US ARMY CORPS
OF
ENGINEERS
Rock Island District

U.S. ARMY DEFENSE AMMUNITION CENTER AND SCHOOL
Savanna, Illinois

Defense Environmental Restoration Program
for
Formerly Used Defense Sites
Ordnance and Explosive Waste

Archives Search Report

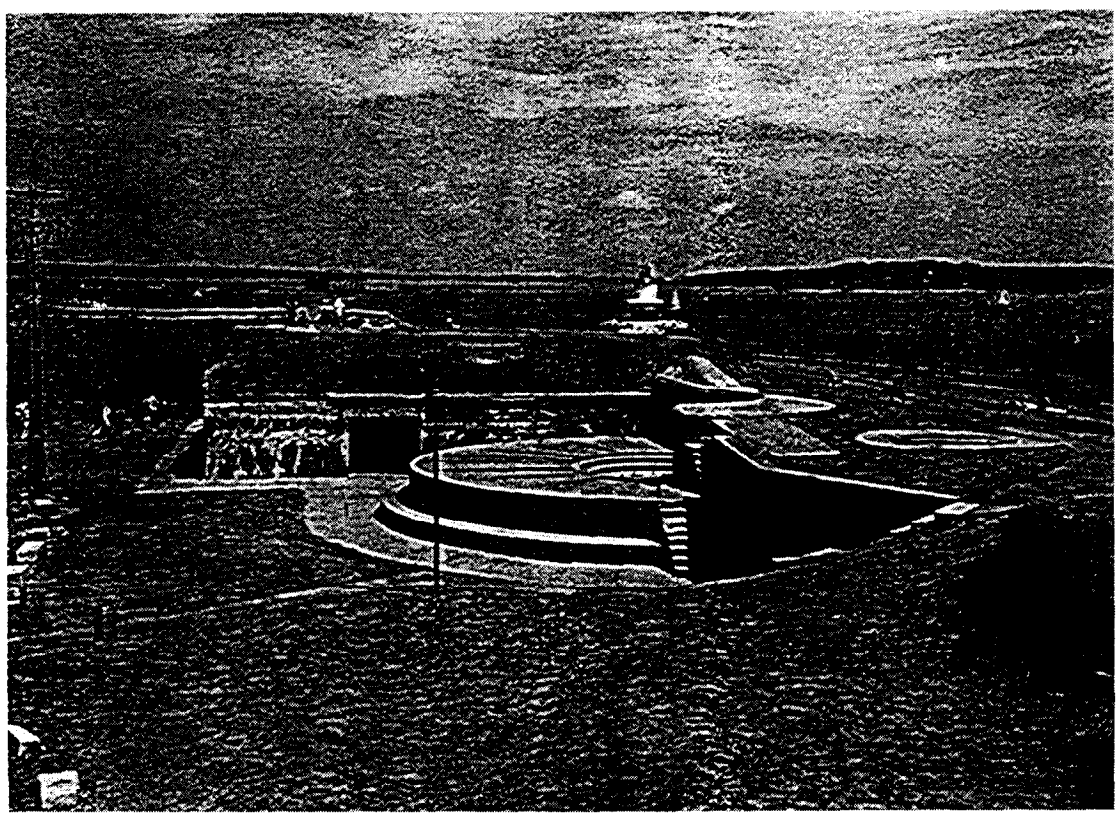
FINDINGS

for

FORT PREBLE

South Portland, Maine
Project Number D01ME012003

September 1994



DEFENSE ENVIRONMENTAL RESTORATION PROGRAM
for
FORMERLY USED DEFENSE SITES

FINDINGS

ORDNANCE AND EXPLOSIVE WASTE ARCHIVES SEARCH REPORT for the former FORT PREBLE South Portland, Maine Project Number D01ME012003

September, 1994

Prepared For
U.S. Army Corps of Engineers
ATTN: CEHND-PM-OT
P.O. BOX 1600
Huntsville, Alabama 35807-4301

Prepared By
U.S. Army Corps of Engineers
Rock Island District
ATTN: CENCR-ED-DN
P.O. Box 2004
Rock Island, Illinois 61204-2004

and

U.S. Army Defense Ammunition
Center and School
ATTN: SMCAC-ESL
Savanna, Illinois 61074-9639

ORDNANCE AND EXPLOSIVE WASTE
ARCHIVES SEARCH REPORT
for the former
FORT PREBLE
SOUTH PORTLAND, ME
PROJECT NUMBER D01ME012003

ACKNOWLEDGMENT

The following persons provided support as indicated.

