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USATHAMA

U.S. Army Toxic and Hazardous Materials Agency

UPDATE OF THE INITIAL INSTALLATION ASSESSMENT OF CRANE ARMY AMMUNITION ACTIVITY, IN

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FINAL REPORT

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Prepared for:

COMMANDER
Crane Army Ammunition Activity
Crane, IN 47522
and
U.S. ARMY TOXIC AND HAZARDOUS MATERIALS AGENCY
Aberdeen Proving Ground, MD 21010-5401



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SUMMARY

An onsite installation assessment was performed at Crane Army Ammunition Activity (CAAA), Crane, IN, on 29 October 1986 to determine if any environmental/hazardous waste disposal conditions had changed since the Initial Installation Assessment (IIA) was conducted in 1978 and if such changes, coupled with interim changes in environmental regulations or mission, had altered the contaminant migration situation and would change the previous non-recommendation status. Information obtained during the onsite visit was used to update the IIA report.

It was concluded that, because CAAA remains a tenant on Naval Weapons Support Center, Crane (NWSC-Crane), the Navy is responsible for all environmental activities on the installation. Three explosives contaminated wastewater treatment facilities are operated by CAAA to comply with NWSC-Crane environmental requirements and National Pollutant Discharge Elimination System (NPDES) regulations.

Because the Navy is responsible for environmental activities, many areas of concern in the 1978 Army IIA have been addressed under the Naval Assessment and Control of Industrial Pollutant (NACIP) program, including completion of the 1983 Navy IAS and initiation of confirmation studies at many potential areas of contamination.

Because the Navy remains the landholder and maintains the primary responsibility for environmental activities, it is recommended that CAAA work with NWSC-Crane to minimize any environmental impact from Army operations.

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LIST OF ACRONYMS AND ABBREVIATIONS

CAAA	Crane Army Ammunition Activity
CE	U.S. Army Corps of Engineers
CERCLA	Comprehensive Environmental Response Compensation and Liability Act
DARCOM	U.S. Army Materiel Development and Readiness Command [now U.S. Army Materiel Command (AMC)]
EPA	U.S. Environmental Protection Agency
EPIC	Environmental Photographic Interpretation Center
ESE	Environmental Science and Engineering, Inc.
ft	feet
ha	hectare
IAS	Initial Assessment Study
IIA	Initial Installation Assessment
km	kilometer
lb	pound
mg/L	milligrams per liter
mm	millimeter
NACIP	Navy Assessment and Control of Industrial Pollutants
NAD	Naval Ammunition Depot
NEESA	U.S. Naval Energy and Environmental Support Activity
NPDES	National Pollutant Discharge Elimination System
NRC	Nuclear Regulatory Commission
NWSC-Crane	Naval Weapons Support Center, Crane
RCRA	Resource Conservation and Recovery Act
TOC	total organic carbon
TOX	total organic halogens
ug/L	micrograms per liter
USAEHA	U.S. Army Environmental Hygiene Agency
USATHAMA	U.S. Army Toxic and Hazardous Materials Agency
WES	Waterways Experiment Station
WWII	World War II

1.0 GENERAL

1.1 PURPOSE OF THE EVALUATION

An onsite records search [Initial Installation Assessment (IIA)] was conducted at Crane Army Ammunition Activity (CAAA), Naval Weapons Support Center, Crane (NWSC-Crane), IN, in 1978 to assess past and current use of toxic and hazardous materials, as well as the potential for these substances to migrate off the installation.

An evaluation of the records search (IIA) report for CAAA was conducted in October 1986 to determine if previous findings, which included no recommendations, had changed and to determine the current status of Army and Navy responsibilities for industrial operations and disposal operations which occur on the installation.

All information concerning operations existing at the time of the original assessment was reviewed and incorporated into this report, along with new information made available to the team upon assignment of the update and by the installation at the time of the revisit.

1.2 AUTHORITY

U.S. Army Materiel Development and Readiness Command (DARCOM) Regulation 10-30, Mission and Major Functions of the U.S. Army Toxic and Hazardous Materials Agency (USATHAMA), 13 July 1984.

1.3 INTRODUCTION

1. In reviewing earlier published records search (IIA) reports (1976 to 1981), the USATHAMA Installation Restoration Division determined some installations would require additional evaluations due to changes in environmental laws, changes in mission, and environmental problems discovered after the onsite visit.

2. Subsequent to the IIA in March 1978, USATHAMA has determined a report update would be required for CAAA.
3. Crane Army Ammunition Activity was contacted to outline the scope of the evaluation, provide guidelines to CAAA personnel, and obtain advance information for review by the evaluation team.
4. Naval Weapons Support Center-Crane and CAAA personnel were briefed on the evaluation program on 29 October 1986 by Dr. John D. Bonds from Environmental Science and Engineering, Inc. (ESE), a USATHAMA contractor.
5. Various Government agencies were contacted for documents and information pertinent to the evaluation effort. Agencies contacted include:
 - a. U.S. Army Environmental Hygiene Agency (USAEHA) (Aberdeen Proving Ground, MD);
 - b. U.S. Environmental Protection Agency (EPA), Environmental Photographic Interpretation Center (EPIC) (Vint Hill Farms Station, Warrenton, VA); and
 - c. U.S. Navy Energy and Environmental Support Activity (NEESA), Port Hueneme, CA.
6. The onsite phase of the evaluation was conducted on 29 October 1986. The information presented in this report is current, as of the date of the evaluation. The following personnel from ESE, under Contract No. DAAA15-85-D-0017, Delivery Order No. 0004, were assigned to the evaluation team:
 - o Dr. John D. Bonds, Team Leader;
 - o Ms. Janet K. Sherwood, Document Coordinator; and
 - o Ms. Kathleen A. Becker, Librarian.
7. In addition to the records review, installation employees were contacted to obtain information on various CAAA activities (see App. A). A ground tour of NWSC-Crane (including the CAAA areas) was made, and photographs were taken.

