HA-1852

Blgs. E5188 & E5190 (Buildings 90 & 90A)

Architectural Survey File

This is the architectural survey file for this MIHP record. The survey file is organized reverse-chronological (that is, with the latest material on top). It contains all MIHP inventory forms, National Register nomination forms, determinations of eligibility (DOE) forms, and accompanying documentation such as photographs and maps.

Users should be aware that additional undigitized material about this property may be found in on-site architectural reports, copies of HABS/HAER or other documentation, drawings, and the "vertical files" at the MHT Library in Crownsville. The vertical files may include newspaper clippings, field notes, draft versions of forms and architectural reports, photographs, maps, and drawings. Researchers who need a thorough understanding of this property should plan to visit the MHT Library as part of their research project; look at the MHT web site (mht.maryland.gov) for details about how to make an appointment.

Last Updated: 02-18-2004

Survey No. HA-1852
Buildings E5188 and E5190
Edgewood Area, Aberdeen Proving Ground
Harford County, Maryland

MARYLAND COMPREHENSIVE HISTORIC PRESERVATION PLAN DATA

Geographic Organization: Piedmont

Chronological/Developmental Period(s):
Modern Period A.D. 1930-Present

Prehistoric/Historic Period Theme(s): Military

Resource Type:

Category:	Building
Historic Environment:	Military installation/Industrial
Historic Function(s) and Use(s):	Chemical Munitions Filling Plant
Known Design Source:	Construction Division, Office of the Quartermaster General; Whitman, Requardt & Smith, Engineers, Baltimore, Maryland

MARYLAND INVENTORY OF HISTORIC PROPERTIES

Survey No. HA-1852

Magi No.

DOE __yes __no

Maryland Historical Trust State Historic Sites Inventory Form

1. Name (indicate preferred name)

historic Buildings 90 and 90A

and/or common Buildings E5188 and E5190 (preferred)

2. Location

street & number South of Magnolia Road _NA not for publication

city, town Edgewood _x vicinity of **congressional district** 2

state Maryland **county** Harford

3. Classification

Category	Ownership	Status	Present Use	
___ district	_x_ public	_x_ occupied	___ agriculture	___ museum
_x_ building(s)	___ private	___ unoccupied	___ commercial	___ park
___ structure	___ both	___ work in progress	___ educational	___ private residence
___ site	**Public Acquisition**	**Accessible**	___ entertainment	___ religious
___ object	___ in process	_x_ yes: restricted	___ government	___ scientific
	___ being considered	___ yes: unrestricted	___ industrial	___ transportation
	_x_ not applicable	___ no	_x_ military	___ other:

4. Owner of Property (give names and mailing addresses of all owners)

name Department of the Army, Aberdeen Proving Ground

street & number Real Estate Section, Directorate of Public Works **telephone no.:** 410-278-7688

city, town Aberdeen Proving Ground **state and zip code** MD 21005-5001

5. Location of Legal Description

courthouse, registry of deeds, etc. Real Estate - Section, DPW **liber**

street & number **folio**

city, town Aberdeen Proving Ground **state** MD

6. Representation in Existing Historical Surveys

title Historic American Engineering Record MD-47

date 1982 _x_ federal ___ state ___ county ___ local

depository for survey records Library of Congress, Prings and Phfotographs Division

city, town Washington **state** D.C.

7. Description

Survey No. HA-1852

Condition		Check one	Check one
___ excellent	___ deteriorated	_x_ unaltered	_x_ original site
__x__ good	___ ruins	___ altered	___ moved date of move _____
___ fair	___ unexposed		

Prepare both a summary paragraph and a general description of the resource and its various elements as it exists today.

(See Continuation Sheet)

8. Significance

Survey No. HA-1852

Period	Areas of Significance—Check and justify below			
___ prehistoric	___ archeology-prehistoric	___ community planning	___ landscape architecture	___ religion
___ 1400–1499	___ archeology-historic	___ conservation	___ law	___ science
___ 1500–1599	___ agriculture	___ economics	___ literature	___ sculpture
___ 1600–1699	___ architecture	___ education	_x_ military	___ social/ humanitarian
___ 1700–1799	___ art	___ engineering	___ music	___ theater
___ 1800–1899	___ commerce	___ exploration/settlement	___ philosophy	___ transportation
_x_ 1900–	___ communications	___ industry	___ politics/government	___ other (specify)
		___ invention		

Specific dates 1942 - 1945 **Builder/Architect** Construction Division, Office of the Quartermaster General; Whitman, Requardt, Smith, Engineers

check: Applicable Criteria: _x_A __B _x_C __D
and/or
Applicable Exception: __A __B __C __D __E __F __G

Level of Significance: _x_national __state __local

Prepare both a summary paragraph of significance and a general statement of history and support.

(See Continuation Sheet)

9. Major Bibliographical References

Survey No. HA-1852

(See Continuation Sheet)

10. Geographical Data

Acreage of nominated property less than 1 acre

Quadrangle name Edgewood **Quadrangle scale** 1:24000

UTM **References** do NOT complete UTM references

A	Zone	Easting	Northing	B	Zone	Easting	Northing
C				D			
E				F			
G				H			

Verbal boundary description and justification

(See Continuation Sheet)

List all states and counties for properties overlapping state or county boundaries N/A

state	code	county	code
state	code	county	code

11. Form Prepared By

name/title Katherine Grandine/Historian

organization R. Christopher Goodwin & Associates, Inc **date** September 1994

street & number 337 East Third STreet **telephone** 301- 694-0428

city or town Frederick **state** MD

The Maryland Historic Sites Inventory was officially created by an Act of the Maryland Legislature to be found in the Annotated Code of Maryland, Article 41, Section 181 KA, 1974 supplement.

The survey and inventory are being prepared for information and record purposes only and do not constitute any infringement of individual property rights.

return to: Maryland Historical Trust
Shaw House
21 State Circle
Annapolis, Maryland 21401
(301) 269-2438

7. DESCRIPTION

CONTRIBUTING RESOURCE COUNT: 2 buildings

Buildings E5188 and E5190 comprise a two-building complex originally constructed as an industrial facility used to fill chemical munitions. Building E5188 was the chemical munitions filling plant while Building E5190 was the chemical storage building. The complex is located in the manufacturing area of Edgewood Arsenal, an area that encompasses approximately ten manufacturing and shell-filling complexes, administrative buildings, and infrastructure buildings.