Function	Name	Title	Organization	Telephone
On-site Assessment	*Michael Patterson	Q.A.Spec., Ammunition (QASAS)	SMCAC-ESL	(815)273-8763
	Dan DeWease	Safety/Occ. Health Specialist	CENCR-ED-DN	(309)794-5808
Engineering Support	Daniel J. Holmes	Professional Engineer	CENCE-ED-DN	(309)794-5480
Technical Records Search	Shirley Daniels	Researcher	SMCAC-ESL	(815)273-8754
Geographic District Support	Anne Laster	Environmental Engineer	CENED-RE-AM	(617)647-8584
Industrial Hygiene	Bob Platt	Industrial Hygienist	HSXP-FS-RIA	(309)782-0806
CADD	Heather Weise	Technician	CENCR-ED-DN	(309)794-5257

*Team Leader

ORDNANCE AND EXPLOSIVE WASTE
ARCHIVES SEARCH REPORT
for the former
FORT PREBLE
SOUTH PORTLAND, ME
PROJECT NUMBER D01ME012003

FINDINGS

TABLE OF CONTENTS

APPENDICES

TABLES

REPORT PLATES

ORDNANCE AND EXPLOSIVE WASTE
ARCHIVES SEARCH REPORT
For the former
FORT PREBLE
SOUTH PORTLAND, ME
PROJECT NUMBER D01ME012003

1. INTRODUCTION

a. Subject and Purpose

(1) This report presents the findings of an historical records search and site inspection for ordnance and explosive waste (OEW) presence located at the former Fort Preble. The investigation was performed under the authority of the Defense Environmental Restoration Program for Formerly Used Defense Sites (DERP/FUDS).

(2) The purpose of this investigation was to characterize the site for potential OEW contamination, to include conventional and chemical warfare material (CWM). This was achieved through evaluation of all historical records available, interviews, and the on-site visual inspection results.

b. Scope

(1) The investigation focused on 32.9 acres of land that was used by the Army as a coastal defense site from 1808 until late in WW II.

(2) This report presents the site history, site description, real estate ownership information, and confirmed ordnance presence based on available records, interviews, and the site inspection. It further provides a complete evaluation of all information to assess actual and potential current day ordnance contamination.

(3) For the purpose of this report, Ordnance and Explosives Waste (OEW) is considered unwanted and abandoned ammunition or components thereof, which contain energetic, toxic, or radiological materials, and was manufactured, purchased, stored, used, and/or disposed of by the War Department/Department of Defense.

2. PREVIOUS INVESTIGATIONS/PROJECTS

a. 1992 Preliminary Assessment

(1) A Preliminary Assessment of Fort Preble was conducted under the Defense Environmental Restoration Program, Formerly Used Defense Sites (DERP/FUDS) by the Corps of Engineers, New England District (reference B-4). At that time, The Findings and Determination of Eligibility (FDE), dated 21 September 1992, concluded that the 32.9-acre site had been formerly owned or used by the Army (see document E-3).

(2) The FDE concluded that there were eligible categories under the DERP/FUDS program. Due to the fact that the site was found to have been used as a coastal defense site by the Army, an Ordnance and Explosives Waste project was recommended, DERP FUDS Project Number D01ME012003, which is the principal subject of this report (see document E-1 and table 2-1).

(3) Due to other conditions at Fort Preble, two other projects were also recommended, those were, Containerized/Hazardous, Toxic, or Radiological Waste (Con/HTRW) Project Number D01ME012001 and Building Demolition/Debris Removal (BD/DR) Project Number D01ME012002 (see documents E-4 and E-5, and table 2-1).

TABLE 2-1
DERP-FUDS PRELIMINARY ASSESSMENT PROJECTS

Project Number	DERP Category	Present Phase	Comments	Location
D01ME012003	OEW	SI	None	-
D01ME012002	BD/DR		Scheduled for fall of 94	Switchboard Room
D01ME012001	Con/HTRW		Scheduled for fall of 94	Buried tank by maintenance building

b. Other Investigations

No other previous investigations were discovered during the Archives Search.

3. SITE DESCRIPTION

a. Existing Land Usage

(1) Fort Preble is located in South Portland, Maine, in Cumberland County. The land the fort occupied as well as many of the fort's buildings are now the campus of Southern Maine Technical College.

(2) Fort Preble consisted of 32.9 acres of land on Spring Point, South Portland, Maine. The boundaries of Fort Preble are described in documents G-1, G-3, L-11 and plate 2. The land was excessed during the period from 1957 through 1961 to the State of Maine (see document E-1 and E-3).

TABLE 3-1
CURRENT LAND USAGE

AREA	FORMER USAGE	PRESENT OWNER	PRESENT USAGE	SIZE/ ACRES	COMMENTS
Fort Preble	Coastal Defense	State of Maine	College	32.9	See Plate 2
			TOTAL	32.9	

b. Climatic Data

(1) Material in paragraphs 3b.(2) through (5) was extracted from Soil Survey of Cumberland County, Maine, by Gary Hedstrom, January 1981 (reference B-6).