8. The installation update focused primarily on those areas identified as potential problems in the original assessment and environmental studies performed subsequent to the original IIA visit.

1.4 INSTALLATION HISTORY

In 1940, Congress appropriated funds to build new inland ammunition production facilities that would be secure from enemy attack. The Naval Ammunition Depot (NAD), Burns City, IN, was constructed using approximately 14,164 hectares (ha) of land from the White River Land Utilization Project, a public land acquisition project begun in 1934, and 18,856 additional ha from private ownership. The depot was officially commissioned on 1 December 1941. On 1 May 1943, NAD, Burns City was renamed NAD, Crane.

During World War II (WWII), there were more than 112,000,000 pounds (lb) of high explosives and 86,000,000 lb of smokeless powder stored in the various magazines. At one time, there were also 54,000 500-lb bombs stored at NAD, as well as other types of bombs and 5,000 torpedoes. Guns, rockets, gun mounts and parts, automotive equipment, and aviation and underwater ordnance were also stored there in the mid-1940s. A chemical warfare area was established in the high explosives area at Crane early in WWII for the purpose of unloading, storing, and servicing chemical warfare material. The first items stored were 155-millimeter (mm) mustard shells. In January 1945, Crane became a major storage point in the Navy for chemical warfare munitions.

After WWII, thousands of carloads of equipment and materials arrived at Crane for storage, preservation, sorting, scrapping, or shipment.

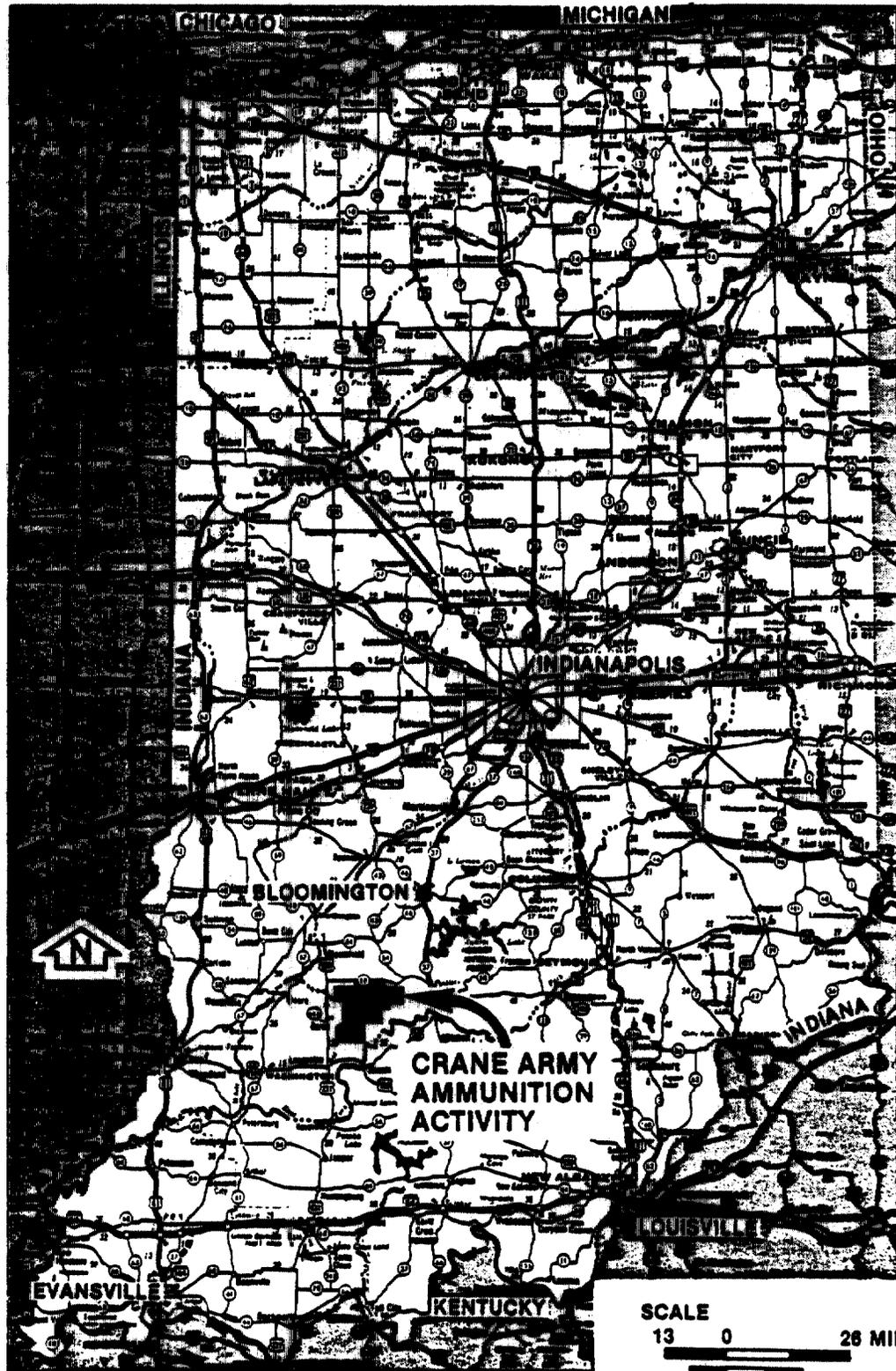
Crane successfully met its purpose of providing ammunition to the Fleet during the Korean and Vietnam Conflicts, reaching a high level of ordnance production in 1967-68 with approximately 1,000,000 MK68 and MK82 bombs; 500,000 major caliber projectiles; and 500,000 MK24 flares being produced.

