US Army Corps of Engineers
HUNTSVILLE ENGINEERING AND SUPPORT CENTER

FINAL VERSION

Defense Environmental Restoration Program
for
Formerly Used Defense Sites

Ordnance and Explosives
Chemical Warfare Materials

ARCHIVES SEARCH REPORT VOLUME III (EBASCO AND SAIC REPORTS)

FORMER FORT SEGARRA

U.S. VIRGIN ISLANDS

Project Number -. I02VI097701

FINAL - 11 MARCH 2002

Prepared by
US ARMY CORPS OF ENGINEERS
ST. LOUIS DISTRICT

ARCHIVES SEARCH

REPORT

THE SAN JOSE PROJECT

in the

U.S. VIRGIN ISLANDS

PREPARED FOR
U.S. ARMY CORPS OF ENGINEERS
HUNTSVILLE DIVISION

JULY 1991

PRPARED BY

EBASCO ENVIRONMENTAL
A Division of EBASCO SERVICES INCORPORATED, HUNTSVILLE, AL

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ARCHIVES SEARCH REPORT
FOR THE SAN JOSE PROJECT
IN THE U.S. VIRGIN ISLANDS

I. **BACKGROUND:** The United States military departments have maintained a presence in the U.S. Virgin Islands since they were purchased from Denmark in 1917. From 1917 to 1936 the U.S. Navy maintained a local headquarters and a U.S. Marine Barracks in Charlotte Amalie, St. Thomas, a Naval Operating Station, on Hassel Island, and a U.S. Marine Barracks in Christiansted, St. Croix. The U.S. Marine Barracks in Christiansted was withdrawn in 1931. Between 1937 and 1941, the U.S. Navy presence increased and a Submarine Base and a Naval Air Station/Marine Corps Air Facility were constructed. All of these facilities continued to operate with their wartime missions until 1946. In 1944, the U.S. Army established a presence in St. Thomas. Coast artillery was installed as a portion of the harbor defense facilities for Roosevelt Roads Naval Station. Coast artillery gun emplacements were constructed to defend the Port of Charlotte Amalie and the Submarine Base, and a number of observation posts were established on St. Thomas. The main defensive battery was located with the artillery headquarters on Water Island. Supporting batteries were consructed on Fortuna Hill, Havensight Point, and Muhlenfels Point. The facilities on Water Island were designated as Fort Segarra in honor of U.S. Army Lieutenant Colonel Rafael Angel Segarra.

After the end of World War II, these facilities were found to be excess to the needs of the War Department; leases were cancelled and other properties were transferred to other government agencies for use or disposal.

During World War II, the U.S. Army initiated a project to determine the effectiveness of chemical munitions and defenses in jungle terrain, and the effects on chemical munitions of storage in tropical climates. This project was initiated in 1943 on the Panamanian Island of San Jose and was named the San Jose Project. The project continued with success after the end of World War II until December, 1947, when negotiations for extension of the lease on San Jose Island from Panama failed. By the end of January, 1948, the San Jose Project had been completely withdrawn from San Jose Island and was temporarily quartered in the Panama Canal Zone. By May, 1948, the facilities on St. Thomas, which were formerly known as the Submarine Base and Fort Segarra, were taken over for use in continuing the tropical testing of chemical weapons systems. In addition to the Submarine Base and Fort Segarra, the Army also acquired rights to the western end of St. Thomas and to the Cays west of St. Thomas for use in testing. The San Jose Project continued to operate until May 1950 when the project was canceled. By September, 1950, all testing was concluded and the project closed. All remaining requirements for testing were transferred to Dugway Proving Grounds in Utah. All leases were terminated and the properties which were owned in fee by the U.S. Army were declared excess and transferred to the Department of the Interior for use or disposal.

II. **PURPOSE:** This archives search was conducted to find and evaluate any available information relative to the San Jose Project in the U.S. Virgin Islands which might exist and; to determine if the sites used by the San Jose Project in the U.S. Virgin Islands are potentially contaminated by conventional or special (chemical) ordnance or explosive wastes.

III. **SUMMARY OF WORK PERFORMED:** The following agencies or activities were contacted as required by the Project Scope of Work and in following leads for additional sources of information, . Files which were germane to the purpose were reviewed:

- The Huntsville Division of the U.S. Army Corps of Engineers in Huntsville, Alabama
- The Jacksonville District of the U.S. Army Corps of Engineers in Jacksonville, Florida
- The National Archives in Washington, DC
- The National Records Center in Suitland, Maryland
- The Cartographic Branch of the National Archives in Alexandria, Virginia
- The U.S. Army Center of Military History in Washington, DC
- The U.S. Army Chemical Research Development and Engineering Center at Aberdeen Proving Grounds, Maryland

- The U.S. Army Technical Escort Unit at Aberdeen Proving Grounds, Maryland
- The U.S. Army Armament, Munitions and Chemical Command at Aberdeen Proving Grounds, Maryland and at Rock Island Arsenal, Illinois
- The U.S. Army Chemical Center and School, in Ft. McClellan, Alabama
- U.S. Army Dugway Proving Ground, Utah
- The U.S. Department of Interior in Washington, DC and Charlotte Amalie, St. Thomas, U.S. Virgin Islands
- The University of the Virgin Islands in Charlotte Amalie, St. Thomas, U.S. Virgin Islands
- U.S. Navy Explosive Ordnance Disposal Detachment, at Roosevelt Roads Naval Base, Puerto Rico.
- U.S. Naval Facilities Engineering Command, in Alexandria, Virginia
- The U.S. Army Institute of Military History of the U.S. Army War College in Carlisle Barracks, Pennsylvania.
- The U.S. Naval Historical Center in Washington, D.C
- Division of Libraries, Archives and Museums, Government of the Virgin Islands
  - Enid M. Baa Public Library
  - Territorial Archives
- The Alexander Hamilton Airport, St. Croix, U.S. Virgin Islands
- Office of the Lieutenant Governor, Government of the Virgin Islands

- Recorder of Deeds (St. Croix & St. Thomas Branches)
- Tax Assessor
- Cadastral Branch

- Water Isle Hotels and Beach Clubs, Water Island, St. Thomas, U.S. Virgin Islands
- Mr. Osbourne Harvey (former employee of San Jose Project), Charlotte Amalie, St. Thomas, U.S. Virgin Islands.

Numerous documents were examined. Documents found which were relevant to this archives search are listed and summarized in Annex A.

A site visit to Water Island took place on May 6, 1991. Potentially affected locations on the Island were observed to determine the need to conduct further investigations.

IV. THE SAN JOSE PROJECT:

A. The San Jose Project in Panama. In 1943, the Chief of the Army Chemical Warfare Service determined that a Chemical Corps proving ground in the tropics was necessary to prepare for potential chemical battlefields in the Pacific and in other Theaters of Operations. After an extensive reconnaissance of Central America and northern South America, San Jose Island, one of

Panama's Perles Islands was chosen for this mission. The work to be performed there was named the San Jose Project, and the purposes of the work were:

1. To gather technical data on the behavior of lethal chemical agents in tropical jungle.

2. To test chemical munitions in order to ascertain their effectiveness under jungle conditions.

3. To develop doctrine for the most efficient employment of lethal chemical agents in jungles.

4. To translate the data obtained into operational instructions for using arms and services.

5. To carry out field testing of chemical warfare materiel as directed by the Chief, Chemical Warfare Service.

San Jose Island was leased from the Government of Panama for the duration of hostilities, and a temporary camp was established there in January, 1944. Experiments began in May, 1944, and continued until December, 1947. As the experiments continued, facilities were improved and expanded. The nature of experiments included evaluation of the effects of tropical environments on the storage of chemical munitions and materials, the usefulness and reliability of chemical protective equipment, and evaluation of the effectiveness of the lethal chemical agents and munitions when used in jungle terrain.

Over 100 field tests were conducted between 1944 and 1947. These tests were the basis for development of a large part of the United States offensive and

defensive chemical doctrine and chemical munitions and equipment of the 1950's and 1960's.

On December 23, 1947, all experimentation was brought to an abrupt halt when the project was notified that San Jose Islands would have to be evacuated immediately due to the failure of the United States and Panamanian Governments to agree to a renewal of the lease. Between this date and the 28th day of January, 1948, when the Island was formally returned to the custody of the Panamanian Government, all efforts were directed toward the evacuation of the Island. During this month, temporary locations in the Canal Zone were found for the equipment and personnel. The move was completed and exploratory trips were made looking for a new home for the project.

From the evacuation date until early in May, 1948, the technical activities of the project were concentrated in an area at the mouth of the Charges River on the Fort Sherman Reservation, Canal Zone. All technical personnel were engaged in guarding and rehabilitating the toxic munitions transferred from San Jose Island. During this time, the main body of the San Jose Project troops and the San Jose Project Headquarters were located at Fort Clayton, Canal Zone. The only test carried on was the Surveillance Test for Bomb, Particulate, 4-lb., E-1 for Camp Detrick.

In the latter part of the stay in the Canal Zone all energies were directed toward the move to St. Thomas, Virgin Islands. The work of evacuating from San Jose Island to the Canal Zone and the reshipping from the Canal Zone to the Virgin Islands was performed by personnel of the project.

B. The San Jose Project in the Virgin Islands. A small advance party was dispatched to the Virgin Islands on March 30, 1948, and was followed by a larger party on April 14,1948. The mission of these parties was to make the new station habitable for the main body. The greater portion of the equipment for the San Jose Project arrived at St. Thomas aboard the USNT Colonel William J. O'Brien on May 4, 1948. Personnel were airlifted from Panama to the Virgin Islands in small groups. Toxic chemicals were towed over on two five-hundred ton ocean-going barges arriving at St. Thomas on May 21, 1948. The explosives arrived on May 27, 1948, completing the movement from the Canal Zone.

The San Jose Project moved into the former U.S. Navy Submarine Base just west of Charlotte Amalie. Barracks, administration buildings, and shops there were adequate for the main post. However, there were no technical facilities of the unique nature needed by the San Jose Project. A small, temporary laboratory was fitted out in a battery-charging room and operations began. The requirements for additional technical facilities for the project were submitted

to the Department of the Army. An area of approximately 2,095 acres of land, consisting of the entire west end of St. Thomas, beginning at the isthmus between Santa Maria Bay and Perseverance Bay, was condemned for lease. The Cays west of St. Thomas were also condemned, to permit the Army to restrict access to areas that would be downwind from their testing. The only other test areas were the former Fort Segarra, located on Water Island, just across the channel from the main post. Water Island was also the site of the Toxic Storage Yard. The former U.S. military facilities that had been the submarine base and Fort Segarra had been declared excess in 1946.

An extensive series of tests was planned for performance in the new test areas. Between May, 1948 and May, 1950, the San Jose Project continued some of the experiments which had been initiated in Panama. Because of the move, test plans needed to be revised and approved by the Chief of the U.S. Army Chemical Warfare Service. Revision of these tests plans caused substantial delays in the test schedules so that by the spring of 1949 very little testing had been accomplished. Review of lists of approved test plans shows that early tests focused primarily on blister (mustard) and choking (chlorine, phosgene and cyanogen chloride) agents, and that later tests were planned to shift to captured German munitions and nerve agents. The records of testing are incomplete, but the only reports found which related to testing on the west end of St. Thomas have indicated that only non-persistent choking agent tests were

performed there. All persistent and lethal agent tests appear to have been performed on Water Island. Figure IV-1 is a map showing the location of property used and restricted areas declared by the San Jose Project.

In the summer of 1949, a series of tests was performed on the west end of St. Thomas to determine the best location for doors for "gas-proof" chemical protective shelters. At least two sites were used, although the locations cannot be determined from the data available. These tests utilized phosgene (a non-persistent, choking agent sold commercially as carbonyl chloride) released from - ton containers. The tests were concluded successfully and the final report was submitted in November, 1949. This is the only test which has been confirmed to have been conducted on the west end of St. Thomas.

A number of tests of persistent * and lethal chemical agents were performed on Water Island. A sketch map of Water Island showing the test areas is shown in Figure IV-2. Attempts at extensive testing appeared to have been frustrated by lack of approved test plans, lack of material, lack of time or lack

* The persistency of a chemical agent is an expression of the duration of effectiveness of the agent. It is dependant upon the physical and chemical properties of the agent, weather, methods of disemination and conditions of terrain.

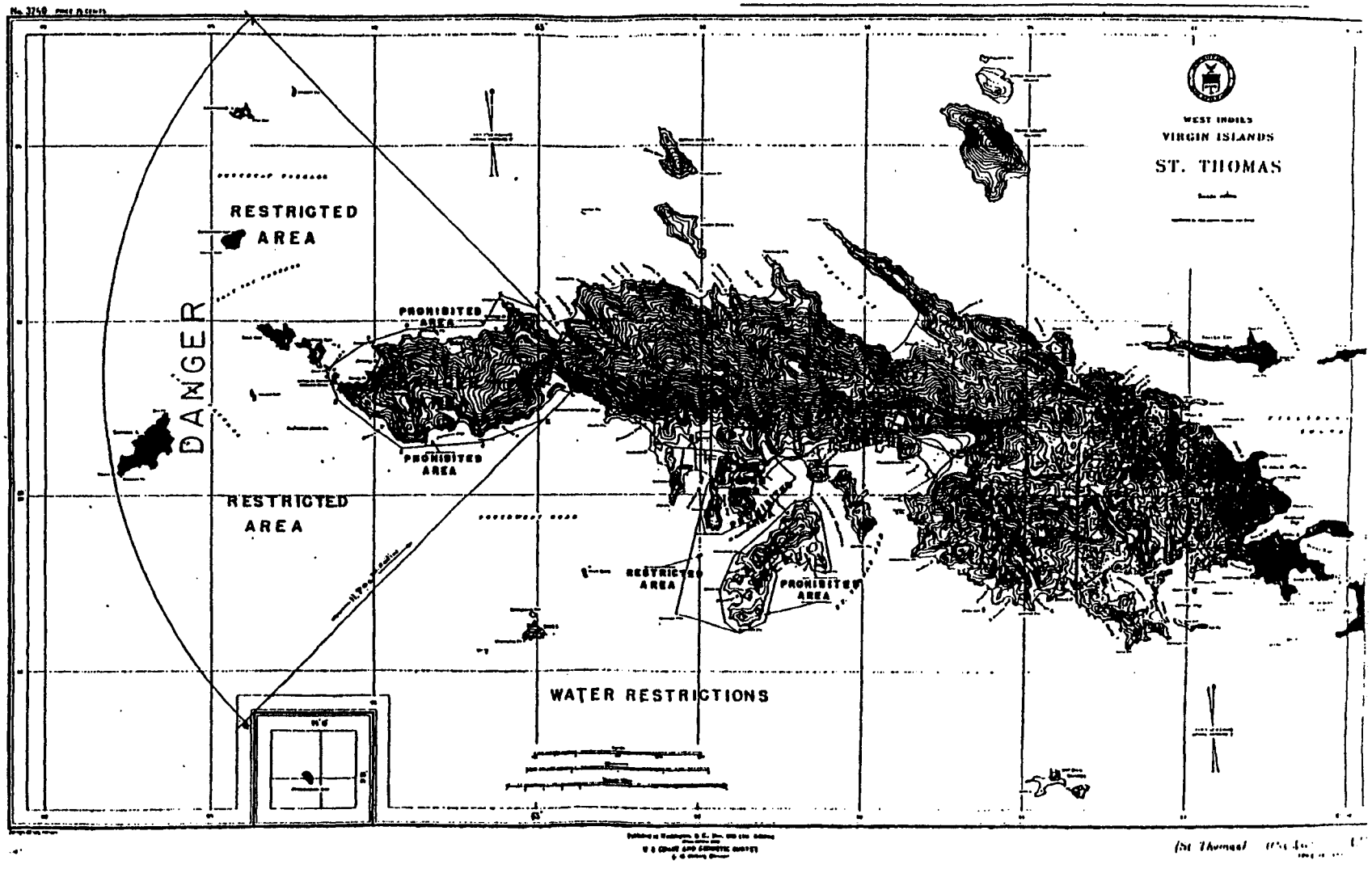


Figure IV-1 Map of San Jose Project

of funds. According to the records found, only a limited number of tests werecompleted. These tests are summarized below.

1. Static Test of M 70 Bomb (HD Filled). The AN-M70 was a 115 lb. bomb which could be filled with a variety of chemical agents or simulants. In this test it was filled with HD (distilled mustard). This type of mustard is a relatively pure liquid which produces blisters on skin when there is liquid contact; and if inhaled in sufficient quantities "burns" the lungs and produces choking or"chemical pneumonia". In this series of tests, the bombs were supported in a vertical or near vertical position just at the ground surface and detonated remotely. The intention was to simulate detonation at ground surface after being dropped from an airplane. Tests were performed in wooded areas with on-shore winds (Test Area 7); in wooded areas with off-shore winds (Test Area 1); open areas with on-shore winds (Test Area 7); and open areas with off-shore winds (Test Area 4). Samples of droplet distribution and vapor concentrations were collected from each test and the effectiveness of the bomb in the particular circumstances was evaluated. This test was completed in early 1949 and the test report distributed on March 22, 1949. (San Jose Project Report No. 136). Additional similar tests were performed later in 1949 to recheck the results. Records of these tests cannot all be found, however, one of these retests (open area, on-shore wind) was performed in Test Area 6.

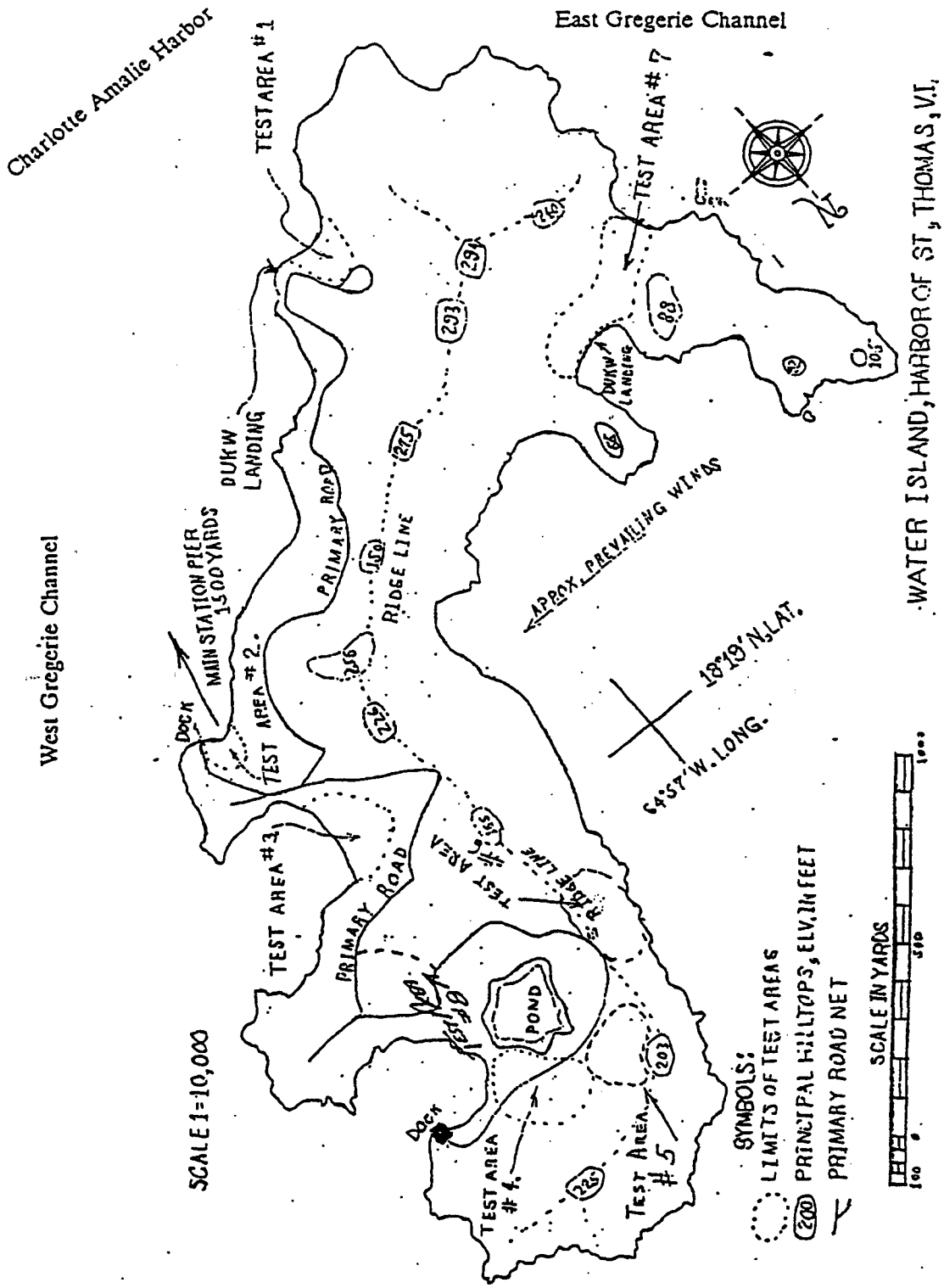


Figure IV-2 Test Area Map of Water Island
Extracted from San Jose Project Report No. 136

2. Static Test of Single E-23 Smoke Pot, HD Filled, In The Open. Smoke pots are used primarily to obscure the battlefield from enemy observation and to deceive the enemy about real intentions. Smoke can also be used to disseminate chemical agents to produce casualties in downwind areas. This test was performed in the summer of 1949 in Test Area 4. The purpose of the test was to determine the dosage produced in the field, the rate of dose created, the degree of decomposition loss in the smoke pot, and the overall efficiency of agent dissemination from a static firing of the smoke pot. The test reports contain black and white photographs which show the location of the smoke pot on the flat area between Flamingo Bay and the pond which is now the boat harbor. The report was completed in August, 1949 and published as San Jose Project Report Number 176.

3. Static test of Single E-23 Smoke Pot, GA Filled In The Open. The report of this test could not be found; however, monthly progress reports indicate tests took place in November and December, 1949. GA is a lethal nerve agent first produced by Germany during World War II. It is a non-persistent agent. This agent can be inhaled or absorbed through the skin and inhibits cholinesterase activity in the body.

There is no indication of the test area used for this test.

4. Static Test Single E 23 Smoke Pot, GA Filled, On Water With On-shore Wind. The report of this test could not be found, however, monthly progress reports state these tests were conducted in November, 1949.

5. Surveillance Projects. The purpose of these projects was to determine the effect of tropical climates on the storage of chemical agents and munitions.

a. 125 lb, T-3 Bomb, HD Filled and H Filled (Heresite Coated) One of the most extensive surveillance tests was of 125 lb. T-3 chemical bombs filled with H and HD. H is a less purified form of the mustard HD. The number of bombs involved is not recorded but results of analyses from at least four bombs are recorded in an interim report. The test started on San Jose Island in December, 1945. The bombs were moved to the Canal Zone in January, 1948 where they were stored under tentage until May 12, 1948 when they were moved to Water Island by barge arriving on May 21, 1948. This surveillance test continued until the Project was canceled. There is no record of the disposition of these bombs.

b. AN-M70, AN-M78, and AN-M79 bombs filled with agent CK (Cyanogen chloride) This program was started after arrival in St. Thomas and continued until the project was canceled. At least 34

M78 (500-lb) bombs and 7 M79 (1000-lb) bombs and an undetermined number of M70 (115-lb) bombs were involved in the test. These is no record of the disposition of these bombs.

c. Other Surveillance Projects. Surveillance projects for VKL (Vegetation Killing Liquid - probably 2, 4, D) and Bomb, Particulate, 4 lb, E-1 were completed and test reports distributed while the San Jose Project was on St. Thomas, but the field work was probably conducted on San Jose Island.

C. Ending the San Jose Project. In 1949, the San Jose Project requested funding to improve technical and personnel related facilities for the Project. In approving the priority for these activities, the Defense Research and Development Board directed that the project be moved to the CEBAR Proving Grounds (now Dugway Proving Grounds) as soon as it was opened. In May 1950, the Army announced the cancellation of the San Jose Project and transfer of its functions to Utah. Project personnel began terminating activities immediately and the project was completely shut down by September 1950. At least one vessel, the USNT William O'Brien, carried chemical munitions of unknown quantity to the United States.

D. Fate of Munitions. Details of shipments to and from the San Jose Project have not been found. In 1947, two barges, containing unknown quantities and types of munitions were brought to Water Island from San Jose Island. In September 1949, "one boxcar" of classified toxic chemical munitions was transferred from The Army Chemical Center (Now the Edgewood area of Aberdeen Proving Ground), Maryland to the San Jose Project. Although there may have been other shipments to the San Jose Project between 1947 and 1950, records of these shipments have not been found. Similarly, there are limited records relative to shipments from the San Jose Project. One shipment of materials took place in May 1950 aboard the USNT Colonel William J. O'Brien. The quantities and types of munitions shipped are not recorded in documents which could be found. The records of the escort officer for munitions on this trip refer to safety issues related to "117 ton containers of butane gas" and to packaging of E 46 and E 52 bombs (variations of the 125 lb T 3 chemical bomb). These materials and munitions were escorted and handled as chemical weapons, and subsequently delivered to the Eastern Chemical Depot at the Army Chemical Center, Maryland. Other documents mention receipt of chemical munitions parts such as bomb bodies, fuzes, fins, mortars etc. which may have been shipped without agent fillers. To date no inventory records or issue documents have been discovered.

E. Incidents. Since 1950 there have been, with one notable exception, no incidents in the U.S. Virgin Islands related to unexploded military ordnance of any type. Territorial police, the Federal Bureau of Investigation, and U.S. military explosive ordnance disposal organizations were contacted to confirm that there had been no such incidents. The one notable exception occurred in 1966 on Water Island.

While excavating in an area on the south shore of Flamingo Bay, metal objects were unearthed which appeared to be bombs. The Naval Ordnance Disposal Detachment at Roosevelt Roads responded. They identified the bombs as M70/M78 chemical bombs. The documentary reports differ considerably from eye witness reports. The Navy report, which has survived, noted "several" bombs had been unearthed; that they believed them to be "Army M70 and M78 (Chemical Bombs)"; that all but one had been vented and they blew the unvented bomb without noticeable release of any chemical. There was no mention of disposition of the bombs or residual materials.

Eye witnesses describe the two bombs as 18 to 24 inches in diameter, both the same size except one had fins and was therefore 8-12 inches longer. The bomb with fins was about five feet long. Witnesses claim the Navy personnel did not detonate the bombs on site, but took the two bombs with them and advised that no more excavation should be performed at the site.

Witnesses were questioned about the inconsistencies between their recollections and the Navy documents and each confirmed that they had clear memories of the incident. The conflicts between the Navy document and eyewitness reports cannot be resolved with available information.

V. SUMMARY OF EXISTING CONDITIONS.

A. Geology of the U.S. Virgin Islands A relatively clear geologic record stretches back some 100 million years to the late Cretatious period. This places the earliest stages of island building at a time when the major continents were probably much closer together.

St. Thomas and St. John are an exposed part of a great submarine mountain range that includes the large islands of the Greater Antilles (Cuba, Hispaniola, Puerto Rico) and the southeast curving necklace of the Lesser Antilles, ending in Trinidad, off the coast of Venezuela. St. Croix is set apart from this necklace and was formed by different geologic processes.

St. Thomas and St. John are basically volcanic in origin, with two major stages of activity evident. The first involved the flow of molten materials through underwater fissures of the earth's crust. This underwater process occurred at great depths and over a long period of time. Eventually, this under-sea

mountain building and uplift brought submarine ridges and peaks to the surface. This first stage of high volcanism was followed by a long period of sedimentary rock formation. Sea plants and corals formed calcareous rock deposits. These deposits were intermittantly modified by periods of explosive volcanism which caused intrusions of molten rock. These processes, along with changes in sea levels and uplifting, have created the island profiles and formations apparent today.

The volcanism which formed the island archipelago, of which St. Thomas and St. John are a part, appears to still be active among some of the newer and more easterly islands like Guadeloupe and Martinique. This archipelago also marks a transition zone between two different parts of the earth's crust. These parts are called tectonic plates and are moving slowly. This causes frequent small earthquakes, none of which seriously affect the Virgin Islands.

St. Croix was never a volcano, but volcanos played an indirect role in its formation. The rocks underlying the mountain ranges on St. Croix are sedimentary rocks formed of the debris from eroding volcanic rocks and from volcanic ash spewed out from an erupting volcano. The sediments were deposited on the deep ocean floor approximately 80 million years ago. The limestone exposed at the surface of the Central Valley of St. Croix is

considerably younger (lower Miocene, 20 million years), and is probably the remains of coral reef that formed as the island was uplifted.

The end result of all these geologic activities is that St. Thomas/St. John and St. Croix are on two separate platforms or plateaus of land that rise out of deep water. The area between St. Thomas/St. John and St. Croix is called the Virgin Islands basin, with depths to 4,500 meters. North of the St. Thomas/St. John area is an area called the Puerto Rican Trench, with depth to 9,710 meters. This is the deepest known area of the Atlantic Ocean.

Water Island is volcanic in origin. It has a shallow soils of the Cramer gravelly clay loam variety, a dense, semiarid vegetation and a rather steeply sloping terrain. A primary ridge line 200 to 290 feet above sea level runs down the center of the island in a north-south direction.

Among the island's outstanding natural features are rugged, steep cliffs along the southern and southeastern shorelines, some 10 sand or sand and gravel beaches, a number of small bays and peninsulas, and four salt ponds with associated mangrove systems, two of which are still in relatively natural condition.

B. Archeological Sites on Water Island. Based on the limited evidence available, human occupancy of Water Island seems to have begun around 2000 years ago. To date, archaeologists have found five Indian sites, all of which are located at sheltered bays, along the western coastline. Pot shards, stone tools and other evidence recovered from very cursory surveys and excavations at these sites indicate small scale, casual, occupation by itinerant fisher-folk and shell gatherers, rather than extensive permanent settlement by agriculturalists. Negroid skeletons have been found at two of these sites, but there is debate over whether they were intrusive or not.

None of the five archaeological sites have been nominated to the National Register of Historic Places. However, the acting territorial archaeologist points out that three sites have not yet been systematically excavated, and that the Elephant Bay site may be of considerable importance because of the early Saladoid pottery found there during an exploratory dig.

C. Current State of Properties Involved Properties used by the San Jose Project in the Virgin Islands consist of three significant parcels. The headquarters, quarters, administrative and support functions were located in the former U.S. Naval Submarine Base. Testing activities were conducted on Water Island (Fort Segarra) and on 2095 acres encompassing the western end of St. Thomas. These areas are indicated in **Figure IV-1.** (Map of San Jose Project

in the U.S. Virgin Islands). The boundaries and topography have changed slightly over the years, however, these changes are minor.

1. U.S. Naval Submarine Base, Charlotte Amalie. Headquarters, quarters, administration and support functions for the San Jose Project were performed in facilities formerly known as the U.S. Naval Submarine Base, Charlotte Amalie. **Figure V-1** is a map of the Submarine Base as it existed in World War II and throughout its use in the San Jose Project. Many of the structures used in support of the San Jose Project still exist, appear to be in fair to good condition, and are still in use.

2. Western End of St. Thomas. An area of approximately 2,095 acres on the west end of St. Thomas, beginning at the isthmus between Santa Maria Bay and Perseverance Bay, and including all lands on St. Thomas to the west, was taken for lease by condemnation in 1948 for use in chemical testing. The properties were released in 1950 and currently are used primarily for residential and agricultural uses. There is no indication that any facilities were constructed during this period.

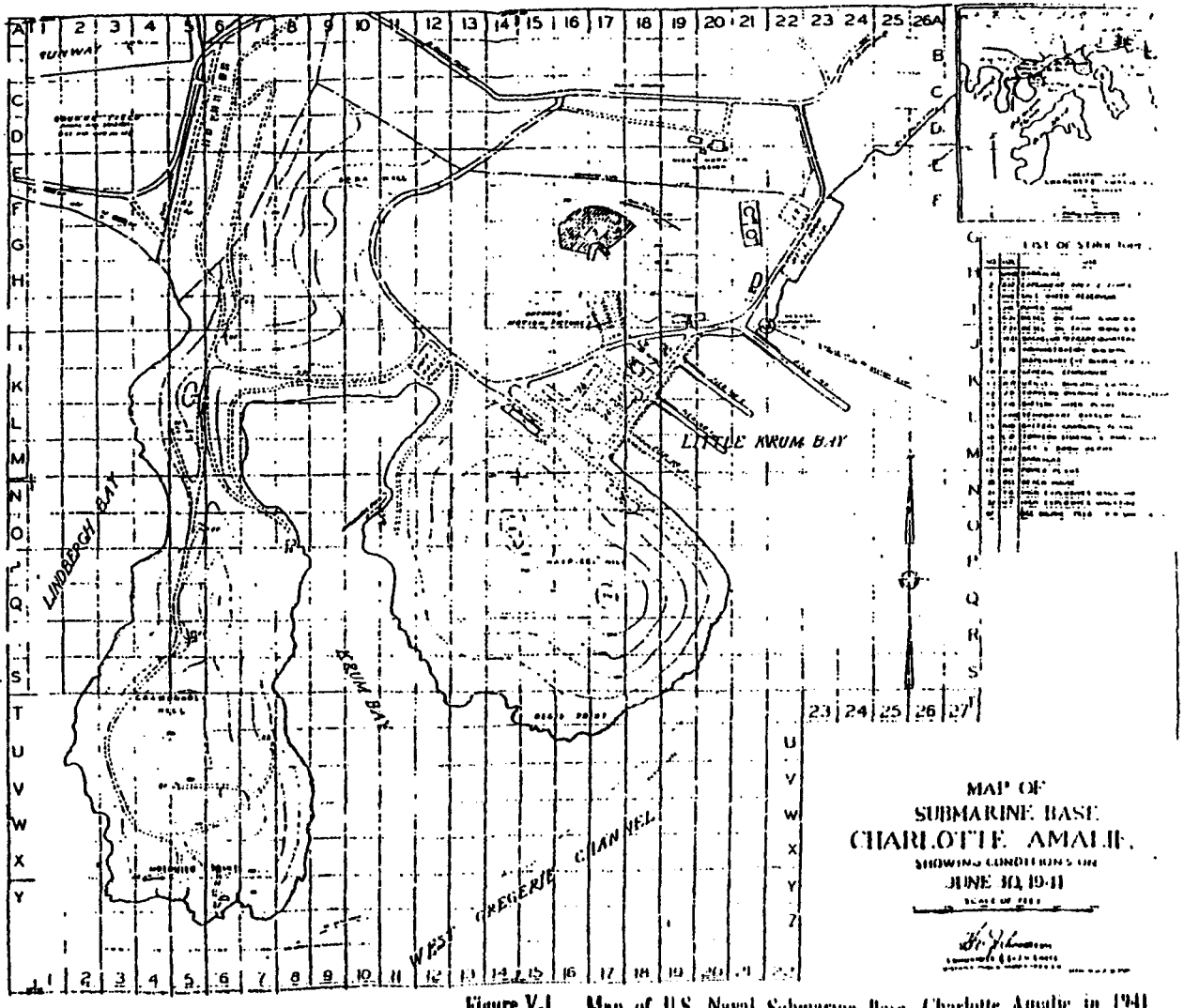


Figure V-1 Map of U.S. Naval Submarine Base, Charlotte Amalie in 1941

3. Water Island (Fort Segarra). Water Island was acquired in 1944 for use as a harbor defense installation. Approximately 33 structures were constructed for this purpose including gun emplacements, bunkers, barracks and support facilities. In 1950, when the San Jose Project was canceled, the Army granted a permit to use the island to the Department of the Interior. In 1952, permanent control of the Island was transferred to the Department of Interior who subsequently leased the Island to Water Island Incorporated for development as a resort area. **Figure V-2** is a Map of Water Island in 1979. The property was extensively subdivided and subleased, and numerous homes have been constructed or created by conversion of military buildings. In addition, an approximately 100-room resort hotel has been constructed on Rainbow Point, north of Flamingo Bay.

The coast artillery gun emplacement on the southern tip of the island is substantially intact, although some of the interior rooms have been walled off to permit their use for water storage. Two ammunition storage bunkers on the north end of the island are substantially intact. One is currently used as a racquetball court and the other is empty and unused. Many of the barracks, administration and support buildings were converted to private homes and are intact, well maintained and currently in use.

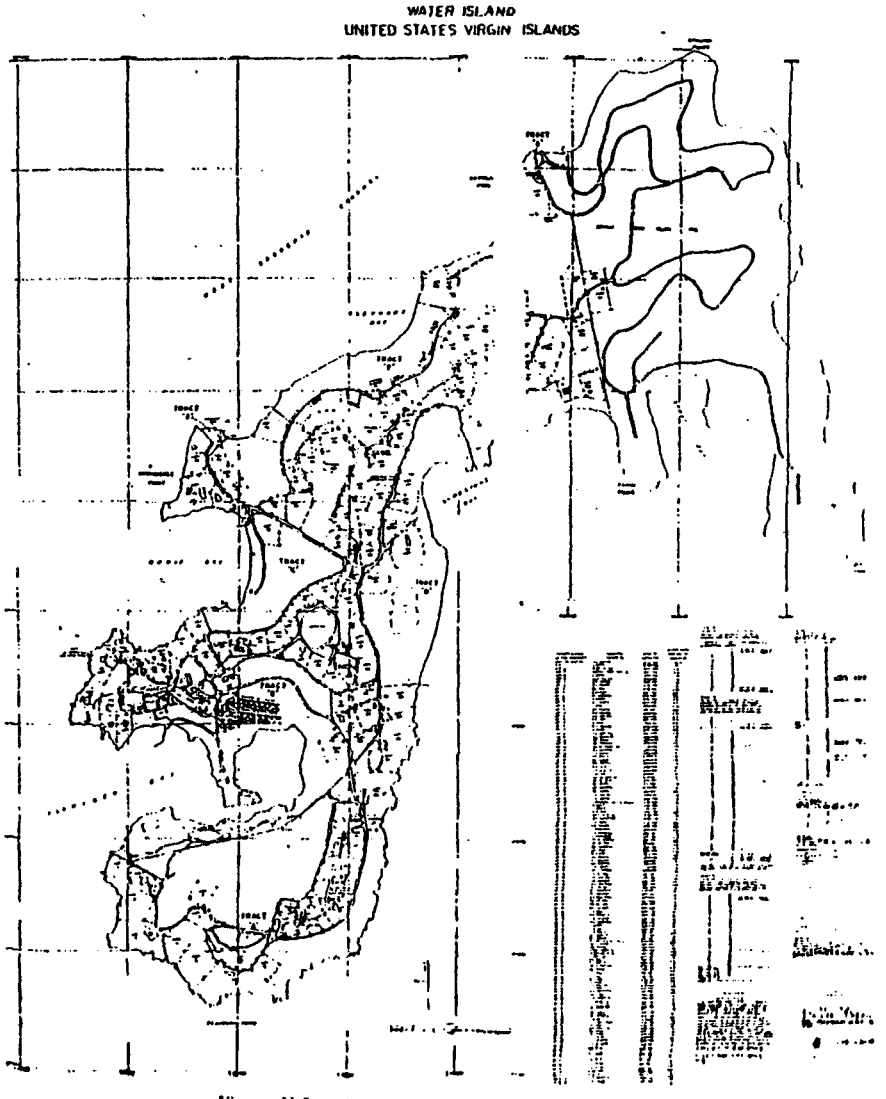


Figure V-2 Water Island in 1970

Many of the areas on Water Island have been extensively disturbed for the construction of homes and other buildings, creation of harbors and docks, and for borrow and fill areas. Many of the disturbed areas were formerly used test areas. Hurricane Hugo caused a great deal of destruction on Water Island. The debris from hurricane-devastated facilities was deposited in areas south of Flamingo Bay. Another area near the Flamingo Bay Harbor is being used as a depository for junk cars. A detailed description of the current conditions of test areas is contained in the following paragraphs.

D. Real Estate History. In 1917, Denmark sold its possessions in the Virgin Islands to the United States for $25,000,000. Denmark was convinced to sell the islands by fear that Germany might claim them if they succeeded in over-running Denmark. The United States was concerned about the possibility of a German base located in such a strategic position to be able to threaten the Panama Canal. Most of the real estate was in private ownership, and the United States respected these interests.

1. <u>U.S. Naval Submarine Base, Charlotte Amalie.</u> The Navy acquired 225 acres of land on Little Krum Bay for construction of a submarine base in October, 1939. The base functioned throughout World War II and was turned over to the Department of the Interior in January, 1948. In May, 1948, the San Jose Project took possession of the base and used it until September, 1950

when the project was canceled. The property was returned to the Department of Interior at that time. Although the property is used by a number of businesses, no real estate tranfers from the Department of Interior have been recorded.

2. Western End of St. Thomas Island. With the exception of Fortuna Hill, all of the western end of St. Thomas has continuously been in private ownership. Fortuna Hill was taken by the United States in August of 1943 for construction of a gun emplacment and sold to private interests in 1953. In 1948, the Army took approximatley 2,095 acres on the west end of St. Thomas for use of the San Jose Project. The properties consisted of the estates known as Botany Bay, Bordeaux, Catherina's Hope, Fortuna, Runnels, Godthaab, Bethesda, Hope and Perserverence. According to newspaper articles of the time, the terms of the condemnation provided for annual lease for a term of five years. In September 1950, the San Jose Project was terminated and the use of the land reverted to its owners.

3. Water Island. The East Asiatic company, A Danish joint-stock company which purchased Water Island through its agents in 1905 and its own name in 1911, planned to develop it into a major coaling and bunkering facility. World War I and the subsequent sale of the Danish West Indies to the United States in 1917 put to rest the Company's plans for Water Island, although it did retain

ownership until 1944, when the U.S. Government acquired title to it for $10,000 through condemnation proceedings. The U.S. Government took Water Island for the explicit purpose of establishing a coastal defense installation there. The Army immediately set to work constructing a large army base known as Fort Segarra on the southern part of the island. Barracks, gun emplacements, watch towers, underground bunkers and other military facilities were constructed, as well as an infrastructure of docks, roads, water, sewage and power systems. When World War II ended, construction was abruptly halted. The facilities were left unused until the San Jose Project arrived in 1948.

After the San Jose Project abandoned the Island in 1950, the Army turned it over to the Department of the Interior by revocable permit for five years. In December, 1951, the term of the permit was made indefinite, but it remained subject to revocation by the Army at any time.

In June 1952, legislation permanently transferred Water Island to the Department of Interior. In December, 1952, the Department of Interior entered into a long term lease with Water Island, Inc. This lease had a term of 20 years until December 31, 1972 and an irrevocable option for an additional 20 years. In 1965, Water Island Inc. sold their rights in the lease to Water Isle Hotel and Beach Club, who retains the current master lease. The Island has

been extensively subdivided an subleased. The master lease runs until December 31, 1992.

E. **Site Visit.** During the week of May 5, 1991, the sites which had served as part of the San Jose Project were visited and observations noted. The following paragraphs summarize the important observations of those visits.

1. **U.S. Naval Submarine Base, Charlotte Amalie.** The area formerly used as the Submarine Base is still known by that name, and is currently used by a number of local government agencies and private interests. In recent years, the areas between the finger piers has been filled in and a wharf constructed. The barracks are currently used by the Government of the Virgin Islands' Department of Licensing and Registration and the Water and Power Authority. The Torpedo Storage and Workshop Building (also used as the chemical laboratory for the San Jose Project) is currently used by the Caribbean Steel Corporation. The General Storehouse, the Utility Building and Garage, the Battery Charging Plant, and Administration Building are currently used, although their current occupants and uses were not determined during the site visit.

2. **Western End of St. Thomas** There are no apparent vestiges of the San Jose Project in the western end of St. Thomas. Most of the 2,095 acres is covered with natural growth on steep, rocky slopes. There are substantial

numbers of private homes in the area, and several estates where access is not permitted to the general public. Other than beautifully scenic views no remarkable observations were made.

3. Water Island (Fort Segarra). Water Island was visited on May 5 and 6, 1991. The visiting group was accompanied by Mr. William G. Couter, of Water Isle Hotels and Beach Clubs. Mr. Couter was present in 1966 when the bombs were discovered and has been in residence since then. Each of the potential areas of interest on Water Island were visited. Observations relevant to each of these areas follow.

a. **Flamingo Bay Breakwater.** The main (deep water) dock for Water Island is located on the southern edge of Flamingo Bay. Based on earlier reports, a large metallic object was observed on the rocky shoreline west of the main dock. Upon inspection, the object was tentatively identified as a 500 lb. general purpose practice bomb filled with concrete. The bomb had a shipping plug in the nose and a vacant tail fuze well. A 12 inch X 18 inch hole was apparent in one side of the bomb. **Figure V-3** is a photograph of the bomb. Approximately 10 feet inland, a smaller rusted metal object was found. This object was tentatively identified as a 2-1/2-inch or 3-inch Stokes mortar. **Figure V-4** is a photograph of the suspected Stokes mortar. No other ordnance was apparent on the surface.