(2) Cumberland County has a cool maritime climate. In winter along the coast, the average temperature in January, the coldest month, is 22 degrees. The average daily temperature during July, the warmest month, is 68 to 70 degrees.

(3) Mean annual precipitation in Cumberland County is about 43 inches. June through August are the driest months, but still receive more rain than most of the country during those months. Thundershowers occur on about 15 to 20 days each year along the coast. Most thunderstorms occur in May through August.

(4) The average seasonal snowfall ranges from 70 inches along the coast to 85 inches falling inland. Average continuous snowcover along the coast is 1.5 months beginning in mid-January and ending in early March. The greatest snow depth at any one time along the coast is approximately 30 inches.

(5) The prevailing winds are southerly.

c. Topography

Fort Preble is laid out on flat land that slopes down to Casco Bay on the north, east, and south.

d. Geology and Soils

(1) Material in paragraphs d.(2) and d.(3)(a) and (b) was extracted from Soil Survey of Cumberland County, Maine, by Gary Hedstrom, August 1974 (reference B-6).

(2) Regional Geology/Soils

Cumberland County is comprised of 40 different soil series. For a complete description of those series see the Soil Survey for Cumberland County, Maine (reference B-6).

(3) Site Specific Geology/Soils

(a) Fort Preble lies within the Windsor Series. This series is described as deep, excessively drained, nearly level to strongly sloping, coarse-textured soils. These soils formed in glacial outwash deposits. They are on terraces adjacent to many streams and rivers throughout the county.

(b) More specifically, the soil around Fort Preble is Windsor loamy sand with 0 to 8 percent slopes. This soil is described as representative of the series being on top of terraces adjacent to streams and rivers. Runoff is slow. This soil can be used for row crops, pasture, hay, and woodland.

e. Hydrology

Cumberland County is bordered on the north by the Androscoggin River and on the south by the Saco River. Fort Preble is bordered on the south, east, and north by Casco Bay with runoff going into the bay.

f. Natural Resources

(1) There are no known species of endangered wildlife inhabiting Fort Preble (see document E-6), but the possibility always exists that an endangered species may migrate into the area. Table 3-2 was compiled from material supplied by the Department of Inland Fisheries and Wildlife. A complete list of endangered species, with detailed information on range and habitat, can be obtained from the Department of Inland Fisheries and Wildlife (see appendix A, reference sources).

(2) There are no species of plants listed as endangered or threatened in the area (see document E-6).

TABLE 3-2
NATURAL RESOURCES

Resource Classification	Type	Comment
Wildlife	Peregrine Falcon	Endangered
	Golden Eagle	Endangered
	Least Tern	Endangered
	Sedge Wren	Endangered
	Box Turtle	Endangered
	Spotted Turtle	Threatened
	Blandings Turtle	Threatened

g. Historical/Cultural Resources

(1) Fort Preble is an historic Maine location. Efforts to have the site put on the National Register of Historical Sites have failed due to extensive renovation of the original buildings on the site (see documents E-6 and H-1, and interview I-2).

(2) No sites of archeological significance have been noted within Fort Preble (see document E-6).

4. HISTORICAL ORDNANCE PRESENCE

a. Chronological Site Summary

(1) Fort Preble, located in South Portland, Maine, was one of many locations in the U.S. used as a coastal defense site

from the early 1800s through WW II. Documentation indicates that Fort Preble was named after Commodore Preble who was born in Portland, Maine.

(2) The fort was built in 1808 on 5 acres of land purchased from Ebenezer Thrasher, as recorded in the deed records of Cumberland County on 29 February 1808 (see document G-1). Additional acreage (approximately 24 acres), was sold to the U.S. Government by private citizens between 16 April 1833 and 2 October 1901, with 3.9 acres added in 1940 (see documents E-1, G-1, G-5, and L-11).

(3) Items in paragraphs 4.a.(4) through 4.a.(11) were extracted from, A Guide to Fort Preble 1808 - 1950, by Joel W. Eastman (reference B-8).

(4) The original Fort Preble was built in a modified star design from brick and stone, mounting 14 guns (see drawing L-1).

(5) In 1839, extensive rebuilding of the fort was done. Earthworks were thickened and powder magazines and barracks were remodeled, and in 1845, two large external batteries were constructed with earthen parapets, with 12 guns in the north battery and 10 in the south battery (see drawings L-2 and L-3).

(6) In 1864, the face of the fort, gun platforms within the fort, and the gun platforms in the north and south batteries were rebuilt to mount heavier guns and "bomb-proof" ammunition magazines were added.

