US Army Corps
of Engineers
Rock island District

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

Archives Search Report

FINDINGS
for

ASSATEAGUE ISLAND

Ocean City, Maryland
Project Number C03MD093001

June 1994

DEFENSE ENVIRONMENTAL RESTORATION PROGRAM
for
FORMERLY USED DEFENSE SITES

FINDINGS

ORDNANCE AND EXPLOSIVE WASTE ARCHIVES SEARCH REPORT FOR ASSATEAGUE ISLAND WORCESTER COUNTY, MARYLAND AND ACCOMACK COUNTY, VIRGINIA PROJECT NUMBER C03MD093001

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ORDNANCE AND EXPLOSIVE WASTE
ARCHIVES SEARCH REPORT
FOR
ASSATEAGUE ISLAND
WORCESTER COUNTY, MARYLAND AND ACCOMACK COUNTY, VIRGINIA
PROJECT NUMBER C03MD093001

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FINDINGS

TABLE OF CONTENTS

APPENDICES

REPORT PLATES

ORDNANCE AND EXPLOSIVE WASTE
ARCHIVES SEARCH REPORT
FOR
ASSATEAGUE ISLAND
WORCESTER COUNTY, MARYLAND AND ACCOMACK COUNTY, VIRGINIA
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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 Assateague Island, Maryland and Virginia (see Plate 1 for general location map). 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 chemical warfare material (CWM)and conventional munitions. This was achieved through thorough evaluation of all historical records, interviews, and the on-site visual inspection results.

b. Scope

(1) The investigation focused on 17,552 acres of land (the entire island) that is believed to have contained 2 rocket ranges known as Stinger-One and Stinger-Two, and 2 accompanying OEW burial trenches used by the Navy and possibly the Army Air Corps.

(2) This report presents the site history, site description, real estate ownership information, and confirmed ordnance presence (prior to and after site closure), based on available records, interviews, and the site inspection. It further provides a complete evaluation of all information to assess current day potential ordnance contamination, where actual ordnance presence has not been confirmed.

2. PREVIOUS INVESTIGATIONS

a. 1988 EOD Team Deployment

(1) Army and Navy EOD Teams were deployed to Assateague Island as requested by the National Park Service when ordnance items washed ashore at the North Ocean Beach

in July of 1988. The North Ocean Beach area is believed to coincide with the Stinger-One rocket range (see Plate 2).

(2) The 144th EOD from Ft. Meade, Maryland (Army), was the first EOD unit to deploy to the site on 14 July 1988. The 144th EOD recovered and disposed of three (3) 5" rockets, with at least one containing a rocket motor. On 15 July 1988, the 144th EOD returned to the site to recover and dispose of another 5" rocket that had washed ashore in the same area. At this time, it appeared that the ordnance was coming from a "hole" approximately 15 meters offshore.

(3) On 16 July 1988, the U.S Navy EOD Mobile Unit II arrived at the site and took over operations from the 144th EOD. From 17-20 July 1988, the Navy EOD conducted an underwater survey of the area around the "hole". Results of the underwater survey led the leader of the Navy EOD team to believe that the "hole" was a trench dug to bury expended shells, etc. found while clearing a range. It was also believed that this trench was originally on Assateague Island, but is now underwater due to island migration.

(4) The ordnance items recovered by both EOD teams included seven (7) rocket motors (one (1) not expended); six (6) 5" shells (two (2) live); and numerous ballistic tips used to improve the aerodynamics of practice rockets. No removal action was taken on the majority of suspected ordnance at this time. A complete report on the EOD team deployments can be found in U.S. Department of the Interior, National Park Service Supplementary Case/Incident Record Number 880407 (see document F-6).

b. **1991 Preliminary Assessment**

(1) A Preliminary Assessment of Assateague Island was conducted under the Defense Environmental Restoration Program, Formerly Used Defense Sites (DERP FUDS) by the U.S. Army Corps of Engineers, Baltimore District (Ref B-7). At that time, the Findings and Determination of Eligibility (FDE), dated 19 December 1991, concluded that the 17,552 acre site located on Assateague Island in Worcester County, Maryland and Accomack County, Virginia, had been formerly used by the War Department (see document E-2).

(2) Neither acquisition nor disposal documentation for the site was available during the PA. However, WD use of Assateague Island was substantiated by statements made by a former Navy spotter and by ordnance washing ashore in July of 1988 (see 2.a above) near an area suspected of being a rocket range.

(3) The PA investigation concluded that there were eligible categories of hazards under the DERP FUDS program. Due to the fact that the site was found to have been used as

a practice rocket target range for Navy pilots (and possibly Army Air Corps pilots), an Ordnance and Explosive Waste (OEW) project was recommended; DERP FUDS OEW Project Number C03MD093001, the principle subject of this report (see document E-2 and Table 2-1).