Figure V-3 Photograph of 500-lb Bomb



Figure V-4 Photograph of Suspected Stokes Mortar

b. Flamingo Bay Warehouse and Trash Dump. A metal warehouse was constructed near the deep-water dock by the Water Isle Hotels and Beach Clubs for storage of vehicles and materials (**See Figure V-5**). The warehouse was constructed on an area filled in for this purpose. The area south of the warehouse was the site where the bombs were discovered in 1966. It was reported by Mr. Couter that they were removing "Elephant Muck" from the site with a dragline when the bombs were located. After they were instructed by the Naval Explosive Ordnance Detachment not to dig there any more, the site was filled in and covered with borrowed soil to a depth of about three feet. Debris and scrap materials have been deposited on the site.

c. Test Area No. 1. This area is located on the north-west shore of Water Island on Ruyter Bay just north of Carolina Point. The area marked on the map on **Figure IV-2** is currently occupied by a home and small parking area. Two ammunition bunkers are located nearby. One is outfitted for use as a racquetball court and the other is empty and unused.

d. Test Area No. 2. This area is located on the north site of Providence Point. Mr. Couter reported that the test area was dredged

out several years ago in preparation for a small harbor, but was subsequently filled in again. This area is shown in **Figure V-6.**

e. Test Area No. 3. This area is located at the point of Druif Bay, and is just east of the hotel's beach area. Mr. Couter reported that this area had been excavated for fill in 1981 or 1988 and subsequently refilled with dirt from another location on the island.

f. Test Area No. 4. This area is located to the south and south-west of the Flamingo Bay Harbor. The site straddles the road which comes from the main dock. The area north of the road is relatively clear of debris, however, the area south of the road is the Island junk yard with approximately 50 abandoned vehicles. The test area can be seen in **Figure V-5.**

g. Test Area No. 5. This area is located south and south-east of the Flamingo Bay Harbor and is south of the road which comes from the main dock. This area was used to accumulate and burn debris from

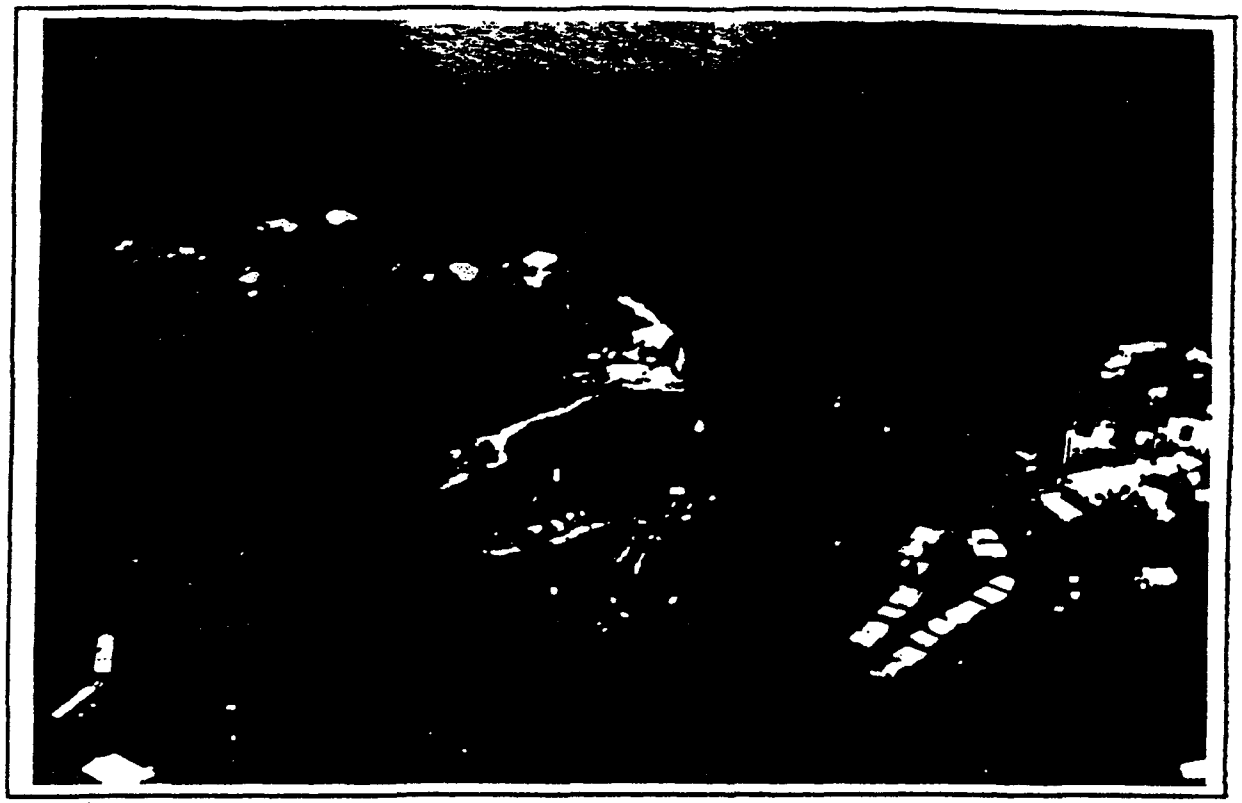


Figure V-5 Aerial Photograph of Flamingo Bay



Figure V-6 Photograph of Test Area 2

Hurricane Hugo. There was a substantial amount of metallic debris on the ground. This test area can be seen in **Figure V-5.**

h. Test Area No. 6 This area is located on the eastern shore of the southern part of Water Island, due east of Flamingo Bay. The site has been extensively developed along the ridge line, but the lower parts of the site were inaccessible during the site visit.

i. Test Area No. 7. This area is located on the north part of Water Island and extends from the point of Sprat Bay northeast to East Greggerie Channel. The northern part of the test area is covered with a red colored pond. The site could not be reached during the visit. The location of the test area can been seen in **Figure V-7.** The northern end of Water Island can been seen in **Figure V-8.**

j. Test Area 8 This test area was in approximately the same location as the Water Isle Hotel. This site can be seen in **Figure V-5.**

k. Flamingo Point Gun Emplacement. This gun emplacement is located at the southern tip of Water Island. It consists of a fortified observation and fire control post at the top of Hill 225. The fire control post connects to underground compartments which were used for ammunition storage, sleeping quarters and other purposes. These

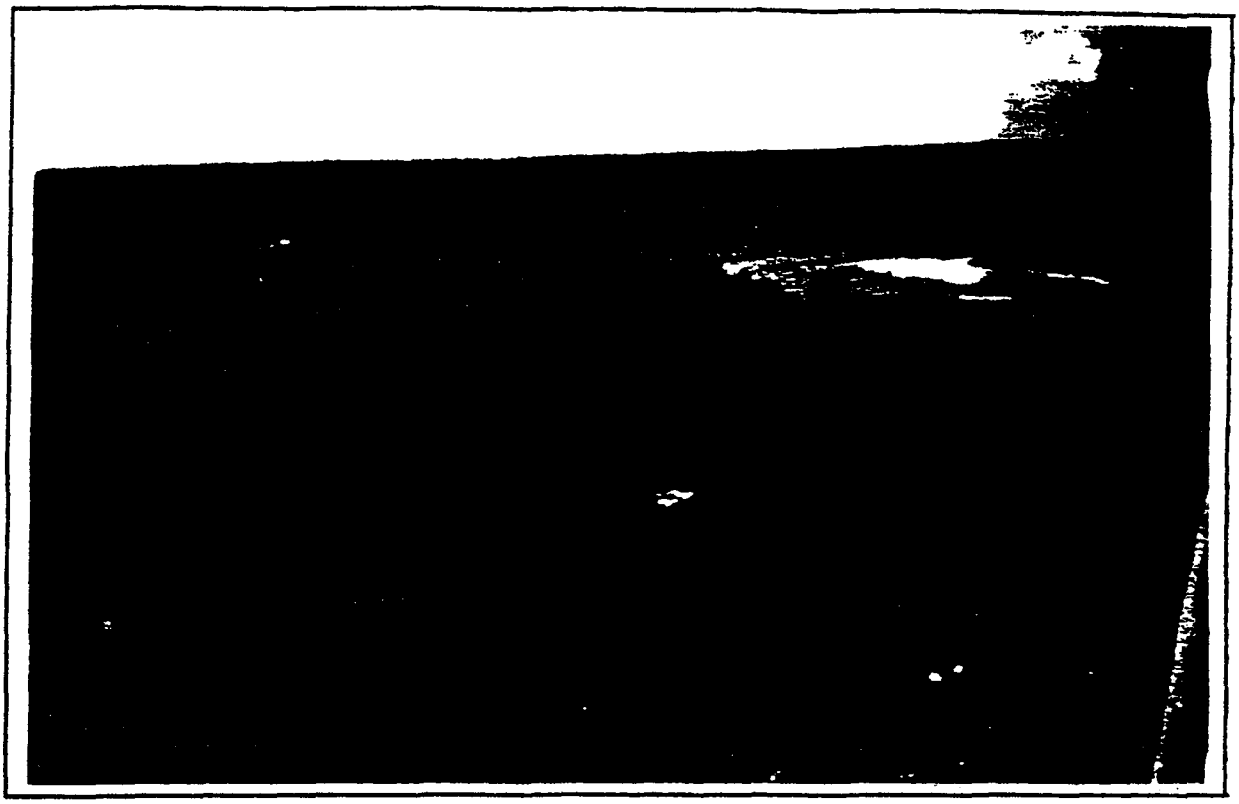


Figure V-7 Photograph of Test Area 7

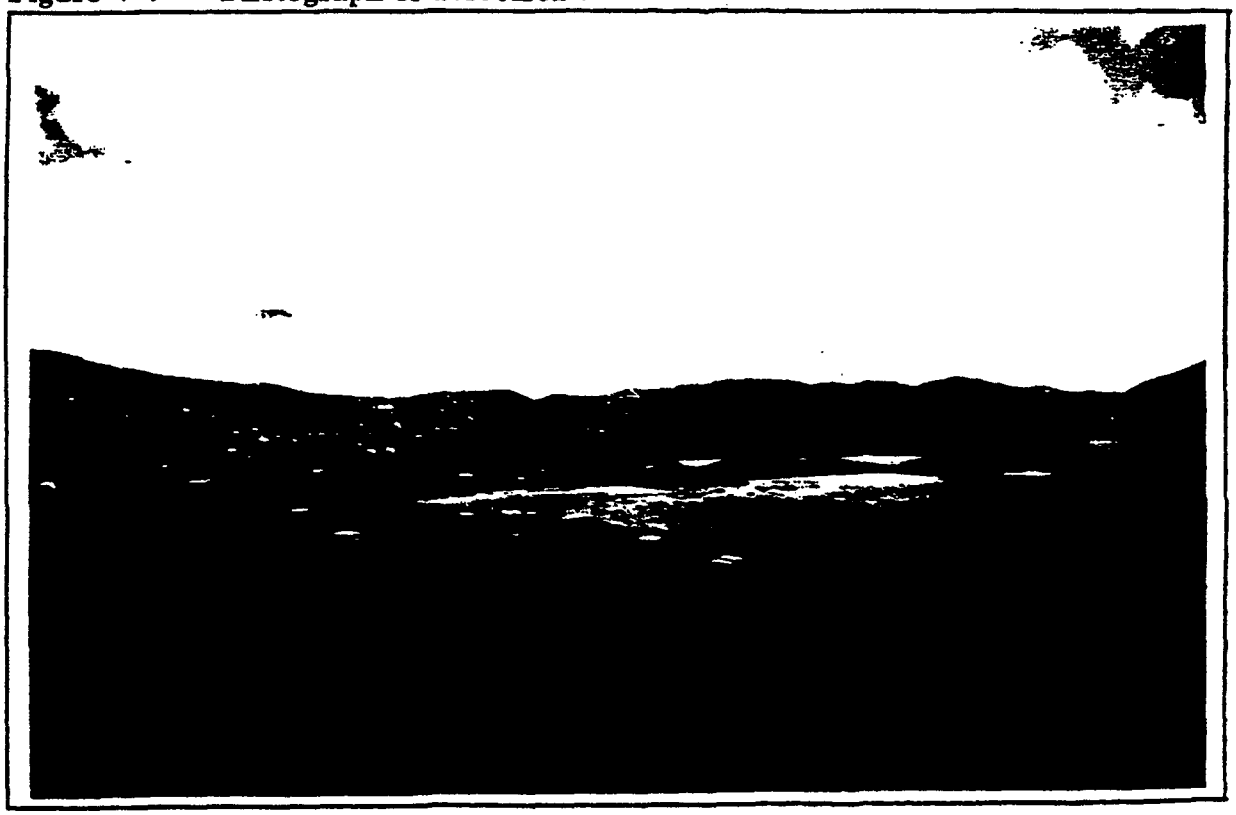


Figure V-8 Photograph of North End of Water Island

compartments have been walled off for use as water storage tanks. Mr. Couter stated that there had been nothing of a military nature left in these compartments. Emplacements were constructed for two coast artillery guns. It was reported that the war ended before these guns could be installed.

F. Meteorological Conditions. A summary of meteorological conditions prevalent in the U.S. Virgin Islands is presented in Annex B.

G. Ordnance and Explosive Waste Risk Assessment. Annex C contains standard Risk Assessment Procedure for Ordnance and Explosive Wastes for the Submarine Base, the west end of St. Thomas and for Water Island. These assessments combine the severity of the potential hazard with the probability of the hazard being experienced to produce a Risk Assessment Code.

The Risk Assessment Code (RAC) for the Submarine Base is: 5

RAC 5. No Action Required.

The Risk Assessment Code for the west end of St. Thomas is: 5

RAC 5. No Action Required.

The Risk Assessment Code for Water Island is: 1

RAC 1. Imminent hazard - Emergency action required to mitigate the hazard or protect personnel (i.e. Fencing, physical barrier, guards, etc.)

The Risk Assessment Codes for the Submarine Base and the west end of St. Thomas indicate that no evidence of existing hazards can be shown or expected based upon information available and therefore no further action is required. The Risk Assessment Code for Water Island portrays an entirely different picture. There is a reasonable possibility that severe hazards do exist on Water Island. The probability of these hazards is not uniform across the Island. The surface of large parts of the Island has been disturbed for construction of homes, businesses and recreational purposes. There is no evidence that munitions or chemical agent residues have been encountered in these disturbed places, and for most of the Island no evidence has been uncovered to indicate the probability of contamination. Two classes of locations differ from the majority of the island. These are some of the former test sites, and the filled area adjacent to Flamingo Bay where the Water Isle warehouse and the trash dump are located.

Some of the former test sites have been subjected to substantial disturbance as part of construction of homes, businesses and recreational facilities. These disturbed areas include Test Areas Nos. 1, 2, 3, and 8. Test Area Nos. 4, 5, 6,

and 7 do not appear to have been severely disturbed over their entire surface, so that the potential for buried munitions or chemical agent residues still exists. No physical evidence or documentary indications have been discovered to demonstrate the existence of a hazard, only the potential for existence of hazards. This lack of firm evidence can be a tempering influence on the assessment of hazard probability at these sites. Additional investigation is warranted.

The filled area adjacent to Flamingo Bay is a likely location for the existence of munitions. Two chemical bombs were found during excavation in 1965 and no effort has been made since that time to locate or remove any other munitions which might be present. This area presents the strongest possibility of existence of chemical or conventional munitions. The current uncontrolled access to this site, now that the possibility of existence of munitions is known, presents a substantial and immediate hazard. Immediate action to reduce access is appropriate, and further actions to investigate this site in detail should be initiated.

H. Analysis of Aerial Photography. The Environmental Protection Agency's Environmental Photographic Interpretation Center has examined available aerial photography of potentially affected sites in and near St. Thomas and Water Island. Their report is presented in Annex D.

ANNEX A

REFERENCES

Documents Obtained from the U.S. Army Center of Military History (Washington DC)

1. Construction and Real Estate Activities in the Caribbean Defense Command, prepared by Historical Section, Caribbean Defense Command, 1 July 1946.

   SUMMARY: This document is contained in two extensive volumes with a total of 944 pages; the first volume deals with the general history of construction in the Caribbean Command during World War II. The first volume describes the friction and disagreements which occurred between the Navy and the Army in determining which facilities would be constructed in the Caribbean area. The Navy, desiring more extensive Army facilities and the Army desiring less extensive facilities than the Navy wanted. There is some mention of the creation of harbor defense facilities for Roosevelt Roads, one portion of which was the facility at Ft. Segarra, St. Thomas, Virgin Islands. In the first volume there is a substantial description of the San Jose Project and how the construction developed in support of the San Jose Project on San Jose Island. The second volume deals with the construction of individual bases and has more detailed information associated with the construction that took place in the Virgin Islands. It describes two significant groups - one on St. Croix, the construction of Benedict Field and the other on St. Thomas where there were 13 separate locations that were described as having had some form of construction. There is an extensive description of the construction of Benedict Field and a somewhat detailed description of the use of marl as the aggregate in the construction of the air field. The report states that 72 wooden theater of operations type buildings were constructed at Benedict Field, and that 38 of these buildings were constructed with native stone walls.

2. Army Installations Outside Continental United States, 30 June 1944, War Department.

   SUMMARY: This document contains a listing of real estate held by the U. S. Army and the U. S. Army Air Corp in 1944. It lists the acreage and costs of land held in lease or in fee by the Army.

3. Army Installations Outside Continental United States, 30 June 1946, War Department.

   SUMMARY: This document contains a listing of all properties held by the U. S. Army and Army Air Corp outside the U. S.. Under the Antilles Department it lists the properties which were held in the U.S. Virgin Islands. It describes the housing capacity, the hospital bed capacity, storage space in square feet and the acres owned, leased or otherwise occupied, the annual costs of leases, the costs of improvements to the property, and also provides remarks, particularly at this point in time, dealing with the status of disposal of properties.

4. Army Installations Outside Continental United States, 30 June 1947, War Department.

SUMMARY: This document contains a listing of all properties held by the U. S. Army and Army Air Corp outside the U. S.. Under the Antilles Department it lists the properties which were held in the U.S. Virgin Islands. It describes the housing capacity, the hospital bed capacity, storage space in square feet and the acres owned, leased or otherwise occupied, the annual costs of leases, the costs of improvements to the property, and also provides remarks, particularly at this point in time, dealing with the status of disposal of properties.

5. Army and Air Force Installations Outside Continental United States, 31 June 1948, Office of The Chief of Engineers.

SUMMARY: This document contains a listing of all properties held by the U. S. Army and Army Air Corp outside the U. S.. Under the Antilles Department it lists the properties which were held in the U.S. Virgin Islands. It describes the housing capacity, the hospital bed capacity, storage space in square feet and the acres owned, leased or otherwise occupied, the annual costs of leases, the costs of improvements to the property, and also provides remarks, particularly at this point in time, dealing with the status of disposal of properties.

6. Army and Air Force Installations Outside Continental United States, 30 June 1949, Office of The Chief of Engineers.

SUMMARY: The only property listed for the U.S. Virgin Islands is the San Jose Project, Charlotte Amalie, St. Thomas, Chemical Storage and Experiment Station. It lists housing as 330 billets with 3200 square feet of covered storage space, 17,400 square feet of open storage space, 880 acres owned in fee and had a cost of improvements of $2,441,329. In the remarks section: Fortuna Hill Reservation, CCD-AD-8006-4-P, formerly a unit of Roosevelt Roads Harper Defense System was made a part of this installation effective 1 May 1949.

7. Army and Air Force Installations Outside Continental United States, 30 June 1950, Office of The Chief of Engineers.

SUMMARY: The only property listed for the U.S. Virgin Islands is the San Jose Project, Charlotte Amalie, St. Thomas, Chemical Storage and Experiment Station. It lists housing as 330 billets with 3200 square feet of covered storage space, 17,400 square feet of open storage space, 880 acres owned in fee and had a cost of improvements of $2,441,329. In the remarks section: Fortuna Hill Reservation, CCD-AD-8006-4-P, formerly a unit of Roosevelt Roads Harper Defense System was made a part of this installation effective 1 May 1949.

8. Army and Air Force Installations Outside Continental United States, 30 June 1951, Office of The Chief of Engineers.

   SUMMARY: This document describes only one property remaining under U.S. Army or Air Force control in the Virgin Islands. This was the Crown Mountain Air Warning Station, Charlotte Amalie. Describes it as having housing for 20 troops, 25 acres were owned in fee and that the improvements costs two hundred and sixty eight thousand, five hundred and eleven dollars. It has been declared excess through the General Services Administration on 17 May 1949.

9. Army and Air Force Installations Outside Continental United States, 30 June 1952, Office of The Chief of Engineers.

   SUMMARY: This document describes only one property remaining under U.S. Army or Air Force control in the Virgin Islands. This was the Crown Mountain Air Warning Station, Charlotte Amalie. Describes it as having housing for 20 troops, 25 acres were owned in fee and that the improvements costs two hundred and sixty eight thousand, five hundred and eleven dollars. It has been declared excess through the General Services Administration on 17 May 1949.

10. General Orders Number 44, United States War Department, 30 May 1944.

    SUMMARY: These general orders named the military installation Ft. Segarra in honor of Lt. Col. Raphael Angel Segarra, U. S. Army, and described the location as Water Island, St. Thomas, Virgin Islands, Harbor Defense of Roosevelt Roads.

Documents Obtained from U.S. Army Technical Escort Unit (Aberdeen Proving Ground, Maryland)

11. Letter, Headquarters, U.S. Army Armament, Munitions, and Chemical Command, AMSMC-HOA (A), dated 26 July 90, to Commander, U.S. Army Corps of Engineers, Mr. Robert Nore.

    SUMMARY: The letter transmitted several documents concerning the San Jose Project and the Virgin Islands. The following are summaries of those enclosures.

    ENCL 1. "The San Jose Project Moves" by CPT Jay S. Stockhardt and 1LT Stephen D. Noyes, from the Armed Forces Chemical Journal, January, 1949. The article describes the events relating to the move from Panama to the Virgin Islands. The facilities described for the project include "the land and buildings of a former submarine base, the quarters and beach of a former U.S. Marine Air Base, the whole of Water Island (a former Army cantonment), and some 2100 acres of land on the westernmost tip of St. Thomas." The article states that a chemical laboratory was located in the

former torpedo storage room and that testing was continuing on a "limited basis by use of temporary expedients."

ENCL 2. Compilation of FY 1951 Facility Proposals and Available Letters of Coordination dated 9 September 1949. The document contains information on the proposed construction of housing, service club, post chapel, and electric power supply for the San Jose Project.

ENCL 3. Trip Report, Technical Escort Detachment. The trip report describes the August 1949 transfer of "one (1) box car of classified toxic chemical munitions" from the Army Chemical Center, MD, to St. Thomas, V.I.

ENCL 4. Minutes of the 27th Meeting of the Research and Development Board. The document contains a review of Research and Development Facilities Proposals. The Research and Development Board gave qualified approval for construction of San Jose Project Facilities on St. Thomas, V.I., with the following reservation, "Upon activation of the CEBAR Proving Establishment, the activities of the San Jose Project be discontinued."

ENCL 5. Special Text No. 2, Organization of the Chemical Corps, Pg. 37. This document contains a statement that extended field tests are conducted in the Virgin Islands.

ENCL 6. Letter, 9710th, Technical Service Unit, dated 233 May 1950, Subject: Shipment of Classified Chemical Munitions from San Jose Project, V.I. to the United States. This document describes the movement of munitions from St. Thomas to the Army Chemical Center, MD, aboard the USNT COL William J. O'Brien. The only munitions specifically identified were E46 and E52 chemical bombs. These were identified because they were not properly palletized for shipment.

ENCL 7. San Jose Project Progress Report #61, 1 Nov 1947-31 Oct 1948, dated 10 Nov 1948. This report details the move from San Jose Island to Panama and subsequently to St. Thomas.

12. Message, From COMTEN to NAV ORD SYS COM dated 26 May 1966, Subject: Report of Toxic Munitions Disposal Operations.

    SUMMARY: The Navy EODT was advised on 17 May 1966 that a civilian contractor had unearthed "several bombs" while dredging on Water Island. The Navy EODT believed the bombs to be M-70 and M-78 chemical bombs. The message states that one bomb was blown without noticeable release of any chemical.

13. Technical Escort Operations Report, Undated, Shipment of Classified Chemical Munitions.

SUMMARY: Reports the movement of an unspecified amount of chemical munitions from St. Thomas, V.I., to the Eastern Chemical Depot, Army Chemical Center, MD, from 6 May to 19 May 1950.

Documents Obtained from the Technical Library, U.S. Army Chemical Research Development and Engineering Center, (Aberdeen Proving Ground, Maryland)

14. San Jose Project Report #102, Locations of Entrances to Gasproof Shelters in Relation to Prevailing Winds, Received 8 Nov 1949.

    SUMMARY: Tests were conducted between 17 May and 30 Sep 1949. A 10 x 10 x 8 1/2 foot shelter was subjected to phosgene (CG released from several ton containers). Page 5 of the Test Plan indicates the test location as "West End of St. Thomas Island."

15. San Jose Project Report #136, Static Test of M70 Bomb HD Filled, dated March 1949.

    SUMMARY: A four-phase test of M70 bombs filled with distilled mustard. The bombs were detonated at ground level to check for dispersion patterns. Conditions indicated open area/wooded area and onshore/offshore winds.

    A map of Water Island showing the test locations follows page 7 of the Test Plan.

Phase	Open/ Wooded	On-shore/ Off-shore	Test Area
I	Open	Off-shore	4
II	Open	On-shore	7
III	Wooded	Off-shore	1
IV	Wooded	On-shore	7

16. San Jose Project Report #136, Interim Report, Phase 8, dated March 1949.

    SUMMARY: Tests were performed in an Open Area with Onshore Winds (a recheck of Phase 7). The tests were performed in Area 6.

17. San Jose Project Report #176, Static Test in the Open of a Single E23 Smoke Pot, HD Filled, dated Aug 1949.

    SUMMARY: The purpose was to determine the dosage produced in the field, the rate of dose, decomposition loss, and overall efficiency for static fire. The test was performed at Test Area 4. Two photographs were included, one facing north from the top of hill 225 and one at ground level with barracks in the background.

18. Test 89, Interim Report of H Surveillance Analysis, Received 17 Nov 1948.

    SUMMARY: This report notes that bombs were moved from San Jose Island during the latter part of January 1949 to Panama and stored on dunnage, covered by canvas on frames until ~12 May 1948. They were then barged to St. Thomas. The bombs were stored in a well-ventilated "one storage building" since 21 May 1948. The bombs were received and stored in Panama on 10 December 1945.

19. San Jose Project Technical Facilities, Organization and Program, dated 1 Jul 1947.

    SUMMARY: This report deals only with the San Jose Project in Panama.

20. San Jose Project Progress Report #61, 1 Nov 47 - 31 Oct 48, dated 10 Nov 48.

    SUMMARY: This report details the move from San Jose Island to Panama to and subsequently St. Thomas.

21. San Jose Project Progress Report #62, 1 Dec 48 - 31 Dec 48.

    SUMMARY: This report contained nothing of significance except the expectation that Naval personnel would come to visit and conduct some unspecified form of test in January 1949.

22. San Jose Project Progress Report #63, 1 Jan 49 - 31 Jan 49.

    SUMMARY: A group of Navy officers and enlisted men arrived on 25 Jan 1949 for the purpose of conducting tests at this site.

23. San Jose Project Progress Report #65, 1 - 28 Feb 49.

    SUMMARY: No mention of the Navy was made in this report.

24. San Jose Project Progress Report #66, 1 - 31 Mar 49.

    SUMMARY: Test plans included 105mm German GA shells and 15cm German rockets, GA filled, 4.2 mortars with GA, 125 lb bombs (T3E2) (with GA), and smoke pots.

25. San Jose Project Progress Report #67, 1 - 30 Apr 49.

    SUMMARY: No real activity reported.

26. San Jose Project Progress Report #68, 1 - 31 May 49.

    SUMMARY: This report listed delayed projects. There was no real activity. The report also listed receipt of 196 goats and 3 kids born enroute. The goats were taken to Water Island.

27. San Jose Project Progress Report #69, 1 - 30 Jun 49.

SUMMARY: The report indicated a second location for the shelter test (SJP Report No. 102) and movement of the shelter. Delays to most test programs due to delayed materials were noted. Future construction plans were also noted. An interim Report on surveillance of CG filled bombs shows 30-M78, 7-M79, and 15 M70 bombs being sampled. Receipt of pigeons for testing were delayed by lack of fiscal year dollars.

28. San Jose Project Progress Report #70, 1 - 31 Jul 49.

SUMMARY: E23 smoke pots were received on 20 Jul 1949. Plans for tests of eight German munitions types were deleted.

29. San Jose Project Progress Reports #74, 1 - 30 Nov 49.

SUMMARY: This report noted performance of E23 smoke pot tests with GA. Improvements in getting impregnated clothing from Panama rather than CONUS was noted. Remodeling of the Water Island change house was nearing completion.

30. San Jose Project Progress Reports #75, 1 - 31 Dec 49.

SUMMARY: Continuation of E23 tests with GA was noted.

31. San Jose Project Progress Reports #76, 1 - 31 Jan 50.

SUMMARY: All testing was suspended to support Camp Detrick group.

32. San Jose Project Progress Reports #77, 1 - 28 Feb 50.

SUMMARY: Tested E23 smoke pots with HQ.

33. San Jose Project Reports #132.

SUMMARY: A surveillance test for bomb particulate was reported for a 4 lb E-1. Simulated agent with fluorescein was used.

34. San Jose Project Plan of Test Number ST-1, Druif Bay Meteorology, 29 September 1948.

SUMMARY: This plan of test calls for the establishment of meteorological stations on Druif Bay, Water Island, U.S. Virgin Islands and prescribes the conditions, procedures and materials necessary to accomplish the mission of obtaining meteorological data on Water Island.

Newspaper Articles from The Daily News, St. Thomas, U.S. Virgin Islands

35. Friday, March 19, 1948 - "Chemical Unit Reported Ready to Move to Virgin Island" Article indicated the Chemical Corps. will occupy the Submarine Base, Water Island and will negotiate for the Western End of St. Thomas.

36. Saturday, September 4, 1948 - "Army Takes Over Eight Estates on West End of Island" The estates of Botany Bay, Bordeaux, Catharina's Hope, Fortuna Runnels, Gothaab, Bethesda, Hope and Perseverance were condemned and leased on a year to year basis for the San Jose Project.

37. Saturday, November 13, 1948 - "U.S. Army Studies Poisonous Gases in Virgin Islands" The article is a translation of a November 2nd, "El Mundo" article that describes the purposes of the San Jose Project in the Virgin Islands.

38. Friday, March 11, 1949 - "Smith Protests Proposed Transfer of Roads to Army" A land owner protested in a letter to the Government Secretary, the ordinance giving the San Jose Project jurisdiction over the roads on the Western end of St. Thomas.

39. Saturday, April 2, 1949 - "The Army to Show Equipment at Roosevelt Park" The article announces a display of San Jose Project Equipment open to the public was scheduled for April 6, 1949 from 9-10 am.

40. Wednesday, June 1, 1949 - "Army has Asked for Eleven Islands West of the Mainland" The San Jose Project took control of the Islands west of St. Thomas. They included Cricket Rock, Cockroach Island, Dutchman's Cap, Salt Cay, West Cay, Savannah Island, Flat Cay, Saba Island, Turtle Dove Cay, Calcoon Cay, and Sala Cay.

41. Thursday, June 9, 1949 - "Army Control of Cays is for Safety of People" San Jose Project Commander announced that the lease of the Western Islands was purely for safety and that no operations would be conducted on the Islands.

42. Wednesday, March 15, 1950 - "No Truth in Rumor" San Jose Project Commander states that the rumors of the project moving are without foundation.

43. Saturday, April 1, 1950 - "San Jose Project Closes September 1" Announcement of the closure of the San Jose Project.

44. Thursday, August 3, 1950 - "Army Transfers Goats, Pigeons to the Government" Reports the transfer of 215 goats and 1,157 pigeons to the government of the Virgin Islands.

Interviews

45. Interview with Mr. Alex Donovan, Water Isle Hotels and Beaches, Inc., May 8, 1991.

    SUMMARY: Mr. Donovan worked for COL Elliott, the first commander of the San Jose Project. His job included delivering supplies from the Sub Base to Water Island. Since he was a civilian, he did not participate in the movement of munitions of any type. He was sure that the munitions used by the San Jose Project were stored on Water Island. Mr. Donovan stated that he had no personal knowledge of the location of the tests, but he has heard that tests were conducted near Fortuna or Bordeaux in addition to several locations on Water Island.

46. Interview with Mr. Couter, Water Isle Hotels and Beaches, Inc., May 7, 1991. (Copy on file with Ebasco Services, Inc.)

    SUMMARY: Mr. Couter was the administrator of the Water Isle Hotel and Beach Clubs. He was on Water Island in 1966 when two bombs were unearthed. They were using a crane and drag line to remove "Elephant Muck" from the area adjacent to the deep water dock when the bombs were unearthed. One of the bombs had fins; the other did not. The one with fins was approximately 5 feet long and 18 inches to 24 inches in diameter. The other was slightly shorter. The EOD team at Roosevelt Roads sent two people to the site. The EOD team took the bombs away and told the workers not to dig there any more. They put the mud back and over the years put a 3-foot cap on the site. Nothing [ordnance related] was found prior to or since that incident to the best of his knowledge.

47. Interview with Mr. Osbourne Harvey, Retired Teacher emeritus, former chemist for the San Jose Project, May 8, 1991.

    SUMMARY: Mr. Harvey was a chemist with the San Jose Project. Mr. Harvey stated that he did not know where the tests were performed or the chemicals were stored. He was sure the munitions were stored on Water Island. He thought he had heard about tests on the west end of St. Thomas but he was not sure. He was fairly sure G Agents had not been tested because there wasn't a good chemical analysis available to determine the airborne concentrations. Mr. Harvey was sure the tests had included phosgene and thought that chlorine had been used in a couple of tests. Mr. Harvey suggested talking to people who had worked in administrative areas who might know more about the storage and disposal of the agents.

48. Interview with Mr. Farrelly, retired former Director of U.S. Virgin Islands Port Authority in St. Croix, United States U.S. Virgin Islands, May 9, 1991.

    SUMMARY: Mr. Farrelly was the director of Alexander Hamilton Airport for many years. During World War II he worked in the port facility. He provided a tour of the abandoned facilities that were Benedict Field and showed where other buildings had been located.

Documents Obtained from the National Records Center (Suitland, Maryland)

49. Letter, United States Engineer Office, Puerto Rico District, San Juan, Puerto Rico, January 16, 1942, Subject: Leases.

    SUMMARY: This letter contains a description of the requirement for leases for a number of properties east of Benedict Field on St. Croix. Copies of proposed leases for 754.9 Danish acres of land are enclosures to the letter.

50. Letter, The Secretary of the Interior, Abe Fortas, to Henry L. Stimson, Secretary of War, September 24, 1943.

    SUMMARY: This letter transmits from the Secretary of Interior to the Secretary of War, Public Land Order Number 170 entitled, "Reserving Land for Use of the War Department, Virgin Islands." This transfer included some land on the southeast corner of Benedict Field in St. Croix.

51. Report of Construction Completed during Fiscal Year 1940-41 at Benedict Field, St. Croix, Virgin Islands, 1 July 1941.

    SUMMARY: This document contains a brief summary of the purpose and the location of the construction which would become Benedict Field in St. Croix. It notes that the land acquired to date was a grand total of 1,356.4 acres which is the actual area of the camp, including the night bombing range. It also gives a description of the soil and the kinds of conditions which were encountered during construction.

Documents Obtained from the Jacksonville District, U.S. Army Corps of Engineers.

52. Memorandum for Commander, Huntsville Division, Re: DERP Negative Findings and Determination of Eligibility (FDEs), Two Virgin Islands Sites, Seven Florida Sites, One North Carolina Site, dated 2 October 1989.

    SUMMARY: This letter contained several FDE's which contained information related to properties being investigated.

53. Map/Drawing, Buck Island, St. Thomas, U.S. Virgin Islands; Access Easement to U.S. Coast Guard Light Station, by Caribbean Division, Naval Facilities Engineering Command, San Juan, Puerto Rico, 1936.

    SUMMARY: This shows the outline of the property and an attached document gives a brief summary of the real estate transaction.

54. Defense Environmental Restoration Program for Formerly Used defense Sites; Inventory Project Report: College of the Virgin Islands, Charlotte Amalie, St. Thomas, U.S. Virgin Islands. Project No. IO4VIO95901, signed by R.M. Bunker, Major General, U.S. Army, Commander, South Atlantic Division Corps of Engineers.

    SUMMARY: This negative FDE stated there was no evidence of hazardous or toxic wastes, ordnance or debris projects required under the DERP.

55. Defense Environmental Restoration Program for Formerly Used Defense Sites, Findings and Determination of Eligibility, Cyril E. King Airport (Bourne Field), St. Thomas, U.S. Virgin Islands, Project No. I02VI095902, dated 17 July 1990, signed by R.M Bunker, Major General, U.S. Army, Commander, South Atlantic Division Corps of Engineers.

56. Site Survey Summary Sheet for Defense Environmental Restoration Program for Formerly Used Defense Sites, Site No. I02VI056400, Alexander Hamilton Airport, St. Croix, U.S. Virgin Islands, dated 2 November 1990, signed by John F. Sobke, Major General, U.S. Army, Commanding South Atlantic Division Corps of Engineers.

    SUMMARY: This negative FDE stated there was no evidence of hazardous or toxic wastes, ordnance or debris projects required under the DERP.

57. Defense Environmental Restoration Program for Formerly Used Defense Sites, Findings and Determination of Eligibility, Alexander Hamilton Airport (Benedict Field), St. Croix, U.S. Virgin Islands, Project No. I02VI056400, dated 2 November 1990, by John F. Sobke, Major General, U.S. Army, Commanding South Atlantic Division Corps of Engineers.

    SUMMARY: This negative FDE stated there was no evidence of hazardous or toxic wastes, ordnance or debris projects required under the DERP.

Documents Obtained from the U.S. Navy Library, Records of the Bureau of Ships and Yards (Washington, DC)

58. Administrative History of The U.S. Marine Corp Air Facility, Naval Air Bases Command, St. Thomas Virgin Islands, 21 June 1944 to 30 June 1946.

    SUMMARY: This document contains a general description of the location and types of facilities which were present at the U.S. Marine Corp Air Facility, Bourne Field, St. Thomas, Virgin Islands. It contains a description of the reduction in status and stature of the facility as combat in the Caribbean appeared to be less and less likely.

59. Letter, U.S. Naval Section Base, Insure Patrol, Naval Operating Base, Charlotte Amalie, to Commander and Chief, United States Fleet, Subject: "War Diary," May 1, 1943. (This document was obtained from the U.S. Navy Library Records of the Bureau of Ships and Yards in Washington, DC).

    SUMMARY: This document contains a detailed description of events which occurred in Charlotte Amalie in May of 1943.

60. History of U.S. Naval Facilities on St. Thomas, U.S. Virgin Islands. Prepared by Op-441H, 26 February 1952.

    SUMMARY: This is a brief summary of the history of Naval installations in the Virgin Islands in World War II. It was prepared in response to a schoolgirl's question about the value of Virgin Islands bases in the War effort.

61. War Diary: U.S. Submarine Base, St. Thomas, U.S. Virgin Islands, dated 1-31 March 1943.

Documents Obtained from the National Oceanic and Atmospheric Administration

62. Climate of Puerto Rico and Virgin Islands, Climatography of the United States Number 60, National Oceanic and Atmospheric Administration, 1982.

    SUMMARY: This document contains a general description of the climate of Puerto Rico and the Virgin Islands.

63. Monthly Normals of Temperature, Precipitation, and Heating and Cooling Degree Days, 1951-80, Virgin Islands, National Oceanic and Atmospheric Administration, September 1982.

    SUMMARY: This document contains monthly normals of temperature, precipitation and heating and cooling degree days.

64. Climatological Data Annual Summary, Puerto Rico and Virgin Islands, 1989, Volume 35, Number 13, National Oceanic and Atmospheric Administration.

    SUMMARY: This document contains detailed climatological data related to the U.S. Virgin Islands.

Miscellaneous Documents

65. U.S. Army Field Manual 3-9, Military Chemistry and Chemical Compounds, October 1985. (Document obtained from the Huntsville Division, U.S. Army Corps of Engineers).

    SUMMARY: This unclassified U. S. Army Field Manual contains descriptions of U. S. Chemical Agents and their etiologic, physical, and chemical properties.

66. The 1988-89 Settlers Handbook for the U.S. Virgin Islands. (Purchased in the Virgin Islands).

    SUMMARY: This handbook contains background information concerning the populations, customs, locations, geography, geology, and history of the Virgin Islands as well as current information pertaining to employment statistics and other information.

67. DCCA Environmental Fact Sheet Number 1, Geology of the Virgin Islands. (Document obtained from the Archives of the Enid M. Baa Library, Charlotte Amalie, St. Thomas)

    SUMMARY: This fact sheet contains basic information related to the general geology of the Virgin Islands in the Greater and Lesser Antilles.

68. Lease for Water Island, between the Secretary of the Interior and Water Island, Incorporated, dated March 26, 1957. (A copy of this lease was obtained from the Department of Interior, Washington, DC).

    SUMMARY: This lease contains the general and special terms and conditions associated with the lease of Water Island to the Water Island, Incorporated for the 20 year lease of the property known as Water Island. The lease also contains a provision for a 20 year extension of the lease at the request of the lessee. It also contains terms for payment for the use of the property and conditions which will be satisfied at the termination of the agreement.

69. "In the Wake of the Golden Galleon or Selecting a Jungle Proving Ground," by Robert D. McCleod, Jr., Col. U.S. Army Retired, Armed Forces Chemical Journal (March-April, 1955). (A copy of this journal article was obtained from the Library of the U.S. Army Chemical School, Ft. McClellan, Alabama).

    SUMMARY: This document describes the techniques, methods, and locations that were utilized by the Army in 1943, to select a tropic test site which would become the San Jose Project. This dealt exclusively with the selection of San Jose Island and did not deal with the San Jose Project in the Virgin Islands.

70. Water Island Study, U. S. Department of Commerce, Economic Development Administration, May 1980. (Document obtained from the U.S. Dept of Interior, Washington, DC)

SUMMARY: This document describes the opportunities for development of Water Island and provided a substantial amount of general information related to the history, geography and uses of Water Island. It also included recommendations for the future developments, including zoning restrictions, to be utilized on Water Island.

71. Various Real Estate Documents, Office of the Recorder of Deeds, St. Thomas, U.S. Virgin Islands.

SUMMARY: Several Deeds and other documents which provided details of the transfers of property in the U. S. Virgin Islands. Not all leases were recorded, and since many of the properties used in the U. S. Virgin Islands were leased, there are many transactions for which there is little if any data.

72. Various Real Estate Documents, Office of the Recorder of Deeds, St. Croix, U.S. Virgin Islands.

SUMMARY: Several Deeds and other documents which provided details of the transfers of property in the U. S. Virgin Islands. Not all leases were recorded, and since many of the properties used in the U. S. Virgin Islands were leased, there are many transactions for which there is little if any data.

ANNEX B

METEROLOGICAL CONDITIONS IN THE U.S. VIRGIN ISLANDS

Temperature

A striking feature of the temperature regime in the U.S. Virgin Islands is the relatively small variation of average temperature from the coolest to the warmest months, which is about 5° to 7°F. The average daily range of temperature (difference between the daytime maximum and the nighttime minimum) is also very small, varying from about 9°F in Charlotte Amalie, located in the central southern part of St. Thomas, to 15°F in Wintberg, located approximately 1 mile east of Charlotte Amalie.

Based on thirty years of climatological data recorded during the period 1951 to 1980 in Charlotte Amalie, St. Thomas, the highest mean maximum temperature is about 87°F with nighttime temperatures falling to about 74° to 78°F and a little lower at the higher elevations. The mean maximum temperatures occur during the month of August, while the lowest mean maximum temperatures occur in either January or February. Since the extent of land areas is small, the air passage over land is quite short and there is not sufficient time for extreme heating to take place. Relatively few days have temperatures of 90°F or above.

In the winter, daily maximum temperatures generally are in the low 80s, and nighttime minimums are in the high 60s or low 70s. The lowest mean minimum temperatures are observed in February, and the highest mean minimum temperature occurs in August.

Wind

The U.S. Virgin Islands are tropical, generally hilly islands which lie directly in the path of the easterly trade winds throughout the year. The trade winds blow almost without exception from the east, but are modified somewhat as they pass inland to a formidable barrier of hills, where they are lifted over the top or pushed aside. The rugged aspect of the terrain also causes wide local variations in wind speed and direction due to sheltering and channeling effects.

Night winds are lighter than the daytime winds. About daybreak, the wind speed begins to increase, reaching a maximum late in the morning or early afternoon. Wind speeds decrease later in the afternoon, usually about 4 p.m. The highest mean maximum wind speeds occur during the month of July, with speeds recorded at Alexander Hamilton Field (Airport), St. Croix slightly above 16 mph, while other stations have mean speeds several miles per hour slower. During recent years, hourly observations taken at Cyril King Airport (formerly Harry Truman Airport or Bourne Field), St. Thomas indicated that less than one percent of all wind observations were above 24 mph, and less than five percent were above 18 mph. Occasional tropical storm related winds of extreme speed are experienced. Winds of 110 mph are expected to occur once every century.

Precipitation

Cloud observations made at Cyril King Airport, St. Thomas and Alexander Hamilton Field, St. Croix show that minimum cloudiness occurs during hours of darkness with increasing amounts after sunrise. Maximum cloudiness, averaged over the year, occurs from 11 a.m. to 3 p.m. at Cyril King Airport, and from 10 a.m. to 5 p.m. at Alexander Hamilton Field. The seasonal variation of cloudiness shows a double maximum at both stations, in May or June and again in September or October, with the June maximum somewhat more pronounced. At both stations, the lowest daily average cloudiness is in March.

Rainfall in the U.S. Virgin Islands falls most frequently in the form of brief showers. Annual rainfall values indicate differences in rainfall from location to location with higher elevations generally receiving greater amounts. No distinct wet-dry season exists. The relatively dry period extends from about December through June, but occasionally, quite heavy rainfall occurs during these months. Based on thirty years of records, the driest month in St. Thomas is February, with an average of 1.63 inches, and the wettest month is September, averaging 5.78 inches. In St. Croix, March is the driest month with 1.64 inches of rainfall. Like in St. Thomas, September is the wettest month, with an average of 5.63 inches. Although the average annual rainfall over both St. Thomas and St. Croix averages from 41 to 42 inches per year, a principal concern in the islands is the short supply of water. This is due partially to a high evaporation rate and the rapid runoff from the steep terrain. During the drier portions of the year, it is necessary to carry water by barge from Puerto Rico.

Storms

The U.S. Virgin Islands lie in the path of tropical storms and hurricanes which form over the ocean to the east of the Lesser Antilles. The islands are outside the main path of the most severe tropical cyclones, except from August through the first half of October. A few "off-season" tropical cyclones have, however, slightly brushed the area at infrequent intervals. Those hurricanes and tropical storms which do severely affect the Virgin Islands develop over the waters of the southern North Atlantic to the east of the Lesser Antilles. The movements of the storms are usually towards the west and northwest. They may pass either to the south or to the north of the islands, and occasionally directly over them. Near misses of intense hurricanes or tropical storms produce little wind damage, but may cause flooding and/or tide damage. An example of the fringe effects of hurricanes in the area occurred during the passage of Donna in September 1960. The hurricane center passed west-northwestward to the north of the Virgin Islands and Puerto Rico, with gusts of wind reaching 62 mph at St. Thomas and nearly 160 mph at San Juan, Puerto Rico.

On September 18, 1989, severe damage was sustained over much of the U.S. Virgin Islands during Hurricane Hugo. Meteorological data from the Alexander Hamilton Field Station in St. Croix is not available because data collection instruments at the station were destroyed during the storm (Batham). Discussion with a Dr. Col'on former engineer for the National Weather Service In Puerto Rico indicated that the hurricane tracked from a southeast to northwest direction across the Virgin Islands and Puerto Rico. The eye of the storm occurred approximately on the western border of St. Croix. Measurements taken at the Roosevelt Roads Station in Puerto Rico registered gusts of wind at 120-mph. Dr. Col'on indicated that the wind speeds across the Virgin Islands would have been higher, resulting in most of the severe damage on the islands. Minimum rainfall damage occurred from the hurricane.

The time of greatest likelihood of flooding is at the time of maximum rainfall expectancy, roughly from May through November. The hilly nature of the Virgin Islands and the steep slope of the waterways from their basins in the mountainous areas to their outlets into the sea indictate that many of the flood situations will be of the flash flood type. Thus with only a relatively short warning period possible, vigilance for possible flood-producing situations must be maintained.

Thunderstorm activity is also most common during the period between May and November. The average number of thunderstorms, reported over various locations in Puerto Rico, ranges from 11 to 35 per year. Hail in the U.S. Virgin Islands is relatively rare; hailstones are usually pea-size and in most cases cause no serious damage. However, in 1969, a severe local hailstorm occurred with hailstones up to 11/2 inches in diameter. This was the first hailstorm on record in the islands.

ANNEX C

ORDNANCE AND EXPLOSIVE WASTE RISK ASSESSMENTS

FOR

SUBMARINE BASE, CHARLOTTE AMALIE,

THE WEST END OF ST. THOMAS,

AND WATER ISLAND - FORT SEGARRA

RISK ASSESSMENT PROCEDURES FOR EXPLOSIVE ORDNANCE (EXO)

Site Name	San Jose Project - Submarine Base St. Thomas	Rater's Name:	J. McIlrath
Site Location	St. Thomas, U.S. Virgin Islands	Organization	Ebasco Services, Inc.
DERP Project #	_____		
RAC	5		

EXO RISK ASSESSMENT:

This risk assessment procedure was developed in accordance with MIL-STD 882B and AR 385-10.

The EXO risk assessment is based upon documented evidence consisting of records searches, reports of Explosive Ordnance Disposal (EOD) detachment actions, and field observations, interviews, and measurements. These data are used to assess the risk involved based upon the hazards identified at the site. The risk assessment is composed of two factors, hazard severity and hazard probability. Any field activities should be made with the assistance of qualified EOD personnel.

Part I. Hazard Severity. Hazard severity categories are defined to provide a qualitative measure of the worst credible mishap resulting from personnel exposure to various types and quantities of unexploded ordnance items.

TYPE OF ORDNANCE

A. Conventional Ordnance and Ammunition

	YES VALUE	NO VALUE	VALUE
Small Arms (.22 cal - .50 cal)	2	0	0
Medium/Large Caliber (20 mm and larger)	10	0	0
Bombs, Explosive	10	0	0
Bombs, Practice (w/spotting charges)	6	0	0
Grenades, Hand and Rifle, Explosive	10	0	0
Grenades, Practice (w/spotting charges)	6	0	0
Landmines, Explosive	10	0	0
Landmines, Practice (w/spotting charges)	6	0	0
Rockets, Guided Missiles, Explosive	10	0	0
Detonators, Blasting Caps	10	0	0
Demolition Charges	10	0	0

Conventional Ordnance and Ammunition ORS Value (Maximum of 10). 0

B. Pyrotechnics

	YES VALUE	NO VALUE	VALUE
Any Munition Containing White Phosphorus or other Pyrophoric Material (i.e., Spontaneously Flammable)	10	0	0
Any Munition Containing A Flame or Incendiary Material (i.e., Napalm, Triethyl aluminum Metal Incendiaries)	6	0	0
Military Flares	4	0	0

Pyrotechnics Value (Maximum of 10). 0

C. Bulk High Explosives (Bulk explosives not an integral part of conventional ordnance).

	YES VALUE	NO VALUE	VALUE
Primary or Initiating Explosives (Lead Styphnate, Lead Azide, Nitroglycerin, Mercury Azide, Mercury Fulminate, etc.)	10	0	0
Booster, Bursting or Fuse Explosives (PETN, Compositions A, B, C, Tetryl, TNT, RDX, HMX, HBX, Black Powder, etc.)	10	0	0
Military Dynamite	10	0	0
Less Sensitive Explosives (Ammonium Nitrate, Favier Explosives, etc.)	3	0	0

High Explosives Value (Maximum value of 10). 0

D. Propellants

	YES VALUE	NO VALUE	VALUE	
Solid or Liquid Propellants	6	0	0	0

E. *Chemical Agent/Weapons*

	YES VALUE	NO VALUE	VALUE
Radiological	25	0	0
Toxic Chemical Agents (Choking, Nerve, Blood, Blister)	25	0	0
Incapacitating Agent (BZ)	10	0	0
Riot Control and Miscellaneous (Vomiting, Tear, Chlorine, Mustard Simulant)	5	0	0
Any Munition Containing Smoke, Illumination, Signal Charge	4	0	0

Chemical Agent/Weapons Value (Maximum 25). **0**

Total Ordnance and Explosive Waste Characteristics Value (Total = **0**
A + B + C + D + E with a Maximum value of 61).

TABLE 1
HAZARD SEVERITY*

Description	Category	Value
CATASTROPHIC	I	>21
CRITICAL	II	>13 ≤ 21
MARGINAL	III	>5 ≤ 13
NEGLIGIBLE	IV	≤5

* Apply Hazard Severity to Table 3.

Part II.

Hazard Probability. The probability that a hazard has been or will be created due to the presence and other rated factors of unexploded ordnance or explosive materials on a formerly used DOD site.

AREA, EXTENT, ACCESSIBILITY OF CONTAMINATION

A. Locations of Contamination

	YES VALUE	NO VALUE	VALUE
Within Tanks, Pipes, Vessel or Other confined locations.	5	0	0
On the surface or within 3 feet.	5	0	0
Inside walls, ceilings, or other parts of Buildings or Structures.	4	0	0
Subsurface, greater than 3 feet in depth.	3	0	0

Value for location of UXO. (Maximum Value of 5). 0

B. Distance to nearest inhabited locations or structures likely to be at risk from EXO site (roads, parks, playgrounds, and buildings).

Distance to Nearest Target	ASSIGNED VALUE
Less than 1250 feet	5
1250 feet to 0.5 miles	4
0.5 miles to 1.0 mile	3
1.0 mile to 2.0 miles	2
2.0 miles to 5.0 miles	1
Over 5.0 miles	0

Distance to Persons Value (Maximum Value of 5). 0

C. Numbers and types of Buildings within a 2 mile radius measured from the hazardous area, not the installation boundary.

Number of Buildings	ASSIGNED VALUE
0	0
1 to 10	1
11 to 50	2
51 to 100	3
101 to 250	4
251 or Over	5

Number of Buildings Value (Maximum Value of 5). 0

D. Types of Buildings	ASSIGNED VALUE	VALUE
Educational, Child Care, etc.	5	
Residential, Hospitals, Hotels, etc.	5	
Commercial, Shopping Centers, etc.	5	
Industrial Warehouse, etc.	4	
Agricultural, Forestry, etc.	3	
Detention, Correctional	2	
Military	1	
No Buildings	0	

Types of Buildings Value (Maximum Value of 5). 0

E. Accessibility to site refers to the measures taken to limit access by humans or animals to ordnance and explosive wastes. Use the following guidance:

Barrier	ASSIGNED VALUE	VALUE
A 24-hour surveillance system (e.g., television monitoring or surveillance by guards or facility personnel) which continuously monitors and controls entry onto the facility;	0	
or		
An artificial or natural barrier (e.g., a fence combined with a cliff), which completely surrounds the facility; and a means to control entry, at all times, through the gates or other entrances to the facility (e.g., an attendant, television monitors, locked entrances, or controlled roadway access to the facility).	0	
Security guard, but no barrier	1	
A barrier, (any kind of fence) but no separate means to control entry	2	
Barriers do not completely surround the facility	3	
No barrier or security system	5	

Accessibility Value (Maximum Value of 5). 0

F. Site Dynamics - This deals with site conditions that are subject to change in the future, but may be stable at the present. Examples would be excessive soil erosion by beaches or streams, increasing land development that could reduce distances from the site to inhabited areas or otherwise increase accessibility.

VALUE	ASSIGNED VALUE	
None Anticipated	0	
Expected	5	
(Maximum Value of 5)		0
Total value for hazard probability. Sum of Values A through F. (Not to exceed 30). Apply this value to Hazard Probability Table 2 to determine Hazard Level.		0

TABLE 2
HAZARD PROBABILITY*

Description	Level	Value
FREQUENT	A	>27
PROBABLE	B	>21 ≤27
OCCASIONAL	C	>15 ≤21
REMOTE	D	> 8 ≤15
IMPROBABLE	E	<8

* Apply Hazard Probability to Table 3.

Part III.

Risk Assessment. The risk assessment value for this site is determined using the following Table 3. Enter with the results of the hazard probability and hazard severity values.

FROM TABLE 1 - HAZARD SEVERITY - IV -NEGLIGIBLE

FROM TABLE 2 - HAZARD PROBABILITY - E - IMPROBABLE

TABLE 3
RISK ASSESSMENT CODE

Probability Level		FREQUENT A	PROBABLE B	OCCASIONAL C	REMOTE D	IMPROBABLE E
Severity Category:						
CATASTROPHIC	I	1	1	2	3	4
CRITICAL	II	1	2	3	4	5
MARGINAL	III	2	3	4	4	5
NEGLIGIBLE	IV	3	4	4	5	5

RISK ASSESSMENT CODE (RAC)

RAC 1 Imminent Hazard - Emergency action required to mitigate the hazard or protect personnel (i.e., Fencing, physical barrier, guards, etc.).

