposed Action

4.9.3.1 Impacts of Construction

Construction of an ACWA facility would not be expected to affect the visual character of the area because (1) there are no significant visual resources in the area, (2) surrounding areas are primarily forested and not accessible to the public, and (3) the effects would be intermittent and temporary. No change in the BLM VRM class designation would be expected.

4.9.3.2 Impacts of Operations

The presence of ACWA facilities is consistent with the surrounding land uses and would not adversely affect the visual character of the area. Operation of the facilities would not create significant, visible emissions. No change in the BLM VRM class designation would be expected.

4.9.4 Impacts of No Action

Under the no action alternative, there would be no change to the existing visual character of ANAD.

4.10 GEOLOGY AND SOILS

4.10.1 Current Environment

4.10.1.1 Geology

ANAD lies within the Alabama sector of the Appalachian Valley and Ridge Province (Adams et al. 1926). Cambrian to Pennsylvanian-age strata are exposed in long narrow belts of the northeast-trending ridges and valleys. ANAD is located in the Coosa Valley, which is 20 mi (32 km) wide and trends northeast-southwest for approximately 100 mi (162 km).

The sedimentary column in this region has been tilted and thrust-faulted into a series of disharmonic sheets. Most of the thrust faults dip to the southeast, and northwest-directed transport along the thrust faults has resulted in the stacking of large thrust sheets. Local-scale (less than several miles in length) geologic structures range from complex folds and fracture

systems near the terminus of a thrust fault, to broader folds within the central regions of the thrust sheets (Thompson et al. 1999).

In the Anniston area, bedrock consists of Cambrian to Ordovician-age clastic and carbonate rocks composed of sandstones, shales (mudstones), cherty limestones, dolomites, and quartzites (Thompson et al. 1999). The carbonate bedrock is overlain by a dolomite-derived residuum that consists of residual clays with chert fragments and rock boulders. Many sinkholes and depressions have formed in the residuum, the result of solution collapse of underlying carbonate bedrock.

A survey of potential economic resources at ANAD has not been conducted. The principal mineral resources in Calhoun County are barite, bauxite, high-alumina clays, limestone, shale, and tripoli (Neathery et al. 1972; Rheams 1992). Tripoli, which is valuable as an abrasive and mineral filler, is the most likely economic mineral in the vicinity of ANAD. Tripoli occurs in association with siliceous limestone and dolomite, which are present at ANAD (Rheams and Richter 1988). A tripoli outcrop was observed by Rheams (1988) approximately 5 mi (8 km) north of ANAD near Brook Mountain.

4.10.1.2 Seismicity

ANAD lies within the Appalachian Tectonic Province (U.S. Army 1991). Other seismic zones in the region include the New Madrid Seismic Zone, located about 267 mi (430 km) from the site; the Piedmont Tectonic Province, located approximately 12.5 mi (20 km) from the site; and a small seismic zone located about 360 mi (580 km) east of the site at the location of the Charleston, South Carolina, earthquake of 1886. Numerous faults occur in the ANAD vicinity, but none of them are considered capable of producing an earthquake. The Pell City Fault, the largest regional fault in the area, is located several miles northwest of the site. The Jacksonville Fault is located on the southeastern boundary of the facility. This fault is not considered to be regional (Yankee Atomic Electric Company 1994). Initial studies indicated the Jacksonville Fault ended near the town of Bynum, southwest of ANAD (Thompson et al. 1999); however, a more recent study indicated the Jacksonville Fault may extend further toward the Jackson Shoals area (Thompson et al. 1999).

The largest known earthquake near ANAD occurred in 1916. It had an epicenter near Fort McClellan, Alabama, about 18.6 mi (30 km) from the facility. This earthquake had a maximum Modified Mercalli Intensity of VII in the epicentral region (Yankee Atomic Electric Company 1994). It was noted by residents in seven states across an area about 100,000 mi^2 (260,000 km^2) in size (USGS 2000). An earthquake of this intensity produces some damage to masonry and causes difficulty in standing. An even larger earthquake, having an intensity equal to a Modified Mercalli Intensity of X, occurred near Charleston, South Carolina, in August 1886 (USGS 2000). Additional Intensity V earthquakes listed for Alabama were centered near Rosemary, Alabama, in June 1917; in the Scottsboro area northeast of Huntsville, Alabama, in June 1927; at Cullman,

Alabama, in May 1931; and in the Anniston area in May 1939. There have been no Intensity V earthquakes with epicenters in Alabama since 1939 (USGS 2000).

The estimated peak ground acceleration at ANAD would be generated by an earthquake having an intensity equal to a Modified Mercalli Intensity of X (U.S. Army 1991). This event would be located at the site and would produce an estimated peak ground acceleration of 0.28 G. The duration of this event would be 15 seconds. A distant event at the location of the Charleston earthquake would produce an estimated peak ground acceleration of 0.10 G at the site.

A recent probabilistic analysis was performed for ANAD (Yankee Atomic Electric Company 1994). According to this analysis, a seismic event resulting in a peak horizontal acceleration at ANAD greater than 0.1 G would occur once in 1,000 years. An event resulting in a peak horizontal acceleration greater than 0.3 G would occur once in 10,000 years, and an event resulting in a peak horizontal acceleration greater than 0.6 G would occur once in 100,000 years.

According to the nuclear power station seismic hazard curves for the eastern United States, ANAD 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 exceedance for this event is 0.075 G.

4.10.1.3 Soils

Soil types across ANAD may be grouped into three soil associations on the basis of shared characteristics (Harlin and Perry 1961) (see Table 4.10-1). As shown in Figure 4.10-1, most of the site is dominated by the Clarksville-Fullerton Association. The Anniston-Allen-Decatur-Cumberland and Rarden-Montevallo-Lehew Associations also are present along the southern edge of ANAD. The soils present at each of the three areas being considered for the construction of ACWA pilot facilities (i.e., Areas A, B, and C) are mapped as part of the Clarksville-Fullerton Association. Specifically, the soils at Areas B and C are mainly Clarksville-Fullerton stony loams and the soils at Area A are a combination of stony loams and cherty silt loams belonging to the Clarksville-Fullerton 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, B, and C are heavily vegetated and largely undisturbed except along the courses of roadways.

4.10.2 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

TABLE 4.10-1 Soil Associations at ANAD

Association	Soil Type	Characteristics
Clarksville-Fullerton	Stony or cherty soils on ridge tops and steep slopes, and local alluvium	Deep, well-drained to moderately drained Moderate to rapid permeability Moderate water capacity Slight to high erosion hazard
Anniston-Allen-Decatur-Cumberland	Gravelly loam, loam, silt loam, silty clay loam, underlain by limestone	Deep, well-drained Moderate to slow permeability Low to moderately low water capacity Moderate erosion hazard
Rarden-Montevallo-Lehew	Silt loam, shaly silt loam, gravelly silt loam, or fine sandy silt loam on ridge tops	Deep or moderately shallow Moderately well to well-drained Slow to rapid permeability Low water capacity Moderate erosion hazard

Source: Harlin and Perry (1961).

geologic resources at or in the vicinity of ANAD. With respect to the soils at ANAD, potential impacts might result from excavation, erosion, or accidental spills or 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 4.21.

4.10.3 Impacts of the Proposed Action

4.10.3.1 Impacts of Construction

Approximately 24 acres (9.7 ha) of ground could be affected to some degree from the construction of a pilot facility at Area A, B, or C (Section 4.1.1). Development of the utilities (e.g., installation of an electric transmission line, gas pipeline, and water pipeline) along the projected utility corridors (Figure 4.10-1) could cause additional soil disturbance. With respect to Area A, the extension of Water Corridor A beyond the existing utility corridor that supports the incinerator could result in the disturbance of approximately 1.2 acres (0.5 ha). For Area B, which is located closest to the existing incinerator, no additional disturbance would occur. For Area C, an additional 1.5 acres (0.6 ha) could be disturbed by the extension of Corridor C from the main existing line (B, C).

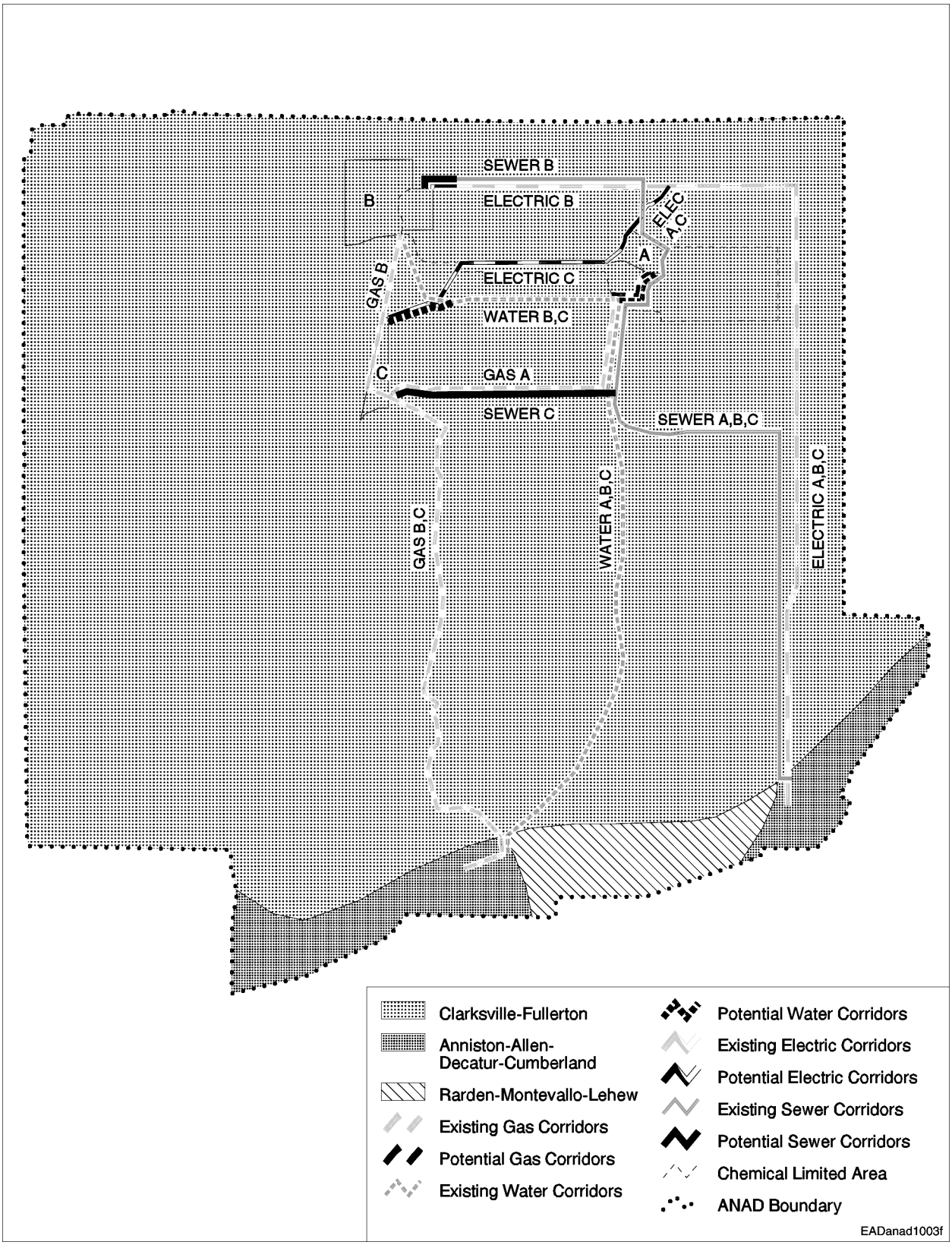

FIGURE 4.10-1 Soil Types at ANAD

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.

In addition, soils could be affected during construction of a pilot facility if there were an accidental spill or release of a hazardous material. Primarily, effects would be limited to those from spills of hazardous materials (e.g., paints, solvents) transported to the site and used during construction of a 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.

4.10.3.2 Impacts of Operations

Impacts on soils from the operation of a pilot facility could occur if there were 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 transport of an ACW 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 4.5 and 4.6) that they would not have a significant impact on surface soils.

4.10.4 Impacts of No Action

Under the no action alternative for ANAD, which is defined as future incineration of the ACWs, potential impacts on soils would be equivalent to those assessed previously in the EIS prepared for the incineration activities (U.S. Army 1991).

4.11 GROUNDWATER

4.11.1 Current Environment

4.11.1.1 Geohydrology

The water-bearing properties of the residuum units at ANAD are summarized in Table 4.10-1. The near-surface alluvium is of Quaternary age and is generally a poor aquifer. Wells completed in this formation generally have a poor yield and the water is high in iron (U.S. Army 1991).

The current conceptual hydrogeological framework of ANAD is a three-layer system, consisting of a thin veneer of overburden capping a layer of dolomite-derived residuum that overlies a dolomite bedrock. In all areas of ANAD, the piezometric surface of shallow bedrock aquifers occurs within the residuum (Science Applications International Corporation [SAIC] 1998). Hydrogeologic data indicate that the residuum serves as a confining (or semiconfining) layer, with transmissivities increasing downward. The weathered zone is extremely heterogeneous, resulting in highly variable permeabilities. In many cases, the shallow groundwater system is not isolated, and leakage of perched water occurs between the residuum and the underlying bedrock.

The unweathered dolomites of the Conasauga and Shady Dolomite are the most transmissive sequences in Calhoun County (Moser and DeJarnette 1992). Large quantities of water can be obtained from the Knox Group, where water-filled solution features are encountered. Fractured areas of the Chilhowee Group clastics yield large quantities of water that may be rich in iron (Moser and DeJarnette 1992). The permeability of the Cambrian rocks is secondary and develops through solution features and joint systems within the carbonate bedrock and fractures within the clastic rocks. Two dominant joint sets, with trendings of N30E and N60W, were reported by Technos (1985). The presence of these fractures provides the interconnection between aquifer systems such as the Chilhowee Group and Knox Group.

4.11.1.2 Groundwater Quantity

Wells completed in the Shady Dolomite and Conasauga Formations have yields that are adequate for domestic, industrial, and municipal uses, with yields in the range of 100 to 500 gal/min (380 to 1,900 L/min) (U.S. Army 1991). There are a number of springs in Calhoun County that discharge groundwater to the surface. These springs are generally located along thrust faults, which tap deep or distant groundwater sources. As a result, the yield from these springs is generally uniform and larger than would be expected if the springs were supplied only from local recharge (U.S. Army 1991).

4.11.1.3 Groundwater Quality

The quality of the groundwater in Calhoun County is generally good. Approximately 90% of the water consumed in the county is supplied by groundwater (U.S. Army 1991). The majority of the municipal water is supplied by Coldwater Spring, which supplies the cities of Anniston, Blue Mountain, several suburban areas, the former Fort McClellan Military Reservation, and ANAD (U.S. Army 1991).

Coldwater Spring is located southwest of Anniston and about 2 mi (3 km) from the southern boundary of ANAD. The spring is fed from the fractured and weathered zones of the Chilhowee Group and from formation cavities and channels in the Shady Dolomite (U.S. Army 1991). The U.S. Army (1991) reviewed a number of studies that address the recharge area for Coldwater Spring. The U.S. Army (1991) concluded that only the southeast corner of ANAD lies within the Coldwater Spring recharge area. It further concluded that groundwater from the area that contains the proposed ACWA sites most likely flows to the northwest, away from Coldwater Spring. Depending on the location of the groundwater divide in the north-central part of ANAD, groundwater from the proposed ACWA sites could potentially flow to the southwest, although this flow direction is unlikely. However, even if the groundwater would flow in a southwesterly direction, the studies reviewed by the U.S. Army (1991) concluded that the flow would not affect Coldwater Spring.

4.11.2 Site-Specific Factors

Annual water resource needs during construction would be essentially the same for all the ACWA technologies being considered. They 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 operation (which include both process and potable water) would range from 7 million gal/yr (26,000 m^3/yr) for Elchem Ox to 24 million gal/yr (91,000 m^3/yr) for Neut/GPCR/TW-SCWO. Both Neut/SCWO and Neut/Bio would use approximately 14 million gal/yr (53,000 m^3/yr) of water. Potable water needs would be essentially the same for all the ACWA technologies being considered at approximately 6 million gal/yr (23,000 m^3/yr). None of the ACWA technologies would discharge any process wastewater. Wastewater generation is related to the number of workers, which would essentially the same for the all technologies being considered at 7.5 million gal/yr (28,000 m^3/yr).

4.11.3 Impacts of the Proposed Action

4.11.3.1 Impacts of Construction

Construction-related impacts on groundwater from ACWA technologies being considered would be essentially the same. Impacts would be none to negligible, and if impacts did occur, they would exist for only a short period of time. 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/year) (Kimmell et al. 2001). This amount is about 0.02% of the minimum yield of Coldwater Spring and would have a negligible impact on the water supply from the spring. Impacts on the groundwater 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 (Kimmell et al. 2001). This waste would be treated according to regulations and released. It would have a negligible impact on groundwater .

4.11.3.2 Impacts of Operations

Any impacts on groundwater resources would result from the use of potable water, process water, and fire control water and from the generation of sanitary sewage. Water use of slightly over 7 million gal/yr (26,000 m^3/year) for Elchem Ox would represent an approximate increase of 33% over the annual water use at ANAD for fiscal year (FY) 2000 (Freeman 2000) but only 0.02% of the minimum flow of Coldwater Spring. Water use of 24 million gal/yr (91,000 m^3/year) for Neut/GPCR/TW-SCWO) would approximately double FY 2000 usage on post and be slightly more than 0.2% of the minimum flow of Coldwater Spring. While the percentage increase of water usage on post would be large, it would not be significant when compared with available water resources from Coldwater Spring. This increased withdrawal and usage would have negligible impacts on regional groundwater resources.

4.11.4 Impacts of No Action

Continued storage of chemical weapons at ANAD would not adversely affect groundwater. 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 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.

4.12 SURFACE WATER

4.12.1 Current Environment

ANAD is located in the Coosa River Basin (U.S. Army 1991). Neely Dam regulates the flow of the Coosa River near ANAD. Water quality in the Coosa River is generally good, although there has been some degradation due to sediment runoff, nutrient loading, and municipal and industrial discharges (U.S. Army 1991). Water quality is satisfactory for domestic, agricultural, and most industrial uses.

The Coosa River is a large perennial stream located approximately 5.3 mi (8.5 km) west of ANAD. Several large reservoirs are associated with dams on the Coosa River, including Logan Martin Lake, west of ANAD, and H. Neely Henry Lake, northwest of ANAD. Two perennial tributaries of the Coosa River in the vicinity of ANAD are Cane Creek, approximately 2.1 mi (3.4 km) to the north, and Choccolocco Creek, approximately 3.4 mi (5.5 km) to the south. Cabin Club Spring, located on the Pelham Range near the northwest boundary of ANAD, supports a shallow pool and stream.

The average flow in the Coosa River is approximately 6,200 million gal/d (270 m^3/s). At Francis Mill, which is northwest of ANAD, Cane Creek has an average flow of 85 million gal/d (4 m^3/s). Near Jenifer, south of ANAD, Choccolocco Creek has an average flow of 1.4 ft^3/s (55 m^3/h) (U.S. Army 1991). The subsurface contribution to Cane Creek is approximately 12% from springs or seeps (base flow). The subsurface contribution to Choccolocco Creek ranges from 33 to 48% (U.S. Army 1991).

ANAD is drained by numerous intermittent streams and one perennial stream. The northern portion of ANAD lies within the Cane Creek watershed, while the southern portion lies within the Choccolocco Creek watershed (U.S. Army 1991). An unnamed perennial stream, a tributary of Cane Creek, flows through the northeast portion of ANAD, including the ammunition storage area and CLA. (Figure 4.12-1 shows the surface water features.) Surface water impoundments on ANAD include Little Lake, which is 5 acres (2 ha) in size, and 25 small ponds, each averaging 0.25 acre (0.1 ha) (U.S. Army 1991).

Except for approximately 12 acres (4.9 ha) of proposed Area A, the proposed ACWA areas are located above the floodplain. Area A is located at the confluence of an unnamed perennial stream flowing from the southwest and an intermittent stream flowing from the south (Figure 4.12-1). Both streams are located within excavated channels. The perennial stream exits ANAD near the northeast corner and passes through the Pelham Range, joining Cane Creek approximately 2.8 mi (4.5 km) north of Area A. An excavated pond lies within the eastern portion of Area A.

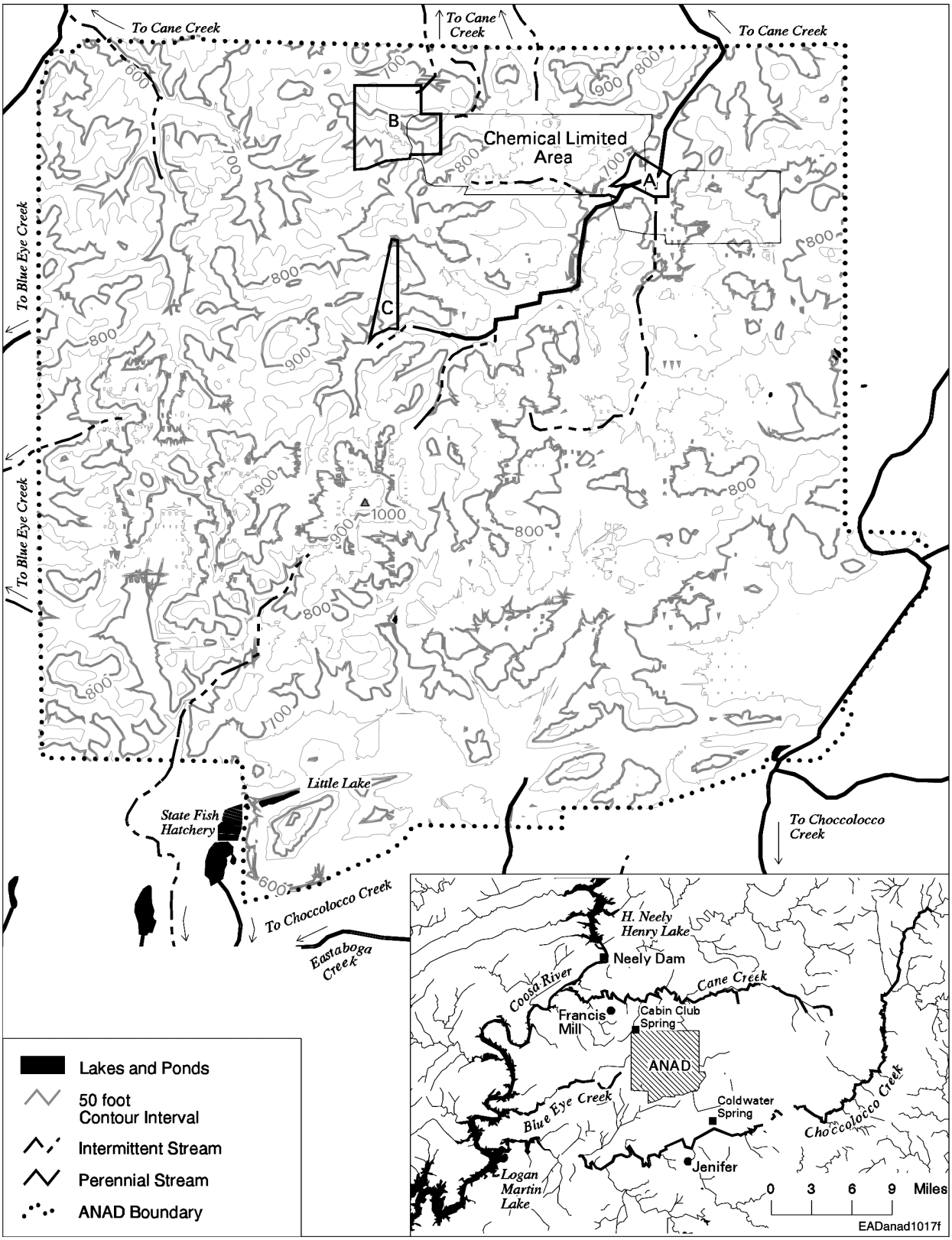

FIGURE 4.12-1 Surface Water Features at ANAD

No permanent surface water features occur in the vicinity of Proposed Area B. The northern portion of ANAD lies within the watershed of an intermittent stream, flowing to the north, which is a tributary to Cane Creek. Perennial flow occurs within this tributary approximately 3 mi (5 km) upstream of its confluence with Cane Creek (U.S. Army 1991). The southern portion of Site B lies within the watershed of an intermittent stream that flows to the northwest. This stream exits ANAD near the northwest corner, and its flow becomes perennial just beyond the ANAD boundary. A number of springs and seeps contribute to this stream, and the quality of the stream is considered relatively good.

Although surface water features do not occur at Proposed Area C, two ponds are located in the vicinity. An excavated pond is located downgradient, approximately 400 ft (120 m) to the southeast of Area C. This pond is more than 20 ft (6.1 m) deep and is permanently flooded. A small impoundment is also located downgradient of Site C, approximately 1,450 ft (442 m) to the east. This pond is semipermanently flooded. In addition, a stream channel also lies downgradient, adjacent to the southeast corner of Area C. Although flow within the stream is intermittent in the vicinity of Area C, perennial flow begins approximately 1,400 ft (430 m) downstream. The stream bed has been modified by excavation within the perennial portion of the stream. This stream passes through Area A and is a tributary of Cane Creek.

4.12.2 Site-Specific Factors

Annual water resource needs during construction would be essentially the same for all the ACWA technologies being considered. They are estimated to be approximately 7 million gal/yr (26,000 m^3/yr) over approximately three years (see Chapter 3). Construction activities would be expected 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 operation (which include both process and potable water) would range from 7 million gal/yr (26,000 m^3/yr) for Elchem Ox to 24 million gal/yr (91,000 m^3/yr) for Neut/GPCR/TW-SCWO. Both Neut/SCWO and Neut/Bio would use approximately 14 million gal/yr (53,000 m^3/yr) of water. Potable water needs would be essentially the same for all the ACWA technologies being considered at approximately 6 million gal/yr (23,000 m^3/yr). None of the ACWA technologies would discharge any process wastewater. Wastewater generation is related to the number of workers, which would be essentially the same for the all technologies being considered at 7.5 million gal/yr (28,000 m^3/yr). The only outfall to surface waters would be treated domestic sewage.

4.12.3 Impacts of the Proposed Action

4.12.3.1 Impacts of Construction

Construction-related impacts on overland water flow would be none to negligible. If impacts would occur, they would exist for only a short period of time. 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 do 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.

4.12.3.2 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 7.5 million gal/yr (28,000 m^3/yr) or 0.03 ft^3/s would be small when compared with surface water flows and would not significantly change flow conditions in the vicinity of the treatment plant.

There would be negligible impacts on off-post surface water from normal operations. The estimated sewage discharge of 7.5 million gal/yr (28,000 gal/yr) or 0.03 ft^2/s would be small when compared with surface water flows and would not significantly change flow conditions.

The additional withdrawals at Coldwater Spring, which would range from 0.08% to slightly more than 0.2% of the minimum flow, would not be significant and would have only negligible impacts on the surface water environment downstream of the spring.

4.12.4 Impacts of No Action

Continued storage of chemical weapons at ANAD 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 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.

4.13 TERRESTRIAL HABITATS AND VEGETATION

4.13.1 Current Environment

Located in northeast Alabama, ANAD lies within the Central Appalachian Ridges and Valleys Ecoregion (Omernik 1986). This region is characterized by a mosaic of agricultural land and woodland or forest on low mountains and hills. The Appalachian oak forest type represents the potential natural vegetation of the region. ANAD is located in the southwest portion of Calhoun County. Prior to settlement, Calhoun County had been entirely forested (Harlin and Perry 1961). Broadleaf deciduous forests occurred along low-lying areas and waterways, pine forests occurred on ridgetops and higher ground, and mixed forests occurred elsewhere. Today, the areas surrounding ANAD are predominantly forest and agricultural land. A city (Anniston) lies immediately to the east.

ANAD is predominantly undeveloped. It contains 1,744 acres (706 ha) of improved grounds (representing 11% of the installation's total area), 2,043 acres (827 ha) of semi-improved grounds (representing 13% of the total area), and 11,492 acres (4,653 ha) of unimproved grounds (representing 75% of the total area) (U.S. Army 1995). The topography of ANAD ranges from gently rolling land in the east to hills and steep slopes in the west (U.S. Army 1995).