TABLE 2-1
DERP-FUDS PRELIMINARY ASSESSMENT PROJECTS

Project Number	DERP Category	Present Phase	Comments	Location
-	CON/HTRW	-	None	-
-	HTRW	-	None	-
-	BD/DR	-	None	-
C03MD093001	OEW	SI	Ordnance or explosive contamination	Entire 17,552 Acres (See Plate 1)

c. 1991 Contracted Research and Site Visit

(1) Human Factors Applications, Inc., under subcontract to EA Engineering, conducted a site visit of Assateague Island and subsequent research at Wallops Flight Center (NASA), Chincoteague, Virginia, on 24-25 July 1991. This site visit and research was done to complete the INPR for the site. EA Engineering was originally contracted by Baltimore District, Corps of Engineers (see document E-3).

(2) The focus of the site visit was to determine the location of the Stinger-Two rocket range and its accompanying burial trench. Although they were not able to positively locate either one, a 5" rocket motor was discovered in the suspected vicinity of the Stinger-Two rocket range. They were also shown an expended MK43 practice bomb and a 20mm casing that was found on the Island by a National Park Service Ranger.

(3) Research at Wallops Flight Center uncovered that Assateague Island was used as a rocket, bombing and strafing range in support of NAS Chincoteague, Virginia and NAS Manteo, North Carolina. The primary use was as a rocket range for inert 2.25 and 5" rockets, but MK43 practice bombs and 20mm cannon rounds were also used there.

(4) As a result of their findings, Human Factors Applications, Inc., recommended a large scale sweep of the Island, paying particular attention to the North Ocean Beach area (see documents E-3 and I-5).

d. **1992 Interim Sweep of North Ocean Beach Area**

(1) ISSI Unexploded Ordnance, Inc., under COE Contract Number DACA87-92-P-0545, conducted a sweep of the North Ocean Beach area on 27 February - 19 March 1992.

(2) Over the three week period, 436 lanes and 570,300 sq ft of beach were swept. Included in the area was the suspected burial trench found during the July 1988 EOD team deployments.

(3) No ordnance or ordnance related items were discovered during the sweep - only fencing, metal piping and a shipwreck (see document E-7 and E-12).

3. SITE DESCRIPTION.

a. **Existing Land Usage**

(1) Assateague Island, a 36 mile barrier island paralleling the Maryland and Virginia coastlines, consists of approximately 17,552 acres of land in Worcester County, Maryland and Accomack County, Virginia (see Plate 1).

(2) Assateague Island consists of 17,552 acres - 8,018 acres in Maryland and 9,534 acres in Virginia. The U.S. Fish and Wildlife Service owns 9,021 acres in Virginia and 418 acres in Maryland that is the Chincoteague National Wildlife Refuge. The U.S. National Park Service owns 6,900 acres in Maryland and 205 acres in Virginia that is the Assateague Island National Seashore. The State of Maryland owns 696 acres that is Assateague Island State Park. The Commonwealth of Virginia owns 308 acres of salt-marshland. The U.S. Coast Guard owns less than 1 acre in Virginia for the operation of a lighthouse. Approximately 4 acres in Maryland are held by private interests (see document E-9). Table 3-1 represents the land usage of the area.

b. **Climatic Data**

(1) The region, which is part of the Delmarva Peninsula, has a humid mesothermal climate that is influenced by maritime tropical air masses in the summer and by continental polar air masses in the winter. Most high and low pressure systems track from west to east, as the region lies in a zone of prevailing westerlies. The region is vulnerable to hurricanes primarily between June and November. Past hurricanes have caused extensive damage, including forming new inlets and closing existing ones.

(2) Normal daily maximum temperatures range from 45°F in January to 85°F in July. Normal daily minimum temperatures range from 30°F in January to 65°F in July.

TABLE 3-1
LAND USAGE

FORMER USAGE	PRESENT OWNER	PRESENT USAGE	SIZE/ ACRES	COMMENTS
Area A: Stinger-One Range Impact Area	Federal, State	National Seashore, State Park	350* MD	See Plates 3 and 7
Area B: Stinger-One Range Buffer Zone	Federal	Ocean	300* /1	See Plates 3 and 7
Area C: Stinger-Two Range Impact Area	Federal	National Seashore	350* MD	See Plates 4 and 8
Area D: Stinger-Two Range Buffer Zone	Federal	Ocean	300* /1	See Plates 4 and 8
Area E: Remaining Land	Federal, State,	National Seashore, Wildlife Refuge	7,318* MD 9,534 VA	Remainder of island
			----------	
			17,552 TOTAL	
			(8,018 MD TOTAL) (9,534 VA TOTAL)	

* Indicates approximated acreage
/1 Areas B and D are not an integral part of Assateague Island. They are ocean areas possibly containing OEW that missed the targets in Areas A and C, respectively.