RAC 2 Action required to mitigate hazard or protect personnel. Feasibility study is appropriate.

RAC 3 Action required to evaluate potential threat to personnel. High priority confirmation study is appropriate.

RAC 4 Action required to evaluate potential threat to personnel. Confirmation study is appropriate.

RAC 5 No action required.

Justification. In narrative form, summarize the documented evidence that supports this risk assessment.

Explosive ordnance was handled at this site when it was an active submarine base. It also was used for the analysis of chemical agents. There is no indication that other than reagent quantities of chemical agents were used or were present in this area. There have been no reports of ordnance or chemical agents found at this site. There is no evidence that explosive ordnance or chemical items exist at this site.

RISK ASSESSMENT PROCEDURES FOR EXPLOSIVE ORDNANCE (EXO)

Site Name	San Jose Project - Submarine Base St. Thomas	Rater's Name:	J. McIlrath
Site Location	St. Thomas, U.S. Virgin Islands	Organization	Ebasco Services, Inc.
DERP Project #	_____		
RAC	5		

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This risk assessment procedure was developed in accordance with MIL-STD 882B and AR 385-10.

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Grenades, Hand and Rifle, Explosive	10	0	0
Grenades, Practice (w/spotting charges)	6	0	0
Landmines, Explosive	10	0	0
Landmines, Practice (w/spotting charges)	6	0	0
Rockets, Guided Missiles, Explosive	10	0	0
Detonators, Blasting Caps	10	0	0
Demolition Charges	10	0	0

Conventional Ordnance and Ammunition ORS Value (Maximum of 10). 0

B. Pyrotechnics

	YES VALUE	NO VALUE	VALUE
Any Munition Containing White Phosphorus or other Pyrophoric Material (i.e., Spontaneously Flammable)	10	0	0
Any Munition Containing A Flame or Incendiary Material (i.e., Napalm, Triethyl aluminum Metal Incendiaries)	6	0	0
Military Flares	4	0	0

Pyrotechnics Value (Maximum of 10). 0

C. Bulk High Explosives (Bulk explosives not an integral part of conventional ordnance).

	YES VALUE	NO VALUE	VALUE
Primary or Initiating Explosives (Lead Styphnate, Lead Azide, Nitroglycerin, Mercury Azide, Mercury Fulminate, etc.)	10	0	0
Booster, Bursting or Fuse Explosives (PETN, Compositions A, B, C, Tetryl, TNT, RDX, HMX, HBX, Black Powder, etc.)	10	0	0
Military Dynamite	10	0	0
Less Sensitive Explosives (Ammonium Nitrate, Favier Explosives, etc.)	3	0	0

High Explosives Value (Maximum value of 10). 0

D. Propellants

	YES VALUE	NO VALUE	VALUE	
Solid or Liquid Propellants	6	0	0	0

E. Chemical Agent/Weapons

	YES VALUE	NO VALUE	VALUE
Radiological	25	0	0
Toxic Chemical Agents (Choking, Nerve, Blood, Blister)	25	0	0
Incapacitating Agent (BZ)	10	0	0
Riot Control and Miscellaneous (Vomiting, Tear, Chlorine, Mustard Simulant)	5	0	0
Any Munition Containing Smoke, Illumination, Signal Charge	4	0	0

Chemical Agent/Weapons Value (Maximum 25). 0

Total Ordnance and Explosive Waste Characteristics Value (Total = 0
A + B + C + D + E with a Maximum value of 61).

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* Apply Hazard Severity to Table 3.

Part II.

Hazard Probability. The probability that a hazard has been or will be created due to the presence and other rated factors of unexploded ordnance or explosive materials on a formerly used DOD site.

AREA, EXTENT, ACCESSIBILITY OF CONTAMINATION

A. Locations of Contamination

	YES VALUE	NO VALUE	VALUE
Within Tanks, Pipes, Vessel or Other confined locations.	5	0	0
On the surface or within 3 feet.	5	0	0
Inside walls, ceilings, or other parts of Buildings or Structures.	4	0	0
Subsurface, greater than 3 feet in depth.	3	0	0

Value for location of UXO. (Maximum Value of 5). 0

B. Distance to nearest inhabited locations or structures likely to be at risk from EXO site (roads, parks, playgrounds, and buildings).

Distance to Nearest Target	ASSIGNED VALUE
Less than 1250 feet	5
1250 feet to 0.5 miles	4
0.5 miles to 1.0 mile	3
1.0 mile to 2.0 miles	2
2.0 miles to 5.0 miles	1
Over 5.0 miles	0

Distance to Persons Value (Maximum Value of 5). 0

C. Numbers and types of Buildings within a 2 mile radius measured from the hazardous area, not the installation boundary.

Number of Buildings	ASSIGNED VALUE
0	0
1 to 10	1
11 to 50	2
51 to 100	3
101 to 250	4
251 or Over	5

Number of Buildings Value (Maximum Value of 5). 0

Part III.

Risk Assessment. The risk assessment value for this site is determined using the following Table 3. Enter with the results of the hazard probability and hazard severity values.

FROM TABLE 1 - HAZARD SEVERITY - IV -NEGLIGIBLE

FROM TABLE 2 - HAZARD PROBABILITY - E - IMPROBABLE

TABLE 3
RISK ASSESSMENT CODE

Probability Level		FREQUENT A	PROBABLE B	OCCASIONAL C	REMOTE D	IMPROBABLE E
Severity Category:						
CATASTROPHIC	I	1	1	2	3	4
CRITICAL	II	1	2	3	4	5
MARGINAL	III	2	3	4	4	5
NEGLIGIBLE	IV	3	4	4	5	5

RISK ASSESSMENT CODE (RAC)

RAC 1 Imminent Hazard - Emergency action required to mitigate the hazard or protect personnel (i.e., Fencing, physical barrier, guards, etc.).

RAC 2 Action required to mitigate hazard or protect personnel. Feasibility study is appropriate.

RAC 3 Action required to evaluate potential threat to personnel. High priority confirmation study is appropriate.

RAC 4 Action required to evaluate potential threat to personnel. Confirmation study is appropriate.

RAC 5 No action required.

Justification. In narrative form, summarize the documented evidence that supports this risk assessment.

Explosive ordnance was handled at this site when it was an active submarine base. It also was used for the analysis of chemical agents. There is no indication that other than reagent quantities of chemical agents were used or were present in this area. There have been no reports of ordnance or chemical agents found at this site. There is no evidence that explosive ordnance or chemical items exist at this site.

RISK ASSESSMENT PROCEDURES FOR EXPLOSIVE ORDNANCE (EXO)

Site Name	San Jose Project - West End of St. Thomas	Rater's Name:	J. McIlrath
Site Location	St. Thomas, U.S. Virgin Islands	Organization	Ebasco Services, Inc.
DERP Project #	_____		
RAC	5		

EXO RISK ASSESSMENT:

This risk assessment procedure was developed in accordance with MIL-STD 882B and AR 385-10.

The EXO risk assessment is based upon documented evidence consisting of records searches, reports of Explosive Ordnance Disposal (EOD) detachment actions, and field observations, interviews, and measurements. These data are used to assess the risk involved based upon the hazards identified at the site. The risk assessment is composed of two factors, hazard severity and hazard probability. Any field activities should be made with the assistance of qualified EOD personnel.

Part I. Hazard Severity. Hazard severity categories are defined to provide a qualitative measure of the worst credible mishap resulting from personnel exposure to various types and quantities of unexploded ordnance items.

TYPE OF ORDNANCE

A. Conventional Ordnance and Ammunition

	YES VALUE	NO VALUE	VALUE
Small Arms (.22 cal - .50 cal)	2	0	0
Medium/Large Caliber (20 mm and larger)	10	0	0
Bombs, Explosive	10	0	0
Bombs, Practice (w/spotting charges)	6	0	0
Grenades, Hand and Rifle, Explosive	10	0	0
Grenades, Practice (w/spotting charges)	6	0	0
Landmines, Explosive	10	0	0
Landmines, Practice (w/spotting charges)	6	0	0
Rockets, Guided Missiles, Explosive	10	0	0
Detonators, Blasting Caps	10	0	0
Demolition Charges	10	0	0

Conventional Ordnance and Ammunition ORS Value (Maximum of 10). 0

B. Pyrotechnics

	YES VALUE	NO VALUE	VALUE	
Any Munition Containing White Phosphorus or other Pyrophoric Material (i.e., Spontaneously Flammable)	10	0	0	
Any Munition Containing A Flame or Incendiary Material (i.e., Napalm, Triethyl aluminum Metal Incendiaries)	6	0	0	
Military Flares	4	0	0	
Pyrotechnics Value (Maximum of 10).				0

C. Bulk High Explosives (Bulk explosives not an integral part of conventional ordnance).

	YES VALUE	NO VALUE	VALUE	
Primary or Initiating Explosives (Lead Styphnate, Lead Azide, Nitroglycerin, Mercury Azide, Mercury Fulminate, etc.)	10	0	0	
Booster, Bursting or Fuse Explosives (PETN, Compositions A, B, C, Tetryl, TNT, RDX, HMX, HBX, Black Powder, etc.)	10	0	0	
Military Dynamite	10	0	0	
Less Sensitive Explosives (Ammonium Nitrate, Favier Explosives, etc.)	3	0	0	
High Explosives Value (Maximum value of 10).				0

D. Propellants

	YES VALUE	NO VALUE	VALUE	
Solid or Liquid Propellants	6	0	0	0

E. Chemical Agent/Weapons

	YES VALUE	NO VALUE	VALUE
Radiological	25	0	0
Toxic Chemical Agents (Choking, Nerve, Blood, Blister)	25	0	- 0
Incapacitating Agent (BZ)	10	0	0
Riot Control and Miscellaneous (Vomiting, Tear, Chlorine, Mustard Simulant)	5	0	0
Any Munition Containing Smoke, Illumination, Signal Charge	4	0	0

Chemical Agent/Weapons Value (Maximum 25). 0

Total Ordnance and Explosive Waste Characteristics Value (Total = 0
A + B + C + D + E with a Maximum value of 61).

TABLE 1
HAZARD SEVERITY

Description	Category	Value
CATASTROPHIC	I	>21
CRITICAL	II	>13 ≤ 21
MARGINAL	III	>5 ≤ 13
NEGLIGIBLE	IV	≤5

* Apply Hazard Severity to Table 3.

Part II.

Hazard Probability. The probability that a hazard has been or will be created due to the presence and other rated factors of unexploded ordnance or explosive materials on a formerly used DOD site.

AREA, EXTENT, ACCESSIBILITY OF CONTAMINATION

A. Locations of Contamination

	YES VALUE	NO VALUE	VALUE
Within Tanks, Pipes, Vessel or Other confined locations.	5	0	0
On the surface or within 3 feet.	5	0	0
Inside walls, ceilings, or other parts of Buildings or Structures.	4	0	0
Subsurface, greater than 3 feet in depth.	3	0	0

Value for location of UXO. (Maximum Value of 5). 0

B. Distance to nearest inhabited locations or structures likely to be at risk from EXO site (roads, parks, playgrounds, and buildings).

Distance to Nearest Target	ASSIGNED VALUE
Less than 1250 feet	5
1250 feet to 0.5 miles	4
0.5 miles to 1.0 mile	3
1.0 mile to 2.0 miles	2
2.0 miles to 5.0 miles	1
Over 5.0 miles	0

Distance to Persons Value (Maximum Value of 5). 0

C. Numbers and types of Buildings within a 2 mile radius measured from the hazardous area, not the installation boundary.

Number of Buildings	ASSIGNED VALUE
0	0
1 to 10	1
11 to 50	2
51 to 100	3
101 to 250	4
251 or Over	5

Number of Buildings Value (Maximum Value of 5). 0

D. Types of Buildings	ASSIGNED VALUE	VALUE
Educational, Child Care, etc.	5	
Residential, Hospitals, Hotels, etc.	5	
Commercial, Shopping Centers, etc.	5	
Industrial Warehouse, etc.	4	
Agricultural, Forestry, etc.	3	
Detention, Correctional	2	
Military	1	
No Buildings	0	

Types of Buildings Value (Maximum Value of 5). 0

E. Accessibility to site refers to the measures taken to limit access by humans or animals to ordnance and explosive wastes. Use the following guidance:

Barrier	ASSIGNED VALUE	VALUE
A 24-hour surveillance system (e.g., television monitoring or surveillance by guards or facility personnel) which continuously monitors and controls entry onto the facility;	0	
or		
An artificial or natural barrier (e.g., a fence combined with a cliff), which completely surrounds the facility; and a means to control entry, at all times, through the gates or other entrances to the facility (e.g., an attendant, television monitors, locked entrances, or controlled roadway access to the facility).	0	
Security guard, but no barrier	1	
A barrier, (any kind of fence) but no separate means to control entry	2	
Barriers do not completely surround the facility	3	
No barrier or security system	5	

Accessibility Value (Maximum Value of 5). 0

F. Site Dynamics - This deals with site conditions that are subject to change in the future, but may be stable at the present. Examples would be excessive soil erosion by beaches or streams, increasing land development that could reduce distances from the site to inhabited areas or otherwise increase accessibility.

	ASSIGNED VALUE	VALUE
None Anticipated	0	
Expected	5	
(Maximum Value of 5)		0
Total value for hazard probability. Sum of Values A through F. (Not to exceed 30). Apply this value to Hazard Probability Table 2 to determine Hazard Level.		0
		0

TABLE 2
HAZARD PROBABILITY*

Description	Level	Value
FREQUENT	A	>27
PROBABLE	B	>21 ≤27
OCCASIONAL	C	>15 ≤21
REMOTE	D	> 8 ≤15
IMPROBABLE	E	<8

* Apply Hazard Probability to Table 3.

Part III.

Risk Assessment. The risk assessment value for this site is determined using the following Table 3. Enter with the results of the hazard probability and hazard severity values.

FROM TABLE 1 - HAZARD SEVERITY - IV - NEGLIGIBLE
FROM TABLE 2 - HAZARD PROBABILITY - E - IMPROBABLE

TABLE 3
RISK ASSESSMENT CODE

Probability Level		FREQUENT A	PROBABLE B	OCCASIONAL C	REMOTE D	IMPROBABLE E
Severity Category:						
CATASTROPHIC	I	1	1	2	3	4
CRITICAL	II	1	2	3	4	5
MARGINAL	III	2	3	4	4	5
NEGLIGIBLE	IV	3	4	4	5	5

RISK ASSESSMENT CODE (RAC)

RAC 1 Imminent Hazard - Emergency action required to mitigate the hazard or protect personnel (i.e., Fencing, physical barrier, guards, etc.).

RAC 2 Action required to mitigate hazard or protect personnel. Feasibility study is appropriate.

RAC 3 Action required to evaluate potential threat to personnel. High priority confirmation study is appropriate.

RAC 4 Action required to evaluate potential threat to personnel. Confirmation study is appropriate.

RAC 5 No action required.

Justification. In narrative form, summarize the documented evidence that supports this risk assessment.

Phosgene is the only material for which there is documented existence of use on the site. Phosgene is a non-persistent, lethal, choking agent. The agent was dispensed from banks of ton containers. No ton containers have been discovered on the site and it is reasonable that they were removed for reuse. However, there is no documentary basis to support this assumption. There is no evidence that explosive ordnance or chemical items exist on these properties.

RISK ASSESSMENT PROCEDURES FOR EXPLOSIVE ORDNANCE (EXO)

Site Name	San Jose Project - Ft. Segarra	Rater's Name	J. McIlrath
Site Location	Water Island U.S. Virgin Islands	Organization	Ebasco Services, Inc.
DERP Project #	_____		
RAC	1		

EXO RISK ASSESSMENT:

This risk assessment procedure was developed in accordance with MIL-STD 882B and AR 385-10.

The EXO risk assessment is based upon documented evidence consisting of records searches, reports of Explosive Ordnance Disposal (EOD) detachment actions, and field observations, interviews, and measurements. These data are used to assess the risk involved based upon the hazards identified at the site. The risk assessment is composed of two factors, hazard severity and hazard probability. Any field activities should be made with the assistance of qualified EOD personnel.

Part I. Hazard Severity. Hazard severity categories are defined to provide a qualitative measure of the worst credible mishap resulting from personnel exposure to various types and quantities of unexploded ordnance items.

TYPE OF ORDNANCE

A. Conventional Ordnance and Ammunition

	YES VALUE	NO VALUE	VALUE
Small Arms (.22 cal - .50 cal)	2	0	0
Medium/Large Caliber (20 mm and larger)	10	0	10
Bombs, Explosive	10	0	10
Bombs, Practice (w/spotting charges)	6	0	0
Grenades, Hand and Rifle, Explosive	10	0	0
Grenades, Practice (w/spotting charges)	6	0	0
Landmines, Explosive	10	0	0
Landmines, Practice (w/spotting charges)	6	0	0
Rockets, Guided Missiles, Explosive	10	0	0
Detonators, Blasting Caps	10	0	0
Demolition Charges	10	0	0

Conventional Ordnance and Ammunition ORS Value (Maximum of 10). 10

B. Pyrotechnics	YES VALUE	NO VALUE	VALUE
Any Munition Containing White Phosphorus or other Pyrophoric Material (i.e., Spontaneously Flammable)	10	0	0
Any Munition Containing A Flame or Incendiary Material (i.e., Napalm, Triethyl aluminum Metal Incendiaries)	6	0	0
Military Flares	4	0	0

Pyrotechnics Value (Maximum of 10). 0

C. Bulk High Explosives (Bulk explosives not an integral part of conventional ordnance).

	YES VALUE	NO VALUE	VALUE
Primary or Initiating Explosives (Lead Styphnate, Lead Azide, Nitroglycerin, Mercury Azide, Mercury Fulminate, etc.)	10	0	0
Booster, Bursting or Fuse Explosives (PETN, Compositions A, B, C, Tetryl, TNT, RDX, HMX, HBX, Black Powder, etc.)	10	0	0
Military Dynamite	10	0	0
Less Sensitive Explosives (Ammonium Nitrate, Favier Explosives, etc.)	3	0	0

High Explosives Value (Maximum value of 10). 0

D. Propellants

	YES VALUE	NO VALUE	VALUE	
Solid or Liquid Propellants	6	0	6	0

E. Chemical Agent/Weapons

	YES VALUE	NO VALUE	VALUE
Radiological	25	0	0
Toxic Chemical Agents (Choking, Nerve, Blood, Blister)	25	0	25
Incapacitating Agent (BZ)	10	0	0
Riot Control and Miscellaneous (Vomiting, Tear, Chlorine, Mustard Simulant)	5	0	5
Any Munition Containing Smoke, Illumination, Signal Charge	4	0	4

Chemical Agent/Weapons Value (Maximum 25). 25

Total Ordnance and Explosive Waste Characteristics Value (Total = 35
A + B + C + D + E with a Maximum value of 61).

TABLE 1
HAZARD SEVERITY*

Description	Category	Value
CATASTROPHIC	I	>21
CRITICAL	II	>13 ≤ 21
MARGINAL	III	>5 ≤ 13
NEGLIGIBLE	IV	≤5

* Apply Hazard Severity to Table 3.

Part II.

Hazard Probability. The probability that a hazard has been or will be created due to the presence and other rated factors of unexploded ordnance or explosive materials on a formerly used DOD site.

AREA, EXTENT, ACCESSIBILITY OF CONTAMINATION

A. Locations of Contamination

	YES VALUE	NO VALUE	VALUE
Within Tanks, Pipes, Vessel or Other confined locations.	5	0	5
On the surface or within 3 feet.	5	0	5
Inside walls, ceilings, or other parts of Buildings or Structures.	4	0	4
Subsurface, greater than 3 feet in depth.	3	0	3

Value for location of UXO. (Maximum Value of 5). 3

B. Distance to nearest inhabited locations or structures likely to be at risk from EXO site (roads, parks, playgrounds, and buildings).

Distance to Nearest Target	ASSIGNED VALUE	VALUE
Less than 1250 feet	5	
1250 feet to 0.5 miles	4	
0.5 miles to 1.0 mile	3	
1.0 mile to 2.0 miles	2	
2.0 miles to 5.0 miles	1	
Over 5.0 miles	0	

Distance to Persons Value (Maximum Value of 5). 5

C. Numbers and types of Buildings within a 2 mile radius measured from the hazardous area, not the installation boundary.

Number of Buildings	ASSIGNED VALUE	VALUE
0	0	
1 to 10	1	
11 to 50	2	
51 to 100	3	
101 to 250	4	
251 or Over	5	

Number of Buildings Value (Maximum Value of 5). 5

D. Types of Buildings	ASSIGNED VALUE	VALUE
Educational, Child Care, etc.	5	
Residential, Hospitals, Hotels, etc.	5	
Commercial, Shopping Centers, etc.	5	
Industrial Warehouse, etc.	4	
Agricultural, Forestry, etc.	3	
Detention, Correctional	2	
Military	1	
No Buildings	0	

Types of Buildings Value (Maximum Value of 5). 5

E. Accessibility to site refers to the measures taken to limit access by humans or animals to ordnance and explosive wastes. Use the following guidance:

Barrier	ASSIGNED VALUE	VALUE
A 24-hour surveillance system (e.g., television monitoring or surveillance by guards or facility personnel) which continuously monitors and controls entry onto the facility;	0	
or		
An artificial or natural barrier (e.g., a fence combined with a cliff), which completely surrounds the facility; and a means to control entry, at all times, through the gates or other entrances to the facility (e.g., an attendant, television monitors, locked entrances, or controlled roadway access to the facility).	0	
Security guard, but no barrier	1	
A barrier, (any kind of fence) but no separate means to control entry	2	
Barriers do not completely surround the facility	3	
No barrier or security system	5	

Accessibility Value (Maximum Value of 5). 5

F. Site Dynamics - This deals with site conditions that are subject to change in the future, but may be stable at the present. Examples would be excessive soil erosion by beaches or streams, increasing land development that could reduce distances from the site to inhabited areas or otherwise increase accessibility.

	ASSIGNED VALUE	
None Anticipated	0	
Expected	5	
(Maximum Value of 5)		0
Total value for hazard probability. Sum of Values A through F. (Not to exceed 30). Apply this value to Hazard Probability Table 2 to determine Hazard Level.		23

TABLE 2
HAZARD PROBABILITY*

Description	Level	Value
FREQUENT	A	>27
PROBABLE	B	>21 ≤27
OCCASIONAL	C	>15 ≤21
REMOTE	D	> 8 ≤15
IMPROBABLE	E	<8

* Apply Hazard Probability to Table 3.

Part III.

Risk Assessment. The risk assessment value for this site is determined using the following Table 3. Enter with the results of the hazard probability and hazard severity values.

TABLE 1 - HAZARD SEVERITY - I - CATASTROPHIC
TABLE 2 - HAZARD PROBABILITY - B - PROBABLE

TABLE 3
RISK ASSESSMENT CODE

Probability Level		FREQUENT A	PROBABLE B	OCCASIONAL C	REMOTE D	IMPROBABLE E
Severity Category:						
CATASTROPHIC	I	1	1	2	3	4
CRITICAL	II	1	2	3	4	5
MARGINAL	III	2	3	4	4	5
NEGLIGIBLE	IV	3	4	4	5	5

RISK ASSESSMENT CODE (RAC)

RAC 1 Imminent Hazard - Emergency action required to mitigate the hazard or protect personnel (i.e., Fencing, physical barrier, guards, etc.).

RAC 2 Action required to mitigate hazard or protect personnel. Feasibility study is appropriate.

RAC 3 Action required to evaluate potential threat to personnel. High priority confirmation study is appropriate.

RAC 4 Action required to evaluate potential threat to personnel. Confirmation study is appropriate.

RAC 5 No action required.

Justification. In narrative form, summarize the documented evidence that supports this risk assessment.

This was an active open air, chemical testing site in the period 1948-1950. H, HD, L, GA, CG, CK, AC and other lethal agents as well as non lethal agents, and possibly herbicides. were used on the island. Their use is documented. There is some indication that unused munitions, and perhaps intact munitions may have been disposed on the Island. No injuries from either conventional or unconventional munitions have been experienced. Two M70 or M78 chemical bombs were unearthed in 1966, and since then no further action has been taken to locate or remove any other munitions which might be present. There is a significant civilian population on the Island, and there are no access control measures. The evidence strongly supports a conclusion that chemical munitions may be burried near Flamingo Bay. Test Area Nos. 4, 5, 6, and 7 present a potential for existance of munitions and chemical agents.

ANNEX D

AERIAL PHOTOGRAPHY ANALYSIS OF WATER ISLAND

The analysis and the aerial photography refered to in this analysis are oversized and are included in a separate volume provided with this report.

U.S. Army
Chemical Materiel Destruction Agency

Former Fort Segarra Scoping Study

10 December 1993

FOREWORD

The Former Fort Segarra (FFS) Site Scoping Study provides the scope of effort anticipated for the remediation of potentially buried chemical warfare materiel (CWM) at the FFS in the U.S. Virgin Islands. It was conducted in accordance with performance requirements of the U.S. Army Chemical Research and Development Procurement Division (Contract Number DAAA15-91-D-0005, Task Order Number NSD-001) for the U.S. Army Chemical Materiel Destruction Agency.

The FFS Scoping Study is designed to be used in conjunction with the Generic Site Scoping Study and the Site Monitoring Concept Study. These documents are written to comply with the current Army position on the treatment of chemical warfare materiel. As such, all of these studies should be considered as working documents. In that regard, the reader and users of these documents should realize that as the Army's position matures, these documents may require modificaiton.

EXECUTIVE SUMMARY

This report identifies regulatory and technical issues associated with efforts to clean up potentially buried chemical warfare materiel (CWM) at the Former Fort Segarra (FFS) in the U.S. Virgin Islands. The report was conducted in accordance with performance requirements of the U.S. Army Chemical Research and Development Procurement Division, Contract Number DAAA15-91-D-0005, Task Order Number NSD-001, for the U.S. Army Chemical Materiel Destruction Agency (USACMDA).

The FFS Scoping Study is designed to be used in conjunction with the Generic Site Scoping Study and the Site Monitoring Concept Study. These two reports have been written so that their information can be applied to generic CWM burial sites. The Generic Site Scoping Study presents a broad generic description of information that can be applied to multiple CWM burial sites. The FFS Scoping Study refers to the Generic Site Scoping Study as the Generic report. The Site Monitoring Concept Study develops monitoring concepts, strategies, and philosophies to be used for chemical agent monitoring during CWM recovery and disposal operations.

The Commander, USACMDA has designated a Program Manager for Non-Stockpile Chemical Materiel (PMNSCM) to be responsible for the destruction of all CWM that was buried as part of previously acceptable disposal practices. This materiel is not specifically included in the unitary chemical stockpile. Cleanup activities for buried CWM sites involve interim storage, transportation, and destruction of the CWM. Other mission responsibilities include providing technical assistance to those agencies performing the recovery of buried CWM in the areas of monitoring, handling, and decontaminating CWM, and in the area of public relations.

Water Island and the western end of St. Thomas in the U.S. Virgin Islands was the site of the U.S. Army's San Jose project in the late 1940's. The purpose of the San Jose project was to determine the effectiveness of chemical munitions and defenses in jungle terrain and the effects on chemical munitions of storage in tropical climates. Although limited testing occurred in the U.S. Virgin Islands, there is some concern that items associated with the test activities may have been left when the Army vacated the Islands in 1950. The area where the San Jose project tests occurred on Water Island is referred to as the FFS. FFS is considered in this report as a potential site that contains a small quantity of explosively configured CWM.

The conclusions presented in this report are intended to identify potential strategies for remediating potentially buried CWM. It is expected that applicable regulations would be followed during the identification, selection, implementation, and operation of cleanup actions at FFS.

Section 1 of this report is an introduction. The Army has designated recovered CWM as hazardous waste. This is a key point that is carried throughout the report and a

significant departure from previous interpretations concerning the applicability of federal hazardous waste regulations to CWM.

Section 2 summarizes background information concerning FFS. CWM activities on the U.S. Virgin Islands have been fairly well defined through the use of San Jose project test reports, progress reports, and personal interviews. Historical documents indicate that a limited number of CWM tests were conducted on the U.S. Virgin Islands. Water Island was the primary location for testing, while limited testing was performed at the west end of St. Thomas. Of the nine tests conducted, three involved the surveillance of CWM during storage, five involved the static firing of CWM, and one involved emitting phosgene to determine penetration characteristics of gasproof shelters.

The disposition of the CWM items is also fairly well defined. Records indicate that the majority of the CWM stored on Water Island was removed at the end of the San Jose project. However, records do not indicate the disposition of all items involved in the tests. Some of these items include four M78, CK-filled, 500-pound bombs involved in the surveillance tests, remnants from the M70 bomb tests, and the smoke pots. Records and personal interviews indicate that CWM testing on Water Island was confined to the southern end of the island. It is therefore recommended that no further investigations be conducted in former test area 1, 2, 3, and 7 at the north end of the CWM site.

Section 3 provides information about the environmental laws and regulations potentially applicable to cleanup actions at FFS. The principal regulations governing this site are the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the amendments enacted as the Superfund Amendments and Reauthorization Act (SARA). Other Federal, U.S. Virgin Islands, Department of Defense (DoD), and Department of Interior (DOI) regulations may apply, depending on the activity undertaken at the site.

Section 4 discusses the elements of risk associated with a non-stockpile site cleanup. Risk management policies, procedures, and strategies must be developed for the FFS cleanup. The federal CERCLA, Occupational Safety and Health Administration (OSHA), and DoD requirements and guidance can provide the basis for developing a FFS-specific risk management program. The use of the CERCLA baseline risk assessment (BRA) and the DoD's hazard assessment processes will provide a comprehensive evaluation of risks associated with the site conditions and the hazards associated with handling, transport, and disposal of CWM.

Non-standard chemical agents and munitions were involved in tests on Water Island. Records indicate that sesquimustard (HQ) (an experimental mustard-series agent) and solidified cyanogen chloride (CK) may be recovered on Water Island. The possible recovery of these items would introduce additional hazards and complicate the agent monitoring and treatment process.

Section 5 discusses the role of a baseline risk assessment in the CERCLA process to select and implement cleanup actions. The principal objective of a baseline assessment is to collect sufficient information to support the cleanup action selected under CERCLA. The primary techniques used in the baseline assessment are soil and groundwater monitoring and geophysical techniques. These techniques are used to minimize intrusive work, avoiding unnecessary exposure to the hazardous materials potentially present at the site.

Section 6 describes specific activities associated with CWM excavation at FFS. If excavation is performed to recover CWM, there exists a variety of applicable mechanized and hand techniques. Geophysical techniques are available that could assist in identifying locations of buried CWM during excavation activities, enhancing safety and environmental protection during recovery operations. Based on a preliminary assessment, the preferred excavation strategy for the former test areas includes the use of magnetometers to perform non-intrusive surveys during excavation. Excavation would begin with mechanized equipment to within 1 foot of detected magnetic anomalies, and then would involve the recovery of the CWM by archeological-type hand excavation techniques.

If excavation is conducted in the Flamingo Bay landfill area, a different excavation strategy using mechanized excavation equipment is recommended. Geophysical techniques would be of minimal use in the Flamingo Bay landfill due to the presence of metal scrap and vehicles reportedly buried in this area.

Section 7 describes the potentially applicable regulatory requirements that govern the packaging of recovered CWM from FFS. The regulatory requirements include federal hazardous waste laws, DoD requirements, and Department of Transportation (DOT) regulations. Also, the packaging systems used by the Army during the European retrograde mission for transporting stockpiled chemical munitions were reviewed. The packaging of recovered CWM from FFS must meet or exceed DOT specifications 49 CFR 173.212 and 49 CFR 173.62. One possible example of a packaging system meeting DOT requirements consists of individually containerizing recovered CWM in a plastic bag, which is then placed in a steel drum packed with absorbent material, such as vermiculite. The drums are then stored on pallets and are ready for transport.

Section 8 presents specific information about interim storage structures for recovered CWM at FFS. Various portable structures were identified. If a new facility is constructed, portable magazine type structures are recommended for use at FFS due to their relatively low cost, security, environmental protection, and safety. Initially, two storage units are recommended at FFS. Additional storage capacity could be provided if more storage is needed to separate incompatible waste or if the first storage units do not have the capacity for the CWM recovered.

At FFS, three siting options were considered: use of existing World War II (WWII) bunkers at the north end of Water Island, use of existing WWII bunkers in the Krum Bay area on St. Thomas, or construction of a portable facility in the Flamingo Bay area on Water Island. Installation of a portable facility in the Flamingo Bay area was

recommended primarily due to the proximity of this location to areas where CWM would most likely be recovered. If a decision is made to site the interim storage facility in the Flamingo Bay area, additional investigation would be needed to identify an exact location for the storage facilities.

Section 9 describes specific requirements for transportation of CWM from FFS. Federal, U.S. Virgin Islands, and DoD requirements restrict the transportation of CWM-type materiel. The transportation of recovered CWM from the FFS site is feasible by air or water shipment. The use of rail, road, air, or ship is feasible for transporting the CWM to the final disposal site within the continental U.S. Regulatory restrictions for each transportation method varies. Hazardous waste requirements for packaging, placarding, manifesting and use of permitted hazardous waste haulers will apply for all modes of transport. DOT requirements specify weight limitations for air transportation. DOT also prohibits the transport of CWM by commercial passenger and by cargo air transport in certain situations. DoD requirements specify limitations for transporting Chemical Surety Materiel (CSM) by military aircraft. DOT also restricts the storage of CWM on shipboard to selected locations.

Section 10 identifies candidate treatment technologies for CWM found at small burial sites with the potential to contain explosively-configured CWM. Potentially applicable technologies, which could be developed for use within a 3-year time frame, were identified, provided that transportability, safety in operation, and the ability to achieve an assumed minimum treatment criteria could be demonstrated. Various containment technologies and techniques used to access CWM were identified. The treatment technology analysis was based on available information from technology vendors, literature, and best professional judgement. Specific scores for technologies indicate a relative ranking among technologies to satisfy the evaluation criteria. The specific scores are not intended to be used to eliminate treatment technologies from consideration during a future CERCLA feasibility study (FS). Selection of a cleanup action for FFS could ultimately involve onsite treatment. However, treatment technologies must be further evaluated during a CERCLA FS and could also require that treatability studies be performed before a decision can be made to select treatment as a preferred component of an FFS cleanup action.

Section 11 summarizes four potentially applicable cleanup alternatives for sites requiring remediation of CWM. Each alternative is evaluated for safety, security, environmental protection, and cost criteria. The alternatives include 1) no intervention; 2) excavation and onsite treatment; 3) excavation and interim storage, followed by onsite treatment; and 4) excavation and offsite treatment. This cleanup alternative evaluation is not intended to replace the one conducted during a CERCLA Remedial Investigation/ Feasibility Study (RI/FS), but it does provide a preliminary analysis of several primary alternatives, which will be further evaluated during any future RI/FS at FFS.

Sections 12 and 13 discuss contingency planning, equipment, and operations. Specially-trained elements within the Army have substantial experience in CWM emergency response, the most noteworthy of these being the U.S. Army Technical

Escort Unit (TEU). Contingency planning issues are described in section 12. Equipment for responding to CWM emergencies is described in section 13. As local emergency response teams could be the first to arrive at the site, recommendations are made to ensure that adequate training and equipment is available for these activities prior to beginning cleanup activities at FFS.

Section 14 summarizes the primary conclusions and recommendations that have been developed in this report. Generally, the conclusions and recommendations have also been presented at the end of each section.

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SECTION 1

INTRODUCTION

1. INTRODUCTION

The U.S. Army Chemical Materiel Destruction Agency (USACMDA) is responsible for the destruction of chemical warfare materiel (CWM) not associated with the unitary chemical stockpile. To accomplish this mission, USACMDA has designated a Program Manager for Non-Stockpile Chemical Materiel (PMNSCM). One of the first activities of the PMNSCM is to support the U.S. Army Corps of Engineers (USACE) at the Former Fort Segarra (FFS) remediation effort on the U.S. Virgin Islands.

Water Island and the western end of St. Thomas were the sites of the U.S. Army's San Jose project in the late 1940's. The purpose of the San Jose project was to determine the effectiveness of chemical munitions in jungle terrain and the effects on chemical munitions of storage in tropical climates. Although limited testing occurred in the U.S. Virgin Islands, there is some concern that items associated with the test activities may have been left when the Army vacated these sites in 1950. The area on Water Island where the San Jose project tests occurred is referred to as the FFS. FFS is considered in this report as a potential site containing a small quantity of explosively-configured CWM.

The objective of the FFS Site Scoping Study is to provide information to decision makers and remediation workers about conducting safe, secure, and environmentally sound cleanup actions at FFS. It is not obvious that CWM excavation is required at FFS. The decision to excavate requires the collection of additional site data, through activities such as monitoring and geophysical work, to determine the nature, extent, or even the existence of CWM contamination at FFS. Should a cleanup action involving excavation and onsite treatment be required at FFS, this report provides recommendations regarding techniques, technologies, and equipment which could be used.

This report provides information concerning historical CWM activities and the present understanding of the nature of CWM contamination at FFS. It also discusses risks associated with buried CWM; reviews potentially applicable regulatory requirements for CWM recovery activities; discusses excavation, storage, transportation, and treatment of CWM; and presents a summary of cleanup actions considered appropriate for CWM remediation

The Generic Site Scoping Study provides an important technical basis for the preparation of the FFS report. The Generic report was prepared to present general discussions about management, regulatory, and cleanup issues associated with CWM remediation, providing a broad and general description of CWM-related issues. The FFS report was then prepared based on information in the Generic report and from knowledge of site-specific conditions at FFS. The FFS report identifies the appropriate

policies, procedures, and equipment from the Generic report to develop a remediation strategy suited for FFS.

When required, assumptions about site conditions and applicable regulations to CWM recovery activities are made to complete the work assignment. The area of greatest concern involves uncertainties about the regulatory policies that govern the remediation of CWM. For this report, USACMDA has directed that CWM is to be categorized as a hazardous waste. Consequently, all federal and U.S. Virgin Islands hazardous waste regulations apply to the management of CWM. USACMDA has also specified that CWM remediation activities are to be performed under the authorities and conditions of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) and the amendments to that act under the Superfund Amendments and Reauthorization Act (SARA). The requirements of these two laws will apply at FFS as well.

SECTION 2

FORMER FORT SEGARRA BACKGROUND ANALYSIS

2. FORMER FORT SEGARRA BACKGROUND ANALYSIS

This section provides background information on the Former Fort Segarra (FFS), including discussions on the history, site characteristics, and the areas which are potentially contaminated with chemical warfare materiel (CWM). Collection and analysis of this type of information supports the first step of a preliminary site characterization under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) process. During a preliminary site characterization, existing data is collected and analyzed to determine areas requiring further investigation and to provide preliminary information on site characteristics.

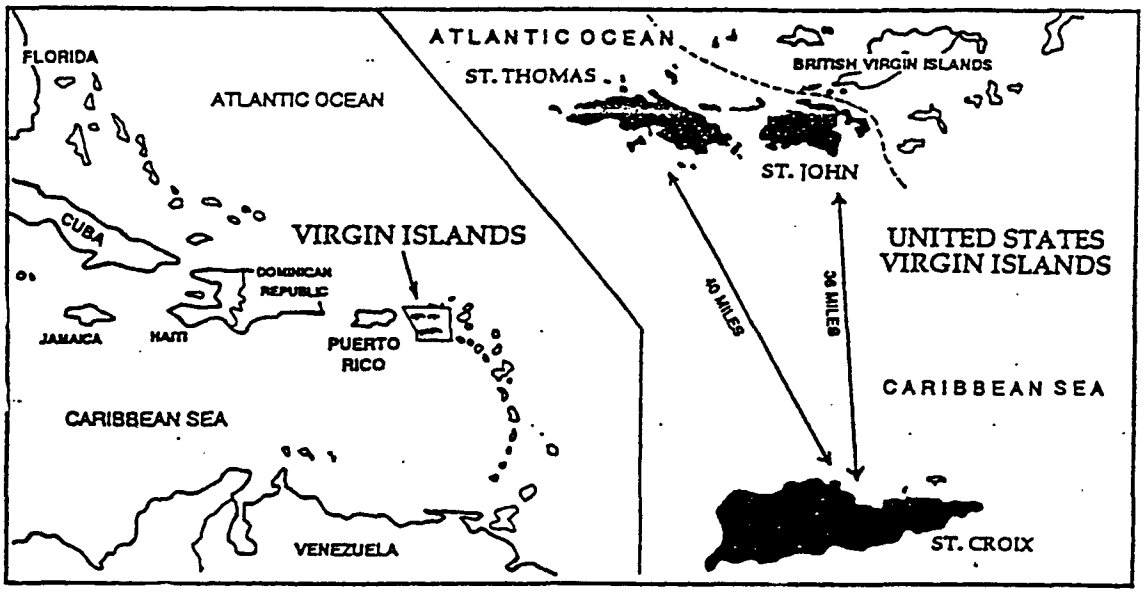
2.1 Former Fort Segarra Historical Documentation

2.1.1 Introduction. FFS is located in the U.S. Virgin Islands on Water Island, a small island approximately 500 acres in size, 1 and 3/4 miles long, and 1/2 mile wide. It is located in the St. Thomas Bay between the East and West Gregerie Channels, and at its closest point is only 1800 feet from St. Thomas. Figure 2-1 shows the general location of Water Island. Water Island is currently owned by the U.S. Department of the Interior (DOI), who subsequently leased it to Water Island, Incorporated for development as a resort area. Water Island, Incorporated sold their lease rights to the Water Isle Hotel and Beach Club in 1965, which retains the current master lease.

The name Fort Segarra refers to the World War II gun emplacements and structures built on Water Island in the early 1940s, named in honor of U.S. Army Lieutenant Colonel Raffle Angel Segarra. These facilities were declared excess in 1946. In 1948, following World War II, the San Jose project was moved to the U.S. Virgin Islands from Panama. The purpose of the San Jose project was to test chemical munitions to determine their effectiveness under jungle conditions.

To research the history of the San Jose project on the U.S. Virgin Islands, test reports and progress reports from the U.S. Army Edgewood Research Development and Engineering Center (ERDEC) library were reviewed, newspaper articles from that era were reviewed, and individuals involved in the San Jose project at that time were interviewed. Newspaper articles from that era are included in appendix B. Army progress reports were available for all periods of time that the San Jose project was in operation on the U.S. Virgin Islands. Appendix C summarizes these progress reports. Test reports were available for four of the nine tests conducted.

Two military personnel and two civilians from the San Jose project were interviewed. Mr. Luke West was a Captain in the military, a test officer on San Jose and Water Island, and a part of the reconnaissance mission once testing ended on the San Jose Island. Mr. Jimmie Mains joined the San Jose project two weeks before it left San



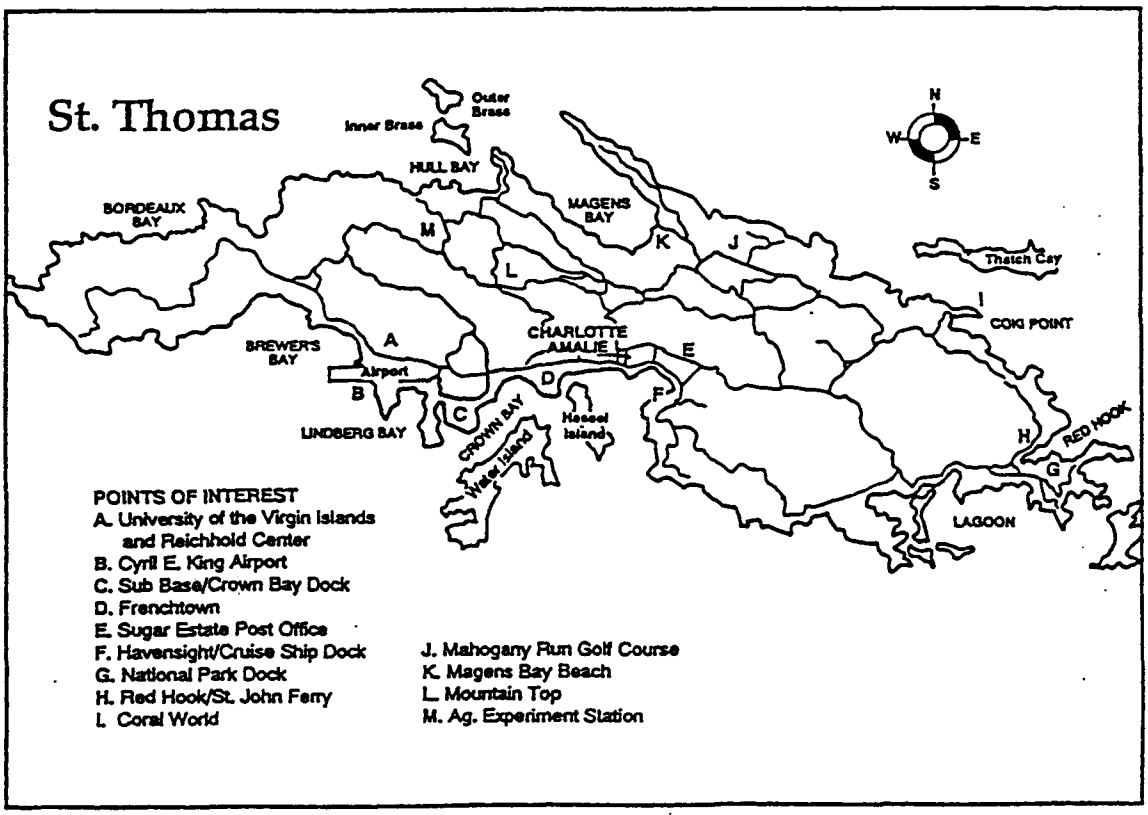


Figure 2-1. Location of Water Island

Jose Island. He did not depart from the project until after he participated in the sea dump of the chemical munitions at the close of the San Jose project on the U.S. Virgin Islands. Mr. Jimmie Mains was one of four military personnel who worked full time on Water Island.

Mr. Alex Donovan, who currently resides on Water Island, was also interviewed. He was a civilian during the San Jose project and was responsible for transporting personnel by boat from St. Thomas to Water Island. Mr. George Perrot, who was a radio operator on the San Jose project, now resides in St. Thomas. Records of these interviews are provided in appendix D.

To obtain additional background information on the San Jose project, a trip was made to the U.S. Virgin Islands. A site visit of the test areas on Water Island and the west end of St. Thomas was conducted. Meetings were held with the U.S. Virgin Islands regulatory officials to include the Department of Planning and Natural Resources, the U.S. Virgin Islands Territorial Emergency Management Agency (VITEMA), and the U.S. Virgin Islands Water and Power Authority (WAPA).

Four interviews were conducted while on Water Island. Mr. Bill Couter of Water Isle Hotels and Beach Clubs was interviewed, and he provided historical information regarding the use of the San Jose test area land since the Army vacated the island in 1950. As mentioned previously, Mr. Alex Donovan, a civilian on the San Jose project, was interviewed. Ms. L.C. Keeler, former president of the Water Island Association, provided information on the residents of Water Island. Mr. Walter Phillips was also interviewed. He was the original major lease holder and a long time resident of Water Island. Mr. Phillips first visited Water Island in April and May of 1951 and he set up residence in 1952. Records of these interviews are provided in appendix D.

2.1.2 The San Jose Project on San Jose Island. The San Jose project originated on the San Jose Island, Panama Canal Zone, in 1943. San Jose Island was leased from the Panama government and a temporary camp was established in January 1944. The ERDEC library has test reports from 84 tests conducted on the San Jose Island. These tests involved hydrogen cyanide (AC), phosgene (CG), mustard (H), and mustard-T mixture (HT). Although laboratory testing was conducted to develop analytical procedures to monitor for tabun (GA), GA tests were not conducted until the project left San Jose Island and continued on Water Island. Figure 2-2 provides a map of the test areas on the San Jose Island.

Periodically, as unserviceable munitions were identified on the San Jose Island, they were taken to sea and dumped. The San Jose Project Progress Report (SJPPR) number 60, which reported on the period just prior to movement of the project to the Canal Zone (October 1947), indicates that permission had been obtained to dispose of a considerable number of H-filled, 75-millimeter howitzer shells by dropping them at sea. Other surplus munitions whose dropping had previously been authorized were to be disposed of at the same time. In addition, SJPPR number 53 indicated that on 11 March 1947, a barge loaded with a large quantity of antiquated, surplus, and

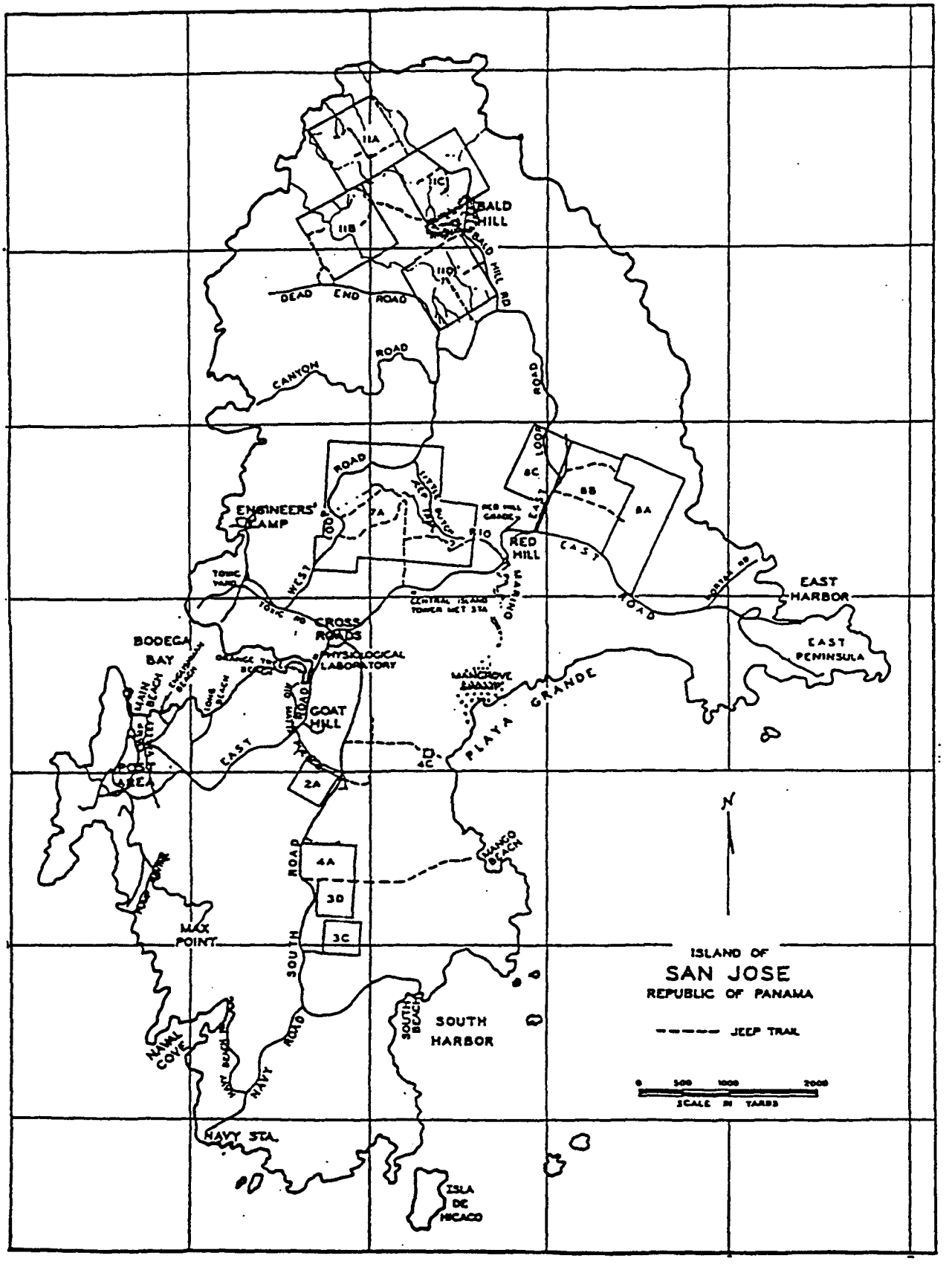


Figure 2-2. Test Areas on the San Jose Island

deteriorated munitions was dumped at sea. Sea disposal of unusable or deteriorated munitions was an accepted practice at that time, and was used as an alternative to burial on the San Jose Island or stockpiling and movement to the U.S. Virgin Islands at the end of the San Jose lease.