Terrestrial communities in the vicinity of ANAD consist primarily of broadleaf deciduous forest and pine forest. Within a 30-mi (50-km) radius of ANAD, mixed broadleaf deciduous/pine forest covers approximately 58% of the landscape, while broadleaf deciduous forest covers 7%, and pine forest covers 8% (Pacific Northwest National Laboratory 1999). Within the nearby Talladega National Forest, the predominant forest communities are longleaf pine forest, white oak/red oak/hickory forest, and loblolly pine forest (U.S. Forest Service [USFS] 1994). Table 4.13-1 gives scientific names of plant species found at ANAD. The Pelham Range, located immediately north of ANAD, contains upland hardwood (oak/hickory), bottomland hardwood, and pine communities (U.S. Army 1998b). Pine represents the largest forest type, with large tracts of loblolly pine plantations. Fort McClellan includes a rare remnant mountain longleaf pine community in isolated old-growth stands (U.S. Army 1998b).

Terrestrial communities at ANAD include several types of forest, open grasslands, and landscaped areas. More than 13,000 acres (4,450 ha) of ANAD are covered by forests and woodlands (U.S. Geological Survey [USGS] 1998) (Figure 4.13-1). Approximately 43% of the forests on ANAD are hardwood forests, including red oak/white oak/hickory and sweetgum/yellow poplar (USGS 1998). Red oak/white oak/hickory forest makes up the largest portion, totaling 5,662 acres (2,292 ha) and representing nearly 43% of the forests on ANAD. The understory of these hardwood forests generally has a greater number of species than the other forest types and includes more herbaceous perennials (SAIC 2000). The 10 most common species of the hardwood understory are all native species and include muscadine grape, flowering

TABLE 4.13-1 Plant Species at ANAD

Common Name	Scientific Name
Bermuda grass	*Cynodon dactylon*
Black cherry	*Prunus serotina*
Blackgum	*Nyssa sylvatica*
Blackjack oak	*Quercus marilandica*
Briars	*Smilax sp.*
Broomsedge	*Andropogon virginicus*
Butternut hickory	*Carya cordiformis*
Chinese lespedeza	*Lespedeza cuneata*
Chustnut oak	*Quercus prinus*
Dallis grass	*Paspalum dilatatum*
Flowering dogwood	*Cornus florida*
Green ash	*Fraxinus pensylvanica*
Greenbriar	*Smilax spp.*
Hickory	*Carya sp.*
Japanese honeysuckle	*Lonicera japonica*
Johnson grass	*Sorghum halepense*
Kudzu	*Pueraria montana*
Oak	*Quercus sp.*
Loblolly pine	*Pinus taeda*
Longleaf pine	*Pinus palustris*
Mockernut hickory	*Carya tomentosa*
Muscadine grape	*Vitis rotundifolia*
Nepal grass	*Microstegium vimineum*
Northern red oak	*Quercus rubra*
Pine	*Pinus sp.*
Shortleaf pine	*Pinus echinata*
Southern red oak	*Quercus falcata*
Swamp chestnut oak	*Quercus michauxii*
Sweetgum	*Liquidambar styraciflua*
Sycamore	*Platanus occidentalis*
Water oak	*Quercus nigra*
White oak	*Quercus alba*
Yellow poplar	*Liriodendron tulipifera*

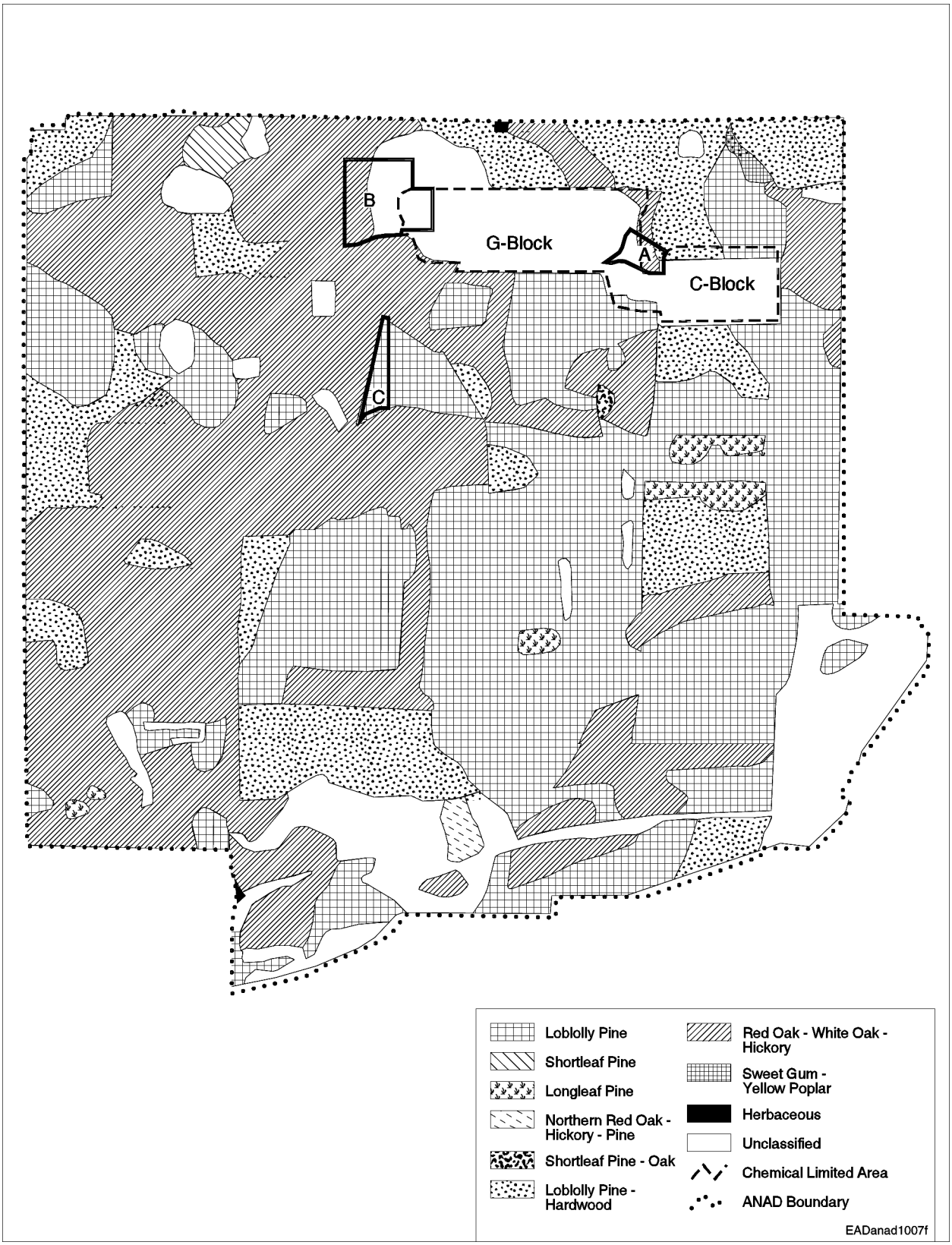

FIGURE 4.13-1 Vegetation at ANAD

dogwood, and blackgum. Pine forests make up approximately 40% of the forests on ANAD and include longleaf pine, loblolly pine, and shortleaf pine forests. Loblolly pine forest makes up the largest portion, totaling 5,158 acres (2,088 ha), representing 39% of the forests on ANAD. The understory of pine forests generally includes muscadine grape, greenbriar, and black cherry. Approximately 17% of ANAD forests are pine/hardwood forest types, including shortleaf pine/oak, loblolly pine/hardwood, and northern red oak/hickory/pine. The understory of pine/hardwood forests generally includes muscadine grape, black cherry, and flowering dogwood. Nonnative invasive species occurring in ANAD forests include Japanese honeysuckle (relatively common in pine and pine/hardwood forest), kudzu, and Nepal grass. Forests on ANAD are managed for multiple uses including timber production, wildlife habitat, and recreation (U.S. Army 1995). Pine and pine/hardwood forests are managed as even/aged stands, while hardwood forests are managed as uneven-aged stands. A 1,000- to 1,200-acre (405- to 486-ha) area of old-growth oak/hickory forest is located in the northwest corner of the restricted area (U.S. Army 1995). The mature hardwood forest in the western portion of ANAD is the least fragmented type of natural terrestrial community present on the installation (Bailey 1997).

In addition to forests, there are approximately 143 acres (57.2 ha) of open land on ANAD that support communities of mostly herbaceous species, including bermuda grass, dallis grass, johnson grass, Chinese lespedeza, broomsedge, and briars (U.S. Army 1995). Open areas are cut once a year between September and March. Some disturbed areas (utility corridors, etc.) have been planted for wildlife use. They include species such as annual rye, winter wheat, grass, and clover. Ammunition storage igloos are typically vegetated with grasses and clover and are mowed (U.S. Army 1995).

Proposed Area A is located within the CLA in the northeast portion of ANAD. This area includes the current location of Building 88. The eastern half of Area A is forested with an immature broadleaf deciduous forest community composed primarily of red oak, white oak, and hickory (USGS 1998). The western half of the site is wooded but is not under forest management because of the chemical storage facilities located there. The area next to the northeast portion is an immature pine-hardwood forest community composed primarily of loblolly pine and broadleaf deciduous species.

Proposed Area B is located directly west of the incinerator facility in the north central portion of ANAD. The western half of Area B lies within a broadleaf deciduous forest community composed primarily of red oak, white oak, and hickory (USGS 1998). Forest management in this area includes selective cutting. The eastern half of the site is wooded but is not under forest management because of the chemical storage facilities located there. Dominant canopy species include chestnut oak, swamp chestnut oak, and southern red oak. The shrub stratum is composed predominantly of flowering dogwood and sapling oaks, while the herbaceous stratum includes numerous oak seedlings. Pines are present in the far western portion of Area B, which is lower in elevation.

Proposed Area C is located near the central portion of ANAD. The entire area is included within an immature loblolly pine forest community (USGS 1998). Additional canopy species

include longleaf pine, shortleaf pine, blackjack oak, mockernut hickory, butternut hickory, and sweetgum and include some large individuals. Kudzu vine is very common in this area. The area slopes down to lower elevations in the east and south. Much of the adjacent area to the north, south, and west is red oak/white oak/hickory forest.

4.13.2 Site-Specific Factors

It is expected that impacts on vegetation caused by construction would be the same regardless of the technology evaluated, given the similarity in space requirements, construction activities, and time requirements for constructing any of the pilot test facilities. Routine pilot testing during operations would generate emissions that would be deposited on vegetation downwind of the facility.

Factors associated with an ACWA pilot test facility that would affect vegetation include construction activities, releases and spills, and accidents. These factors could occur during construction of the test facility complex itself and during the installation of utilities, communication cables, and other support areas (such as parking lots and material lay-down areas). The transportation of workers and building materials to the site would also be a factor during both construction and operations.

4.13.3 Impacts of the Proposed Action

The locations of the potential sites and utility corridors are described in Sections 4.1 and 4.3, shown in Figure 4.3-1, and summarized in Table 4.3-2. The construction of an ACWA pilot test facility would disturb about 25 acres (10 ha) for the site complex and up to another 52 acres (21 ha) for the site infrastructure. The total area likely to be disturbed during construction is shown in Table 4.3-2.

4.13.3.1 Impacts of Construction

Impacts on terrestrial habitats might result from disturbances due to construction-related activities or other modifications to the landscape. Landscape modifications generally involve large-scale soil disturbances due to facility construction. Such disturbances may eliminate particular vegetation types or cause the replacement of one type for another. Soil disturbances may also result in the dispersal and deposition of soil particles on surrounding vegetation, potentially reducing photosynthesis and transpiration. Impacts could include mortality of individual organisms, habitat loss, or changes in biotic communities. Erosion of exposed soil at construction sites could reduce the effectiveness of restoration efforts and create downgradient sedimentation.

Impacts on terrestrial habitats might also result from the release to the environment of substances known to cause toxic effects in biota. Construction of a pilot facility might release organic or inorganic compounds, including agent or processing by-products, to the environment. Releases could occur as a single event (a spill, for example) or occur as continual low-level releases. Exposure of biota could result from airborne transmission of materials, surface water contamination, groundwater contamination, or contaminants released to soils. Atmospheric releases of contaminants could result in the widespread dispersal and deposition of contaminants. Exposure routes might include plant root uptake or foliar exposure. Exposures could result in lethal effects, reduced growth or other limiting effects, or no observable effect.

The types of impacts on terrestrial communities from construction were considered to be the same for all of the technologies evaluated, given the similarity in their 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, B, and C 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 communities in these areas.

The construction of the pilot facility and infrastructure would disturb up to 77 acres (31 ha) of land. Existing vegetation would be destroyed during land clearing activities. The implementation of best management practices for erosion and sedimentation control, fugitive dust emissions, installation of storm-water retention ponds, and immediate replanting of disturbed areas with native species would help minimize impacts on vegetation.

Portions of Area A were previously disturbed during the construction of roads and Building 88. Construction of the pilot facility at Area A would eliminate up to 25 acres (10 ha) of forest community types, including red oak/white oak/hickory and loblolly pine/hardwood. Infrastructure corridors for Area A would require the disturbance of an additional 15 acres (6 ha) of forest types, predominantly red oak/white oak/hickory and loblolly pine. The forest communities occurring on undeveloped land at Area A and along new infrastructure corridors are relatively common and well-represented in the vicinity. Construction at Area A would result in the loss of up to 40 acres (16 ha) of the forest habitat.

Construction of the pilot facility at Area B would eliminate up to 25 acres (10 ha) of forest communities, primarily the red oak/white oak/hickory forest type. Infrastructure corridors for Area B would require the disturbance of an additional 6 acres (2.4 ha) of forest types, predominantly red oak/white oak/hickory. The forest communities occurring on undeveloped land at Area B and along new infrastructure corridors are relatively common and well-represented in the vicinity. Construction at Area B would result in the loss of up to 31 acres (13 ha) of forest habitat.

Construction of the pilot facility at Area C would eliminate up to 25 acres (10 ha) of forest communities, primarily the loblolly pine forest type. Infrastructure corridors for Area C would require the disturbance of an additional 52 acres (21 ha) of forest types, primarily red

oak/white oak/hickory. The forest communities occurring on undeveloped land at Area C and along new infrastructure corridors are relatively common and well-represented in the vicinity. Construction at Area C would result in the loss of up to 77 acres (31 ha) of forest habitat.

4.13.3.2 Impacts of Operations

During routine operations, a portion of the materials released from the pilot facility stacks would be deposited on the soils surrounding the site. Deposition from atmospheric emissions would result in very low concentrations of trace metals and organic compounds.

A soil screening-level ecological risk assessment was conducted for each of the four technologies considered for ACWA pilot testing at ANAD to determine potential impacts to biota from routine emissions. This analysis showed that routine emissions would pose negligible ecological risk to terrestrial vegetation (Section 4.14.3.2).

Air concentrations and deposition of emission constituents from a pilot test facility using any of the four technologies being considered would pose negligible ecological risk to terrestrial biota. Consequently, routine operations of a pilot test facility would result in negligible impacts on terrestrial habitats and vegetation.

4.13.4 Impacts of No Action

Under the no action alternative, an ACWA pilot facility would not be constructed. Continued storage of chemical agents at ANAD, including routine maintenance and monitoring operations, would not adversely affect terrestrial habitats or vegetation.

4.14 WILDLIFE

4.14.1 Current Environment

A survey of neotropical migrant birds and resident birds at ANAD was conducted in 1997, and a survey of small mammals and herpetofauna was conducted there in 2000. The ANAD natural resource management plan indicates that forest management is carried out and that plots and strips have been planted to provide food for game and nongame animals. Annual rye, winter wheat, clover, and various grass species are planted in certain open areas at ANAD (U.S. Army 1995).

4.14.1.1 Mammals

Given the geographic location and the different habitats known on the installation, a list of representative mammal species typical of the deciduous forests and southeastern United States was generated (Brown 1997). A survey of small mammals was conducted at ANAD in 1999 and 2000. Species that were observed at ANAD are indicated by an asterisk in the list of representative species below (SAIC 2000):

- Open fields:

Cotton rat	*Sigmodon hispidus**
Eastern cottontail	*Sylvilagus floridanus**
Prairie vole	*Microtus ochrogaster**

- Woodlands (hardwood, mature forests, seedling and sapling, caves):

Eastern pipistrelle	*Pipistrellus subflavu*
White-footed mouse	*Peromyscus leucopus**
Southern flying squirrel	*Glaucomys volans*
Red bat	*Lasiurus borealis*
Gray squirrel	*Sciurus carolinensis**
Northern short-tailed shrew	*Blarina brevicauda*

- General habitats in the southeastern United States:

Coyote	*Canis latrans**
Gray fox	*Urocyon cinereoargenteus*
Raccoon	*Procyon lotor**
Southeastern shrew	*Sorex longirostris*
Striped skunk	*Mephitis mephitis*
Virginia opossum	*Didelphis virginiana**
White-tailed deer	*Odocoileus virginianus**
Wild boar	*Sus scrofa*

Additional species observed at ANAD include eastern chipmunk (*Tamias striatus*), southern short-tailed shrew (*Blarina carolinensis*), woodchuck (*Marmota monax*), beaver (Castor canadensis), and feral cat (*Felis domesticus*) (SAIC 2000).

4.14.1.2 Birds

In 1997, a survey of neotropical birds and resident birds was conducted at ANAD during the spring and summer seasons for a total of nine days. The 15,279 acres (6,112 ha) of land surveyed were found to provide habitat for at least 28 neotropical migrant species and 37 resident species, for a total of 65 different bird species (Bailey 1997).

Although no bird point-count stations were operated in Area A, the species represented in the broadleaf deciduous forest community in other areas are assumed to be represented in Area A. In addition, the burning ground area was not surveyed for safety and security reasons. The blue-winged warbler (*Vermivora pinus*), a rare/uncommon species in Alabama, was spotted once during the survey in the southeast corner of the depot. The Alabama Natural Heritage Program database classifies this species as G5 S3B, meaning its population is secure internationally, but it is a rare breeder in Alabama (Bailey 1997). No additional sitings of this species were made from other observation points during the survey. Birds observed at ANAD include the following:

- These were observed in mature oak/hickory communities:

Carolina wren	*Thryothorus ludovicianus*
Blue grosbeak	*Guiráca caerúlea*
Scarlet tanager	*Piranga olivacea*
Chimney swift	*Chaetura pelagica*

- These were observed in mixed pine/hardwood communities:

Wild turkey	*Meleagris gallopavo*
Red-bellied woodpecker	*Melanerpes carolinus*
Northern bobwhite	*Colínus virginiánus*
Red-tailed hawk	*Buteo jamaicensis*

- These were observed in deciduous woods communities:

Mourning dove	*Zenaida macroura*
Prairie warbler	*Dendroíca díscolor*
Northern rough-winged swallow	*Stelgidopteryx serripennis*

- These were observed in loblolly, shortleaf pine communities:

Indigo bunting	*Passerina cyanea*
American robin	*Turdus migratorius*

- These were observed in swamps and open water:

Belted kingfisher	*Ceryle alcyon*
Green-backed heron	*Butorides virescens*

Because of their habitat and food requirements, green-backed herons, which were generally seen near shorelines and marsh habitats bordering open water, may no longer be present on the depot. The green-backed heron was sighted only once by the Cone Reservoir during the 1997 bird survey. However, the Cone Reservoir has since reverted to dry land because the dam that belonged to the reservoir was breached (Burns 2000a). The belted kingfisher is still likely to be present. There were three confirmed sightings; one was near an unnamed creek, and the other two were located in the mixed pine-hardwood area. None of the sightings were near the reservoir.

4.14.1.3 Amphibians and Reptiles

During a visit to the installation in July 2000, a green anole (*Anolis carolinensis*) was observed near Area C. Surveys of herpetofauna amphibians and reptiles conducted at ANAD in 1999 and 2000 (SAIC 2000) identified 34 species. Herpetofauna were found to be more common in hardwood forest and pine/hardwood forest than in pine forest. Surveys in hardwood forest identified eight species of amphibians and 10 species of reptiles. Nine species occurred only in hardwood forest:

Southern two-lined salamander	*Eurycea cirrigera*
Ocoee salamander	*Desmognathus ocoee*
Marbled salamander	*Ambystoma opacum*
American toad	*Bufo americanus*
Green anole	*Anolis carolinensis*
Black rat snake	*Elaphe obsoleta*
Gray rate snake	*Elaphe obsoleta spiloides*
Corn snake	*Elaphe guttata guttata*
Eastern box turtle	*Terrapene carolina carolina*

Surveys in pine forest identified three species of amphibians and six species of reptiles. Two species occurred only in pine forest:

Midland water snake	*Nerodia spideon pleuralis*
Timber rattlesnake	*Crotalus horridus*

Surveys in pine/hardwood forest identified five amphibian species and four reptile species. One species was found only in pine/hardwood forest:

Northern ringneck snake	*Diadophis punctatus edwardsii*

An additional five species of amphibians and seven species of reptiles were identified from other observations at the ANAD site.

- These were observed throughout the site in general:

Green anole	*Anolis carolinensis*
Three-lined salamander	*Eurycea longicauda guttolineata*

- These were observed in moist forested areas:

Eastern box turtle	*Terrapene carolina carolina*
Three-toed box turtle	*Terrapene carolina triunguis*
Southern ringneck snake	*Diadophis punctatus punctatus*

- These were observed in ponds, wetlands, and streams:

Southern copperhead	*Agkistrodon contortrix contortrix*
Gray treefrog	*Hyla versicolor*
Eastern mud turtle	*Kinosternon subrubrum subrubrum*
Upland chorus frog	*Pseudacris triseriata feriarum*

- These were observed in subterranean burrows:

Eastern narrow-mouthed toad	*Gastrophryne carolinensis*
Eastern spadefoot toad	*Scaphiopus holbrooki holbrooki*
Eastern tiger salamander	*Ambystoma tigrinum tigrinum*

4.14.2 Site-Specific Factors

It is expected that impacts on wildlife caused by 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. Operational impacts on wildlife would be related to emissions from routine operations, noise, and the presence of the work force.

During construction, impacts on wildlife might result from clearing vegetation for an ACWA pilot test facility and associated infrastructure. Increased activity from the presence of workers and increases in vehicle traffic might also affect wildlife.

4.14.3 Impacts of the Proposed Action

4.14.3.1 Impacts of Construction

Various factors could have environmental impacts on wildlife during the siting, construction, and operation of an ACWA pilot test facility, during an accident, and during no action. Impacts on wildlife might result from habitat loss and land disturbances caused by construction-related activities or other modifications to the landscape. Landscape modifications generally involve large-scale soil disturbances due to facility construction. Such disturbances would eliminate particular habitat types or cause one type to replace another. Landscape modifications might displace or eliminate wildlife that use the area as breeding or foraging habitat or for protection from predators. Impacts could include mortality of individual organisms or habitat loss. Erosion of exposed soil at construction sites could reduce the effectiveness of restoration efforts and create downgradient sedimentation. Wildlife could be affected by land clearing, noise, road kills caused by construction vehicles, and human presence.

Impacts on wildlife might also result from the release to the environment of substances known to cause toxic effects in biota (only with sufficient magnitude and duration of exposure). Construction of a pilot facility could release organic or inorganic compounds, including agent or processing by-products, to the environment. Releases could occur as a single event (a spill, for example) or as continual low-level releases. Exposure of biota could result from airborne transmission of materials, surface water contamination, groundwater contamination, or contaminants released to soils. Atmospheric releases of contaminants could result in the widespread dispersal and deposition of contaminants. Exposure routes might include inhalation, dermal contact with contaminants (including contaminated soil or water), or ingestion (including ingestion of contaminated soil, water, or food). Exposures might result in lethal effects, reduced growth or other limiting effects, or no observable effect.

The general types of impacts on terrestrial communities from construction were considered to be the same for all of the technologies evaluated, given the similarity in their 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, B, and C 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 communities in these areas.

Construction of the pilot facility and infrastructure would disturb up to 77 acres (31 ha) of land. 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 wildlife.

Portions of Area A were previously disturbed during the construction of roads and Building 88. Construction of the pilot facility at Area A would eliminate up to 25 acres (10 ha) of forest community types, including red oak/white oak/hickory habitat and loblolly pine-hardwood habitat. Infrastructure corridors for Area A would require the disturbance of an additional 15 acres (6.0 ha) of forest types, predominantly red oak/white oak/hickory habitat and loblolly pine habitat. Wildlife associated with these habitats would be eliminated or displaced. Communities occurring on undeveloped land at Area A and along new infrastructure corridors are relatively common and well-represented in the vicinity of the site. Areas of disturbance due to the construction of a pilot test facility and infrastructure are presented in Table 4.13-2.

Construction of the pilot facility at Area B would eliminate up to 25 acres (10 ha) of forest communities, primarily the red oak/white oak/hickory habitat type. Infrastructure corridors for Area B would require the disturbance of an additional 6 acres (2.4 ha) of forest habitat, predominantly red oak/white oak/hickory. Wildlife associated with these habitats would be eliminated or displaced. Communities occurring on undeveloped land at Area B and along new infrastructure corridors are relatively common and well-represented in the vicinity of the site.

Construction of the pilot facility at Area C would eliminate up to 25 acres (10 ha) of forest communities, primarily the loblolly pine habitat type. Infrastructure corridors for Area C

would disturb an additional 52 acres (21 ha) of forest habitats, primarily red oak/white oak/hickory. Wildlife associated with these habitats would be eliminated or displaced. Communities occurring on undeveloped land at Area C and along new infrastructure corridors are relatively common and well-represented in the vicinity of the site.

Wildlife with restricted mobility, such as burrowing species or juveniles of nesting species, would be destroyed during land clearing activities. More mobile individuals would relocate to adjacent available areas with suitable habitat. Population densities and competition would increase in these areas, potentially reducing the survival rates or reproductive capacity of displaced individuals. Some wildlife species would be expected to quickly recolonize replanted areas near the facility after completion of construction. The permanent loss of up to 77 acres (31 ha) of habitat would not be expected to threaten local populations of any wildlife species since similar habitat would be available nearby. Losses of forested vegetation would not be expected to include any links between patches of similar habitat; thus, impacts from habitat fragmentation are not anticipated. The losses would not adversely affect the movements of larger mammals such as white-tailed deer, foxes, and squirrels.

4.14.3.2 Impacts of Operations

During routine operations, biota in the vicinity of the pilot test facility would be exposed to atmospheric emissions from the facility stacks. A portion of the materials released from the stacks would become deposited on the vegetation, soils, and surface waters surrounding the site. Deposition from atmospheric emissions would result in very low concentrations of trace metals and organic compounds.

A soil screening-level ecological risk assessment was conducted to assess the risk to terrestrial biota from air emissions expected from each of the four ACWA technologies. None of the chemicals evaluated exceeded the soil benchmark values and thus would not result in a hazard quotient (HQ) of >1 for any of the four technologies. An HQ of <1 indicates concentrations below those that are known to be harmful to biota. The highest HQ was for benzene (HQ = 0.38) from Neut/Bio; this HQ value is almost three times less than the soil benchmark value. Mercury had the next highest HQ of 4.3×10^{-3} (from Neut/GPCR/TW-SCWO), which is 200 times below the benchmark value. For any of the toxic air pollutants emitted from the stacks to achieve an HQ of >1, the deposition radius would have to be limited to 580 yd (530 m), a distance not physically possible given the stack heights and existing wind characteristics, which would result in metals and organic compounds being carried much greater distances. Table 4.14-1 lists the number of chemicals evaluated for the air emissions from each ACWA technology.

TABLE 4.14-1 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 ANAD

Technology	No. of Chemicals Evaluated	Chemicals of Potential Concern from Stack Emissions[a]
Neut/Bio	40	None
Neut/SCWO	46	None
Neut/GPCR/TW-SCWO	55	None
Elchem Ox	45	None

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

Air concentrations and deposition of emission constituents from a pilot test facility using any of the four technologies being considered would pose negligible ecological risks to species in terrestrial habitats. Consequently, routine operations of a pilot test facility would result in negligible impacts on wildlife.

During the period of operation of the pilot test facility, increased vehicle traffic nearby could result in a higher mortality for wildlife as a result of vehicle-wildlife collisions. Species most affected would include nocturnal mammals, amphibians, and reptiles. The increase in mortality would constitute a negligible to minor adverse impact on local wildlife populations.

Operation of the facility would increase the ambient noise level. A number of wildlife species would tend to avoid otherwise suitable habitats in the vicinity of the facility, resulting in a negligible to minor adverse impact on local wildlife populations. Species that adapt readily to human presence would be less affected by noise impacts.

4.14.4 Impacts of No Action

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

4.15 AQUATIC HABITATS AND FISH

4.15.1 Current Environment

The Coosa River is a large perennial stream, approximately 5.3 mi (8.5 km) west of ANAD. Several large reservoirs are associated with dams on the Coosa River, including Logan Martin Lake, west of ANAD, and H Neely Henry Lake, northwest of ANAD. Logan Martin Lake supports a recreational fishery for bass, bluegill, spotted bass, black crappie, and white crappie. Additional species include threadfin shad, gizzard shad, catfish, suckers, and minnows (U.S. Army 1991).