(3) Average annual precipitation is approximately 49 inches. Rainfall, derived from cyclonic weather systems in the fall, winter and spring, and from local convective storms in the summer, is distributed fairly evenly throughout the year. The lowest average monthly precipitation of 3.41 inches occurs in December, while the highest average monthly precipitation of 5.67 inches occurs in August. Thunderstorms occur on average 20-40 days a year, primarily in the summer months. Mean average annual snowfall is 6-12 inches. The mean annual number of days with heavy fog is 20-30 (reference B-5).

c. **Topography**

The topography of Assateague Island consists mainly of flat to gently rolling sand dunes. Island elevations range from sea level to approximately 15 feet.

d. **Geology and Soils**

(1) Regional Geology

(a) The subsurface sediments of the Delmarva Peninsula rest on a seaward sloping basement of Paleozoic crystalline rocks. The basement is folded and faulted into a series of northwest-southeast trending ridges and depressions (Ref B-5). The axis of one major depression, the Salisbury Embayment, crosses the Delmarva Peninsula near the Virginia-Maryland border.

(b) Cretaceous Cenozoic and Mesozoic sands, silts and clays account for more than half of the thickness of subsurface sediments (Ref B-5). Lower Cretaceous formations representing non-marine deposition in river channels, flood plains and swamps are overlain by Upper Cretaceous lagoonal, estuarine and deep-water marine rocks. This represents the gradual encroachment of the Upper Cretaceous Sea over the region.

(2) Site Geology

(a) The 17,552 acre site is a barrier island off the Atlantic Coast of the Delmarva Peninsula. The sand barrier rests on soft lagoonal mud that contains oyster, clam and snail shells.

(b) The lagoonal mud overlies organic coastal salt marsh mud, and peat, which, in turn, overlies organic debris-rich sandy mud. This entire sequence overlies pre-Halocene sediments undergoing transgression (Ref B-5).

(3) Site Soils

(a) The sand barrier is composed of beach and washover sands and gravels topped by wind blown sand dunes. Except for steep slopes on dunes this "soil" is nearly level and is composed of light-gray to white marine sand and shell material. The sand is constantly shifted by waves and wind, is excessively drained, exhibits no soil development, and supports little vegetation (Ref B-5).

(b) The lagoon behind Assateague Island is open water with areas of marsh and mud flats. Tidal marsh "soils" are sandy to clayey, poorly drained, acidic, saline and can contain peat or highly organic black muck (Ref B-5).

these "soils" are included in the Tidal Marsh-Coastal Beach association.

(c) Additionally, a small amount of Plummer soils can be found in stabilized depressions on coastal beaches.

e. **Hydrology**

(1) Groundwater

(a) Groundwater in the region surrounding Assateague Island is supplied primarily by the Manokin, Pokomoke, and Quaternary aquifers.

(b) The Manokin aquifer is recharged by the overlying Pokomoke aquifer, which is recharged by the downward movement of water from the Quaternary sediments. Recharging of the Manokin and Pokomoke aquifers occurs along a drainage divide between the Atlantic Ocean and Chesapeake Bay. The Quaternary aquifer is recharged by precipitation over a broad area (Ref B-5).

(c) Regional movement of groundwater in the Manokin and Pokomoke aquifers is away from the drainage divide and towards the ocean, bays, rivers and areas of pumping (Ref B-5). Groundwater movement in the Quaternary aquifer is from areas of high water table to streams, bays and the ocean.

(2) Tidal Hydrology

(a) Tide ranges and tidal currents in the inshore waters of Assateague Island are controlled by the position of ocean inlets (Ref B-5). The two ocean inlets on Assateague Island are the Ocean City inlet on the north, which leads to Sinepuxent Bay, and the Chincoteague inlet 30 miles to the south, which leads to Chincoteague Bay.

(b) Mean tide range at the Ocean City and Chincoteague inlets is 3.4 to 3.8 ft, but near the midpoint between the two inlets in northern Chincoteague Bay, the tide range is only 0.4 ft. High water at the midpoint occurs approximately 7 hrs after high water at the inlets. Tidal currents in the bays range from 0.15 to 0.5 knots. Through the tides, approximately 7% of the water in the bays is renewed each day (Ref B-5).

f. **Natural Resources**

Several threatened or endangered species of animal wildlife have been identified in the study area. However, no threatened or endangered plant species are known to exist

on Assateague Island. A summary of threatened or endangered wildlife is in Table 3-2 (see documents E-6, E-8 and E-10).

g. **Historical/Cultural Resources**

Several historical sites exist on Assateague Island. Some are included on the National Park Service (NPS) List of Classified Structures. A thorough archeological survey of the site has never been completed, and because of the island's composition and dynamics, it is doubtful that an additional undisturbed archeological site will be discovered in the future. Historical sites on Assateague Island are included in Table 3-2 (see documents E-6, E-8, E-10, K-1, K-2 and K-3).