Over the years, the need for scientific and engineering personnel at Crane has increased, while the need for laborers, helpers, and munitions workers has decreased. On 1 July 1975, NAD, Crane was renamed NWSC-Crane to more accurately reflect the expanded scientific and engineering functions.

The 25,280-ha tract of land which currently comprises the real estate holdings of NWSC-Crane is located in southwest Indiana. It lies approximately 120 kilometers (km) southwest of Indianapolis, IN and 114 km northwest of Louisville, KY and is located within Martin County. The immediate area surrounding the installation is rural in nature, with extensive farmland bordering all sides. The Indiana communities of Bedford, Washington, Loogootee, Shoals, Bloomfield, and Bloomington all are located within 48 km of the NWSC boundaries (see Fig. 1-1).

The facility, previously known as NAD, Burns City, was opened in 1941 to serve as an inland ammunition storage and production activity. Today, the Center's mission is to provide material, technical, and logistic support to the Navy for ships and crafts equipment, shipboard weapons systems, and assigned expendable and nonexpendable ordnance items; and to perform additional functions as directed by the Commander, Naval Sea Systems Command.

In 1977 the single service manager concept placed conventional ammunition procurement responsibility, for all branches of the military, with a single branch--the Army. Under the Single Service Management Program and included in a resulting Interservice Support Agreement, a segment of the



SCALE
13 0 26 MILES

13 0 13 26 KILOMETERS

SOURCES: Rand McNally, 1984; ESE, 1987.

Figure 1-1
LOCATION OF CRANE ARMY
AMMUNITION ACTIVITY

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U.S. Army Toxic and Hazardous
Materials Agency
Aberdeen Proving Ground, Maryland

Center's mission is to provide support (including environmental protection) to CAAA, a tenant on Center. The Army has assumed ordnance production, storage and related responsibilities under the single service manager directive. The Army is tasked with the production and renovation of conventional ammunition and related items; the performance of manufacturing, engineering, and product quality assurance to support production; and the storage, shipment, and/or demilitarization and disposal of conventional ammunition and related components. The operations of CAAA correspond to those formerly performed by the Crane Ordnance Department. Former employees from this department (approximately 700) were transferred to the Army payroll. The CAAA is headed by a commanding officer, generally holding the rank of lieutenant colonel or above, who maintains a small administrative staff. Responsibility for station safety security and environmental protection remains with the commanding officer, NWSC-Crane.

The number of employees at Crane has varied from a high of approximately 10,000 during WWII; 4,700 during the Korean Conflict; 7,000 during the Vietnam Conflict, to the current level. Approximately 4,400 people are currently employed at Crane in 21 departments and 6 tenant activities. Crane Army Ammunition Activity is the largest tenant organization on NWSC-Crane and has a workforce of 898. These personnel are engaged in a variety of functions and processes to accomplish the missions of the Navy and Army.

2.0 CONCLUSIONS, RECOMMENDATIONS, AND CURRENT STATUS
OF RECOMMENDATIONS RESULTING FROM THE 1978
INITIAL INSTALLATION ASSESSMENT OF CRANE
ARMY AMMUNITION ACTIVITY

2.1 CONCLUSIONS (AS STATED IN THE IIA PUBLISHED BY USATHAMA IN 1978)

1. Past Explosive Operations

Several areas of the installation (including the explosive and pyrotechnic areas, burial and burning sites, landfills, and test ranges) are suspected of being contaminated with toxic and hazardous materials. No firm conclusions can be drawn regarding migration of contaminants from past manufacturing, demilitarization, and disposal operations because of limited surface and subsurface water data.

2. Current Manufacturing Operations

A potential exists for contamination from current manufacturing operations to exit the installation via unmonitored surface and subsurface waters. Of particular concern is explosive waste (Red Water) from the Rockeye operation which is dumped into Sulphur Creek. This creek is one of several creeks in the eastern and southern areas of the installation not monitored under the installation's water quality program. In addition, NWSC is exceeding discharge limits imposed by the National Pollutant Discharge Elimination System (NPDES) permits.

3. Lake Greenwood

Because Lake Greenwood is not monitored by the installation for the presence of explosive or pyrotechnic waste materials, the possibility exists for the lake to be contaminated by those waste materials.

4. Chemical Agent Burial Ground

An unknown quantity of mustard munitions is still buried at the Chemical Agent Burial Ground. The area is fenced; however, the exact location and number of burial pits is not known. Based on location of the burial ground, the possibility of contaminant migration beyond installation boundaries is considered remote.

5. Burial of Pyrotechnic Dyes

An estimated 50,000 lb of pyrotechnic smoke is buried at the Ordnance Burning Ground. During periods of heavy rain, colored materials seep from the filled pits. Since the dyes remain buried, a potential exists for them to migrate via surface and subsurface waters.

6. Water Monitoring Program

The installation's present water monitoring program does not include analysis for explosive waste materials nor does it monitor all streams exiting the installation.

2.2 RECOMMENDATIONS (AS STATED IN THE IIA PUBLISHED BY USATHAMA IN 1978)

At the time of the 1978 IIA, the installation designated as NWSC-Crane was owned and operated by the U.S. Navy. The U.S. Army (as CAAA), a tenant on the installation, was not responsible for environmental affairs and interaction with regulatory agencies; therefore, no recommendations were made for actions by CAAA.