On 23 December 1947, all testing was brought to an abrupt halt when the project was notified that San Jose Island would have to be evacuated immediately due to the failure of the United States and Panama to agree to a lease renewal. Between this date and 28 January 1948, when the island was formally returned to the custody of Panama, all efforts were directed toward evacuation of the island. Temporary locations in the Canal Zone were found for the equipment and personnel, and exploratory trips were made for a new home for the project (SJPPR No. 61). A small group of military personnel stayed behind to conduct a reconnaissance mission. Mr. Luke West, one of the military personnel interviewed, was part of this reconnaissance mission. According to Mr. West, all chemical items remaining on the island at that time were removed (West, 1993).

2.1.3 The San Jose Project in Panama. From January 1948 through May 1948, the chemical munitions from the San Jose project were stored adjacent to the Chagres River on the Fort Sherman Reservation in the Panama Canal Zone. A guard station was set up at the crossroad to Fort San Lorenzo. Chemical testing personnel stayed at Ft. Sherman and other personnel stayed at Ft. Clayton in the Canal Zone. Munitions were secured on Panama (Mains, 1993). The only test conducted in the Canal Zone was the surveillance test for the 4-pound E-1 particulate bomb for Camp Detrick (SJPPR No. 61).

2.1.4 The San Jose Project on the U.S. Virgin Islands. Movement of the San Jose project to the U.S. Virgin Islands began in March 1948. A small advance party was dispatched at that time, followed by a larger party on 14 April 1948. The mission of these parties was to make the new station habitable for the main body. The greater portion of the equipment for the San Jose Project arrived at St. Thomas aboard the *Colonel William J. O'Brien* on 4 May 1948. Military and civilian personnel and their dependents were airlifted from Panama to the U.S. Virgin Islands in small increments. The toxic chemicals were towed on two 500-ton ocean-going barges, arriving at St. Thomas on 21 May 1948. The explosives were brought in the hold of a separate boat, arriving on 27 May 1948 and completing the movement from the Canal Zone (SJPPR No. 61).

Test areas to support the San Jose project on the U.S. Virgin Islands were located on Water Island and the west end of St. Thomas, beginning at the isthmus between Santa Maria Bay and Perseverance Bay. A map of the test areas on Water Island is included in figure 2-3. The former U.S. Navy Submarine Base, just west of Charlotte Amalie on St. Thomas, was used for barracks, administrative buildings, and a chemical laboratory. The test area and administrative areas on St. Thomas are shown in figures 2-4 and 2-5.

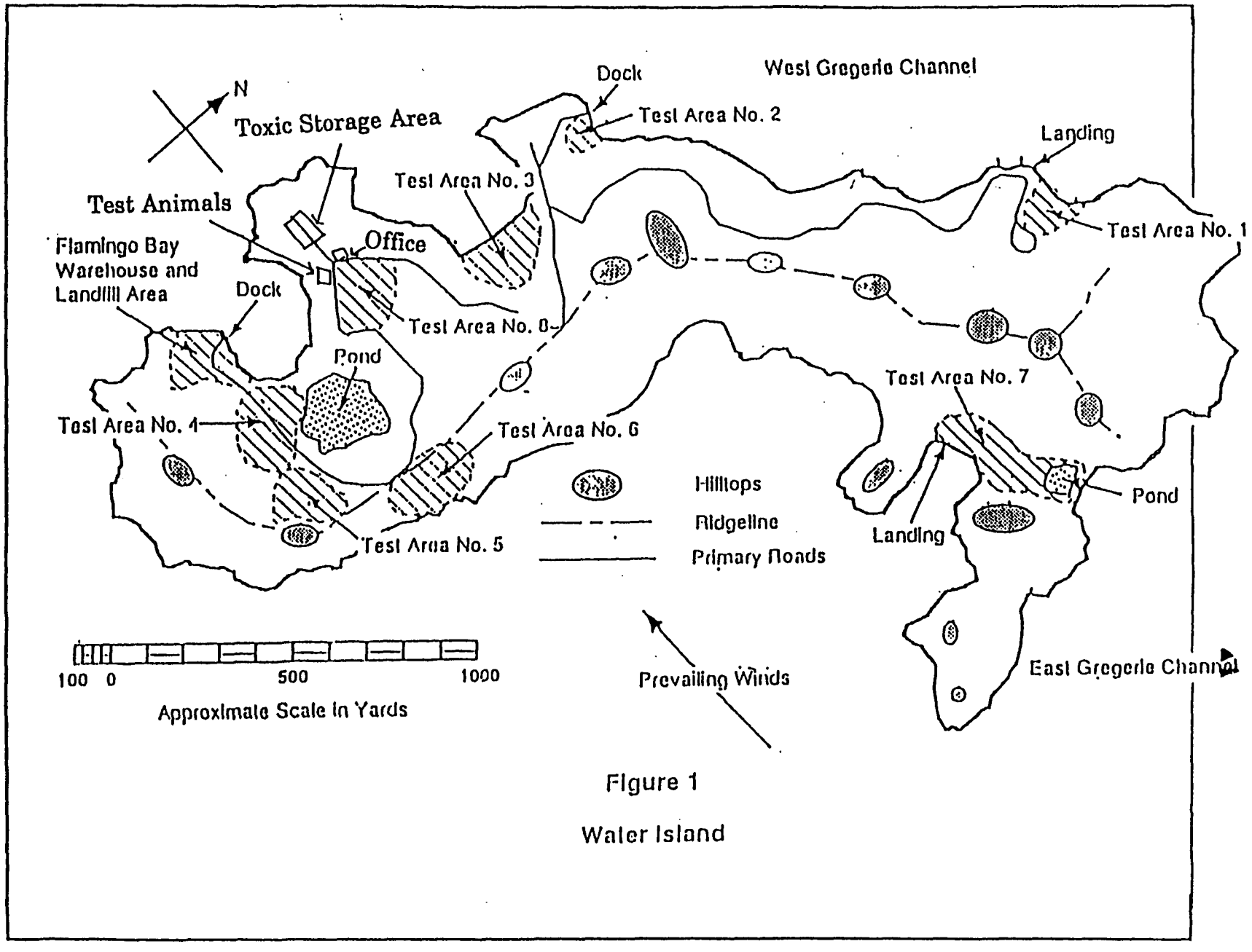


Figure 1

Water Island

Figure 2-3. Test Areas on Water Island

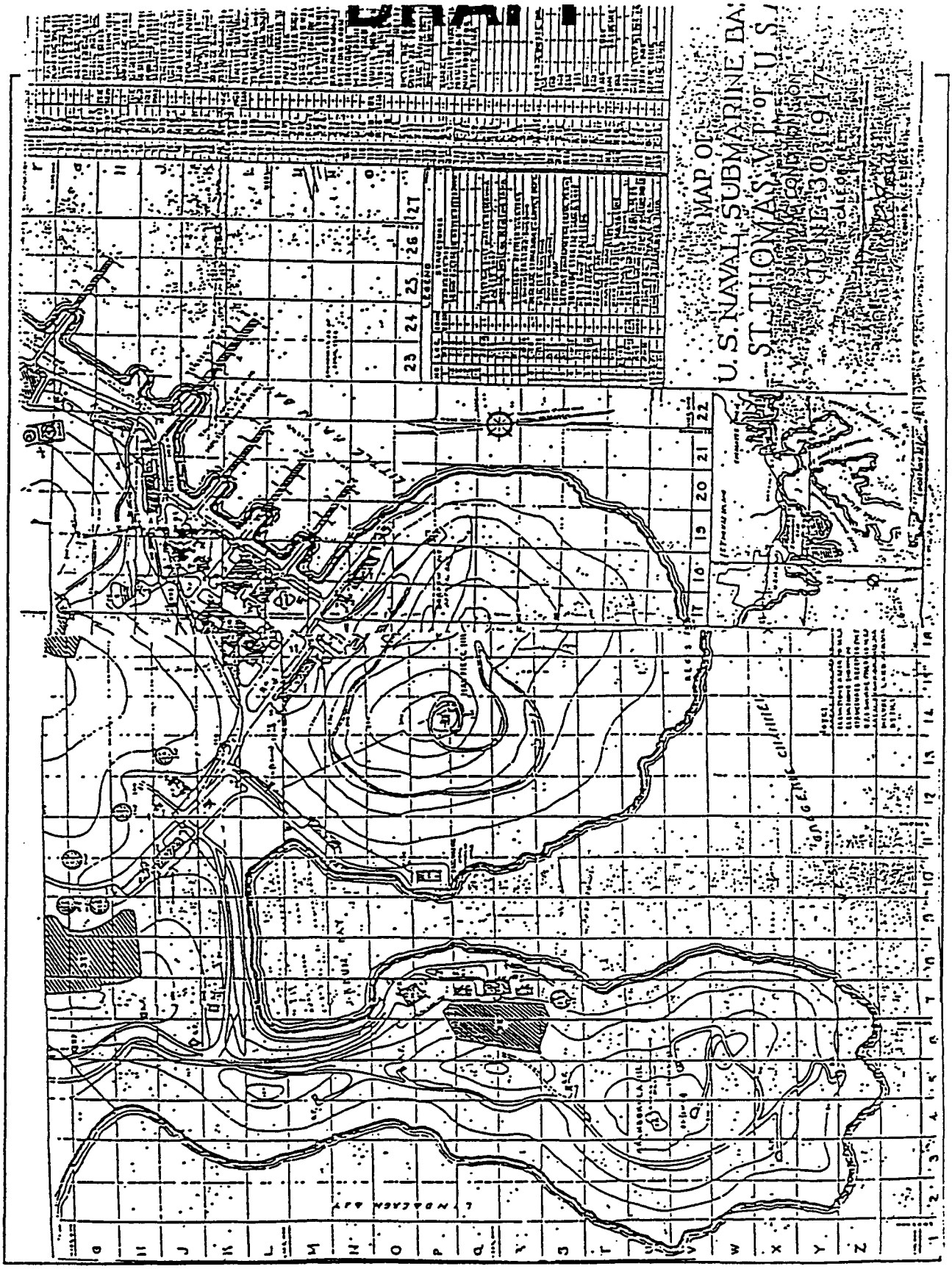


Figure 2-4. Administrative Areas on St. Thomas

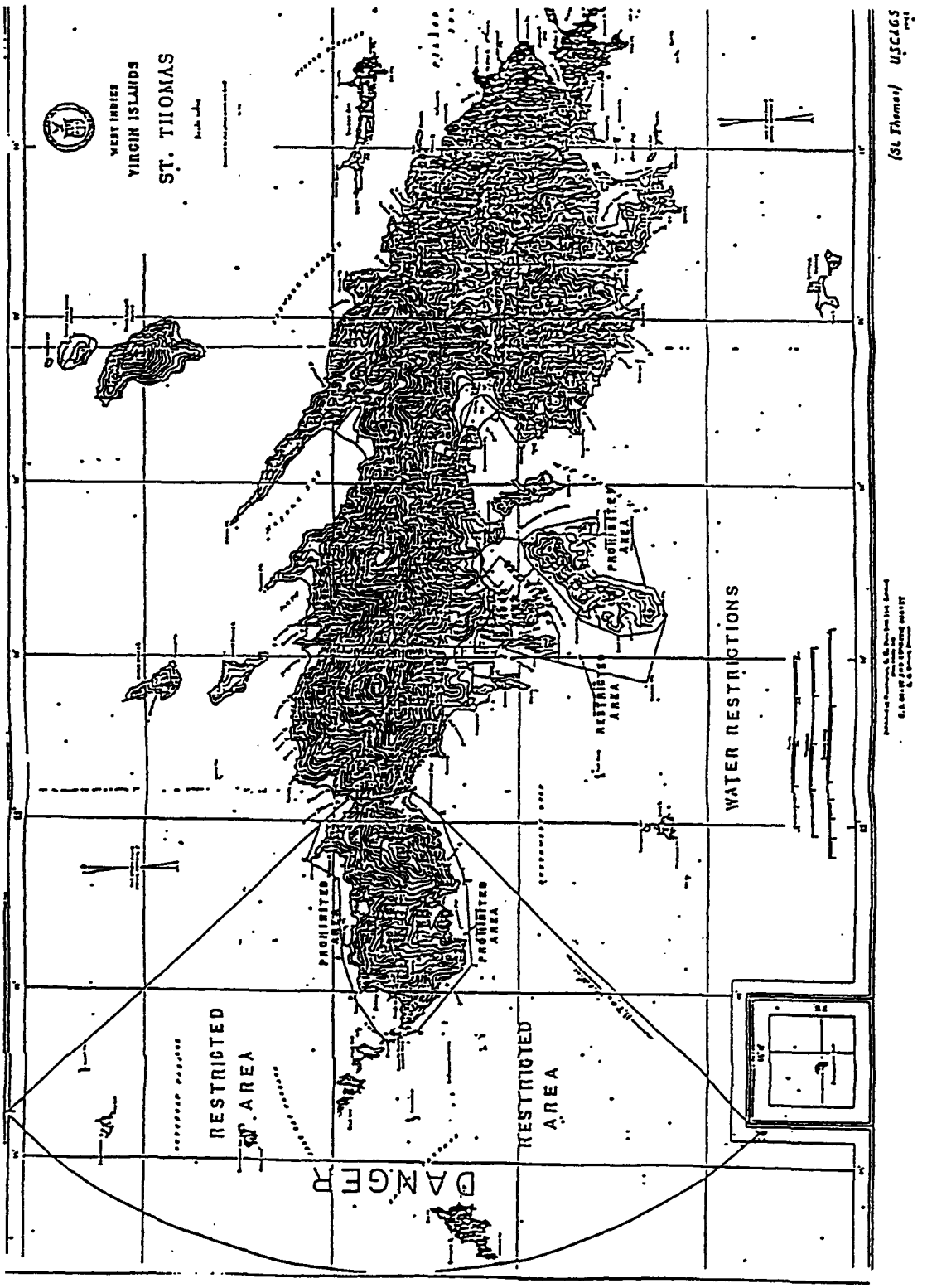


Figure 2-5. Test Areas on St.Thomas

Water Island was the site for the Toxic Storage Yard (SJPPR No. 61). Based on information obtained during the interviews, this storage yard was located where the Water Isle Hotel is currently situated and is designated on the map at figure 2-3. Bombs involved in the surveillance tests were stored outside in this area, and all other items where stored inside buildings. Four military personnel, including Mr. Jimmie Mains, were stationed on Water Island 5 days per week, 8 hours per day, to maintain the chemical munitions. Their office was located adjacent to the storage area. During his interview, Mr. Mains indicated that the items in the storage yard were carefully maintained since the workers understood the hazard and were in close proximity to the storage area (Mains, 1993).

At one time, 57 tests were planned to be conducted in the U.S. Virgin Islands. Only nine of these tests, three of which were surveillance tests, were actually conducted. A complete listing of tests which were planned for the San Jose project on the U.S. Virgin Islands is provided in appendix E.

Table 2-1 provides a listing of the chemical agent tests which were actually conducted, the time period the test was conducted, the location of the test, and the quantity of test items involved in the tests. Each test is discussed in more detail in the following paragraphs.

2.1.5 San Jose Project Tests on the U.S. Virgin Islands.

a. *San Jose Progress Report Number (SJPRN) 89, Surveillance of H/HD-Filled T-3 Bombs.* This surveillance test was conducted from May 1948 until the termination of the San Jose project in March 1950. It is believed that the items were stored in the Toxic Storage Yard on Water Island (Mains, 1993).

   The bombs were stored on dunnage in a well-ventilated building on 21 May 1948. In December 1948, the bombs were moved from that building to a new, outdoor storage location. The bombs were protected by canvas covers. Based on the sampling results, it appears only four bombs were involved in these tests. They included two T-3 bombs, H-filled and heresite-coated, and two T-3 bombs, HD-filled and not coated (SJPPR No. 48).

   Semi-annual sampling was performed on the bombs. The first record of this sampling occurred following movement outdoors on 12 January 1949 (SJPPR No. 64). Sampling was conducted again on 5 July 1949 and on 12 January 1950. Data collected included the weight of the bombs, weight of the agent fill, and the percentage of residue and purity of the agent sample (SJPPR No. 71 and 76).

b. *SJPRN 102, Location of Entrances to Gasproof Shelters in Relation to Prevailing Winds.* This test was conducted from 17 May 1949 to 30 September 1949 to determine by field tests the best location of entrances for gasproof shelters with respect to the wind. A shelter 10 by 10 by 8 1/2 feet was

Table 2-1. Chemical Agent Tests Conducted on the U.S. Virgin Islands

Test No.	Area of Test	Date of Test	Test Title	Test Items
89	Water Island, Toxic Storage Yard	5/48 to 3/50	Surveillance of T-3 bombs, H/HD.	4
102	West End, St. Thomas	5/49 to 9/49	Location of entrances to gasproof shelters in relation to winds.	CG ton containers
132	St. Thomas	2/48 to 10/48	Surveillance of bomb, particulate.	50
135	Water Island, Toxic Storage Yard	12/48 to 3/50	Surveillance of CK stored in M70, M78, and M79 bombs.	55
136	Water Island, Area 4, 5, 6, and 8	11/48 to 2/49	Test of M70 bomb, HD-filled, static fired.	8
166	Water Island, Area 4	9/49 to 11/49	Test of single E-23 smoke pot, GA-filled, functioned statically.	4
168	Unknown	11/49 to 12/49	Test of single E-23 smoke pot, GA-filled, functioned statically on water.	4
176	Water Island, Area 4	7/49 to 8/49	Test of single E-23 smoke pot, HD-filled, functioned statically in open on land.	13
179	Unknown	2/50	Test of single E-23 smoke pot, HQ-filled, functioned statically in open on land.	2

constructed in two areas on the west end of St. Thomas. During phase I, results were obtained with the shelter on a downgrade slope with respect to the source. Phase II was conducted in the second location, with the shelter on an upgrade slope with respect to the source. Throughout the test, the source of agent consisted of several one-ton containers of CG placed about the shelter (SJPRN 102). Figure 2-6 shows the setup for phase I. Figure 2-7 shows the test setup for phase II, and figure 2-8 is a picture of the CG ton containers used in these tests (SJPRN 102).

During each phase, preliminary tests were first conducted with HC and colored smokes. HC smoke and colored grenades were released upwind and downwind of the shelter to photograph convection currents caused by the presence of trees and vegetation around the shelter (SJPRN 102).

Following these preliminary tests, CG was released from a series of upwind sources. The flow of CG was regulated by needle valves. During phase I, CG was released over a period of 2 days from five one-ton containers located 45 feet upwind of the shelter. Additionally, CG was released from 12 one-ton containers located 150 feet upwind of the shelter over a period of 2 days. Tests were conducted for 1 day with the CG released downwind from the protective shelters approximately 8 feet from the shelter so that convection currents present around the shelter could be evaluated (SJPRN 102).

During phase II, the shelter was situated on a downgrade slope. Preliminary tests with smoke were conducted and then the CG tests were repeated. CG operations with the source upwind were run for a 3 day period while those with the source downwind were run for 1 day. The source consisted of 16 one-ton containers at a distance of approximately 100 feet. At one point, a ventilation system was installed in the shelter and CG was released upwind to determine the effectiveness of the system (SJPRN 102).

During the test, the test area was declared by the safety personnel as out-of-bounds to all except those involved in the testing. The munitions and weapons section were to supply 50 HC grenades and 20 colored grenades to support the testing (SJPRN 102).

c. *SJPRN 132, Surveillance Test Particulate Bombs, 4-lb, E-1.* During this test, 50 bombs were subjected to a variety of tropical and semi-tropical storage and rough usage conditions and observations were made on their condition during and following the treatment. The actual test covered a 6 month period.

Test bombs were filled with a simulated agent which was non-toxic to personnel. Fluorescein had been added in sufficient amount to cause a small drop of liquid fill to glow with a green color under ultra-violet light. The bombs were inert, containing no explosives and requiring no special handling techniques (SJPRN 132).

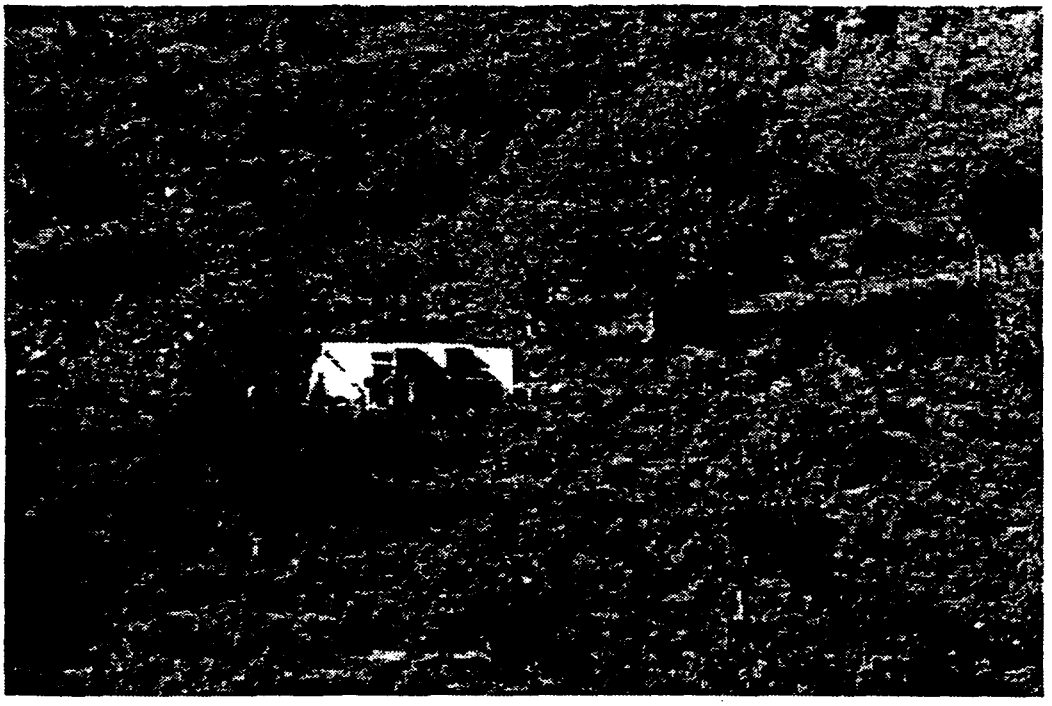


Figure 2-6. Gas Proof Shelter - Phase I



Figure 2-7. Gas Proof Shelter - Phase II

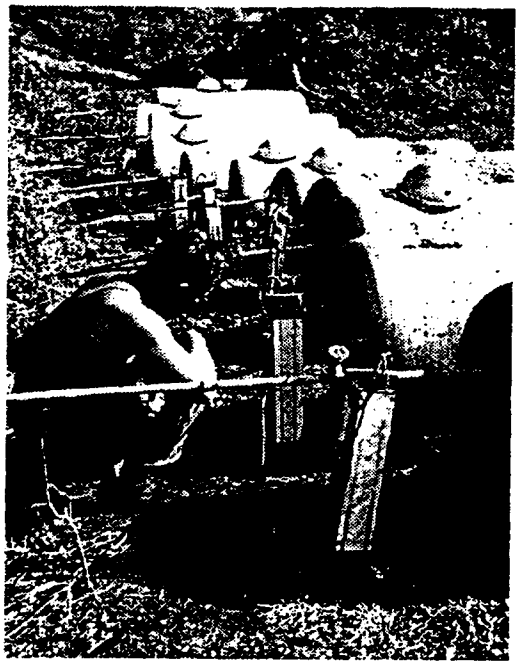


Figure 2-8. Phosgene Source

The bombs used in these tests are shown in figure 2-9. No leaks developed at any time throughout the test, although the bombs stored outdoors rusted and rough usage caused dents and bending. Direction for the test was received from Camp Detrick, MD. Since Camp Detrick was and still is the center for biological warfare studies, it is believed that the items were biological.

Initial testing of the bombs began on 9 February 1948 at Ft. Sherman in the Panama Canal Zone, and tests were completed on 22 October 1948 in St. Thomas, U.S. Virgin Islands.

During these tests, the 50 bombs were divided into 5 groups of ten and each group was stored on St. Thomas in the following manner:

- ten bombs were stored in a cold room with an average temperature of 4° to 10°C (40° to 50°F);
- ten bombs were stored outdoors in a clearing with no cover;
- ten bombs were stored outdoors in a clearing but covered from rain and sun;
- ten bombs were stored outdoors in a jungle and wooded area, exposed to all elements; and

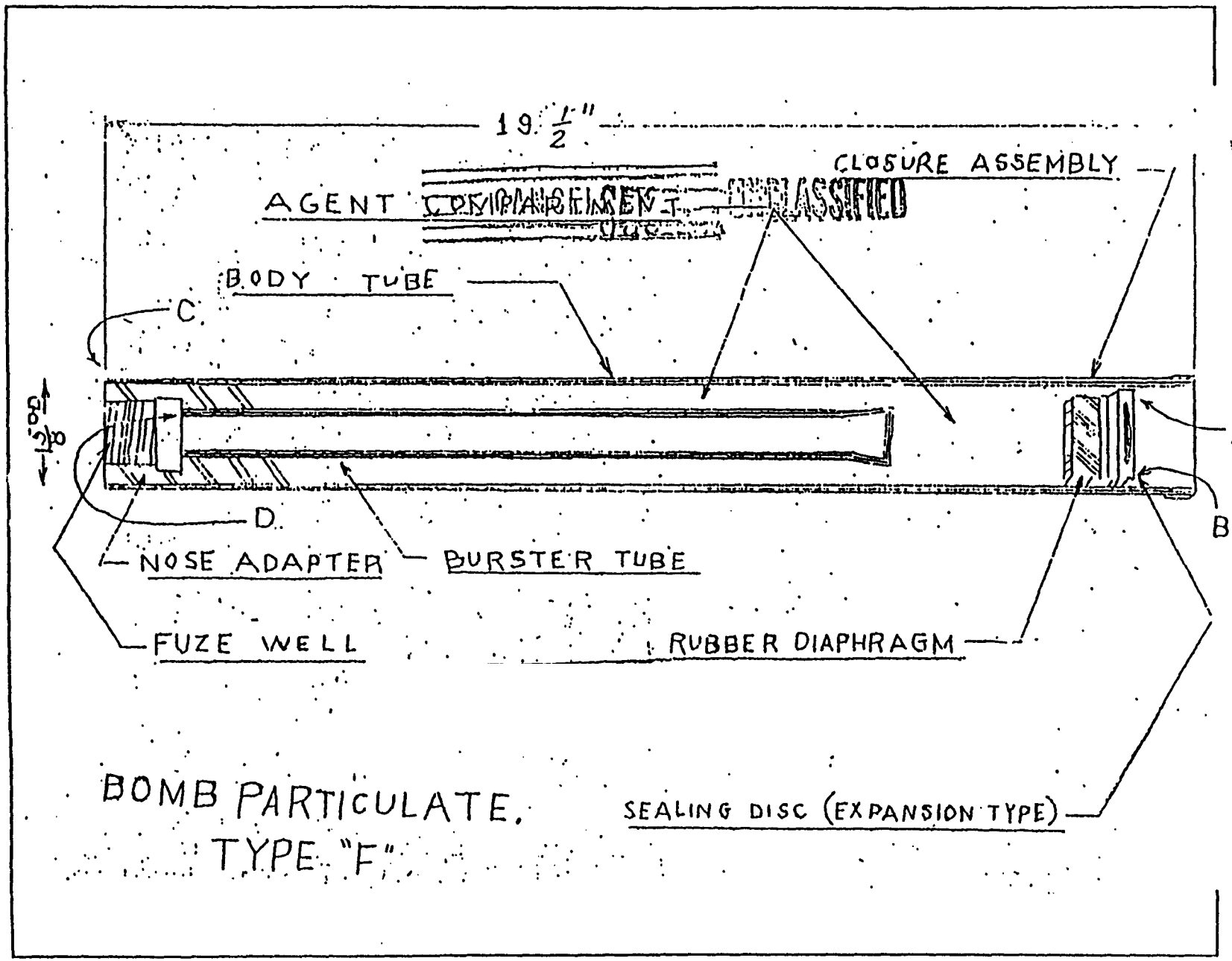


Figure 2-9. Four-Pound Particulate Bomb

- ten bombs were stored outdoors in a jungle and wooded area protected from precipitation.

Bombs used in this test were shipped back to Camp Detrick, MD during the week of 15 November 1948 (SJPPR No. 62).

d. *SJPRN 135, Surveillance of Unstabilized Cyanogen Chloride in M70, M78, and M79 Bombs.* The actual sampling work for this test began in December 1948 and the initial results are reported in the SJPPR No. 63 and 67. The M70 bombs were not sampled until June 1949 when the appropriate tapping and sampling devices had arrived. Of the M78 and M79 bombs, absolute pressure, percent acidity, and percent soluble, nonvolatile residue were determined. Four M78 bombs could not be sampled because the valves were clogged. Tapping the bombs revealed that they were largely solid. Bomb No. 10 was vented and sampled, and found to be 12.9-percent nonsoluble residue, and destroyed. No information is provided as to how or where this bomb was destroyed. The other three bombs were not sampled in followup tests. Thirty-three M78 bombs were originally involved in this test, four of which could not be sampled. Seven M79 bombs were sampled.

Semi-annual sampling continued in June 1949 (SJPPR No. 69) and in January 1950 (SJPPR No. 75 and 76). During each sampling period, twenty-nine M78, seven M79, and fifteen M70 bombs were sampled.

Two important points should be noted about these tests. One is that unstabilized CK was used and that four of the bombs were found to be largely solid. When stabilizers are not added, CK solidifies to form cyanuric chloride. The reactive properties of cyanuric chloride are addressed in section 10 in this report. The second point is that 500-pound bombs were disposed of during this test. Since they were involved in surveillance tests, they were most likely not explosively configured.

e. *SJPRN 136, Static Test of M70 Bomb, HD-Filled.* This test was performed in eight phases during the period from 23 November 1948 through 23 February 1949. In each phase, an M70 bomb, filled with HD and dyed with DuPont oil red or yellow, was fired statically in a vertical position. The purpose of the test was to establish meteorological and terrain factors at this site so results could be used as a basis for comparison between tests run at the U.S. Virgin Islands and other sites.

The eight phases of the tests were run in the following areas under the following conditions:

- phases 1 and 2: open area with offshore winds, area 4;
- phases 3 and 4: wooded area with offshore winds, area 5;

- phases 5 and 6: wooded area with onshore winds, area 8; and
- phases 7 and 8: open area with onshore winds, area 6.

The test plan indicated these tests would be conducted in areas 1, 4, and 7. Based on the test report and mustard contamination contours which provided the results of the test, no tests were conducted in areas 1 and 7, which is located at the north end of Water Island (SJPRN 136).

During each phase of this test, a single M70 bomb, HD-filled, was emplaced vertically, nose down, and fired statically. The HD was dyed 0.50-percent DuPont oil yellow for phases 1 through 4 and 0.25 percent DuPont oil red for phases 5 through 8. From the photographs of the test setups, it appears these bombs were electrically fired. Figures 2-10 and 2-11 show the test setup for two phases of this test.

f. *SJPRN 176, Static Test in the Open of a Single E-23 Smoke Pot, HD-Filled.* The objective of this test was to determine the dosage field, rate of dosage achievement, total dosage, decomposition loss, and overall efficiency for a single E-23 smoke pot, HD-filled, when fired statically in an open area. This test was conducted from 27 July 1949 through 10 August 1949 (SJPRN 176).

There were five phases to this test. During the first four phases, a single E-23 smoke pot filled with HD and dyed with DuPont oil red was burned statically in



Figure 2-10. Static M70 HD-Filled Bomb Test

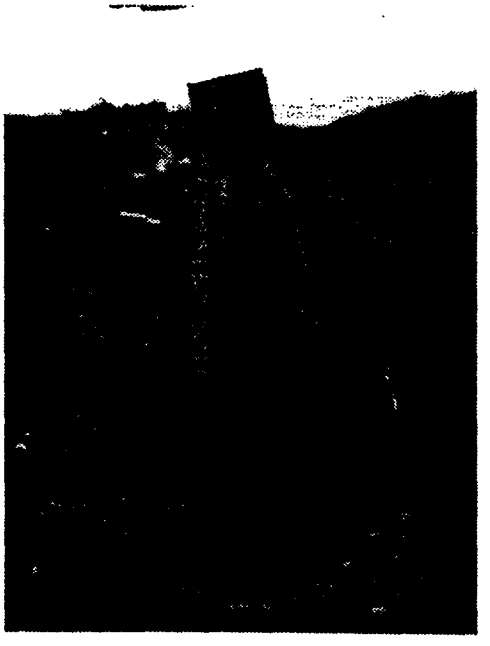


Figure 2-11. Static M70 HD-Filled Bomb Test

the open at area 4 on Water Island. Figure 2-12 shows the test area and setups for these tests. On several occasions, a considerable portion of the agent was left in the pot and it was not uncommon for a pot to swell noticeably from the heat of the burning. Overall efficiency ranged from 2.7 to 60 percent. During phase 1, 3800 cubic centimeters of agent remained in the pot after burning. Phases 1 and 2 were conducted in mid-morning to obtain lapse conditions, and phases 3 and 4 were conducted in early morning to obtain inversion conditions (SJPRN 176).

Phase 5 involved the simultaneous burning of nine pots. The smoke pots were placed in three rows on a grid 2 feet from center to center. Following the test, 2400 cubic centimeters of agent was left in one of the pots. This test was conducted in the open at area 4. Figure 2-13 is a photograph of the test area and test setup.

Figure 2-14 is a photograph of the smoke pots involved in the test and figure 2-15 is a drawing of the smoke pot. The smoke pots are a 5-gallon, thin-walled metal can with HC smoke in the bottom half and approximately 18-pounds of HD on the top half. The smoke pot was ignited remotely and the agent was heated and dispersed. There were no high explosives involved in these tests (Mains 1993). Monitoring devices included jumpcards and bubblers. Ground contamination contours are provided in the test report (SJPRN 176).

g. *SJPRN 166, Static Test in the Open of Single E-23 Smoke Pot, GA-Filled.* Very little information is available detailing the last three tests conducted in the San Jose project. It is believed the reports were not finalized before the San Jose project was to be disbanded, and therefore final reports may never have been published. The progress reports indicate that the final reporting of these three tests was delayed pending further information and materials required in preparation of the report.

The four phases of Test No. 166 occurred from 1 September 1949 through 9 November 1949 (SJPPR No. 72-74). Of all the tests conducted on Water Island, Mr. Mains was most familiar with this test. Mr. Mains believed the GA smoke pot tests had all been conducted in a cleared segment of area 4. During each phase, a single smoke pot was placed in the open area and goats and cages of pigeons were placed alternately in two rows in a half-circle downwind of the smoke pot. Agent monitors were also placed around the smoke pot and the agent dispersion characteristics were determined. The smoke pots were electrically fired (Mains 1993).

h. *SJPRN 168, Test of Single E-23 Smoke Pot, GA-Filled, Functioned Statically on Water with Onshore Wind.* The four phases of this test were conducted from 18 November 1949 through 9 December 1949. Phase I was conducted twice. During the initial run, no agent was dispersed by the smoke pot (SJPPR No. 74-75). Mr. Mains did not recall a smoke pot test being conducted on the



Figure 2-12. Single HD Filled Smoke Pot Test



Figure 2-13. Nine Smoke Pots Burning



Figure 2-14. Smoke Pots Involved in Test

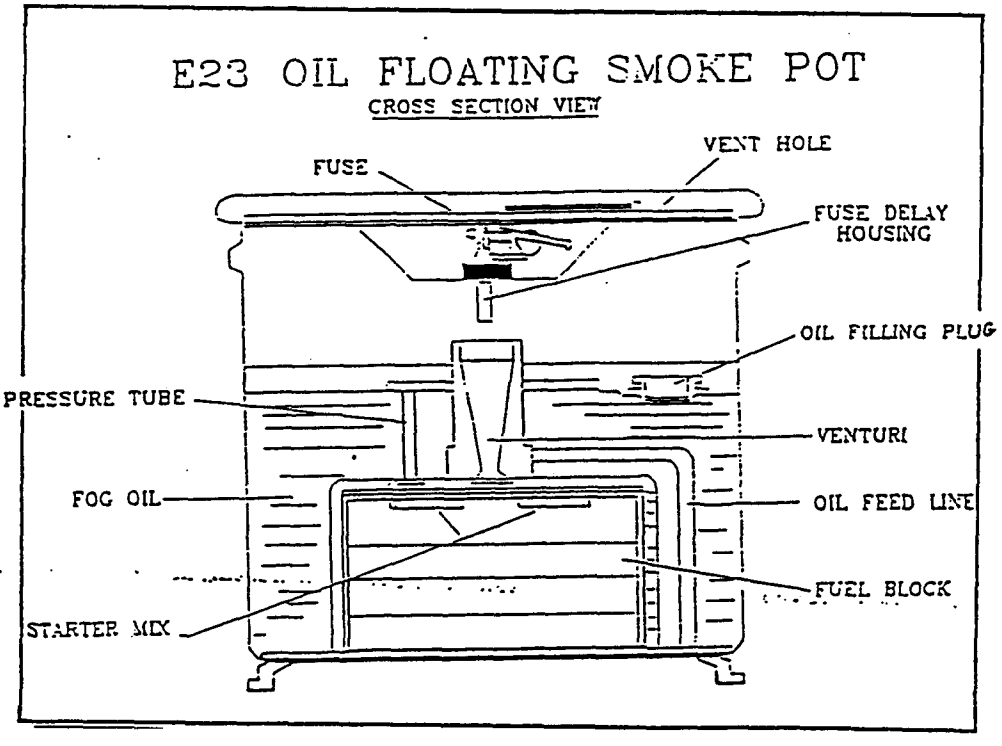


Figure 2-15. E-23 Smoke Pot

water, and could not provide information as to the test area. Since the test was conducted on the water with onshore winds it may have been conducted off the shore in area 6. It is believed that no other test areas other than those used in SJPRN 136 (Static Test of M70 Bombs) would have been used since this test was the baseline. It was conducted to establish the effects of local meteorological and terrain factors in the test areas so that results could be compared with tests outside the U.S. Virgin Islands. Area 6 was used in this baseline to characterize an open area with onshore winds.

i. *SJPRN 179, Test of Single E-23 Smoke Pot, HQ-Filled, Functioned Statically in Open on Land.* Phases 1 and 2 of this test were performed on 15 February and 17 February 1950 (SJPPR No.77). There are no records of the location of these tests or if the tests were ever completed. The progress report for the month of March indicates that this test was still in progress. The test most likely involved 4 phases, as was the case for the other smoke pot tests. It is unknown whether two additional smoke pots were filled with sesquimustard (HQ) in preparation for the remaining phases of the test.

2.1.6 Disposition of the Chemical Agent Munitions. The disposition of the chemical munitions and personnel at the end of the San Jose project is detailed in a 1950 Army memorandum (U.S. Army, 1950), included with appendix F. The memorandum designates which munitions were dumped at sea and which items were shipped to the Army Chemical Center, Maryland; the Midwest Chemical Depot, Arkansas; and the Dugway Proving Ground, Utah.

Many of the items were dumped at the Naval Ammunition Dumping Ground in the Caribbean Sea south of Vieques Island on 15 May 1950 (Army, Aug 1950). Mr. Mains participated in the sea dump and provided the photograph in figure 2-16.

The following observations can be drawn from the list of munitions which were removed from the San Jose project on Water Island and interviews with military personnel involved in the San Jose project.

a. Twenty-nine CK-filled 500-pound M78 bombs were removed from Water Island and ocean dumped. These are the only CK-filled M78 bombs recorded to have been removed at the termination of the San Jose project. As discussed in paragraph 2.1.5 d., 33 CK-filled M78 bombs were involved when surveillance test number 135 was initiated. The contents of four of these bombs were found to be largely solid and further sampling on these items was not continued. It is noted that one of the four bombs was destroyed. The final disposition of all four bombs is not provided in the memorandum in appendix F.

b. The surveillance tests also involved seven CK-filled M79 bombs, fifteen CK-filled M70 bombs, two HD-filled T-3 bombs, and two H-filled T-3 bombs. Removal of these items at the close of the San Jose project can be accounted



Figure 2-16. Sea Dump at the Termination of the San Jose Project

for. One hundred and twenty-four CK-filled M70 bombs and eight CK-filled M79 bombs were ocean dumped. One hundred and sixty-eight HD-filled and sixty-six H-filled T-3 bombs were shipped to the Army Chemical Center in Maryland.

c. The test item used in four of the nine tests was smoke pots filled with GA, HD, and HQ. The disposition of smoke pots is not indicated in the memorandum in appendix F. At least 23 smoke pots were involved in tests on Water Island.

d. Plans were made to test GA-filled spray tanks and GB-filled munitions. The status of these tests in the progress reports indicate that they were awaiting material (SJPPR No. 66 indicated they were awaiting the spray tank). Disposition of these items is not provided in the memorandum in appendix F, possibly because the test items were never shipped to Water Island.

e. Mr. Mains indicated that at the termination of the San Jose project, all items, with the exception of excess burster charges, were removed from Water Island and either ocean dumped or sent back to the states for storage. At the end of the project, Mr. Mains was responsible for detonating excess burster charges. Hundreds of these items were detonated in area 4, between the road and the currently existing marina. Three boxes at a time were typically detonated (Mains, 1993).

f. Mortar rounds configured with agent and high explosives were removed from Water Island at the close of the San Jose Project. The possibility exists that 4.2 inch mortar rounds with agent or high explosives may be recovered from Water Island.

2.1.7 History of the Former Fort Segarra Test Areas. The following paragraphs present the history of the test sites of the San Jose project on the U.S. Virgin Islands. For each test area, the tests that were conducted and the history of the site since the San Jose project are summarized. The test areas on Water Island and St. Thomas are shown in the maps at figures 2-3 and 2-5. In addition, a 1954 aerial photograph is shown in figure 2-17. Figure 2-18 shows a map of the south end of Water Island as it exists today, with significant features from the San Jose project superimposed.

a. *Flamingo Bay Landfill Area.* The Flamingo Bay landfill area is located in the southwest corner of Water Island. During the San Jose project, the Flamingo Bay deep-water dock was used to deliver equipment and munitions. Personnel were transported to and from Water Island using the existing dock at the center of the island (Mains, 1993).

A salt water pond existed in the Flamingo Bay area in the 1950s. This area had been used as a landfill since that time. Compacted vehicles and other trash were disposed of in the salt pond in a single layer and covered with dirt fill. Subsequent layers of trash with a dirt cover were disposed of in this area until the salt pond was filled. The original salt pond was thought to have been about 10 feet deep. Trash was also burned in this area until 1982, when U.S. Environmental Protection Agency (USEPA) regulations precluded open-air burning (Couter, 1993).

The location and size of the old salt pond can be distinguished from the 1954 aerial photograph. The salt pond was approximately 75 feet from the shore in the Flamingo Bay area, approximately 50-feet wide by 100-feet long lying parallel to the coast. It appears that the salt pond was adjacent to the existing warehouse in the Flamingo Bay area. The salt pond is superimposed on the map in figure 2-18.

While excavating in the area of the salt pond in 1966, some metal objects believed to be chemical bombs were uncovered. The bombs surfaced in the area of the salt pond when a draw line was being used during a mucking operation at an approximate depth of 20 feet. The bombs could have been located anywhere above that depth. The bombs were reported to be the size of small butane tanks with dimensions of 18 to 24 inches in diameter. Mr. Couter believed them to be 500-pound bombs (Couter, 1993). Figure 2-19 is a letter report of this incident from the Water Isle Colony Club to the DOI.

The Naval Ordnance Disposal Detachment at Roosevelt Roads was contacted and they removed the items from the site. The detachment identified the



Figure 2-17. 1954 Aerial Photograph of Water Island

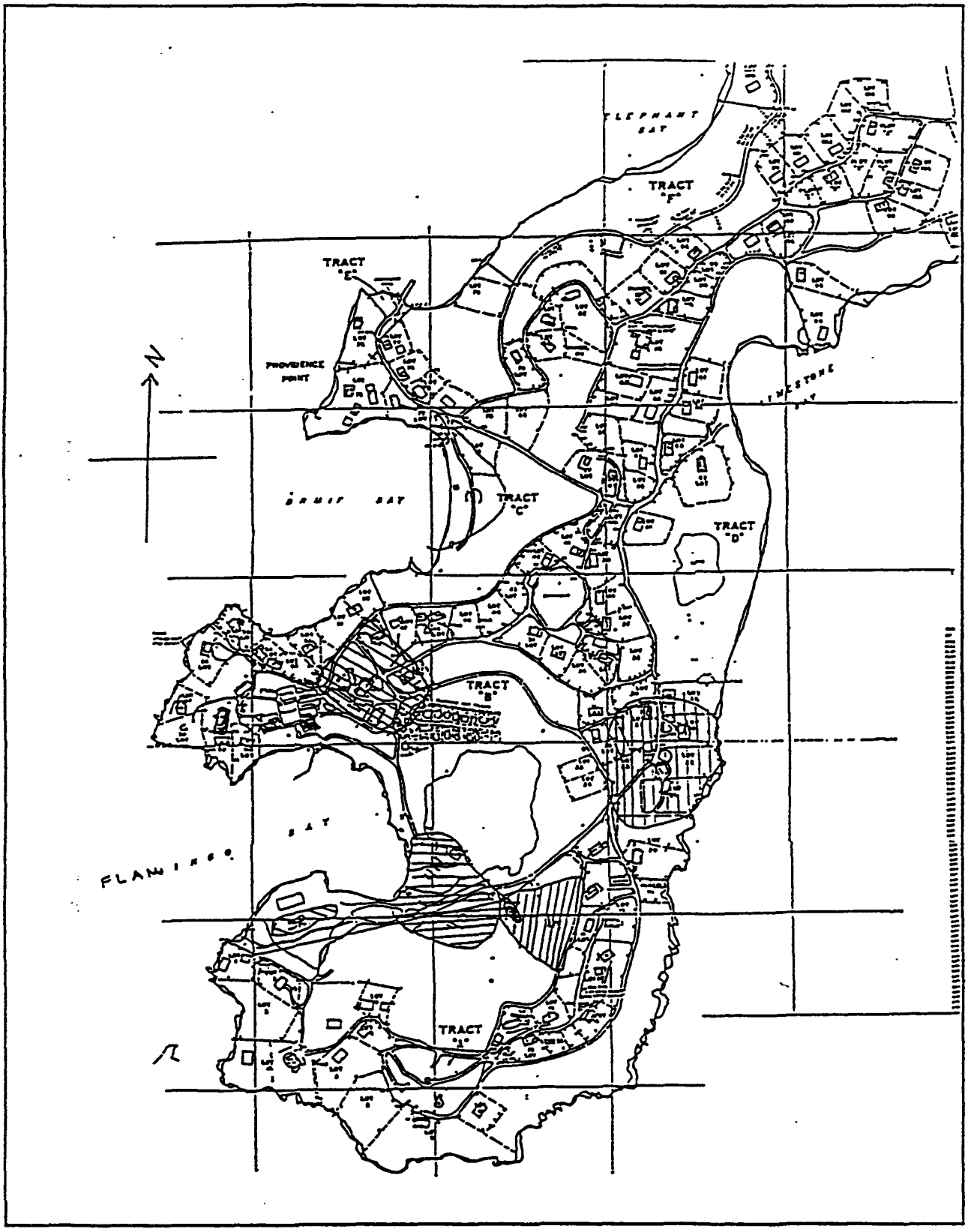


Figure 2-18. 1992 Map of the South End of Water Island with Test Areas Superimposed

WATER ISLE COLONY CLUB/WATER ISLE. ST. THOMAS. VIRGIN ISLANDS. U.S.A. 00801

June 23, 1966

Mrs. Ruth G. Van Cleve, Director
United States Department of Interior
Office of Territories
Washington 25, D.C.

Dear Mrs. Van Cleve:

In reference to your letter of June 13 regarding the unearthing of several bombs on Water Island, I wish to advise you that this took place in a swamp area on the island. We had hired a drag line to dig a hole to bury cans and bottles, which had accumulated over the years, so that they would not be so unsightly. While digging this hole a backhoe operator unearthed several objects, which we recognized as bombs. We notified the Navy and they came over, and upon inspection they advised us that there was no danger from these objects. We burried the cans and bottles and covered over this area.

We contemplate no more excavation in this area in the near future.

Sincerely,

Edward J. McArdle
President

EJMcA:lro

CABLE ADDRESS "WATERISLE" • TELEPHONE 809/774-1213

Figure 2-19. Letter Reporting 1966 Incident

bombs as M70 and M78 chemical bombs. The report noted several bombs had been unearthed and that all but one had been vented. The unvented bomb was blown up without noticeable release of any chemicals (COMTEN, May 1966).

In September 1991, a fence was installed in the Flamingo Bay area by Ebasco Services, Incorporated, under contract with the U.S. Army Corps of Engineers (USACE), Huntsville Division. The decision to build this fence resulted from the bombs that were surfaced in 1966. On the northern face of the fence, several of the fence post holes were terminated at approximately 3 feet due to encountering gray ash and a black oily substance. In the southwestern corner, one of the holes was terminated at 2 1/2 feet when an unknown, orange-colored, waxy substance was encountered (Ebasco, 1991).

During the site visit in January 1993, it was noted that the Flamingo Bay landfill area has a warehouse structure that was damaged during Hurricane Hugo. There is surface debris and scrapped vehicles throughout the fenced-in area. In addition, there is debris along the shoreline. Figures 2-20 and 2-21 are photographs of the shoreline taken during the site visit in January 1993. According to Mr. Couter, the concrete-filled bomb in figure 2-20 surfaced during Hurricane Hugo. Figure 2-22 is a photograph of the Flamingo Bay warehouse and landfill area.