Two perennial tributaries of the Coosa River in the vicinity of ANAD are Cane Creek, approximately 2.1 mi (3.4 km) to the north, and Choccolocco Creek, approximately 3.4 mi (5.5 km) to the south. Cabin Club Spring, located on the Pelham Range near the northwest boundary of ANAD, supports a shallow pool and stream that are potential habitat for the pygmy sculpin and coldwater darter (U.S. Army 1998b). ANAD contains a portion of the watershed immediately above the spring. Fish species commonly occurring in surface waters on the adjacent Pelham Range include largemouth bass, bluegill, sunfish, channel catfish, blacknose dace, creek chub, and stoneroller (U.S. Army 1998b). Coldwater Spring, approximately 3 mi (5 km) east of ANAD, supports a population of the pygmy sculpin (*Cottus pygmaeus*) and sculpin snail (*Stiobia nana*) (Godwin et al. 1994). A state fish hatchery is located immediately southwest of ANAD.

ANAD is intersected by numerous intermittent streams and one perennial stream. The northern portion of ANAD lies within the Cane Creek watershed, while the southern portion lies within the Choccolocco Creek watershed (U.S. Army 1991). The unnamed perennial stream is a tributary of Cane Creek and flows through the northeast portion of ANAD, including the Ammunition Storage Area and CLA (Figure 4.12-1). Surface water impoundments include Little Lake, 5 acres (2 ha) in size, and 25 small ponds averaging 0.25 acre (0.1 ha) each (U.S. Army 1991). The small lakes on the ANAD are stocked with bluegill and largemouth bass.

Area A is located at the confluence of the unnamed perennial stream flowing from the southwest and an intermittent stream flowing from the south (Figure 4.12-1). Both of these streams are located within excavated channels. The perennial stream exits ANAD near the northeast corner and passes through the Pelham Range, joining Cane Creek approximately 2.8 mi (4.5 km) north of Area A. Fauna within the stream include fish and aquatic gastropods (Godwin et al. 1994). An excavated pond lies within the eastern portion of Area A.

No permanent surface water features occur in the vicinity of Area B. The northern portion of the area lies within the watershed of an intermittent stream flowing to the north, which is a tributary of Cane Creek (Figure 4.12-1). Perennial flow occurs within this tributary approximately 3.1 mi (5 km) upstream of its confluence with Cane Creek (U.S. Army 1991). The

southern portion of Area B lies within the watershed of an intermittent stream that flows to the northwest. This stream exits ANAD near the northwest corner, and its flow becomes perennial just beyond the ANAD boundary. A number of springs and seeps contribute to this stream, and the quality of the stream is considered to be fairly good (Godwin et al. 1994). It supports a breeding population of snapping turtle (*Chelydra serpentina*). Fish diversity is limited. The coldwater darter (*Etheostoma ditrema*) occurs within this stream on the Pelham Range. Protection of the watershed has been recommended by the Alabama Natural Heritage Program of the Department of Conservation and Natural Resources (Godwin et al. 1994).

Although aquatic habitats do not occur at Area C, two ponds are located in the vicinity. An excavated pond is located downgradient, approximately 400 ft (120 m) to the southeast of Area C. This pond is more than 20 ft (6.1 m) deep and is permanently flooded. A small impoundment is also located downgradient of Area C, approximately 1,450 ft (442 m) to the east. This pond is semipermanently flooded. In addition, a stream channel also lies down-gradient, adjacent to the southeast corner of Area C. Although flow within the stream is intermittent in the vicinity of Area C, perennial flow begins approximately 1,400 ft (430 m) downstream. The stream bed has been modified by excavation within the perennial portion of the stream. This stream passes through Area A and is a tributary of Cane Creek.

4.15.2 Site-Specific Factors

It is expected that impacts on aquatic habitats and fish caused by 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.

4.15.3 Impacts of the Proposed Action

4.15.3.1 Impacts of Construction

The nature of impacts on aquatic habitats and fish from construction were considered to be the same for all the technologies evaluated, given the similarity in their 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, B, and C (Figure 4.3-1) 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.

Construction of the pilot facility would disturb approximately 25 acres (10 ha) of land at Area A, B, or C. 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 aquatic habitats and fish resulting from construction.

Construction of an ACWA pilot test facility in Area A could affect specific features of the 33-acre (13-ha) Area A, including the two streams that converge there. Rerouting or culverting of the streams in Area A, if necessary, could result in the loss of up to 1,912 linear ft (583 m) of stream habitat, consisting of excavated channels. Approximately 1,238 ft (377 m) of habitat occurs within the perennial stream in Area A, and 674 ft (205 m) occurs within the intermittent stream. Similar habitat, however, occurs along extensive portions of the streams.

Because of the limited diversity of aquatic habitat and the lack of undisturbed habitat within the streams on Area A, disturbances to the streams resulting from construction would constitute a minor adverse impact. Construction at Area A could also eliminate an excavated pond, approximately 0.4 acre (0.2 ha) in size, located in the eastern portion of ANAD. Similar ponds are fairly common on post and in the vicinity of ANAD. The new corridor for the natural gas supply to Area A would cross the perennial stream southwest and upstream of Area A. Approximately 30 ft (9 m) of the stream 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 streams within the corridors and on downstream aquatic habitats.

Aquatic habitats do not occur on Area B. The implementation of best management practices for erosion control and immediate replanting of disturbed areas with native species would help minimize impacts on streams within the utility corridor and on aquatic habitats downstream of Area B.

No aquatic habitats occur on Area C. However, the new utility corridor would cross an intermittent stream within the chemical agent storage area. This stream is a tributary of the perennial stream intersecting Area A. Approximately 120 ft (37 m) of stream channel would be included within the corridor. A service road currently crosses the stream next to the proposed corridor. In addition, approximately 30 ft (9 m) of the perennial stream 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 streams within the corridor and on downstream aquatic habitats.

4.15.3.2 Impacts of Operations

Water withdrawal from surface waters for the pilot process, as well as wastewater discharge, would have only negligible impacts on aquatic ecosystems.

A portion of the materials released from the pilot facility stacks would become deposited on the soils and surface waters surrounding ANAD. Deposition from atmospheric emissions would result in very low concentrations of trace metals and organic compounds.

A screening-level ecological risk assessment was conducted to assess the risk to aquatic biota from air emissions generated by ACWA pilot test facilities. Aqueous concentrations from the deposition of airborne emissions during normal operations for each of the four technologies were compared with ecotoxicological benchmark values established to protect aquatic biota, which includes fish, aquatic invertebrates, and aquatic plants (Suter and Tsao 1996). The methodology used for this analysis is similar to that used for soil (Section 4.13.3.2). A total of 38 chemicals were subjected to the screening-level ecological risk assessment. The results of the analysis indicate that none of the metals and organic compounds evaluated exceeded the criteria (Tsao 2001g). For organics, the highest HQ was for hexane (HQ = 0.85), while barium had the highest HQ among the metals (HQ = 3.2×10^{-4}). An HQ of <1 indicates concentrations below levels that are known to be harmful to biota.

Therefore, air concentrations and deposition of emission constituents from a pilot test facility using any of the four technologies being considered would pose negligible ecological risk to aquatic biota. Consequently, routine operations of a pilot test facility would result in negligible impacts to aquatic habitats and fish.

4.15.4 Impacts of No Action

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

4.16 PROTECTED SPECIES

4.16.1 Current Environment

4.16.1.1 Overview

Information from the Alabama Department of Conservation and Natural Resources and USFWS indicates that 39 threatened or endangered species and nine state-protected species occur in the counties within the 30-mi (50-km) radius of the potential impact zone (Lewis 2000a; Goldman 2000). Species documented within the 30-mi (50-km) radius of ANAD are listed in Table 4.16-1. A general overview of threatened and endangered species determined by the USFWS that could potentially be affected by the proposed action is provided in this section.

TABLE 4.16-1 State Protected and Federal Listed Threatened and Endangered Species Occurring within 30 Miles (50 Kilometers) of ANAD[a]

Category, Status, Common Name	Scientific Name	Blount	Calhoun	Cherokee	Clay	Cleburne	Etowah	Jefferson	Randolph	Shelby	St Clair	Talladega
Plants												
Federal endangered												
Alabama leather-flower	*Clematis socialis*			X			X				X	
Green pitcher-plant	*Sarracenia oreophila*			X			X					
Harperella	*Ptilimnium nodosum*			X								
Kral's water-plantain	*Sagittaria secundifolia*			X								
Leafy prairie-clover	*Dalea foliosa*							X				
Piedmont mock bishopweed	*Ptilimnium nodosum*			X								
Tennessee yellow-eyed grass	*Xyris tennesseensis*		X									
Federal threatened												
Eggert's sunflower	*Helianthus eggertii*	X										
Mohr's Barbara's-buttons	*Marshallia mohrii*		X	X			X					
Mammals												
Federal endangered												
Gray bat	*Myotis grisescens*		X							X		
Indiana bat	*Myotis sodalis*	X								X		
State protected												
Rafinesque's big-eared bat	*Corynorhinus rafinesquii*	X										
Birds												
Federal endangered												
Red-cockaded woodpecker	*Picoides borealis*		X		X	X						X
Federal threatened												
Bald eagle	*Haliaeetus leucocephalus*			X								
Aquatic biota												
Federal endangered												
Cahaba shiner	*Notropis cahabae*	X						X		X		
Coosa moccasinshell	*Medionidus parvulus*			X								X
Cylindrical lioplax	*Lioplax cyclostomaformis*									X		
Flat pebblesnail	*Lepyrium showalteri*									X		
Ovate clubshell	*Pleurobema perovatum*	X									X	
Plicate rocksnail	*Leptoxis plicata*	X						X				
Southern acornshell mussel	*Epioblasma othcaloogensis*			X						X	X	
Southern clubshell	*Pleurobema decisum*			X			X	X				X
Southern combshell mussel	*Pleurobema penita*						X					
Southern pigtoe (mussel)	*Pleurobema georgianum*		X	X		X	X				X	
Triangular kidneyshell	*Ptychobranchus greeni*	X		X		X	X	X		X	X	
Tulotoma snail	*Tulotoma magnifica*		X							X	X	X
Upland combshell	*Epioblasma metastriata*	X		X				X		X		
Watercress darter	*Etheostoma nuchale*							X				

TABLE 4.16-1 (Cont.)

Category, Status, Common Name	Scientific Name	Blount	Calhoun	Cherokee	Clay	Cleburne	Etowah	Jefferson	Randolph	Shelby	St Clair	Talladega
Federal threatened												
Alabama moccasinshell	*Medionidus acutissimus*			X			X			X		
Blue shiner	*Cyprinella caerulea*		X	X				X		X		X
Fine-lined pocketbook	*Lampsilis altilis*	X	X	X	X	X	X	X		X	X	X
Goldline darter	*Percina aurolineata*									X		
Lacy elimia (snail)	*Elimia crenatella*											X
Little amphianthus	*Amphianthus pusillus*								X			
Orangenacre mucket	*Lampsilis perovalis*							X		X		
Painted rocksnail	*Leptoxis taeniata*		X							X		X
Pygmy sculpin	*Cottus pygmaeus*		X									
Round rocksnail	*Leptoxis ampla*									X		
Slackwater darter	*Etheostoma boschungi*					X						X
State protected												
Coldwater darter	*Etheostoma ditrema*		X				X			X		X
Crystal darter	*Crystallaria asprella*									X		
Holiday darter	*Etheostoma brevirostrum*		X			X						
Vermilion darter	*Etheostoma chermocki*							X				
Amphibians and reptiles												
Federal threatened												
Flattened musk turtle	*Sternotherus depressus*	X					X	X				
State protected												
Alabama map turtle	*Graptemys pulchra*		X	X			X	X				X
Dusky gopher frog	*Rana capito sevosa*									X		
Green salamander	*Aneides aeneus*			X							X	
Southern hognose snake	*Heterodon simus*		X							X		

[a] The bald eagle (*Haliaeetus leucocephalus*) and red-cockaded woodpecker (*Picoides borealis*) may occur in any county, if habitat exists. Bald eagle/wintering birds are possible in areas with reservoirs.

4.16.1.2 Threatened and Endangered Species

Tennessee Yellow-Eyed Grass (Federal Endangered). Tennessee yellow-eyed grass (*Xyris tennesseensis*) is known from only 14 extant populations. Eight of these occur in Alabama; six other colonies occur in Georgia and Tennessee (Reisz Engineers 1999). This perennial occurs in clumps containing few to many bulbous-based individuals with stems from 2.3 to 3.3 ft (0.7 to 1 m) in height. The basal leaf blades are typically pink, red, or purplish and overlap each other one-eighth to one-third of their length. The pale yellow flowers open in late morning and start to close in mid-afternoon, for a total opening time of approximately 4 hours per day from August through September.

Xyris tennesseensis prefers soil that is moist to wet year round and colonizes in open or thinly wooded areas. Unlike other *Xyris*, *X. tennesseensis* are found associated with calcareous rocks; soils near *X. tennesseensis* are generally neutral to alkaline. The plants can be found either in full sun or in partial shade.

Currently, this endangered forb occurs in Franklin, Bibb, and Calhoun Counties in Alabama. Two populations exist on ANAD. One is located near the burning ground in the explosives/energistics handling area in the northwest area of the installation, about 1.4 mi (2.2 km) directly west of Area C. The other population is in the northern part of the installation, on both sides of the fence around the tank firing range, about 2.1 mi (3.4 km) east of Area B. Located close to the unnamed perennial stream, this population is also located 0.9 mi (1.4 km) downstream of Area A (see Figure 4.16-1). The closest populations to Areas A, B, and C are located about 0.9 mi (1.4 km), 1.9 mi (3 km), and 1.4 mi (2.2 km) away, respectively. The population closest to Area A is located near the northern border, directly downstream of Area A (Figure 4.16-1).

Red-Cockaded Woodpecker (Federal Endangered). The red-cockaded woodpecker (*Picoides borealis*) is a small, black-and-white striped species endemic to the southeastern United States. Historically, the red-cockaded woodpecker occurred in pine forests throughout the southeastern United States. However, only a few remain today in some highly isolated areas. The reason is the birds' preference for southern pines infected with red heart fungus. This disease is not common in pine trees until they are about 75 to 100 years old. In addition, the birds typically require at least 100 to 400 acres (41 to 162 ha) of open mature pine woodland and Savannah habitat. Today, the red-cockaded woodpecker breeding group nearest ANAD is in the Talladega National Forest, located about 25 mi (40 km) east of ANAD. Although the 1997 bird survey at ANAD did not cover off-limit secured areas, which contain older tree stands, it can be assumed that because of the fragmented nature of the habitat, these areas are not likely to sustain any cluster of this species.

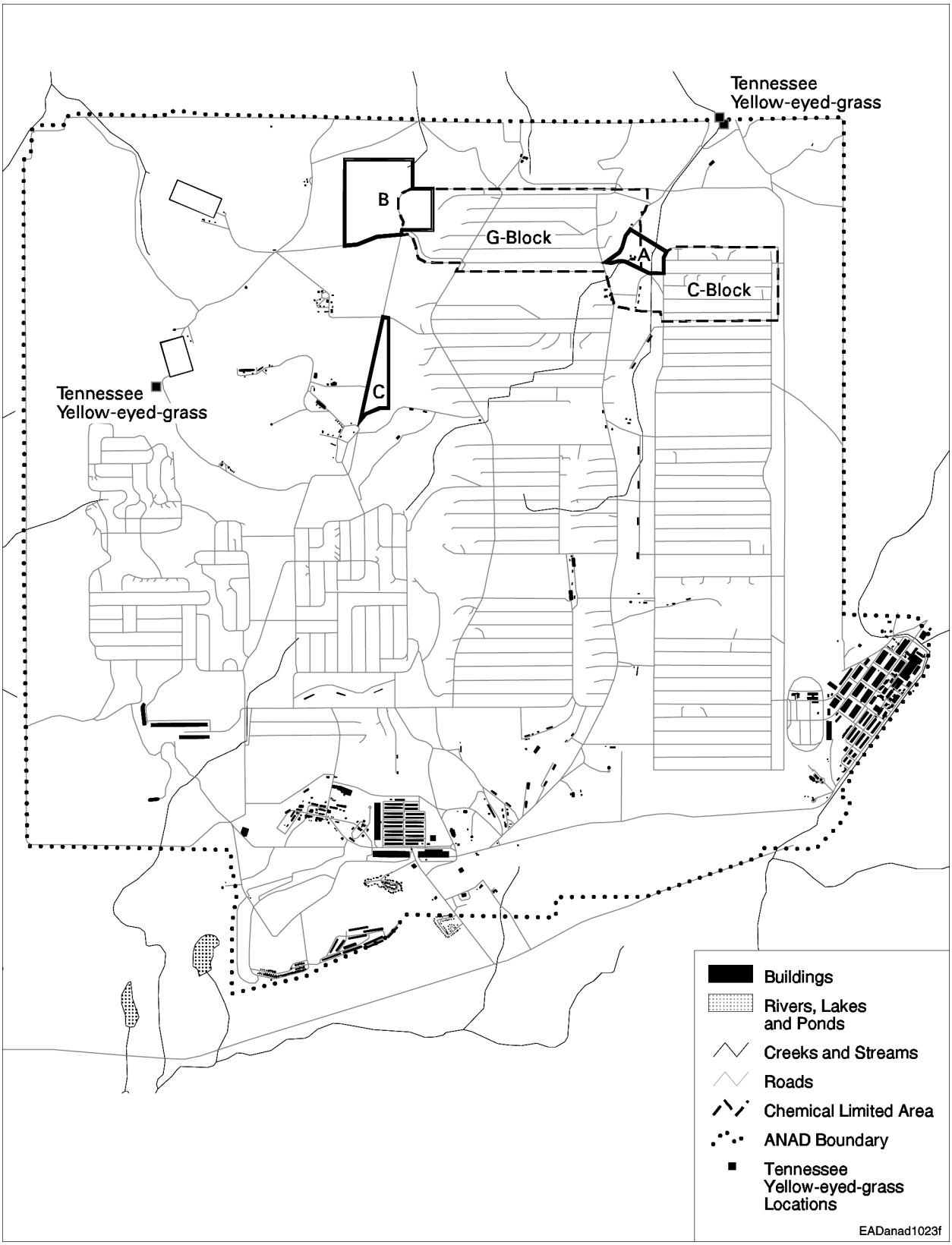

FIGURE 4.16-1 Locations of Tennessee Yellow-Eyed Grass at ANAD

Gray Bat (Federal Endangered). As the largest member of the genus *Myotis* in the eastern United States, the gray bat (*Myotis grisescens*) can be distinguished from other bats by its unicolored dorsal fur. This species is found mostly in Alabama, northern Arkansas, Kentucky, Missouri, and Tennessee. Gray bats also occur in parts of other states, including Georgia, Indiana, Illinois, and Kansas.

Gray bats are restricted almost entirely to habitats like caves or cave-like structures. They are highly selective of caves that provide specific temperature and roosting conditions. In winter, gray bats roost only in deep vertical caves with a temperature range of 6 to 11°C (42–51°F). As a result, only a small number of caves can be used throughout the year. Blowing Wind Cave and Fern Cave National Wildlife Refugees, both of which are located in Decatur, Alabama, are known to be the most important summer and winter caves, respectively, for gray bats. The two caves are about 85 mi (136 km) northwest of ANAD in northern Alabama.

The gray bat has been captured on the Pelham Range next to ANAD, although no roosts have been identified (U.S. Army 1998b). The other closest known occurrence is located southwest of ANAD, approximately 43 mi (69 km) from Area A, 42 mi (67 km) from Area B, and 41 mi (66 km) from Area C.

Mohr's Barbara's Buttons (Federal Threatened). Mohr's Barbara's buttons (*Marshallia mohrii)* is a perennial herb with stems 1 to 2.5 ft (0.3 to 0.8 m) in height. The tubular-shaped flower is white, pale pink, and lavender and blooms from mid-May through June. Fruit is produced in July and August. This herb prefers moist openings in woodlands and is also found along shale-bedded streams. Associations with soils of the Conasauga-Firestone Association are known to occur. These are sandy clays with high organic content. Mohr's Barbara's buttons can be found in either full sun or partial shade.

Once known to span three different physiographic regions in Alabama and Georgia, Mohr's Barbara's buttons are now found only in Alabama in Calhoun, Etowah, Bibb, and central Cherokee Counties. The location of Mohr's Barbara's buttons closest to ANAD is in Calhoun County, approximately 4 mi (6 km) from Area A, 2 mi (3 km) from Area B, and 3 mi (5 km) from Area C.

Pygmy Sculpin (Federal Threatened). Found only in Calhoun County, Alabama, the pygmy sculpin (*Cottus pygmaeus*) is designated a federal threatened species because of its extremely limited distribution. To date, it is found only in Coldwater Spring and Coldwater Spring Run in Calhoun County, Alabama. These two locations represent the entire known range of this species (McCaleb 1973).

Through a cooperative agreement between the City of Anniston and the USFWS, the pygmy sculpin is protected against any action that would be harmful. Currently, the greatest

threat to this species is groundwater contamination from ANAD and a proposed highway construction project. Coldwater Spring and Coldwater Spring Run next to each other south of ANAD. They are approximately 5 mi (8 km) from Area A, 6 mi (10 km) from Area B, and 5 mi (8 km) from Area C.

Blue Shiner (Federal Threatened). Blue shiner (*Cyprinella caerulea*), formerly of the Cahaba River, is now found only in the Coosa River drainage in the Little River and Choccolocco Creek. The blue shiner lives in medium to large streams and requires clear waters for its existence. It is located southeast of ANAD, approximately 13 mi (21 km) from Area A, 15 mi (24 km) from Area B, and 15 mi (24 km) from Area C.

Fine-Lined Pocketbook Mussel (Federal Threatened). The fine-lined pocketbook mussel (*Lampsilis altilis*) is a medium-sized mollusk, rarely exceeding 4 in. (10 cm) in length. It is differentiated from the orange-nacre mucket by its white nacre, sharper posterior, and rays on its shells. Historically, the fine-lined pocketbook mussel was found in the Tombigbee River drainage, Black Warrior River and tributaries, Alabama River, and other river systems in Alabama. However, the fine-lined pocketbook mussel seems to limit its habitat mostly to creeks in various counties in Alabama. It is located south of ANAD, approximately 12 mi (19 km) from Area A, 12 mi (19 km) from Area B, and 11 mi (17 km) from Area C.

Tulotoma Snail (Federal Endangered). Tulotoma (*Tulotoma magnifica*) is an operculate gastropod with a globular shell ornamented with knob-like structures. The tulotoma snail is found in cool, clean, free-flowing, well-oxygenated waters. Currently, it is located in the Coosa River tributaries of Weogufka and Hatchet Creeks of Coosa County, Kelly Creek of St. Clair and Shelby Counties, and Ohatchee Creek of Calhoun County. The closest location of Tulotoma snail is northwest of ANAD, approximately 9 mi (15 km) from Area A, 8 mi (13 km) from Area B, and 9 mi (15 km) from Area C.

Painted Rocksnail (Federal Threatened). The painted rocksnail (*Leptoxis taeniata*) is a small to medium-sized gastropod about 0.8 in. (2 cm) in length and oval to globular in shape. It is the only known remaining species of the 15 rocksnail species from the Coosa River drainage. In a survey conducted by the USFWS (Lewis 2000a,b), only three local populations were found in Alabama. They were reported to be in Choccolocco Creek in Talladega County, Buxahatchee Creek in Shelby County, and Ohatchee Creek in Calhoun County. All three counties lie within the 30-mi (50-km) radius of the potential impact zone. The closest reported location of painted rocksnail is southwest of ANAD, approximately 11 mi (17 km) from Area A, 10 mi (16 km) from Area B, and 9 mi (15 km) from Area C.

Southern Pigtoe Mussel (Federal Endangered). The southern pigtoe (*Pleurobema georgiana*) is a small to medium-sized mollusk, typically no longer than 2.4 in (6.1 cm) in length and elliptical to oval in shape. Historically, the southern pigtoe appears to be restricted to the Coosa River drainage, but it has now been found in other drainage systems in Tennessee and Georgia. The USFWS considers *Unio georgianus* to be equivalent to *Pleurobema georgiana*. The closest colony of the southern pigtoe is located east of ANAD, approximately 18 mi (28 km) from Area A, 19 mi (31 km) from Area B, and 20 mi (32 km) from Area C.

4.16.2 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 are unlikely to affect federal and state protected or sensitive species.

4.16.3 Impacts of the Proposed Action

4.16.3.1 Impacts of Construction

None of the proposed sites for a pilot test facility or routes for infrastructure corridors are located in the immediate vicinity of the populations of Tennessee yellow-eyed grass at ANAD. Therefore, there would be no direct impacts on these populations as a result of construction. Implementation of storm-water control measures would greatly reduce the potential for indirect impacts on this population. Consequently, impacts on Tennessee yellow-eyed grass are expected to be negligible. Construction of an ACWA facility at Areas B or C would not affect Tennessee yellow-eyed grass. A detailed evaluation of impacts associated with construction and operation of an ACWA facility is provided in the biological assessment for ANAD (see Appendix D).

The red-cockaded woodpecker does not occur at ANAD. The nearest breeding group is approximately 25 mi (40 km) east of ANAD in Talladega National Forest. Facility construction would not affect nesting habitat for the red-cockaded woodpecker, since suitable habitat currently does not exist on ANAD or in the immediate vicinity. Consequently, construction of an ACWA pilot test facility would not result in impacts on the red-cockaded woodpecker.

Although the gray bat (*Myotis grisescens*) is known to occur on the Pelham Range north of ANAD, it does not occur on ANAD. Facility construction would not affect caves used for hibernating, maternity, or roosting since suitable caves do not exist on ANAD or in the

immediate vicinity. Foraging habitat, such as large stream corridors, lakes, or adjacent forests, also would not be affected by facility or infrastructure construction. Consequently, construction of an ACWA pilot test facility would not result in impacts on the gray bat.

Mohr's Barbara's buttons (*Marshallia mohrii*) is not known to occur on ANAD, although it is present on Pelham Range to the north. Habitat associated with Mohr's Barbara's buttons on the Pelham range, such as ephemeral streams with an open canopy maintained by frequent wildfires, is not present at or near the proposed facility or infrastructure construction sites. Therefore, facility construction would not result in impacts on Mohr's Barbara's buttons.

Potential impacts on aquatic habitats could occur as a result of the construction of an ACWA pilot test facility. A perennial stream and tributary intersect Area A, while Areas B and C are located next to intermittent streams. However, the implementation of best management practices for control of storm-water runoff and sedimentation and the immediate replanting of disturbed areas with native species would help minimize impacts on streams. Thus, impacts on the blue shiner, tulotoma snail, and painted rocksnail from facility construction would be negligible. The pygmy sculpin, fine-lined pocketbook mussel, and southern pigtoe mussel are not located in watersheds that contain potential construction sites or utility corridors and therefore would not be affected by construction of an ACWA pilot test facility.

Although not located on ANAD, the coldwater darter (*Etheostoma ditrema*), protected by the state of Alabama, is distributed at various places in different watersheds within a 30-mi (50-km) radius of ANAD (Lewis 2000b). However, only one of the tributaries could be potentially affected by construction, because of downstream effects. It is discussed here. The coldwater darter is known to reside in a tributary of Cane Creek, in the western portion of the Pelham Range (Godwin et al. 1994; Lewis 2000b). Because Area B is located within this watershed, upstream of the tributary, there could potentially be effects from construction at this location. However, if proper mitigation techniques were used (i.e., prevention of sediment flowing into the streams), impacts from construction would be negligible. There would be no impacts on the coldwater darter from construction at Areas A or C. The other locations where coldwater darters are found are in a separate tributary of the same watershed or in different watersheds. Thus it is highly unlikely that construction of an ACWA facility would affect their habitat conditions.

4.16.3.2 Impacts of Operations

During routine operations, biota in the vicinity of the pilot test facility would be exposed to atmospheric emissions from the facility stacks. A portion of the materials released from the stacks would be deposited on the vegetation, soils, and surface waters surrounding the site. Deposition from atmospheric emissions would result in very low concentrations of trace metals and organic compounds.

A screening-level ecological risk assessment was conducted to assess the risk to aquatic biota from air emissions generated by ACWA pilot test facilities (Tsao 2001g). The assessment indicated that the deposition of emission constituents from a pilot test facility using any of the four technologies being considered would pose negligible ecological risks to biota in aquatic habitats (see Section 4.15.3.2). A soil screening-level ecological risk assessment was also conducted to assess the risk to terrestrial biota (see Section 4.13.3.2). The deposition of emissions from a facility using any of the four technologies was shown to pose negligible ecological risks to biota in terrestrial habitats.