2.3 CURRENT STATUS OF RECOMMENDATIONS PRESENTED IN THE 1978 INITIAL INSTALLATION ASSESSMENT

No recommendations were made as part of the 1978 IIA. Several conclusions were made, however, and the installation has taken action on several items of environmental concern. Those areas of environmental concern which have been addressed since the 1978 IIA are discussed in Section 3.0.

3.0 ENVIRONMENTAL PROBLEMS IDENTIFIED AND
OTHER CHANGES SUBSEQUENT TO THE 1978 INITIAL
INSTALLATION ASSESSMENT OF CRANE ARMY AMMUNITION ACTIVITY

3.1 ENVIRONMENTAL PROBLEMS IDENTIFIED

3.1.1 NACIP STUDY

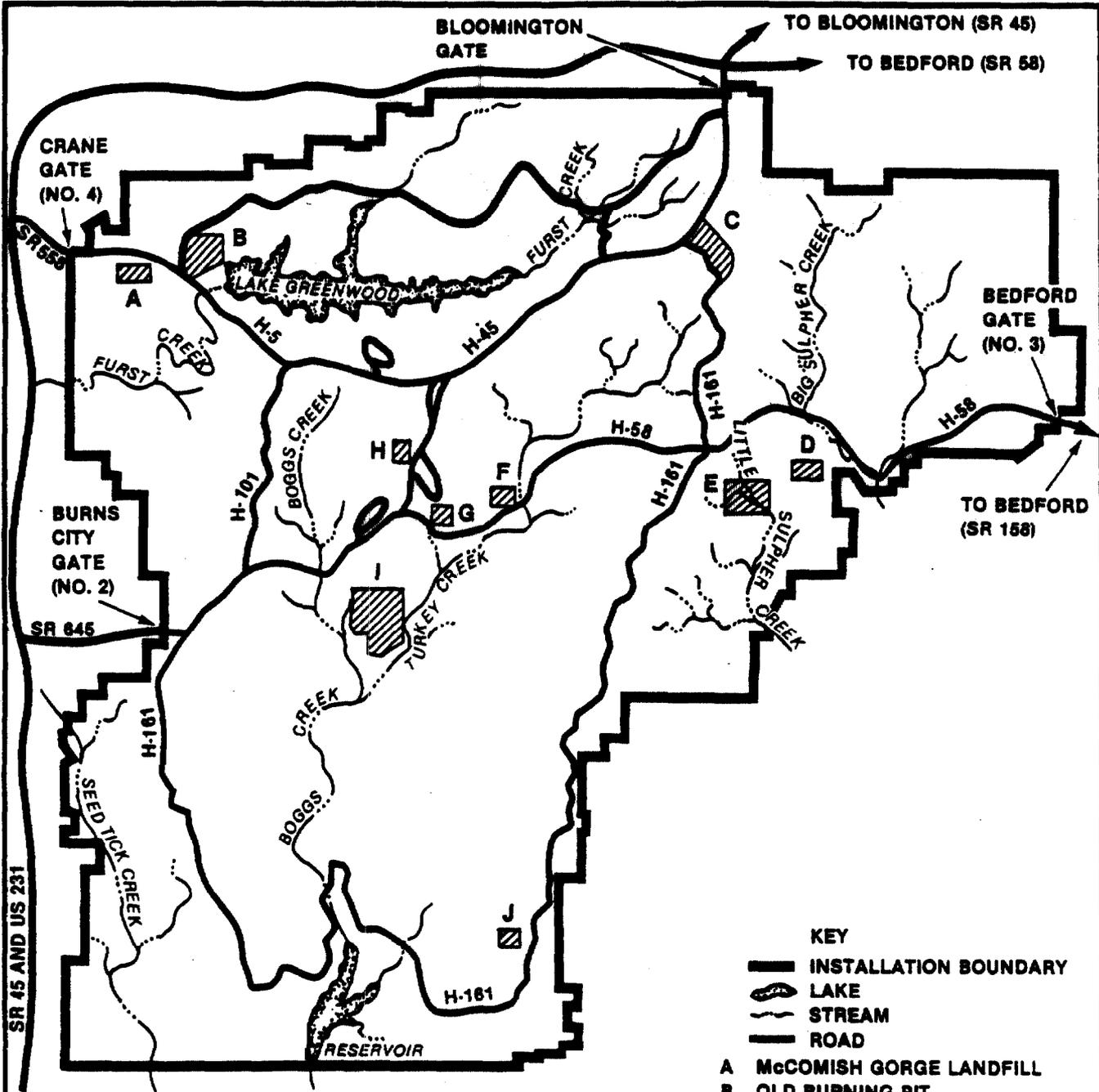
Since the 1978 IIA was published by USATHAMA, NEESA completed an Initial Assessment Study (IAS) of NWSC-Crane, in 1981 under the Naval Assessment and Control of Industrial Pollutants (NACIP) Program. Areas of potential concern identified (see Fig. 3-1) in the IAS included: McComish Gorge Landfill (A), Old Burning Pit (B), Rockeye Area (C), Dye Burial Ground (D), Ammunition Burning Ground (E), Pest Control Area (H), Demolition Area (I), and Mustard Gas Burial Area (J). A brief description of each of these areas, including actions addressed by the confirmation study, is included in the following sections.

McComish Gorge

During the IAS, it was reported that ordnance and non-ordnance wastes were placed in McComish Gorge. Specific quantities and types of wastes were not verifiable. Because hazardous wastes were reportedly disposed of at this location, the potential existed for ground water contamination. The installation, with the assistance of the U.S. Army Corps of Engineers (CE), Waterways Experiment Station (WES) installed six ground water monitoring wells. The ground water was analyzed, and no contamination was detected. The installation has continued monitoring these wells as part of an ongoing water quality program.