(8) In 1871, modification of the fort and the north and south batteries started but was suspended in 1875 due to lack of funds. In 1886, the suspended modifications were restarted, and finished in 1887. The south battery was expanded to 24 large guns and 10 magazines.

(9) Between 1896 and 1904, the fort was rebuilt as a coast artillery post. The 1808 fort was rebuilt as Battery Rivardi with twin 6-inch rifled guns mounted on disappearing carriages. The keystone of the original fort remains (see photograph J-8 and plate 3). Battery Mason, with a 3-inch gun, was added to the north battery. Batteries Chase and Kearney were constructed near the south battery mounting sixteen 12-inch mortars (see drawings L-4, L-5, L-6, L-7 and L-8, and document E-7).

(10) Fort Preble was fully manned through WWI, with the 8th Coast Artillery Regiment stationed at the fort being responsible for maintenance of all Portland defenses.

(11) The fort remained fully manned through WWII with temporary buildings added. In 1950, Fort Preble was deactivated and declared surplus.

(12) On 26 June 1951, the Army transferred 1.45 acres of land to the Department of the Air Force (see document G-1).

(13) On 21 July 1952, the Army transferred 28 acres of the land to the Department of the Navy (see document G-1).

(14) On 3 February 1953, the Army transferred 3.45 acres of land to the Department of the Air Force. With this transfer, the entire 32.9 acres had been transferred from the Army to the Air Force and the Navy (see document G-1).

(15) On 13 December 1957, the Navy transferred 28 acres to the State of Maine for educational purposes (see document G-2).

(16) On 20 March 1961, the Air Force leased 4.9 acres to the State of Maine for educational purposes (see document G-4).

(17) On 17 October 1961, the Air Force transferred ownership of 4.9 acres of land to the State of Maine for educational purposes (see document G-3).

(18) The Southern Maine Technical College has utilized the 32.9 acres since the land was acquired by the State of Maine.

b. Ordnance Related Records Review

(1) Research efforts began with a thorough review of all reports, historical documents, and reference material gathered during the archival records search. During the review, an effort was made to focus on the area of potential OEW contamination as described in the Inventory Project Report (INPR) (reference documents B-4 and E-1).

(2) A number of letters and memorandums dealing with the gun emplacements at the fort were found as described in paragraphs (a) through (f) below.

(a) Letter from Major Russell, Ordnance Department, U.S. Army, to the Artillery District Ordnance Officer, Fort Preble, Maine, dated 24 December 1904, subject: Order for supplies. The letter requested two 6-inch disappearing gun carriages and 2 covers for telescopic sights (see document F-1).

(b) Letter from the Military Secretary's Office to The Commanding General, Atlantic Division, dated 14 January 1905, subject: Naming of two gun batteries on Fort Preble, Maine (see document F-2).

(c) Letter from the Office of Inspector of Ordnance to the Artillery District Ordnance Officer, dated 8 January 1906, subject: Correction of invoice. The letter gave corrected serial numbers for 3-inch telescopic sights (see document F-3).

(d) Letter from Major Hobbs, Ordnance Department, U.S. Army, Watertown Arsenel (sic), to the Commanding Officer, Artillery District of Portland, dated 31 January 1906, with endorsements, subject: Turn-in of gun carriage parts (see document F-4).

(e) Letter from Major Hobbs, Ordnance Department, U.S. Army, Watertown Arsenel (sic), to the Commanding Officer, Artillery District of Portland, dated 9 February 1906 with endorsements. Subject: Turn-in of firing pistols for 6-inch disappearing gun carriages (see document F-5).

(f) Letter from Lt. Mark Ireland, Ordnance Department, U.S. Army to the Commanding Officer, Artillery District of Portland, Fort Williams, Maine, dated 4 September 1909, subject: Irregularities observed in the armament of Battery Rivardi, Fort Preble, Maine. The correspondence indicated that the numbers 8 and 10 six-inch guns had breech blocks that did not rotate properly and that the recoil roller paths on carriage numbers 39 and 40 needed cleaning (see document F-6).

(3) Table 4-1 has been developed based on information abstracted from previously stated correspondence and historical drawings (see drawings L-1, L-2, L-3 and L-4, and document E-8).