Therefore, air concentrations and deposition of emission constituents from a pilot test facility using any of the four technologies being considered would pose negligible ecological risk to protected species in terrestrial or aquatic habitats. Consequently, routine operations of a pilot test facility would result in negligible impacts on protected species.

Routine operation of an ACWA pilot test facility would not affect either of the two populations of Tennessee-yellow-eyed grass, the only federal listed species on ANAD.

Although not located at ANAD, coldwater darters are distributed at various places in different watersheds within a 30-mi (50-km) radius of ANAD (Lewis 2000b). The one tributary discussed in the construction section would not be affected by air emissions, since the amount emitted into the air would be so small. It is unlikely that operations would cause any impact, much less deposit all of the combustion materials in the same tributary or watershed. The ACWA facility would be designed so that wastewater released during operations would be fully contained and sent to the wastewater treatment plant for further processing. Thus, there would be no effect on the coldwater darter from the operation of an ACWA facility at Areas A, B, or C.

The other locations inhabited by the coldwater darter are in different watersheds. It is highly unlikely that the operation of an ACWA facility would affect any of these habitat conditions.

4.16.4 Impacts of No Action

No impacts on protected species would occur from continued storage of chemical weapons at ANAD. The two locations where Tennessee yellow-eyed grass is found are fenced in to prevent disturbance by any surface activities.

4.17 WETLANDS

4.17.1 Current Environment

Hardwood bottomland forests occur along the Coosa River and tributaries. They are extensive along Cane Creek to the north of ANAD (U.S. Army 1998b). Hydrologic regimes in these wetland communities are seasonally flooded and temporarily flooded. Forest canopy species include water oak, swamp chestnut oak, sycamore, sweetgum, and green ash, as well as a number of other species. More than 3,400 acres (1,360 ha) of wetlands are found on Fort McClellan (U.S. Army 1998b).

Approximately 112 acres (45.3 ha) of wetlands occur on ANAD (Geonex Corporation 1995). Types of wetlands range from permanently flooded lakes to intermittent streams:

- Forested wetlands supporting broad-leaved deciduous trees (classified as palustrine forested broad-leaved deciduous wetlands) total 28.5 acres (11.5 ha), with an additional 6.5 mi (10.4 km) of wetlands mapped as linear features.

- Unvegetated ponds (palustrine unconsolidated bottom wetlands) cover 15.8 acres (6.4 ha).

- Wetlands supporting shrubby vegetation communities (palastrine scrub-shrub) total 12.6 acres (5.1 ha), with an additional 0.6 mi (1.0 km) of wetlands mapped as linear features.

- Wetlands with predominantly herbaceous vegetation (palustrine emergent wetlands) total 8 acres (3.2 ha), with an additional 0.4 mi (0.6 km) mapped as linear features.

- A total of 10.2 acres (4.1 ha) of perennial streams (riverine lower perennial wetlands) occur on ANAD, with an additional 2.3 mi (3.7 km) mapped as linear features.

- There are 4.3 acres (1.7 ha) of intermittent streams (riverine intermittent wetlands), which are temporarily flooded or seasonally flooded, with an additional 18.7 mi (29.9 km) mapped as linear features.

The most frequently occurring type of wetland is the semipermanently flooded impoundment (unvegetated ponds), at 15 occurrences. The type of wetland represented by the greatest total acreage is the seasonally flooded broad-leaved deciduous forest, with 16.6 acres (6.7 ha).

Area A is located at the confluence of the unnamed perennial stream flowing from the southwest and an intermittent stream flowing from the south (Figure 4.17-1). Both streams are situated within excavated channels. The perennial stream is classified as a riverine lower perennial wetland, with an unconsolidated bottom (Geonex Corporation 1995). This stream passes northward and exits ANAD near the northeast corner. The intermittent stream is classified as an intermittent riverine streambed wetland that is seasonally flooded. Area A includes the 100-year floodplain of these two streams (Figure 4.17-1). The floodplain reaches from slightly upstream of Area A, along both streams, and extends downstream beyond the ANAD northern boundary (U.S. Army 1998a). The 100-year floodplain occupies approximately 12 acres (4.9 ha) of Area A, leaving less than 21 acres (8.3 ha) of the area above the floodplain.

A second intermittent stream flows from the west and joins the perennial stream approximately 350 ft (107 m) south of Area A. This stream is also classified as an intermittent riverine streambed wetland that is seasonally flooded. Two wetlands are located in the western portion of Area A. These wetlands support deciduous shrubby vegetation communities (palustrine scrub-shrub broad-leaved deciduous wetlands) and are seasonally flooded. The eastern portion of Area A contains an excavated pond (palustrine unconsolidated bottom wetlands) that is unvegetated. A small impoundment (palustrine unconsolidated bottom wetlands) is located approximately 0.3 mi (0.5 km) south of Area A, near the intermittent stream. This wetland is semipermanently flooded and is unvegetated.

An intermittent stream flows northward along the eastern margin of the incinerator facility, immediately east of Area B (Figure 4.17-1). This stream is classified as an intermittent riverine streambed wetland that is seasonally flooded. It enters a small impoundment (palustrine unconsolidated bottom wetland) north of the incinerator before continuing to Cane Creek, north of ANAD. The northern portion of Area B lies within the watershed of this stream.

Immediately to the south and downgradient of Area C, an intermittent stream flows along the north side of the road (Figure 4.17-1). This stream, a tributary of Cane Creek, lies within an excavated channel and, becoming perennial, passes through the CLA and Area A. Along most of its length between Areas A and C, the stream is classified as a lower perennial riverine wetland, with an unconsolidated bottom. An excavated pond lies downgradient to the southeast of Area C, immediately beyond the road. This pond (more than 20 ft [6.1 m] in depth) is permanently flooded and does not support wetland vegetation. It is classified as a palustrine wetland with an unconsolidated bottom. A small impoundment lies downgradient and approximately 1,450 ft (442 m) to the east of Area C. This palustrine wetland with an unconsolidated bottom is semipermanently flooded and also does not support wetland vegetation. Approximately 750 ft (229 m) to the northwest of Area C is an impounded forested wetland (palustrine forested broad-leaved deciduous wetland) that is semipermanently flooded. This wetland lies across the north-south road and is not downgradient from Area C.

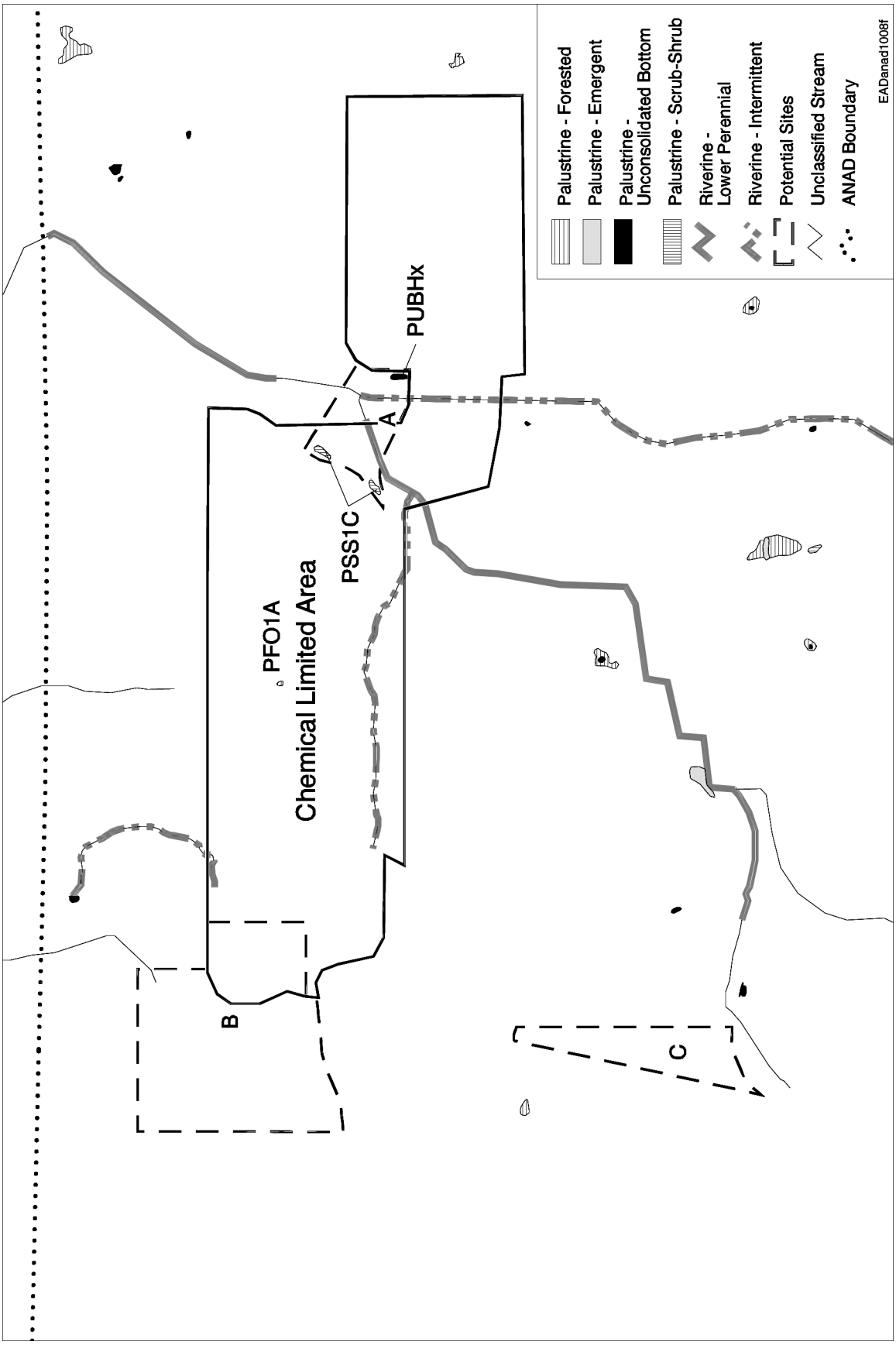

FIGURE 4.17-1 Wetlands in the Vicinity of the Proposed Locations for an ACWA Pilot Test Facility at ANAD

4.17.2 Site-Specific Factors

It is expected that impacts on wetlands 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. Factors associated with an ACWA pilot test facility that would affect wetlands include construction activities, releases, and spills. These factors could occur during the construction of the proposed test facility on about 25 acres (10 ha) and during installation of the infrastructure and parking lots. The transportation of workers and building materials to the site and vehicle traffic during facility operations would also be factors.

4.17.3 Impacts of the Proposed Action

4.17.3.1 Impacts of Construction

Construction-related activities might eliminate particular wetlands or cause one type to replace another. Landscape modifications might displace or eliminate the 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, resulting in indirect impacts on wetlands. Impacts could include mortality of individual organisms or habitat loss. 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 (a spill, for example) of substances known to cause toxic effects in biota. Exposure routes might include dermal contact, ingestion, plant root uptake, or foliar exposure. Exposures might result in lethal effects, reduced growth or other limiting effects, or no observable effect. However, implementation of standard procedures to avoid or respond to releases would minimize the potential for impacts on wetlands.

The following discussion of construction-related impacts identifies the potential impacts from building a facility within Areas A, B, and C (Figure 4.3-1) 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 occupy approximately 25 acres (10 ha) of land. 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.

At Area A, grading to prepare for the construction of an ACWA pilot test facility could disturb wetlands and drainage patterns throughout the area. In addition, the physical requirements for a 25-acre (10-ha) facility at Area A might affect specific features of the 33-acre (13-ha) area during construction. Construction of the pilot facility at Area A could potentially eliminate the three palustrine wetlands located in the area and the riverine wetlands within the two streams that converge in the area. Activities that result in impacts on wetlands are regulated by the U.S. Army Corps of Engineers (COE). A permit from the COE would be required for discharges of fill material into these wetlands.

The two palustrine wetlands in the western portion of Area A are seasonally flooded scrub-shrub wetlands. Each one is 0.4 acre (0.2 ha) in size; together, they total approximately 0.8 acre (0.3 ha), which represents about 8% of the scrub-shrub wetland type on ANAD. Although this type of wetland is not rare at ANAD, it accounts for only about 11% of the total wetland area on at ANAD. The palustrine unconsolidated bottom wetland type, represented by the permanently flooded excavated pond in the eastern portion of Area A, accounts for approximately 14% of the wetland area at ANAD. This wetland is approximately 0.4 acre (0.2 ha) in size and accounts for about 3% of the total palustrine unconsolidated bottom wetlands at ANAD. Approximately 1,238 ft (377 m) of perennial riverine unconsolidated bottom wetland is included in the streams on Area A. Although perennial streams are not common at ANAD, this wetland type is well represented along the stream below Area A and in the ANAD vicinity. In addition, approximately 674 ft (205 m) of seasonally flooded riverine streambed wetland occurs in the intermittent stream on Area A. This wetland type is fairly common at ANAD and in the vicinity. The new corridor for the natural gas supply to Area A would cross the perennial stream southwest and upstream of Area A. Approximately 30 ft (9 m) of the stream 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.

Sedimentation might occur in riverine wetlands downstream from Area A as a result of grading and stream channel impacts. Construction in close proximity to the stream channels might also result in accidental releases of contaminants into the streams. Construction of the utility corridor north of Area A could result in similar impacts. The new corridor would be located next to the perennial stream intersecting Area A. These impacts could be minimized by the implementation of storm-water runoff control measures and the avoidance of construction activities or the operation of equipment within buffer areas along streams where practicable. Large areas of exposed soil at Area A could result in the deposition of PM, through wind erosion,

onto wetlands in the vicinity of Area A. Impacts from deposition could be reduced by limiting the area of land exposed at any time.

Area A also includes the 100-year floodplain of the two streams that converge there. The floodplain occupies approximately 12 acres (4.9 ha) of Area A, leaving less than 21 acres (8.3 ha) of the area above the floodplain available for construction. Therefore, the construction of a pilot facility at Area A could potentially require construction activities within the 100-year floodplain.

The loss of up to 1.2 acres (0.49 ha) of palustrine wetland, up to 1,912 ft (582.9 m) of riverine wetland, and up to 12 acres (4.9 ha) of floodplain as a result of the construction of a pilot test facility at Area A would constitute a moderate to large adverse impact.

Wetlands do not occur on Area B. However, sedimentation might occur in riverine wetlands downstream from the construction site as a result of grading. Construction activities might also result in accidental releases of contaminants into surface waters in downstream portions of the watershed. Wetlands within downgradient streams to the east and west of Area B could be adversely affected by surface water contaminants. Water quality impacts, however, could be minimized by the implementation of storm-water runoff control measures. If both storm-water runoff and soil erosion control measures were implemented, impacts on wetlands from the construction of a pilot facility at Area B would be likely to be minor.

No wetlands occur on Area C. However, sedimentation might occur in riverine wetlands downstream from the construction site as a result of grading. Construction activities might also result in accidental releases of contaminants into surface waters in downstream portions of the watershed. Such impacts could be minimized by the implementation of storm-water runoff control measures. Fugitive dust from construction might be dispersed by wind and deposited on wetlands in the vicinity, such as the ponds east and southeast of Area C, or in nearby streams.

The new utility corridor for Area C might eliminate all or portions of two palustrine wetlands in the western portion of Area A. These are classified as seasonally flooded scrub-shrub wetlands; together, they total approximately 0.8 acre (0.3 ha). The new corridor would also cross an intermittent stream within the chemical agent storage area. This stream is classified as a seasonally flooded riverine streambed wetland and is a tributary of the perennial stream intersecting Area A. Approximately 120 ft (37 m) of riverine wetland would be included within the corridor. A large segment of this stream and a small permanently flooded palustrine wetland would be located next to the new corridor. In addition, approximately 30 ft (9 m) of the perennial stream would be included within the corridor. Wetlands near or downstream of the new utility corridor would be adversely affected by uncontrolled runoff from the corridor. Impacts on water quality, however, could be minimized by the implementation of storm-water runoff control measures. If both storm-water runoff and soil erosion control measures were implemented, impacts on wetlands from the construction of a pilot facility at Area C would be likely to be moderate.

4.17.3.2 Impacts of Operations

Water withdrawal from surface waters for pilot plant processes, as well as wastewater discharge, would result in negligible changes in surface water levels. These changes would, in turn, result in negligible impacts on aquatic ecosystems, including wetlands located along the periphery of these surface water bodies.

A portion of the materials released from the pilot facility stacks would be deposited on the vegetation, soils, and surface waters (including wetlands) surrounding the site. Deposition from atmospheric emissions would result in very low concentrations of trace metals and organic compounds.

A screening-level ecological risk assessment was conducted to assess the risk to aquatic biota from air emissions generated by ACWA pilot test facilities (Tsao 2001g). The assessment indicated that the deposition of emission constituents from a pilot test facility using any of the four technologies being considered would pose negligible ecological risks to biota in aquatic habitats (Section 4.15.3.2). A soil screening-level ecological risk assessment was also conducted to assess the risk to terrestrial biota (see Section 4.13.3.2). The deposition of emissions from a facility using any of the four technologies was shown to pose negligible ecological risks to biota in terrestrial habitats.

Therefore, air concentrations and deposition of emission constituents from a pilot test facility using any of the four technologies being considered would pose negligible ecological risk to wetland biota. Consequently, routine operations of a pilot test facility would result in negligible impacts on wetlands.

4.17.4 Impacts of No Action

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

4.18 CULTURAL RESOURCES

4.18.1 Current Environment

Human occupation in the Coosa Valley may have begun as early as 12,000 B.C. However, in most periods, the land that became ANAD was more suitable as a place to obtain

resources rather than a place to live. The temperate forests that cover the site contained an abundance of plant and animal resources that were exploited by both prehistoric and frontier populations (Dye 1984; COE 1997). The earth contained mineral resources, such as chert and iron ore, used by prehistoric and historic populations, respectively, for manufacturing tools. In some cases, the original soils, now much eroded, were suitable for agriculture (Jordan and Whitley 1999). However, most of the well-drained uplands that form the ANAD landscape were not suitable for long-term settlement. Surface water is not readily available within ANAD, and its rolling topography and narrow entrenched valleys make permanent occupation a challenge. Level ridge tops and alluvial floodplains are the most likely locations for settlement (Dye 1984). In short, while the Coosa Valley has a long history of occupation, the uplands that form ANAD were peripheral to the main areas of settlement. This is one of the reasons that it was attractive for the construction of a weapons depot.

4.18.1.1 Archaeological Resources

Because ANAD presented few opportunities for permanent settlement and because there is a significant history of ground disturbance at ANAD, the potential for finding archaeological resources at ANAD is limited. Industrialization of the Anniston area began in the mid-nineteenth century. As industrialization increased, the land that became ANAD was increasingly disturbed. Four mines and numerous gravel pits or quarries now within ANAD's boundaries are indicated on soil survey maps (Harlin and Perry 1961). In the 1940s, when ANAD was established, large sections of the site were disturbed during the construction of the storage igloos and industrial areas (Figure 4.18-1). The main potential for preserved archaeological resources lies in certain favorable locations within the buffer zones surrounding and separating the storage areas. An initial cultural resources reconnaissance of ANAD concluded that because of the restricted public access to ANAD, there was a good possibility of intact cultural resources in these areas (Dye 1984). In 1984, surveys of the less disturbed areas began to be conducted, including the areas under consideration for an ACWA pilot facility.

The COE Mobile District conducted six archeological surveys at ANAD between 1984 and 1997. These included surveys of proposed construction sites, timber sale lots, and areas considered to have a high potential for yielding archaeological remains (COE 1997). In 1997, the Alabama State Historic Preservation Officer (SHPO) concurred that the necessary surveys of "all areas within ANAD considered suitable for archeological survey" have been completed (COE 1997). However, since these surveys were conducted at different levels of intensity, with the broader surveys checking only those areas with the highest potential for yielding sites, the Alabama SHPO may require a more intensive survey of any selected construction site.

Area A is located along an intermittent drainage separating Storage Area G from Storage Area C, partly within the fenced and restricted chemical agent storage area (Figure 4.17-1). Floodplains are one of the areas with a high potential for yielding archaeological remains (Dye 1984). The portion of Area A within the chemical agent storage area has not been surveyed for

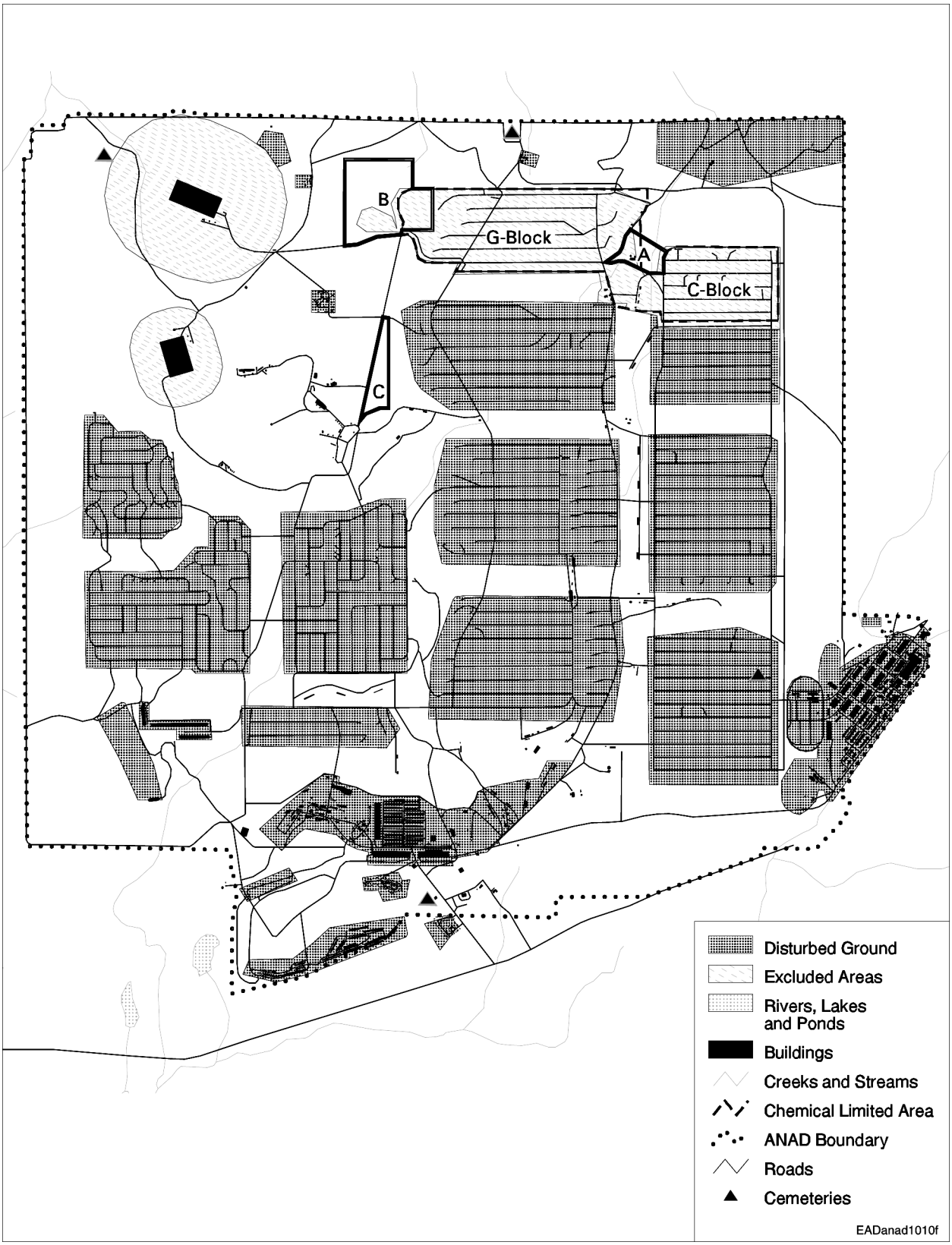

FIGURE 4.18-1 Areas of Disturbance at ANAD (Source: COE 1997)

archaeological resources. However, soils in this part of Area A have been at least partly disturbed by the construction of Building 88 and the roads connecting the building to the storage igloos. It is not clear whether the area outside the fence was investigated in one of the archaeological surveys conducted at ANAD.

Area B is located adjacent to the demilitarization incinerator currently under construction at ANAD. It lies partly within the chemical agent storage area but is mostly outside its fences. Part of the area outside the fence has been surveyed for cultural resources at least twice. In 1984, part of Area B was considered as part of the M55 Rocket Demilitarization Plant Project (COE 1984). Later, in 1991, a survey that included all of Area B was conducted as part of the Demilitarization Project (COE 1991). No cultural resources were recorded in these surveys.

Area C is located east of West Patrol Road near the Lance Missile Facility. This area is relatively undisturbed and has been considered for an archaeological survey. However, it is not clear whether this area was included in any of the timber sale or high probability archaeological surveys. While no archaeological site has been recorded in its vicinity, a more intensive archaeological survey may be required if Area C is chosen for the construction of an ACWA pilot facility.

4.18.1.2 Traditional Cultural Properties

A traditional cultural property is 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). Such properties are often, although not exclusively, associated with Native American communities. By 1836, Native American populations, mostly Creek and Cherokee, were removed from this part of Alabama and forced to resettle in Oklahoma. There are no known Native American traditional cultural properties at ANAD. In 1996 and 1997, five Creek and three Cherokee tribal groups were contacted regarding artifacts recovered from the Coosa River Storage Annex, formerly a part of ANAD. No response was received at that time (Burns 2000b). Native American groups with a historical interest in the Anniston area have been contacted as part of this analysis.

Properties reflecting traditional rural cultures of Afro-American and Euro-American groups are also potentially present in the area. The historic cemeteries located within ANAD, which are noted in Appendix F, may be considered traditional cultural properties relating to these populations.

4.18.1.3 Historic Structures

Construction of ANAD began in 1941 as part of Phase A of World War II depot construction. This time occurred during the protective mobilization phase of the war. Thus,

ANAD played an important role in the logistical support of the Army during the critical early months of World War II (Whelan et al. 1997). Because of ANAD's potential significance with regard to the U.S. arms buildup in preparation for World War II, an evaluation of ANAD architecture constructed before 1946 was conducted in 1984. No structures were found to meet Army criteria for designation as important historical structures or eligibility criteria for the *National Register of Historic Places* (NRHP) at that time (Hightower 1984). However, this part of Alabama does not lack significant historic resources. There are at least 72 properties listed on the NRHP located within 30 mi (50 km) of ANAD.

Of the three possible locations for an ACWA pilot facility at ANAD, only one includes an existing standing structure. Area A includes Building 88, which is now abandoned and in disrepair. The building was formerly used as a maintenance facility for chemical weapons (Burdell 2000a). It is currently scheduled for demolition (Burdell 2000a). Building 88 was built in 1944 but was not considered in the 1984 Historic American Building Survey/Historic American Engineering Record (HABS/HAER) survey (Hightower 1984; Library of Congress 2000). An evaluation of the structure's historical significance may be required if this site is chosen for an ACWA pilot facility. The building is unlikely to be considered eligible for the NRHP since it played no role in the critical early months of the war.

4.18.2 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.

4.18.3 Impacts of the Proposed Action

4.18.3.1 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 very small. The potential for occurrence of archaeological sites is low in most areas of ANAD. Each of the proposed ACWA areas is a considerable distance from known archeological sites, and each of the three proposed areas has been at least partly subject to some level of archeological survey. Part of Area B has already undergone intensive surveying for other proposed construction projects (COE 1984, 1991). Part of Area A and all of Area C have been considered in less-intensive surveys that focused on areas with archaeological potential (COE 1997). Only the parts of Areas A and B that lie within the CLA have not been surveyed, and the ground in these areas is at least partially disturbed. For the most part, the potential utility and access road corridors would follow existing right-of-ways; therefore, they would be expected to have little impact on archaeological resources. While further intensive survey may be required before the Alabama SHPO concurs on a "no adverse effect" determination for this project, the chances of encountering additional significant archaeological resources in areas of proposed construction appear to be small.

If cultural material were unexpectedly encountered during ground-disturbing activities at previously disturbed or surveyed areas of the depot, construction would cease immediately, and the Alabama 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 the ACWA facility; therefore, no impacts on traditional cultural properties are expected. Consultations with interested Native American tribes regarding the proposed action have occurred. Copies of the consultation letters and any responses received are presented in Appendix F.

Historic Structures. Only Area A includes an existing structure, Building 88. This former maintenance facility for chemical weapons is now abandoned, in disrepair, and scheduled for demolition (Burdell 2000a). Building 88 was built in 1944 and should have been considered in the 1984 HABS/HAER survey (Hightower 1984) but was not (Library of Congress 2000). An evaluation of the structure's historical significance may be required before SHPO concurs on a "no adverse effect" determination for this project. The building is unlikely to be considered eligible for listing on the NRHP because it played no role in the critical early months of the war.