Building E5188 is a rectangular building with a footprint that measures approximately 73 x 306 feet. A small wing projects from the west elevation and measures 6 X 21 feet. The building employs two types of construction. The eastern end of the building is constructed with a bolted steel-frame. Twelve structural bays defined by framing members are spaced 24 feet on center. The exterior walls of the east end of the plant are clad with corrugated asbestos siding (transite). The western 63-feet of the building contains two structural bays and is constructed of reinforced concrete. Though one-story, the western end of the building is slightly taller in scale than the eastern end of the building.

The complete building is supported by a concrete foundation. The windows in the eastern end are steel-frame industrial sash while windows in the western end are steel-frame casement units. The building has a gable roof clad with corrugated transite. The roof includes skylights and numerous metal air vents.

A concrete loading platform spans the south elevation. Eight doors open onto the platform: two loading doors, six double doors, and one single door. Two sliding metal doors are located on the west elevation. The north elevation includes one loading door and three sets of double doors. One set of double doors is found on the east elevation.

The interior finishes of Building E5188 are utilitarian. The walls are clad in layers of asbestos insulation. The building includes a irregular floor plan which has been modified over time. Original partitions are metal frame units, which are infilled with transite panels. Partitions added to the building following its

construction are concrete block.

A mechanical air ventilation system is located on the north side of Building E5188, east of the concrete section of the building. The system comprises an air washer, an induction fan, electrical motors, and an exhaust pipe. The system originally was attached to Building E5188 through a large circular metal tube; the connection to the building has been cut. The tube originally exited Building E5188 through an underground concrete trench and entered the air washer above grade. The air washer is a cylinder with an exterior metal ladder. A small pipe is located on the western side of the cylinder and was used to pump water to the top of the system. The cylinder also is attached to the building by two other above-ground pipes. A small metal pipe extends from the top of the large cylinder to a square metal clean-out box located on the ground; this box has a metal door. Air exits the cylinder through a metal exhaust pipe located above the induction draft fan.

Building E5190 is a one-story building that measures 38 x 25 feet. The building is constructed in concrete and includes a corrugated-asbestos roofing. Metal-frame casements are located on all elevations. Paired metal-clad wood doors are located on both the south and east elevations.

8. SIGNIFICANCE

Introduction

The objective of this investigation was to document and to assess the potential significance of a free-standing air ventilation system associated with Building E5188 at Edgewood Arsenal, Aberdeen Proving Ground applying the criteria for evaluation of The National Register of Historic Places (36 CFR 60.4). Building E5188 is the principal structure in a two-building industrial site that includes a chemical plant (E5188) and a storage building (E5190).

The air ventilation system was assessed as both (1) a component of Building E5188, which may contribute to its overall integrity, and (2) as a structure, which may possess significance as an engineering property. The investigation does not suggest that the ventilation system, which was in-service between 1941-1945, is a character defining feature important to the overall integrity of the Building E5188, nor does it possess individual importance.

Summary: Significance

Buildings E5188 and E5190 comprise an industrial site that was associated with the primary mission of Edgewood Arsenal during World War II (Criterion A), when the installation served as the Headquarters for the Chemical Warfare Service. The installation also was the center of experimentation in chemical weapons. The manufacturing plants at Edgewood Arsenal augmented large-scale chemical production lines located at other chemical arsenals, produced specialized munitions, and undertook research and develop at experimental pilot plants. Buildings E5188 and E5190 originally served as a fulminating smoke (FS), chloroacetophenone and chloropicrin in chloroform (CNS), and carbon tetrachoride and benzene (CNB) filling plant; these chemical munitions were not mass produced at the other major chemical arsenals. In 1945, an experimental plasticized white phosphorus (PWP) shell filling line was added.

Archival research does not suggest that the industrial site was historically associated with the lives of important historical personages (Criterion B). The buildings are examples of World War II military industrial construction (Criterion C); however, neither building possesses high artistic value. Research does not suggest that the industrial buildings have yielded or are likely to yield information important in prehistory or history (Criterion D).

Storage Building E5190 individually was assessed during an architectural reconnaissance survey of the installation and found not to possess individual significance (Goodwin et al. 1993). The current investigation addressed the importance of the two-building industrial property.

Both Buildings E5188 and E5190 retain their overall design integrity. Building E5188 contains equipment related to WW II PWP processing; no FS, CNS and CNB filling machinery survives. Building E5190 contains its original chemical storage tank.

The air ventilation system associated with Building E5188 was installed in 1941 and was in-service until June 1945. The air ventilation system was not directly associated with chemical manufacturing on the site during World War II. The system was a common mechanical system installed for interior ventilation of industrial plants. Research does not suggest that the system represented a unique design or embodied significant technological innovations. The ventilation system employs engineering technologies that were developed during the last years of the nineteenth century and that were improved during the early decades of the twentieth century. The technology was advertised widely during the first decades of the twentieth century. During World War I, installation of similar air ventilation systems was common practice at chemical production and filling plants at Edgewood Arsenal. Chemical filling plants constructed in anticipation for World War II included ventilation systems among the standard building mechanical systems. The air ventilation system was substantially modified during the early 1970s.

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Buildings E5188 and E5190
Edgewood Area, Aberdeen Proving Ground
Harford County, Maryland
Section 8.3

Historic Background

The construction of Buildings E5188 and E5190 was proposed in 1940 as part of a major World War II expansion program at Edgewood Arsenal. Edgewood Arsenal, established during World War I, was the primary U.S. site for the manufacture of chemical weapons used during that war. Major chemicals produced at the arsenal included mustard gas, phosgene, chlorine, and chlorpicrin. During the inter-war period, Edgewood Arsenal served as the Headquarters of the Chemical Warfare Service; the arsenal was the site for developing chemical defensive weapons and protection equipment, for training, and for stockpiling chemical weapons.

Prior to World War II, President Roosevelt established the policy that the U.S. would not initiate toxic gas warfare, but would retaliate swiftly if such weapons were introduced. The Chemical Warfare Service subsequently developed plans for establishing a toxic chemical arsenal sufficient to respond effectively should retaliation be necessary. Between 1939 and 1941, new chemical production and munitions filling plants were planned and constructed at Edgewood Arsenal. The toxic chemicals produced included mustard gas, lewisite, phosgene, and adamsite. In preparation for war, manufacturing facilities were upgraded and improved so that production proceeded quickly.