TABLE 3-2
NATURAL AND CULTURAL RESOURCES

Resource Classification	Type	Comment
Wildlife		
Fish	Shortnose Sturgeon	Endangered; in estuarine and marine waters
Reptile	Loggerhead Turtle	Endangered; limited nesting
Bird	Southern Bald Eagle	Endangered; Chincoteague Wildlife Refuge
	American Peregrine Falcon	Endangered; Chincoteague Wildlife Refuge
	Red-cockaded Woodpecker	In mature pine tree stands
	Savannah (Ipswich) Sparrow	Chincoteague Wildlife Refuge; winter inhabitant of dunes
	American Osprey	Undetermined status; summer nesting
	Eastern Marlin	Undetermined status; winter nesting
	Piping Plover	Endangered; nesting area protected

TABLE 3-2
NATURAL AND CULTURAL RESOURCES Continued

Resource Classification	Type	Comment
Wildlife		
Mammals	Delmarva Peninsula Fox Squirrel	Endangered; Chincoteague Wildlife Refuge
	Sperm, Sei, Right, Humpback, and Finback whales	All endangered; occasionally stranded on beaches
Vegetation	(None)	
Historical	Pope Island Boathouse	In MD; owned by NPS; at North Beach; on NPS List of Classified Structures
	Site of North Beach Lifesaving Station	In MD; owned by NPS; foundation rubble only
	Site of Birchs Saltworks	In MD; owned by NPS; near end of North Beach Drive
	Site of Green Run Lifesaving Station	In MD; owned by NPS; buildings have been moved
	Site of Scotts Ocean House	In MD; owned by NPS
	Site of Green Run Village	In MD; owned by NPS
	Green Run Cemetery	in MD; owned by NPS
	Assateague Beach Coast Guard Station	In VA; owned by NPS; on NPS List of Classified Structures; registered VA landmark
	Ruins of Seaboard Oil and Guano Co Fish Factory	In VA; owned by FWS; on NPS List of Classified Structures

TABLE 3-2
NATURAL AND CULTURAL RESOURCES Continued

Resource Classification	Type	Comment
Historical (Cont)	Site of Conant Brothers Fish Factory	In VA; owned by FWS
	Site of Pope Island Lifesaving Station	In VA; owned by NPS
	Assateague Lighthouse	In VA; owned by FWS; operated by Coast Guard; on National Register of Historical Places
Cultural	Artifacts	Island once used by Indians primarily for hunting

4. HISTORICAL ORDNANCE USAGE

a. **Chronological Site Summary.**

(1) Assateague Island is one of many barrier islands located off the coast of Maryland and Virginia. The island has an extensive and lengthy history, all of which cannot be captured in this brief document.

(2) Assateague Island saw its share of wartime activity during both world wars. In World War I (WWI), the first successful U-boat attack in U.S. coastal waters occurred 30 miles southeast of Toms Cove, and the last ship sent down in 1918 was within 10 miles of Assateague. During World War II (WWII), several vessels were torpedoed and sunk within sight of the Pope Island Coast Guard station (see document E-8). The U.S. Coast Guard manned stations on the Barrier Islands of Assateague, Chincoteague, Wallops, Metompkin, Cedar, and Parramore during WWII, and several of these "islands were used for quarantine purposes and special training" (see document E-5).

(3) From approximately 1944 through 1947, the U.S. Navy and/or Army Air Corps reportedly established two rocket/bombing ranges on portions of Assateague Island along the Maryland coast. These ranges were used for target practice by land based aircraft. Additionally, two, and possibly three, ordnance burial sites were constructed at the end of the war for disposal of ordnance as the ranges

were cleared (see document L-3). No records relating to the method of acquisition of these lands by the War Department were found during the historical records search (see documents E-2 and E-3).

(4) In 1943, the southern portion of the island became the Chincoteague National Wildlife Refuge. The area was developed for greater daytime use in 1956. During the 1950s, the northern section of the island was subdivided into thousands of vacation homes. The 1962 storm destroyed most of the existing development and discouraged any further construction. In 1965, Assateague Island was authorized as a national seashore.