The structures within the CLA at ANAD were recommended as not being eligible for NRHP listing (Hightower 1984). It is unclear whether the Alabama SHPO has concurred with this recommendation. Nonetheless, none of these structures would be demolished or modified during construction of an ACWA facility at ANAD. Therefore, no adverse impacts to structures are anticipated.

4.18.3.2 Impacts of Operations

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

Traditional Cultural Properties. No traditional cultural properties are known to occur within the operations area for an ACWA facility; therefore, no impacts on traditional cultural properties are expected. Consultations with interested Native American tribes regarding the proposed action have occurred. Copies of the consultation letters and any responses received are presented in Appendix F.

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

4.18.4 Impacts of No Action

4.18.4.1 Archaeological Resources

The no action alternative (i.e., continued storage of chemical weapons that might otherwise be destroyed by pilot testing) would not directly affect archaeological resources. No ground-disturbing activities are currently planned for the area should an ACWA facility not be constructed at ANAD. Archaeological resources might be affected if there were an accident while munitions were in storage (see Section 4.21).

4.18.4.2 Traditional Cultural Properties

No known traditional cultural properties are known to occur within ANAD. Therefore, the no action alternative (i.e., continued storage of chemical weapons that might otherwise be destroyed by pilot testing) 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 4.21).

4.18.4.3 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. Building 88 is slated for demolition regardless of the ACWA action taken. 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 bunkers. If the SHPO has concurred with the recommendation that they are not eligible for NRHP listing, these structures also would not be affected if there were an accident while munitions were in storage (see Section 4.21).

4.19 SOCIOECONOMICS

4.19.1 Current Environment

Socioeconomic data for ANAD describe a region of influence (ROI) surrounding the installation that is composed of three counties: Calhoun County, Etowah County, and Talladega County (Figure 4.19-1). The ROI is based on the current residential locations of government workers directly related to ANAD activities and captures the area in which these workers spend their wages and salaries. More than 90% of ANAD workers currently reside in these counties (Whatley 2000). The following sections present data on each of the counties in the ROI. However, since the majority of ANAD government workers live in Calhoun County and in the city of Anniston, 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.

4.19.1.1 Population

The population of the ROI in 2000 stood at 296,029 (U.S. Bureau of the Census 2001b), and it was expected to reach 296,676 by 2001 (Table 4.19-1). In 2000, 112,249 people (38% of the ROI total) resided in Calhoun County, with 24,276 living in the city of Anniston itself

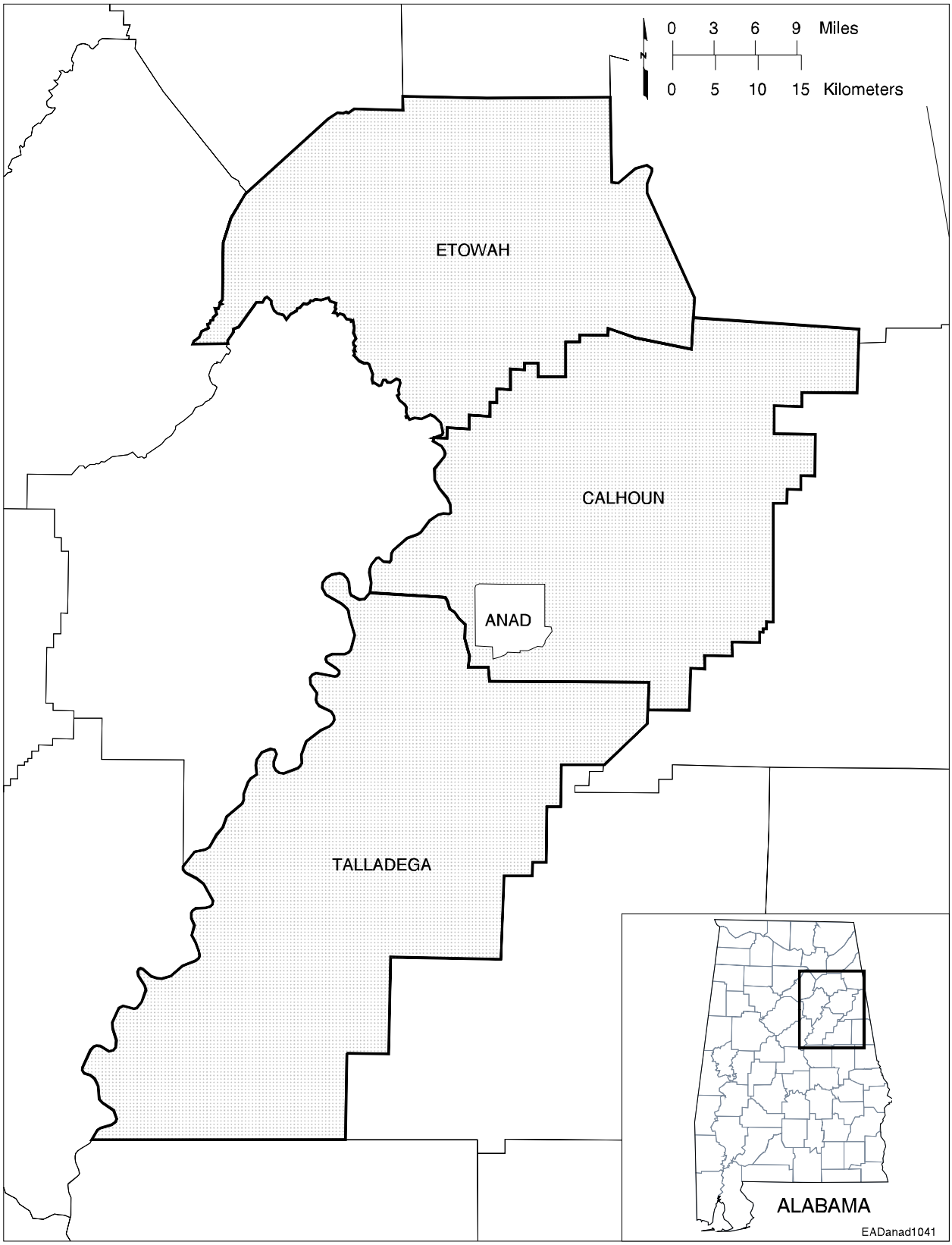

FIGURE 4.19-1 ANAD Region of Influence

TABLE 4.19-1 Population in the ANAD Region of Influence in Selected Years

Location	1980[a]	1990[a]	Annual Average Growth Rate (%) 1980–1990	2000[b]	Annual Average Growth Rate (%) 1990–2000	2001[c] (Projected)
City of Anniston	29,135	26,638	-0.8	24,276	-0.9	24,300
Calhoun County	119,761	116,032	-0.3	112,249	-0.3	112,000
Etowah County	103,057	99,840	-0.3	103,459	0.4	104,000
Talladega County	73,826	74,109	0.0	80,321	0.8	81,000
ROI total	296,644	289,981	-0.2	296,029	0.2	297,000
Alabama	3,894,000	4,048,508	0.4	4,447,100	0.9	4,449,000

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

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

[c] Allison (2001).

(U.S. Bureau of the Census 2001b). During the 1980s, Calhoun and Etowah Counties experienced small decreases in population, while the population in Talladega County grew slightly. Anniston itself experienced an annual average growth rate of –0.8%. The ROI annual average growth rate during this period was –0.2%. Over the period 1990–2000, population in the ROI as a whole grew slightly, with an annual average growth rate of 0.2%, while population in the city of Anniston continued to fall at an annual rate of –0.9%. Over the same period, population in the state grew at an annual rate of 0.9%. Other incorporated places in Calhoun County in the vicinity of ANAD are Blue Mountain (population 233 in 2000), Hobson City (878), Oxford (14,592), and Weaver (2,619) (U.S. Bureau of the Census 2001b).

4.19.1.2 Employment

In 1999, total employment in Calhoun County stood at 40,906 (U.S. Bureau of the Census 2001a); it was expected to reach 42,600 by 2001 (Allison 2001). The economy of the county is dominated by the trade and service industries, with employment in these activities contributing more than 60% to total employment in the county (see Table 4.19-2). The manufacturing sector is also a significant employer in the county, representing 27% of total county employment in 1999. Annual average employment growth in the county was 2.0% over the period 1990 to 1998 (U.S. Bureau of the Census 1992c, 2001a).

TABLE 4.19-2 Employment in Calhoun County by Industry in 1999

Employment Sector	Number Employed	% of County Total
Agriculture	659[a]	1.6
Mining	85	0.2
Construction	1,782	4.4
Manufacturing	11,024	26.9
Transportation and public utilities	1,128	2.8
Trade	8,209	20.1
Finance, insurance, and real estate	1,445	3.5
Services	16,574	40.5
Total	40,906	

[a] 1997 data.

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

In 1999, total employment in the ROI stood at 96,005 (U.S. Bureau of the Census 2001a); it was expected to reach 98,800 by 2001 (Allison 2001). The economy of the ROI is dominated by the trade and service industries, with employment in these activities contributing almost 60% to total employment in the ROI in 1999 (see Table 4.19-3). Average annual employment growth in the ROI was 3.4% during the period 1990 to 1999 (U.S. Bureau of the Census 1992c, 2001a).

Employment at ANAD currently stands at 3,838 (Burdell 2000c), including 90 employees working at the CLA (Burdell 2000d). A number of commercial and industrial tenants occupy land and buildings currently used by the military, and employment in these activities currently stands at 584 people. There are also 1,117 contractors currently working at the site (Burdell 2000c).

Unemployment in Calhoun County steadily declined during the late 1990s from a peak rate of 9.1% in 1993 to the current rate of 5.1% (Table 4.19-4) (U.S. Bureau of Labor Statistics 2001). Unemployment in the ROI currently stands at 6.7%, compared with 5.0% for the state.

4.19.1.3 Personal Income

Personal income in Calhoun County stood at almost $2.4 billion in 1999 and was expected to reach $2.6 billion in 2001. The annual average rate of growth was 4.6% over the

TABLE 4.19-3 Employment in the ANAD Region of Influence by Industry in 1999

Employment Sector	Number Employed	% of ROI Total
Agriculture	2,057[a]	2.1
Mining	520	0.5
Construction	4,449	4.6
Manufacturing	26,107	27.2
Transportation and public utilities	2,926	3.0
Trade	18,118	18.9
Finance, insurance, and real estate	3,523	3.7
Services	38,305	39.9
Total	96,005	

[a] 1997 data.

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

TABLE 4.19-4 Unemployment Rates in Calhoun County, ANAD Region of Influence, and Alabama

Location and Period	Rate (%)
Calhoun County	
1990–2000 average	6.8
2001 (current rate)	5.1
ROI	
1990–2000 average	7.2
2001 (current rate)	6.7
Alabama	
1990–1999 average	5.9
2001 (current rate)	5.0

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

period 1990–1999 (Table 4.19-5). County per capita income also rose in the 1990s. It was expected to reach $23,300 in 2001, compared with $13,758 at the beginning of the period.

The annual average growth rate in personal income was slightly higher in the ROI than in Calhoun County. Total personal income in the ROI grew at an annual rate of 5.0% over the period 1990–1999 and was expected to reach $6.6 billion by 2001. ROI per capita income was expected to rise from $13,236 in 1990 to $22,100 in 2001, representing an average annual growth rate of 4.8%.

4.19.1.4 Housing

Housing stock in Calhoun County grew at an annual rate of 0.9% over the period 1990–2000 (Table 4.19-6) (U.S. Bureau of the Census 2001b). The total number of housing units was expected to reach 51,200 in 2001, reflecting the negative annual growth in county population. Average annual growth in the city of Anniston over this period was 0.6%, with 12,700 total housing units expected in 2001. During this period, 4,569 new units were added to the existing housing stock in the county, with 687 additional units present in the city of Anniston at the end of the period. Vacancy rates currently stand at 18.3% in the city and 11.7% in the county as a whole for all types of housing. Based on annual average growth rates between 1990 and 2000, there would be 6,000 vacant housing units in the county in 2001, of which 2,100 would be rental units available to construction workers at the proposed facility.

TABLE 4.19-5 Personal Income in Calhoun County and ANAD Region of Influence

Location and Personal Income	1990[a]	1999[b]	Annual Average Growth Rate (%) 1990–1999	2001[c] (Projected)
Calhoun County				
Total (millions of $)	1,596	2,388	4.6	2,610
Per capita ($)	13,758	21,204	4.9	23,300
Total ROI				
Total (millions of $)	3,838	5,955	5.0	6,570
Per capita ($)	13,236	20,160	4.8	22,100

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

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

[c] Allison (2001).

TABLE 4.19-6 Housing Characteristics in Anniston, Calhoun County, and ANAD Region of Influence

Location and Type of Housing	1990[a]	2000[b]	2001[c] (Projected)
City of Anniston			
Owner occupied	6,531	6,215	6,160
Rental	4,276	4,232	4,190
Total unoccupied units	1,293	2,340	2,320
Total units	12,100	12,787	12,700
Calhoun County			
Owner occupied	30,222	32,856	32,700
Rental	12,761	12,451	12,400
Total unoccupied units	3,770	6,015	6,000
Total units	46,753	51,322	51,200
ROI total			
Owner occupied	78,731	87,221	87,400
Rental	29,375	30,375	30,400
Total unoccupied units	10,295	14,154	14,200
Total units	118,401	131,750	132,000

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

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

[c] Allison (2001).

Housing grew at a faster rate in the ROI as a whole than in Calhoun County or Anniston during the 1990s; the annual growth rate was 1.1%. The total number of housing units was expected to reach 132,000 by 2001, with more than 13,300 housing units to be added in the 1990s. The vacancy rate currently stands at 10.7%, meaning that more than 4,100 rental units would be available to construction workers at the proposed facility.

4.19.1.5 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 4.19-7 presents data on employment and levels of service (number of employees per 1,000 population) for public safety and general local government services. Tables 4.19-8 and 4.19-9 provide staffing data for school districts and hospitals. Table 4.19-10 presents data on employment and levels of service for physicians.

4.19.1.6 Traffic

Vehicular access to ANAD is afforded from State Highway 202, which runs southwest from Anniston toward Pell City along the southern perimeter of ANAD (see Figure 4.1-1). The entrance is located approximately 10 mi (16 km) from downtown Anniston. Other roads in the immediate vicinity of ANAD that are used by employees working on post include:

- U.S. Highway (US) 78, which runs east-west within the vicinity of the southern perimeter of ANAD;
- The Bynum Cutoff, which runs north-south between State Route (SR) 202 and US 78;
- County Road (CR) 109, which runs north-south between Coldwater and Eulaton and Blue Mountain, along the southeastern and eastern perimeter of ANAD;
- CR 26, which runs southeast from SR 202 and CR 109;
- SR 21/US 431, which runs north-south through Oxford and Anniston; and
- Interstate (I) 20, which runs east-west between Oxford and Pell City to the west.

TABLE 4.19-7 Public Service Employment in Calhoun County, Various Cities near ANAD, and Alabama in 2000[a]

	Calhoun County[b]		Anniston[b]		Hobson City[b]	
Employment Category	Number Employed	Level of Service	Number Employed	Level of Service	Number Employed	Level of Service
Police protection	31	0.6	98	4.0	4	4.6
Fire protection[c]	0	0	88	3.6	0	0
General services	194	3.5	124	5.1	6	6.8
Total	225	4.1	310	12.8	10	11.4

	Jacksonville[b]		Ohatchee[b]		Oxford[b]	
Employment Category	Number Employed	Level of Service[a]	Number Employed	Level of Service[a]	Number Employed	Level of Service[a]
Police protection	22	2.6	6	4.9	40	2.7
Fire protection[c]	14	1.7	0	0	0	0
General services	84	10.0	6	4.9	100	6.9
Total	120	14.3	12	9.9	140	9.6

	Piedmont[b]		Weaver[b]		Alabama[d]
Employment Category	Number Employed	Level of Service	Number Employed	Level of Service	Level of Service
Police protection	15	2.9	10	3.8	2.5
Fire protection[c]	4	0.8	0	0	1.1
General services	73	14.3	25	9.5	37.0
Total	92	18.0	35	13.4	40.6

[a] Level of service represents the number of employees per 1,000 persons in each jurisdiction. Data on the number of persons employed came from local government sources (Nieves 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 4.19-8 School District Data for Calhoun County, Various Cities near ANAD, and Alabama in 2000

Location	Number of Teachers Employed	Student to Teacher Ratio[a]
Calhoun County	591	16.3
Anniston	201	14.1
Jacksonville	104	15.6
Oxford	197	15.6
Piedmont	72	15.6
Alabama		15.6

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

Source: Crawford (2000).

TABLE 4.19-9 Medical Facility Data for Calhoun County in 1999

Hospital	Number of Staffed Beds	Occupancy Rate (%)[a]
Jacksonville Hospital	62[b]	24[b]
North East Regional Medical Center	253[b]	76[b]
Stringfellow Memorial Hospital	125[b]	31[b]
County total	440	-

[a] Percent of staffed beds occupied.

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

Table 4.19-11 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 4.19-10 Physician Employment in Calhoun County and Alabama in 1997[a]

	Calhoun County		Alabama
Employment Category	Number Employed	Level of Service	Level of Service
Physicians	203	1.7	2.1

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

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

TABLE 4.19-11 Average Annual Daily Traffic (AADT) in the Vicinity of ANAD

Road Segment	Traffic Volume (AADT)	Level of Service[a]
CR 109 in Eulaton	10,370	B
CR 109 at SR 202	7,670	B
CR 109 at US 78	8,840	A
SR 202 west of ANAD Main Gate	5,610	A
SR 202 in Eulaton	13,990	B
US 78 and CR 109 in Coldwater	8,970	A
US 78 east of SR 202/US 78	4,710	A
US 78 and CR 93	9,340	A
I 20 in Oxford	32,340	A

[a] Allison (2001).

Source: Oliver (2000).

4.19.2 Site-Specific Factors

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

4.19.3 Impacts of the Proposed Action

Impacts from construction and operations are summarized in Table 4.19-12. The impacts of no action are provided as well for comparison.

4.19.3.1 Impacts of Construction

Neutralization/Biotreatment. The potential socioeconomic impacts from constructing a Neut/Bio facility at ANAD would be relatively small. Construction activities would create direct employment of about 640 people in the peak construction year and an additional 540 indirect jobs in the ROI. Construction activities would increase the annual average employment growth rate by 0.1% over the duration of construction. A Neut/Bio facility at ANAD would produce approximately $35 million of income in the peak year of construction.

In the peak year of construction, about 640 people would in-migrate to the ROI. However, in-migration would have only a marginal effect on population growth and would require only about 6% of vacant rental housing in the peak year. No significant impact on public finances would occur as a result of in-migration, and less than 10 additional local public service employees would be required to maintain existing levels of service in the various local public service jurisdictions in Calhoun County. In addition, on-post employee commuting patterns would have no impact on levels of service in the local transportation network surrounding ANAD.

Neutralization/SCWO. The potential socioeconomic impacts from constructing a Neut/SCWO facility at ANAD would be relatively small. Construction activities would create direct employment of approximately 730 people in the peak construction year and an additional 520 indirect jobs in the ROI. Construction activities would increase the annual average employment growth rate by 0.1% over the duration of construction. Neut/SCWO-related employment and related wages and salaries at ANAD would also produce about $37 million of income in the peak year of construction.

TABLE 4.19-12 Effects of Construction, Operations, and No Action at ANAD on Socioeconomics[a,b]

	Neut/Bio		Neut/SCWO		Neut/GPCR/TW-SCWO		Elchem Ox		
Impact Category	Construction	Operation	Construction	Operation	Construction	Operation	Construction	Operation	No Action
Employment (number of jobs in ROI)									
Direct	640	660	730	660	740	660	790	660	90
Indirect	540	580	520	580	580	590	620	820	60
Total	1,180	1,240	1,250	1,240	1,320	1,250	1,410	1,480	150
Income (millions of $ in ROI)									
Direct	22.1	33.4	24.7	33.4	25.3	33.4	27.1	33.4	5.2
Indirect	13.2	12.4	12.2	12.5	13.8	12.6	14.9	19.5	1.3
Total	35.3	45.8	36.9	45.9	39.1	46.0	42.0	52.9	6.5
Population (number of new residents in ROI)	640	740	890	740	970	740	1,100	930	0
Housing (number of units required in ROI)	240	270	330	270	350	270	400	340	0
Public finances (% impact on fiscal balance)									
Cities in Calhoun County[c]	1	1	1	1	1	1	1	1	0
Calhoun County	<1	<1	<1	<1	<1	<1	<1	<1	0
Schools in Calhoun County[d]	1	1	1	1	1	1	1	1	0
Public service employment (number of new employees in Calhoun County)[c]									
Police officers	1	1	2	1	2	1	2	2	0
Firefighters	1	1	1	1	1	1	1	1	0
General	2	3	3	3	4	3	4	3	0
Physicians	1	1	1	1	1	1	1	1	0
Teachers[d]	3	4	5	4	5	4	6	5	0
Number of new staffed hospital beds in Calhoun County	1	2	2	2	2	2	3	2	0
Traffic (impact on current levels of service in Calhoun County)	None	None	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 Anniston, Hobson City, Jacksonville, Ohatchee, Oxford, Piedmont, and Weaver and in Calhoun County.

[d] Includes impacts that would occur in Anniston, Jacksonville, Oxford, Piedmont, and Calhoun County school districts.

In the peak year of construction, about 890 people would in-migrate to the ROI, both as a result of SCWO employment at ANAD 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 8% of vacant rental housing during the peak year. No significant impact on public finances would occur as a result of in-migration, and only 12 additional local public service employees would be required to maintain existing levels of service in the various local public service jurisdictions in Calhoun County. In addition, on-post employee commuting patterns would have no impact on levels of service in the local transportation network surrounding ANAD.

Neutralization/GPCR/TW-SCWO. The potential socioeconomic impacts from constructing a Neut/GPCR/TW-SCWO facility at ANAD would be relatively small. Construction activities would create direct employment of approximately 740 people in the peak construction year and an additional 580 indirect jobs in the ROI. Construction activities would increase the annual average employment growth rate by 0.1% over the duration of construction. Neut/GPCR/TW-SCWO-related employment and related wages and salaries at ANAD would also produce about $39 million of income in the peak year of construction.

In the peak year of construction, about 970 people would in-migrate to the ROI, both as a result of SCWO employment at ANAD 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 9% of vacant rental housing during the peak year. No significant impact on public finances would occur as a result of in-migration, and only 13 additional local public service employees would be required to maintain existing levels of service in the various local public service jurisdictions in Calhoun County. In addition, on-post employee commuting patterns would have no impact on levels of service in the local transportation network surrounding ANAD.

Electrochemical Oxidation. The potential socioeconomic impacts from constructing an Elchem Ox facility at ANAD would be relatively small. Construction activities would create direct employment of approximately 790 people in the peak construction year and an additional 620 indirect jobs in the ROI. Construction activities would increase the annual average employment growth rate by 0.1% over the duration of construction. Elchem-Ox-related employment and related wages and salaries at ANAD would also produce about $42 million of income in the peak year of construction.

In the peak year of construction, about 1,100 people would in-migrate to the ROI, both as a result of Elchem Ox employment at ANAD 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 10% of vacant rental housing during the peak year. No significant impact on public finances would occur as a result of in-migration, and only 14 additional local public service employees would be required to maintain existing levels of service in the various local public service jurisdictions in Calhoun County. In addition, on-post employee commuting patterns would have no impact on levels of service in the local transportation network surrounding ANAD.

4.19.3.2 Impacts of Operations

Neutralization/Biotreatment. The potential socioeconomic impacts from operating a Neut/Bio facility at ANAD would be relatively small. Operational activities would create about 660 direct jobs annually and an additional 580 indirect jobs in the ROI. A Neut/Bio facility would produce about $46 million annually during operations.

About 740 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 14% of vacant owner-occupied housing during facility operations. No significant impact on public finances would occur as a result of in-migration, and 10 new local public service employees would be required to maintain existing levels of service in the various local public service jurisdictions in Calhoun County. In addition, on-post employee commuting patterns would have no impact on levels of service in the local transportation network surrounding ANAD.

Neutralization/SCWO. The potential socioeconomic impacts from constructing and operating a Neut/SCWO facility at ANAD would be relatively small. Operational activities would create about 660 direct jobs annually, and an additional 580 indirect jobs in the ROI. Direct Neut/SCWO-related employment and related wages and salaries at ANAD would also produce about $46 million annually during operations.

About 740 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 14% of vacant owner-occupied housing during facility operations. No significant impact on public finances would occur as a result of in-migration, and 10 new local public service employees would be required to maintain existing levels of service in the various local public service jurisdictions in Calhoun County. In addition, on-post employee commuting patterns would have no impact on levels of service in the local transportation network surrounding ANAD.

Neutralization/GPCR/TW-SCWO. The potential socioeconomic impacts from operating a Neut/GPCR/TW-SCWO facility at ANAD would be relatively small. Operational

activities would create about 660 direct jobs annually, and an additional 590 indirect jobs in the ROI. A Neut/GPCR/TW-SCWO facility would produce $46 million annually during operations.

About 740 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 14% of vacant owner-occupied housing during facility operations. No significant impact on public finances would occur as a result of in-migration, and 10 new local public service employees would be required to maintain existing levels of service in the various local public service jurisdictions in Calhoun County. In addition, on-post employee commuting patterns would have no impact on levels of service in the local transportation network surrounding ANAD.

Electrochemical Oxidation. The potential socioeconomic impacts from operating an Elchem Ox facility at ANAD would be relatively small. Operational activities would create about 660 direct jobs annually and an additional 820 indirect jobs in the ROI. An Elchem Ox facility would produce about $53 million annually during operations.

About 930 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 17% of vacant owner-occupied housing during facility operations. No significant impact on public finances would occur as a result of in-migration, and 12 new local public service employees would be required to maintain existing levels of service in the various local public service jurisdictions in Calhoun County. In addition, on-post employee commuting patterns would have no impact on levels of service in the local transportation network surrounding ANAD.

4.19.4 Impacts of No Action

The socioeconomic impacts of continuing operations at ANAD would be relatively small. The CLA currently employs 90 workers. Wage and salary expenditures by these employees on goods and services have created an additional 60 indirect jobs in the ROI (Table 4.19-14) and increased the annual average employment growth rate in the ROI by less than 0.01% over the period 1990–2000. CLA-related wage and salary expenditures have also created an estimated $7 million in annual income in the ROI.

4.20 ENVIRONMENTAL JUSTICE

On February 11, 1994, President Clinton issued Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations* (Volume 59, page 7629 of 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 issues in the context of the ACWA Program at ANAD. 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 provided 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 Nonwhite 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 environmental justice consider Calhoun County to be the core county for ANAD. 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 ANAD. The block groups considered include all of Calhoun and St. Clair Counties and parts of Blount, Cherokee, Clay, Cleburne, Etowah, Randolph, Shelby, and Talladega 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, is 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 that 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).

4.20.1 Current Environment

Of the Calhoun County residents recorded in the 2000 census, 22.0% were minority (U.S. Bureau of the Census 2001c). This percentage was less than the percentage of minorities in the United States as a whole. The largest percentage of minority persons in Calhoun County (18.5% of the total population) was Black. The 1990 census recorded that 15.7% of the Calhoun County population were below the poverty level (U.S. Bureau of the Census 1992b); this percentage was slightly higher than the percentage in the United States as a whole.

Of the 294 census block groups defined in the 2000 census partially or totally within a 30-mi (50-km) radius of ANAD, 71 contained minority populations in excess of the percentage of minority representation in the United States (Figure 4.20-1). These 71 block groups contained a total of 43,605 minority persons in 2000. Block groups with disproportionately high minority populations included the scattered farming communities of Ashland, Attalla, Lineville, and Pell City, as well as several block groups in the cities of Anniston, Gadsden, and Talladega. The majority of the block groups containing disproportionately high minority populations lie east, north, and southwest of the installation.