The amount of chemical munitions necessary to launch an effective retaliation was greater than the production capacity at Edgewood. The Chemical Warfare Service established three additional arsenals. Huntsville Arsenal, Alabama was designed to include six mustard gas plants, two chlorine plants, four lewisite plants, one phosgene plant, and one white phosphorus plant. Pine Bluff Arsenal, Arkansas contained production facilities for mustard gas, lewisite, incendiary bombs, white phosphorus, and napalm. Plants at Rocky Mountain Arsenal, Colorado initially produced lewisite and mustard gas. These production plants generally incorporated design innovations and technological improvements developed and refined at Edgewood Arsenal.

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The delegation of weapons production to other arsenals freed Edgewood Arsenal to serve as Headquarters of the Chemical Warfare Service. Personnel researched and developed new chemicals; produced special chemical munitions; produced gas masks and protective clothing; and provided training. Chemical production plants at Edgewood Arsenal specialized in tear gases, chlorine, impregnite, white phosphorus, and a variety of smoke munitions. In general, the Edgewood industrial plants were arranged in clusters on the installation, rather than in the linear production lines found at other chemical arsenals. Some production lines at Edgewood were housed in single large buildings that were supported by smaller support structures.

Buildings E5188 and E5190 were planned in 1940 as a filling plant for FS, a smoke agent, and CNS and CNB, tearing agents. Whitman, Requardt & Smith, Engineers, of Baltimore, Maryland, worked with the Construction Division of the Office of the Quartermaster General to prepare plans for the building. Whitman, Requardt & Smith, Engineers, was founded in 1915 and continues operation under the name of Whitman, Requardt and Associates. During the firm's first fifty years of practice, the firm specialized in public works projects and was noted for its expertise in water and waste water treatment (Richard Lortz, Whitman, Requardt & Associates, personal communication 9/22/94). During World War II, the company also was active in the construction of Huntsville Arsenal (now Redstone Arsenal) in Alabama and Rocky Mountain Arsenal in Colorado.

The designs of Buildings E5188 and E5190 are utilitarian and lack ornamentation. The design for Building E5188 illustrates several features typical of 1940s factory architecture. The building is a monumental, one-story structure to accommodate the industrial processes on one level. Structural framing is steel and configured in regular bays to create large open work spaces and make possible flexible interior plans (Goodwin et al. 1994:235). Construction materials included corrugated asbestos (transite), which served as a fire retardant. Poured concrete was used for the foundation, the floors, and the walls in the

western end of the building where raw chemicals were stored. Large banks of steel-frame industrial sash windows provided light for the shell-filling process.

The filling line operated in Building E5188 between October 1941 and July 1944. The facility was used for miscellaneous packing, FS filling and assembly, and CNB filling. During 1942, workers filled one-gallon land mines in the plant. In July 1943, the building was equipped to fill 4.2-inch shell with FS. The plant operated one shift per day, six days per week. The average output was 1000 shells per shift. By June 1944, additional FS and CNS fill lines were added. Building E5190 was constructed in 1941 as a benzene storage building (List of Buildings Manufacturing and Filling Branch from 1 January 1940 to 31 October 1945 and A Monograph of Service Division Activities from 30 June 1940 to 25 November 1943, U.S. Army Chemical and Biological Defense Command, History Office).

In the original design, the reinforced-concrete end of Building E5188 contained metal storage tanks for raw chemicals that were pumped directly from railroad tank cars. The northeast room of the concrete section was the mixing and supply room for preparing chemicals for loading. The north half of the building housed the loading line. Empty and filled shells were stored in the south half of the building. The eastern end of the building housed the office, first aid room, toilets, showers, and locker rooms. The toilet, shower rooms, and locker areas were segregated according to race. Building E5190 had an open floor plan and contained tanks to store benzene. The benzene was pumped through underground pipes to Building E5188 (Directorate of Public Works, 1940 Drawing 6297-1149, Aberdeen Proving Ground).

Building E5188 included two mechanical ventilation systems. The standard metal vents were located in the roof. These vents served specific areas such as the toilet and shower areas, chemical storage areas, and the shell storage areas.

A separate mechanical ventilation system was installed to serve the chemical mixing area and the filling line located in the north side of the building. This ventilation system comprised interior ventilation ducts attached to an exterior air washing and exhaust system. Ventilation ducts were installed in tunnels

under the floor in the mixing and supply room and along the western half of the filling line (1940 drawings showing ventilation ducts in E5188, Directorate of Public Works, Aberdeen Proving Ground). The air was pulled through the tunnel by electrically-powered fans and into an exterior washing tower. In the washing tower, air was treated with a caustic water solution to neutralize harmful gases. After treatment, the air was discharged into the atmosphere (Construction Division 1919:12-13; U.S. Army Environmental Hygiene Agency 1989:889). No drawings detailing the external air ventilation equipment were located at the Directorate of Public Works at Aberdeen Proving Ground. Drawings survive that show the location of the floor duct trenches in the building. The exterior ventilation system appears on a 1941 aerial photograph archived in the U.S. Army Chemical and Biological Defense Command History Office.

Inspection of the equipment revealed the name of B.F. Sturtevant Co. of Boston Massachusetts on a name plate attached to the induction draft fan. The B.F. Sturtevant Co. was a prominent heating and ventilating company during the late nineteenth and first half of the twentieth centuries. Benjamin Franklin Sturtevant patented the rotary exhaust fan in 1867 and built a factory to manufacture heating and ventilation equipment in 1878. Self-proclaimed as the largest company of its kind, the company developed and installed numerous heating, air washing, cooling, and ventilation systems and system components between 1878 and the 1950s. By 1952, the company was a division of Westinghouse Electric Corporation. While the name plate appears only on the induction fan, B.F. Sturtevant Company possessed the expertise to construct and install the entire air washing system attached to Building E5188, including the washing tower and induction fan. Sturtevant fans also were installed in the roof during the 1950s. Currently, the Sturtevant Fan Company operates in Hyde Park, Massachusetts (Ingels 1952:112-113, 120, 126; *Who Was Who in America*, Historical Volume 1963:514; Lipnick 1952:23).