TABLE 4-1 FORT PREBLE GUN EMPLACEMENTS			
BATTERY	**DATE OF CONSTRUCTION**	**NUMBER OF GUNS**	**COMMENTS**
Ft. Preble	1808	14 cannon	Star shaped fort.
North Battery	1845	12 cannon	
South Battery	1845	10 cannon	Expanded to 24 cannon in 1887.
Rivardi	1896-1904	2 6-inch guns	Battery was built around the original fort. The guns were mounted on disappearing carriages. Guns removed during WWI.
	1920	2 3-inch anti-aircraft guns	Removed in 1929 and battery abandoned.
Mason	1896-1904	3-inch gun	The gun was mounted on a pedestal mount. Moved to South Battery in 1943.
Chase/Kearny	1901	16 12-inch mortars	At some time between 1901 and 1940, 4 mortars were removed from each battery. Remaining mortars removed after WWII. Batteries buried with new construction on top.

(4) No historical or current documentation could be found relating to any OEW being found on the land where Fort Preble is situated or anywhere in the surrounding area since site closure.

(a) Sources that were checked in the search for any OEW contamination included:

[1] National Archives.
[2] Regional Archives.
[3] The Military History Institute.
[4] U.S. Army Center for Military History.
[5] Emergency Ordnance Disposal (EOD)
[6] Maine State Archives.
[7] Local police departments.
[8] County courthouses.
[9] Local residents.

(b) For a complete list of sources checked, see Appendix A, Reference Sources.

c. Interviews with Site Related Personnel.

(1) In an attempt to verify the War Department did, in fact, use Fort Preble as a coastal defense site, interviews were conducted with individuals previously employed by the War Department or who had knowledge of the area.

(2) Mr. Tom DePeter, of the maintenance department for Southern Maine Technical College, was interviewed 15 July 1994. Mr. DePeter said that he had worked on campus for over 25 years and had been involved in digging and construction projects all over the campus. He had never encountered any type of OEW. He also said that he knew of no one who had ever encountered any OEW. Mr. DePeter did point out an underground storage tank (see photograph J-3 and plate 3) which is the subject of a Con/HTRW project No. D01ME012001 and also pointed out the Switchboard Building (see photographs J-4, J-5 and J-6, and plate 3) which is the subject of a Building Demolition/Debris Removal project No. D01ME012002. Mr. DePeter was asked if the gun emplacements on Fort Preble had ever been fired during WWII and he said he didn't think so (see interview I-1).

(3) Mr. Joel W. Eastman, Professor, University of Southern Maine, was interviewed 17 July 1994. Mr. Eastman is an historian who has done an extensive study of coastal defense sites including Fort Preble. Mr. Eastman walked the site with the inspectors and pointed out various points of interest. Mr. Eastman was asked if anyone to his knowledge had ever found any OEW at Fort Preble. He said nothing had ever been found. He said when the military left they emptied the powder magazines and removed all the projectiles. He said the very rocky subsurface would make burying anything more trouble than just removing it would be. Mr. Eastman was asked if the guns at the fort had been fired at all during WWII. He said no, that the guns on the outer islands had been used extensively for practice,

but the guns on Fort Preble were not used. Mr. Eastman was asked if the harbor at Fort Preble had mines placed in it during WWII and he said yes. He was asked if he thought there was any chance any mines remained in the water and Mr. Eastman said no, that all the mines were connected by cables and precisely plotted so they could all be recovered. Mr. Eastman discussed the buildings remaining on the site that were a carryover from the site being used by the military. He said all the buildings had been completely refurbished and were used by the Southern Maine Technical College (see interview I-2).

(4) Lt. Ed Guevin, Portland, Maine Police Department, was interviewed 18 July 1994. Lt. Guevin was asked if he had ever heard of any OEW being found or rumors of any OEW being found at Fort Preble. He said that he had been on the force for 24 years and had never heard of any type of ordnance being found at the fort. He said he had heard of OEW being found at Fort Scammel on House Island. He restated the idea that ground at Fort Preble is too rocky to try to bury anything there for the purpose of hiding it (see interview I-3).

(5) Deputy Chief Boyce Sandborn of the South Portland City Police Department was interviewed and asked about OEW at Fort Preble. He said that he had been with the department for over 20 years and could not remember any reports or rumors of any ammunition being found at the fort (see interview I-4).

(6) Lt. Im from the 54th EOD, Fort Monmouth, New Jersy, said that they had no responses to the site.

5. SITE ELIGIBILITY

a. Confirmed Formerly Used Defense Site

(1) Former land usage by the War Department was previously confirmed for the entire 32.9 acre site, as summarized in section 4 of this report. The site remained an active coastal defense site until it was declared surplus and deactivated in 1950 (see document E-1).

(2) There are no recapture or restricted use documents on record for Fort Preble.

b. Potential Formerly Used Defense Site

No areas were identified as Potential Formerly Used Defense Sites during the site investigation. OEW noted as being found at Fort Scammel on House Island is currently under assessment by the Corps of Engineers, New England Division.

6. VISUAL SITE INSPECTION

a. General Procedures and Safety.