During his interview, Mr. Walter Phillips indicated that the Army is looking in the wrong place for CWM left from the San Jose project. When Mr. Phillips first arrived on Water Island in 1951, there were a few empty poison gas shells at the Flamingo Bay warehouse area. He did not know what happened to these shells. The Navy was called in and took them away. According to Mr. Phillips, the Army installed the fence in the wrong area. If items remain, he believes they would be located closer to the shore.

b. *Test Area 4.* Test area 4 is located on the southwest end of Water Island and straddles the road leading to the Flamingo Bay area. Based on the 1954 aerial photographs, the area on the north side of the road was a cleared area. The area to the south side of the road was primarily covered with vegetation, with the exception of a small cleared area.

Records indicate that phase I and II of the static, HD-filled, M70 bomb test (SJPRN 136) and phases I through V of the static, HD-filled, E-23 smoke pot test (SJPRN 176) were conducted in the open in test area 4. Figures 2-12 through 2-14 are photographs of the smoke pot tests in this area. Figure 2-23 is the test set up for the M70 bomb test conducted in this area. From these photographs, it can be determined that the tests were conducted on the north side of the road. According to the interview with Mr. Mains, GA smoke pot tests were also conducted in this area. The decontamination truck would be situated in the cleared area on the south side of test area 4 while the test was



Figure 2-20. Concrete-Filled Bomb along Flamingo Bay Shoreline



Figure 2-21. Debris along the Flamingo Bay Shoreline

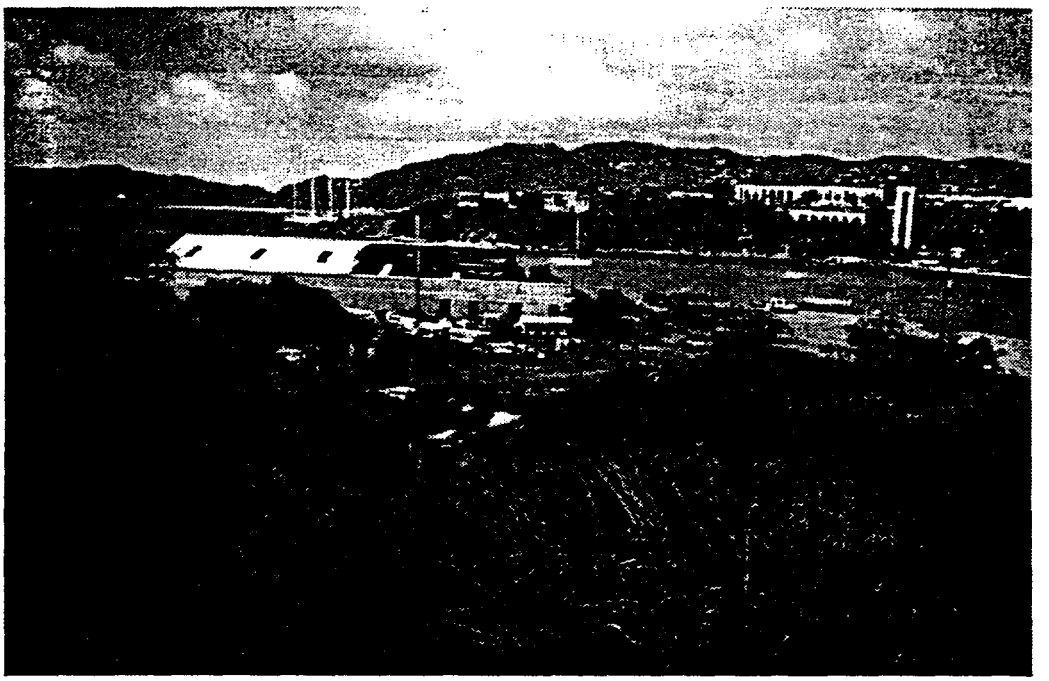


Figure 2-22. Flamingo Bay Warehouse and Landfill Area

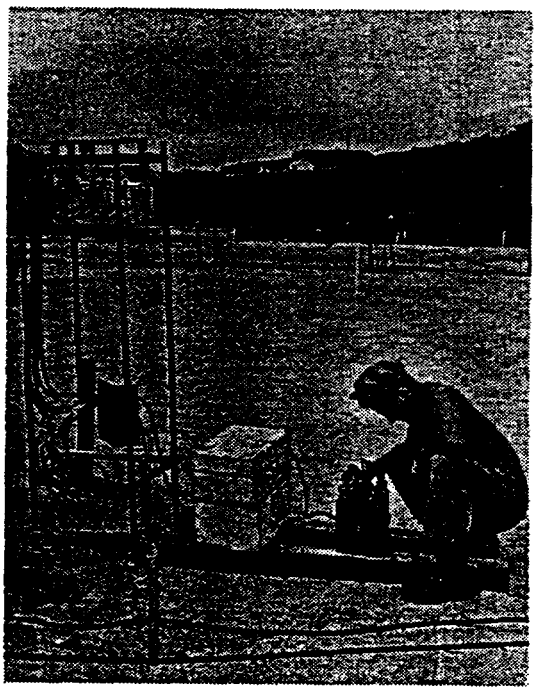


Figure 2-23. Area 4 Test Setup for M70 Bomb Test

being conducted. In addition, at the end of the San Jose project, burster charges were detonated and destroyed in this area (Mains, 1993).

The northern area of test area 4, where the tests are believed to have been conducted, is relatively clear of debris and covered with light vegetation. In 1966, this area was dredged to open the adjacent pond into a marina and much of the test area was removed at that time. This area is relatively flat and approximately 2- to 3-feet above sea level. A small concrete pad (30 by 30 feet) is located along the shore of this site.

The southern portion of test area 4 has been used as a junkyard by Water Island residents. There are scrapped vehicles, household appliances, containers of unknown substances, and an empty tanker truck on the site. Figure 2-24 is a photograph of this area.

c. *Test Area 5.* Test area 5 is located on the southern end of Water Island adjacent and east of test area 4. Based on the 1954 aerial photograph, this area was covered with vegetation, with a depressed area located within. Records indicate that the only test conducted in this area was phase III and IV of the static, HD-filled, M70 bomb test (SJPRN 136).

Based on the January 1993 site visit, test area 5 is still covered with vegetation, and the depressed area still exists. Some trash is visible on the surface. According to Mr. Couter, this area was used to dispose of debris generated from Hurricane Hugo.

d. *Test Area 8.* Test area 8 was located in the vicinity of the existing Water Isle Hotel. The 1954 aerial photograph indicates there were buildings within this test area at that time. According to existing records, phase V and VI of the static, HD-filled, M70 bomb test (SJPRN 136) was conducted in a wooded area with offshore winds within this test area.

Test area 8 has been significantly disturbed since the San Jose testing. Currently, the bar and dining area to the Water Isle Hotel and some support facilities are located in this area.

e. *Toxic Storage Area.* According to interviews with Mr. Jimmie Mains, Mr. Luke West, and Mr. Alex Donovan, the toxic storage yard was located on Water Island in the area of the existing Water Isle Hotel (see figure 2-3). An office for the military personnel working on Water Island was located adjacent to the storage area. T-3 H/HD-filled bombs and aged, CK-filled, M70, M78, and M79 bombs involved in surveillance tests (SJPRN 89 and 135) were stored outside while all other munitions were stored in buildings. Agent transfer operations to support the tests were also conducted in this area (Mains, 1993).



Figure 2-24. Existing Debris at Southern Portion of Area 4

The storage area for test animals was located near the toxic storage yard on Water Island. Approximately 1050 feet of fencing had been strung to furnish separate corrals for fresh and contaminated goats. The total area for both fresh and contaminated goats was approximately two acres. Sufficient cages were constructed to accommodate 2000 pigeons. These facilities were constructed by May 1949 when the test goats arrived (SJPPR 66 and 68). SJPPR 74 indicates that work was nearing completion on the remodeling of the change house, which was also located in this area on Water Island. The new arrangement was thought to contribute to the safety in dressing and undressing of personnel working in or around contaminated areas.

This area has been significantly disturbed since the San Jose project. Currently, the main hotel building is located in this area.

f. *Test Area 6.* Test area 6 is located on the eastern shore in the southern part of Water Island. Records indicate that phases VII and VIII of the static HD-filled M70 bomb test (SJPRN 136), in an open area with onshore winds, was the only test conducted in this area. Based on the 1954 aerial photograph, it appears that the only open areas in this test area are located near the shore.

This site has been significantly developed along the ridgeline since the San Jose project. The lower part of the site is along the rocky shoreline and is undeveloped and heavily grown with vegetation. There does not appear to be any significant debris on the surface. Tests conducted in this area were in an

open area with onshore winds. It is most likely that these tests occurred in the undeveloped area near the shore.

g. *Test Areas 1, 2, 3, and 7.* Test areas 1 and 7 are located on the northwestern and northeastern corners, respectively, of Water Island. Test areas 2 and 3 are located on the western shore in the middle of Water Island. All of these test areas are located downwind of the military office used to support the project. No records were found which indicate any tests were ever conducted in these four areas. The test plan for the M70 bomb test identified test areas 1 and 7 as test areas. The test report which presented the final results of the test and showed contamination contours for each area indicated that the tests had actually been conducted in test areas 4, 5, 6, and 8. In addition, Mr. Jimmie Mains and Mr. Luke West indicated during their interviews that no tests had been conducted on the northern end of the island. Mr. Mains, who was stationed full-time on Water Island, was not aware that roads existed leading to that end of the island.

h. *Flamingo Bay Gun Emplacement.* Although there are no records that tests associated with the San Jose project were conducted in this area, this area is discussed since there has been some concern in the past that investigation of this area may be warranted.

   The gun emplacement is located at the top of the hill on the southern portion of Water Island. This facility was part of the original World War II Fort Segarra gun emplacements built in the early 1940s and was not part of the San Jose project. There are underground compartments used in the early 1940s for ammunition storage and sleeping quarters. Based on the interview with Mr. Couter, these compartments were walled off and used to store water to support the Water Isle Hotel when it was in operation prior to Hurricane Hugo (Couter, 1993). Based on the past usage, it is unlikely any chemical agent contamination exists within this structure.

i. *Western End of St. Thomas.* On the west end of St. Thomas, 2095 acres, beginning at the isthmus between Santa Maria Bay and Perseverance Bay, was leased for testing. In November 1948, 9 1/2 tons of fencing arrived to be used to isolate property held on the western end of the island.

   Based on existing records, there were two tests conducted on St. Thomas. The first was a surveillance test involving fifty 4-pound E-1 particulate bombs. These inert (no explosives) bombs, filled with simulant, never developed leaks during the tests and were shipped back to Camp Detrick at the end of the test (SJPRN 132 and SJPPR No.62). Test reports indicate these tests were conducted on St. Thomas. Due to the innocuous nature of the tests, they may have been conducted in the administrative area in the submarine base.

   During the second test, CG gas was emitted from ton containers to determine penetration characteristics of gasproof shelters (SJPRN 120). A gasproof

shelter was constructed in two separate areas on the west end of St. Thomas to support the two phases of the test. Figures 2-6 and 2-7 show the setup for these tests. Phase I was completed near a road 20 feet south of a weather station (SJPRN 102). The location of the test area for phase II may be located based on the geographic features shown in the photograph at figure 2-7.

A site visit was made by USACMDA personnel to the western end of St. Thomas in January 1993. Other than one housing development in the Fortuna area and a Bible college at the far west end of the island along Route 30, the population at this end of the island is sparse. Various estates are located at this end of the island to include Perseverance, Botany Bay, Bordeaux, Catherina's Hope, Runnels, and Bethesda. Figure 2-25 is a photograph taken of the Fortuna Bay area on Route 30. Geographic features in this area are very similar to those photographed in the test area during phase II of SJPRN 102.

j. *Submarine Base, St. Thomas.* The submarine base in St. Thomas was the location of the administrative facilities used to support the San Jose project. Figure 2-26 is a photograph of the laboratory used at that time. This laboratory was the only place within the administrative area where chemical agents were present (Mains, 1993). This facility has since been torn down.

2.1.8 Conclusions Based on Historical Information

The records regarding the history of the San Jose project and the tests conducted on the U.S. Virgin Islands are fairly complete. Progress reports have been obtained which cover all periods of testing on the U.S. Virgin Islands. Since each progress report indicates what testing occurred during each period, the number and types of tests are well defined. Appendix C presents a table which summarizes each progress report, the time period covered, and the tests which were conducted during that time. From this table, it can be seen that only nine tests were conducted on the U.S. Virgin Islands.

Based on interviews and Army memoranda, the disposition of the chemical items is also fairly well defined. For the most part, items were removed at the termination of the San Jose project. Appendix G and H provide information on the munitions and agents tested or removed from Water Island at the end of the San Jose project.

Through the use of interviews and test reports, the area where each test was conducted is defined for all but the last two tests conducted, which involved GA-filled and HQ-filled smoke pots. The location of these last two tests can be surmised by information provided by interviewees. The military personnel indicated that chemical tests occurred only on the south end of Water Island. In addition, the purpose of the first test conducted on Water Island (SJPRN 136, static test of M70 Bombs) was to



Figure 2-25. Fortuna Bay Area, St. Thomas



Figure 2-26. San Jose Project Laboratory at the Submarine Base, St. Thomas

establish meteorological and terrain factors at sites within the U.S. Virgin Islands so that results obtained could be used as a basis of comparison between tests run at this site and other sites. Since this was a baseline test and records indicate testing was only conducted in areas 4, 5, 6, and 8, it is believed subsequent tests would have been confined to these areas.

Based on the information collected in the preparation of this report, the following paragraphs list CWM which would most likely be uncovered in the U.S. Virgin Islands and the test areas which would most likely have been contaminated from these tests.

a. *Chemical Warfare Materiel Items Most Likely Recovered in the U.S. Virgin Islands.*

(1) *Remnants from Tests.* Remnants from tests may have been left on Water Island. Mr. Mains and Mr. West did not recall any burial sites but they did say that standard practices during that era were to bury remnants from tests. Remnants may have been buried from the M70 HD-filled bomb tests, which involved eight bombs; and the smoke pot tests, which involved eight GA-, thirteen HD-, and two HQ-filled E-23 smoke pots. It should be noted that the disposition of the E-23 smoke pots was not defined in Army memoranda, re-enforcing the possibility that these items were left behind. At the end of the HD smoke pot test, some pots contained as much as 3800 cubic centimeters of chemical agent (SJPRN 176). If these items had been buried in this condition, standard practices during that era would have required that decontamination solution be added to the burial pit.

(2) *Surveillance Test Items.* Items from the surveillance tests may also have been left on Water Island. As mentioned previously, the disposition of four CK-filled M78 bombs involved in the surveillance test are unaccounted for. During the 1966 incident, the Navy identified the bombs uncovered in the Flamingo bay area as M70 and M78 bombs. Since the M70 bombs were intact, they were most likely involved in the surveillance tests as opposed to the M70 HD-filled bomb test.

(3) *Ton Containers.* Ton containers were a useful storage container for all chemical agents. CG-filled ton containers used in test number 102 on St. Thomas would have remained in useful condition following the tests. It is therefore believed that these items would have been retained for subsequent agent storage and not destroyed or buried on the U.S. Virgin Islands.

(4) *Other.* In September 1949, an organization day was held celebrating the fifth anniversary of the establishment of the San Jose Project on San Jose Island. During this celebration, chemical equipment was displayed and demonstrated. The demonstrations included the burning of colored smoke grenades, firing of a 4.2-inch chemical mortar, and

screening of an area by boat with E-23 floating smoke pots (SJPPR 72). According to Mr. Mains, these demonstrations were conducted without chemical agent in test area 4 on Water Island. Mr. Mains indicated that some difficulties were encountered during the demonstration of 4.2-inch mortars. It took four attempts before the mortar was finally functioned (Mains, 1993). The remnants of these demonstrations may remain on Water Island.

b. *Test Areas Most Likely to Contain Chemical Warfare Materiel Contamination.* The following areas are listed in order of most likely to least likely of being contaminated from the San Jose project.

(1) *Flamingo Bay Salt Pond and Shoreline.* Since chemical items were uncovered from the old salt pond during the incident in 1966, it is possible that this area was used as a burial site during the San Jose project. This was reinforced during the interview with Mr. Walter Phillips. He indicated if items had been left behind, they would have been left close to the shore in the Flamingo Bay area. Mr. Phillips first came to Water Island in April or May of 1951, just one year after the San Jose project had ended. No residents lived on Water Island during that time (Phillips, 1993). In addition, according to Mr. Mains, the Flamingo Bay deep water dock had been used to load munitions for transport on and off the island. Chemical weapon items had therefore passed through this area.

(2) *Test Area 4, Northern Side of Road.* All available records indicate that testing in this area was limited to the open area on the northern side of the road in test area 4. Much of this area was dredged when the adjacent pond was opened into a marina. It should be noted that standard practice following each test was to decontaminate the area so that no contamination existed to interfere with the results of followup tests (Mains, 1993). This area should therefore have little to no residual agent. Remnants from exploding excess burster charges at the end of the San Jose project may remain.

(3) *Test Area 5.* Test area 5 was the site for two phases of the M70 HD-filled bomb test. The depression in that area which exists today was also present in the 1954 aerial photographs. This site is in close proximity to test area 4, where the majority of the tests were conducted on Water Island. Area 5 may have been a convenient place to dispose of remnants from these tests.

(4) *Test Area 6.* The flat area near the shore is the most likely place where two phases of the M70 HD-filled bomb test were conducted, since they were trying to characterize an open area with onshore winds. In addition, the E-23 GA-filled smoke pot test on the water may have been conducted off the shore in this area (paragraph 2.1.5 h.).

(5) *Test Area 8 and the Toxic Storage Yard.* Of the 5 areas listed with possible contamination on Water Island, this area is the least likely. There has been heavy excavation in this area to construct the Water Isle Hotel with no reported incident of encountering CWM contamination. In addition, this was the location of the military office where military personnel responsible for maintaining the stockpile were stationed. It is unlikely these personnel would have allowed any contamination in this area to persist.

(6) *West End of St. Thomas.* Two tests were conducted on St. Thomas. The first involved a surveillance test of 4-pound particulate bombs. These inert bombs, filled with simulant, were shipped back to Camp Detrick at the end of the test. The second test was recorded to have occurred on the west end of St. Thomas and involved emitting CG from ton containers to determine penetration characteristics of gasproof shelters. As mentioned previously, it is unlikely these ton containers were left at the test area since they were not damaged during the test and were useful for subsequent storage of chemical agents. CG is a nonpersistent agent and therefore residual contamination would be unlikely.

2.2 Review of Site Documentation for the U.S. Virgin Islands

This section contains existing data on the U.S. Virgin Islands which would be useful in planning a possible remediation effort at FFS. Information includes population, economic, meteorologic, and geologic data, as well as information on residents and existing utilities available on Water Island. Limited information is provided with regard to the recent cultural resource and endangered species survey conducted on Water Island. Additional information will be added as it is released for public dissemination.

2.2.1 Population Data. Population data for the U.S. Virgin Islands was obtained from the U.S. Department of Commerce, Bureau of Census for 1990. Residential population data were obtained for St. Thomas by geographic sector and by age distribution. Figure 2-27 is a map of St. Thomas and Water Island indicating the population distribution. Appendix I provides the population distribution by age. Population data is summarized in table 2-2.

Since the U.S. Virgin Islands is a major resort area, the actual population is significantly higher when the transient population is added to the residential population. Tourist information was obtained from the U.S. Virgin Islands Department of Economic Development and Agriculture (U.S. Virgin Islands, 1991). This information is summarized in table 2-2 and provided in more detail at appendix I.

Population by Geographic Sector

Geographic Sector	Population	Name
9601	2472	East End
9602	3325	Tutu CSD south
9603	5759	Tutu CSD North
9604	2986	Northside CSD
9605	3442	West end
9606	1645	Charlotte Amalie North
9608	3342	Charlotte Amalie West
9609	1953	Charlotte Amalie
9610	2908	Charlotte Amalie south
9611	3	Charlotte Amalie shore
9612	4755	Charlotte Amalie
9613	4642	Charlotte Amalie west
9614	4693	Southside CSD
9615	3261	East end CSD
9616	172	Water/Hassel Island

Figure 2-27. Population Distribution on St. Thomas and Water Island

Table 2-2. Population Data and Tourism Indicators for the U.S. Virgin Islands

Residential Population:	
St. Thomas	48,166
Water and Hassel Island	172
St. John	3504
St. Croix	50,139
Tourism on St. Thomas and St. John	
Annual air visitors	505,000
Cruise passengers	1,208,400
Number of cruise ships	1,216
Number of hotels	30
Total rooms or units	3686
Occupancy rate	59.6%

Many cruise ships call in St. Thomas with many docking near Water Island. The peak tourist season for the U.S. Virgin Islands is from December to April.

2.2.2 Economic Factors. The potential economic impact on the U.S. Virgin Islands should be considered when evaluating potential alternatives for the possible recovery and treatment of CWM. Tourism is the U.S. Virgin Islands primary industry. St. Thomas, which has been ranked as one of the world's prime shopping paradises, depends on deriving large revenues from the retail purchases by cruise ship passengers, hotel guests, and day-trippers from Puerto Rico. Other than retail firms, restaurants, hotels, and general service businesses, the only other major employer on St. Thomas is the U.S. Virgin Islands government (Megnin, 1992). Figure 2-28 shows the U.S. Virgin Islands nonfarm employment distribution for 1990. It should be noted that manufacturing accounts for only 6 percent of the U.S. Virgin Islands employment.

2.2.3 Meteorology Data.

a. *Climate.* The climate in the U.S. Virgin Islands is maritime tropical. It is characterized by generally fair weather; steady wind; and slight but regular annual, seasonal, and diurnal ranges of temperature. A significant feature of the rainfall pattern is the marked variation within short distances with change in terrain and elevation (Calvesbert, ESSA).

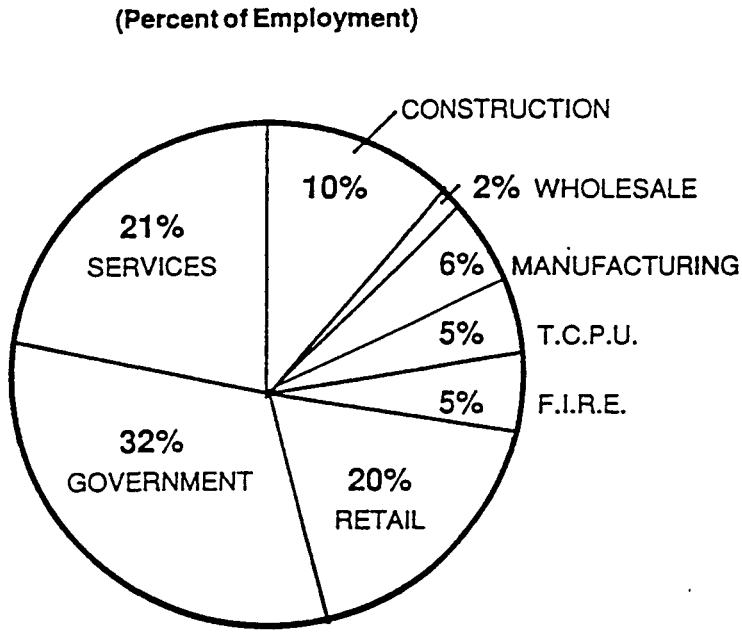


Figure 2-28. U.S. Virgin Islands Nonfarm Employment Distribution for 1990.

b. *Temperature.* Variations in temperature between the coolest and the warmest months are 5 to 7 degrees at the most. The highest temperatures are in August and the lowest in January or February. During the warmest months, the highest average daytime temperature is about 87°F (30°C). During hot spells, which occur nearly every year, the temperature exceeds 88° (31°C) or 90°F (32°C) for several days in succession. The average lowest nighttime temperature during the warmest months is between 74°F (23°C) and 78°F (26°C). During the coldest months, the highest temperature is generally in the low 80s, and the lowest in the high 60s or low 70s (Calvesbert, ESSA).

c. *Rainfall.* On Water Island, the average annual rainfall is 40 to 45 inches. Whether an exposure is on the windward or the leeward side of a slope is a significant factor in the amount of rainfall received. In general, there is a much higher occurrence of rainfall by day than by night. There is no sharply defined wet season or dry season on the islands. The rainfall is lightest during the period of December through June. Rainfall is generally lightest in February and March and is heaviest in September and October (Calvesbert, ESSA).

d. *Wind and Mixing Height Data.* Regularity in direction of the trade winds is one of the most dependable weather phenomena on the islands. Almost without exception, the trade winds blow from an easterly direction. The velocity varies daily; a velocity of more than 15 miles per hour occurs more frequently in winter than in other seasons. The nighttime offshore land breeze and the daytime onshore sea breeze, which are typical of Puerto Rico, are lacking on the U.S. Virgin Islands because of the small total land area; the diurnal variation in windspeed (that is, the calms and low speeds at night and the increase in velocity at daybreak) is present. Figure 2-29 provides wind roses for the U.S. Virgin Islands by month (Calvesbert, ESSA). Figure 2-30 provides a wind rose indicating the average wind throughout the year.

   Appendix J provides mixing-height information for Puerto Rico. This information was the closest available. Mixing-height and windspeed data is necessary to estimate dispersion characteristics of a hazardous substance.

e. *Relative Humidity.* The average relative humidity over a 6-year period is summarized in table 2-3. The relative humidity and the salt content of the air are sufficiently high to cause corrosion and deterioration of buildings and metal equipment.

f. *Hurricanes and Tropical Storms.* The U.S. Virgin Islands are occasionally affected by tropical storms and hurricanes. They lie outside the main paths of severe tropical disturbances, except for those that occur from August through the first half of October. The storms that develop over the south Atlantic are of

Table 2-3. Average Relative Humidity*

Month	2:30 a.m.	2:30 p.m.
January	81	66
February	84	63
March	83	63
April	85	66
May	87	70
June	84	69
July	86	70
August	87	69
September	88	73
October	90	72
November	90	72
December	86	69

* Atlantic standard time.

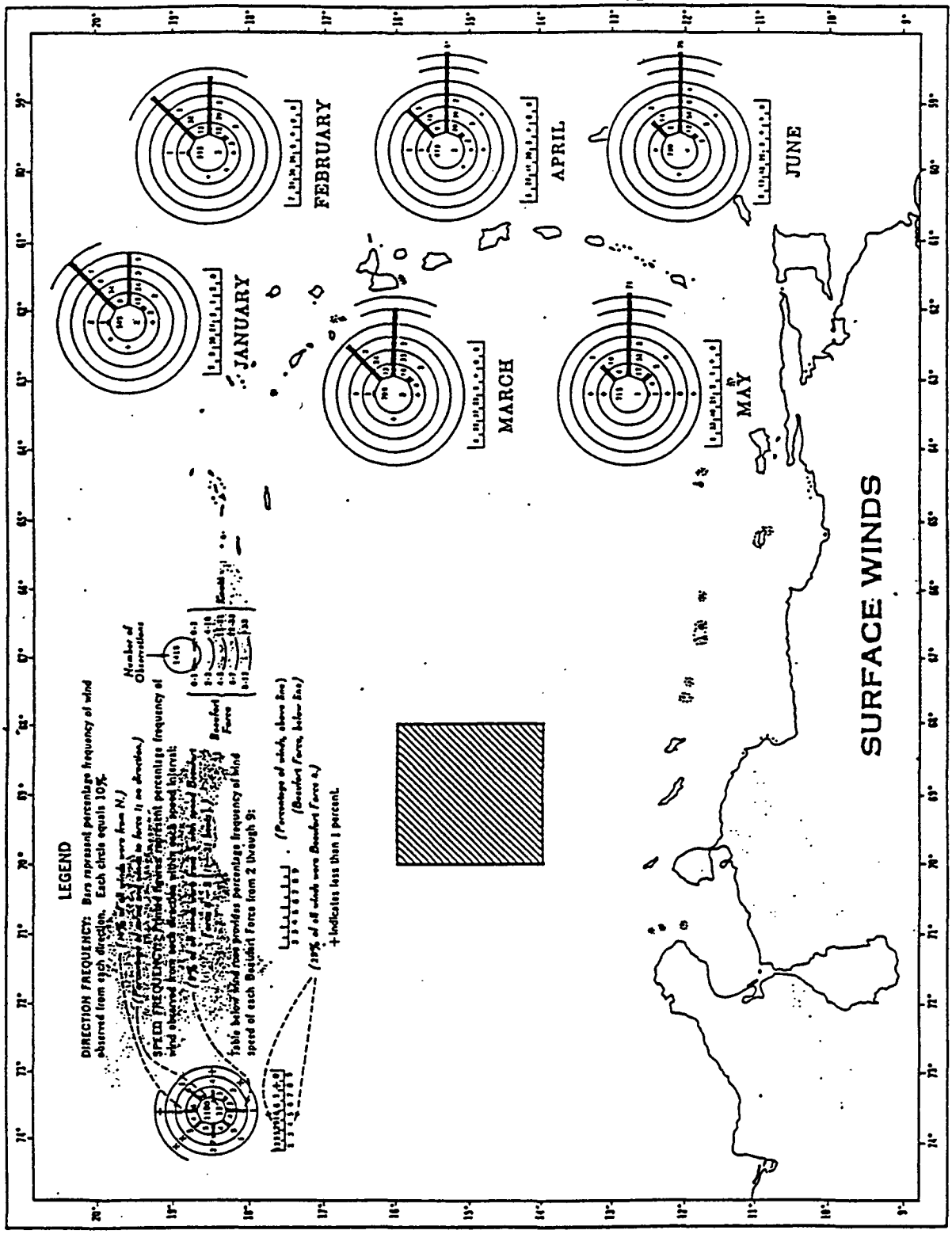


Figure 2-29. U.S. Virgin Islands Monthly Wind Roses

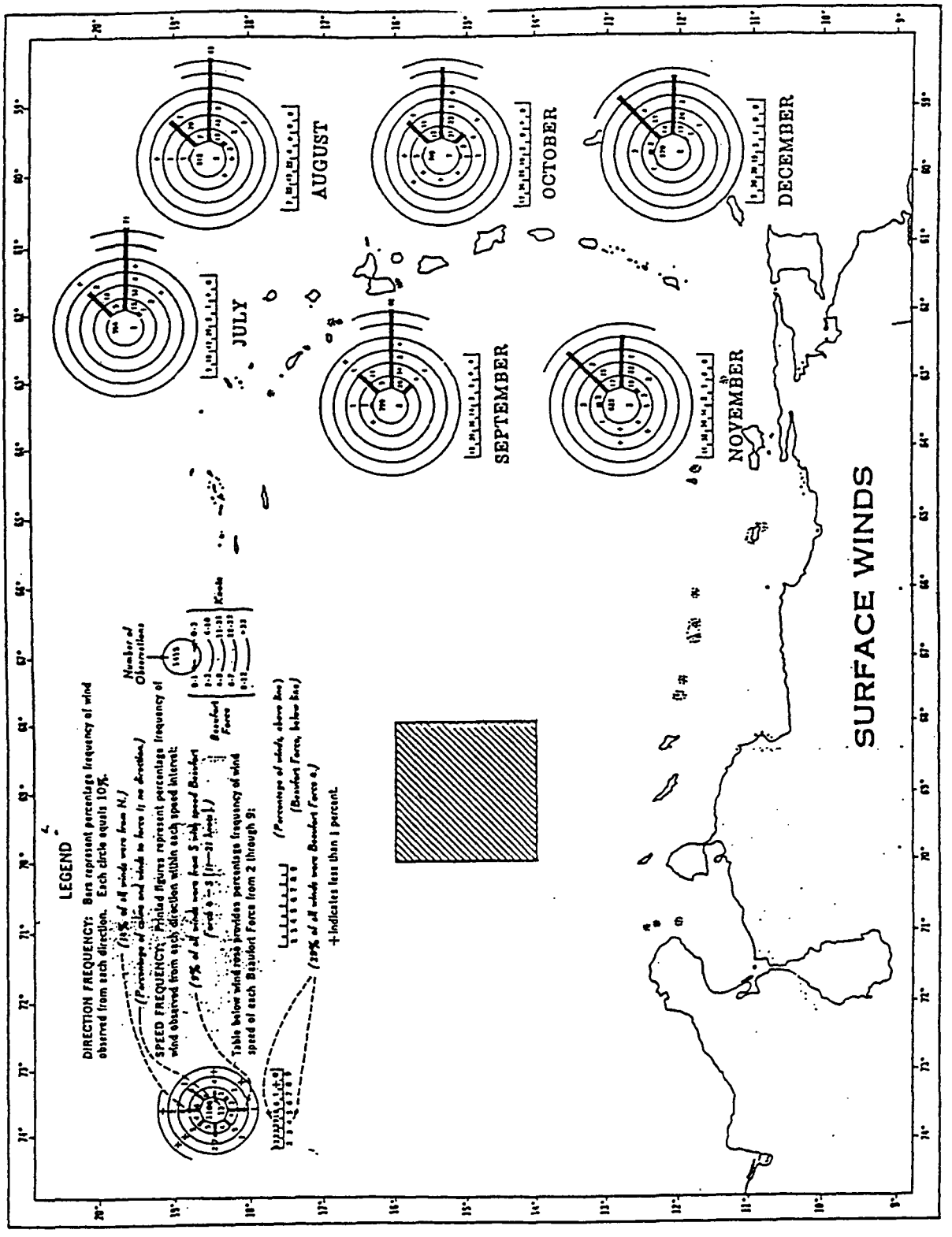


Figure 2-29. U.S. Virgin Islands Monthly Wind Roses (Continued)

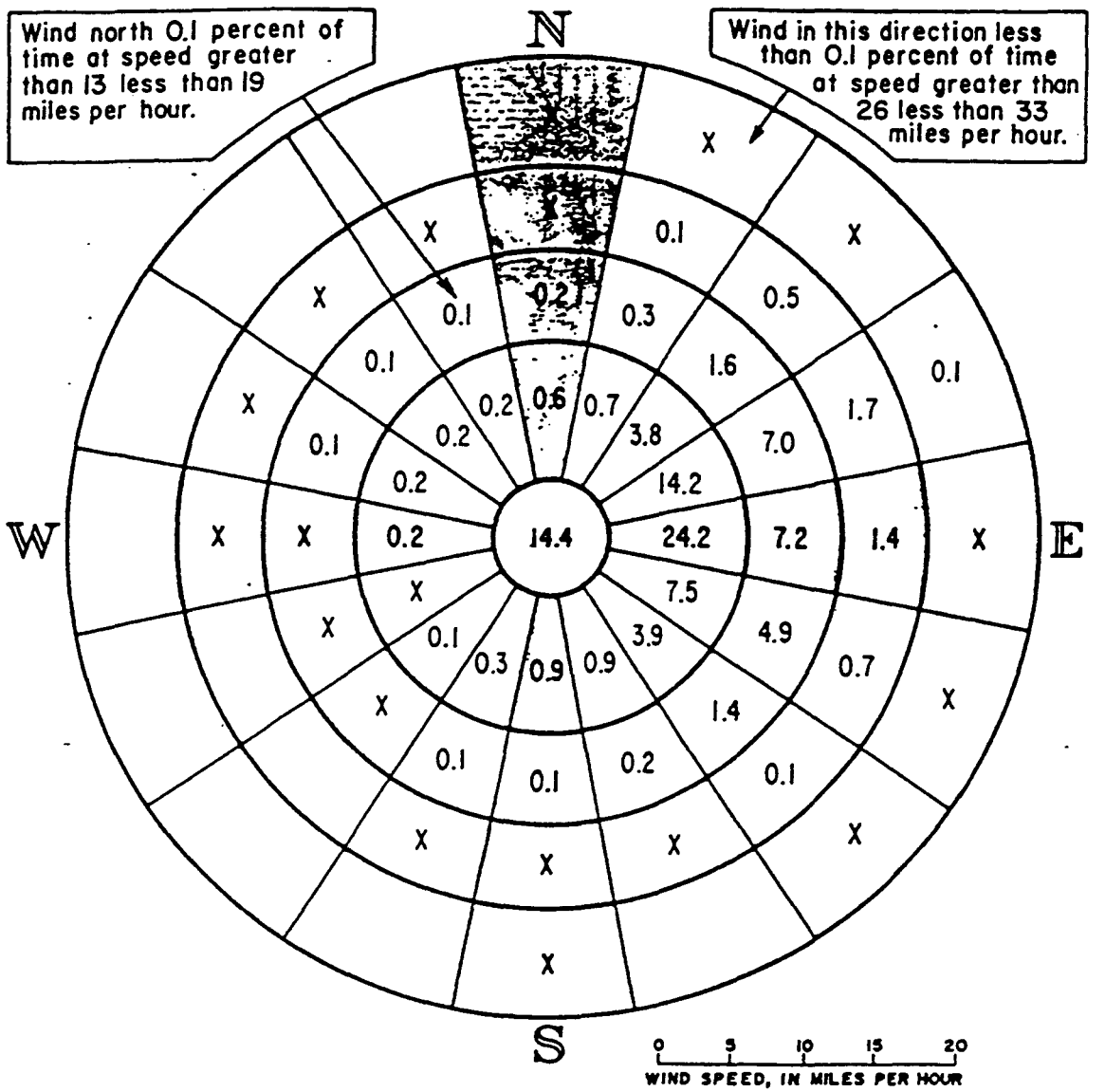


Figure 2-30. U.S. Virgin Islands Annual Wind Rose

the Antilles chain and usually move toward the north or northwest and pass north or south of the islands; rarely do they pass directly over them. There is risk of hurricane-force winds about once every 9 or 10 years (Calvesbert, ESSA).

2.2.4 Geology. Water island is situated on the eastern end of the Greater Antilles submarine shelf. Many geologists believe that the Greater Antilles was originally part of the Rocky-Andes mountain chain, which extends from the northwest tip of North America to the southern tip of South America (Government of the U.S. Virgin Islands, 1974). Water Island is comprised of relatively undeformed and metamorphosed Cretaceous volcanic and volcanic sedimentary rocks. The Water Island formation predominantly consists of lava flows and flow breccias deposited at great depths on the sea floor. The maximum thickness is believed to be greater than 15,000 feet (Donnelly, 1959).

Appendix K provides soil type, depth to bedrock, and the seasonal high-water table for areas on Water Island. This information was compiled in 1969 as part of a soil survey conducted by the Soil Conservation Service of the U.S. Department of Agriculture. The terrain on Water Island is steeply sloped. A primary ridge line 200 to 290 feet above sea level runs down the center of the island in a north-to-south direction.

2.2.5 Water Island Residents. Water Island is owned by the DOI, who subsequently lease it to Water Isle Hotel and Beach Club for development as a resort area. The 20 year lease, signed on 10 December 1952, had a renewal option for 20 additional years. This lease expired in December 1992 and, to date, a resolution to the lease has not been obtained. The land was appraised for possible sale to the current residents under the Bush administration. As reported in the 25 March 1993 newspaper of the U.S. Virgin Islands (The Daily News) turnover of the island is being further reviewed by the Clinton administration in response to complaints by U.S. Virgin Islands officials that the plan does not take into account the territory's interests.

During peak times, Water Island has a population of approximately 200 residents. About 50 percent of these people stay year round. The peak population occurs in mid January. The majority of the people are retired, but there is an increasing population of young residents who work on St. Thomas. There are a few residents that rent to tourists. This includes the Limestone Reef Terraces, which has 10 rental units. There is also a bed and breakfast located on the island (Keeler, 1993). Table 2-4 provides the age distribution of the Water Island residents (Scott, 1993).

Water Island is divided into two areas. Approximately two-thirds of the island at the southern end is owned by individual subleases under the major lease holder, who is Mr. McCartel of Water Isle Hotel and Beach Club. Structures and homes situated on this portion of Water Island, with former chemical weapons test areas superimposed, are shown in figure 2-18 (Couter, 1993). The remaining one-third of the island is the Sprat Bay area, which was sold off as one large sublease in January 1956. It consists of 156.5 acres at the northern end of the island and has been developed into a residential housing community with 90 one-acre lots.

Table 2-4. Age Distribution of Water Island Residents

Age Group	Number of Residents
0 to 24	27
24 to 44	77
45 or older	68

The remaining acres are devoted to common use. The community in the Sprat Bay area maintains its own roads and has its own marina and private beach. The area is easily distinguishable by the no trespassing signs posted at the beginning of the Sprat Bay area. In addition, a small strip of roadway is not paved, designating the area in which road maintenance responsibility is turned over from the main Water Island community to the Sprat Bay community. Test areas 1 and 7 are located within the Sprat Bay area.

The Water Island Association was established to represent the interests of residential property owners on the main portion of the island. According to Ms. Keeler, former president of the Water Island Association, this committee meets annually and is comprised of elected officials. They levee taxes on the Water Island residents to maintain the roads and provide other services. These are voluntary taxes, since there are no police on Water Island to enforce payment. Typically, 80 percent of the taxes are paid. There are several committees, including finance, roads, beaches, coordination with the U.S. Virgin Islands government, lease-hold resolution, safety, and noise (such as airplanes flying to and from St. Thomas which may fly over Water Island) (Keeler, 1993).

Water Island residents do not pay U.S. Virgin Islands taxes. For this reason, many of the services provided by the U.S. Virgin Islands government are not provided to the Water Island residents. For example, following Hurricane Hugo, VITEMA provided emergency services to the residents on the main islands (St. Thomas, St. John, and St. Croix) on a priority basis prior to providing assistance to the residents on Water Island. It was several months before phone lines and electricity was restored to the residents on Water Island (Ms. Keeler, 1993).

2.2.6 Site Characteristics. The following paragraphs utilize the population distribution and meteorology data to further characterize sites with the greatest potential of containing CWM contamination. Table 2-5 provides the size of each site, the estimated distance to the nearest downwind resident on Water Island, and the quantity of downwind residents from each site. This information is useful in assessing the downwind hazard associated with possible recovery of CWM on a site-by-site basis. This information is used in follow-up sections of this report to evaluate siting alternatives for the possible interim storage or treatment of recovered CWM.

The definition of downwind, as it is applied in table 2-5, is that the wind is blowing from the west-north-west, north-west, north-north-west, north, north-north-east, north-east, east-north-east ,east, or east-south-east. During these conditions, the wind is blowing away from both St. Thomas and the populated areas of Water Island. Based on the windrose in figure 2-30, these winds occur 77.6 percent of the time. There is essentially no wind (that is, wind speed is less than 3 miles-per-hour) 14.4 percent of the time.

2.2.7 Utilities. Water Island is a remote location with limited utilities. The following paragraphs summarize the existing utilities on Water Island.

Table 2-5. Site-Specific Information

Site Name	Area	Distance to nearest downwind residence	Number of downwind residences
Flamingo Bay salt pond	50 x 100 ft	300 ft	16
Fenced area of Flamingo Bay	5.5 acres	100 ft.	18
Former test area 4 (south)	.5 acres	500 ft.	20
Former test area 4 - (north)	.8 acres	800 ft.	20
Former test area 5	3.3 acres	50 ft.	27
Former test area 6	2.3 acres	Residences are located within test area	45
Former test area 8	5 acres	Residences are located within test area	45
West end of St. Thomas	2095 acres	heavily populated	heavily populated

U.S. Virgin Islands WAPA provides power to Water Island (through a single underwater cable) and maintains the power distribution system. At the Water Isle Hotel, three-phase power is provided (220 volts). Single-phase (110 volts) power is distributed to other areas of the island, but this system could be upgraded to three-phase also. An application would need to be submitted through the U.S. Virgin Islands Department of Planning and Natural Resources. Once approved and after a pole study is conducted, transformers and lines would most likely be installed on existing poles. Additional poles would be expensive to install (Francois, 1993).

WAPA does not provide water to Water Island. The residents have cisterns at the individual homes and one large cistern in the center of the island. When the hotel was in operation, a reverse osmosis unit was used to provide water to the rooms. This unit was damaged during Hurricane Hugo and never was repaired. WAPA does provide bulk water at $16.00 per 1000 gallon. This is the price provided to the truckers and does not include transportation. There are no fire services on Water Island. Phone lines are strung with the power distribution system, which follows virtually all roads on Water Island. Water Island residents use septic systems for their sewage.

2.2.8 Cultural Resources. Human occupancy appears to have begun on Water Island approximately 2000 years ago. Archaeologists have found five Indian sites, all of which are located at sheltered bays, along the western coastline. Early Saladoid pottery, pot shards, stone tools, and other evidence recovered from these sites indicate small-scale occupation by itinerant fishermen and shell gatherers rather than extensive permanent settlement by agriculturalists. These findings were based on exploratory digs. The sites were not investigated in detail until September and October 1992 when the National Park Service conducted cultural resources field investigations on Water Island. Twelve historic and archeological sites were identified during this study. Further results of this study have not been published, but significant cultural resources were identified. Potential impacts to these resources will be considered by the Jacksonville District, USACE, when conducting the RI/FS for Water Island (Bridgers, 1993).

2.2.9 Threatened and Endangered Species. Appendix L provides a listing of the threatened or endangered plants and animals of the U.S. Virgin Islands that are protected by either the U.S. Endangered Species Act of 1973 or the U.S. Virgin Islands Endangered and Indigenous Species Act of 1990. A survey of threatened or endangered species was recently conducted on Water Island, which resulted in the identification of two suspected endangered species (the leatherback turtle and the brown tree boa). An endangered tree species has also been found on Water Island. Potential impacts to these species will be considered by the Jacksonville District when conducting the RI/FS for Water Island (Bridgers, 1993).

2.2.10 Other Data Collected. As the agency given the mission of CWM destruction by the Department of the Army, the U.S. Army Chemical Materiel Destruction Agency (USACMDA) is involved with all aspects of the remediation on Water Island until the potential for CWM presence has been eliminated. As part of the scoping effort,

USACMDA reviewed work plans concerning remediation of Water Island and provided comments to the Huntsville District, USACE. Comments to the work plan are included at Appendix M. In general, the plans did not support a RI/FS and eventual record of decision (ROD), as required under CERCLA. Management and Technologies Associates, Inc. (MTA) outlined a plan to clean the site but did not first collect information to support the CERCLA decision making process. In addition, plans were not developed to handle recovered CWM as hazardous waste.

2.3 Recommendations

Review of historical information and site characteristics is the first step in the site investigation phase of the CERCLA process. Under the CERCLA process, a site need not be investigated at all unless there is evidence of a substantial threat of a release from a hazardous substance. The following paragraphs provide recommendations regarding areas which may warrant further investigation, based on site characteristics and historical information on past CWM uses of the site. Recommendations are based on whether there is reason to believe CWM may be buried in FFS test areas and the Flamingo Bay area. This report does not address contamination due to disposal of non-DoD wastes.

At FFS, there is no evidence that CWM tests were conducted in former test areas 1, 2, 3, and 7. These areas were originally identified as San Jose project test areas, but based on personal interviews and actual test reports it is not believed any tests were ever conducted. It is therefore recommended that no further investigation be conducted in these areas.

Records indicate that SJPRN 102 and possibly SJPRN 132 were conducted on St. Thomas. SJPRN 132 involved inert bombs filled with simulant, which were all shipped back to Camp Detrick at the conclusion of the test. SJPRN 102 involved emitting CG gas from ton containers to determine penetration of gasproof shelters. As discussed in paragraphs 2.1, it is unlikely that the ton containers were left at the test area, since they were not damaged during the test and were useful for subsequent storage. Based on the limited testing conducted on the west end of St. Thomas and the nonpersistent nature of CG, it is recommended that no further investigation of this area be conducted.

Former test area 8 and the adjacent toxic storage yard area have been heavily developed with the construction of a hotel and associated support buildings. There were no reported incidents of CWM recovery during this construction; therefore, it is recommended that no further investigation of this area be conducted.

Photographs of test setups and personnel interviews all indicated that tests conducted in former test area 4 were confined to the open area in the northern portion of the site. It is therefore recommended that no further investigation for CWM be conducted at the dump area in the southern portion of former test area 4.

Further investigation may be warranted in the Flamingo Bay landfill area and shoreline, the northern portion of test area 4, test area 5, and the undeveloped portion of test area 6 near the shoreline. Further recommendations regarding the extent of investigations which could be conducted in these areas are contained in section 5 of this report.

Based on the historical information regarding CWM items most likely recovered at FFS, remediation and treatment plans should be developed, assuming the following CWM items may be recovered on Water Island:

- remnants from M70 mustard bomb tests;
- intact smoke pots with residual smoke and agents GA, HD, or HQ;
- Intact M70 (115-pound), M78 (500-pound), and M79 (1000-pound) bombs filled with solidified or liquid CK;
- 4.2-inch mortar with agent or high explosives;
- H/HD-filled T-3 bombs (125-pound); and
- CWM with CG or HT.

Since FFS was a test site involving explosively-configured rounds, it should be assumed that explosively-configured CWM may be recovered. For this reason, FFS should be categorized as a type 3 burial site, which is a burial site containing small quantities of explosively-configured CWM and small quantities of non-explosively-configured CWM. This terminology is used to classify all small burial sites in the non-stockpile program and is further defined in section 7 of the Generic report.

Water Island is owned by the DOI and leased to Water Isle Hotel and Beach Club. Ownership of the land is important in obtaining authority to remediate the area as a CERCLA site. This information will be used in subsequent sections of this report.

Very little information is available regarding groundwater flow on Water Island. According to the U.S. Geological Survey on St. Thomas, only two wells have been drilled on Water Island to characterize the groundwater flow. These were both located near the ferry dock on the northern shore in the middle of Water Island. The wells are not in close vicinity to the test area recommended for further investigation.

When planning an investigation or remediation effort on Water Island, consideration should be given to the prevailing winds. Based on local meteorology data, the wind is blowing away from populated areas 77.6 percent of the time and there is essentially no wind (that is, wind is less than 3 miles-per-hour) 14.4 percent of the time.

There are limited utilities available on Water Island. The logistics involved in planning an investigation or remediation effort on Water Island will be complex and require careful planning due to the remoteness of the island and the limited utilities available. These issues should also be considered when evaluating treatment systems and evaluating onsite versus offsite treatment alternatives for recovered CWM at FFS.

SECTION 3

ENVIRONMENTAL LAWS

3. ENVIRONMENTAL LAWS

Environmental laws can be segregated into four basic categories according to legislative intent: laws that promote planning, laws that promote preservation, laws that provide controls, and laws that regulate and promote cleanup activities. A discussion about the environmental laws for each category is presented in section 3 of the Generic Site Scoping Study.

This section presents potentially applicable laws and regulations that will govern the Former Fort Segarra (FFS) chemical warfare materiel (CWM) recovery activities. Specifically, laws and regulations for the following CWM recovery activities are identified:

- baseline assessment techniques,
- excavation,
- packaging,
- interim storage,
- transportation,
- onsite treatment, and
- contingency planning.

3.1 Comprehensive Environmental Response, Compensation, and Liability Act Approach

CWM recovery operations at FFS will be performed as part of an environmental response action pursuant to Section 104 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (42 USC 9604) (Lee, 1992).