The purpose of the air ventilation system attached to Building E5188 was to draw toxic gases out of the building's interior. During the last half of the nineteenth century, ventilation technology became an important part of factory design and construction. Adequate ventilation was linked to worker productivity

and safety. Heating and ventilation engineers claimed responsibility not only for the quantity of air provided to workers, but also for air quality. Heating and ventilation equipment was installed in textile mills, metallurgy shops, printing shops, offices, public buildings, and schools. Ventilation was particularly important in the mining industry.

In order to provide clean air, inventors patented air washer systems. Between 1790 and 1873, U.S. patent office issued 76 patents for ventilators. During the 1870s, two inventors experimented with air purification methods. One patent was issued for a ventilator and dust arrestor and another patent was issued for a machine that purified air by passing it through layers of wet charcoal (Ingels 1952:114-115). A patent for "Apparatus for Collecting Gases, Vapors, and Foreign Particles" was issued in 1899. The machine was described as a vertical unit, disc fan, in which water flowed downward (Ingels 1952:126). By 1900, several more patents for air washers were issued. Experimentation continued during the first decades of the twentieth century to clean particulate matter, especially dust, from building air supplies.

The air washer was used both to purify air before circulation through buildings and to clean air following industrial processes (Heating and Ventilating Magazine, volume 10, 1913). In 1917, the National Board of Fire Underwriters proposed the installation of special ventilation systems to protect worker health in industries that generated dust, fumes, gases, vapors, odors, fibers, or other impurities. Mechanical exhaust systems located near polluting equipment were recommended; roof ventilation was the preferred method. In addition, special air purifying and dust collecting equipment was recommended where noxious materials might contaminate the neighboring fresh air supply (*Ventilation Laws* 1917:166-167).

The chemical industry was particularly associated with dangerous gases and fumes. During World War I, the Chemical Warfare System installed exterior air washer systems to service all filling and chemical production plants at Edgewood Arsenal. The systems resembled the air ventilation system installed during World War II. Ventilation tunnels were installed under the filling lines. Induction fans pulled air through the ducts to for external air washers. Air was passed through a caustic soda and water solution before it was

released into the atmosphere. After World War I, the installation of ventilation systems became common construction practice in factories with the adoption of legislation to protect worker health. The air ventilation system for Building E5188 at Edgewood Arsenal employed the World War I-era technology, although the system appears more compact when compared to the World War I air washers (Construction Division 1919:12-13; Photographs, U.S. Army Chemical and Biological Defense Command, History Office).

In July 1944, the FS, CNS, and CNB filling equipment was removed from Building E5188. The building was re-equipped to produce white phosphorus (WP), an incendiary chemical and a smoke agent. Smoke agents were defensive measures designed to reduce visibility. Smoke was used to camouflage troop activity and to blind or mislead enemy forces. Although smoke agents have a long history of wartime use, smoke became a standard military weapon during World War I. During World War II, smoke agents were used extensively and successfully to hide Allied movements in all theaters of operation.

WP was the most popular smoke agent employed during World War II. It is a waxy solid that ignites when exposed to oxygen and develops a dense white smoke. Between 1942 and 1945, the Chemical Warfare Service purchased more than 200 million pounds of WP to fill shells, rockets, bombs, and grenades. WP not only provided smoke screens, but also killed enemy soldiers as readily as other munitions. Between July 1944 and October 1945, Building E5188 operated as a WP filling plant for 2.36-inch rockets. Production statistics record that 2,697,025 rockets were filled in Building E5188 by 1945. The Army fired over 2.5 million of these rockets to screen operations, start fires, and as direct weapons (Brophy 1959:198; E5188 building and production files, U.S. Army Chemical and Biological Defense Command, History Office).

One disadvantage of WP was that the smoke tended to rise into the air as a pillar rather than stay close to the ground. Scientists at the Chemical Warfare Service experimented with ways to keep WP in large fragments that would burn close to the ground. In 1943, scientists working at the National Defense Research Council's Munitions Development Laboratory at the University of Illinois developed a method to implant granules of WP in a rubber. The new process, called plasticized white phosphorus (PWP), created

munitions that exploded in larger chunks, burn more slowly, and produce smoke that stayed close to the ground. In April 1944, the first PWP plant was constructed at the Victor Chemical Works at Chicago Heights, Illinois. By May 1944, PWP was used in chemical munitions. In July 1944, the Chemical Warfare Service recommended installing a PWP plant at Edgewood Arsenal. Installation of the line began in October 1944 and production began in December of that same year (Gaus 1945:1-2).

Between June 1945 and August 1945, Building E5188 was equipped to operate as a PWP filling plant for all munitions types. During 1945, the Army produced 551,252 pounds of PWP in this building, representing approximately 62 per cent of total PWP production (891,941 pounds total) in the United States. PWP was used to fill 23,963 4.5-inch Navy rockets; 3,949 100-lb. bombs; 7,027 3.5-inch rockets; 65 5-inch rockets; 275 4.2-inch shells; and 25 155-mm shells. These shells were issued during the last months of the war against Japan, so their use was not widespread (Brophy 1959:198-200; E5188 building file and 1946 Plant Status Report, U.S. Army Chemical and Biological Defense Command, History Office; Gaus 1945:10).

PWP production required the preparation of rubber and WP, and combining the mixture into munitions. The rubber was cut into cubes and fed into a Jeffrey Rigid Hammer Mill (extant) that shredded the rubber into particles that could be dissolved in xylene. Xylene was pumped from its storage tank in Building E5190 and mixed with the rubber to form a gel. Molten WP obtained was pumped into a granulator where cold water was added to freeze WP into granules. WP granules and the rubber gel were placed in PWP mixers (extant) and covered with carbon dioxide. After mixing, the PWP was transferred into extruding hoppers to fill munitions. Filled munitions were transferred by railroad car to Building E5185 for painting and marking (Gaus 1945:4-5). The 1940 hammer mill, xylene ventilation hood, PWP mixers, and scales used in the PWP processing line are still in place in Building E5188, though no longer utilized as a working munitions filling line.

Ventilation for the pilot plant proved to be a problem. Two areas required ventilation: the rubber gel room and the filling line. In the rubber gel room, xylene, a toxic gas, was mixed with the rubber. Xylene

was mixed under a ventilating hood that operated by an induction fan to exhaust fumes out through the roof (Gaus 1945:13).