(5) Except for the refuge and campsites, Assateague Island is virtually undeveloped today (see document E-10).

b. **Review of Ordnance Related Records**

(1) Research efforts began with a thorough review of all material gathered during the ASR historical document search. A considerable collection of documents relative to Assateague Island was located. A few documents were surfaced that indicated War Department usage of the island as an aircraft bombing/strafing range during WWII. No records, however, were surfaced that related to the method of acquisition of this real property by the military. Important to the verification of real property use by the War Department and the presence of ordnance contamination are the following documents.

(2) A case/incident record exists (see document F-6) wherein National Park Service and military EOD personnel located WWII era ordnance, e.g., rocket motors, 5" High Velocity Aircraft Rockets (HVAR), and component parts from practice/target rockets on the North Ocean Beach of Assateague Island in 1988. Also identified was an ordnance burial site located off shore. This burial site would have originally been located on land, but through the years and because of the migratory nature of the barrier islands the ocean has reclaimed this land.

(3) An architectural and engineering firm memorandum dated 30 July 1991 (see document E-3) was located which states that Assateague Island was an active bombing range in support of the then Naval Air Station Chincoteague, Virginia and Naval Air Station Manteo, North Carolina between 1944 and 1947. These ranges, as other similar ranges of the WWII era, were used for training using 20mm cannon, 2.25 and 5" rockets and practice bombs. Table 4-1 lists typical WWII Navy aircraft and accompanying armament that may have utilized the ranges on Assateague Island.

TABLE 4-1
Aircraft Possibly Utilizing Assateague Island

Model	Type	Tactical Weapons	Practice Weapons
Curtiss SB2C/A-25 Helldiver	Bomber	20mm Cannon	Same
		.30 cal Machine Gun	Same
		5 inch Rockets	2.5 inch rockets
		1000 lb of bombs under wings	3, 25 and 100 lb practice bombs
		1000 lb of bombs internally	100 lb practice bombs
Grumman TBF/TBM Avenger	Bomber	.30 cal Machine Gun	Same
		.50 cal Machine Gun	Same
		5 inch Rockets	2.25 inch Rockets
		1 Torpedo	Practice Torpedo
		2,000 lb of bombs	3, 25 and 100 lb practice bombs
Grumman F6F Hellcat	Fighter	.50 cal Machine Gun	Same
		20mm Cannon	Same
		5 inch Rockets	2.25 inch Rockets
		2,000 lb of bombs	3, 25 and 100 lb practice bombs
Vought V-166B/F4U Corsair	Fighter	20mm Cannon	Same
		5 inch Rockets	2.25 inch Rockets
		1,000 lb bombs	3, 25 and 100 lb practice bombs
		1,600 lb bombs	

(4) Also reviewed were letters (see documents F-1 through F-5) written by a former Navy target range spotter assigned duties at Assateague Island in 1945. These letters, in detail, identify the locations of two target ranges on the island used by the Navy during WWII. The northern most range, called Stinger-One Range was located just to the north of North Ocean Beach, and the southern most range, Stinger-Two, was located to the east across from Green Run Bay.

(5) Residual OEW has washed ashore in the Stinger-One Range area (4.b.(2) above). Based on range operations as described in document F-5, it is possible that a small number of munitions missed the range targets and landed in the Atlantic Ocean adjacent to the range areas.

c. **Interviews with Site Related Personnel.**

(1) In an attempt to verify that Army Air Corps or Navy aircraft used Assateague Island as a rocket or bombing target range during WWII, interviews were conducted with two individuals who were previously employed by/for the Navy

within the barrier islands during that timeframe. Both individuals were aware that aircraft departed from the then Naval Air Station (NAS) located on Wallops Island on training missions, but neither were privy to their destination (see documents I-1 and I-2).

(2) A continuing dialogue was maintained with Mr. Bob Thomas, District Ranger for the Assateague Island National Seashore during the site inspection. These meetings and discussions included review of historical records, maps, and drawings. These reviews allowed the site inspection team to identify the most likely aerial approaches to the target ranges and of the burial sites.

(3) Historical interviews by personnel from EA Engineering, Inc. give some site history and current owner information (see documents I-3 and I-4).

5. SITE ELIGIBILITY

a. **Confirmed Formerly Used Defense Site**

(1) Former land usage by the Department of Navy was previously confirmed for the entire site. The 17,552 acre site was used by the U.S. Navy (and possibly the Army Air Corps) as a practice rocket range for aircraft pilots based at NAS Chincoteague, Virginia and NAS Manteo, North Carolina.

(2) Assateague Island was used by the Navy from 1944 until 1946 or early 1947. No acquisition or disposal documentation has been found for the site. Similarly, no official documentation verifying WD use of the Island has been discovered. However, Navy use of the site, as well as the location of two ranges, was substantiated by a former Navy enlisted man who was a spotter for one of the two rocket ranges on Assateague Island.

b. **Potential Formerly Used Defense Site**

(1) All acreage for this site is accurately covered in the "Findings and Determination of Eligibility" dated 19 December 1991 (see document E-2). The FDE covered the entire land portion of the island. No other acreage with potential WD or DoD use was discovered during the literature search or site investigation for Assateague Island.