3.1.1 Comprehensive Environmental Response, Compensation, and Liability Act Authority. FFS is currently owned by the U.S. Department of Interior (DOI), who has leased the property to Water Isle Hotel and Beach Club for development as a resort area. Therefore, under CERCLA (42 USCA 9601 et. seq.), FFS represents a Federal facility under the jurisdiction, but not custody or control, of an executive department of the Federal Government. As such, pursuant to CERCLA and Executive Order (EO) 12580 (52 FR 2923, 1987), DOI has ultimate responsibility with respect to any releases or threatened releases of hazardous substances, pollutants, or contaminants at or from FFS. Furthermore, unless the site is added to the CERCLA National Priorities List (NPL), any environmental response activities conducted pursuant to CERCLA must fall within the scope of the CERCLA authority delegated to the head of DOI under EO 12580.

Under EO 12580, the President has delegated his authority, duties, and responsibilities for the implementation of CERCLA to different departments and agencies of the Executive Branch of the Federal Government. While the majority of CERCLA implementation is the responsibility of the U.S. Environmental Protection Agency (USEPA), authority for the implementation of CERCLA response actions was delegated to the heads of the other executive departments and agencies of the Federal Government. However, this authority is only with respect to releases or threatened releases at sites not on the NPL, where either the release is on, or the sole source of the release is from, any facility or vessel under the jurisdiction, custody, or control of the corresponding department or agency.

FFS was formerly owned by the Department of Defense (DoD) and during that time, the Army used the facility for the testing of CWM. Some of the sites where the testing was conducted may now require some form of environmental response action to mitigate contamination. If so, pursuant to CERCLA, DoD would be liable for any response actions necessary to mitigate any release or threatened release resulting from the activities performed by the Army when it was owned by DoD. DoD's responsibility under these circumstances was specifically stated by Congress, who amended title 10 of the U.S. Code (Armed Forces) to create a new chapter, chapter 160, entitled the Defense Environmental Restoration Program (DERP) (10 USCA 2701-2707). In this legislation, the Secretary of Defense was made responsible for carrying out, in accordance with the provisions of the DERP and CERCLA, all response actions with respect to releases of hazardous substances from each facility or site which was under the jurisdiction of the Secretary and owned by, leased to, or otherwise possessed by the U.S. at the time of the actions leading to contamination by hazardous substances [10 USCA 2701 (c)(1)].

While the DERP specifically made the Secretary of Defense responsible for hazardous substances contamination resulting from DoD's activities at formerly used defense sites (FUDS), the legislation did not give the Secretary any additional authority to carry out such responses under CERCLA beyond the authority already delegated to him (pursuant to EO 12580) for sites currently under the jurisdiction, custody, or control of DoD. Therefore, in order to carry out a CERCLA response action at a FUDS, DoD must obtain the authority from the appropriate Federal agency or department that currently has jurisdiction, custody, or control of the site. In the case of FFS, DoD must obtain the authority to carry out the CERCLA response action from DOI, who would act as the lead agency at the site. DoD would serve as the support agency.

Pursuant to the authority delegated to DOI under EO 12580, as long as the site is not placed on the NPL, DOI may enter into an agreement under section 122 of CERCLA (42 USC 9622) with any potentially responsible party to carry out any CERCLA response action (within DOI's scope of authority) if it determines that such action will be done properly by such party. This agreement, however, may be exercised only with the concurrence of the U.S. Attorney General. Section 122 of CERCLA would, therefore, provide the mechanism for DoD to carry out a CERCLA response action at FFS since, for the purposes of section 122 of CERCLA, DoD would be considered a potentially responsible party for the contamination at the site.

An alternative mechanism that would provide DoD with authority to carry out a CERCLA response action at FFS would be to sign an agreement with DOI whereby DOI temporarily or permanently transfers jurisdiction, custody, or control of the site back to DoD. DoD would then be able to carry out the response action pursuant to its authority under EO 12580. This type of agreement, however, could be considered a property transfer, thereby subject to the requirements of section 120 (h) of CERCLA [42 USC 9620 (h)].

Before any remedial action under CERCLA can actually take place at FFS, including any potential CWM recovery operation, the remedy must be selected and implemented in accordance with the requirements stipulated in section 121 of CERCLA (42 USC 9621). Section 121 of CERCLA establishes not only the procedures to be followed for the selection of remedy and the cleanup standards to be attained as part of the remedy, but it also establishes procedures for the substantial and meaningful involvement of the States in the remedy selection process. (Under CERCLA, the term States also includes the U.S. Virgin Islands.)

Under section 121 of CERCLA, preference will be given to remedies that rely on treatment permanently and significantly reducing the volume, mobility, or toxicity of the waste. Moreover, section 121 of CERCLA stipulates that the offsite transportation and disposal without treatment should be the least favored remedial alternative when practical treatment technologies are available. As a minimum requirement, remedial actions selected pursuant to section 121 of CERCLA should protect human health and the environment and be cost effective, utilizing permanent solutions and alternative treatment technologies to the maximum extent practicable.

3.1.2 Applicable or Relevant and Appropriate Requirements. Section 121 of CERCLA also sets forth the basic requirements that site cleanups must attain. These requirements stipulate that onsite actions must comply with all Federal applicable or relevant and appropriate requirements (ARARs), as well as State ARARs that are more stringent than any standard, requirement, criteria, or limitation under any Federal ARARs when such requirement has been identified by the State in a timely manner. On the other hand, Section 121 of CERCLA exempts response actions taken pursuant to CERCLA and carried out entirely onsite from any procedural Federal, State, or local permit requirements. States, however, may enforce in Federal court any Federal or State ARARs to which the remedial action is required to conform.

Applicable requirements are (53 FR 51435, 1988):

> those cleanup standards, standards of control, or other substantive environmental protection requirements, criteria, or limitations promulgated under Federal or State law that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site.

Applicable requirements are those requirements that any action would have to comply with, regardless of whether the action is being conducted under CERCLA. The determination of applicability is a legal one; therefore, all the jurisdictional

requirements of a law must be met before the requirement can be applicable at the site.

Relevant and appropriate requirements are those standards that address "problems or situations sufficiently similar to those at the CERCLA site that their use is well-suited to the particular site" (53 FR 51436, 1988).

Once a requirement has been determined to be relevant and appropriate, however, it must be complied with as if it were applicable. In some cases, only portions of a requirement or regulation may be considered to be relevant and appropriate, and only that portion would be applied. The determination of whether a requirement is relevant and appropriate is based on professional judgement, taking into consideration the specific environmental and technical factors at the site. Furthermore, while a requirement may be relevant because it addresses situations very similar to those at the site, it may not be appropriate to apply the requirement for various reasons. Therefore, the requirement would not be well-suited to the site and would not be applied.

Section 121 of CERCLA also stipulates that, under certain circumstances, ARARs can be waived. However, the basic requirement that the selected remedy must protect human health and the environment can never be waived. The six exceptions under which ARARs may be waived are as follows:

a. when the selected remedy is only an incremental step toward the final remedy that will comply with the ARARs when completed;
b. when compliance with the ARARs will result in a greater risk to human health and the environment;
c. when compliance with the ARARs is technically impracticable from an engineering perspective;
d. when the selected remedy will attain a standard of performance that is equivalent to the ARARs through the use of an alternative method or approach;
e. when, with respect to State ARARs, the State has not consistently applied or demonstrated intent to consistently apply the requirement within its jurisdiction; and
f. when, with respect to CERCLA-funded actions only, the selection of a remedy that attains the ARARs will not provide a balance between the need for protection of human health and the environment and the availability of CERCLA funds to respond to other sites in need of cleanup.

Cleanup requirements for onsite response actions can be applicable or can be relevant and appropriate, but never can be both. Furthermore, compliance with ARARs does not apply to offsite actions. Offsite response actions must comply fully with any applicable laws and regulations. Therefore, waivers for ARARs are not available for requirements that apply to offsite actions. In addition, for CERCLA response actions carried out on Federal facilities not on the NPL, section 120 of CERCLA specifies that applicable state laws must be complied with (that is, cannot be waived) to the extent the state law is generally applicable.

The identification of ARARs is dependent on the hazardous substances present at the site (chemical-specific), site characteristics and location (location-specific), and the specific remedy being evaluated (action-specific). Therefore, the process of identification of ARARs is a continuous one and is not finalized until the remedy is selected and documented in the record of decision (ROD).

Chemical-specific standards have been established under several Federal statutes including the Resource Conservation and Recovery Act (RCRA), the Safe Drinking Water Act (SDWA), the Clean Water Act (CWA), the Clean Air Act (CAA), and similar State regulations. In those cases where more than one standard is available for a given chemical, the selected remedy should comply with the most stringent standard, depending on the applicability or relevance and appropriateness of the standard.

Location-specific requirements are those that affect the remedy because of where the site happens to be located. Examples of requirements that affect potential remedies include areas protected under the Wilderness Act, identified in the National Registry of Historic Places, or designated as wetlands under the CWA.

Action-specific requirements affect specific technologies or activities being evaluated as potential remedies at the site, such as RCRA regulations concerning hazardous waste incinerators or RCRA requirements for clean closure or closure-in-place for hazardous waste landfills.

In the absence of Federal or State promulgated standards, criteria, or limitations, or when ARARs are not sufficiently protective of human health or the environment, there are other criteria, advisories, guidance, and proposed standards that, while not legally binding, may need to be used to establish cleanup levels. These are not ARARs, but are to-be-considered (TBC) requirements. TBC requirements generally include health effects information [such as reference doses (RfDs) or cancer slope factors], technical guidance, and policy.

The specific goals and expectations that reflect the requirements for the selection and implementation of remedy as part of CERCLA response actions are provided in the National Contingency Plan (NCP) (40 CFR Part 300). The NCP defines the criteria that must be used to compare remedial alternatives, establish the basis for the selection of a remedy, and demonstrate that the statutory requirements stipulated in section 121 of CERCLA have been satisfied.

3.1.3 Chemical Warfare Materiel Recovery at the Former Fort Segarra. CWM recovery operations at FFS, if chosen as a remedy, are expected to be performed as non-time critical Removal Action (RA). This RA will address a specific problem at the site (that is, the CWM) and is expected to be followed by other actions that will subsequently address the full scope of environmental restoration at FFS. According to the NCP, the selected remedy for an IRA must neither exacerbate the existing conditions at the site nor interfere with final remediation of the site. Therefore, the excavation to recover any CWM present at FFS and the treatment to destroy the

recovered CWM must be consistent with the expected final environmental restoration of FFS.

IRAs are equivalent to non-time-critical removal actions, which are conducted as part of the overall remedial action process at the site. The remedy selection process described in the NCP that applies to the final selection of a remedy also applies to the selection of remedy for an IRA, with the exception that an Engineering Evaluation/Cost Analysis (EE/CA) report is used to document the evaluation of response alternatives instead of a Remedial Investigation/Feasibility Study (RI/FS) report. Furthermore, the response action implemented as an IRA is required to meet ARARs only "to the extent practicable, considering the exigencies of the situation" (55 FR 8695, 1990).

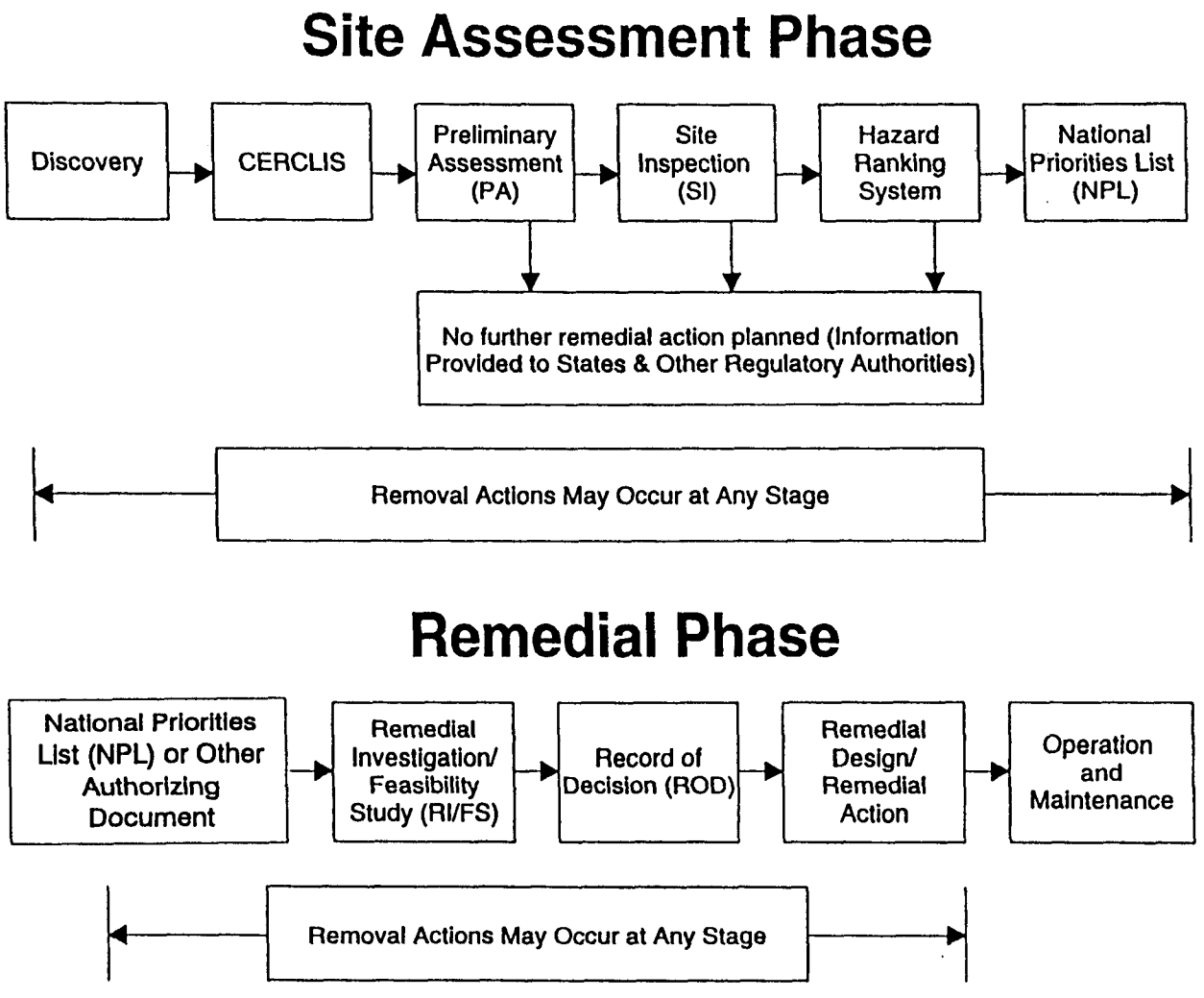
The specific procedures for the selection of a remedy as part of non-time-critical response actions are described in 40 CFR 300.415 and must be documented in a ROD.

Figure 3-1 illustrates how the CWM recovery operations would take place at FFS under CERCLA. The CWM is a source material that includes or contains hazardous substances, pollutants, or contaminants. Excavation and CWM destruction technologies represent primary treatment alternatives that should be considered during the selection of a possible source control IRA.

Source control actions must consider treatment alternatives, engineering controls, and other alternatives that provide little or no treatment but still meet the requirements of section 121 of CERCLA. Therefore, implementation of a source control IRA at FFS does not necessarily require that a CWM recovery operation be conducted at FFS. Furthermore, while the evaluation of a potential IRA may conclude that a source control IRA at FFS is not warranted, a CWM recovery operation could still be necessary as part of the final CERCLA cleanup action at the site. The NCP [40 CFR 300.430 (f)] requires that source control actions be evaluated as part of the RI/FS process.

3.2 Preliminary Applicable or Relevant and Appropriate Requirements for the Former Fort Segarra

The CERCLA process recognizes the need for complying with requirements, criteria, or limitations promulgated under other environmental and public health statutes when conducting cleanups. Consequently, other federal laws [such as the CAA, CWA, RCRA, and the Occupational Safety and Health Act (OSHA)] and state, local, and DoD requirements can be considered applicable or relevant and appropriate to the FFS CWM recovery activities. In addition, AR-200-1 requires the Army to comply with local laws and regulations. Once these requirements are determined to be applicable or relevant and appropriate, they will provide the regulatory framework for conducting these activities. A discussion about CERCLA and the other environmental laws and regulations are presented in section 3 of the Generic report. The following paragraphs discuss the principal laws and regulations that may be considered ARARs at FFS.



CERCLIS: Comprehensive Environmental Response, Compensation, and Liability Information System
Source: Figure 1-1; USEPA, 1991.

Figure 3-1. CERCLA Process

A summary list of preliminary ARARs for FFS is presented in appendix N. This list includes major federal and U.S. Virgin Islands laws and regulations and DoD requirements.

3.2.1 Federal Laws. A full discussion of federal laws may be found in section 3 of the Generic report. In accordance with CERCLA, the following federal laws may be applicable to FFS recovery activities. However, onsite actions taken at FFS need not comply with the procedures or permitting requirements of these laws. OSHA regulations specify that activities at hazardous waste sites should be done by trained workers familiar with hazardous waste operations. They also specify safety equipment and procedures to be followed, including the use of supplied air and the wearing of personal protective clothing.

The CAA will restrict the particulate and volatile emissions during investigation and cleanup and require the preparation of implementation plans that describe steps needed to comply with the CAA requirements.

The CWA will require that procedures be taken to avoid the release of contamination into nearby surface waters. Contingency planing for releases to surface water will also be required.

The National Environmental Policy Act (NEPA) requires a formal, systematic, interdisciplinary approach to ensure consideration of environmental impacts of actions. The NEPA process is required for all federal actions which significantly affect the quality of the environment.

USEPA and Department of Transportation (DOT) regulations will specify requirements for transporting hazardous materials such as contaminated groundwater, surface water, soil, debris, and recovered CWM. RCRA also specifies procedures for package marking and labeling, vehicle placarding, shipment manifests, and emergency response requirements during transport. In addition, RCRA regulations specify requirements for permitting, interim- and long-term storage, and treatment and disposal facilities.

Several federal laws limit or prohibit the implementation of cleanup actions that could adversely impact protected resources. These laws include the National Historic Preservation Act; the Archaeological and Historic Preservation Act; the Archaeological Resources Protection Act; the Historic Sites, Buildings, Objects, and Antiquities Act; the Fish and Wildlife Coordination Act; and the Endangered Species Act. An evaluation of each law should be conducted to determine whether cleanup actions proposed for FFS will be allowed. This evaluation should be performed at the time the cleanup remedy is selected.

3.2.2 U.S. Virgin Islands Territorial Laws. USEPA has delegated authority to the U.S. Virgin Islands to regulate air and water quality standards and solid waste regulations in that area. These standards are either equivalent to or more stringent than the Federal standards. USEPA has retained the authority to regulate CERCLA

and hazardous waste requirements. Therefore, RCRA regulations will be promulgated by USEPA.

The land encompassing the FFS site is owned by the DOI. Activities undertaken by the DoD on this land are subject to the regulations of the DOI unless modified by agreement. The DOI has delegated control of Water Island to the Territorial and International Bureau. This Bureau has leased this land to a private individual. The Bureau does not currently have any regulations concerning hazardous wastes at this site.

The U.S. Virgin Islands' authority to regulate operations on Water Island was questioned in a 1986 case between the Water Isle Hotel and Beach Club and the U.S. Virgin Islands Government. The court ruled the U.S. Virgin Islands Government did have authority and title 16 VIC§1456 was enacted. This section of the U.S. Virgin Islands Code (VIC) defines the U.S. Virgin Islands' authority over a Federal agency and indicates that each Federal agency conducting or supporting activities directly affecting the coastal zone shall conduct or support those activities in a manner which is, to the maximum extent practicable, consistent with approved state management programs. The premise for the ruling was the Presidential executive order 12088.

The U.S. Virgin Islands is not a state but a U.S. territory. The U.S. Virgin Islands governmental structure is comprised of a legislative branch and an executive branch, in addition to the territorial governor. The legislature has passed many laws which are applicable to possible operations by the DoD during a site cleanup at the FFS. The U.S. Virgin Islands laws are not easily grouped into the four general categories of the Federal laws as outlined in the Generic report. The U.S. Virgin Islands laws are grouped in a manner consistent with the codification of the U.S. Virgin Islands laws in 1957 and revised in 1982. The U.S. Virgin Islands laws are reviewed in this section in this manner.

In the continental United States, states and local jurisdictions pass various environmentally-oriented laws. The states may derive the authority to do so from specific Federal laws (such as RCRA). Many have adopted these Federal laws and have implemented their own rules and regulations. Additional environmental laws were passed by the states under their own authority, and counties, townships, cities, and towns have added further legislation in their respective jurisdictions.

The U.S. Virgin Islands have handled their laws differently. In the U.S. Virgin Islands, the laws enacted by the territorial legislature encompass the laws generally passed by states as well as towns, cities, counties, and townships. All of these laws have been incorporated into the U.S. Virgin Islands Code.

a. *U.S. Virgin Islands Code, Title 3 - Planning and Natural Resources.* This title creates the Department of Planning and Natural Resources. This department is the administrative and enforcement authority for activities involving fish, wildlife, vegetation, water resources, drinking water, air pollution, water pollution, flood control, sewers, sewage disposal, archaeological resources, historical

resources, coastal zone management, coastal lands, islands, cays, moorings, environmental protection, land development, building permits, earth change permits, and overall planning.

This title also creates the Historic Preservation Commission and Historic Preservation Officer. The rules and regulations concerning each of these areas is covered under another title.

b. *Title 12 - Conservation.* This title covers wildlife, trees and vegetation, water resources conservation, water pollution control, air pollution, commercial fishing, open shorelines, environmental protection, oil spill prevention, and coastal zone management. The following are the chapters under this title for each of these areas:

(1) *Title 12, Chapter 1 & 2 - Wildlife.* The general thrust of chapter 1 is to control the hunting and taking of game animals. However, there is a prohibition for wounding or killing agoutis or iguanas. Chapter 2 covers the protection of indigenous, endangered, and threatened species of fish, wildlife and plants, and prohibits the taking, possessing, harassing, injuring, or killing of such species. Endangered or threatened species are any species so listed by the Federal or territorial governments, including several species of whales (finback, humpback, sei, and sperm), the white-necked crow, the brown pelican, the roseate tern, the tree boa, the ground lizard, the green turtle, the hawksbill turtle, the leatherback turtle, the loggerhead turtle, and the shrub known as the St. Thomas prickly-ash. Appendix L provides a listing of the threatened or endangered plants and animals of the U.S. Virgin Islands, which are protected by either the U.S. Endangered Species Act of 1973 or the U.S. Virgin Islands Endangered and Indigenous Species Act of 1990. The law prohibits disturbing, damaging, or removing any nest of any indigenous or endangered species. This includes all sea bird nests. The law prohibits the pruning, cutting, removing, or otherwise disturbing any growth of mangroves without a permit. The law also prohibits flying over any off-lying island at an altitude of less than 1000 feet. The U.S. Virgin Islands have set up wildlife sanctuaries, marine sanctuaries, and game preserves, with each site having rules and regulations appropriate for the site. In 1990, the legislature added a section stating that nothing in this chapter shall prevent a Federal or territorial government employee or personnel he directly supervises from performing his or her official duties.

(2) *Title 12, Chapter 3 - Trees and Vegetation Adjacent to Watercourses.* This law provides that no one shall cut or injure any tree or vegetation within 30 feet of the center of any natural watercourse or within 25 feet of the edge of such watercourse, whichever is greater, unless permission is granted by the landowner and the Commissioner of Conservation. A watercourse is any stream with a well defined channel,

even if flowing only intermittently. The Commissioner may only grant such permission when it appears to him that it is necessary for access or development.

(3) *Title 12, Chapter 5 - Water Resources.* Since the U.S. Virgin Islands has a limited fresh-water supply, the government has declared that an emergency condition exists with respect to the availability of surface and underground water. The government has found it necessary to prevent over-pumping of wells, depletion of surface and underground water, and the intrusion of salt water and other pollutants into the water resources. The government has declared that all water belongs to the people of the U.S. Virgin Islands and is to be controlled. The law provides for licensing of well-drillers and permits for wells unless on private land for private use. The law provides for the proper sealing of wells and prohibits pumping a well and discharging the flow to waste unless in connection with a pumping test. The regulations cover certain requirements for any well. These requirements include location on the property, elevation of the top of the well, incursion protection, sealing, distances to other facilities, location above high water mark, provisions for casing cleaning, proper disinfecting, pump installation, back flow preventors, well capping, no cross connections, test wells to meet all requirements of a regular well, requirements for well repair, construction materials and methods definition, routing and sealing material specified, and well-plugging requirements. The law also requires metering and record keeping, including well logs and flow readings.

(4) *Title 12, Chapter 7 - Water Pollution Control.* It is the policy of the U.S. Virgin Islands to conserve its waters and protect, maintain, and improve water quality for public health, the environment, and recreation. This is done by assuring that no untreated waste is discharged into the waters, to prevent, abate, and control new pollution sources and implement the provisions of the Federal Water Pollution Control Act. The U.S. Virgin Islands have instituted a permit system for control of discharges into its waters. In addition, no permit shall be issued authorizing the discharge of any chemical or biological warfare agent into the waters of the U.S. Virgin Islands, any discharge which would substantially impair the anchorage or navigation, or any discharge which would be controlled under the U.S. Water Pollution Control Act. The Commissioner has set standards for water quality for the waters of the U.S. Virgin Islands. The laws have provisions for providing reports and records to the Commissioner, requiring monitoring equipment, requiring sampling, allowing inspections, allowing the right of entry for such inspections, and making provisions to provide public access to all such information. CERCLA provides that permits for activities onsite are not required. A discharge of pollutants by pumping would be an offsite discharge, which would require a Territorial Pollution Discharge Elimination Permit. The U.S. Virgin Islands law makes an exemption from the permit

requirement for discharges which conform with the NCP for removal of oil or hazardous substances pursuant to section 311(c)(2) of the Federal Water Pollution Control Act.

(5) *Title 12, Chapter 9 - Air Pollution.* This law prohibits, from any source, various air contaminant emissions that exceed certain levels, concentrations, or quantities. The levels, concentrations, or quantities are set by regulation. Exceptions from the requirement are possible at the discretion of the Commissioner of Conservation and Cultural Affairs, but only if the Commissioner finds that the proposed discharges do not constitute a danger to public health or safety. The law grants the right to the Commissioner's representative to enter any land to inspect, at reasonable times, for possible air pollution. The Commissioner is authorized to conduct tests of any new or existing process, fuel-burning, refuse-burning, or control equipment if the Commissioner has reason to believe it may result or cause emissions in excess of the regulated limitations. In addition to the regulatory limits, it is unlawful to allow, cause, or suffer the emission of obnoxious, pungent, odorous, or ill-smelling gases, fumes, or other air pollutants from any source in the U.S. Virgin Islands if the emission is determined to be objectionable. As a further requirement, air contaminant discharges are prohibited which cause injury, are detrimental, are a nuisance, or are an annoyance to any considerable number of persons endangers the public comfort, repose, health, or safety of any person; or which has a tendency to cause injury or damage to business or property. The law prohibits open burning unless for recreational purposes or if the Commissioner determines that there is no other method for the disposal of material which exists or can be reasonable obtained.

The law prohibits air contaminate discharges which have shade or density darker than number 2 on the Ringelmann Chart, not including water vapor. The regulations set particulate emissions standards for fuel-burning equipment and incinerators.

Anyone handling, transporting, or storing any material shall take all reasonable measures to control or prevent particulate matter from becoming airborne. Sulfur emissions shall not exceed 0.5 parts per million in any one hour and 0.1 parts per million in 24 hours. Hydrogen sulfide shall not exceed 0.03 parts per million in any 30 minutes on more than two occasions in 5 consecutive days. Other pollutants and emissions, such as carbon monoxide, nitrogen oxides, ozone, lead, and others, are also regulated.

If a source has the possibility of releasing any regulated air contaminate, then an emergency response plan shall be prepared, approved by the Commissioner, and maintained by the owner or operator of the source. Any owner or operator of a facility subject to U.S. Air Pollution

Regulation (40 CFR part 60 standards) shall comply with all monitoring and reporting requirements of 40 CFR part 60.

(6) *Title 12, Chapter 9A - Commercial Fishing.* This chapter covers the aspects of commercial fishing. However, a possible applicable section is section 309, which declares that all beds and bottoms of navigable rivers, streams, lagoons, lakes, sounds, inlets, bays, roadsteads, harbors, oceans, seas, or other bodies of water within the jurisdiction of the territory shall be the property of the territory except such as may be held under some grant or alienation heretofore made. This declaration is also subject to the provisions of Federal laws pertaining to the proprietary rights of the Government of the United States.

In addition, all species of fauna and flora within the territorial jurisdiction, excluding all privately-owned enclosed ponds not exceeding fifty acres, are the property of the U.S. Virgin Islands. The jurisdiction of the U.S. Virgin Islands extends to the 3-mile limit offshore.

This chapter also prohibits the disturbance of any sea turtle nest or eggs. The law further regulates the taking of other species within the jurisdiction of the U.S. Virgin Islands.

Section 323 prohibits the depositing into the waters of the U.S. Virgin Islands oil, acid, poison, or any other substance which destroys or injures fish.

(7) *Title 12, Chapter 10 - Open Shorelines.* This law prohibits the erection, creation, maintenance, or construction of any obstructions, barriers, or restraints across or within the area which runs from the low-water line to fifty feet inland or to the extreme seaward boundary of natural vegetation which spreads continuously inland or to a natural barrier, whichever is the shortest distance. Whenever the shore is extended into the sea by filling or dredging, the boundary of the shorelines shall remain at the line of vegetation as previously established.

(8) *Title 12, Chapter 13 - Environmental Protection.* This law prevents improper development of land and harmful environment changes relating to watershed conditions. The law controls changes in the land which would effect erosion, sediment deposition, flooding, gutting, drainage filling and alteration, pollution, and other harmful environmental changes. Before any real property is cleared, graded, filled, or otherwise disturbed for any purpose or use by the United States Government or anyone else, an earth-change plan shall be approved by the Department of Planning and Natural Resources. Development within the coastal zone and a permit under the Coastal Zone Code will constitute compliance with the earth-change requirements.

The regulations set technical principles and conservation practices to be followed during any land work. These include saving natural vegetation whenever possible, using sediment traps, avoiding unnecessary soil movement, and establishing water retention, slope control, slope stabilization, and other conservation methods.

(9) *Title 12, Chapter 21 - Coastal Zone Management.* This is the U.S. Virgin Islands program under the Federal Coastal Zone Management Act of 1972. The law protects, maintains, preserves, enhances, and restores the quality of the environment in the coastal zone. The law creates a Coastal Zone Management Commission within the Department of Conservation and Cultural Affairs. The Coastal Zone is defined with maps under the U.S. Virgin Islands Code, title 29, chapter 3. Based on the U.S. Virgin Islands Coastal Zone map, Water Island is within the first tier of the coastal zone. The law covers all activities in the area of the immediate coast line and includes activities such as development, structures, piers, filling, underwater cables, rip-rap, ramps, moorings, and scientific experiments within the zone.

The Coastal Zone Management section sets forth goals for first tier development. The first priority for development is for water-dependent uses; the second priority is for water-related uses and the third priority is for additional uses. The U.S. Virgin Islands government has adopted a Coastal Land and Water Use Plan, and this chapter adopts and implements this plan. The law sets a requirement for permits for development within the Coastal Zone. If the development is of submerged or filled lands, additional requirements are imposed, including the requirement of an environmental assessment report, approval by the Governor, and ratification by the legislature.

c. *Title 19 - Health.* This title includes laws and regulations covering drinking water, solid and hazardous waste, sanitation, sewage, solid waste transportation, solid waste disposal and resource recovery, insect and pest control, and waste disposal.

(1) *Title 19, Chapter 51 - Drinking Water.* This chapter sets drinking water standards and treatment techniques to protect the drinking water of the U.S. Virgin Islands. Upon receipt of information that a contaminant is present or likely to enter a public water system and the contaminant may present an imminent and substantial endangerment to the health of persons, the Commisioner may take necessary action to protect the health of such persons.

(2) *Title 19, Chapter 52 - Solid & Hazardous Waste.* This law provides for proper storage, transportation, and disposal of solid and hazardous wastes in the U.S. Virgin Islands. The regulations define hazardous waste as a solid waste which, because of its quantity, concentration, or

physical, chemical or infectious characteristics, may cause or significantly contribute to an increase in mortality or an increase in serious irreversible or incapacitating reversible illness, or pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, disposed of, or managed. Prohibited acts include contaminating surface or groundwater or drinking sources beyond the disposal site boundary, or depositing waste in a manner that will contaminate surrounding air, land, or water, injure the public health or environment, or create offensive conditions and cause substantial dispersion or accumulation of dust on other premises. Anyone engaged in generation, storage, transportation, treatment, disposal, or recovery of hazardous waste must obtain a permit.

(3) *Title 19, Chapter 53 & 55 - Sanitation and Sewage.* These chapters deal with water containers, privies, sewer systems, garbage collection, and other sanitation facilities.

(4) *Title 19, Chapter 56 - Solid Waste Transportation.* All waste shall be transported in such manner and in such vehicles as to avoid spillage, leakage, or wind scattering of contents. Special transportation requirements for certain hazardous waste may from time to time be established by regulation of the Commissioner of Conservation. These rules may include facilities and requirements for activities whether on or off the site of generation.

(5) *Title 19, Chapter 56A & 71 - Solid Waste Disposal, Resource Recovery, and Antilittering.* These chapters deal with solid waste disposal, antilittering, and recovery of resources, with hazardous wastes being treated under a separate chapter.

(6) Title 19, Chapter 59 - Cemeteries. Cemeteries may not be disturbed.

d. *Title 20 - Highways and Roads.* This chapter covers the construction or use of roadways.

e. *Title 23, Chapter 9 - Fire and Explosives.* A permit is required to keep, use, store, or transport any explosives. During the transportation of explosives, no metal, metal tools, oils, matches, firearms, electric storage batteries, flammable substances, acids, or oxidizing or corrosive compounds shall be carried in the bed or body of any vehicle transporting explosives. Permits are required to store and handle certain flammable liquids.

f. *Title 25, Chapter 1 & 7 - Navigation and Harbor Master.* Harbor administration shall be under the authority of the harbor master. Vessel mooring and anchoring are under the authority of the Commissioner of Conservation. This chapter also prohibits the disposal of pollutants of any kind into the shoreline

area or territorial water of the U.S. Virgin Islands. If this disposal does occur, the pollutants shall immediately be removed or arrangements must be made for the removal of such pollutants to the Department of Conservation's satisfaction.

g. *Title 29, Chapter 3, 5, & 10 - Zoning, Land Planning, and Building Codes.* These three chapters deal with the erection of structures and control the placement and type of structures to be erected. If any structure is to be built, the requirements of these sections will apply to the structures.

3.2.3 Local Laws. There are no local laws which govern activities on the U.S. Virgin Islands beyond the territorial laws.

3.2.4 Department of Defense Requirements. The DoD has established procedures and requirements that may be applicable for many aspects of CWM recovery at FFS. Army regulations and procedures address all categories and activities, including requirements that promote planning and preservation, provide controls, and requirements that regulate and promote cleanup activities. DoD requirements are presented in the Generic report. DoD is obligated to follow their own regulations and procedures. However, Army regulations (for example, AR 200-1) could be considered relevant and appropriate requirements for the FFS CWM recovery project. The Federal and state requirements should be applicable to the CWM recovery project unless more stringent Army requirements are determined during an ARARs evaluation to be applicable for the program. Army procedures are considered to be the authoritative approach for performing certain tasks. This is particularly true for investigating and handling explosively- and non-explosively-configured CWM.

3.2.5 Department of Interior Requirements. The land which encompasses the FFS site belongs to the DOI. Activities undertaken by the DoD on this land are subject to the regulations of the DOI unless modified by agreement. The DOI has delegated control of Water Island to the Territorial and International Bureau. This Bureau has leased this land to a private individual. The Bureau does not currently have any regulations concerning hazardous wastes at this site.

3.3 Applicable Requirements

This section addresses how the regulations discussed in paragraph 3.2 would apply to the different activities of the CWM recovery operations at FFS. This is not intended to be an all-inclusive discussion of applicable regulations, but rather to address the more significant requirements. A cross-reference of potential ARARs and their applicability to individual CWM recovery stages at FFS is provided in appendix O.

3.3.1 Baseline Assessment Techniques. Baseline assessment techniques consist of field and analytical methodologies used to investigate the nature and extent of contamination at the FFS CWM site. The assessment techniques also include personal and area monitoring techniques designed to monitor the safety of workers and the public during site investigations, site cleanup, and storage, transport, and disposal of recovered CWM.

There are no regulatory laws or regulations that designate the use of specific sample collection or analytical methods. However, the USEPA, DoD, and many state organizations have developed guidance documents and analytical procedures for sample collection and analysis of soil, air, water, and waste media. The selection of sample collection and analytical methods for the FFS CWM site investigation and cleanup will depend on site conditions and the intended use of the data. USEPA-approved procedures and analytical methods should be reviewed for applicability to potential contaminants found at FFS. It should be recognized that the DoD has procedures and analytical methods which could complement the USEPA procedures. These procedures and methods are needed because existing USEPA analytical methods do not address all chemicals of concern (for example, agent and munitions).

The U.S. Virgin Islands territorial laws would need to be reviewed for applicability to all phases of the remediation process as part of the baseline assessment. The official ARARs listing would be developed based on this assessment. Some U.S. Virgin Islands codes, which would most likely be applicable during this phase, are addressed in the following paragraphs.

Due to the importance of water resources on the U.S. Virgin Islands, 12 VIC sections 151-167 provides approvals and requirements for well drilling. These requirements should be reviewed for their applicability to drilling monitoring wells during the baseline assessment. Requirements for wells drawing less than 500 gallons of water per day appear minimal.

In addition, as indicated in section 2.2.8 and 2.2.9 of this scoping study, significant cultural resources and endangered species have been identified on Water Island. Potential impacts to these resources must be evaluated during the baseline assessment and considered in the selection of the remedial action.

Based on the U.S. Virgin Islands coastal zone map, Water Island is within the first tier of the coastal zone. The Coastal Zone Management (CZM) Act requires that all developers in the first tier of the coastal zone obtain a CZM permit. The permit process requires the developer to minimize negative impacts on the land and waters of the U.S. Virgin Islands. Section 911 (c) (5) prohibits any committee of the CZM commission or the commissioner from granting a CZM permit unless either one finds that there will be compliance with the U.S. Virgin Islands territorial air and water quality standards. Although actual permits are not required under the CERCLA process, the intent of this requirement will need to be met for all phases of the remediation process and considered during the baseline assessment.

3.3.2 Excavation. Excavation activities involve techniques to unearth and recover buried CWM. Federal and territorial requirements will restrict excavation activities to prevent the release of contaminants to the air, water, or soil. These restrictions are intended to protect public health and the environment during excavation. Worker safety will be ensured through the enforcement of OSHA requirements and through implementation of DoD procedures for handling CWM.

Just prior to excavation, trees and vegetation may need to be cleared. Per 12 VIC section 123, approval is required from the U.S. Virgin Islands' government prior to cutting any tree or vegetation within 30 feet of the center of any natural water course, or within 25 feet of the edge of the water course, whichever is greater. This will affect clearing activities at the north end of former test area 4, the Flamingo bay area, and the former test area 6 near the shoreline.

The U.S. Virgin Islands Environmental Protection Act requires that an earth-change plan be filed before any person may clear, grade, fill, or otherwise disturb land for any purpose. If the earth-change plan is satisfactory, an earth-change permit is typically issued. Since recovery of CWM at FFS is to be conducted under the authority of CERCLA, an earth-change plan should be submitted and approved, but a permit need not be issued. A copy of an earth-change plan permit application is included in appendix P.

Also, 12 VIC chapters 1 and 2 prohibit the pruning, cutting, removing, or otherwise disturbing any growth of mangroves without a permit. Sites will need to be surveyed for these plants prior to clearance.

The Water Pollution Control Act (WPCA) has a comprehensive definition of waters of the U.S. Virgin Islands. The waters include all waters within the U.S. Virgin Islands, including surface and underground water, seas, oceans, water courses, and wells. The WPCA prohibits the discharge of any pollution into the waters of the U.S. Virgin Islands without a discharge permit. Title 12 VIC § 185 (g) outlines prohibitions against issuing permits to authorize discharges in certain instances. This includes the discharge of any radiological, chemical, or biological warfare agent or high-level radioactive water. The term pollution also is defined very broadly. Pollution means alteration of the physical, chemical, or biological properties of any waters of the U.S. Virgin Islands, including changes in color, temperature, taste, turbidity, and odor. A Territorial Pollution Discharge Elimination System (TPDES) permit is required to discharge into U.S. Virgin Islands waters.

During excavation at FFS, groundwater will most likely be encountered, particularly in the Flamingo Bay landfill area. If excavation is conducted in this area, this water will need to be monitored and may need treatment prior to discharge. If agreed-to discharge limits from the CERCLA process are met, a permit is not required. Discharge of this groundwater will need to be coordinated with the U.S. Virgin Islands government to establish approved procedures. In terms of the prohibition on discharging any chemical warfare agent, groundwater can be monitored for the presence of chemical agents. However, detection techniques are not available to prove there is not any agent present. The Army may need to submit a proposal indicating the lowest detectable level and the health effects at that level in order to obtain approval to discharge.

3.3.3 Packaging. Packaging of recovered CWM facilitates handling, interim storage, and transportation. The packaging of hazardous material (for example, CWM) is governed by federal laws and territorial requirements.

DOT regulations represent the minimum regulatory requirements for shipping non-leaking CWM. No regulations were identified that specifically govern the packaging of leaking CWM.

Army regulations have been developed to package chemical weapons and material that are part of the United States stockpile as part of the Chemical Stockpile Disposal Program. This stockpile may pose different hazards than recovered CWM. These Army regulations may not directly apply to recovered CWM but will be useful if packaging systems for the non-stockpile mission are developed.

Authority to regulate the storage, transportation, or disposal of hazardous waste has not been delegated to the U.S. Virgin Islands but has been retained by the USEPA. The definition of hazardous waste under the U.S. Virgin Islands regulations is more inclusive than the Federal definition. U.S. Virgin Islands Hazardous Waste Regulation §1560-500 specifically includes poisons and toxic chemicals as hazardous waste. Since all chemical agents are class A poisons, it is likely that they would be categorized as hazardous waste under these laws on this basis. U.S. Virgin Islands Hazardous Waste Regulation §1560-502 indicates the Commissioner of Conservation and Cultural Affairs may require separate, special storage or waste containers or methods for the storage and handling of hazardous wastes. Hazardous waste containers must conform to the requirements of 40 CFR 265(I) and (J) and are to be clearly marked "Contains Hazardous Waste Material." These are the federal RCRA requirements for the use and management of containers and tank systems used to store hazardous wastes. In addition, RCRA requires hazardous waste (for example, CWM) be characterized, manifested, labeled, and reported in accordance with 40 CFR 264.13 and 40 CFR 264.70-77.

3.3.4 Interim Storage. Interim storage facilities of hazardous waste (for example, recovered CWM) is governed by Federal, territorial, and DoD requirements. These requirements restrict the following interim storage activities: siting, design, construction, and operation. Siting requirements prohibit the construction of interim storage facilities when the facility is incompatible with current and adjacent land uses. A comprehensive description of the RCRA and DoD regulations which would apply to an interim storage facility is provided in section 8 of this report.

Requirements for the storage of explosives are provided in 23 VIC § 712 and 713. Explosives must be stored in approved explosive magazines located from neighboring buildings, highways, and railways at distances in conformance with the American Table of Distances for Storage of Explosives.

3.3.5 Transportation. Transportation activities involve all aspects of planning and moving recovered CWM by road on Water Island or by air or water to offsite locations.

The regulatory requirements for transporting hazardous waste, (for example, CWM), include Federal, territorial, and DoD requirements. Federal requirements include RCRA, CERCLA, and DOT regulations. DoD requirements include Army regulations and Army Materiel Command (AMC) regulations for the management of chemical

surety materiel (CSM). Non-leaking CWM could be transported as a minimum according to DOT regulations. RCRA and DOT regulations are the primary requirements that will govern the transportation of recovered CWM by road, air, or water. However, the DoD requirements for handling CWM can complement Federal regulations and help identify procedures for transporting recovered CWM by road, air, and water.

Transportation of hazardous material on the navigable waters or contiguous zone of the United States by a vessel with a capacity of 250 barrels or more is subject to the laws which regulate the U.S. Coast Guard. The transportation in the waters of the U.S. Virgin Islands are also subject to the local jurisdictional control of the harbor master and the Commissioner of Conservation.

Requirements for the transportation of explosives are provided in 23 VIC § 714. Detonators cannot be transported over the highways of the U.S. Virgin Islands on the same vehicles with explosives. This regulation also provides vehicle and labeling requirements and stipulates other items which may not be transported in a vehicle also transporting explosives. These items include flammable substances, acids, and oxidizing or corrosive compounds.

The U.S. Virgin Islands wildlife laws prohibit flying over any off-lying island at an altitude of less than 1000 feet.

3.3.6 Onsite Treatment. A preliminary evaluation of onsite treatment technologies which could be applicable for recovered CWM has been performed and is provided in the Generic report. CERCLA specifies procedures for identifying, evaluating, and selecting the most appropriate cleanup action from an evaluation of remedial alternatives. Onsite treatment represents a category of remedial alternatives that involve treatment technologies that are constructed and operated onsite.

If onsite treatment is selected as the cleanup action at FFS, Federal, territorial, and DoD requirements will govern the siting, design, construction, and operation of a treatment system.

The U.S. Virgin Islands has established air emission standards under the Air Pollution Law. Per 12 VIC § 216, tests may be required to be conducted for any new or existing fuel-burning or control equipment to insure it is within regulatory limits.

As mentioned previously, developers in the first tier of the coastal zone (which would include Water Island) are required to obtain a Coastal Zone Management (CZM) permit. Although actual permits are not required under the CERCLA process, the intent of this requirement will need to be met and extensive coordination with the U.S. Virgin Islands government would be required prior to treating recovered CWM onsite.

3.3.7 Contingency Planning. Contingency planning involves the development of policies and procedures used during emergencies involving the release of chemical agent through leakage or detonation of chemical munitions (for example, from

recovered CWM). Contingency-planning activities are governed by Federal, territorial, and DoD requirements. All Federal and territorial hazardous waste management requirements will apply to the recovery, transport, storage, disposal, and contingency-planning activities.

Federal requirements include RCRA, CERCLA, NEPA, and OSHA. The DoD requirements include, but are not limited to, Army regulations and AMC regulations. RCRA regulates the management of hazardous waste, which includes recovered CWM. CERCLA will establish the general program objectives that ensure that the public and the environment are protected during cleanup. OSHA and DoD requirements will be the primary requirements that specify procedures and equipment to be used during emergencies.

The selection and use of contingency equipment during the FFS cleanup will be governed by policies and procedures developed by Federal, territorial, and DoD programs. No regulations were identified that specifically govern the selection and use of contingency equipment for managing CWM.

OSHA and DoD requirements and procedures are considered most applicable for identifying personal protective equipment (PPE) and other contingency equipment potentially needed during FFS CWM recovery activities.

OSHA and other organizations have developed guidelines for assessing chemical and physical hazards for industrial substances. OSHA has also established enforceable standards (such as
permissible exposure limits) which identify exposures above which protective clothing and respiratory protection must be worn. Currently, there are no OSHA standards for military chemical agents. Only the DoD has established standards for chemical agents. Without OSHA requirements, the Army standards are recommended to ensure the safe handling and treatment of CWM.

Chemical agents have long been controlled and handled by the Army, and the Army has established an emergency response system for chemical accidents and incidents. Thus, the Army program guidelines could be applicable requirements and could help establish specific plans and procedures for managing recovered CWM during emergencies. However, some DoD contingency equipment does not meet OSHA standards, particularly when the DoD equipment is unique to military operations.

A requirement of 12 VIC chapter 9 is that if a source has the possibility of releasing any regulated air contaminate, then an emergency response plan shall be prepared, approved by the Commissioner, and maintained by the owner or operator of the source.

3.4 Conclusions and Recommendations

The principal regulations which would govern the FFS would be CERCLA and the amendments enacted as the Superfund Amendments and Reauthorization Act

(SARA). Other Federal, U.S. Virgin Islands, DoD, and DOI regulations may apply, depending on the activity undertaken at the site.

Water Island is a Federal facility owned by the DOI. Since Water Island is not on the NPL, authority to remediate the area as a CERCLA site could be obtained by DOI under section 122 of CERCLA. As an alternative, an agreement could be established between DoD and DOI under section 122 providing DoD the authority to carry out the response action. It is recommended that an agreement be established between DOI and DoD, providing DoD the authority to carry out the CERCLA response action.

Since Water Island is owned by the DOI, DOI regulations will be applicable. The DOI has delegated control of Water Island to their Territorial and International Bureau. The Bureau does not have any regulations concerning hazardous waste at this site.

An applicable or relevant and appropriate requirements (ARARs) evaluation is needed to select the most applicable requirement, particularly when a FFS remediation activity is governed by no specific regulation or by several, conflicting regulatory requirements. The results of a preliminary ARARs evaluation has identified some primary federal and territorial requirements that will govern CWM investigations and remediation efforts at FFS.

RCRA regulations have not been delegated to the U.S. Virgin Islands. Therefore the Federal RCRA requirements will apply.

Water Island is in the first tier of the coastal zone. The U.S. Virgin Islands government requires more extensive reviews and approvals for developers within the first tier of the coastal zone.

It is recommended that a report developed by the National Park Service, documenting a cultural resource field investigation conducted in September and October 1992, be obtained once it is released to the public. In addition, it is recommended that the recent survey on threatened and endangered species on Water Island be obtained. These findings and potential impacts to these resources should be considered in the baseline assessment. In addition, it is recommended that sites which will require clearing be surveyed for mangroves. If any mangroves require clearing, approvals will be required per 12 VIC chapter 1 and 2.

SECTION 4

RISK MANAGEMENT AT THE FORMER FORT SEGARRA

4. RISK MANAGEMENT AT THE FORMER FORT SEGARRA

This section presents risk management measures which should be considered when planning a remediation effort at the Former Fort Segarra (FFS), including a summary of risk assessment techniques discussed in the Generic Site Scoping Study, the framework for a hazard assessment at FFS, management of risk during the various remediation phases at FFS, and specific recommendations for FFS. This section does not contain a risk assessment for the FFS recovery operation but does discuss the framework for developing a risk assessment using standard Army procedures.

There are two types of risk associated with a chemical warfare materiel (CWM) recovery operation. The first type is the immediate or short-term risk concerns associated with the release of lethal concentrations of chemical agent or the blast effects of a munition functioning. These risks are discussed in this section. The second type is the long-term or chronic type of risk normally considered as environmental risk. An environmental risk assessment is required under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and is discussed in section 5.