Along the filling line, the original air ventilation system with its underground suction tunnel proved inadequate. The PWP line operated in a vertical manner rather than as a horizontal line on the first floor. The mixers and hoppers were located on a mezzanine and the extrusion equipment was located near the floor level. When PWP ignited, the smoke drifted upward. One of the first improvements to the line was the installation of ducts over the mixers, hoppers, and extruders that exhausted air through the roof (Gaus 1945:66, 67). The role played by the exterior air washing system in the revamped PWP loading plant is unclear. Evidence suggests that the system was not on-line. Water laced with WP inadvertently drained into the ventilation tunnel ducts. To correct this problem, the tunnel ducts were sealed with pitch and water lines were installed in the ventilation duct trench to keep any WP or PWP from igniting (Gaus 1945:74).

The PWP filling plant was placed on standby status after August 1945. Between 1 July and 31 December 1950, Buildings E5188 and E5190 were overhauled and made operational during the Korean Conflict. Building E5188 was painted, including all equipment and pipe lines. The air ventilation system and all suction ducts from the building to the tower and electrical equipment were overhauled and made operational. Between September 1951 and January 1952, the filling line produced 18,763 bombs. A 1952 description of the industrial process contains no mention of the role of the air ventilation system (Lipnick, P.W.P. Plant Operations September 1951 to January 1952 and E5188 building file, U.S. Army Chemical and Biological Defense Command, History Office).

During March 1952, the PWP filling line was modified to automate some operations previously accomplished by manual labor. By January 1953, the design to reconstruct the WP filling plant was 97 per cent complete. Plans included a munitions washer, cooler, drier, and paint spray. Designs were completed in April 1953, and the new equipment was installed during 1954. Automation succeeded in eliminating the

hand method of inserting burster tube wells in shells (E5188 building file, U.S. Army Chemical and Biological Defense Command, History Office).

During the late 1960s or early 1970s, the air ventilation system was modified to remove xylene from the PWP waste water and to oxidize WP located in waste water. The phossy water was pumped to the top of the tower and filtered downwards. Extant piping suggests that the water was recirculated and filtered more than once (Interview with Mike Kauslarich and Don Leadore, 9/19/1994).

WP filling operations in Building E5188 were reactivated during the Vietnam War. Since the Vietnam War, Building E5188 remained on war reserve status until 1992. The building currently is used for special, small-scale WP smoke filling projects. The current filling equipment is contained in a small area; the remainder of the building is used for research and storage (E5188 building files, U.S. Army Chemical and Biological Defense Command, History Office).

9. MAJOR BIBLIOGRAPHIC REFERENCES

Directorate of Public Works, Aberdeen Proving Ground. Drawing files, real property records, survey records.

Brophy, Leo P. and George J.B. Fisher
1959 *The Chemical Warfare Service: Organizing for War*. Office of the Chief of Military History, Department of the Army, Washington, D.C.

Brophy, Leo P., Wyndham D. Miles, and Rexmond C. Cochrane
1959 *The Chemical Warfare Service: From Laboratory to Field*. Office of the Chief of Military History, Department of the Army, Washington, D.C.

Construction Division, War Department
1919 Report on the Construction of the Filling Plants at Edgewood Arsenal. Government Printing Office, Washington, D.C.

Gaus, Frank L.
1945 PWP Plant Operations, 1 June to 14 August 1945, U.S. Army Chemical and Biological Defense Command, TMs, History Office, Edgewood Area, Aberdeen Proving Ground.

Goodwin, R. Christopher et al.
1993 *Aberdeen Proving Ground Cultural Resource Management Plan*. Draft Report prepared for U.S. Army Corps of Engineers.

1994 *Historic Context for Department of Defense Facilities World War II Permanent Construction*. Draft Report prepared for U.S. Army Corps of Engineers, Baltimore, Maryland.

Heating and Ventilating Magazine
1913 Volume 10.

Ingels, Margaret
1952 *Willis Haviland Carrier: Father of Air Conditioning*. Country Life Press, Garden City, New Jersey.

Kauslarich, Mike and Don Leadore
9/19/1994 Personal communication.

Lipnick, S.
1952 P.W. Plant Operations September 1951 to January 1952. TMs, History Office, Edgewood Area, Aberdeen Proving Ground.

Lortz, Richard, Whitman, Requardt & Associates
9/22/94 Personal communication.

Scrifftner, Kenneth C. and Howard E. Hasketh
1983 *The Environment and Energy Handbook Series: Wet Scrubbers.* Ann Arbor Science Publishers, Michigan.

Smart, Jeffrey K.
1988 *U.S. Army Chemical Research, Development and Engineering Center Historical Highlights.* U.S. Army, Chemical Research, Development and Engineering Center, Historical Office.

Sturtevant, B.F., Company
1892 500 Representative Buildings Heated and Ventilated by the Sturtevant System. B.F. Sturtevant Co., Boston, Massachusetts.

1917 *Fans, Heaters and Air Washers.* B.F. Sturtevant Co., Boston, Massachusetts.

U.S. Army Chemical and Biological Defense Command, History Office. Building files for E5188; 1946 Plant Status Report; A Monograph of Service Division Activities From 30 June 1940 to 25 November 1943; List of Buildings Manufacturing and Filling Plant from January 1940 to 31 October 1945.

U.S. Army Chemical Center and School
1968 *The Story of Chemical and Biological Agents and Weapons.* Fort McClellan, Alabama.

U.S. Army Environmental Hygiene Agency
1989 *RCRA Facility Assessment, Edgewood Area.* Aberdeen Proving Ground, Maryland.

Ventilation Laws in the United States
1917 Heating and Ventilating Magazine Company, New York.