(1) During the period 15-19 July 1994, members of the Site Inspection (SI) team traveled to the former Fort Preble, South Portland, Maine. The primary task of the SI team was to assess OEW presence and potential due to the gun emplacements that had been built on the site.

(2) Real estate rights-of-entry were not obtained. Access to the Fort Preble was granted by Ms. Penny Carey, assistant to the president of the college.

(3) A site safety plan was developed and used to assure an injury-free site inspection of Fort Preble. A briefing was conducted prior to the SI which stressed that OEW should only be handled by military EOD personnel. Site safety was maintained by the inspection team at all times during the on-site inspection.

(4) Prior to the site visit, a thorough review was made of available reports, historical documents, texts, and technical ordnance reference materials gathered during the ASR historical records search. This review was made to ensure team awareness of potential ordnance types and hazards.

(5) The actual inspection of the site began on 15 July 1994, at the office of Mr. Tom DePeter, head of the college maintenance department (see interview I-1). It should be stressed, again, that intrusive sampling methods were not used during this site inspection.

b. Fort Preble

(1) The former Fort Preble is accessed by exiting Interstate 95 onto Broadway Avenue in South Portland. Follow Broadway Avenue until it runs into Spring Point Marina. Turn right, go two blocks to the former Fort Preble, now the site of Southern Maine Technical College (see plates 1 and 3, and photographs J-1 and J-2).

(2) The OEW assessment of Fort Preble began at the maintenance building on the northeast side of the site where an underground storage tank is located (see photograph J-3 and plate 3).

(3) Directly south of the maintenance building is the switchboard building (see photographs J-4, J-5, and J-6, and plate 3). This building was a wood frame building that was covered by a concrete bunker then covered with dirt. No OEW was found at this location.

(4) South of the switchboard bunker is Battery Mason gun emplacement (see photograph J-7 and plate 3). This emplacement, built in 1906, had one 3-inch rapid-fire breechloading gun on a pedestal mount. The gun was removed in 1943 and placed on a new gun block in the south battery. This gun was then removed following WWII. No OEW was found at this location.

(5) Next to Battery Mason is Battery Rivardi. It was built around the original Fort Preble (see photograph J-8) in 1904, and was comprised of powder magazines (see photograph J-9 and plate 3), projectile storage rooms, and office space (see photographs J-10, J-11, and J-12, and plate 3). The emplacement was originally equipped with two 6-inch breechloading rifles on disappearing carriages. These guns were removed during WWI and not replaced. In 1920, two 3-inch anti-aircraft guns were mounted on concrete blocks on the top of the battery. These were removed and the battery abandoned in 1929. No OEW was found at Battery Rivardi.

(6) Batteries Chase and Kearney were both built in 1901. Originally they each contained eight 12-inch mortars (model 1890). At some time, four mortars were removed from each battery. The remaining mortars were removed after WWII and the batteries were buried. The Children's Learning Center and the Computer Center were constructed on top of these batteries (see photographs J-14 and J-15, and plate 3). No OEW or any indications of OEW residue were found.

(7) Many of the buildings that were a part of Fort Preble are now used as campus buildings (see photographs J-16, J-17, and J-18, and plate 3). No indications of OEW were found around any of the campus buildings.

(8) A thorough walk-over of the entire site revealed no OEW, or any indications of any OEW.

7. EVALUATION OF ORDNANCE HAZARDS

a. General Procedures

(1) The site was evaluated to determine confirmed, potential, or uncontaminated ordnance presence. Confirmed ordnance contamination is based on verifiable historical evidence

or direct witness of ordnance items. Verifiable historical records evidence consists of ordnance items located on site and documented by the local bomb squad, Army Explosive Ordnance Demolition team, newspaper articles, correspondence, current findings, etc. Direct witness of ordnance items consists of the inspection team directly locating ordnance items by visual inspection. Additional field data is not needed to identify a confirmed subsite.

(2) Potential ordnance contamination is based on a lack of confirmed ordnance. Potential ordnance contamination is inferred from records or indirect witness. Inference from historical records would include common practice in production, storage, usage, or disposal, at that time, which could have allowed present day ordnance contamination. Potential ordnance contamination could also be based on indirect witness or from present day site features. Additional field data is needed to confirm potential ordnance subsites.

(3) Uncontaminated ordnance subsites are based on a lack of confirmed or potential ordnance evidence. Historical records evidence and present day site inspections do not indicate confirmed or potential ordnance contamination. There is no reasonable evidence, either direct or inferred, to suggest present day ordnance contamination. Additional field data is not needed to assess uncontaminated ordnance subsites.

b. Fort Preble

(1) Fort Preble has no confirmed ordnance contamination.