Old Burning Pit

From 1942 until 1972, garbage and trash were burned at this location. Ordnance was not burned at this location. Residue from the burning pit was buried in a gully to the north of the pit, along with nonburnable metallic items. Potentially contaminated leachate could migrate into the ground water from this location.



- KEY**
- INSTALLATION BOUNDARY
 - LAKE
 - STREAM
 - ROAD
- A MccOMISH GORGE LANDFILL
 - B OLD BURNING PIT
 - C ROCKEYE AREA
 - D DYE BURIAL GROUNDS
 - E AMMUNITION BURNING GROUNDS
 - F HIGHWAY 58 DUMP A
 - G HIGHWAY 58 DUMP B
 - H PEST CONTROL AREA
 - I DEMOLITION AREA
 - J MUSTARD GAS BURIAL GROUND
- SOURCES: NWSC, 1986; ESE, 1987.

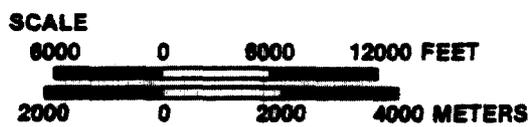


Figure 3-1
LOCATIONS OF AREAS WHERE
CONFIRMATION STUDIES
HAVE BEEN INITIATED

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Materials Agency
Aberdeen Proving Ground, Maryland

Nineteen ground water monitor wells were installed at this location by WES as part of a confirmation study. The analysis of the ground water at this location indicated contamination by trans 1,2-dichloroethylene, chloroform, and trichloroethylene. Ground water monitoring is continuing at this location.

Rockeye Area

Until a treatment facility was installed in 1978, wastewater discharges from the Rockeye Area, Bldgs. 2731 and 2734, included TNT, HMX, and RDX constituents. It was determined that the two discharge points had the potential to drain into surface water tributaries during wet weather and to recharge the upper ground water table during dry weather.

As part of a ground water confirmation study, monitor wells were installed and samples were analyzed. The results of the ground water study indicated contamination by munitions type compounds. Monitoring is continuing at this location.

Dye Burial Grounds

From 1952 to 1964, about 50 tons of dyes, including toxic and potentially carcinogenic dyes, were buried at the Dye Burial Grounds. Because these dyes are a potential source of ground water contamination, a confirmation study was initiated. Eight ground water monitor wells were installed at this location and ground water monitoring was initiated. The results of the monitoring did not indicate any ground water contamination. Ground water monitoring is continuing at this location.

Ordnance Burning Grounds

Since the early 1940s, all ordnance and ordnance-contaminated materials from production areas have been taken to the Ordnance Burning Grounds for disposal. The area where these materials are disposed of by burning is located in a valley which contains an active stream. This stream flows into Little Sulphur Creek. Although current monthly surface water

analyses have found no contamination of Little Sulphur Creek to date, the potential for surface water and ground water contamination exists. As part of a confirmation study, 25 monitor wells were initially installed at this location. The results from this study indicated the ground water was contaminated. The installation is continuing the ground water monitoring program. At the time of the 1986 visit, the installation, through a contract with WES, was installing additional wells at this location.

Pest Control Area

In the 1960s and early 1970s, pesticide spray tanks and containers were rinsed in the parking lot at Bldg. 2189. A washrack connected to the sanitary sewer was installed in 1977. Because the potential accumulation of pesticide residue on the lot and in the surrounding soil presents a potential for surface water contamination due to runoff and for ground water contamination from percolation, a confirmation study was initiated. Nine ground water monitor wells were installed, and soil sampling was conducted. The results of this study indicated elevated levels of total organic halides (TOX) present in the ground water.

Demolition Area

High-explosives waste munitions have been disposed of by detonation at the Demolition Area since the 1940s. As much as 10 tons per day were disposed of at this location from 1956 to 1960. The area is located on a ridge. The sedimentation pond on Highway 333 and three other sedimentation ponds constructed in 1985 are located downslope from the Demolition Area, but surface runoff may also exit the Demolition Range down the Boggs Creek side and the Turkey Creek side of the ridge. Because surface water discharge and percolation into ground water may potentially transport contaminants to the ground water, to Boggs Creek, or to Turkey Creek, a confirmation study was initiated at this location. As part of the study, surface runoff water from the ponds was sampled and analyzed for solids content and pH. In addition, 19 monitor wells were installed, and ground water samples were collected for analysis. The results of these analyses indicated ground water contamination. The installation is continuing the ground water monitoring program at this location.

Mustard Gas Burial Area

The Mustard Gas Burial Area received materials such as mustard gas bombs and thorium nitrate. The mustard gas bombs were neutralized and the thorium nitrate was removed to a Nuclear Regulatory Commission (NRC)-approved landfill in 1974 and 1980. However, all the contaminated material may not have been removed. This is especially possible because thorium nitrate is highly soluble in water. Any remaining contaminated material could potentially migrate into ground water.

Because the possibility for contamination of the ground water exists, 16 monitor wells were installed as part of a confirmation study. The results from the analysis of ground water from this area indicate elevated TOX. The installation is continuing the monitoring program at this location.

3.2 OTHER CHANGES

3.2.1 ADDITIONAL WES STUDY AREAS

During 1981 to 1984, when WES was installing monitor wells as part of a confirmation study, two additional potential areas of contamination were identified--Highway 58 Dump Area A and Highway 58 Dump Area B (see Fig. 3-1). These areas potentially received hazardous materials, and the ground water was potentially contaminated.

Five monitor wells were installed at Dump Area A, and nine wells were installed at Dump Area B. The results of the monitoring did not indicate any contamination of the ground water.