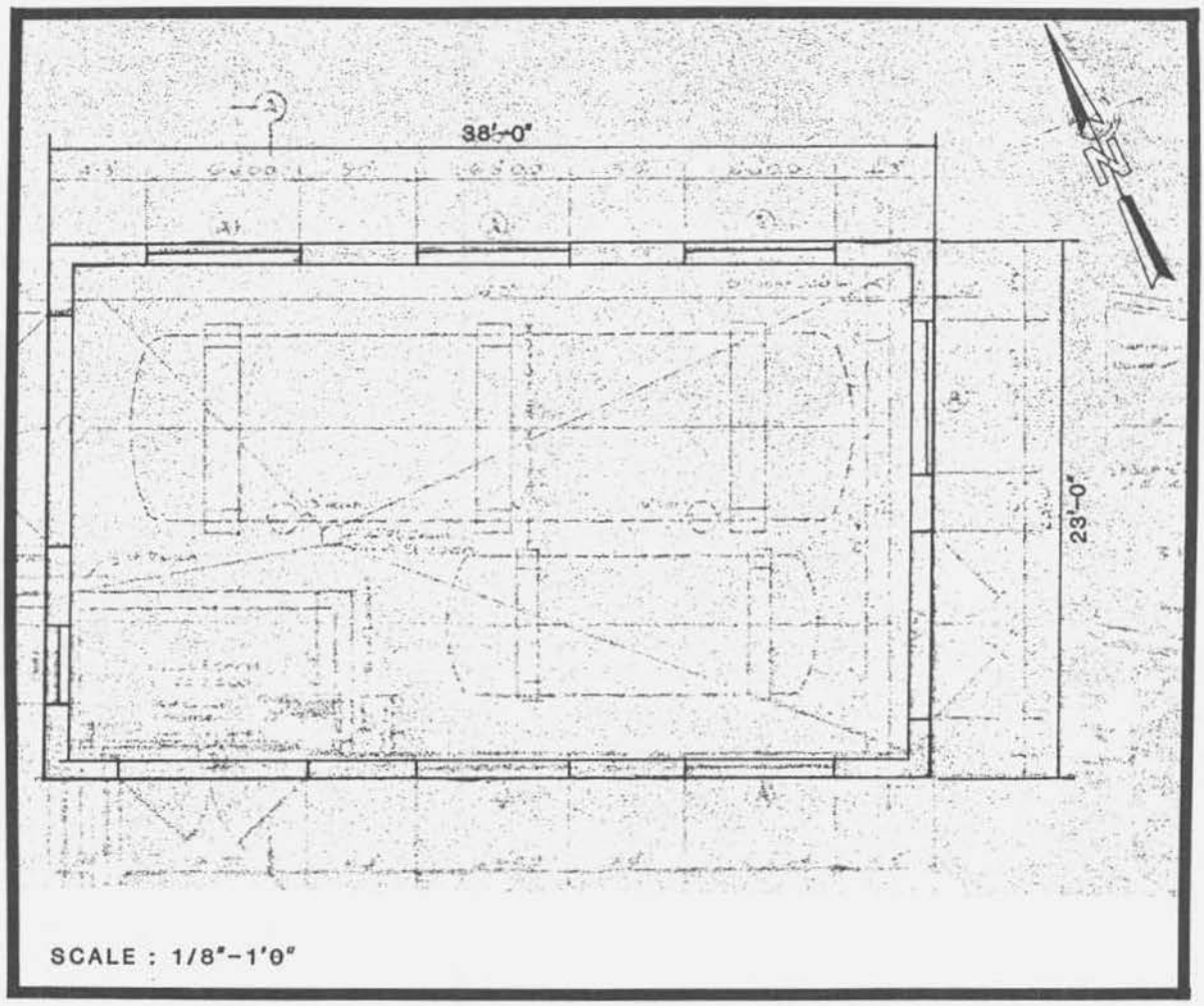
Who Was Who in America
1963 Historical Volume 1607-1896. Marquis-Who's Who Company, Chicago, Illinois.

10. GEOGRAPHICAL DATA

Building E5188, its ventilation system, and Building E5190 are located south of Magnolia Road in Edgewood Area at Aberdeen Proving Ground. Building E5188 is located east of 34th Street. Building E5190 is located west of 34th Street. The boundary of the property is designated on a map accompanying this form. The subject of this evaluation was one building and its attendant ventilation system.

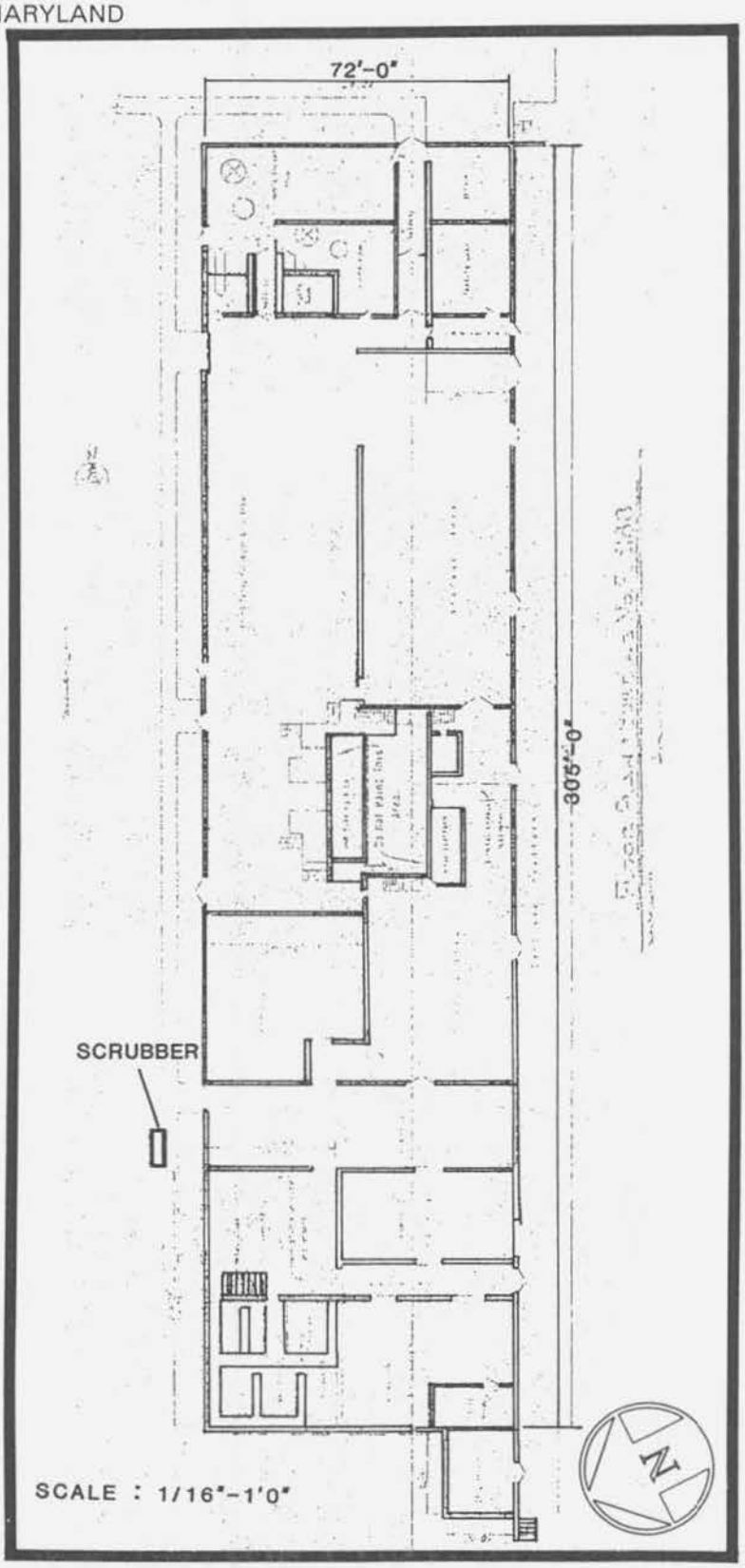
HA-1852
BUILDING E5190
EDGEWOOD AREA
ABERDEEN PROVING GROUND
HARFORD COUNTY, MARYLAND