4.1 Risk Assessment Techniques

Risk is defined as the probability of an accident occurring times the potential consequences of that accident. In the case of CWM recovery operations, the risk analysis would primarily focus on accidents with the potential to release chemical agent during the various phases of the remediation process. Much of the background information in section 2 could be used to develop a risk assessment for CWM recovery operations at FFS. Information on CWM operations in the late 1940s could be used to determine the most likely items which might be recovered and the possible accidents associated with the recovery, transport, and treatment of these items. Potential consequences from these accidents could be determined by estimating the downwind hazard associated with these accidents. The population distribution data coupled with wind-rose and mixing-height data from section 2 would be necessary to calculate the potential consequences. Meteorology conditions are favorable at FFS because the predominant wind direction is away from the more populated areas.

The element which is missing for this analysis is the potential accidents which could occur based on past CWM operations as well as the manner in which the agent released in those accidents could be dispersed into the environment. Section 9 of the Generic report presents the theories and procedures which could be used to define hazard severity categories and accident probabilities for a CWM recovery operation. The hazard analysis techniques developed assumes that CWM recovery planning will include compliance with PM Cml Demil 385-1, the Chemical Demilitarization Safety Program. This includes the assignment of risk assessment codes (RACs) as defined

by AR 385-10, the Army Safety Program. A RAC should be determined for each phase of the remediation process to include excavation, onsite destruction, transportation, etc. Factors that influence the assignment of this code were explained in the Generic report.

It is likely that a hazard severity of catastrophic or critical would be assigned at FFS due to the possibility of encountering chemical or explosive munitions or lethal components. Examples of variables that can influence the assignment of a RAC and hazards peculiar to a CWM recovery operation are detailed in section 9 of the Generic report. This generic listing of potential hazards was used to generate a site-specific list for FFS.

Some assumptions used in developing the risk assessment techniques generated in the Generic report and applicable to FFS include the following:

- CWM recovery planning will include compliance with Department of Defense (DoD) standards for safety, incorporating MIL-STD-882C, System Safety Program Requirements.

- System safety engineers will be included during preparation of actual risk assessment and hazard analysis.

- Initial identification of any unexploded ordnance (UXO) or CWM will be done by personnel who have been trained at the U.S. Naval Explosive Ordnance Disposal (EOD) school and who are experienced in chemical UXO recovery.

- Recovery operations and any subsequent onsite treatment or disposal will be done after completion of an approved work plan that includes safety management. Any disposal conducted under emergency procedures will be done only when no other alternative exists and the hazard presented is immediately dangerous to life and health. For this risk assessment, the mere existence of CWM or agent does not constitute an emergency.

- All operations involving handling of CWM or UXO will use personal protective equipment (PPE) according to Occupational Safety and Health Act (OSHA) standards, even though CWM recovery may be military-unique.

- Any required render-safe procedures (such as disarming or defuzing) will be done by properly trained and certified EOD personnel. No assumption was made that they must be active duty military.

- The probability of an accident is difficult to determine for unknown sites. As more information is known, probabilities can be better defined (increased or decreased) for concerns like those listed in the Generic report.

4.2 Hazard Assessment at the Former Fort Segarra

Systematic identification of hazards is central to the concept of system safety and is best accomplished by conducting a hazard analysis. The intent of a hazard analysis is to structure the safety review process to minimize the chance of having an unidentified potential for receiving harm. By comparison, risk analysis seeks to analyze entire groups of hazards for their consequences. The following paragraphs first include a search for hazards associated with a CWM recovery operation. It does not address how these hazards could be mitigated. The next step would be to describe the magnitude of the hazards and state, where appropriate, efforts required to control them.

Background information shows that non-standard munitions and agents were involved in tests at FFS. Items that are currently used only for nontoxic chemical agents (such as, smoke pots) were filled with nerve and blister agents during testing. Munitions were static fired by using electric blasting circuits instead of fuzing systems normally associated with these types of ordnance. Water Island was not used as an impact area for fired or dropped munitions except for possible display purposes. At least one firing of 4.2-inch mortars was conducted in Area 4 of Water Island to demonstrate screening smoke. The mortar used probably contained white phosphorus (WP) with an internal explosive burster to produce the smoke clouds. This demonstration apparently did involve misfired and possibly dud-fired munitions.

To assist with a risk assessment, background information should be used to define a maximum credible event (MCE). An MCE, as defined by DA Pam 50-6, is the worst single event that could occur at any time with maximal release of chemical agent. The event must be realistic with reasonable probability of occurrence. The likelihood of encountering a fuzed, explosive-filled munition instead of a chemical munition appears less likely at FFS than in test areas that also served as impact areas. The MCE for FFS could be taken as the largest release of agent which could result from the detonation of a single CWM item which was known to have been stored or tested at FFS. Based on munition types removed from Water Island, the MCE might be defined as a U.S. 500-pound, or a pre-World War II (WWII) German 250-kilogram, sarin (GA)-filled bomb with internal burster. The instantaneous release of agent from a 1-ton container is only likely for highly-volatile or gaseous agents. Once an MCE is decided upon, hazard zones can be predicted for workers and the public.

The most probable event (MPE) may be difficult to determine until intrusive work is begun. An MPE, as defined by DA Pam 50-6, refers to the worst potential event likely to occur during routine handling, storage, maintenance, surveillance, or demilitarization operations that results in the release of agent and exposure of personnel. Discovery of armed, fuzed munitions seems unlikely, but thin-cased containers with volatile agents are possible. Assigning actual probability to each possible combination of munitions and events will have to be performed continually throughout the investigation phase of the project.

The MPE could be taken as the hazard associated with an explosion from an intact 500-pound bomb containing solidified cyanogen chloride (CK). San Jose Progress Report Number (SJPRN) 135 involved a surveillance test of unstabilized CK in M70, M78, and M79 bombs. Four of the M78 bombs (500-pound) were found to be largely solid and the disposition of these bombs is unaccounted for. When unstabilized, CK polymerizes and forms cyanuric chloride. Further research indicates that this polymer reacts violently with water and other solvents. FM 3-9 indicates that CK tends to polymerize in storage and may explode. No additional information regarding explosive properties of polymerized CK has been found.

This hazard could result from puncturing the intact round during excavation, exposing the polymerized CK to the salt water environment and resulting in an explosive reaction. The fragmentation distance for a bomb with polymerized CK may be greater than that calculated by using the explosive weight of the burster. It is unknown whether these bombs were explosively configured during the surveillance test. If so, the greater distance should be used as the MPE.

A second example of an MPE for FFS might be the hazard involved in rupturing a smoke pot with residual agent and smoke. Test reports indicate that as much as 3800 cubic centimeters of agent remained in the smoke pot at the conclusion of the test. If these items were buried without first removing or decontaminating the residual agent, the smoke pot could have containerized the agent and precluded natural decontamination by the salt water environment. Selection of the MPE will effect contingency planning in addition to the hazard assessment.

4.3 Risk Management at the Former Fort Segarra

4.3.1 Risk during Excavation. A site-specific hazard analysis and an initial RAC should be established for excavation of CWM prior to making the decision to excavate. A preliminary hazard list should be prepared for each type of excavation operation being considered. Examples of hazards from activities peculiar to UXO operations and operations that can reduce those hazards are included in the Generic report. The preliminary hazard analysis should not be confined to only UXO concerns. For example, confined-space entry and industrial chemical hazards may need to be addressed for some operations.

The preliminary hazard list should be used to assist in determining a site- and operation-specific RAC. The operation with the highest number RAC (that is, the most desirable operation) would be the preferable method from a risk standpoint. The risks during excavation would be the same as those listed in the Generic report. Liquid and gaseous agents were tested and stored on Water Island. There is a possibility that as many as four 500-pound bombs containing solidified CK could be recovered, since the disposition of these items is unknown. The disposition of the smoke pots involved in tests is also unknown.

There is a possibility that agent could be contained in munition bodies or bulk containers or in varying purity in the soil. Disposal practices in that era included

dumping agent into pits with decontaminant, burying components from test firings, and perhaps burying munitions which have malfunctioned. There is also a possibility of encountering WP or high-explosive mortars that failed to function as a result of the demonstration firings.

a. *Concerns That May Increase the Severity or Probability an Accident.* The puncturing of a deteriorated weapons case or bulk container should be avoided to reduce risk of exposure to workers and the public. The steps taken to reduce puncture of casings are given in the Generic report.

   The possibility of misidentifying a munition or a filler, as addressed in the Generic report, is greatly increased because non-standard munitions and fillers were tested at FFS. Specific examples are given in the following paragraphs. Measures to reduce misidentification should include training UXO personnel on the specific identification features of the munitions involved in each test.

   (1) Smoke pots are normally considered by EOD personnel as non-toxic or expended. The smoke pots tested at FFS were filled with distilled mustard (HD), sesquimustard (HQ), or GA. Expended smoke pots may have residual agent with the ash from the pyrotechnic mixture.

   (2) The 4-pound particulate bomblet tested has the same general shape and dimensions of a mass-produced incendiary bomblet. If corroded, it would be difficult to determine which munition is involved.

   (3) Difficulties may be encountered in monitoring for HQ. Very little information is available on this agent since it was experimental and never developed on a large scale. It was typically a mixture of 76% mustard and 24% sesquimustard, so monitoring techniques for other H-series agents may apply.

   (4) Bomb bodies used for agent tests may have had filling and testing valves installed. These valves may be confused with fusing systems. Depending on valve configuration and placement, it may cause a bomb to be misidentified as a pressure bottle or other container.

   (5) Bombs filled with volatile agents may be considered empty even though residual amounts of agent are present.

   (6) High-explosive, 4.2-inch mortar rounds were stored on Water Island. EOD personnel should be aware that recovery of rounds containing high-explosives is possible.

   The risk of encountering munitions that will not fit standard shipping containers may be increased if static firing systems or valves were left in place. EOD procedures would preclude removal of such items. Reduction of this risk involves having various sizes of containers available.

There is a risk that geophysical survey instruments will produce inaccurate results because of ferrous interference at the site. There is additional risk of not detecting small munitions because of case construction or material. Smoke pots and thin-cased bombs may be harder to detect under the same conditions that a small chemical projectile would be detected. Measures to reduce interference are discussed in the excavation section of the Generic report.

Use of active detectors [for example, ground penetrating radar (GPR)] may not be permissible when searching for static-fired munitions. Personnel interviewed stated that conventional electric firing circuits were used for static tests. It is doubtful that the wires used for the firing circuit were shielded or that the lengths were standardized. Therefore it will be difficult to certify that active detectors are safe for use with the suspected ordnance. EODB 60A 1-1-12 provides more information.

Risk of exposure to levels of H-series mustard above permissible exposure limits (PELs) for unprotected workers may be increased because of the time it takes for low-level monitors to measure and sound an alarm for this agent. Use of supplied air respirators or a self-contained breathing apparatus (SCBA) should reduce this risk for workers.

There is a risk of encountering CK. This agent can penetrate mask filters upon prolonged exposure. This may preclude the use of shelters that might concentrate vapors. Use of supplied-air respirators may be required when working in CK contamination. Any use of a shelter may also require use of ventilation and filtering designed for CK vapors.

There is an increased risk of heat-related injuries while wearing PPE in the FFS climate. Selection of PPE should take wear-time into account. Use of cooling vests and working during hours of darkness may increase worker wear-times.

There is a risk that selected PPE, to protect against agent vapors, may induce static electricity sufficient to function electrically-fired munitions. Ensuring that PPE has been certified for use by the Army Materiel Command (AMC) Surgeon General for use in ammunition operations should reduce this risk.

b. *Concerns that may Decrease the Severity or Probability of an Accident.* The risk of a fire causing explosives to function may be reduced because munitions and any possibly exposed explosive would be in the soil. Fire capable of producing excessive heat is unlikely in the soil unless it spreads from equipment at the site to the soil due to an event such as a fuel leak.

The risk of encountering influence fuzing is unlikely because personnel interviewed stated no air-burst tests were conducted.

Risks to the public may be reduced because of limited development in the area. It may be feasible to evacuate personnel during work as a precautionary measure.

The risk of agent being found in a pure state in the soil is reduced if sea water has had contact with any contaminated areas, which may have occurred during storms. FM 3-9 states that dilute alkaline solutions can be used to decontaminate GA. However, GA tends to persist twice as long in sea water than in fresh water.

Areas of Water Island that have not been developed or used as a landfill may be particularly well suited for GPR. Determination of GPR's effect on electroexplosive devices (EEDs) should be made prior to testing at sites that may involve electric firing circuits. This technique may be appropriate for the open area of former Test Area 6.

4.3.2 Risk during Treatment. As with excavation, an initial RAC is established to determine if onsite destruction or offsite transportation, storage, and treatment is preferable from a risk perspective. If the RAC is most acceptable for onsite destruction and the decision is made accordingly, a separate preliminary hazard list and analysis should be prepared for each system considered for disposal. The system with the most preferable RAC should be selected to reduce risks. Examples of activities peculiar to UXO operations and concepts or operations that can reduce hazards are included in the Generic report. As with excavation, the preliminary hazard assessment should not be confined to only CWM concerns. For example, physical and industrial chemical hazards may need to be addressed for some operations.

As a contingency, emergency destruction onsite may be required if conditions preclude handling or offsite treatment. RAC decision criteria may be less applicable if immediate destruction is the only realistic option. The concepts involved in determining a RAC may be useful in selecting which emergency procedure (such as neutralization, detonation, open-pit burning, or some other method) is most preferable.

Risks during treatment may be the release of chemical agent to the environment, as discussed in the Generic report. The risk of detonation of a chemical munition during onsite treatment would be the same as those addressed during any handling operation.

a. *Increased Risks during Treatment.* Risks during onsite treatment may be the result of agent misidentification, causing selection of an inappropriate neutralization chemical. The result could be incomplete neutralization, or for GA, may generate toxic agent vapors during neutralization.

   The risk of incorrect decontaminant is of importance as some munition component materials (for example, aluminum) may not be compatible with neutralization solution (such as caustic soda and water). This risk may be greater at test sites if exotic metals or coatings were involved in testing.

Emergency disposal procedures may not destroy the agent to acceptable levels. If neutralization is selected as the appropriate emergency disposal, it is likely that an increased volume of liquid hazardous waste will result. The additional volume of hazardous waste may increase the probability of an accident but would probably decrease the severity of the hazard because the waste generated during neutralization should be less toxic than the initial agent.

Procedures are not listed in current EOD publications for neutralization of CK. Venting is the emergency disposal option given in EODB 60A 1-1-11. Background information from FFS indicates that venting was not successful for bombs filled with CK if solidified.

Neutralization of solidified CK could result in an explosive reaction. The reactive properties of solidified CK are further discussed in section 10 of this report.

If an onsite treatment system is developed for use at FFS, the hazards may be similar to those involved in the chemical stockpile disposal program (CSDP). Due to the large quantity of chemical items involved in the CSDP, the risk there would be much higher. Additional differences would be related to misidentification of munitions or fillers, which could occur at a non stockpile site as explained in the Generic report. The possibility of combinations of agents and mixtures of agents with other chemicals may compound neutralization problems.

If the onsite treatment system involves removal of explosive components, there is a risk that the removal action (for example, unscrewing burster tubes) may detonate the munition.

Lack of development and transportation systems for Water Island may increase problems in handling and transporting munitions or equipment. This may also impact contingency planning and emergency response.

b. *Reduced Risks during Treatment.* The risk of a release of pure agent to the soil in quantities equivalent to that originally dumped or treated should be reduced. Alkaline properties of sea water may have neutralized some agent. The exception would be H-series blister agent, which tends to form globules that resist oxidation.

The risk that misidentification of ordnance, possible explosive fill, or components that were believed to have been removed should be reduced. Background information demonstrates that few explosively-filled munitions were used on Water Island.

4.3.3 Risk of Explosion. Hazard severity expected from an accidental detonation will probably equate to catastrophic, as most explosions would be capable of causing death. Burning of propellants, pyrotechnics, or the detonation of small amounts of

high explosive (less than an ounce) when not confined in munition bodies may not be capable of causing fatalities.

The probability of an explosion occurring depends on the explosive configuration of munitions encountered. It may be difficult to determine the presence or absence of explosive components in munitions recovered from the soil. Any attempt to remove soil that is imbedded in burster tubes or fuze wells should be done only if it is absolutely required to assure safe handling. Unnecessary removal of soil may puncture deteriorated tubes, allowing agent to leak. It is also possible that hidden but damaged fuze components or primary explosives could be initiated by friction or pressure during cleaning. Use of a preliminary hazard list and risk assessment concepts may assist with deciding whether it is preferable to determine if explosives are present or if it is safer to consider all munitions to be explosively configured.

The potential for explosion and definitions of hazard categories that may apply are explained in the Generic report. Tasks and steps that may increase or decrease the probability of causing an explosion are presented in Section 9 of the Generic report.

As chemical munitions and few WP or explosive munitions were predominantly used on Water Island, the risk of causing a detonation capable of propelling fragments at lethal velocity, causing injury to personnel outside the immediate work area, is reduced. Bombs filled with solidified CK may be capable of producing lethal fragments, due to the explosive properties of deteriorated agent.

The risk of explosion is greater than at general sites because of the use of electrically-initiated static firing systems in lieu of standard fuzing. These firing circuits would not have safety shielding to prevent accidental firing from induced electrical currents.

4.3.4 Risk of Leaking Chemical Agent. Hazard severity for accidental release of chemical agent can vary depending on agent and site characteristics. PM CML DEMIL Reg 385-1 para 6.4.3 and table 3 give definitions for severity categories based on immediately dangerous to life and health (IDLH) and PEL levels for onpost release. During the site-specific hazard analysis, it may be necessary to determine the ability of the agent or munition to reach those concentrations. The risks presented when encountering toxic chemical agents and definitions of hazard severity categories that may apply is explained in the Generic report. Operations and steps that may influence the probability of causing chemical agent release are presented in section 9.

As with accidental explosion, the configuration and condition of the munition will affect the probability of accidental release. Until the actual level of deterioration is known, probabilities will be difficult to estimate. The bombs suspected at FFS include those with very thin bodies.

Background information does indicate the likelihood of encountering toxic chemical agents, particularly fragments and components contaminated with low levels of agent. Any excavation involved in further development of the area may indicate increased

risk of releasing chemical agent. Munition types capable of being chemically filled have been found on Water Island. At least one munition appeared intact.

4.4 Recommendations for the Former Fort Segarra

AR 385-10 and PM CML DEMIL Reg 385-1 prescribe adequate system safety management concepts. These procedures reflect those recommended by the Center for Chemical Process Safety of the American Institute of Chemical Engineers in their Guidelines for Hazard Evaluation Procedures (1985). It is recommended that these standards and guidelines be followed when performing a risk assessment of the FFS remediation effort.

To implement the requirements of the AR 385-10 effectively, it is recommended that a panel of technical personnel be appointed to assist with actual risk assessment. This panel might be modelled after the System Safety Working Group as stated in PM CML DEMIL Reg 385-1. It is recommended that this panel include personnel that are qualified in EOD and Technical Escort Unit procedures, and have experience with CWM and UXO recovery.

After appointment, the panel of technical personnel should review specific and general background information to determine variables that can influence assignment of a RAC for the initial recovery project. This will allow managers to make decisions regarding the safest method to handle the recovery of CWM. Examples of variables that can influence hazard severity and accident probability are included in section 9 of the Generic report.

When a decision is made to implement a specific process (for example, CWM excavation), a specific hazard analysis should be prepared. This will start with a preliminary hazard list that attempts to include all possible hazards. This task, as with RAC variable selection, might best be prepared by a panel of people knowledgeable about the CWM and the system being considered to recover or treat it. Examples of CWM peculiar actions that affect preliminary hazard selection are given in section 9.3 of the Generic report.

Proper implementation of System Safety Management principles, prescribed by PM CML DEMIL Reg 385-1, should accomplish the purpose of that regulation: "providing a safe environment for chemical demilitarization workers, the highest possible degree of safety to the Public, and protection of property from accidental loss."

The primary purpose of any risk analysis is to identify accidents with the highest probability of occurring with the worst potential consequences such that these accidents can be focussed on in developing mitigation measures to reduce the overall risk of the program. Once completed, the risk analysis should be used as a tool to reduce overall risk of the program. Some mitigation measures recommended for FFS might include confining operations to off-season tourism periods. In addition, it may be advisable to limit operations to when predominant winds are blowing away from populated areas.

Another recommendation for FFS is to conduct further research to determine the explosive characteristics of solidified CK to better understand and mitigate against hazards associated with recovering or treating these items.

SECTION 5

BASELINE ASSESSMENT

5. BASELINE ASSESSMENT

Chemical warfare materiel (CWM) recovery operations consist of four stages: baseline assessment, excavation and recovery, storage, and treatment or transportation and offsite treatment of recovered CWM. CWM recovery operations will typically be conducted as interim response actions (IRAs) under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). These IRAs should specifically address the CWM as part of an overall program of environmental restoration at a site. CWM recovery operations as described here do not include final environmental restoration of the site after the CWM has been recovered.

The principal objective of the baseline assessment phase is to collect sufficient information to support the recommended response action. The baseline assessment efforts need to focus on collecting all the data necessary to evaluate the effectiveness, implementability, and cost of each potential IRA alternative, to aid in selecting the most appropriate alternative while keeping in mind that the selected IRA must not interfere with the final remediation of the site.

The challenge of the baseline assessment is to assess the site with as little intrusive work as possible, which could cause unnecessary exposure to the hazardous materials potentially present at the site. The primary techniques used in this assessment will therefore be geophysical techniques and monitoring of the soil and groundwater for suspect chemical agents and their degradation products. The two phases of the baseline assessment (the preliminary site characterization and the baseline investigation) will be discussed, as will the baseline risk assessment (BRA), which is required to support the no-action alternative. Generic monitoring and geophysical techniques from the site Monitoring Concept Study and the Generic Site Scoping Study which could be used during the baseline assessment, are also summarized. Specific recommendations for the Former Fort Segarra (FFS) are provided.

5.1 Baseline Assessment Phases

The baseline assessment consists of two stages, the preliminary site characterization and the baseline investigation. The preliminary site characterization will qualitatively assess where contamination is most likely to be found and will provide data necessary to plan the subsequent baseline investigation. The baseline investigation will then collect whatever additional data is necessary to support the selection of a remedy. These data will also support subsequent activities, including the implementation of the selected IRA as well as any other subsequent site restoration activities.

The baseline assessment phase will provide workers with information about the current and potential hazards at the site. If contamination is discovered in air, soil,

surface water, groundwater, or sediments, the nature and extent of the existing agent contamination will need to be assessed and defined as part of additional environmental restoration efforts at the site.

5.1.1 Preliminary Site Characterization. During the preliminary site characterization, the site is analyzed to determine the media and locations that should be sampled as part of the baseline assessment. This information will also support monitoring and sampling efforts during the implementation of the selected IRA. To determine where contamination may occur, airflow patterns and migration pathways surrounding each suspected CWM location should be assessed and potential receptors of contamination (either human and ecological) should be identified. This information will be used in the BRA discussed in paragraph 5.2. The BRA is necessary to support the selection of a remedy under CERCLA. The information collected during the preliminary site characterization will also allow for the development of the spill prevention and response plans required per 29 CFR 1910.120.

During the preliminary site characterization, data describing the site is collected and analyzed to develop a conceptual understanding of the site. This data includes data on past and present land uses at and surrounding the site, existing historical and archaeological resources, water features (such as waterways, wetlands, floodplains, drainage patterns, surface water containment areas, and production and groundwater monitoring wells), human and environmental receptors, and potential migration pathways (based on the regional and site-specific topography, geology, pedology, hydrogeology, physiography, hydrology, water quality, meteorology, and air quality). Much of this data has been collected for FFS and is presented in section 2 of this report. The data collected during this preliminary site characterization will not only help to develop an understanding of the site but will also help in the preliminary identification of applicable or relevant and appropriate requirements (ARARs).

If necessary, additional information may also be gathered during the preliminary site characterization by performing, as appropriate, minimally-intrusive field activities (such as geophysical investigations or soil gas surveys) or by sampling and measuring well-water levels in pre-existing monitoring wells, field-mapping the site, or collecting a limited amount of surface soil and surface water and sediment samples as part of the field reconnaissance activities of the preliminary site characterization. These limited field activities would provide for a relatively easy, safe, and effective mechanism to assess the hazards posed by the site and determine the need for further, more complex activities to assess the presence of CWM-related material at the site.

Numerous references are available for performing a preliminary site characterization and the baseline investigation, two of which are the Remedial Investigation/Feasibility Study (RI/FS) guidance document (USEPA, 1988) and the Resource Conservation and Recovery Act (RCRA) Groundwater Monitoring Technical Enforcement Guidance Document (TEGD) (USEPA, 1981). These and other appropriate guidance documents should be consulted throughout the baseline assessment phase.

Upon completion of the preliminary site characterization, the appropriate locations to install any necessary soil borings and monitoring wells and to collect additional surface water, sediment, air, and soil gas samples may be determined, and a systematic sampling plan may then be developed. Should no field activities be performed during the preliminary site characterization, they would then need to be performed as part of the baseline investigation.

5.1.2 Baseline Investigation. During the baseline investigation, the sampling plan developed during the preliminary site characterization is implemented. Migration pathways and potentially contaminated areas identified during the preliminary site characterization are sampled to determine the need for an IRA and to collect data to develop the required engineering evaluation/cost analysis (EE/CA) as part of the IRA remedy selection process under CERCLA.

The data collection and sampling effort conducted during the preliminary site characterization is essentially expanded during the baseline investigation to provide the necessary information needed to select the proper response action to take at the site. The sampling effort is expanded during the baseline investigation by installing and sampling wells in the perimeter of the known or suspected burial area, in an attempt to positively identify the presence of chemical agents or signature compounds that may indicate the presence of CWM-related material in the burial, which in turn may justify the need for a CWM recovery operation.

5.2 Baseline Risk Assessment

A BRA is conducted during a RI/FS for sites being remediated under CERCLA. The BRA provides an evaluation of the potential threat posed to human health and the environment from current site conditions. It provides the basis for determining whether or not a cleanup action is necessary and provides the justification for performing cleanup actions. The BRA is one method used to support a decision to perform CERCLA removal actions (for example, IRAs). Removal actions are cleanup actions performed according to an accelerated schedule that reflects the urgency required to stabilize the situation.

The level of effort required to conduct a BRA depends on the complexity of the site. The goal is to gather sufficient information to adequately characterize the potential risk from site conditions in the most efficient manner possible. The risk assessment process consists of four elements:

- contaminant identification,
- exposure assessment,
- toxicity assessment, and
- risk characterization.

5.2.1 Contaminant Identification. The objective of contaminant identification is to identify the hazardous substances present at the site. Specific contaminants of concern are then selected based on intrinsic toxicological properties, presence in large

quantities, or current or potential migration into critical exposure pathways (for example, drinking water). This information will be used in subsequent efforts during the risk assessment process. The goal is to identify those contaminants that are of greatest concern, whose identification will help ensure that the selected cleanup strategies will address the risks posed by the range of contaminants found at the site.

5.2.2 Exposure Assessment. The objective of the exposure assessment is to identify actual or potential exposure pathways, characterize the potentially exposed populations, and determine the actual or potential extent of exposure. Identification of potential exposure pathways helps determine how contaminants may migrate from a source of contamination to an existing point of contact. An exposure pathway consists of the contaminant source location, the means for chemical release to the environment (for example, groundwater migration, volatilization, surface water runoff, or sorption), the transport medium (for example, air, water, or soil), the point of exposure (for example, workers, nearby residences, or domestic water wells), and exposure route (for example, inhalation or ingestion). This evaluation should consider the current exposures and the future exposures that may occur, assuming a reasonable maximum exposure scenario. The exposure scenario should consider current and anticipated future land uses. The exposure assessment will result in a quantitative value that represents the exposure rate of contaminants to receptors, providing decision makers with an understanding of both the current risks and potential future risks if no cleanup action is taken. The final step of the exposure assessment is to develop a qualitative and/or quantitative estimate of the expected exposure levels resulting from the actual or potential release of contaminants from the site.

5.2.3 Toxicity Assessment. A toxicity assessment identifies the types of adverse health or environmental effects associated with single or multiple chemical exposures. A toxicity assessment also identifies the relationship between the adverse effects and the magnitude of the chemical exposures. This process identifies toxicity information such as carcinogen exposures associated with specific lifetime cancer risk [for example, risk-specific doses (RSDs)] and systemic toxicant exposures that are not likely to present appreciable risk of significant adverse effects to human populations over a lifetime [for example, reference doses (RfDs)]. This information is used in subsequent efforts in the BRA process. Specific information on toxicity of chemical agents can be found in the Site Monitoring Concept Study.

5.2.4 Risk Characterization. Risk characterization is the final element of the risk assessment process. Risk characterization develops and summarizes the potential risks of adverse health or environmental effects for each exposure scenario identified during the exposure assessment. Risk estimates are estimated using information from the exposure and toxicity assessments to characterize potential or actual risk, including carcinogenic and noncarcinogenic risks. The risk characterization to human receptors should involve the summary of risks for each exposure route, from each contaminant of concern, and to each group of receptors. The risk characterization for environmental receptors should involve the summary of potential exposures and anticipated effects to the surrounding ecological receptors.

5.3 Baseline Monitoring Techniques

Baseline monitoring techniques consist of sampling and analysis methods performed to monitor for the release of contaminants during site characterization, and cleanup. These techniques are performed to ensure that the public, workers, and the environment are protected. Baseline monitoring techniques include analytical techniques, laboratory detection equipment, and procedures and equipment for characterizing contaminants in air, surface water, groundwater, soil, and soil gas. A discussion about these techniques is presented in the Site Monitoring Concept Study.

The frequency and duration of sampling during a CWM recovery operation can be initially determined during the baseline investigation but will need to be frequently reevaluated according to changing conditions. The total number of samples will need to be determined on a site-by-site basis, according to the individual media and initial findings involved.

The purpose of the monitoring in the soil or groundwater is primarily to identify the presence of chemical agents or signature compounds that may indicate the presence of CWM related material. Guidance on sample collection in the various medias is provided in the Site Monitoring Concept Study.

Signature compounds or degradation products for the various agents tested or stored on Water Island should be reviewed to support a remediation effort at FFS. For example, thiodiglycol is a degradation product of mustard. Similar to distilled mustard (HD), sesquimustard (HQ) is produced from thiodiglycol. The 2-mercaptoethanol condenses with the thiodiglycol, forming the glycol of sesquimustard, which in turn is chlorinated yielding sesquimustard (Army, 1948). It is therefore suspected that thiodiglycol would also be a degradation product of HQ.

5.4 Geophysical Techniques

5.4.1 Generic Geophysical Techniques. Geophysical survey techniques are described in the Generic report based on past recovery of conventional unexploded ordnance (UXO) and CWM. These techniques are summarized in the following paragraphs.

Geophysical survey instruments capable of detecting buried CWM can be divided into two general categories, active and passive. Active instruments generate a signal and receive the signal back after being bounced off the buried item. Passive instruments merely measure a pre-existing signal generated by the buried site or a naturally occurring signal that is changed in the presence of an object.

Active instruments include self-inductance locators, balanced-bridge locators, ground-penetrating radar (GPR) and electrical and acoustic locators. The signal emitted by these instruments can function electrically-actuated explosives and should be used with some precautions. Some systems are limited in their effectiveness based on the type of soil or other conditions at the site. For example, GPR can be used to identify

anomalies or changes in density beneath the soil. This system is of limited effectiveness in highly conductive soils. When it is effective, it is a superior technique capable of detecting and locating not only ferrous ordnance but non-metallic objects as well.

Available passive locator technologies include magnetometers of the following types: fluxgate, proton precession, optical pumping, superconducting quantum interference devices, thin film, Hall effect, and fiber optic. Thin film, Hall effect, and fiber optic technologies are currently in a research-and-development stage. These systems and there effectiveness under various conditions are further described in the Generic report.

5.4.2 Analysis of Geophysical Techniques for the Former Fort Segarra. Background information on testing at FFS indicates that munitions were fired with conventional electric blasting circuitry. These circuits were located outside the body of the munition and therefore have no metallic shielding. The leg wires used to attach the blasting caps to blasting machines were probably not of a standard length. This would make it harder to determine frequency ranges for transmitters used for detection that would not induce electric current in the firing wires.

German World War II (WWII) bombs were stored on Water island. These bombs may have had electronic fuzing in transverse fuze wells. The bomb bodies or fuze components may have undergone deterioration that altered any shielding. The present condition of metal components may act as an antennae, magnifying electro-magnetic radiation effects.

The use of active geophysical survey instruments that generate a signal that can induce electricity in metal wires or components should be avoided. Passive instruments do not generate any signal. This will limit the types of detection equipment that can be safely employed at FFS.

As expected at many formerly used defence sites (FUDS), the areas that have been abandoned contain large quantities of metal-containing wastes. Portions of Water Island once used for testing were later used for an automobile junk yard and a land fill. This quantity of ferrous material can interfere with detection equipment. Calibrating equipment to consider unknown interference as background may skew the results of any sweep. It may cause small or light-cased munitions (such as smoke pots) to be missed.

Soil temperatures at Water Island should preclude the possibility of UXO moving closer to the surface, as is sometimes experienced at site that have soil freezing and thawing.

As recommended in the Generic report, a combination of various geophysical survey techniques should be considered to reduce the possibility of missing significant contamination. For FFS these techniques may include a review of available background information, including aerial photographs, visual sweeps to find possible

CWM components or depressions resulting from back-filled pits, removal of as many metal contaminants as possible, passive magnetometer surveys, layered excavation, and repeated sweeps.

5.5 Recommendations for the Former Fort Segarra

As recommended in section 5.3, signature compounds or degradation products for the various agents tested or stored on Water Island should be reviewed prior to initiating an investigation at the site.

The use of active geophysical survey instruments which generate a signal that can induce electricity in metal wires or components should be avoided. Passive instruments do not generate any signal. This will limit the types of detection equipment that can be safely employed at FFS.

Many of the areas which may require further investigation at FFS have been used as residential landfills and dump areas. The ferrous material from these dumps can interfere with detection equipment. Calibrating equipment to consider unknown interference as background may skew the results of any sweep. It may cause small or light-cased munitions (such as smoke pots) to be missed.

The remaining part of this section describes each of the areas recommended in section 2.3 as potentially requiring additional investigation and recommends geophysical and monitoring techniques which could be conducted in these areas to collect additional data to support the baseline assessment. The purpose of collecting this data would be to assess the CWM-related hazards at the site and further determine where contamination is likely to be found. This section is not intended to be an all-inclusive listing of investigative work which should be conducted. It does not define the location, number, duration, or frequency of samples which should be collected. However, it does present a proposed approach and discusses the types of information which could be collected at FFS to further definitize the site based on the limited information available at this time.

5.5.1 Flamingo Bay Landfill/Salt Pond Area. The salt pond present in aerial photographs from the 1950s is the primary candidate for recovering buried CWM. This is primarily due to the incident in 1966 when suspect CWM was uncovered. In addition, CWM was shipped on and off Water Island at the Flamingo Bay dock, making the location convenient to discard unwanted items. The salt pond, which was approximately 50 feet by 100 feet, has since been used as a landfill by island residents and is filled. The surface to the former pond is approximately 4 feet above sea level and approximately 75 feet from the shore.

Since this area has been used as a landfill, more extensive environmental damage could result from dredging the area and removing domestic waste and potential CWM. Due to the location of the salt pond and the fact that it is primarily located below sea level, the progressing and receding ocean tides could have acted to naturally decontaminate any residual CWM in this area. The first step in developing a baseline

assessment at this site would be to determine potential migration pathways and identify if contaminants are present. An approach could be to install monitoring wells up and down gradient from the old salt pond to determine if there is a release of hazardous substances, pollutants, or contaminants. This information could be used to determine potential pathways for contaminant migration which would be used in a subsequent investigation to determine the extent of environmental restoration warranted at the site. Samples would need to be taken at varying depths to at least a 10-foot depth since the original salt pond present in 1950 was believed to have been to this depth.

The upgradient wells should be far enough away from the salt pond area to provide true background conditions, allowing for the established contamination associated with the site. Downgradient wells should be located close to the edge of the old salt pond but far enough away that they will not interfere with excavation activities conducted during the recovery phase.

If there are no hazardous substances found in the wells, it may be recommended that monitoring continue on a periodic basis to insure that conditions (for example, release of contaminants) do not change. Based on the monitoring results, other recommended response actions may be to containerize the site or to dredge the salt pond and remove waste material. Geophysical techniques are not recommended in this area since it could not be used to distinguish CWM from other non-Department of Defence (DoD) wastes present in this area.

5.5.2 Flamingo Bay Shoreline. During the site visit, suspect CWM debris was identified along the shoreline in the Flamingo Bay area. A concrete-filled bomb was present, which was reportedly washed to shore during Hurricane Hugo. In addition, deteriorated compressed gas cylinders and drums were located in the area. It is believed that since the old salt pond was adjacent to this area, no additional burials would have been developed in this area. Any other CWM contamination in the Flamingo Bay area would most likely be near the surface. It is recommended that random shallow soil samples be analyzed for chemical agents and their degradation products and that geophysical techniques be used to identify CWM in this area. CWM will need to be distinguished in this area from non-DoD material since there is a significant quantity of other trash which has been disposed in this area. Based on personnel interviews, this area was also used to open-burn trash prior to the 1970s, when USEPA regulations precluded this.

5.5.3 Northern Portion of Test Area 4. The open area at the northern end of test area 4 was used for smoke pot and M70 bomb tests. In addition, burster charges were detonated and destroyed at the close of the San Jose Project. A large portion of the area has since been dredged to cut a channel to the marina. There are portions of the test area on either side of the dredged channel. Since this was a test area, it is suspected that CWM would only be present at the surface of this site. It is recommended that random shallow soil samples be taken and analyzed for chemical agents and their degradation products. In addition, it is recommended that a geophysical survey be made of the area for metal objects near the surface.

5.5.4 Test Area 5. Test area 5, approximately 3.3 acres, was the site of one M70 bomb test. It is adjacent to test area 4, where the majority of CWM tests were conducted on Water Island. A depression exists in area 5 which was also present in the 1950 aerial photographs of that site. It is recommended that random shallow soil samples be taken throughout the site, with concentrated samples taken around the depression. The test area was used to accumulate and burn debris from Hurricane Hugo. This debris should be removed and a geophysical survey should be conducted to search for CWM.

5.5.5 Test Area 6. Test area 6 is a 2.3 acre site located on the eastern shore in the southern part of the island. Tests conducted in this area were those with onshore wind. This site has been significantly developed along the ridge line. The lower part of the site is along the rocky shoreline, undeveloped and heavily grown with vegetation. There does not appear to be any significant debris on the surface. Since the tests conducted in this area were those with onshore winds, it is suspected that they would have been conducted in the flat area near the shoreline. It is recommended that random surface soil samples be collected in the flat, undeveloped area near the shoreline and that a geophysical survey be conducted of the area.

SECTION 6

EXCAVATION

6. EXCAVATION

This section formulates recommended excavation techniques for chemical warfare materiel (CWM) remediation at the Former Fort Segarra (FFS). Included is a description of site-specific characteristics which should be considered when developing excavation techniques for FFS, a summary of generic excavation techniques as described in the Generic Site Scoping Study, ways these techniques would apply to FFS, and recommended excavation techniques for FFS.

6.1 Assumptions at the Former Fort Segarra

In this section, it is assumed that a decision process has resulted in the requirement for excavation of suspect CWM. The suspect items have been located and identified using appropriate geophysical techniques for the soil type and condition at FFS.

Excavation techniques should be developed based on FFS site characteristics and on suspect CWM identified from historical documentation. Based on the background analysis contained in section 2 of this report, items most likely found during the recovery operation include remnants from the M70 mustard bomb tests, cyanogen chloride (CK-filled) M78 bombs, and smoke pots containing residual distilled mustard (HD), sarin (GA), sesquimustard (HQ), and smoke. It appears that the M70 bombs were electrically fired and therefore may be sensitized. It is suspected that the CK-filled M78 bombs were not explosively configured since they were only involved in storage surveillance tests. The bombs were most likely disposed after they were found to be largely solid; therefore, it is possible they were filled with CK and solidified CK when buried. Test reports indicated as much as 3800 cubic centimeters of mustard remained in one smoke pot following testing. Ordnance and explosive waste (OEW) experts should be aware of these findings during the excavation operation and react accordingly if any of these items are found. In addition, information on CWM items and agents stored and tested at FFS is included in Appendixes G and H. This type of information concerning the munitions stored and tested at FFS should be available to onsite OEW experts to facilitate proper identification of recovered CWM.

There are two types of areas to be investigated on Water Island which may necessitate employment of separate excavation techniques. These include the Flamingo Bay area and the test areas on Water Island. The Flamingo Bay area was the location of a salt pond in the 1950s. This was the location where chemical bombs were discovered during a mucking operation in 1966 and, based on the background analysis in section 2, is believed to be the most likely area on Water Island for CWM to be recovered. It should be noted that excavation is typically not conducted in a landfill area when the benefits of the excavation are outweighed by the risk associated with the excavation to the public, workers, or the environment. Risks associated with

the excavation of possible CWM as well as non-Department of Defense (DoD) waste should be considered prior to excavating the landfill area.

6.2 Summary of Generic Techniques

Several excavation techniques currently exist that are suggested for use in accessing and recovering buried UXO, including excavation-by-hand (manual), excavation with machinery (mechanized), and excavation with more novel techniques such as high-pressure water jets. These same techniques may be applicable to buried CWM as well. The Generic report provides detailed descriptions of these techniques. The Site Monitoring Concept Study discusses monitoring strategies for the excavation and recovery phase.

6.2.1 Manual Techniques. Manual techniques are often the most common means used to excavate buried suspect CWM. Most CWM and conventional UXO recovery projects evaluated as part of this study have used manual techniques alone or in conjunction with other methods.

The advantage of manual excavation is the ability to delicately and deliberately approach and handle sensitive items such as CWM. For CWM near the surface, manual techniques may also be the fastest and simplest.

However, manual excavation is the most labor-intensive of the various techniques. This disadvantage is further exacerbated by the required use of personal protective equipment (PPE) when dealing with CWM. Besides being slowed by the weight and confinement of the PPE, work schedules are limited, especially under warm conditions, to avoid heat exhaustion or excessive fatigue. For example, while wearing an Army level A ensemble (full-body outergarment, boots, hood, gloves, and respirator), Army regulations limit PPE wear times to a schedule as shown in table 6-1. If the CWM is explosively configured or its configuration is unknown, the additional use of blast and fragmentation suits would further compound this disadvantage. Thus, a relatively shallow excavation may take a significant amount of time and labor to complete manually. These conditions may expose personnel to the potential CWM hazards of detonation and chemical agent exposure for a longer period of time than any other method.

Other drawbacks of manual excavation include difficulty in digging through hard or rocky layers of soil and the significant use of skilled manpower and shafting materials required when excavating deeply-buried CWM. Nonsparking, nonmagnetic hand beryllium tools, required in sensitive explosive environments, also have the disadvantages of high expense, potential toxicity, and a tendency to bend or splinter.

Despite these drawbacks, manual excavation techniques are being used routinely in the recovery of CWM at various sites, including the Old O-Field disposal area at the Edgewood Area of Aberdeen Proving Ground.

Table 6-1. Wear Times for Level A Protective Clothing Ensembles*

Ambient Temperature (°F)	Maximum Wear Time (hours)
Above 90	¼
85 - 90	½
80 - 84	1
70 - 79	1½
60 - 69	2
50 - 59	3
30 - 49	5
Below 30	8

* Local medical authority may use discretion to vary the wearing time depending on such factors as relative humidity, use of cooling suits, and activity levels. Source: DA PAM 385-61.

6.2.2 Mechanized Techniques. Mechanized techniques include conventional, remote, force-feed remote, and additional techniques.

a. Conventional Mechanized Techniques. The use of conventional mechanized techniques for excavation activities is the preferred method in the construction industry. Equipment such as excavators, backhoes, draglines, and dozers are regularly used for excavation from depths of a few feet to several hundred feet. Advantages of using machinery of this type include its ability to dig through hard surfaces and move large volumes of earth quickly and with limited labor. For the same reasons, conventional mechanized techniques have also been used, at least in part, to excavate CWM.

   As with all of the evaluated excavation techniques, conventional mechanized techniques are not without their disadvantages. Equipment of this type is not always readily available, and skilled operators can be in short supply. Even rarer are skilled operators with experience working with UXO or in other dangerous areas containing such items as gas pipe lines or hazardous waste. Even when these resources are available, time and money may be required to transport and prepare the machinery for operation. In some situations, limited access to or within the recovery site will restrict or prohibit the use of large and heavy excavation equipment. However, the biggest disadvantage of conventional mechanized techniques is the potential to detonate explosively-configured CWM or cause leakage to delicate CWM as a result of the weight or rough action of the equipment.

   Explosive Ordnance Disposal (EOD) teams have attempted to minimize this potential problem by using conventional mechanized equipment to remove only the CWM overburden. Following initial and ongoing geophysical surveys to identify the position of the CWM, mechanized equipment is used to excavate within approximately 1 foot of the CWM. Manual techniques are then used for the final recovery.

   UXB International of Chantilly, Virginia, in conjunction with the U.S. Army Technical Escort Unit (TEU), has reportedly used this combination of manual and mechanized techniques with success at a number of buried UXO (including CWM) sites, including Dugway Proving Ground, Rocky Mountain Arsenal, and Tooele Army Depot. The choice of equipment depended on a number of factors, including the site terrain and extent of excavation. For example, a backhoe was generally utilized for excavations 10 feet below ground surface, whereas a smaller backhoe was preferred in areas with limited access. This equipment was often modified with protective glass, shielding material, and an air-supplied cab.

b. Remote Mechanized Techniques. As a means to improve the safety of the previously discussed mechanized excavation techniques, remote-control capabilities have been added to much of the aforementioned conventional equipment. Teleoperated, remote-controlled power equipment is commercially

available and has been used for a number of applications, including environmental monitoring, materials handling, and surveillance. This type of equipment has also been used in the excavation of UXO, including the clearing of munitions at a former bombing range.

c. Force-Feedback Remote Techniques. In response to the lack-of-feel complaint with remote-control power equipment, several companies and national laboratories are investigating force-reflection or feedback systems. At least one company, Kraft TeleRobotics of Overland Park, Kansas, has developed a prototype, 7000-pound, hydraulic excavator and material-handling system known as the Haz-Trak, which uses a combination of force-feedback and master-slave control techniques.

6.2.3 Other Techniques. In addition to manual and mechanized excavation techniques, several more novel methods are suggested in the literature or by various sources for the recovery of UXO and perhaps CWM. These additional techniques are described in the Generic report.

6.3 Analysis of Generic Techniques for the Former Fort Segarra

Separate excavation techniques may need to be adopted for the Flamingo Bay landfill area as opposed to test areas on Water Island. Techniques are analyzed for each of these areas in the following paragraphs.

6.3.1 Flamingo Bay Landfill Area. Excavation in this area will be difficult since groundwater will most likely be encountered at a depth of 4 feet (the Flamingo Bay area is approximately 4 feet above sea level). This level may fluctuate due to tidal effects and the site's close proximity to the Flamingo Bay. The FFS excavation project should include the capability and readiness to conduct pit-dewatering activities.

Since this was a landfill area, the water will most likely require monitoring and treatment. Walls may need to be construction within the excavated area to prevent the influx of water. In addition, due to the depth of the excavation in the Flamingo Bay landfill area and the expected high moisture content of the soil, precautions will need to be taken to prevent cave-ins. These precautions include support, sloping, and benching systems in accordance with the requirements of the Occupational Safety and Health Act (OSHA) construction standards, 29 CFR Part 1926.

As discussed paragraph 6.2.2, excavation techniques typically recommended for CWM recovery are to use mechanized equipment following initial and ongoing geophysical surveys to dig within approximately 1 foot of the items. Once items are identified as being within 1 foot, manual techniques are used for the final recovery. In the case of the salt pond area on Water Island, it is recommended that mechanized equipment be solely used. This is primarily because geophysical surveys will not be able to distinguish between bomb bodies which may be buried and other trash and vehicles which were reportedly disposed in the Flamingo Bay landfill area. In addition, the area is estimated to be 50 feet by 100 feet. Manual excavation techniques would be very

labor intensive and it would be physically impossible to manually dredge this large of an area. It is recommended that the area be dredged through the use of a drag line or heavy equipment with a bucket attached to the line. The bucket could be used to skim the debris off each layer until the pond has been dredged to its original depth. Explosive shields may be appropriate on the heavy equipment to protect the operator, since some of the bombs tested on Water Island were explosively configured. In addition, there may be an explosive hazard with polymerized CK. Archeological or manual techniques should be used to sort through the debris removed from the salt pond area.

6.3.2 Water Island Test Areas. If burial sites are present at test locations on Water Island, it is believed that, considering the shallow soils common to the Virgin Islands, the depth of disposal pits in these areas would be relatively shallow. At these sites it is recommended that a combination of manual and, if possible, conventional mechanized excavation techniques should be employed. Small, light-weight, conventional equipment should be used, since heavy equipment may not be able to be transported to Water Island and may have difficulty maneuvering about the island's rough terrain. Light equipment may be able to dig or scrape within 1 foot of any buried CWM. Once within this range, only manual excavation techniques should be used for final identification and recovery. For shallow excavations of less than 2 feet or in areas inaccessible to mechanized equipment, manual techniques will probably be the only option. These excavation techniques should be done in a layered manner to allow additional geophysical survey techniques to reconfirm the position of the buried CWM as the items are approached.

6.3.3 Other Excavation Techniques. As noted previously, there is extensive non-DoD debris located at the Flamingo bay landfill area, at the southern portion of test area 4, and at test area 5. Surface debris will need to be removed prior to beginning excavation. Additional non-DoD debris will most likely surface as the excavation operation begins. This will make the excavation very tedious since each item uncovered will need to be identified as CWM or as a non-DoD item prior to removal from the pit area. In addition, non-DoD items which are hazardous waste should be segregated from nonhazardous waste. EOD and hazardous waste experts should be present during all excavation operations to properly identify items which are uncovered.

Care should be taken to segregate soils which are potentially contaminated versus those which are believed to be clean. Potentially-contaminated soils should be stockpiled and contained in an area until it can be monitored for agents and their degradation products if CWM contamination is suspected or organics if contamination is suspected from the non-DoD waste. Typically, a dirt berm is constructed in the area with a plastic covering to protect the earth from potentially-contaminated soils. Once the excavation is complete, clean soils should immediately be used to fill the excavated area. Appropriate erosion- and sediment-control measures should be instituted.

Use of filtered structures to collect and contain agent vapors that may be emitted during excavation should be considered but is not necessarily recommended at FFS. Due to its large area, use of a containment structure at the salt pond area would be difficult to implement. In addition, Water Island is a fairly remote area and, based on the direction of the prevailing winds, the test areas of concern are downwind of most Water Island residents.

To determine if a filtered structure is required under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), an assessment should be conducted to determine if there is the potential for an uncontrolled release. During this assessment, the maximum credible event (MCE) during the excavation operations is estimated and a determination is made as to whether this would exceed the general population limit (GPL). Factors such as the population distribution and meteorology conditions are all considered in the analysis. Methods such as evacuation of certain residents, confining the excavation operation to when the prevailing winds are away from populated areas on St. Thomas and Water Island, and limiting site activities to the off-season months of May to November would be considered in this analysis.