(2) Two areas exist offshore of Asssateague Island in the Atlantic Ocean that were not covered in the FDE are potential formerly used defense sites (see Table 3-1 and plates 3 and 4). These areas could have become contaminated with munitions that missed the target in the range areas.

(3) During the historical records search, documentation was found which indicated the existence of test ranges on Wallops Island (near the South end of Assateague Island) and at a shipwreck in Chesapeake Bay, and a machine gun and rocket range at an undisclosed location (see documents E-1, E-4 and E-11). These ranges were used by the U.S. Naval Aviation Ordnance Test Station in Chincoteague, Virginia. Based on the potential OEW hazards associated with these 3 ranges, further research into these areas as possible DERP FUDS sites is warranted. Preliminary assessment actions for these areas should be conducted by the Geographic District if they have not already done so.

6. VISUAL SITE INSPECTION

a. **General Procedures and Safety.**

(1) During the period 5-9 April 1993, members of the Site Inspection (SI) team traveled to the site of two former Navy bombing and rocket target ranges and two suspected burial sites, Assateague Island, MD. This travel was in support of and IAW references B-1 through B-4. The primary task of the SI team was to assess OEW presence and potential. Due to training, there were at least two Navy aircraft bombing/rocket target ranges located on Assateague Island during WWII and due to disposal, there were also three suspected burial sites on the island. The site inspection was limited to nonintrusive methods, i.e., subsurface sampling was not authorized or performed.

(2) Real Estate rights-of-entry were not obtained by the SI team due to the willingness of National Park Service personnel to grant access and provide the team a tour of the points of interest on Assateague Island prior to the actual site inspection.

(3) A site safety plan was developed and used by the SI team and National Park Service personnel to assure an injury-free site inspection of the former Navy bomb and rocket target ranges. A briefing was conducted prior to the SI which stressed that OEW should only be handled by military EOD personnel.

(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 record search. This review was made to ensure team awareness of potential ordnance types and hazards.

(5) The visit began on 6 April 1993 at the offices of the National Park Service, Assateague Island National

Seashore, District Ranger (see photos J-1 through J-4). There was an exchange of information between Mr. Bob Thomas, District Ranger and SI team members Mary Jo Civis and Mike Harper. During this initial meeting with Mr. Thomas, the SI team was presented a short history of the island, given a tour, and shown the most probable locations of the former Navy bomb/rocket target ranges and burial locations. Maps and texts appropriate to the island were also made available to the team. A plan of action for the site inspection was coordinated with all concerned, radio communication was made available, and the site inspection of the formerly Navy-used island began. It should be stressed, again, that intrusive sampling methods were not used during this site inspection.

b. **Area A: Stinger-One Range Impact Area**

The OEW assessment of the formerly Navy-used barrier island of Assateague began in the vicinity of the North Ocean Beach (see photos J-3 through J-8, document L-2 and plate 3). This area was the location of one of two Navy bomb/rocket target ranges and, also a possible ordnance burial site. The beach and dunes inland were inspected for the presence of OEW. On the shoreline, the SI team located metal fragments, most probably the remains of exploded ordnance (see photo J-4). The remnants of an old ship on this stretch of beach was located. These remnants lie very near the ordnance burial site which was used during clearance of this target range (see photos J-5 and J-6). Inland from this beach area is a fenced area of dunes (see photos J-7 and J-8). During an extensive search of this area, a suspected nose section from a 3.25" AA target rocket, M2 series was found (see document D-6 and photos J-9 through J-11). Photo J-12 is a view toward the North Beach beach house from the location where this nose section was found.

c. **Area B: Stinger-One Range Buffer Zone**

Area B is a section of the Atlantic Ocean adjacent to Area A. The area was viewed from ashore as underwater investigation was not practical during the site inspection.

d. **Area C: Stinger-Two Range Impact Area**

The site inspection of Assateague Island continued in the southern part of the island between Dune Crossings (DC) 9 and 13 including the width of the island. This area was the location of the second Navy bomb/rocket target range and two suspected ordnance burial sites (see photos J-13 through J-18, J-20 through J-22, document L-2 and plate 4). The eastern shoreline, inland dunes, and western wooded portion of the island were inspected. Just inland from the western shore in the Green Run Bay area, the team located the metal parts of an expended 5" high velocity aircraft

rocket (HVAR) rocket motor (see photo J-19). The suspected ordnance burial sites were not located.

e. **Area D: Stinger-Two Range Buffer Zone**

Area D is a section of the Atlantic Ocean adjacent to Area C. The area was viewed from ashore as underwater investigation was not practical during the site inspection.

f. **Area E: All Remaining Lands**

There was no OEW noted by the SI team elsewhere on Assateague Island.