3.2.2 RCRA PERMIT STATUS

Since the 1978 IIA; NWSC-Crane has filed both Part A and Part B permit applications as required by EPA. As required by the Part B permit application, the installation was in the process of identifying all solid waste management practices to assist EPA in determining the potential for

release and planning corrective action measures for all potential releases. The installation is working closely with EPA to identify and rectify any problem areas.

3.2.3 SURFACE WATER QUALITY MONITORING

At the time of the 1978 IIA, it was concluded that lakes and streams on NWSC-Crane could be contaminated and the contaminants could be migrating from the installation. Since the onsite visit, the installation has initiated a water quality program. To ensure the quality of the waterways exiting the base, the Center monitors surface waters for cyanides, heavy metals, explosives (TNT, RDX, and HMX), oil and grease, and chlorides. Monthly analyses have shown that the surface waters are within limitations for the above constituents for Turkey, Furst, Boggs, Big Sulphur, Little Sulphur, and Seed Tick Creeks.

3.3 POTENTIAL CONTAMINATION AREAS IDENTIFIED FROM PHOTOGRAPHIC IMAGERY

The U.S. States Environmental Protection Agency's Environmental Photographic Interpretation Center, under contract to USATHAMA, prepared a report in which potential contamination areas on CAAA were identified. These areas were identified based on ground staining, ground scarring, open trenches, aboveground tanks, sludge beds, equipment storage areas, and other signatures which are readily recognizable to aerial photographic imagery experts.

Potential contaminated areas identified at CAAA are listed in Table 3-1. Descriptions of the areas are also given in Table 3-1. The locations of these areas are shown in Figure 3-2. One new area was added to the report as a result of the EPIC study. The study proved very useful in confirming the existence and areal extent of various potential areas identified in the 1978 IIA.

Table 3-1. Description of Potential Contaminated Areas Identified From Aerial Photographic Imagery

Area No.	EPIC Description of Area	Assessment of Area
1	<p>Excavated areas, with smaller areas of standing liquid were observed in photographs from 1953 through 1958. An unidentifiable structure was present in the southwest corner of the area. Scarred areas were observed surrounding the excavation. Photographs from 1966 do not show any standing liquid and shows the structure has been removed. 1974 photographs, the area is filled with pooled liquid. Areas surrounding the excavation were revegetated in the photographs from 1974 to date.</p>	<p>Available information indicates garbage and trash were burned at this old burning ground from 1942 until 1973. Residue from the pits was buried in a gully to the north of the area. One monitor well was installed following the NACIP survey and no contamination was detected. The WES study in 1983 determined that concentrations of trans-1,2-dichloroethylene, chloroform, and trichloroethylene had exceeded 50 micrograms per liter (ug/L) in 2 of 19 monitor wells. The contaminated plume was calculated to be approximately 90 to 195 ft in width and 500 feet (ft) in length, and moving in a north-northwest direction. Ground water monitoring studies have continued at the location.</p>
2	<p>This area was identified as a tank farm in 1953. The farm contained 17 tanks. Ground staining around the tanks was observed.</p>	<p>The area is confirmed as a tank farm. No investigations of activities have been conducted at the tank farm.</p>
3	<p>This area was identified as the Rockeye manufacturing area. Ground scarring and drainage pathways were observed in photos from 1953 and 1956.</p>	<p>This area is the Rockeye manufacturing area. Discharges from the area included TNT, HMX and RDX. A treatment plant was installed in 1978. Two wells were installed in this area by WES. The results indicate contamination is present. Twenty additional wells were installed in 1983.</p>

Table 3-1. Description of Potential Contaminated Areas Identified From Aerial Photographic Imagery
(Continued, Page 2 of 5)

Area No.	EPIC Description of Area	Assessment of Area
4	This area was identified as the 40-mm Loading Complex. Drum storage areas are identified in 1948 aerial photographs. Ground staining was observed in photographs from 1948 and 1958. Ground staining was observed in photographs from 1953 and 1974.	This area includes Bldg. 146, the cast high explosive fill location. Wastewater discharges containing RDX, TNT, and ammonium picrate have been released from this facility. In addition, lead, chromium, and cadmium were potentially discharged from a furnace. Monitor wells were installed and sampling events have been conducted. Since the treatment system was installed at the Rockeye area, contaminants generated at Bldg. 146 have been transported to that location for treatment.
5	This area was identified as the pyrotechnic area. The roofs of buildings appeared stained, the ground is scarred, and stains were observed in several areas.	This area is the major industrial area on CAAA. No monitoring of the area has been performed.
6	Ground scarring, buried pipelines, and erosion are apparent in photographs from 1948.	This area is the Booster Area where initiating devices containing tetryl, lead azide, and lead styphnate are loaded into canisters. Prior to 1978, large quantities of booster devices were loaded with TNT and tetryl. The 1978 IIA report indicated that the operation was well controlled and no contaminated materials entered the sewer lines. No monitor wells have been installed in the area.