(2) Based on the fact that nothing has been found at Fort Preble since its closure, on information from historians indicating that the Fort had not used its guns and that the ground is too rocky to permit easy burying of ammunition, Fort Preble is considered to be uncontaminated.

8. SITE ORDNANCE TECHNICAL DATA

a. End Item Technical Data

(1) No comprehensive list of the exact types/models of ammunition used at Fort Preble was uncovered. Data was compiled based upon the weapons used at Fort Preble.

(2) Table 8-1, a listing of ammunition used or possibly used, at Fort Preble along with explosive fillers has been developed.

(3) Technical data for items in table 8-1 can be found in references D-1 and D-2.

TABLE 8-1
Ammunition Used and Explosives/Chemical Filler

Item	Type/Model	Filler Weight
Small Arms Ammo	M2 Ball	Soft Steel
.50 Cal	M2 AP	Tungsten Chrome Steel
with gilding	M1 Tracer	Tracer
metal jacket	M10 Tracer	Composition
	M17 Tracer	Tracer
	M21 Tracer	Composition
	M1 Incend	Incendiary
	M23 Incend	Mixture
Propellant		Single base or Double-base (DB) powder
Canister, Fixed	M1	38 lead balls
37mm		
Propelling Charge		550 gr FNH powder
Primer, percussion	M23A1	1 gr No. 70 primer mixture
		20 gr black powder
Shell, Fixed, HE	M54	0.10# Tetryl
37mm		
Fuze, P.D.	M56	
Detonator		Primer mixture
		Lead azide
		Tetryl
Booster		Tetryl
Tracer, S.D.		Tracer mixture
Relay Pellet		Black powder
Propelling Charge		0.38# FNH powder, M1
Primer, percussion	M38A2	Primer mixture
		55 gr black powder
Shell, Fixed, HE	M63	0.085# TNT
37mm		
Fuze, B.D.	M58	
Detonator		Priming mixture
		Lead azide
		Tetryl
Booster		Tetryl
Tracer, S.D.		Tracer mixture
Relay Pellet		Black powder
Propelling Charge		0.44# FNH powder, M1
Primer, percussion	M38A2	Primer mixture
		55 gr black powder

TABLE 8-1
Ammunition Used and Explosives/Chemical Filler

Item	Type/Model	Filler Weight
Shot, Fixed, A.P.C.	M51	Hard steel core
37mm		
Tracer		Tracer composition
Propelling Charge		0.15# FNH powder, M1 or M5
Primer, percussion	M38A2	See above
Shot, Fixed, A.P.C.	M59 or	Hard steel core
37mm	M59A1	
Tracer		Tracer composition
Propelling Charge		0.31# FNH powder, M1 or 0.52# FNH powder, M5
Primer, percussion	M38A2	See above
Shot, Fixed, A.P.	M74	Solid steel slug
37mm		
Tracer		Tracer composition
Propelling Charge		0.44# FNH powder, M1
Primer, percussion	M38A2	See above
Shot, Fixed, A.P.	M80	Solid steel slug
37mm		
Tracer		Tracer composition
Propelling Charge		0.56# FNH powder
Primer, percussion	M38A2	See above
Shrapnel, Fixed	Mk. I	253 0.5" lead balls
3-inch		(hardened with antimony)
Expelling charge		3 oz. black powder
Fuze	Mk. IIIA2	
Primer		Primer composition
Powder Pellet		Black powder
Magazine Charge		20 gr black powder
Propelling charge		4.62# NH powder, M1
Primer, percussion	M28	

TABLE 8-1
Ammunition Used and Explosives/Chemical Filler

Item	Type/Model	Filler Weight
Shell, fixed, 3" AA HE	Mk. IX	TNT, .91#
Propellant		FNH 4.8#
Primer	M1	Black powder 100 gr
	M21	Black powder 330 gr
Fuze, time 21 second	Mk III	Black powder 95 gr
Booster	Mk X	
Detonator		Fulminate of mercury 12 gr
Booster charge		Pressed Tetryl 170 gr
Projectile, 6" HE	Mk II	TNT or Amatol
Propelling charge		NH powder
Fuze, point detonating	Mk V	Fulminate of mercury Black powder
Primer, friction	M1914	
Projectile, 12" HE		TNT or Amatol
Propelling charge		NH powder
Fuze, base detonating	Mk V	Fulminate of mercury Black powder
Primer, friction	M1914	

b. Chemical Data of Ordnance Fillers

Table 8-2 has been developed to provide information on the explosive/chemical compounds used in the ordnance cited in table 8-1.