7. EVALUATION OF ORDNANCE HAZARDS

a. **General Procedures**

(1) Each area 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 since site closure. 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 areas.

(3) Uncontaminated ordnance areas are based on a lack of confirmed or potential ordnance evidence. All 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 areas.

b. **Area A: Stinger-One Range Impact Area**

(1) The approximate boundaries for Area A were given by Mr. Adrien Smith, a former Navy spotter during WWII that was stationed at Assateague Island (see document F-5). However, definitive WD mapping or real estate documents officially designating this area have not been discovered.

(2) Direct witness of OEW in this area by National and State Park officials resulted in the deployment of Army and Navy EOD teams in 1988 (see document F-6). The SI team directly witnessed a piece of OEW believed to be a nose of a rocket (see photos J-9 through J-12.) These instances of direct witness confirm the presence of ordnance in this area.

(3) Mr. Adrien Smith stated a burial trench was dug in the range area to dispose of OEW when the range was cleared (see document F-3). Standard practice suggests this burial trench would be located along the high water line of the island, but the exact area of the trench is not known. It is possible that considerable additional OEW exists where the trench is located.

c. **Area B: Stinger-Two Range Buffer Zone**

Range operations as described in document F-5 indicate it is possible that a small number of munitions may have missed the range targets in Area A and landed in the Atlantic Ocean. Area B extends approximately 3,000 feet from Area A into the Atlantic Ocean. OEW was not witnessed in Area B by the SI team. Potential ordnance contamination exists in this area.

d. **Area B: Stinger-Two Range Impact Area**

(1) The approximate boundaries for Area B were given by Mr. Adrien Smith, a former Navy spotter during WWII that was stationed at Assateague Island (see document F-5). However, definitive WD mapping or real estate documents officially designating this area have not been discovered.

(2) The SI resulted in the direct witness of OEW contamination in this area (see photo J-19). In 1991, a contractor performing a site visit to Area B directly witnessed a rocket motor, a practice bomb and a 20mm casing (see document E-3). These instances of direct witness confirm the presence of ordnance in this area.

(3) Mr. Adrien Smith stated a burial trench was dug in the range area to dispose of OEW when the range was cleared (see document F-3). Standard practice suggests this burial trench would be located along the high water line of the island, but the exact area of the trench is not known.

It is possible that considerable additional OEW exists where the trench is located.

e. **Area D: Stinger-Two Range Buffer Zone**

Range operations as described in document F-5 indicate it is possible that a small number of munitions may have missed the range targets in Area C and landed in the Atlantic Ocean. Area D extends approximately 3,000 feet from Area C into the Atlantic Ocean. OEW was not witnessed in Area D by the SI team. Potential ordnance contamination exists in this area.

f. **Area E: All Remaining Lands**

There was no indication of OEW contamination resulting from ordnance usage or disposal elsewhere on Assateague Island (see plate 2).

8. SITE ORDNANCE TECHNICAL DATA

a. End Item Technical Data

Table 8-1, a listing of ammunition and explosive fillers used on Assateague Island and Table 8-2, a summary of site ordnance fillers have been developed. These tables are based on a review of historical documentation, drawings and specifications at appendices D-1 through D-8. Exact models/types have been included as documentation has permitted.

TABLE 8-1

AMMUNITION USED AND EXPLOSIVE/CHEMICAL FILLER

ITEM	MODEL/TYPE	FILLER/WEIGHT	FUZE/TYPE
20mm Cartridge	MKI/HE-I	0.025# Tetryl PLUS 175.2 gr incendiary mix Fuze - Mercury Fulminate, Tetryl Primer- 2.1 gr primer mixture (Mercury Fulminate, Potassium Clorate, Antimony Sulfide) Propelling Charge - 0.07# FNH powder, Type II	Percussion
	T23 (M97)/HE-I	0.017# Tetryl PLUS 175.2 gr incendiary mix Fuze - Mercury Fulminate, Lead Azide, Tetryl Primer - 2.1 gr primer mixture Propelling Charge - 0.07# FNH powder, Type II	PD
	T18 (M96)/HE-I	0.020# Incendiary mixture Primer - 2.1 gr primer mixture Propelling Charge - 0.07# FNH powder, Type II	
	M75/AP-T	Solid steel shot Primer - 2.1 gr primer mixture Propelling Charge - 0.07# FNH powder, Type II Tracer - Tracer mixture	
	T9E5 (M95)/ AP-T	Solid steel shot Primer - 2.1 gr primer mixture Propelling Charge - 0.07# FNH powder, Type II Tracer - Tracer mixture	