FLOOR PLAN
SOURCE: 1940 DRAWING,
DIRECTORATE OF PUBLIC WORKS,
APG

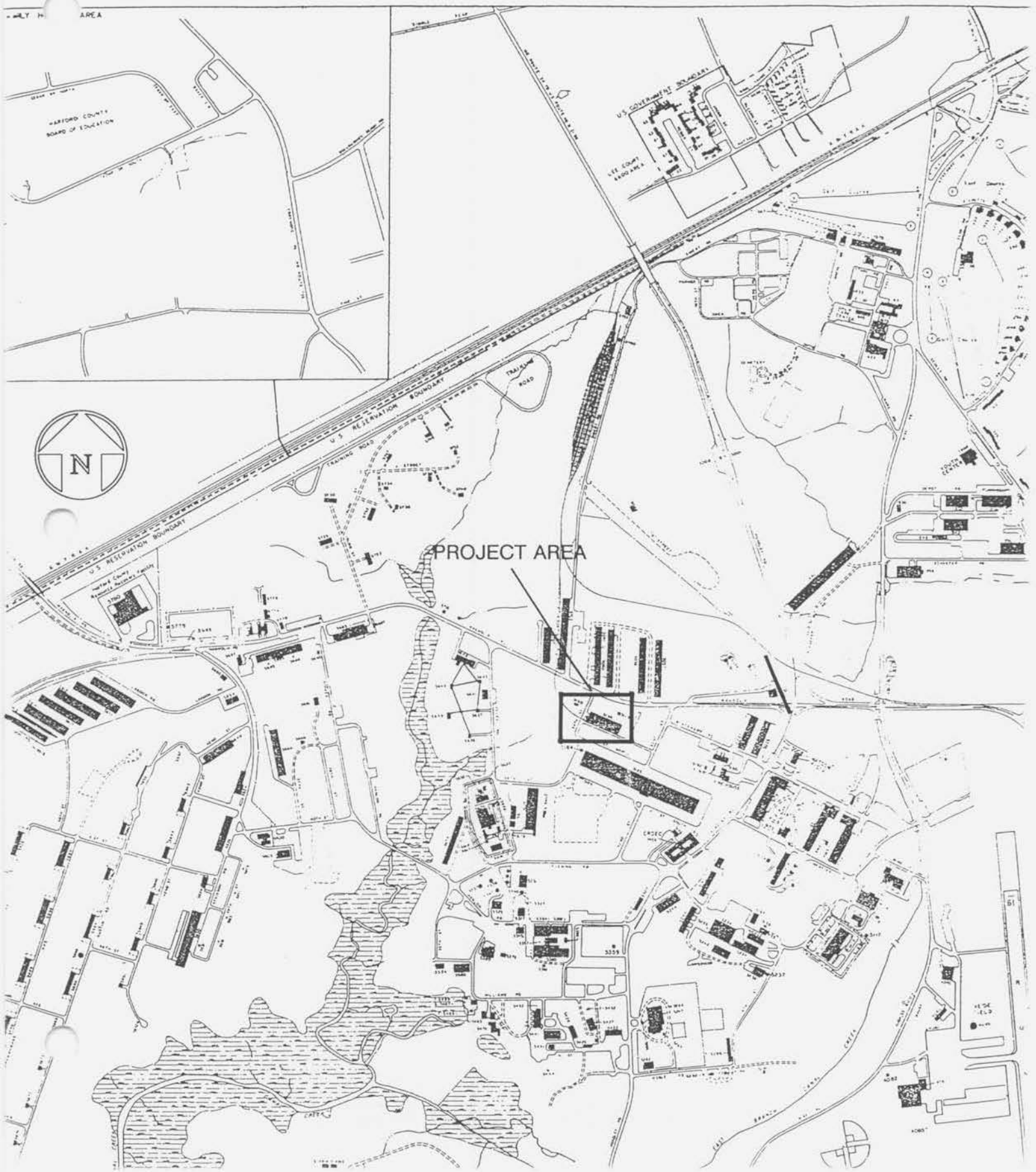


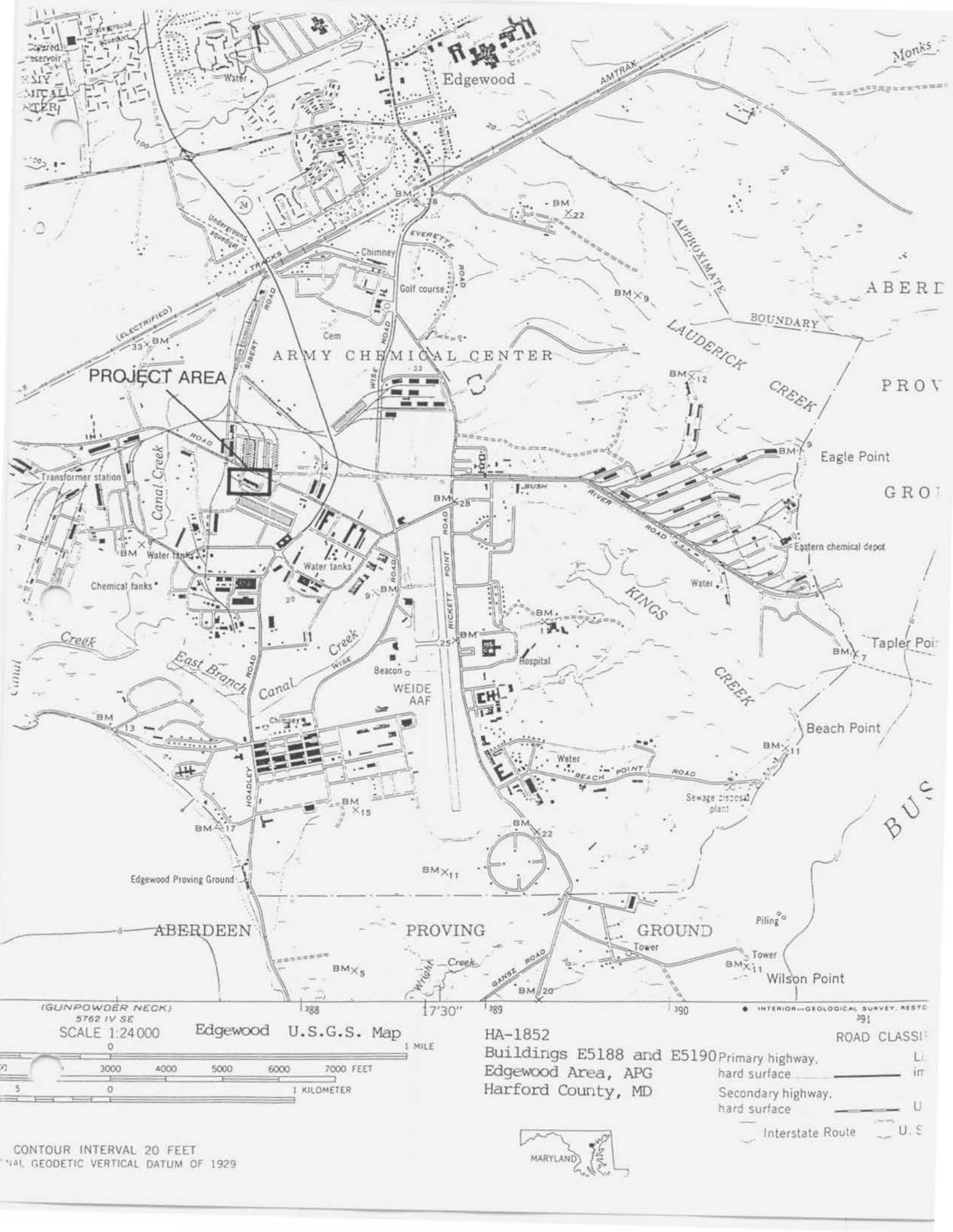
HA-1852
BUILDING E5188
EDGEWOOD AREA,
ABERDEEN PROVING GROUND
HARFORD COUNTY, MARYLAND

FLOOR PLAN
SOURCE: 1968 DRAWING,
DIRECTORATE OF PUBLIC WORKS,
APG



HA-1852
Buildings E5188 and E5190
Edgewood Area, Aberdeen Proving Ground
Harford County, Maryland




PROJECT AREA
Edgewood
AMTRAK
Monks
ARMY CHEMICAL CENTER
APPROXIMATE
BOUNDARY
LAUDERICK
CREEK
Eagle Point
Golf course
Chimney
EVERETTE
ROAD
TRACKS
(ELECTRIFIED)
SIBERT
ROAD
WISE
ROAD
Cem
Transformer station
Canal Creek
Water tanks
Chemical tanks
Water tanks
BUSH
RIVER
ROAD
Eastern chemical depot
Water
KINGS
CREEK
Tapler Point
RICKETT
POINT
ROAD
Hospital
Beacon
WEIDE
AAF
East Branch
Canal
Creek
HOADLEY
ROAD
Beach Point
Water
BEACH
POINT
ROAD
Sewage disposal plant
Edgewood Proving Ground
ABERDEEN
PROVING
GROUND
Piling
Tower
Tower
Wright
Creek
GANSZ
ROAD
Wilson Point
(GUNPOWDER NECK)
5762 IV SE
388
17'30"
389
390
391
INTERIOR—GEOLOGICAL SURVEY, RESTO
SCALE 1:24000
Edgewood U.S.G.S. Map
1 MILE
3000
4000
5000
6000
7000 FEET
1 KILOMETER
CONTOUR INTERVAL 20 FEET
VAL GEODETIC VERTICAL DATUM OF 1929