TABLE 8-2
Chemical Data of Ordnance Fillers

Explosive Materiel	Synonym(s)	Chemical Formula
Amatol (50-50) or (80-20)		
Ammonium Nitrate		NH_4NO_3
TNT	2,4,6-trinitrotoluene	$C_6H_2CH_3(NO_2)_3$
Black Powder		
74% Potassium Nitrate	Saltpeter; Niter	KNO_3
11% Sulfur		S
16% Charcoal		C
Double-base Powder	Ballistite	
60% Nitrocellulose	Guncotton; Pyroxylin	$[C_6H_8O_5(NO_2)_3]_n$
39% Nitroglycerin		$CH_2NO_3CHNO_3CH_2NO_3$
0.75% Diphenylamine	Stabilizer DPA	$(C_6H_5)_2NH$
FNH Powder, Type II		
Nitrocellulose	Guncotton; Pyroxylin	$[C_6H_8O_5(NO_2)_3]_n$
Dibutylphthalate	Gelling agent	$C_6H_4(CO_2C_4H_9)_2$
Dinitrotoluene	DNT	$C_6H_3CH_3(NO_2)_2$
Diphenylamine	Stabilizer DPA	$(C_6H_5)_2NH$
Incendiary Compositions*		
IM-11		
50% Barium Nitrate		$Ba(NO_3)_2$
50% Magnesium Aluminum Alloy		Mg & Al
IM-23		
50% Potassium Perchlorate		$KClO_4$
50% Magnesium Aluminum Alloy		Mg & Al
IM-28		
40% Barium Nitrate		$Ba(NO_3)_2$
50% Magnesium Aluminum Alloy		Mg & Al
10% Potassium Perchlorate		$KClO_4$
IM-68		
24% Barium Nitrate		$Ba(NO_3)_2$
50% Magnesium Aluminum Alloy		Mg & Al
25% Ammonium Nitrate		NH_4NO_3
IM-69		
40% Barium Nitrate		$Ba(NO_3)_2$
50% Magnesium Aluminum Alloy		Mg & Al
10% Iron Oxide, Ferric		Fe_2O_3
IM-136		
49% Potassium Perchlorate		$KClO_4$
49% Magnesium Aluminum Alloy		Mg & Al
IM-142		
48% Barium Nitrate		$Ba(NO_3)_2$
46% Magnesium Aluminum Alloy		Mg & Al

TABLE 8-2
Chemical Data of Ordnance Fillers

Explosive Material	Synonym(s)	Chemical Formula
IM-144		
50% Barium Nitrate		$Ba(NO_3)_2$
50% Red Phosphorus		P
Incendiary Compositions		
IM-162		
25% Incendiary Composition IM-23		
75% Zirconium		Zr
IM-163		
50% Incendiary Composition IM-23		
50% Zirconium		Zr
Incendiary Mixture	(see incendiary compositions)	
Lead Azide	Azide	$Pb(N_3)_2$
Mercury Fulminate	Mercuric Cyanate	$Hg(CNO)_2$
Primer Composition		
FA-90A (for percussion primers)		
25% Lead Thiocyanate		$Pb(SCN)_2$
12% Antimony Sulfide		Sb_2S_3
10% PETN		$C(CH_2ONO_2)_4$
53% Potassium Chlorate		$KClO_3$
FA-70		
25% Lead Thiocyanate		$Pb(SCN)_2$
17% Antimony Sulfide		Sb_2S_3
5% TNT	2,4,6-trinitrotoluene	$CH_3C_6H_2(NO_2)_3$
53% Potassium Chlorate		$KClO_3$
Primer Mixture*		
Mercury Fulminate	Mercuric Cyanate	$Hg(CNO)_2$
Potassium Chlorate		$KClO_3$
Antimony Sulfide		Sb_2S_3
Tetryl	Trinitrophenyl-methylnitramine	$(NO_2)_3C_6H_2N(NO_2)CH_3$
TNT	2,4,6-trinitrotoluene	$CH_3C_6H_2(NO_2)_3$

TABLE 8-2
Chemical Data of Ordnance Fillers

Explosive Materiel	Synonym(s)	Chemical Formula
Tracer Compositions*		
R-256		
8.3% Calcium Resinate		
26.7% Strontium Peroxide		SrO_2
26.7% Magnesium Powder		Mg
33.3% Strontium Nitrate		$Sr(NO_3)_2$
R-284		
17% Polyvinyl Chloride		
28% Magnesium Powder		Mg
55% Strontium Nitrate		$Sr(NO_3)_2$
R-321		
16% Polyvinyl Chloride		
26% Magnesium Powder		Mg
52% Strontium Nitrate		$Sr(NO_3)_2$

*Most frequently used chemical compositions and their major ingredients.

9. OTHER ENVIRONMENTAL HAZARDS

There are no other environmental hazards.