Two hundred thirteen of the 358 census block groups defined in the 1990 census lying partially or totally within a 30-mi (50-km) radius of ANAD contained low-income populations in excess of the 13.1% calculated for the United States as a whole (Figure 4.20-2). These block groups contained 43,977 low-income persons in 1989. Block groups with a disproportionately high representation of low-income populations included the same four farming communities noted in the preceding paragraph, other rural communities close to ANAD (Blue Mountain,

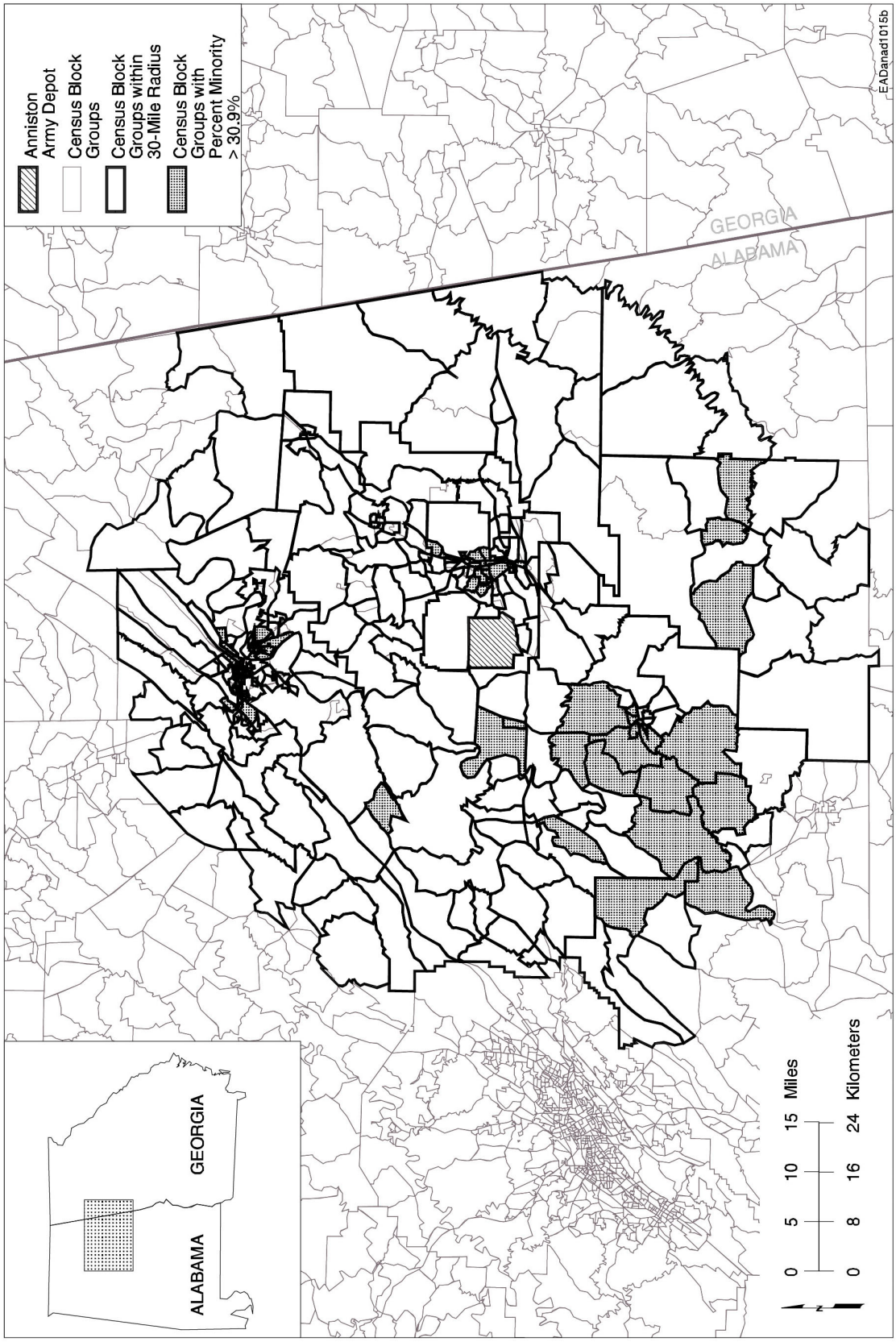

FIGURE 4.20-1 Census Block Groups within a 30-Mile (50-Kilometer) Radius of ANAD with Minority Populations Greater than the National Average in 2000 (Source: U.S. Bureau of the Census 2001d)

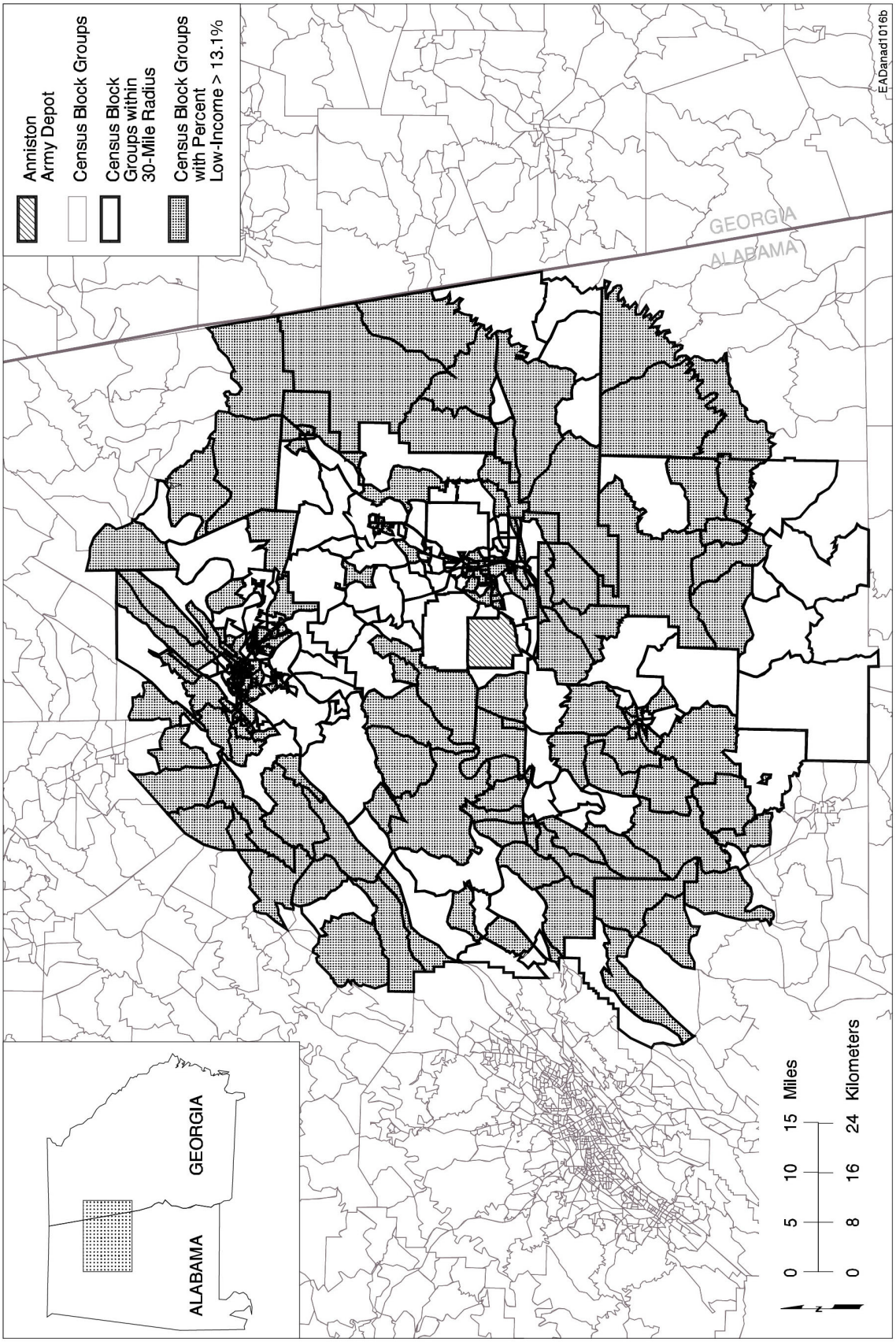

FIGURE 4.20-2 Census Block Groups within a 30-Mile (50-Kilometer) Radius of ANAD with Low-Income Populations Greater than the National Average in 1989 (Source: U.S. Bureau of the Census 1992b)

Edwardsville, Hobson City, Jacksonville, Ohatchee, Ragland, Ridgeville, Riverside, and West End-Cobb Town), and portions of the cities of Anniston, Gadsden, and Talladega.

4.20.2 Site-Specific Factors

Factors considered in this EIS with potential implications for environmental justice are any activities associated with the ACWA Program at ANAD. 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 them 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 4.7.2.2). The present analysis considers that a disproportionate effect could occur only if the proportion of a population is in excess of the proportion 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 (Calhoun County or census block groups within 30 mi [50 km] of ANAD) containing disproportionately high minority or low-income populations.

4.20.3 Impacts of the Proposed Action

4.20.3.1 Impacts of Construction

The primary socioeconomic impacts from constructing any of the four alternative technologies, discussed in Section 4.19.3.1, 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 or 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.

4.20.3.2 Impacts of Operations

The primary socioeconomic impacts from operating an ACWA facility, discussed in Section 4.19.2.2 for the four technologies, would be increases in employment and income. They would also include small increases in the demand for local housing, schools, and public services. Once again, none of these impacts are 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. As a result, no environmental justice impacts are anticipated.

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.

4.20.4 Impacts of No Action

As discussed in Section 4.19.4, socioeconomic impacts of continued operations at ANAD would be small: primarily a continuation of small, positive economic impacts and a slight increase in demands 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 the workers at ANAD or the general public are not anticipated (see Section 4.7.4). As a result, no environmental justice impacts are anticipated under the no action alternative.

4.21 ACCIDENTS INVOLVING ASSEMBLED CHEMICAL WEAPONS

4.21.1 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 related to the no action alternative (continued storage of the chemical weapons). The accidents selected for analysis were the accidents that were shown to have the highest risk in previous Army analyses (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 into a

storage igloo) has an estimated frequency on the order of 7×10^{-4} per year (i.e., one occurrence in 1,400 years). The accident considered for the pilot facilities (handling accident in rocket storage igloo) has a somewhat lower estimated frequency of approximately 2×10^{-4} (i.e., one occurrence in 6,000 years).

4.21.1.1 Scenarios

The hypothetical highest-risk accident for ACWA pilot testing of GB and VX assumes that a handling accident would occur in a rocket igloo, and a fire and the release of agent from all the munitions in the igloo would follow. The hypothetical highest-risk accident for ACWA pilot testing of mustard assumes that an earthquake would cause the part of the unpack area where munitions are located to fall. The hypothetical highest-risk accident for continued storage assumes that lightning would strike a GB- or VX-rocket-containing igloo, and a fire and the release of agent from all the munitions in the igloo would follow. Therefore, for GB and VX processing, the accident consequences under the no action alternative (continued storage) would be the same as those under the proposed action alternative (pilot facility). However, for mustard-only processing (which would be the case if Neut/Bio was chosen as the ACWA technology at ANAD), the accident consequences under the no action alternative and the proposed action alternative would differ.

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 Neut/Bio pilot facility accident scenario for mustard processing, data given in the ANAD Phase I quantitative risk assessment for a baseline incineration facility (SAIC 1997) were used to estimate the maximum amount of mustard agent that could be released during an earthquake. The Neut/Bio process would use a modified baseline process for ACW access (Parsons and Allied Signal 1999); therefore, it was assumed that the configuration of the unpack area would not deviate significantly from that for the baseline. For ANAD, it was assumed that the maximum number of munitions in the unpack area at the time of the earthquake would be the contents of four on-site containers (ONCs) containing mustard-filled 155-mm projectiles. (This assumption results in the largest possible amount of mustard agent being present in the unpack area among the mustard munition types present at ANAD.)

ONCs are used to transport munitions at the Tooele Chemical Agent Disposal Facility, but the Army is investigating the feasibility of using modified ammunition vans. A change in the transport system used might also entail changes in the dimensions and capacity of the unpack area or a similarly functioning building or area. Such changes should not invalidate the impact

estimates for pilot facility accidents during mustard processing given here, because the assumption about the number of munitions present in the unpack area was meant to represent a high-end estimate of the amount of mustard that could be released in an earthquake. These accident impact estimates should be representative for either type of transportation system.

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 could result in an explosion and propagation by fire, also causing the entire igloo contents to be released. The probability of such accidents occurring is fairly low (on the order of 7×10^{-4}), 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 ANAD rocket-containing igloo (Burdell 2000b).

4.21.1.2 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[10] 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).

For modeling mustard agent instantaneous releases, the “time after functioning” (TAF) parameter was assumed to be 20 hours. (The TAF was applicable only for accident modeling involving mustard agent instantaneous releases; it is defined as the time after detonation required

[10] 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.

to remove the agent source by decontaminating it or by containing it so it would no longer enter the atmosphere [Whitacre et al. 1987]).

4.21.1.3 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 4.21.2 and 4.21.3 below. These distances are summarized in Table 4.21-1. For reference, the minimum distance from the hypothetical accident locations (i.e., CLA or the unpack area within the proposed facility locations) to the ANAD installation boundary is about 0.5 mi (0.8 km), and the distance to the on-site administrative area is about 2 mi (3 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.

4.21.2 Impacts of Accidents during the Proposed Action

4.21.2.1 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 4.21.2.9 and 4.23). 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.

4.21.2.2 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

TABLE 4.21-1 Chemical Agent Plume Distances Resulting from Accidents at an ACWA Pilot Test Facility (Proposed Action) or in the Chemical Limited Area (No Action) at ANAD[a]

Effect	Impact Distance, mi (km)[b]	Exposure Dose (mg-min/m^3)[c]	Impact Area	
			km^2	acres
GB Accidents				
Proposed action, D-3 (i.e., handling accident in rocket storage igloo)				
1% lethality	6.7 (11)	10	7.4	1,800
No deaths	9.1 (15)	6	13	3,200
No effects	>30 (>50)	0.5	210	52,000
Proposed action, E-1 (i.e., handling accident in rocket storage igloo)				
1% lethality	29 (46)	10	50	1,200
No deaths	>30 (>50)	6	74	18,000
No effects	>30 (>50)	0.5	130	32,000
No action, D-3 (lightning strike on rocket igloo)				
1% lethality	6.7 (11)	10	7.4	1,800
No deaths	9.1 (15)	6	13	3,200
No effects	>30 (>50)	0.5	210	52,000
No action, E-1 (lightning strike on rocket igloo)				
1% lethality	29 (46)	10	50	1,200
No deaths	>30 (>50)	6	74	18,000
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	10 (16)	4.3	15	3,700
No deaths	15 (24)	2.5	31	7,700
No effects	>30 (>50)	0.4	210	52,000
Proposed action, E-1 (i.e., handling accident in rocket storage igloo)				
1% lethality	>30 (>50)	4.3	79	20,000
No deaths	>30 (>50)	2.5	95	23,000
No effects	>30 (>50)	0.4	130	32,000
No action, D-3 (lightning strike on rocket igloo)				
1% lethality	10 (16)	4.3	15	3,700
No deaths	15 (24)	2.5	31	7,700
No effects	>30 (>50)	0.4	210	52,000

TABLE 4.21-1 (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	79	20,000
No deaths	>30 (>50)	2.5	95	23,000
No effects	>30 (>50)	0.4	130	32,000
Mustard Accidents				
Proposed action, D-3 (earthquake impacts; unpack area)				
1% lethality	0.31 (0.50)	150	0.03	7.4
No deaths	0.38 (0.62)	100	0.04	10
No effects	3.7 (6.0)	2	2.3	570
Proposed action, E-1 (earthquake impacts; unpack area)				
1% lethality	1.2 (1.9)	150	0.18	44
No deaths	1.5 (2.4)	100	0.27	67
No effects	14 (23)	2	15	3,700
No action, D-3 (lightning strike on rocket igloo) – Not applicable[d]				
No action, E-1 (lightning strike on rocket igloo) – Not applicable[d]				

[a] Distances and plume areas in table are from D2PC output. Meteorological conditions of either D stability and 3-m/s wind speed or E stability and 1-m/s wind speed, and a "time after functioning" of 20 hours (for instantaneous mustard releases) are assumed.

[b] Impact distances downwind of accident that would have 1% lethality, no deaths, or no effects on humans (see Table 4.21-2).

[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).

[d] Highest-risk accidents for continued storage (no action) are limited to rocket-containing igloos, which do not contain mustard agent.

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 Alabama hazardous waste regulations. If an accident that would involve the release of a chemical agent, such as mustard agent, were to occur, any contaminated residue, soil, water, or other debris resulting from the cleanup of that agent would be characterized to determine if it was a hazardous waste (*Alabama Administrative Code Revised* [Admin. Code R.] 335-14-2). 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 of it or most of it as nonhazardous waste in a local landfill.

4.21.2.3 Air Quality

Depending on the amount, an accidental release of GB, VX, or mustard at ANAD 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 4.21.2.4). However, the deposition of agent from the air onto the ground surface and/or its degradation in the environment would occur within a relatively short period of time. Mustard decomposes in air relatively quickly; its half-life is about 1.4 days (see Appendix A). 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 mustard, GB, or VX.

4.21.2.4 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 ANAD (i.e., persons residing within a 30-mi [50-km] radius of the post) is about 370,000 people. A handling accident in a VX rocket storage igloo 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 GB stored in any single ANAD igloo (Burdell 2000b). 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 4.21-2). The corresponding estimated number of fatalities among the general public would be about 4,400. The estimated number of fatalities for the on-post population would be about 710. If such an accident occurred under D-3 meteorological conditions, the 1% lethality distance would decrease to 10 mi (16 km). The corresponding estimated number of fatalities among the general public would be about 1,500. The estimated number of fatalities for the on-post population would increase somewhat, to about 860 fatalities. This on-post fatality estimate would increase because the D-3 plume would be wider but not extend as far downwind as the E-1 plume.

Since the Neut/Bio technology is applicable only to mustard agent destruction and not to nerve agent destruction, a handling accident in a VX or GB rocket igloo is not an applicable scenario for mustard processing. The highest-risk accident for mustard processing would be an earthquake impacting the unpack area. The impact distances for this accident were found to be much lower. The 1% lethality distance under E-1 meteorological conditions would be 1.2 mi (1.3 km) (see Table 4.21-2). The corresponding estimated number of fatalities among the off-post general public would be 0. The estimated number of fatalities for the on-post population would be about 670 under E-1 meteorological conditions and 230 under D-3 meteorological conditions. This scenario would apply to each of the technologies during mustard processing.

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 if 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 1991) and when it is assumed that about 35% of the general population in the ANAD ROI (see Section 4.19) falls into the sensitive subgroup, the fatality estimates for the accident scenarios addressed here for alternative

TABLE 4.21-2 Fatality Estimates for Potential Accidents Involving Agent Release at ANAD[a]

Accident Scenario[b]	Distance (mi) To LCt_{50} Dose	To LCt_{01} Dose	To No Deaths Dose	On-Post Population at Risk (no. of persons)[c] Source to LCt_{50}	LCt_{50} to LCt_{01}	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 into VX rocket storage area with fire: D-3	4.3	10	15	986	468	109	857
Lightning strike into VX rocket storage area with fire: E-1	18	>30	>30	883	179	55	707
Facility highest-risk accident (applicable to all ACWA technologies except Neut/Bio)							
Handling accident in VX rocket storage igloo: D-3	4.3	10	15	986	468	109	857
Handling accident in VX rocket storage igloo: E-1	18	>30	>30	883	179	55	707
Highest-risk accident involving mustard (applicable to all ACWA technologies during mustard processing)							
Earthquake impacting UPA: D-3	0.016	0.31	0.38	0	918	0	230
Earthquake impacting UPA: E-1	0.54	1.2	1.5	873	45	0	666

Accident Scenario[b]	Off-Post Public Population at Risk (no. of persons)[c] Source to LCt_{50}	LCT_{50} to LCt_{01}	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 into VX rocket storage area with fire: D-3	444	4,689	3,439	1,523
Lightning strike into VX rocket storage area with fire: E-1	4,795	3,063	848	4,366
Facility highest-risk accident (applicable to all ACWA technologies except Neut/Bio)				
Handling accident in VX rocket storage igloo: D-3	444	4,689	3,439	1,523
Handling accident in VX rocket storage igloo: E-1	4,795	3,063	848	4,366
Highest-risk accident involving mustard (applicable to all ACWA technologies during mustard processing)				
Earthquake impacting UPA: D-3	NA	NA	NA	NA
Earthquake impacting UPA: E-1	0	0	6	0

Footnotes appear on next page.

TABLE 4.21-2 (Cont.)

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[a] Scenarios are highest-risk accidents for 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. UPA = unpack area.

[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, 42, and 600 for VX, GB, and mustard, 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, <35, and 900 for VX, GB, and HD, 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.

technologies would increase by a factor of 1.3 to 1.9. (Details of this assessment are provided in Appendix H.) For example, if children and the elderly are up to 10 times more 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 5,700 fatalities (4,400 × 1.3) 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. If this accident occurred while mustard or VX agent was being processed, the amount released from the facility stacks would be negligible, because these agents are relatively nonvolatile and because the room in which the leak would occur is relatively small and would contain the agent, providing only a limited surface area for agent evaporation. In addition, the facility's pollution abatement system would be expected to capture most of the agent that might evaporate from the spill.

Except for biotreatment, 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 (in the unpack area and during munitions disassembly), the maximum agent release amounts in the pilot facilities would be similar for all technologies and less than the amount released in a rocket igloo handling accident. Biotreatment looks at a different scenario because no rockets contain mustard, so that accident is not applicable.

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 to separate 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/Bio process would use seven major process chemicals: sodium hydroxide, sulfuric acid, hydrogen peroxide, ferrous sulfate, liquid nitrogen, aqueous ammonia, and dextrose (PMACWA 1999). The Neut/SCWO process would use five: 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.

4.21.2.5 Soils

Under the accident scenarios considered for ACWA pilot testing activities at ANAD, 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, with rates being slightly faster for nerve agents than for mustard agent (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.

4.21.2.6 Water Resources

Impacting Factors. The agent deposited on the soil after the rocket igloo handling accident or earthquake accident (for mustard) 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.

The fine mustard particles on the soil surface downwind of the accident would degrade quickly. Under cold conditions, mustard might be present for as long as 2,000 hours (three months). However, even under cold conditions, within two weeks, the amounts present would be negligible: less than 0.0001% of the original deposition amount (see Appendix A). Under warmer conditions, the mustard would be degraded within a few hours to a few days of deposition. These estimates were based on tests of mustard droplets on the surface. Because the mustard particles deposited downwind of the accident would be very small, it is expected that the mustard would actually degrade in less time than predicted by these estimates.

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.

Mustard has two breakdown products that are relatively persistent in groundwater: 1,4-oxathiane and 1,4-dithiane. These two products are not toxic at the levels that would be expected to be found in water resources after an accident, but their presence could be used to indicate that past contamination had occurred. 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. Both mustard and GB hydrolyze rapidly, and they would break down before being transported any significant distance in the subsurface. VX hydrolysis takes a slightly longer time, but it 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, the mustard and 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.

4.21.2.7 Biological Resources

Accident analyses were conducted for a scenario that involved a handling accident in a rocket storage igloo for VX or GB or an earthquake accident for mustard. 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. On the basis of the limited number and qualitative nature of reports on mustard phytotoxicity studies, it was not possible to estimate an area of impacts for acute exposure of terrestrial plants due to an accidental release of mustard. In all likelihood, an accidental release of mustard would cause a certain degree of defoliation and retarded germination downwind from the accident location (Opresko et al. 1998). However, hydrolysis of mustard and GB would probably occur quickly after deposition on plant surfaces and soils (see Appendix A). 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). Model runs for an earthquake involving the unpack area during mustard processing under D-3 (daytime) meteorological conditions showed an average mustard deposition area of 2.8 ha (7.4 acres) in the 1% human lethality area that extends to 0.3 mi (0.5 km) downwind from

the accident location (see Table 4.21-1). The maximum deposition after an accident would occur during daytime conditions. The downwind distance from the accident location to the 1% human lethality location would be greater for accidents involving VX and GB. Distances and deposition areas for daytime (D-3) conditions would be 10 mi (16 km) and 1,500 ha (3,700 acres) for VX and 6.8 mi (11 km) and 740 ha (1,800 acres) for GB.

Wildlife. The deposition plume areas projected by the D2PC model are 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 ANAD, the prevailing winds that would result in the greatest consequences from an accident would be from the south or southeast. A release of mustard or nerve agents would thus have a higher probability of affecting ecosystems located north or northwest 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 mammalian wildlife species observed in the vicinity of ANAD: 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, GB, and mustard. Risks to the four species from the accident were characterized by using the hazard quotient (HQ) approach for exposure to mustard, VX, and GB. The HQ is the ratio between the concentration of a contaminant (mustard, GB, VX) in a medium (air, water) and a contaminant-specific benchmark concentration representing a “no observed adverse effects level” (NOAEL) and “lowest observed adverse effects level” (LOAEL) on the basis of results from laboratory studies. HQs for air impacts 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 (U.S. Army Center for Health Promotion and Preventive Medicine [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 time 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 due to the different body masses of the four species examined. Distances that were affected by an earthquake or 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 the NOAEL and LOAEL exposures. Details on the derivation of contaminant-specific inhalation benchmarks and the HQ calculations for mustard, VX, and GB are provided in Tsao (2001a–f).

Exposure to mustard for wildlife within 5.6 mi (9.0 km) downwind from the accident location and exposure to VX or GB out to 30 mi (50 km) downwind of the accident location would result in mortality, particularly to species with small home ranges, such as small mammals, reptiles, and amphibians. These species would remain in a mustard exposure plume during the accident (see Table 4.21-3). 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 Army 1988).

No data could be found on the uptake of mustard through ingestion under field conditions. Some uptake of mustard deposited on vegetation, particularly in areas downwind of the release, could occur by herbivores during the first few days after the accident. Hydrolysis of mustard would likely occur during the first one to two days after the accident, resulting in various degradation products. No data could be found on exposures of wildlife to mustard degradation products under field conditions. An article that reviews the toxicity of CWA degradation products suggested that a major hydrolysis by-product of mustard, thiodiglycol (TDG), could persist in soils following an accidental release (Munro et al. 1999). Laboratory exposures of rats for 90 days to various levels of TDG resulted in a NOAEL of 500 mg/kg/d. Even if all mustard degraded to TDG (low likelihood of occurrence) within the deposition area, it would be highly unlikely that a herbivore would receive a dose through the food pathway that would be above the NOAEL reported for laboratory rats (Munro et al. 1999).

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 site over an extended period (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. The impacts on aquatic habitats and fish from the deposition of mustard, GB, and VX would be very similar to the impacts on protected aquatic vertebrate and

TABLE 4.21-3 Distance from Accident Location That Would Result in No or Lowest Adverse Effects on Wildlife at ANAD[a]

	Distance (mi) with Hazard Quotient of <1[b]											
	Mustard				VX				GB			
	Daytime Conditions		Nighttime Conditions		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]	LOAEL[c]	NOAEL[d]	LOAEL[c]	NOAEL[d]
White-tailed deer	0.56	1.2	1.9	3.1	>30	>30	>30	>30	>24	>30	>30	>30
Red fox	1.2	1.2	2.4	3.7	>30	>30	>30	>30	>30	>30	>30	>30
Meadow vole	1.2	1.9	4.4	5.6	>30	>30	>30	>30	>30	>30	>30	>30
White-footed mouse	1.2	1.9	3.7	4.4	>30	>30	>30	>30	>30	>30	>30	>30

[a] Scenarios are a VX release or a GB release that results from a handling accident or lightning strike at a rocket storage igloo or a mustard release that results from an earthquake impacting the unpack area.

[b] Hazard quotient = (dose at a given distance from the source) divided by (benchmark value 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 effects level; the maximum distance from the site at which an adverse effect would be expected to occur.

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

invertebrate species. All three chemical agents could have significant short-term impacts. No data on the effects of mustard and GB on aquatic invertebrates could be found. However, the LCt_{50} for VX on aquatic fish is 0.28 µg/L (Appendix O in U.S. Army 1988), indicating that the impact from VX could be severe. Except for VX, long-term impacts of chemical agents on aquatic vertebrates would not be expected because of the quick hydrolysis of mustard and GB.

Protected Species. The impacts on protected mammalian species would be very similar to the impacts on mammals (i.e., wildlife). Because of the scarcity of federal protected species and their distance from the source, impacts on them would be less than impacts on other terrestrial wildlife. On the other hand, state protected species would be more likely to be affected since they would be much closer to the potential source areas. The concentration distances projected by the D2PC model and used for analyzing short-term impacts from accidents on mammals were also used for protected species (i.e., the plume area 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 ANAD, the prevailing winds (which would result in the greatest consequences from an accident) are from the south or southeast. A release of mustard or nerve agents would thus have a higher probability of affecting ecosystems located north or northwest of the storage igloo. Yet they could presumably affect ecosystems in any direction, depending on the wind direction and speed at the time of an accident.

A screening-level ecological risk assessment was conducted to determine impacts of the bounding accident to threatened and endangered species in the vicinity of ANAD. The species studied was the gray bat (*Myotis grisescens)*. The threatened and endangered aquatic invertebrate species and terrestrial plants and the red-cockaded woodpecker (*Picoides borealis*) are discussed qualitatively, since plume deposition amounts and adequate toxicological data on the effects of chemical agents on these aquatic and terrestrial biota were not available. Risks to threatened and endangered species from the accident were characterized by using the HQ approach for exposure to mustard, VX, and GB, as discussed under wildlife above.