HA-1852
Buildings E5188 and E5190
Edgewood Area, APG
Harford County, MD
ROAD CLASSI
Primary highway, hard surface
Secondary highway, hard surface
Interstate Route
U. S
MARYLAND


ROAD CLOSED
TO
THRU TRAFFIC

HA-1852
Building E3777
Harford County, MD
Katherine Grason
8/1994
TOM CLARK×(05 9[illegible] 0281 N N N-2 NN 2
R. Christopher Goodwin 337 E. 25th St. Frederick, MD
View looking West
1/6

A-1853
Building E5184
Hartford County, MD
Pat Irion Goodine
8/1994

TOM CLARK×CE1 1993 3281 N N N-2-02 2
Rich Stoplar Goodine House 337 E 3rd St, Frederick MD
View looking SE
2/6

A-1852
Building E5188
Harford Co. MD
Katherine Grandine
8/1997

OM CLARK×C23J9:8 3281 N N N-2-** 2
R Christopher Goodwin + Assoc. 337 E 3rd St. Frederick MD
View looking SSE
3/6

HA-1852
Building E5183
Harford Co. MD
Katherine Grandine
8/1994
R. Christopher Goodwin & Assoc. 337 E. 3rd St Frederick MD
View looking SE
4/6

HA- 1852
Building E5188
Harford Co. MD
Katherine Grandine
8/1994
R. Christopher Goodwin + Assoc. 337 E 3rd St. Frederick MD
View looking W
5/6

A-1852
Building E5190
Harford Co. MD
Katherine Grandine
8/1994

TOM CLARK (301) 713-3281 N N N-2 NN 2
R Christopher Goodwin & Assoc.
View looking SW
6/6