Table 3-1. Description of Potential Contaminated Areas Identified From Aerial Photographic Imagery
(Continued, Page 3 of 5)

Area No.	EPIC Description of Area	Assessment of Area
7	<p>The photographs from 1948 show ground scarring related to building construction and a pipeline leading to Area 9. The photograph from 1966 shows a circular basin on the southern tip of area with dark-toned liquid. A photograph from 1974 shows the basin contains less liquid than in prior photographs.</p>	<p>This area is identified as Mine-Filling Area A, a cast loading area. In the past, considerable quantities of TNT and RDX were used in munitions processed at this area. The 1978 IIA reports contamination in the area could result from both wastewater disposal and washdown of materials from the roof which accumulated from the discharge of the ventilation system. A wastewater system was installed prior to the 1978 IIA. Soil sampling in the area indicated explosives contamination.</p>
8	<p>Dark-toned ground staining was observed in photographs from 1948 and 1958 of a storage area. A smokestack and vertical tanks were also observed. The roofs of the production buildings were also seen.</p>	<p>This area is the load and fill (Bldgs. 106 and 107) area. Rework operations in these buildings generated acid and caustic wastes. Prior to 1972, waste was discharged into a small unlined pond. The overflow from the pond discharged into a neutralizing system, with the neutralized wastewater discharging into a sanitary sewer. The NACIP report recommended a 1-time sampling of the pond sediment for mercury, chromium, phosphorous, and trichloroethylene.</p>
9	<p>Ground scars were observed in the 1948 photograph and along the pipeline connecting with Area 7. In 1966, roofs of buildings appeared stained. A photograph from 1974 shows possible liquid draining from southern end of building.</p>	<p>This area is Mine-filling Area B. Staining on the roofs apparently resulted from ventilation system discharge. Washdown from roofs and wastewater disposal are potential sources of drainage. Soil sampling was conducted for evidence of TNT, HMX, and RDX contamination. Contamination by explosives was detected at this location.</p>

Table 3-1. Description of Potential Contaminated Areas Identified From Aerial Photographic Imagery
(Continued, Page 4 of 5)

Area No.	EPIC Description of Area	Assessment of Area
10	Beginning in 1948, the aerial photographs show trenches, ground staining, vehicle access roads, buildings, and a pipeline between the buildings and trenches.	This area is the Ordnance Burning Grounds where ordnance materials are burned and disposed. A stream runs through the area and flows into Little Sulfur Creek. Current practice is to collect residual ash and dispose of it in a hazardous waste landfill. Based on the NEESA survey, wells were installed and samples analyzed for total organic carbons (TOC), TNT, RDX, HMX, and ammonium picrate. TOC has been measured in the 20 to 40 milligrams per liter (mg/L) range during multiple sampling events. Explosives were not detected.
11	The area is comprised on multiple pits with ground scarring and staining. A flash pad is evident.	This area is the high explosives demolition area. This area has been in use since 1940, with as much as 10 tons per day of materials disposed of in this area from 1956 to 1960. The NEESA survey recommended the installation of wells to test for TOC, RDX, HMX, and ammonium picrate. Thirteen wells were installed and monitored. TOCs ranging from 10 to 25 mg/L were observed and explosives were detected.
12	This area was described by EPIC as a partially dismantled barracks with a large circular ground scar and possible revetment or burning stall and a possible vertical tank.	This area is Cranewood Barracks, an area not used for production or disposal of any potentially hazardous materials. Although the area was inspected during the visit, no evidence of any contamination was observed.

Table 3-1. Description of Potential Contaminated Areas Identified by Photographic Imagery
(Continued, Page 5 of 5)

Area No.	EPIC Description of Area	Assessment of Area
13	The 1948 photograph does not show any evidence of a potential landfill. The 1953 photograph shows a trench method landfill under operation. The 1958 photograph shows a landfill no longer active and almost completely revegetated. Photographs from 1966 and 1974 show vegetative cover in all of the northwestern corner of the landfill area.	This area is a landfill which was not previously identified in NEESA survey or IIA. No monitoring of the area has occurred.
14	No evidence of activity until the 1974 photograph showing a disturbed area with three large trenches and a pool of standing liquid visible between two of the trenches. Materials are mounded at trench sides. A small rectangular liquid impoundment is visible west of the area of disturbed ground.	This area is used for collection of sanitary landfill leachate. Monitor wells have been installed around the area. No contamination data are reported.
15	Area is identified as mustard gas burial area.	Area was used as a burial ground for materials, such as mustard gas bombs and thorium nitrate. The mustard gas bombs were neutralized and the thorium nitrate removed to an NRC-approved landfill in 1974 and 1980. Five monitor wells were installed following the NEESA survey. TOCs ranging from 3 to 56 mg/L have been measured.