Gray Bat and Red-Cockaded Woodpecker. Gray bats are known to occur outside the 30-mi (50-km) radius of ANAD. The nearest red-cockaded woodpeckers are located 28 mi (49 km) east of ANAD in the Talladega National Forest (Lewis 2000a). Individual bats or red-cockaded woodpeckers occupying roosting and nursery habitat downwind of the accident site would be most susceptible to a handling accident that would release GB or VX. HQ calculations indicate that gray bats could die from inhaling airborne GB or VX while they were congregated in maternity clusters out to or beyond 30 mi (50 km) downwind from the accident site (see Table 4.21-4). An accidental release of mustard might affect the woodpeckers if the plume were to travel far enough to reach their foraging area.

The nearest gray bats are located 41 mi (66 km) southwest of the installation (Lewis 2000a). Other bats are located in the Blowing Wind Cave and Fern Cave National Wildlife

TABLE 4.21-4 Distance from Accident Location That Would Result in No or Lowest Adverse Effects on Protected Species at ANAD[a]

	Distance (mi) with Hazard Quotient of <1[b]											
	Mustard				VX				GB			
	Daytime Conditions		Nighttime Conditions		Daytime Conditions		Nighttime Conditions		Daytime Conditions		Nighttime Conditions	
Species Name	LOAEL[c]	NOAEL[d]	LOAEL[c]	NOAEL[d]	LOAEL[c]	NOAEL[d]	LOAEL[c]	NOAEL[d]	LOAEL[c]	NOAEL[d]	LOAEL[c]	NOAEL[d]
Gray bat	1.9	2.5	4.9	6.2	>30	>30	>30	>30	>30	>30	>30	>30

[a] Scenarios are a VX release or a GB release that results from a handling accident or lightning strike at a rocket storage igloo or a mustard release that results from an earthquake impacting the unpack area.

[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 effects level; the maximum distance from the site at which an adverse effect would be expected to occur.

[d] NOAEL = no observed adverse effects level; the distance beyond which no adverse effects would be expected to occur; at this distance or farther, the air concentration would not result in adverse effects to receptor species as indicated by results for laboratory animals.

Refuges in Decatur, Alabama, which are 85 mi (136 km) northwest of ANAD. Gray bats are restricted almost entirely to caves or cavelike habitats. The accidental release of mustard would probably not affect gray bats, given that their home range would not overlap the plume that would cause adverse effects. The affected area for a mustard release could extend to 14 mi (23 km) from the source (Table 4.21-1). The home range of the gray bat does not extend closer than 12 mi^2 (20 km^2) southwest of ANAD. The affected area for VX and GB extends for more than 30 mi (50 km) (HQ values of greater than one). Bats would be less likely to be affected from exposure to chemical agents during the day (when they roost in caves) than at night (when they are outside and more susceptible).

Pygmy Sculpin, Blue Shiner, Coldwater Darter. Two federal threatened species, pygmy sculpin and blue shiner, are located within a 30-mi (50-km) radius of ANAD (Lewis 2000a). Coldwater darter (*Etheostoma ditrema*), a state protected species, is also within the 30-mi (50-km) radius (Lewis 2000a). Located south of ANAD, the pygmy sculpin is extremely limited in its distribution and is found only in Calhoun County. Blue shiners have been sited at different locations in Talladega National Forest, approximately 17 mi (27 km) east of ANAD, and in Talladega County, southwest of ANAD. Coldwater darters are located along the western tributary in the Pelham Range (north of ANAD), downstream from Area B. The long-term impact of a mustard, VX, or GB release on aquatic biota would not be significant, since all three chemical agents are broken down by hydrolysis rather quickly, especially GB and mustard, and their potential to bioaccumulate is low. The bioaccumulation potential of VX is sufficiently low that its release would not result in a significant long-term impact on the three aquatic vertebrates.

The short-term impacts of these agents on the pygmy scuplin, blue shiner, and coldwater darter could be considerable. They could be affected by the subsequent deposition of mustard, GB, or VX onto water bodies after their accidental release into the air. Because Area B is located upstream of the tributary, accidentally released chemical agent could potentially be deposited in the stream and subsequently migrate downstream to the coldwater habitat. No studies on the effects of VX on aquatic organisms were found except for one study on striped bass (cited in U.S. Army 1998b). VX is more environmentally persistent than GB. VX is moderately to highly soluble in water, with a solubility of 30 g/L at 25°C (Munro et al. 1999). Its half-life ranges from 17 to 42 days at a temperature of 25°C and a pH of 7 (Appendix A). Impacts on aquatic species would be likely to be most severe in small, shallow streams or water bodies such as Coldwater Spring or the Coldwater Spring Run, where pygmy sculpin are located. Exposure to VX would also increase after the first rainfall event occurred, resulting in runoff of VX into surface waters.

The nerve agent GB is considered nonpersistent in the environment. It quickly breaks down in water. Impacts from GB through aquatic bioaccumulation would not be likely to occur given the agent's tendency to volatilize quickly. GB degradation products have low toxicities (see Appendix A) and also are not likely to pose a threat to wildlife through biomagnification in the food chain.

Mustard can be hydrolyzed quickly, and it has a half-life of a few minutes. Although mustard has limited solubility in water, some mustard could sink to the bottom of the water body and remain there for some time. However, since the hydrolysis-rate-limiting step is essentially the rate of solution, mustard deposited on a surface water body after an accidental release would most likely form a surface film on the water that would quickly be hydrolyzed by the agitation and turbulence in the water body (Opresko et al. 1998; Munro et al. 1999). No adequate aquatic toxicity test of mustard was available for aquatic vertebrates or invertebrates. The major by-product from mustard hydrolysis is TDG. TDG is low in toxicity and is used commercially as a solvent in antifreeze. Small bluegill sunfish were exposed to 1,000 mg/L for 42 days without toxic effects (Munro et al. 1999). The presence of hydrolysis products in surface water would not have a significant impact on the three aquatic vertebrates.

Fine-Lined Pocketbook Mussel, Tulotoma Snail, Painted Rocksnail, and Southern Pigtoe Mussel. Four federal threatened and endangered aquatic invertebrates, the fine-lined pocketbook mussel (*Lampsilis altilis*), southern pigtoe mussel (*Pleurobema georgianum*), Tulotoma snail (*Tulotoma magnifica*), and painted rocksnail (*Leptoxis taeniata*), are known to occur within the 30-mi (50-km) radius of ANAD (Lewis 2000a). If these aquatic invertebrates were located in shallow perennial or intermittent streams downwind from the accident site, they could be exposed to relatively high concentrations of VX from air deposition from the source. VX is known to persist in water for 17 to 42 days at a temperature of 25°C and a pH of 7 (Appendix A). Given the sedentary nature of these aquatic invertebrates, individuals would be exposed to the entire aliquot of water containing agent deposited from the vapor plume following the accident, and the initial impact would be considerably severe.

The nerve agent GB is considered nonpersistent in the environment and quickly breaks down in water. Impacts of GB through aquatic bioaccumulation would not be likely to occur, given the agent's tendency to volatilize quickly. GB degradation products have low toxicities (see Appendix A) and also are not likely to pose a threat to wildlife through biomagnification in the food chain. Potential effects of mustard on these aquatic invertebrates would be as previously discussed for the aquatic vertebrates.

Tennessee Yellow-Eyed Grass and Mohr's Barbara's Button. Two Tennessee yellow-eyed grass colonies are located on ANAD. One is located by the toxic burning ground, and the other is located close to Area A, near the border of Pelham Range (Burns 2000a). A third colony is on the other side of the border in Pelham Range, next to the colony on ANAD. Two other colonies are located elsewhere on Pelham Range (Reisz Engineers 1998). There is only one colony of Mohr's Barbara's button within the 30-mi (50-km) radius (Lewis 2000a), and it is located on Pelham Range, north of ANAD. Mustard might cause some adverse effects on Tennessee yellow-eyed grass and Mohr's barbara's button. It has been demonstrated that liquid mustard is phytotoxic in several species of terrestrial plants (Opresko et al. 1998), although its hydrolysis by-product, TDG, seems to have no effects on several species (Opresko et al. 1998).

On the other hand, VX and GB deposits after the accident are expected to be negligible (Opresko et al. 1998).

Wetlands. Wetlands would be exposed to mustard under the scenario involving an earthquake impacting the unpack area. The limited amount of data available on known impacts on plants suggests that some absorption of VX would occur if VX were released as the result of a handling accident in a rocket storage igloo. (Appendix O in U.S. Army 1988). VX and its breakdown products would be harmful and potentially lethal to animals that ingested contaminated plant material. Plant species exposed to mustard and GB downwind of the accident site would unlikely to become contaminated because of the tendency for both compounds to break down relatively quickly by hydrolysis.

4.21.2.8 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 accident assessed here, only temporary impacts (i.e., access restrictions) would be expected on cultural resources located outside the maximum radial no effects distance of 30 mi (50 km) (see Table 4.21-1). 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 (listed in 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, the Army might require that the properties of concern 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 site. Extended public access restrictions, lasting until the contaminant dissipated, would be the most likely measure for preserving significant properties.

4.21.2.9 Socioeconomics

The accidental release of chemical agent at ANAD 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 ANAD would be significant (Table 4.21-5), it is unlikely that the severity of these losses would be any different under the no action and the proposed action alternatives.

Businesses and Housing. Although the evacuation of businesses as a result of an accident at ANAD 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 ANAD, consisting of Calhoun, Clay, Cleburne, Etowah, Talladega, and St. Clair 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 an 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 4.21-5. 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 ANAD 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.

4.21.2.10 Environmental Justice

Within 30 mi (50 km) of ANAD, 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 4.21.2.4). 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 4.20.1 for identification of these census tracts). Such severe human health impacts would

TABLE 4.21-5 Socioeconomic Impacts of Accidents at ANAD Associated with the Proposed Action and No Action[a]

Parameter	Neut/Bio	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)	47,000	47,000	47,000	47,000	47,000
Income (millions of $)	1,360	1,360	1,360	1,360	1,360
75% loss of agricultural output					
Employment (no. of jobs)	35,200	35,200	35,200	35,200	35,200
Income (millions of $)	1,020	1,020	1,020	1,020	1,020
50% loss of agricultural output					
Employment (no. of jobs)	23,500	23,500	23,500	23,500	23,500
Income (millions of $)	680	680	680	680	680
Impacts from a single-day evacuation of businesses					
100% of economic activity affected					
Sales (millions of $)	62	62	62	62	62
Employment (no. of jobs)	142,000	142,000	142,000	142,000	142,000
Income (millions of $)	37	37	37	37	37
75% of economic activity affected					
Sales (millions of $)	46	46	46	46	46
Employment (no. of jobs)	107,000	107,000	107,000	107,000	107,000
Income (millions of $)	28	28	28	28	28
50% of economic activity affected					
Sales (millions of $)	31	31	31	31	31
Employment (no. of jobs)	71,000	71,000	71,000	71,000	71,000
Income (millions of $)	18	18	18	18	18

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

have similarly high and adverse socioeconomic consequences in the counties that make up the ROI (see Section 4.19), including the removal of some of the work force and the interruption of agricultural activity (see Section 4.21.2.9). However, such accidents have a low frequency of occurrence, on the order of 7×10^{-4} per year (i.e., one occurrence in 1,400 years), so the risk of the resultant disproportionate impacts would be low. Such impacts are not anticipated.

4.21.3 Impacts of Accidents during No Action (Continued Storage)

4.21.3.1 Land Use

Land use impacts from accidents under the no action alternative would be the same as those discussed under the proposed action (Section 4.21.2.1).

4.21.3.2 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 4.21.2.2).

4.21.3.3 Air Quality

After an accidental release of agent from a storage igloo at ANAD, deposition of agent from the air onto the ground surface and/or degradation in the environment would occur within a relatively short period of time (see Section 4.21.2.3). 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 mustard, GB, or VX.

4.21.3.4 Human Health and Safety

The U.S. Army and Federal Emergency Management Agency (FEMA) routinely conduct CSEPP exercises, in coordination with the communities surrounding ANAD 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 ANAD, 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 would involve three rounds of munitions spilling their contents on the igloo floor. Emergency response preparation for potential

accidents of this type during normal ANAD operations (e.g., maximum credible events [MCEs] for daily operations) is routinely evaluated under CSEPP (Freil 1997).

For this EIS, the hypothetical accident for continued storage is assumed to be an event that could release the entire contents 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 7×10^{-4}), but it increases slightly with increasing length of continued storage. A lightning strike could result in an explosion and propagation by fire, causing the entire igloo contents to explode and/or burn (SAIC 1997). Thus, the impacts from a lightning strike would be identical to those from a handling accident (Section 4.21.2.4) because the estimated amount of nerve agent that would be released is identical. The consequences from a lightning strike on a VX storage igloo have been estimated in terms of the number of fatalities and are given in Table 4.21-2. A discussion of the impacts is provided in Section 4.21.2.4.

4.21.3.5 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 4.21.2.5).

4.21.3.6 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 4.21.2.6). 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.

4.21.3.7 Biological Resources

The impact from an accident involving a lightning strike on a GB or VX rocket storage igloo, followed by a fire 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 accident scenario (see Section 4.21.2.7). Table 4.21-1 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 VX and GB deposited after the lightning strike accident would be the same as those for a handling accident at a storage igloo (4.21.2.7). 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. Mustard release is not considered under the no action alternative because the hypothetical highest-risk scenario is a lightning strike on a GB or VX rocket-containing igloo followed by a fire.

Wildlife. The impacts to wildlife under the no action accident scenario would be the same as those discussed under the proposed action scenario (see Section 4.21.2.7).

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 4.21-1). Aquatic habitats and fish would experience impacts similar to those discussed under the proposed action (Section 4.21.2.7).

Protected Species. The impacts on protected species from exposure to chemical agents released following an accident during continued storage would be the same as impacts from an accident under the proposed action (Section 4.21.2.7).

Wetlands. The impacts on wetland vegetation from a lightning strike during continued storage would be the same as impacts from a handling accident at a storage igloo under the proposed action (Section 4.21.2.7).

4.21.3.8 Cultural Resources

Potential impacts on cultural resources associated with accident scenarios under the no action alternative would be as those discussed under the proposed action (Section 4.21.2.8). Appendix F discusses historic properties that could be affected by the modeled accidents under the no action alternative.

4.21.3.9 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 4.21.2.9).

4.21.3.10 Environmental Justice

Potential impacts on environmental justice associated with the accident scenarios considered under the no action alternative would be the same as those discussed under the proposed action (Section 4.21.2.10).

4.22 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.

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.

Finally, 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. The cumulative 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 the impacts of a baseline 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:

- Anniston Army Depot;
- Alabama Department of Environmental Management, Air Division;
- Division 4, Alabama Highway Department;
- Calhoun County Economic Development Council;
- Talladega County Economic Development Council;
- Calhoun County Highway Department; and
- Talladega County Road Department.

4.22.1 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.

4.22.1.1 On-Post Actions

Some on-post actions have already been included in the proposed action as defined and analyzed in this document. These include building an access road to the ACWA site and building required infrastructure. Other reasonably foreseeable on-post actions included here in Section 4.22 in this cumulative impact analysis include:

- Constructing and operating new facilities, including a DRMO electric induction furnace, the plasma energy pyrolysis system (PEPS), the PTFMC, the blast chamber facility, and

- Clear-cutting to control Southern pine beetle infestation.

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

The only other on-post Chem Demil action would be the operation of the baseline incinerator. An EIS for the baseline incinerator at ANAD has been prepared (U.S. Army 1991). The construction of a baseline incinerator is complete. Cumulative impacts in each impact area are assessed on the basis of the assumption that the baseline incinerator would be operating.

4.22.1.2 Off-Post Actions

The reasonably foreseeable off-post actions have been identified broadly as highway construction; housing development; industrial expansion, including the Honda plant currently under construction; light industrial expansion; and some commercial development.

4.22.2 Land Use

ANAD lies in a predominantly rural area with land cover dominated by forest. Areas of residential use and agriculture are interspersed among the forested tracts. Of the 18,000 acres (7,000 ha) of land at the post, 13% is semiimproved and 75% is unimproved. The Fort McClellan Military Reservation's Pelham Range abuts ANAD to the north. Private land ownership predominates in other nearby area. Past and present land use on ANAD has been primarily for industrial and related purposes, including administrative, residential, and recreational uses. The dominant feature of the facility is more than 11,000 acres (4,400 ha) of woodland (U.S. Army 1991). Use of the northeastern portion of the installation for an ACWA pilot test facility is consistent with other past, current, and planned future land use at ANAD.

An ACWA pilot test facility would have negligible effects on land use both on and off the post (Section 9.2). The baseline incinerator is located on the northern border of Proposed Area B, a location consistent with current land use. U.S. Army (1991) found no significant land use impacts from the baseline incinerator. The baseline incinerator and an ACWA pilot test facility together would disturb about 150 acres (59 ha) or 0.81% of the total area of ANAD, some of it in previously disturbed areas. Other reasonably foreseeable on-post actions would disturb additional land and follow current land use patterns.

Housing development is occurring south and west of Oxford and east of Anniston. Jacksonville is experiencing a housing boom (Smith 2001). A new Honda plant is under construction about 8.5 mi (14 km) west of ANAD, and a concrete pole plant is being built in Anniston. These and other anticipated activities in the vicinity of ANAD would not contribute to significant adverse land use impacts when aggregated with impacts from on-post activities.

4.22.3 Infrastructure

Table 4.22-1 presents the expected utility demands for a baseline incinerator at ANAD.

4.22.3.1 Electric Power Supply

ANAD purchases electric power from Alabama Power Company. It used 62 GWh of electric power in 2000. A new transmission line and substation have been built to supply the baseline incinerator. Additional power distribution infrastructure beyond that built for the baseline incinerator would be needed to meet the electric power needs of an ACWA pilot test facility (Section 4.3) and other reasonably foreseeable on-post actions. Depending on the ACWA technology chosen, more than 105 GWh/yr of electric power in addition to the 33 GWh/yr required for the baseline incinerator might be needed while other on-post uses were still being supplied (Tables 4.3-1 and 4.22-1). Other reasonably foreseeable on-post actions would add to the amount of additional electric power needed. This need would represent an increase of about 220% over year 2000 consumption levels. Discussions with local planners indicated no current or foreseen problems in supplying electric power in the Calhoun County area (Smith 2001).

TABLE 4.22-1 Estimated Annual Utility Demands for a Baseline Incinerator at ANAD

Utility	Annual Demand
Electric power (GWh)	33
Natural gas (scf)	1,300,000,000
Process water (gal)	88,000,000
Potable water (gal)	6,400,000
Sewage produced (gal)	7,500,000

Source: Folga (2001b).

4.22.3.2 Natural Gas Supply

ANAD purchases its natural gas from Algasco. It used 310 million ft^3 (8.8 million m^3) in 2000. Additional gas distribution infrastructure beyond that built for the baseline incinerator would be needed to supply the natural gas needs of an ACWA pilot test facility (Section 4.3) and other reasonably foreseeable on-post actions. Depending on the ACWA technology chosen, more than 130 million scf/yr (3.7 million m^3/yr) of natural gas in addition to the 1,300 million scf/yr (37 million m^3/yr) required by the baseline incinerator might be needed while other on-post uses were still being supplied (Tables 4.3-1 and 4.22-1). Other reasonably foreseeable on-post actions would add to the amount of additional natural gas needed. This need would represent an increase of about 460% over year 2000 consumption levels. It could not be determined whether the post could be supplied with this amount of natural gas through existing lines. Discussions with local planners indicated no current or foreseen problems in supplying natural gas in the Calhoun County area (Smith 2001).

4.22.3.3 Water (Supply and Sewage Treatment)

The water supply system is currently being upgraded to support the baseline incinerator, and a water tower has been built to supply emergency needs. Normal operations of an ACWA pilot test facility would result in minor impacts on groundwater (Section 4.11). Depending on the technology chosen, an ACWA pilot test facility's potable and process water use of, at most, 24 million gal/yr (92,000 m^3/yr) would exceed the water use during construction (Table 4.3-1). The baseline incinerator could use up to 94 million gal/yr (356,000 m^3/yr) of water when 365 days per year of operation are assumed (Table 4.22-1). The total use of 120 million gal/yr (450,000 m^3/yr) is about 14% of the minimum reserve of Coldwater Spring but only 1.4% of the spring's minimum flow. Although quantitative water use figures were not available, water use by other reasonably foreseeable on-post actions would be smaller and cumulatively would not exceed the water available from Coldwater Spring. Additional water distribution pipelines and a supply system to provide for peak water demands for emergency response would be needed for an ACWA pilot test facility (Section 4.3). Other reasonably foreseeable on-post actions would increase the required overall emergency capacity beyond that required for an ACWA pilot test facility alone and would also require additional pipelines.

Sanitary sewage production during operation of an ACWA pilot test facility would exceed sewage production during construction. Operating an ACWA pilot test facility and a baseline incinerator could produce up to 15 million gal/yr (57,000 m^3/yr) of sewage, an increase of more than 960% over the volume treated in 1999. Other reasonably foreseeable on-post actions would generate additional, but smaller, amounts of sanitary sewage. A new sewage treatment plant is being built to handle sewage from the baseline incinerator. An additional increase in capacity might be needed to handle the additional load from an ACWA pilot test facility.

4.22.4 Waste Management

Cumulative impacts from the construction and operation of an ACWA pilot test facility with the baseline incinerator and other reasonably foreseeable facilities should be minimal. Discussions with local planners indicated that current off-post hazardous and nonhazardous waste disposal capacities appear adequate (Smith 2001; U.S. Army 1991).

Hazardous wastes are transferred to and stored at hazardous waste storage facilities on post. Most are packaged and transported off post to permitted treatment and disposal facilities. In 1999, ANAD generated about 3.6 million lb (1.7 million kg) of hazardous wastes. Nonhazardous wastes are disposed of off post or recycled. Sanitary wastewater is treated in the on-post sewage treatment plant. In 1999, ANAD treated 1.6 million gal (5,900 m^3) of sewage.

The quantities of wastes generated by construction of an ACWA pilot test facility (Table 4.4-2) and other on-post actions would be small and have minimal impacts on waste management systems. Operating any of the ACWA pilot test facilities and a baseline incinerator would produce an amount of hazardous and nonhazardous wastes that, while representing a substantial increase in the amount of waste generated by ANAD, would be minimal in the vicinity of ANAD (Tables 4.4-3, 4.4-4, and 4.4-5). U.S. Army (1991) found no significant impacts on waste management systems from operation of the baseline incinerator. The total stockpile to be demilitarized is fixed, so the amounts and types of wastes produced would depend on the distribution of the stockpile among the technologies. Any of the technologies alone would produce minimal amounts of hazardous wastes. Amounts of wastes from other reasonably foreseeable on-post facilities including PEPS and the DRMO induction furnace could not be quantified but would be expected to be minimal. Overall, hazardous wastes from these facilities would have a minimal impact on waste management systems. A baseline incinerator would also produce brine salts, for which the ultimate disposal requirements are currently unclear (Section 4.4.3).

Sanitary sewage production during operation of an ACWA pilot test facility would exceed sewage production during construction. Operating an ACWA pilot test facility and a baseline incinerator could produce up to 15 million gal/yr (57,000 m^3/yr) of sewage, an increase of more than 960% over the volume treated in 1999. Other reasonably foreseeable on-post actions would generate additional, but smaller, amounts of sanitary sewage. A new sewage treatment plant is being built to handle sewage from the baseline incinerator. An additional increase in capacity might be needed to handle the additional load from an ACWA pilot test facility.

4.22.5 Air Quality

Emissions of toxic and hazardous air pollutants are of interest primarily because of their potential impacts on human health or biological resources. Sections 4.22.6 and 4.22.12 discuss

potential cumulative impacts in these impact areas. This analysis assumes that a baseline incinerator would be operating during the construction and operation of an ACWA pilot test facility.

4.22.5.1 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 from these sources would not exceed NAAQS levels (Section 4.5).

Table 4.22-2 summarizes the maximum ambient total particulate concentrations, including the background concentration, from construction of an ACWA pilot test facility and operation of a baseline incinerator. Except for the annual $PM_{2.5}$ concentration, these concentrations are, at most, 90% of the NAAQS levels. The annual $PM_{2.5}$ level — when the particulate concentrations from the background level (96% of the NAAQS level), from the operation of the baseline incinerator (0.53% of the NAAQS level), and from the construction of an ACWA pilot test facility (2.8% of the NAAQS level) are taken into account — would exceed 99% of the NAAQS level. (Background levels in Alabama 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 raise the cumulative annual $PM_{2.5}$ concentrations during the temporary period of ACWA construction activities.

4.22.5.2 Impacts of Operations

Table 4.22-3 summarizes the maximum ambient concentrations, including the background concentration, from concurrent operation of an ACWA pilot test facility and a baseline incinerator. Except for the annual $PM_{2.5}$ concentration, these concentrations would be, at most, 83% of the NAAQS levels. The annual $PM_{2.5}$ level — when the concentrations from the background level (96% of the NAAQS level), from the operation of the baseline incinerator (0.53% of the NAAQS level), and from the operation of any ACWA facility (0.33% of the NAAQS level) are taken into consideration — would be almost 97% of the NAAQS level. (Background levels in Alabama tend to be near or above the annual $PM_{2.5}$ NAAQS level.) Other reasonably foreseeable on-post and off-post actions that would emit particulates would contribute small or temporary concentrations to this level and raise the cumulative annual $PM_{2.5}$ concentration during operation of an ACWA pilot test facility.

TABLE 4.22-2 Air Quality Impacts from Construction of an ACWA Pilot Test Facility and Operation of a Baseline Incinerator at ANAD and Other Nearby Actions[a]

		Concentration ($\mu g/m^3$)				
Pollutant	Averaging Time	Maximum Increment[b]	Background	Total	NAAQS	Percentage of NAAQS[c]
PM_{10}	24 hours	22	68	90	150	60 (15)
	Annual	0.92	26	27	50	55 (1.8)
$PM_{2.5}$	24 hours	12	46	58	65	90 (19)
	Annual	0.50	14.4	14.9	15	99.4 (3.3)

[a] See Section 4.5 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 a baseline incinerator. The ACWA pilot test facility increment is based on Table 4.5-8. Baseline incinerator PM_{10} impacts are based on U.S. Army (1991). Baseline incinerator $PM_{2.5}$ 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 a baseline incinerator. Values in parentheses are based on the increment due to the two facilities alone and ignore the background concentration.

4.22.6 Human Health and Safety — Routine Operations

4.22.6.1 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 from these sources would not exceed NAAQS levels (Section 4.5).

Particulate NAAQS levels would not be exceeded off post during construction of an ACWA pilot test facility with concurrent operation of the baseline incinerator (Section 4.22.5). However, even without any new actions, the current background annual $PM_{2.5}$ level is at 96% of the NAAQS level. (Background levels in Alabama tend to be near or above the annual $PM_{2.5}$ NAAQS level.) Concurrent construction of an ACWA pilot test facility and operation of a baseline incinerator would raise the maximum level to more than 99% of the NAAQS level (Table 4.22-2). Other reasonably foreseeable future actions would contribute small

concentrations to this level and raise the cumulative annual $PM_{2.5}$ concentrations during the temporary period of ACWA pilot test facility construction activities. With the preexisting high background level almost equal to the NAAQS level, there is a potential for adverse health impacts off post from the existing environment during construction of an ACWA pilot test facility.

4.22.6.2 Impacts of Operations

The EIS for ANAD (U.S. Army 1991) does not discuss post-specific risks from the baseline incinerator. However, risks associated with the Johnston Atoll Chemical Agent Disposal System (JACADS) incinerator were estimated on the basis of measured stack concentrations. Risk estimates based on representative conditions at ANAD would differ from those derived for JACADS. However, the methodology used in assessing risks from JACADS emissions was very conservative (i.e., it overestimated risks). Thus, the JACADS risks can be taken as reasonable indicators of the expected risks from the baseline incinerator at ANAD.

Noncarcinogenic risks from operation of an ACWA pilot facility would be 0.5% or less of the levels considered to present hazards (Table 4.7-2). The maximum carcinogenic risk to on-post and off-post populations from agent processing and worst-case agent emissions associated with any ACWA technology would be 2×10^{-7}, or 20% of the 1×10^{-6} benchmark level generally considered representative of negligible risk. As summarized in the EIS for PBA (Appendix H of U.S. Army [1997b]), the maximum risk from the JACADS incinerator would be 6.2×10^{-7}, or 62% of the 1×10^{-6} level generally considered representative of negligible risk. When additivity for the carcinogens is assumed (a common assumption in risk assessments), a baseline incinerator and an ACWA pilot test facility operating simultaneously would represent an increased carcinogenic risk of approximately 8.2×10^{-7}, 82% of the benchmark level. This risk would 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 4.6). 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 0.34% of maximum allowable level recommended by the CDC (Table 4.6-6). U.S. Army (1991) estimates the maximum risk from the baseline incinerator 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 4% 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 4.34% 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

would occur if all emissions were from one stack. Also, the assumption of continuous agent release at the detection limit (Section 4.6) is very conservative and results in overestimates of possible agent releases.