TABLE 8-1

AMMUNITION USED AND EXPLOSIVE/CHEMICAL FILLER Continued

ITEM	MODEL/TYPE	FILLER/WEIGHT	FUZE/TYPE
3 lb bomb, practice w/signal	AN-Mk23	Inert (Cast iron) 10 gr zinc oxide 3 gr black powder 3 gr smokeless powder Titanium Tetrachloride	
4.5 lb bomb, practice w/signal	AN-Mk43	Inert (Lead) 10 gr zinc oxide 3 gr black powder 3 gr smokeless powder Titanium Tetrachloride	
25 lb bomb, practice w/signal	AN-Mk76	Inert (Cast metal) 10 gr zinc oxide 3 gr black powder 3 gr smokeless powder Titanium Tetrachloride	
Rocket, practice	2.25'' SCAR	Inert warhead (Machined steel, cast iron or zinc) Motor - 14 gr black powder 1.75 lb ballistite	
Rocket, target	3.25'' M2,M2A1,M2A2	Inert ogival nose Motor - black powder 3.2# propellant grains	
Rocket, practice	3.5'' AR	Inert warhead (Steel) Motor - black powder 8.5 lb ballistite	
Rocket, practice	5'' HVAR	Inert warhead Motor - 55 gr black powder 24.8 lb ballistite	

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

FILLER/WEIGHT	SYNONYM(S)	CHEMICAL FORMULA
Ballistite	(see DB powder)	
Black Powder	Saltpeter; Niter	
74% Potassium Nitrate		KNO_3
11% Sulfur		S
16% Charcoal		C
Charcoal		C
Dibutylphthalate	gelling agent	$C_6H_4(CO_2C_4H_9)_2$
Dinitrotoluene	DNT	$C_6H_3CH_3(NO_2)_2$
Diphenylamine	stabilizer DPA	$(C_6H_5)_2NH$
Double-base (DB) Powder	Ballistite	
60% Nitrocellulose	Guncotton; Pyroxylin	$[C_6H_8O_5(NO_2)_3]_n$
39% Nitroglycerine	stabilizer DPA	$CH_2NO_3CHNO_3CH_2NO_3$
0.75% Diphynylamine		$(C_6H_5)_2NH$
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

TABLE 8-2
CHEMICAL DATA OF ORDNANCE FILLER Continued

FILLER/WEIGHT	SYNONYM(S)	CHEMICAL FORMULA
Incendiary Compositions* (cont)		
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
IM-144		
50% Barium Nitrate		$Ba(NO_3)_2$
50% Red Phosphorus		P
IM-162		
25% Incendiary Comp IM-23		
75% Zirconium		Zr
IM-163		
50% Incendiary Comp IM-23		
50% Zirconium		Zr
Incendiary Mixture	(See incendiary comps)	
Lead Azide	Azide	$Pb(N_3)_2$
Mercury Fulminate	Mercuric Cyanate	$Hg(CNO)_2$
Nitrocellulose	Guncotton; Pyroxylin; Nitrocotton; Cellulose Nitrate	$[C_6H_8)_5(NO_2)_3]_n$
Nitroglycerin		$CH_2NO_3CHNO_3CH_2NO_3$
Potassium Chlorate		$KClO_3$
Potassium Nitrate	Saltpeter; Niter	KNO_3
Primer Composition		
FA-90A (for percussion primer)		
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		$KCLO_3$

TABLE 8-2
CHEMICAL DATA OF ORDNANCE FILLER Continued

FILLER/WEIGHT	SYNONYM(S)	CHEMICAL FORMULA
Primer Mixture*		
Mercury Fulminate	Mercuric Cyanate	$Hg(CNO)_2$
Potassium Chlorate		$KClO_3$
Antimony Sulfide		Sb_2S_3
Red Phosphorus		P
Smokeless Powder	(see nitrocellulose)	
Flashless-nonhygroscopic(FNH)		
Nonhygroscopic(NH)		
Sulfur		S
Tetryl	Trinitrophenylmethyl-nitramine	$(NO_2)_3C_6H_2N(NO_2)CH_3$
Titanium Tetrachloride	White smoke	$TiCl_4$
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		$Sr(NO_3)_2$
Zinc Oxide	Chinese White	ZnO

* Most frequently used chemical compositions and their major ingredients

9. EVALUATION OF OTHER SITE INFORMATION

a. **Hazardous, Toxic, and Radiological Waste**

No information has been found to indicate there are any potential sites/sources of HTRW.

b. **Building Demolition/Debris Removal**

No information has been obtained to indicate that any buildings/facilities were constructed by the Department of the Navy (or WD).