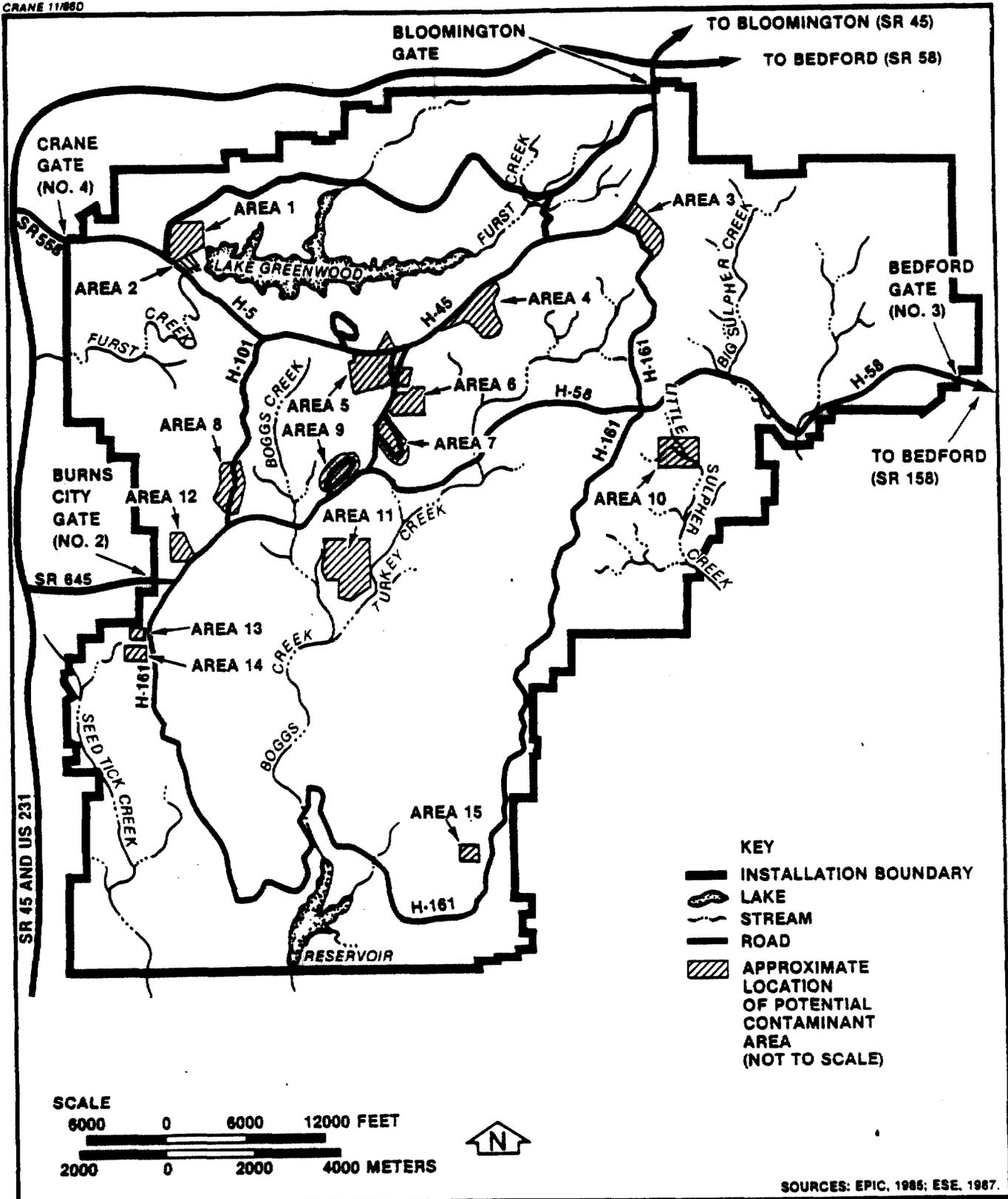


Figure 3-2
LOCATIONS OF POTENTIAL CONTAMINATION
AREAS IDENTIFIED FROM AERIAL
PHOTOGRAPHIC IMAGERY

Prepared for:
U.S. Army Toxic and Hazardous
Materials Agency
Aberdeen Proving Ground, Maryland

4.0 1986 EVALUATION OF CRANE ARMY AMMUNITION ACTIVITY

4.1 FINDINGS

4.1.1 ENVIRONMENTAL RESPONSIBILITY

Crane Army Ammunition Activity is a tenant operation on NWSC-Crane. All facilities used by CAAA are maintained by the Navy Public Works Center. The Navy maintains responsibility for treatment, storage, and disposal of all liquid or solid sanitary and industrial wastes generated by the Navy and tenant operations on the installation, with the exception of three explosives contaminated wastewater treatment facilities operated by CAAA. These facilities are operated and maintained by the Army to assure the treated effluent meets NPDES requirements.

The Navy also maintains responsibility for interaction with all government environmental agencies and compliance with all applicable environmental regulations. Crane Army Ammunition Activity is responsible for complying with the NWSC-Crane environmental program.

4.1.2 CONFIRMATION STUDIES

As a result of the 1978 IIA, the NACIP IAS completed by NEESA in 1981, the Resource Conservation and Recovery Act (RCRA), and the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), the installation contracted WES to institute confirmation studies at many of the potential areas of contamination identified in the above-mentioned reports and at other areas identified subsequent to the reports.

As a results of these studies, ground water contamination was detected at five of the locations where monitor wells were installed (Old Burning Pit, Rockeye Area, Ordnance Burning Ground, Mustard Gas Burial Area, and Pest Control Area). At the time of the onsite visit, the installation was completing additional monitor wells and continuing the ground water monitoring program. The extent of ground water contamination has not been established; however, none of the contaminated aquifers is used for drinking water by the installation.

The installation has also established a surface water analysis program to monitor the quality of waterways exiting the base. Parameters monitored includes cyanides, heavy metals, explosives (TNT, RDX, and HMX), oil and grease, and chlorides. The surface water monitoring studies have not detected any contaminants at levels exceeding established regulatory limitations.

4.1.3 RCRA PERMIT STATUS

Since the 1978 IIA; NWSC-Crane has submitted their Part A and Part B permit applications as required by regulatory agencies. At the time of the onsite visit, the installation was in the process of identifying all solid waste practices to assist EPA in determining the potential for release of contaminants and planning corrective measures to minimize any releases. The installation works closely with EPA to identify and rectify potential problem areas.

4.2 CONCLUSIONS

1. Crane Army Ammunition Activity is only a tenant on NWSC-Crane, and the Navy is responsible for all environmental activities completed on the installation with respect to the treatment, storage, and disposal of all liquid or solid sanitary and industrial wastes generated by the Navy and tenant operations, with the exception of the three explosives contaminated wastewater treatment facilities operated by the Army to meet the environmental requirements of the Navy and the NPDES regulations.
2. Naval Weapons Support Center-Crane has performed site investigations and identified areas of contamination.

4.3 RECOMMENDATION

It is recommended that CAAA work with NWSC-Crane to minimize any environmental impact from Army operations.

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APPENDIX A--CAAA AND NWSC PERSONNEL CONTACTED

PERSONNEL

<u>Name</u>	<u>Organization</u>
Randall Burcham	CAAA
Jim Hunsicker	NWSC