Only annual $PM_{2.5}$ concentrations would exceed 83% of the corresponding NAAQS levels during concurrent operation of an ACWA pilot test facility and a baseline incinerator (Table 4.22-3). Even without any new actions, the current background annual $PM_{2.5}$ level is 96% of the NAAQS level. (Background levels in Alabama tend to be near or above the annual $PM_{2.5}$ NAAQS level.) Concurrent operation of an ACWA pilot test facility and the baseline incinerator would raise the maximum level to about 97% 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. With the preexisting high background level almost equal to the NAAQS level, there is a potential for adverse health impacts off post from the existing environment during operation of an ACWA pilot test facility.

4.22.7 Noise

No sensitive noise receptors are located near ANAD. Currently, noise-producing activities at ANAD are associated with the operation of the tank firing range, burning ground, demolition pit, and recoilless rifle range. Off-post noise sources include firing activities on Pelham Range. There is no off-post noise problem from operation of the ranges and demolition pit at ANAD.

Construction and operation of an ACWA pilot test facility would result in maximum noise levels that would not exceed 48 dBA at the eastern boundary if the facility were located in Area A (Section 4.8). If it were located in Area B nearer to the baseline incinerator, the maximum noise level at the western boundary would be less. Operation of the baseline incinerator would add less than 3 dBA, a barely perceptible increase, to the maximum level, regardless of which site was chosen for the ACWA pilot test facility. The cumulative noise level from both facilities would be less than the EPA's 55-dBA guideline. Noise from the blast chamber facility could have an impact on areas affected by an ACWA pilot test facility in Area B. Its impact would be intermittent, and no significant cumulative noise impact would be expected. Other reasonably foreseeable on-post actions would be located far enough away from locations affected by noise from an ACWA pilot test facility to preclude significant cumulative impacts. The widening of Route 109 east of the post would add temporarily to overall noise levels, but the cumulative impact would not be significant.

TABLE 4.22-3 Air Quality Impacts from Operation of an ACWA Pilot Test Facility and a Baseline Incinerator at ANAD and Other Nearby Actions

		Concentration ($\mu g/m^3$)				
Pollutant	Averaging Time	Maximum Increment[a]	Background	Total	NAAQS	Percentage of NAAQS[b]
SO_2	3 hour	22	346	368	1300	28 (1.7)
	24 hours	7.4	149	156	365	43 (2.0)
	Annual	0.17	32	32	80	40 (0.21)
NO_2	Annual	1.36	21	22	100	22 (1.4)
CO	1 hour	100	14,171	14,271	40,000	36 (0.25)
	8 hours	52	8,000	8,052	10,000	81 (0.52)
PM_{10}	24 hours	7.5	68	76	150	50 (5.0)
	Annual	0.13	26	27	50	53 (0.26)
$PM_{2.5}$	24 hours	7.5	46	54	65	83 (12)
	Annual	0.13	14.4	14.5	15	97 (0.87)

[a] The maximum increment is the sum of the increment for the ACWA pilot test facility plus the increment for a baseline incinerator. The ACWA pilot test facility increment is based on the largest modeled value for any technology (Tables 4.5-9 through 4.5-12). Baseline incinerator impacts are based on U.S. Army (1991). Baseline incinerator $PM_{2.5}$ impacts are 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 a baseline incinerator. Values in parentheses are based on operation of the two facilities alone and ignore the background level.

4.22.8 Visual Resources

The PEPS, PTFMC, and the DRMO induction furnace would be in keeping with the industrial and administrative nature of the southeastern portion of the post. The detonation chamber would be located in the northwestern portion of the site, and any view of it would be limited by rolling terrain and forest. Increased traffic and dust during construction of an ACWA pilot test facility would be temporary and intermittent. During operations, an ACWA pilot test facility could produce a small steam plume. When present, this plume would add to the visual impact of the large steam plume from the baseline incinerator. Any plumes associated with other reasonably foreseeable on-post facilities would be small. Overall, the visual impacts in the vicinity of ANAD should not be significant.

4.22.9 Soils

With the exception of soil contamination resulting from air emissions during operations, the analysis area for cumulative impacts to soils was limited to the immediate on-post vicinity of the proposed sites. Activities that would disturb soils would have very localized impacts and hence little chance of creating cumulative impacts.

The baseline incinerator and an ACWA pilot test facility, along with its supporting infrastructure, could disturb up to 150 acres (59 ha) of soils, some of them previously undisturbed.

Future construction actions not associated with an ACWA pilot test facility would be located at least 0.6 mi (1 km) away from all alternative ACWA pilot test facility locations. These activities could contribute to soil erosion and accidental spills and releases, which are the same types of impacts as those associated with construction of an ACWA pilot test facility. These impacts would be temporary and would be minor if the best management practices mentioned in Section 4.10 were followed.

There would be no significant cumulative impacts on surface soils from the routine operation of an ACWA pilot test facility and other on-post and off-post actions, including the routine operation of the baseline incinerator. On the basis of its low emissions, the ACWA pilot test facility should have no significant impacts (Section 4.10). The emissions from the baseline incinerator would also be low (U.S. Army 1991; Raytheon 1996). Deposition from the ACWA pilot test facility would add to deposition from the baseline incinerator, but given the low emissions from both units, the impact should be negligible. Other reasonably foreseeable on-post and off-post actions would take place far enough away or be small enough to preclude significant on-post deposition.

4.22.10 Groundwater

Coldwater Spring, which discharges groundwater to the surface, supplies water to ANAD, Fort McClellan Military Reservation, Anniston, Blue Mountain, and several suburban areas (Section 4.11). Coldwater Spring has a minimum reserve of 876 million gal/yr (3.3 million m^3/yr) and a minimum yield of 23.5 million gal/d (61.8 m^3/min) (U.S. Army 1991). ANAD currently uses about 260 million gal/yr (0.98 million m^3/yr) of water.

Impacts on groundwater from the construction of an ACWA pilot test facility and other on-post facilities would be none to negligible if standard precautions to prevent leaks and spills were followed during equipment refueling and other activities (Section 4.11).

Normal operations of an ACWA pilot test facility would result in minor impacts on groundwater (Section 4.11). Depending on the technology chosen, an ACWA pilot test facility's potable and process water use of, at most, 24 million gal/yr (92,000 m^3/yr) would exceed the water use during construction (Table 4.3-1). The baseline incinerator could use up to 94 million gal/yr (356,000 m^3/yr) of water when 365 days per year of operation are assumed (Table 4.22-1). The total use of 120 million gal/yr (450,000 m^3/yr) is about 14% of the minimum reserve of Coldwater Spring but only 1.4% of the spring's minimum flow. Although quantitative water use figures were not available, water use by other reasonably foreseeable on-post actions would be smaller and cumulatively would not exceed the water available from Coldwater Spring.

Neither an ACWA pilot test facility nor the baseline incinerator would release process water (Section 4.11 and U.S. Army 1991). The discharge of treated sanitary sewage from both facilities and from other reasonably foreseeable on-post facilities to surface waters would not affect groundwater flows.

Although data were not available to account for the water supply needs of off-post actions such as the Honda assembly plant, in discussions, local planners indicated that water supplies in the vicinity of ANAD would be expected to be adequate to meet needs (Smith 2001).

4.22.11 Surface Water

Impacts on surface water from the construction of an ACWA pilot test facility would be negligible if standard precautions to prevent leaks and spills were followed during equipment refueling and other activities (Section 4.12). If spills and leaks did occur, remediation procedures would need to be applied quickly to reduce potential impacts on surface waters.

Neither an ACWA pilot test facility nor the baseline incinerator would discharge process water during operations. ACWA pilot test facility operations would thus result in negligible impacts on surface waters (Section 4.12). U.S. Army (1991) found no adverse impacts on surface waters from the operation of the baseline incinerator. Although quantitative water use figures were not available, water use and discharge by other reasonably foreseeable on-post actions would not be expected to affect surface water flows significantly.

An ACWA pilot test facility and the baseline incinerator together would discharge about 15 million gal/yr (57,000 m^3/yr) of treated sanitary sewage. This discharge would be small compared to surface water flows and would not significantly change flow conditions in the vicinity of ANAD.

4.22.12 Biological Resources

4.22.12.1 Terrestrial Habitats and Vegetation

ANAD is predominantly undeveloped, and about 75% of the post is unimproved (Section 4.13). In the past, southern pine beetle infestations required the cutting of trees. Infestations are expected to continue. Land is normally returned to timber after clear-cutting (Smith 2001).

Depending on the site chosen, construction of an ACWA pilot test facility would disturb up to about 77 acres (31 ha) of previously undisturbed land (Table 4.3-2) in addition to the 70 acres (28 ha) disturbed by construction of the baseline incinerator. Construction of other on-post facilities would increase terrestrial habitat and vegetation loss as sites were cleared. In addition, the ongoing clear-cutting to control Southern pine beetle infestations would increase the cumulative loss of vegetation. Using best management practices would minimize 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 4.13). U.S. Army (1991) found no adverse impacts associated with routine operation of a baseline incinerator. In addition, the total stockpile to be demilitarized is fixed; if the ACWA pilot test facility and the baseline incinerator were operating, fewer munitions would be demilitarized in an ACWA pilot test facility, thereby reducing its overall emissions and deposition. Given the small emissions potential of other reasonably foreseeable actions or their distance from the ACWA pilot test facility, cumulative impacts on terrestrial habitats and vegetation from an ACWA pilot test facility, the baseline incinerator, and other potential facilities would be negligible during routine operations.

Cumulative impacts associated with off-post facilities should be negligible. The new Honda plant located about 8.5 mi (14 km) west of the western border of ANAD and other reasonably foreseeable actions would have localized impacts that would be negligible on ANAD.

4.22.12.2 Wildlife

Depending on the site chosen, construction of an ACWA pilot test facility would disturb up to 77 acres (31 ha) of previously undisturbed land in addition to the 70 acres (28 ha) disturbed by construction of a baseline incinerator. Each additional on-post construction action would increase loss of habitat, 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 cumulatively displace additional small mammals and potentially lead to increased habitat abandonment by songbirds. Similar impacts would have

already resulted from the prior construction of the baseline incinerator (U.S. Army 1991). Use of the mitigation measures discussed in Sections 4.13 and 4.14 would reduce adverse cumulative impacts on both habitats and wildlife.

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 4.14). U.S. Army (1991) found no adverse ecological impacts associated with routine operation of the baseline incinerator. In addition, the total stockpile to be demilitarized is fixed; if both the ACWA pilot test facility and the baseline incinerator were operating, fewer munitions would be demilitarized in an ACWA pilot test facility, thereby reducing its overall emissions and deposition. Given the small emissions potential of other reasonably foreseeable actions or their distance from the ACWA pilot test facility, cumulative impacts on wildlife from an ACWA pilot test facility, the baseline incinerator, and other potential facilities would be negligible during routine operations.

Additional operations on post would increase roadkills as worker traffic and deliveries increased.

If it is assumed that the operational noise from an ACWA pilot test facility and the baseline incinerator are about the same, operating an ACWA pilot test facility would increase noise levels by less than 3 dBA. Noise generated at additional locations would increase the area that would be subject to increased noise levels. However, other facilities would be too far away to contribute to average noise levels from an ACWA pilot test facility alone, and the cumulative noise impacts on wildlife would be minor.

Cumulative impacts associated with off-post facilities should be negligible. The new Honda plant located about 8.5 mi (14 km) west of the western border of ANAD and other reasonably foreseeable actions would have localized impacts that would be negligible on ANAD.

4.22.12.3 Aquatic Habitats and Fish

Disturbance of streams in Proposed Area A could result in loss of up to 1,900 ft (580 m) of stream habitat (Section 4.15) and eliminate an excavated pond about 0.4 acre (0.2 ha) in size. Aquatic habitats do not occur in Areas B and C. Construction in any of the three areas could have impacts on downstream habitats. The potential for aquatic habitat loss from construction of other on-post projects was not evaluated for this EIS; any impacts would add to the impacts caused by construction of an ACWA pilot test facility. Avoidance of streams where possible and implementation of best management practices to control erosion and sedimentation would be needed to minimize the impacts at all on-post construction sites.

A screening-level ecological risk assessment for aquatic biota found that air emissions from routine operation of an ACWA pilot test facility have negligible impacts on aquatic habitats

and fish (Section 4.15). U.S. Army (1991) found no adverse ecological impacts associated with the routine operation of the baseline incinerator. In addition, the total stockpile to be demilitarized is fixed; if both the ACWA pilot test facility and the baseline incinerator were operating, fewer munitions would be demilitarized in an ACWA pilot test facility, thereby reducing its overall emissions and deposition. Given the small emissions potential of other reasonably foreseeable actions or their distance from the ACWA pilot test facility, cumulative impacts on aquatic habitats and fish from an ACWA pilot test facility, the baseline incinerator, and other reasonably foreseeable on-post and off-post facilities would be negligible during routine operations.

4.22.12.4 Protected Species

Construction in Area A or the associated utility corridors would not be likely to affect Tennessee yellow-eyed grass (federally listed as endangered) adversely. Construction in Areas A, B, or C or the associated utility corridors would have negligible impacts on the aquatic habitats of the blue shiner, tulotoma snail, and painted rocksnail (Section 4.16). Clear-cutting to control Southern pine beetle infestations could increase runoff and the potential for impacts on these species. Implementation of storm-water control measures during construction would reduce the potential for these impacts, and the cumulative impacts would be negligible. The DRMO induction furnace, PEPS, and PTFMC avoid Tennessee yellow-eyed grass populations. The potential of these actions to affect this species by runoff and sedimentation was not assessed for this EIS. Implementing the practices noted in Section 4.16 would reduce the potential for such impacts.

Routine operation of an ACWA pilot test facility would have negligible impacts on protected species (Section 4.16). U.S. Army (1991) found no adverse ecological impacts associated with the routine operation of the baseline incinerator. In addition, the total stockpile to be demilitarized is fixed. If both the ACWA pilot test facility and the baseline incinerator were operating, fewer munitions would be demilitarized in the ACWA pilot test facility, thereby reducing its overall emissions and deposition. Given the small emissions potential of other reasonably foreseeable actions or their distance from the ACWA pilot test facility, cumulative impacts on protected species from an ACWA pilot test facility, the baseline incinerator, and other potential on-post and off-post facilities would be negligible during routine operations.

4.22.12.5 Wetlands

There are about 112 acres (45 ha) of wetlands on ANAD. Locating the ACWA pilot test facility in Area A could result in the loss of wetlands in that area and might require construction in a 100-yr floodplain (Section 4.17). Construction in Area A could cause the loss of up to 1.2 acres (0.49 ha) of palustrine wetland, up to 1,900 ft (580 m) of riverine wetland, and up to 12 acres (4.9 ha) of floodplain. No wetlands occur in Areas B and C. Construction in any of the three areas could affect downstream wetlands. Impacts downstream of the sites would be

negligible if standard measures for controlling erosion and runoff were followed. The potential for loss of wetlands due to other on-post projects would need to be addressed for each action. The PTFMF might affect a nearby perennial stream, contributing to adverse cumulative impacts on wetlands. Use of the mitigation measures described in Section 4.17 for controlling runoff and erosion would reduce wetland impacts.

Routine operation of an ACWA pilot test facility would have negligible impacts on wetlands (Section 4.17). U.S. Army (1991) found no adverse ecological impacts associated with the routine operation of the baseline incinerator. In addition, the total stockpile to be demilitarized is fixed; if both the ACWA pilot test facility and the baseline incinerator were operating, fewer munitions would be demilitarized in an ACWA pilot test facility, thereby reducing its overall emissions and deposition. Given the small emissions potential of other reasonably foreseeable actions or their distance from the ACWA pilot test facility, cumulative impacts on wetlands from an ACWA pilot test facility, the baseline incinerator, and other potential facilities would be negligible during routine operations.

4.22.13 Socioeconomics

Construction and operation of an ACWA pilot test facility might result in cumulative impacts if construction and operation activities occurred concurrently with other existing or future activities on post at ANAD and in the three-county ROI (see Section 4.19) surrounding the post.

Other reasonably foreseeable on-post actions could create additional demands 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 employ far fewer people than an 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 impacts could not be adequately planned for.

The cumulative socioeconomic impacts from the operation of any of the ACWA technologies together with the operation of a baseline incinerator and existing or planned economic development activities would be relatively small. Construction of an ACWA pilot test facility would be expected to generate approximately 1,300 direct and indirect jobs in the peak year in the ROI, with employment during the operation of both facilities likely to be roughly 2,600. Operations jobs for both facilities would be filled partially by workers moving into the ROI; these workers would have a relatively minor effect on the local housing market. Demand for rental housing during the peak year of construction of an ACWA facility would require approximately 8% of the vacant rental housing stock, with roughly 20% 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 should not occur.

A number of local road expansion projects, including bypasses of Anniston and Talladega and the widening of I20, are either under construction or planned for the next five years. Fairly substantial growth in employment is expected to occur in the ROI as a result of the construction of a number of new industrial facilities in the near future. A new car assembly and engine manufacturing facility is under construction 15 mi (24 km) west of ANAD is expected to employ 1,500 workers when construction is complete in 2001. Smaller facilities include a steel coil facility planned for Talladega and a concrete pole plant in Anniston. More specific information on the size and precise timing of these projects was not available. However, when judged 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 a baseline incinerator and an ACWA pilot test facility, 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 baseline incinerator and projected off-post activities. The post is located in the Anniston Metropolitan Statistical Area (MSA) and is adjacent to the Gadsden MSA and Birmingham MSA. A variety of occupations are represented in these MSAs, and the number of unemployed workers there would be sufficient to meet the demand for local labor that would be created by both projects.

Concurrent operation of a baseline incinerator, an ACWA pilot test facility, and projected off-post activities might produce moderate impacts on the local transportation network. Construction of an ACWA pilot test facility would result in an additional 1,000 daily trips on CR 109/SR 202, the local road segment most heavily used by existing post employees, representing a 13% increase in annual average daily traffic. Concurrent operation of both facilities would result in an additional 1,300 daily trips, or an increase of 17% in annual average daily traffic on CR 109/SR 202.

Although more local public service employees, medical services workers, and teachers would be needed if the operation of an ACWA pilot test facility and the baseline incinerator, and projected off-post activities were to occur concurrently, given sufficient planning, local public service providers should be able cope with the additional demands through associated increases in city, county, and school district revenue collections.

4.22.14 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 4.20). During construction and routine operations of any ACWA technology at ANAD, high and adverse impacts would not be anticipated with regard to either socioeconomic activities or human health (Sections 4.7 and 4.19). U.S. Army (1991) did not predict any significant impacts on human health. Moreover,

the cumulative impacts associated with an ACWA pilot test facility and other reasonably foreseeable actions, including the operation of the baseline incinerator, would not be anticipated to contribute to high and adverse impacts on populations (Sections 4.22.6 and 4.22.13). As a result, significant cumulative environmental justice impacts from the construction and routine operation of an ACWA pilot test facility, the baseline incinerator, and other reasonably foreseeable actions are not anticipated.

4.23 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 ANAD 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.

4.23.1 Current Environment

4.23.1.1 Land Use

The region of influence (ROI) used to assess impacts on agriculture consists of 11 counties located entirely or partly within a radius of 30 mi (50 km) around ANAD. This agricultural ROI contains 4.7 million acres (1.9 million ha) of land, of which 20% were in farmland in 1997 (USDA 1999). The ROI contained 6,500 farms in 1997, of which about a third were operated by full-time farmers (Table 4.23-1). Among the ROI counties, average farm size varied from 97 to 249 acres (39 to 101 ha).

4.23.1.2 Employment

Agriculture was historically only a moderately significant local source of employment in the 11-county ROI, and its importance declined during the 1990s. Farm worker and agricultural services employment totaled 9,589, contributing a little more than 1% to total employment in the ROI in 1999 (U.S. Bureau of the Census 2001a). In Calhoun County, 659 people were employed in agriculture in 1999 (U.S. Bureau of the Census 2001a). This number constitutes 1.6% of employment in the county. Information on numbers of migrant and seasonal farm workers was unavailable. 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).

TABLE 4.23-1 Farms and Crop Acreage in the Agricultural Region of Influence around ANAD in 1997[a]

	Land (acres) and Farms (no.)	
Farms and Land	ROI	State
Land in farms (acres)	964,346	8,704,385
Number of farms	6,532	41,384
Full-time farms	2,429	15,568
Average farm size (acres)	97–249	210
Total cropland (acres)	479,250	4,197,670
Harvested cropland (acres)	203,026	2,077,139

[a] The agricultural ROI is composed of the following counties: Blount, Calhoun, Cherokee, Clay, Cleburne, Etowah, Jefferson, Randolph, Shelby, St. Clair, and Talladega.

Source: USDA (1999).

4.23.1.3 Production and Sales

Hay, cotton, beans, corn, and wheat are the primary crops harvested (Table 4.23-2). Poultry production for eggs and for meat is a major component of livestock production in the ROI. Farms in the region generated $540 million in agricultural sales in 1997, representing 17% of total agricultural sales in the state as a whole. Livestock contributed the majority of sales (88%), with a smaller contribution from crops (Table 4.23-3) (USDA 1999).

4.23.2 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 4.5 and 4.6). 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.

TABLE 4.23-2 Agricultural Production in the Agricultural Region of Influence around ANAD in 1997[a]

	Crops (acres) and Livestock (no.)	
Crops and Livestock	ROI	State
Selected crops harvested		
Hay	115,282	778,602
Cotton	30,569	433,160
Beans	26,931	316,019
Corn	16,765	230,484
Wheat	6,364	82,440
Livestock inventory		
Cattle and calves	214,701[b]	1,530,566
Hogs and pigs	28,444[b]	183,811
Sheep and lambs	911[b]	8,173
Layers and pullets	870,535[b]	13,432,845
Broilers sold	181,877,784[b]	871,123,702

[a] The agricultural ROI is composed of the following counties: Blount, Calhoun, Cherokee, Clay, Cleburne, Etowah, Jefferson, Randolph, Shelby, St. Clair, and Talladega.

[b] ROI inventory is an underestimate due to data unavailability for some counties.

Source: USDA (1999).

4.23.3 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.

4.23.3.1 Impacts of Construction

Construction impacts would be confined to the installation; therefore, no significant impacts on agriculture would be likely from facility construction activities.

TABLE 4.23-3 Sales by Farms in the Agricultural Region of Influence around ANAD in 1992 and 1997[a]

	Sales (millions of $)	
Product	1992	1997
Livestock	277.8	476.0
Harvested crops	54.6	64.4
Agricultural ROI total	332.5	540.4
State total	2,369.2	3,099.0

[a] The agricultural ROI is composed of the following counties: Blount, Calhoun, Cherokee, Clay, Cleburne, Etowah, Jefferson, Randolph, Shelby, St. Clair, and Talladega.

Sources: USDA (1994, 1999).

4.23.3.2 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 4.5 and 4.6).

A screening-level ecological/agricultural risk assessment was conducted to assess the risk to agriculture resources from deposition of air emissions during routine operations of each of the four 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 ANAD 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 ANAD. 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. None of the chemicals emitted by the pilot test facilities, when deposited on soils,

would exceed the soil benchmark values, indicating that the risks of impacts on agriculture from maximum concentrations would be negligible (Tsao 2001g). 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 4.6) 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).

4.23.3.3 Impacts of Accidents

Section 4.21 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 ANAD would be significant. Table 4.23-4 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.

4.23.4 Impacts of No Action

4.23.4.1 Impacts of Routine Operations

The agricultural impacts of continuing routine operations at ANAD would be negligible and as included in baseline conditions for the ANAD region.

TABLE 4.23-4 Agricultural Impacts of Accidents at ANAD Associated with the Proposed Action and No Action[a]

Parameter	Neut/Bio	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)	47,000	47,000	47,000	47,000	47,000
Income (millions of $)	1,360	1,360	1,360	1,360	1,360
75% loss of agricultural output					
Employment (no. of jobs)	35,200	35,200	35,200	35,200	35,200
Income (millions of $)	1,020	1,020	1,020	1,020	1,020
50% loss of agricultural output					
Employment (no. of jobs)	23,500	23,500	23,500	23,500	23,500
Income (millions of $)	680	680	680	680	680

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

4.23.4.2 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 4.23.3.3).

4.24 OTHER IMPACTS

4.24.1 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 implementing 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 75 acres (30 ha) of land and could result in unavoidable adverse impacts comparable to those that would occur at any construction site of similar size.

As much as 77 acres (31 ha) of vegetative and terrestrial habitats could be disturbed. Cleared lands would include hardwood forests, which have an understory containing a greater number of species than other forest types. 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. Increased population densities and competition in adjacent habitats could reduce the survival rates or reproductive capacity of displaced individuals. However, wildlife communities associated with habitats in any of the construction areas (A, B, or C) are relatively common and well represented near the site.

Aquatic habitats, fish, and wetlands could be affected by grading during site preparations, which could disturb surface waters and drainage patterns throughout the site because of sedimentation, accidental releases of contaminants into streams, erosion, or storm-water runoff. Aquatic habitats are not present in Areas B or C but could be indirectly affected by construction in these areas because of these factors. Area A has aquatic habitats that could be directly affected by construction activities. The physical requirements of the post may preclude the avoidance of specific water features, including the two streams that converge on post. Rerouting or culverting of the streams at Area A, if necessary, could result in the loss of up to 1,912 ft (583 m) of stream habitat (excavated channels). Construction in Area A could also eliminate a small excavated pond.

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 high.

Adverse health impacts from PM inhalation could occur because the background level for $PM_{2.5}$ in the vicinity of ANAD is at the health-based annual NAAQS level. (Note: This risk would be present with or without an ACWA facility.)

A small number of worker injuries would be expected during construction of an ACWA facility: 49 for Neut/Bio, 61 for Neut/SCWO, 55 for Neut/GPCR/TW-SCWO, and 61 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.

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 53–286 worker injuries would be expected (about 53 for mustard agent processing only and about 274–286 for both mustard and nerve agent processing). 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.

4.24.2 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 4.3. 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 4.3.) When proposed operations would cease, water used by an 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.

4.24.3 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.

4.25 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, protected species, socioeconomics, or environmental justice were identified, no mitigation would be required for these resource areas.

4.25.1 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 any of the neutralization pilot test facilities; Elchem Ox would generate a smaller volume of hazardous wastes. 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.

4.25.2 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 sites.

4.25.3 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.

4.25.4 Human Health

Some risk to workers is present as a result of 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 7.21).

4.25.5 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) to prevent migration of spills from an operational accident.

4.25.6 Groundwater, Surface Water, and Wetlands

Runoff created by construction or preparation for construction (i.e., grading) would be contained or minimized by using standard erosion and storm-water runoff control measures (i.e., siltation fences or straw bales, stormwater retention ponds). In addition, construction activities or equipment within buffer areas along streams would be avoided where possible.

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. A storm-water management plan would be developed to minimize the potentially adverse effects of storm-water runoff on aquatic habitats, fish, and wetlands.

4.25.7 Vegetation, Wildlife, and Aquatic Resources

Construction could affect as much as 77 acres (31 ha) of vegetative, terrestrial, and aquatic habitat. The following mitigation measures would be implemented to reduce adverse impacts on ecological resources during construction.

- Best management practices would be implemented for erosion and sedimentation control to avoid impacts to ecological resources from changes in stream flow characteristics or water quality.
- Storm-water retention ponds would be implemented to contain erosion and sedimentation from stormwater runoff during construction or operations.
- Disturbed areas would be immediately replanted with native species
- Where possible, a buffer area would be instituted for construction activities and equipment along the stream channels in Area A. A buffer area would also be instituted for construction of the utility corridors north of Area A (adjacent to the stream) and southwest of Area A (crossing the stream) to minimize impacts on the streams and downstream aquatic habitats and wetlands.
- A buffer area would be maintained around wetlands during construction.
- Wetlands would be avoided during construction, where possible.
- Construction workers would be briefed on sensitive ecological resources and mitigation measures.

4.25.8 Cultural Resources

The construction areas have been largely surveyed for archaeological resources. Those areas that were not surveyed were previously disturbed and are not considered likely to contain important resources. 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 the depot, construction would stop immediately, and the Alabama SHPO and a qualified archaeologist would be consulted to evaluate the significance of the cultural artifacts.

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