One benefit to utilizing a containment structure is that they could be temperature controlled to protect workers from the high temperatures and humidity prevalent in the U.S. Virgin Islands. Utilizing temperature-controlled structures would permit workers to wear PPE for longer periods than estimated in table 6-1 and help reduce the public's concern for site activities and its impact on the local economy. Any structure considered for use should be able to provide comfort without increasing the concentration of CK to the point that filters would be in jeopardy. Units may need filters designed specifically to handle CK.

6.4 Intrusive Activities

Any activity at a CERCLA site can be potentially intrusive. Once identified as a potential hazardous waste-containing site, risks to workers and the public should be assessed prior to taking any action. Simple activities, such as visual site assessments, can be covered under generalized work plans or agreements. Activities such as fence erection should have accompanying decision documents. Actions requiring digging or disturbing anything on the site should have detailed work plans including safety assessments and contingency planning.

6.5 Recommended Excavation Techniques for the Former Fort Segarra

Excavation techniques recommended for FFS include use of mechanized equipment at the Flamingo Bay salt pond area. It should be noted that excavation is typically not conducted in a landfill area when the benefits of the excavation are outweighed by the risk associated with the excavation to workers, the public, or the environment. Risk associated with the excavation of possible CWM as well as non-DoD waste should be considered prior to excavating the landfill area.

Based on a preliminary assessment, the preferred excavation strategy for the former test areas includes the use of magnetometers to perform non-intrusive surveys during excavation. Excavation would begin with mechanized equipment to within 1 foot of detected magnetic anomalies, and then would involve the recovery of the CWM by archeological-type hand excavation techniques.

The use of filtered structures to collect and contain agent vapors that may be emitted during excavation should be considered but is not necessarily recommended. An assessment should be conducted in accordance with the CERCLA process to determine if this is required at FFS.

SECTION 7

IDENTIFICATION, HANDLING, AND PACKAGING REQUIREMENTS

7. IDENTIFICATION, HANDLING, AND PACKAGING REQUIREMENTS

7.1 Identification

After uncovering buried chemical warfare materiel (CWM), one of the most critical steps is the positive identification of the items. A mistake in identification could lead to a serious accident. The simplest identification technique is to read the markings on the CWM. However, since the majority of CWM have been buried for a significant time, considerable corrosion can be expected to have discolored or obliterated most if not all of the markings. The identification process is further complicated at the Former Fort Segarra (FFS) by the potentially wide variety of CWM to be excavated, including U.S., foreign, experimental, and obsolete items. The external characteristics of these different types of ordnance can be identical and may be difficult to distinguish. For example, a U.S. 4.2-inch mortar round containing high explosives may be difficult to distinguish from a similar mortar containing chemical agents. Both of these items were stored on Water Island.

Besides markings, there are additional factors which may assist in the identification of CWM. These factors include the following:

7.1.1 Background Research. A thorough investigation of records and interviewing personnel involved at the time of suspected burial may narrow the potential list of CWM expected to be encountered. This step has been completed for FFS and the results are contained in section 2 of this scoping study.

7.1.2 Photographs. Technical staffs at the U.S. Naval Explosive Ordnance Disposal Technology Center (NAVEODTECHCEN), the Huntsville Division of the U.S. Army Corps of Engineers (CEHND), Red Stone Arsenal, U.S. Army Technical Escort Unit (USATEU), and elsewhere can assist in the identification of field photographs. Field photographs could be taken prior to overpacking and a more positive identification could be obtained while the CWM is placed in interim storage.

7.1.3 Monitoring of Leakage. Various monitoring techniques are available to identify chemical agents released from CWM.

7.1.4 External Configuration. The external configuration and construction details of CWM may assist in its identification. Appendix H provides dimensions and other external characteristics of the CWM items which may be encountered at FFS.

7.1.5 Internal Construction and Details. Without significantly disturbing the target, portable X-rays (such as the Baltograph 300D) have been used to view the internal features of CWM. This method has been used to distinguish between rounds filled with liquid or white phosphorus (WP). However, the equipment is bulky, slow, and

potentially hazardous. Also, this technique, like many others, is not fail-safe. Although in need of further development, similar techniques using ultra-sonic waves or neutron radiation might also assist in providing identification of the internal components, including fill, of cased munitions. A discussion of these and other nondestructive identification techniques can be found in chapter 9 of the Site Monitoring Concept Study.

7.2 Handling

Pending fuze identification and condition, moving an item by hand to determine if its center-of-gravity changes is a method used to determine if an item is liquid filled. It should be noted, however, that some forms of mustard and polymerized cyanogen chloride (CK) may be solid at ambient temperatures and would not be readily identified by this method.

During the identification phase and before any movement of CWM, the type and condition of the fuze (if any) must be positively ascertained. If positive identification is not possible, initial movement of the round should be done remotely. Typically, this is done by carefully tying a rope to the item and laying the rope to a length outside the bursting radius of the item encountered. If positive identification of the fuze precludes movement of the item, fuze-safing techniques may be necessary. Fuze-safing techniques (such as gagging or nose protection) are described in detail in various Army technical manuals.

Due to the likely age and corrosion of buried CWM, a significant number of leakers may be detected visually or through the use of monitoring devices. Thus, any CWM recovery project should include the capability and readiness to conduct leak suppression and sealing operations. The choice of method varies depending on the type of agent and the size of the holes. Further details on leak sealing procedures (such as immersion in decontaminant, plugging, bandaging, and cooling) can be found in various Army technical manuals.

Once the amount of agent escaping has been reduced or stopped, an initial gross decontamination applied liberally on the outside of the munition or container should be performed. Compatibility must be considered in the choice of decontaminant. After this initial decontamination, the leaking CWM should be sealed. Following this sealing, a four-step decontamination should be performed as follows:

- apply decontaminant,
- wait appropriate contact time,
- rinse the items, and
- monitor for chemical agent to ensure proper decontamination.

Details on appropriate decontaminants, wait times, and monitoring can be found in various documents (such as AR 385-61). It should be noted that the above decontamination sequence is only required for obviously leaking CWM or for CWM judged through the use of monitoring devices to be contaminated.

Ideally, to limit the spread of contamination, decontamination efforts should begin as close to the excavation site as possible. For example, single CWM items excavated at the Edgewood Area of Aberdeen Proving Ground are typically surface-decontaminated in the excavation pit to allow safer handling. Consideration should be given to incorporating this methodology to the remediation project at FFS.

Following decontamination, CWM are often wrapped in plastic to collect vapors prior to field testing. After a collection period of 5 to 10 minutes, the vapors are tested to ensure proper decontamination. Decontamination and plastic wrapping continues until field tests are negative. Alternatively, the use of standardized packaging may be justified, especially where significant numbers of CWM are encountered. As suggested in the Naval Explosive Ordnance Disposal Facility (NAVEODFAC) Technical Report (TR) 190, clear containers of various sizes with sealable, vapor-tight covers would permit visual observation of the contained CWM until overpacked.

Depending on a number of factors including the depth of burial, the size and quantities of CWM uncovered, and the excavation method being used, lifting measures may be necessary to safely bring excavated CWM to the surface. As with manual excavations, the necessary requirements for unexploded ordnance (UXO) rigging are covered in the Army TM 60A-1-1-5. Mechanized techniques (such as cranes and forklifts) may also be applicable. The advantages and disadvantages of each of these techniques are similar in many ways to those discussed for excavation.

7.3 Packaging

The following paragraphs provide information about packaging requirements for recovered CWM at FFS. While not forming a specific decision in itself, it is expected that this information will support the selection of appropriate packaging systems for recovered CWM. Based on background information contained in section 2, the potential exists for a wide variety of munitions to be recovered. Consideration should be given to a one-size-fits-all packaging system or a custom-design packaging system. Included in this consideration in regards to size would be the bombs' configuration when recovered. The bombs may be damaged and disfigured and may require a slightly-oversized overpack to accommodate them.

At FFS, it may be advisable to use two separate overpacks, a large overpack for bombs and ton containers and a smaller overpack for smoke pots and mortars. The largest CWM tested or stored on Water Island were the ton containers, which were 85.1 inches in length and 30.1 inches in diameter. The next largest item was the 1000-pound M79 bombs, which were 69.5 inches in length with a 25.4 inch diameter. Since explosively-configured munitions were tested and stored at FFS, provisions should be made to overpack both explosively-and non-explosively-configured rounds. For planning purposes, the following types of CWM could be recovered at FFS:

- 100- to 1000-pound bombs with the burster;
- smoke pots containing smoke and residual agent,or;
- other explosively- and non-explosively-configured chemical munitions.

7.3.1 Regulations Governing the Packaging of Chemical Warfare Materiel. The potentially applicable laws and regulations governing packaging of recovered CWM include:

- Resource Conservation and Recovery Act (RCRA);
- Comprehensive Environmental Resource Conservation and Liability Act (CERCLA);
- Department of Transportation (DOT) Regulations (49 CFR Parts 171-179);
- U.S. Army Regulations:

    -- AMC-R 700-103,
    -- Chemical Surety Program (50-6), and
    -- DOT Exemptions (DOT-E 757);

- Public Law 91-121; and
- Public Law 91-441.

A discussion of these laws and regulations and other environmental requirements is presented in section 3 of the Generic Site Scoping Study. These laws and regulations were reviewed and evaluated for their applicability and ability to ensure the safe management of recovered CWM. Federal and territorial hazardous waste regulations and DOT requirements establish the minimum packaging requirements. The Army requirements for packaging chemical surety materiel (CSM) exceeds hazardous waste packaging requirements and are not directly applicable to recovered CWM.

a. *Hazardous Waste Requirements.* For purposes of this evaluation, recovered CWM is considered a hazardous waste, and all federal and territorial hazardous waste regulations are directly applicable.

   Hazardous waste is regulated under RCRA and CERCLA. These regulations are under title 40 CFR. Both CERCLA and RCRA require that hazardous waste transportation must meet all applicable requirements of 40 CFR 263.11 and 40 CFR 263.31 and must meet or exceed DOT requirements 49 CFR parts 171-179.

   Copies of applicable portions of packaging and transportation regulations are presented in the Generic report.

b. *U.S. Department of Defense.* The Army has established requirements for packaging and transporting shipments of stockpiled CSM. However, no specific criteria specified by the Department of Defense (DoD) or the Army were identified which govern the packaging of recovered CWM.

   A discussion of the Army's experience with packaging and transporting CSM is presented in section 6 of the Generic report.

c. *Department of Transportation.* DOT is the primary regulator of hazardous material transportation. The packaging requirements listed in 49 CFR parts 171-179 regulate the packaging and transport of serviceable (that is, non-leaking) munitions. Recovered CWM can be transported in a packaging container meeting the minimum requirements given in 49 CFR 212. The general process to determine the proper DOT packaging for specific recovered CWM begins with identification of the proper shipping name and packaging category (49 CFR 172.101). DOT regulations provide both general and specific packaging requirements for explosives, presented in 49 CFR 173.60. Specific requirements for non-bulk packaging of explosives, applicable for recovered CWM at FFS, are presented in 49 CFR 173.62. Container specifications for packaging are presented in 49 CFR 178. Additional information about DOT regulations is presented in section 3 of the Generic report.

7.3.2 Identification of Available Containment Equipment. Currently available containment equipment was identified from a review of equipment used during the West German retrograde mission for transporting stockpiled chemical munitions by road, rail, and sea and of commercially-available, DOT-approved packaging systems. Additional information about the retrograde mission containers and commercially-available packaging equipment is presented in section 6 of the Generic report.

Containment equipment identified include the following:

- retrograde mission packaging system:
  - -- single round container (SRC),
  - -- secondary steel container (SSC), and
  - -- milvans;
- onsite container;
- DOT-approval, non-bulk overpack containers; and
- type A radioactive shipping container.

a. *Containment Equipment Developed for the Retrograde Movement.* This information is the result of a government study used to develop a transportation concept plan for managing CSM.

SSCs were designed, developed, and used for the retrograde of chemical munitions from the former West Germany. Information about this effort was provided from interviews, a standard operating procedure (SOP), and the mission report. The CSM was packaged and transported during the retrograde project. This project is a model for packaging and transporting stockpiled, lethal, agent-containing projectiles by truck, train, and ship. The retrograde mission experience could provide insight about the procedures needed to package and transport recovered CWM.

The retrograde mission involved three secondary steel shipping containers: the SRC, the SSC, and the milvan. The SRC and SSC were designed and developed specifically for the retrograde. The milvan was modified to meet the mission requirements.

The purpose of the SRC was to provide a safe and logistically sound overpack for leaking chemical munitions. The SRC was designed based on the following criteria:

- meet, as a minimum, the general packaging criteria required by DOT;
- contain a 155-millimeter and 8-inch chemical projectile that had been declared unserviceable or damaged;
- meet container requirements for original munitions;
- meet all continental U.S. (CONUS) and outside the continental U.S. (OCONUS) shipping requirements;
- provide long-term storage capability; and
- provide capability for being shipped by surface transportation.

SRCs are used to contain unserviceable or damaged munitions. To accomplish this, three sizes were developed. Two were designed specifically to fit the 155-millimeter round and an 8-inch round without leaving much room for the round to move on the inside. The third, SRC-X, was deliberately oversized to serve as an overpack container for damaged or deformed munitions.

The SSC was designed and developed for the retrograde movement as a vapor-tight storage containment system for non-leaking, palletized 8-inch and 155-millimeter projectiles. The SSC is not the primary packaging system, so its design does not provide complete confinement of liquid or vapor chemical agent that could be released during transport. That was the function of the primary container and/or the SRC as the primary containment overpack. The design requirements for the SSC are far more stringent than those provided by DOT requirements. The SSC is also compatible with shipment by milvan. Pallets of munitions, three 155 millimeter and two 8-inch, could be loaded into one SSC. The cost for constructing 5680 containers was $13.6 million.

A milvan is the outermost shipping container for the retrograde movement. The milvans are ammunition shipping steel containers, 8-feet by 8-feet by 20-feet long. The milvan can be transported on a flatbed truck or on an International Standardization Organization (ISO) chassis. While the milvan is weather-tight, it has no special features for containment of liquid or vapor chemical agent. However, as the primary method for moving ammunition during the retrograde, it provides a standardized configuration for moving the SSC. The milvan also provides a third method of containment in the total shipment package for leaking or damaged chemical munitions, although it was not designed for this purpose.

Milvans used for the retrograde move were modified to meet international standards. An average repair cost to modify a milvan was $4400. New milvans constructed to meet the international standards would cost approximately $10,800 each.

The SSC packaging system could manage 5 pallets of munitions in each SSC, and 10 SSCs could be contained in each milvan. Detailed performance documentation is not available for these containers other than the success of the retrograde mission.

b. *Onsite Container Development for the Chemical Stockpile Disposal Program.* The onsite container (ONC) is the product of the recommendation made by a panel of experts convened during the preparation of the Final Programmatic Environmental Impact Statement (FPEIS) for the Chemical Stockpile Disposal Program (CSDP). The ONC was designed and developed to reduce the likelihood of potential handling, transport, or externally-induced accidents to the maximum feasible degree. The ONC is a double-walled, horizontal, cylindrical, stainless steel shell, approximately 8 feet in diameter and 12 feet long, with a hinged loading or unloading door at one end and an integral handling frame. The ONCs are to be transported on special trailers, pulled by conventional diesel-fueled tractors. Two ONCs are mounted lengthwise on the trailer. The most recent cost estimate to manufacture one ONC is approximately $240,000.

c. *Commercial Containment Equipment.* According to the DOT regulation 49 CFR 212, authorized non-bulk packaging for solid waste materials in packaging group II (which includes CWM) include steel drums, plastic drums, fiber drums, and steel boxes with plastic liners. Figure 7-1 shows a DOT-approved plastic drum, which costs approximately $150 each.

The Compressed Gas Association, Inc. and the Chlorine Institute, two industry representative organizations, were contacted to identify industry standards for managing industrial gases such as chlorine and phosgene. It was believed that the procedures used to store and transport industrial gases could also be successfully used for CWM. Neither organization has specific policies or procedures for managing phosgene gas. However, both organizations have established technical specifications, safety standards, and training and educational materials for managing chlorine and other industrial gases. Representatives from these organizations suggested that a review of their training and educational materials would provide a clear understanding of the industry standards and procedures for handling industrial gases.

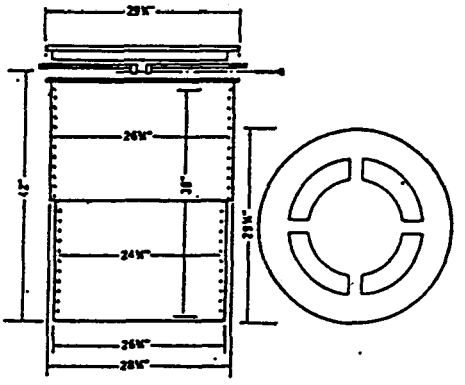
A preliminary review of DOT regulations for chlorine gas identified requirements for outside packaging of compressed gases in cylinders (49 CFR 173.301).

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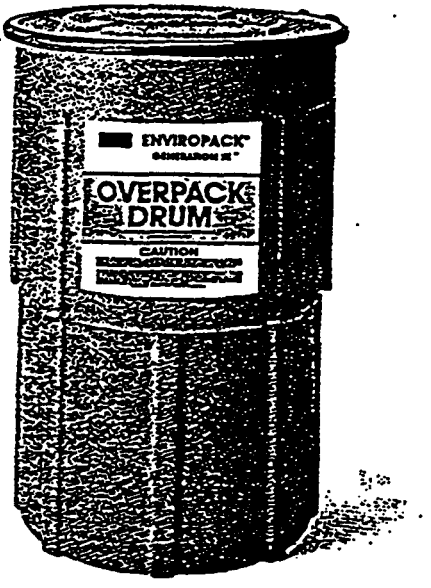
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part number E85-42-30, is engineered for overpacking hazardous waste drums. The GENERATION III meets all performance requirements of D.O.T. CFR 49 SEC. 173.3 (c) and is U N certified. It is designed to accept standard drums 55 gallon or smaller and D.O.T. specification drums meeting 17C, 17H and 17E. It meets the safety requirements of hazardous waste regulatory agencies.

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BOLTED STEEL-LOCKING-RING
FOR SAFE SEALING
Only Enviropack has the patented, bolted steel-locking-ring that locks the double wall lid to the drum for safe handling and storage. Increased hoop strength eliminates sagging and deformation of the drum when handling and moving heavy loads.



PROPRIETARY HEAD DESIGN
IMPROVES TRANSPORTATION
AND STORAGE
The Enviropack lid and drum base are designed to interlock so they can be stacked. Empty drums will nest at 50% of the total height for maximum space savings. Conventional handling equipment is adaptable for mechanized moving of Enviropack drums.

LONG-LIFE PROTECTION
Enviropack uses only first quality specification controlled polyethylene. The one-piece rotationally molded drum is seamless and leak resistant in all weather conditions. Safely contains acids and corrosive materials as specified in Enviropack chemical compatibility chart (available upon request).

OVERPACKING
Overpacking of drums containing hazardous materials for transportation on public access roads must meet certain standards and specifications. Contact the nearest representative of the Department of Transportation for instructions.

Figure 7-1. DOT-Approved Packaging Container for CWM

The outside packaging identified in this requirement could possibly be used as secondary containers for recovered CWM that contain compressed gases. Similarly, a review of DOT regulations for phosgene gas identified requirements for additional protection for poisonous materials required to be packaged in cylinders (49 CFR 173.40). The additional packaging identified in this requirement could also be used as a secondary container for recovered CWM.

7.3.3 Analysis of Containment Equipment. DOT regulations (such as 49 CFR 173) are the minimum requirements for shipping non-leaking CWM. The packaging of recovered CWM from FFS must meet or exceed DOT specifications 49 CFR 173.212 and 173.62.

Based on the review of available containment equipment and regulatory requirements, three general options were identified for selecting packaging systems for CWM potentially recovered from Water Island. These are:

- existing containment equipment meeting DOT requirements;
- existing containment equipment used for CSM stockpile missions (for example, the SSC and ONC); or
- containment equipment specifically designed and constructed for the non-stockpile mission, meeting or exceeding DOT requirements and meeting the needs of the non-stockpile mission.

One possible packaging system meeting DOT requirements consists of containerizing individually recovered CWM in a plastic bag, which is then placed in a steel drum packed with an absorbent material such as vermiculite. The drums are then placed on pallets and are ready for transport.

The use of the packaging systems used for the CSM missions exceed DOT regulations but would be considered overly restrictive for recovered CWM. These systems were developed for the transportation of a large quantity of chemical munitions, whereas the non-stockpile program is believed to involve a small volume of CWM with a much smaller associated risk.

Developing specific packaging systems that meet or exceed DOT regulations and meet the needs of the non-stockpile mission is possible but would require a risk assessment to be performed. The risk assessment would help identify packaging requirements based on an assessment of hazard severity, accident probabilities, and environmental risk associated with the storage and/or transportation of recovered CWM. The goal of this effort would be to determine the appropriate level of packaging needed to respond to the non-stockpile program needs.

7.4 Recommendations

Packaging for intact, recovered CWM should use DOT packaging requirements (49 CFR 173.62 and 173.212).

No regulations specifically regulate leaking CWM. However, there are several options available, including DOT requirements for CSM, DOT requirements for industrial gases, Army regulations for CSM, and the development of specific non-stockpile mission packaging.

It is recommended that the requirements for industrial gasses be further reviewed. Applicable DOT requirements and the training and educational materials offered by the Compressed Gas Association, Inc. and the Chlorine Institute should be evaluated. In addition, an assessment to determine the need for developing specific non-stockpile mission packaging should be performed. It is anticipated that this effort will involve the preparation of a risk assessment that will help identify the packaging performance standards that will address the risks posed from managing recovered CWM.

SECTION 8

INTERIM STORAGE FACILITIES

8. INTERIM STORAGE FACILITIES

This section discusses specialized facilities for interim storage of chemical agent-contaminated munitions and other material which may be recovered from the Former Fort Segarra (FFS). Material would be stored only until it can be properly disposed of onsite (that is, destroyed) or transported to its ultimate disposal or destruction site. Specific issues that are addressed include general requirements for an interim storage facility for recovered chemical warfare materiel (CWM); applicable Federal, U.S. Virgin Islands, and Army regulatory requirements; siting restrictions and options for siting a facility at FFS; descriptions of possible portable structures which could be sited, the existing fixed facilities, and the relative cost of these facilities; a physical security analysis for the sites under consideration on Water Island; and recommendations for interim storage of CWM at FFS.

8.1 Former Fort Segarra Interim Storage Requirements

Unless an existing fixed facility is found to be desirable, the interim storage facility for FFS is recommended to be of portable design. These units would be removed from the FFS site once non-stockpile cleanup activities are completed. It is anticipated that, based on current schedules, the interim storage facility at FFS may be in service for up to three years. An anlysis of fixed and portable structures can be found in the Generic Site Scoping Study.

The interim storage facility design should utilize a modular concept. Because the exact type and quantity of munitions that may be encountered at FFS are unknown, the design should allow for easy expansion of the storage capacity. Modules, whether they are separate structures or rooms within one structure, should be designed to provide safety for the public and for workers involved in the storage operation. Particular features of the modules should include containment systems for accidental spills or leakage of hazardous materials, to prevent them from entering the physical environment. The storage unit will likely be used at multiple sites so it should be transportable. The size of the interim storage unit will be determined by limitations in transporting the unit to the site.

Two storage units should be placed initially on the site to provide the capability to separate different agent types or burstered and unburstered CWM. This is an Army safety requirement. Since the quantity and types of CWM that will be recovered at FFS are unknown, it is prudent to have this capability.

The materiel should be delivered to the storage facility in an overpack with the identification of the material labeled on each container and a hazardous waste

manifest completed. Preparation work, such as identification and encapsulation or placement in an overpack container, should be performed at the excavation site.

An access road or drive and a staging area with spill prevention provisions, where CWM can be unloaded from conveyances, sorted, and placed into storage, is required.

8.1.1 Storm Drainage. Storm drainage from the storage site should comply with territorial regulations for permitting and design. In addition, site grading and drainage should be designed in accordance with applicable technical manuals and other guidance from the government. Clean surface runoff should be segregated from potentially contaminated runoff, channelled, and returned to the natural drainage pattern. Potentially-contaminated runoff should be channelled to sumps or industrial sewers where it can be collected and properly treated. Measures such as canopies or other coverings over open paved areas should be used where required to minimize the contaminated runoff that must be collected and treated.

8.1.2 Landscaping. Minimal landscaping is required to meet the mission of the storage facility. Landscaping should be limited to turfing areas disturbed by construction or other methods for erosion control.

8.1.3 Utility Connections. Utility connections will depend on the final storage facility chosen, and may include some or all of the following:

- Fire protection water, as required for fire suppression systems in the storage facility. A tank may be required to supply this water since there is no water supply on Water Island.

- Potable water, if required. May only be required for emergency eyewash/ showers, in which case a local tank may suffice.

- Electrical power, if required. Electrical power should be supplied from the nearest public utility connection. Minimal lighting should be installed. Should requirements of AR 50-6-1 and AR 190-11 be strictly enforced, uninterruptable power may be required. This would not be available from local sources on Water Island and would have to be made available at the site. This could be accomplished with generator power.

- Communications. If hard wired communications are required, connections should be made to the nearest public communications lines. Otherwise, cellular phones should be used.

8.1.4 Ventilation. The storage facility should be ventilated by side ventilation and a roof exhaust. The size of louvers and exhaust vents will need to meet all applicable codes and standards including Occupational Safety and Health Act (OSHA) requirements.

codes and standards including Occupational Safety and Health Act (OSHA) requirements.

To adequately assess first-entry conditions, an external sampling port should be installed. This will allow the use of monitors to sample the inside of the structure prior to entry by personnel.

8.1.5 Environmental Control. Due to the high ambient temperatures on Water Island, the storage structure should be environmentally controlled.

8.1.6 Materials of Construction. The structure should be compatible with agent decontamination solutions. A sump system should be incorporated to remove spent decontamination solution. If any agent is detected by agent monitors during storage, the facility will most likely require 3X decontamination prior to removal of the structure from the site.

8.1.7 Roads and Pavement. Roads and pavement should be provided as required to access the storage facility from the San Jose test areas and the Flamingo Bay Area. Flexible pavement or possibly even gravel may be adequate for the access road.

Rigid pavement (that is, concrete) should be provided in the immediate area of the storage facility to allow for standing vehicles and provide a better surface for unloading operations. The unloading area should be provided with a curb to contain spills and a sump to collect spills and allow the spilled material to be collected and disposed.

Pavement design analyses should be based on site-specific criteria and anticipated traffic type and volume, which should be available when the non-stockpile recovery operations are better defined. As a minimum, the unloading area rigid pavement should be designed for an H_2O semi-trailer (as defined by the American Association of State Highway and Transportation Officials), accessible by a 4000-pound capacity forklift truck from both sides and the rear.

8.1.8 Materials to Be Stored. AMC-R 385-100 classifies chemical agents into chemical groups and storage-based classifications. Chemical group designations specified for the agents also apply to the munitions containing those agents. Group A chemical agents includes highly-toxic liquid agents that in either liquid or vapor form may be absorbed through the respiratory tract, skin, or eyes. The group A agents which were tested or stored at FFS include mustard-series (H-series) agents and tabun (GA). These are required to be stored in accordance with AR 385-61 and DA Pam 385-61.

Chemical group B includes chemical materiel (gaseous, liquid, or solid) that are toxic or incapacitating by inhalation, ingestion, or percutanaceous absorption. The group B agents stored or tested at FFS include phosgene (CG) and cyanogen chloride (CK).

Chemical group D includes signaling smokes and incendiary material for which conventional fire-fighting methods (except use of water) may be used. From this group, HC and FS smoke material was stored or tested at FFS.

All of these materials are classified in the same storage compatibility group, group K, but AMC-R 385-100, section 11 generally requires separate storage for materials in each of the four groups. However, it refers to AMC-R 385-100, section 19, which allows combined storage of some materials under certain circumstances.

8.2 Regulatory Requirements

Army regulations and major public sector codes and regulations that may apply to the construction of an interim storage facility for CWM were reviewed for possible incorporation into the selection criteria. While Army regulations provide necessary and prudent guidance for the long-term, controlled storage of toxic chemicals and munitions, application of all of these regulations to interim storage of CWM may be overly stringent or may be difficult to site because of space limitations. It has been the practice in the past to relax many of these regulations and practices in emergency situations where CWM is accidentally uncovered. However, it may not be appropriate or even permissible to relax regulations and procedures for a planned cleanup of a known CWM site being performed under the applicable environmental protection regulations and other applicable or relevant and appropriate requirements (ARARs). The approach taken for this report is to assume that the interim holding facility meets Federal requirements for hazardous waste holding facilities and the Army draft security requirements.

8.2.1 Federal Regulations. Federal environmental regulations are presented in section 3 of this report. In addition to these environmental regulations, the Federal OSHA standards, 29 CFR 1910, also apply.

Since the Army has classified chemical agents as characteristic Resource Conservation and Recovery Act (RCRA) hazardous waste for reactivity [as defined by 40 CFR 173.23(a)(4)], the interim storage facility must meet the requirements of a hazardous waste storage facility. Typically, RCRA requires a permit be obtained for facilities where hazardous waste is accumulated onsite for longer than 90 days (40 CFR 262.34). Since this is to be operated as a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) site, the requirements of RCRA must be met but an actual permit is not required. Plans for the storage facility will most likely need to be submitted to the appropriate regulatory officials. Some of the major RCRA requirements that would apply to the interim storage facility are listed in the following paragraphs.

- An Environmental Protection Agency (EPA) identification number must be obtained (40 CFR 264.11).

- CWM hazardous waste must be characterized, manifested, labeled, and reported in accordance 40 CFR 264.13 and 40 CFR 264.70-77 and applicable territorial regulatory requirements.
- Security must be adequate to prevent unknowing entry and minimize the possibility of unauthorized entry. Appropriate signs must be posted restricting access to the facility (40 CFR 264.14).
- Inspection plans must be prepared and available onsite. As a minimum, the owner or operator must inspect areas for leaks or deteriorated containers on a weekly basis (40 CFR 264.174).
- All facility personnel involved with hazardous waste management must be properly trained to ensure personnel can deal with emergencies and activation of a facility contingency plan (40 CFR 264.6).
- The storage facility must be equipped with a secondary containment system to contain 10 percent of the volume of the containers or the volume of the largest container, whichever is greater (40 CFR 264.175.). Incompatible wastes must be stored separately with separate containment structures.
- Containers holding reactive wastes must be located at least 50 feet from the facility's property line (40 CFR 264.176).
- A facility located in a 100-year floodplain must be designed, constructed, operated, and maintained to prevent washout of any hazardous waste by a 100-year flood, unless the owner or operator can demonstrate to the regulatory authority this is not required per 40 CFR 264.18.

8.2.2 U.S. Virgin Islands Codes.

a. *Building Code.* The applicable territory and local building code for the FFS is the Virgin Islands Code (VIC) title 29, Public Planning and Development. Chapter 5, Building Code, is relevant to permits, inspections, and other applicable codes. The Virgin Islands also refers to the Uniform Building Code for certain applications. Chapter 3 addresses zoning, subdivision, and conservation.

b. *Fire Codes.* In addition to the applicable articles of the Uniform Building Code, VIC title 29, paragraph 312 (c) may apply for fire resistance and fire protection for interim storage facilities.

Requirements for the storage of explosives are provided in the VIC (23 VIC § 712 and 713). Explosives must be stored in approved explosive magazines located at distances from neighboring buildings, highways, and railways that conform with the American Table of Distances for Storage of Explosives.

In most cases, the safety regulations of the Army should be more than adequate to meet these requirements, except possibly in the area of permitting, notice to local officials in the event of problems, and inspection requirements.

c. *Environmental Regulations.* Interim storage facilities at FFS should meet the environmental regulations contained in the VIC. Facilities should be sited in compliance with the coastal zone permit. In addition to chapter 3 (Zoning) and chapter 5 (Building Code), a coastal zone permit is required since Water Island is in the first tier of the coastal zone. Coordination will need to be conducted with the U.S. Virgin Islands regulatory officials to confirm that permits are not required, if operated as a CERCLA site.

8.2.3 Local Codes. There are no local codes that apply other than the U.S. Virgin Islands regulations and codes addressed in paragraph 8.2.2.

8.2.4 Army Regulations. Design or selection of interim storage facilities at FFS should meet the following Army regulations (ARs):

- AR 50-6: Chemical Surety.
- AR 190-11: Physical Security of Arms, Ammunition, and Explosives.
- AR 190-59: Chemical Agent Security Program.
- AR 200-1: Environmental Quality, Environmental Protection and Enhancement, June 1982.
- AR 385-10: Army Safety Program.
- AR 385-30: Safety Color Code Marking and Signs, October 1983.
- AR 385-61: Army Toxic Chemical Agent Safety Program.
- AR 385-64: Ammunition and Explosive Safety Standards.
- AR 420-70: Buildings and Structures, November 1976.
- AR 420-90: Fire Protection, February 1985.
- AR 700-112: Portable Buildings, September 1985.

8.2.5 Army Material Command Regulations.

a. *AMC-R 385-100: Safety Manual.* Provides guidance on storage of munitions, including quantity distance requirements from storage areas to inhabited areas for protection of the public.

b. *AMC-R 385-131: Safety Regulation for Chemical Agents H, HD, HT, GB, and VX.* Provides guidance for storage of chemical agents and munitions. References AMC-R 385-100 for final determination of separation distances from inhabited areas.

8.2.6 Army Technical Manuals.

a. *TM 3-250:* Storage, Shipment, Handling, and Disposal of Chemical Agents and Hazardous Chemicals.

b. *TM-Series.* Depending on the type of structure and materials of construction, some or all of the following technical manuals (TMs) should apply to the design and procurement of the interim storage facility at FFS.

- TM 5 -744: Structural Steelwork
- TM 5-809-1: Load Assumptions for Buildings
- TM 5-809-2: Concrete Structural Design for Buildings
- TM 5-809-4: Steel and Aluminum Structural Design for Buildings
- TM 5-809-10: Seismic Design for Buildings
- TM 5-810-1: Mechanical Design Heating Ventilating and Air Conditioning
- TM 5-811-1: Electric Power Supply and Distribution
- TM 5-812-1: Fire Protection Manual, April 1977
- TM 5-853-1: Designing for Security
- TM 5-1300: Structures to Resist the Effects of Accidental Explosions

8.2.7 U.S. Army Corps of Engineers Guide Specifications. The following are two of the U.S. Army Corps of Engineers (USACE) guide specifications (CEGS) that may apply to the procurement and construction of an interim storage facility. Depending on the type of structure chosen, numerous additional guide specifications in every engineering discipline should apply.

- CEGS 07270: Firestopping
- CEGS 16721: Fire Detection and Alarm Systems

8.2.8 Army Field Manuals.

- FM 19-30: Physical Security

8.2.9 Army Pamphlets and Handbooks.

- Army Pamphlet 385-61: Safety, Toxic Chemical Agent Safety Standards (Draft)
- MIL-HDBK-1008A: Fire Protection For Facilities Engineering, Design, and Construction

8.2.10 Department of Defense. The following Department of Defense (DoD) documents apply to construction of interim storage facilities.

- AEI Instructions: Architectural Engineering Instructions for Government Construction Projects
- DoD 4270.1-M: Construction Criteria
- DoD 5100.76-M: Physical Security of Sensitive Conventional Arms, Ammunition, and Explosives
- DoD 6055.9-STD: Ammunition and Explosives Safety Standards, July 1984

8.2.11 American Concrete Institute.

- ACI 318-89, R93: Building Code Requirements for Reinforced Concrete

8.2.12 American Institute of Steel Construction.

- AISC *Specification*: *Specification for Structural Steel Buildings*, Allowable Stress Design and Plastic Design, June 1, 1989
- AISC Load Resistance Factor Design Specification for Structural Steel Buildings, September 1, 1986

8.2.13 U.S. Army Corps of Engineers Standards. Design performed for or under the jurisdiction of the USACE may have to comply with criteria established by the responsible USACE office. In the case of military construction, there may be two USACE offices involved (for example, the Huntsville Division and the division or district having jurisdiction over the area where the non-stockpile site is located).

- HNDM 1110-1: Design Manual for Architect-Engineer and USAEDH Personnel, U. S. Army Engineer Division, Huntsville (USAEDH), Huntsville Alabama
- SWD-EIM: Southwest Division Engineering Instruction Manual (for project sites located in the area under the jurisdiction of the Southwest Division of the USACE)

8.3 Facility Siting

8.3.1 Siting Requirements. Siting for the interim storage facility should conform to the most restrictive requirements of the applicable territorial codes and the following:

- AMC-R 385-100: Army Material Command Safety Manual
- AMC-R 385-131: Army Material Command Safety Regulation for Chemical Agents H, HD, HT, GB, and VX
- DoD 4270.1-M: Department of Defense Construction Criteria
- RCRA: Resource Conservation and Recovery Act
- CERCLA: Comprehensive Environmental Response, Compensation, and Liability Act
- MIL-HDBK-1008A: Military Handbook for Fire Protection for Facilities Engineering, Design, and Construction
- 29 CFR 1910: Occupational Safety and Health Act (OSHA) Standards

As an alternative, the storage facilities may be sited in accordance with the applicable building codes and territorial regulations only, and then the variances that would be required from the applicable Army regulations could be considered.

The siting of interim storage facilities will probably require a review by the U.S. Virgin Islands planning officials. Local requirements for setbacks and local zoning requirements should be reviewed.

Where possible, existing facilities should be reviewed for suitability of use as interim storage facilities to minimize disruption of the existing site.

Structures, pavement, and fencing should be arranged to ensure the proper flow of material and allow for access by materials handling equipment (MHE). The layout should also allow for movement of material into storage and out of storage.

If possible, the interim storage facility should be sited at an elevation above the Federal Emergency Management Agency (FEMA) 100-year flood plain.

8.3.2 Separation Distances. Separation distances for storage of chemical munitions should be as specified in chapter 11 of AMC-R 385-131 and should be considered the governing criteria. However, it may be necessary to deviate from these requirements due to the close proximity of other structures at and adjacent to the site.

a. *Public Access Exclusion Distance.* To ensure the safety of the public, AMC-R 385-131 defines the public access exclusion distance (PAED) for storage of agent-filled munitions containing explosives as the greater of either the inhabited building distance (IHBD) or the one-percent lethality distance [calculated from a given maximum credible event (MCE), meteorological conditions (such as temperature, wind speed, etc.), and permissible exposure levels (specified in the standard)]. The calculation of one-percent lethality distance will need to be performed on a site-specific basis for FFS to confirm siting requirements for the storage facilities.

b. *Inhabited Building Distance.* The IHBD required to ensure the safety of the public and others not involved directly in the CWM recovery activities is based on the fragment hazard distance or the net explosive weight (NEW) of the munitions. For chemical munitions containing both explosive components and agent filler, the IHBD should be as shown in the applicable tables in AMC-R 385-100 based on the hazard class involved. Per AMC-R 385-131, most chemical munitions within AMC are (12) 1.2 (that is, category 12, class 1.2) hazard class, which would require an IHBD of 1200 feet based on table 17-10 of AMC-R 385-100, and an explosive quantity not exceeding 500,000-pounds NEW. IHBD cannot be reduced by providing barricades or using igloos (such as earth-covered magazines) for storage. However, the NEW of materiel which will be stored in the interim storage facilities is expected to be much less than 500,000 pounds.

c. *Unbarricaded Intraline Distance.* The unbarricaded intraline distance (UBID) is applicable to separation of related operations, facilities, and support facilities within the operating area. This distance is specified in AMC-R 385-100 based on the hazard class of the explosives or munitions. From table 17-10 of AMCR 385-100, UBID is 600 feet based on an explosive quantity not exceeding 500,000 pounds NEW. This distance can be reduced to 200 feet for explosive quantities less than 5000 pounds and can also be reduced by providing barricades between the explosive source and the other facilities to meet the requirements of the barricaded intraline distance (BID).

d. *Magazine Distance.* The distances between barricaded structures or igloo-type storage magazines for munitions containing both chemical agent and explosives should be as specified in AMC-R 385-100. For storage of (12) 1.2 hazard class munitions, this distance depends on the type of magazine and their direction of orientation (that is, front, rear, or sides). For storage of dissimilar class 6.1 agents (without explosives), the magazine distance is 50 feet.

e. *Public Highway and Railroad Distance.* A separation distance for protection of the public should be as defined in AMC-R 385-131. All state and multi-lane interstate highways and major railroad lines should be considered inhabited areas, and the greater of the public traffic route (AMC-R 385-100) or the one-percent lethality distance should govern. Additional guidance is contained in section 11 of AMC-R 385-131.

f. *Other Spacing Considerations.* In the event that more than one structure is required in the facility, lateral spacing between structures should be based on the most restrictive requirements of AMC-R 385-100 or 385-131, or the fire separation requirements of the applicable fire codes and MIL-HDBK-1008A. In addition, per 40 CFR 264.176, containers holding reactive wastes must be located at least 50 feet from the facility's property line. Since CWM has been categorized as a reactive waste, this requirement would apply.

8.3.3 Siting Options. During a site visit in January 1993, the Army discussed the possibility of using existing WWII ammunition bunkers for interim storage of CWM. The WWII bunkers under consideration are located at the north end of Water Island and in the Old Submarine Base in the Krum Bay Area of St. Thomas. Another possibility for an interim storage facility is to site portable storage structures in the Flamingo Bay area at the south end of Water Island. Figure 8-1 shows the location or proposed location of these storage structures. Each of these alternative sites are evaluated in this section in terms of their ability to meet the separation distances addressed in section 8.3.2, their proximity to populated areas, and their proximity to areas where CWM is most likely to be recovered.

a. *Install a Portable Facility in the Flamingo Bay Area.* The Flamingo Bay area is located at the southern end of Water Island. This is the area where bombs were uncovered during the incident in 1966. Two portable storage structures could be sited in the flat area across the road from the warehouse structure, between the Flamingo Bay landfill area and area 4. The structures may also be sited on the pad at the metal warehouse within the Flamingo Bay area. Space is limited in the Flamingo Bay area and the site would need to be further reviewed before an exact location could be identified. This general area is located between 300 and 500 feet from the nearest island resident and is approximately 4 feet above sea level.

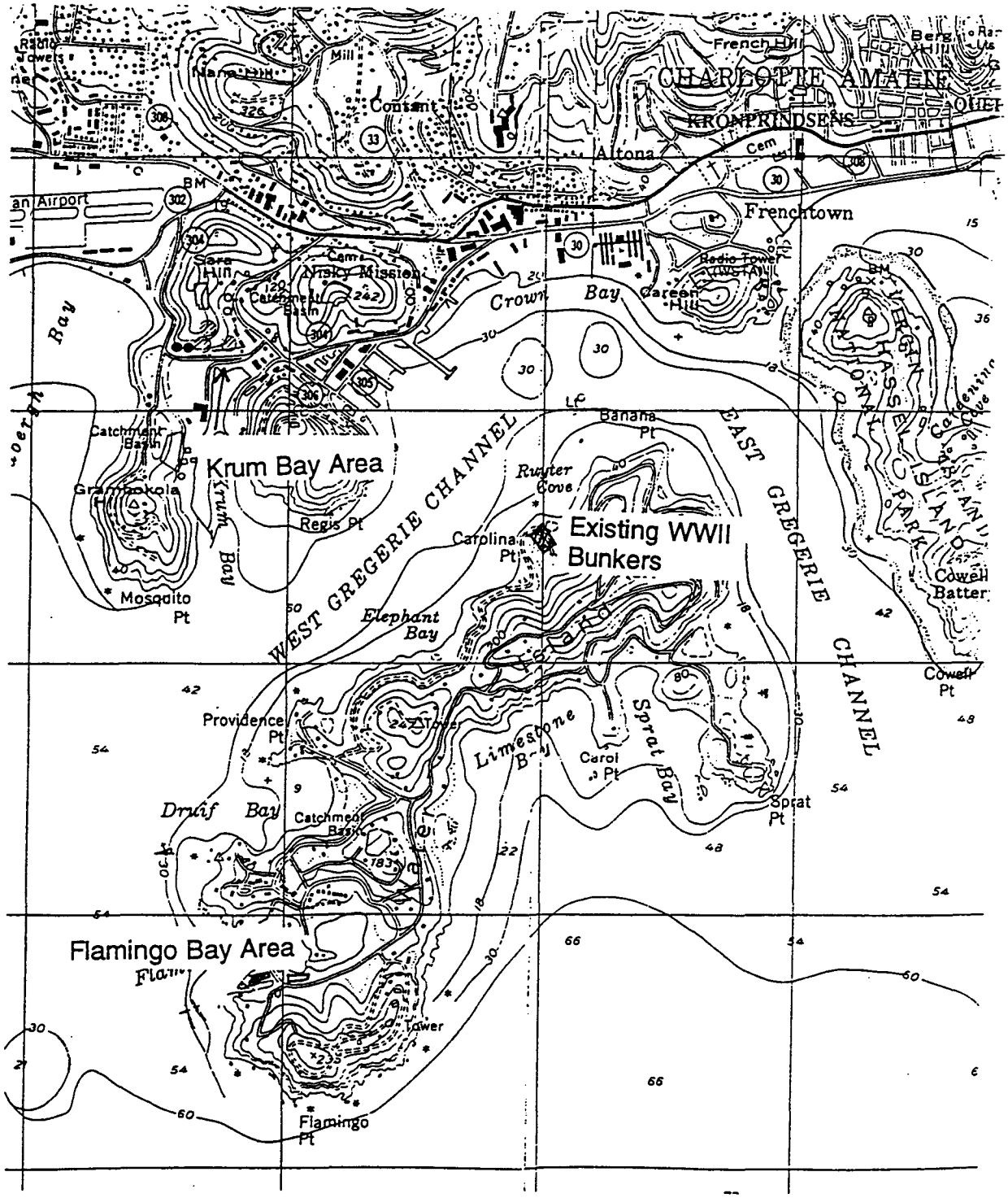


Figure 8-1. Interim Storage Facility Siting Options

The major advantage to locating the facility in this area is that, based on the prevailing wind direction (as defined in section 2.2.6), the storage facility would be located downwind from the majority of the Water Island population and St. Thomas residents. Of the three storage locations under consideration, the Flamingo Bay area would have the minimum amount of downwind residences (approximately 16). Based on the 1966 incident, it is expected that this is the most likely area on the island where CWM would be recovered. The facility would be in close proximity to former test areas 4 and 5 where the majority of the CWM testing was conducted. If CWM is recovered in these areas, transportation to the interim storage facility would be minimal and through unpopulated areas. In addition, minimal road upgrades would be required due to the short distance from the major test areas to the storage facility location. This area is also under the main lease holder of Water Isle, Incorporated and has not been sub-leased. There would be less parties involved and less disruption of current activities to site an interim storage facility. Flamingo Bay is also the area of the deep water dock. If offsite transportation by water is selected, transportation from the storage structure to the dock would be minimal.

A disadvantage of this location is that it is only 300 to 500 feet from the nearest Water Island residence. The Army IHBD requirement, as defined in section 8.3.2, would most likely not be met. There are also no existing structures at this end of the island which could be used as an interim storage area. Portable units would need to be sited. Care will need to be taken in selecting the exact location for the storage facility. Geophysical work should be conducted to determine if there is any remediation requirements for the storage facility site. In addition, this area is only 4 feet above sea level. FEMA drawings would need to be reviewed to determine if it is within the 100-year flood plain. A fragmentation analysis would need to be conducted on these portable storage facilities to determine if additional fragmentation barriers should be constructed for the safe storage of explosively-configured CWM.

b. *Utilizing Existing Bunkers on the Northern End of Water Island.* There are two WWII ammunition bunkers located adjacent to test area 1 on the northern end of Water Island. These bunkers were constructed to support the defensive battery located on Water Island in 1944 and were not associated with the San Jose project. They are located within the Sprat Bay area adjacent to the marina and a private beach. One of the two bunkers has been made into a racquetball court. This bunker had wooden steps leading up to a door about two feet off the ground. The bunker is constructed of concrete and is approximately 25-feet wide by 40-feet long. There is electricity to the bunkers, but the electricity was not working during the January site visit. Approximately 500 yards of the road leading to the bunker is dirt or dirt covered with light vegetation. The bunkers are approximately 200 and 500 feet from the nearest residence located in the marina area.

An advantage to these bunkers is that an existing structure could be used to store recovered CWM. Added protection might be provided from the bunker during storage of explosives. However, since these facilities were built during WWII and have not been maintained by the Army, a structural analysis would need to be conducted to ensure they are adequate for interim storage. As currently constructed, the facility would not provide vapor containment for the chemical agent.

One disadvantage associated with this site is that it is upwind of the majority of the Water Island residents plus the western end of St. Thomas. Also, the bunkers are at the end of Water Island opposite from where CWM would most likely be recovered. Items recovered at the south end of the island would need to be transported through populated areas to the storage bunkers, adding additional risk to the program. In addition, if a decision is made to transport the items offsite by water for treatment, recovered CWM would need to be transported back to the south end of the island to the deep water dock. Since island residences are within 300 to 500 feet, the Army IHBD would most likely not be met. In addition, these bunkers are located within the Sprat Bay area, which involves a second tier of subleasing from the major lease holder. Additional parties would need to be involved in obtaining approval to use this site.

c. *Utilizing Existing Bunkers in the Krum Bay Area of St. Thomas.* During the January 1993 site visit to the U.S. Virgin Islands, Mr. "Chickie" Morciglio of the U.S. Virgin Islands Territorial Emergency Management Agency (VITEMA) indicated that VITEMA has 12 bunkers located at the old submarine base in the Krum Bay area on St. Thomas. These bunkers were used to store WWII munitions during that era. Currently, they are empty with the exception of one which contains explosives stored by the Federal Aviation Administration (FAA) for excavation purposes. There are no utilities at these sites. According to Mr. Morciglio, these bunkers may be available for Army use.

A major disadvantage to this option is that as items are uncovered, they would need to be transported from Water Island to St. Thomas. The transportation associated with moving the CWM and the movement of CWM from a relatively remote island to one that is heavily populated and a major tourist area does not appear prudent, given the potential hazard associated with any recovered CWM. Based on figure 2-27, which provides the residential population in the Krum Bay area, this is one of the most populated areas on St. Thomas with 3342 residents. The risk associated with storage and transport in this area would be greater on St. Thomas, since it is a more populated area than Water Island and many residents are located downwind of these bunkers. An advantage to this site is that these facilities may provide some explosion protection during storage of explosively-configured CWM. As currently constructed, the facility would not provide vapor containment for the chemical

agent. A structural analysis would need to be conducted for the storage bunkers since they have not been maintained by the Army.

8.3.4 Siting Recommendations. Of the three sites considered for an interim storage facility, the preferred option is to install a portable facility in the Flamingo Bay area. The Krum Bay area on St. Thomas is not recommended because of the additional transportation involved and the requirement to move any recovered CWM from a fairly remote area to a major tourist area on a separate island. Of the two sites considered on Water Island, neither can meet the Army's IHBD requirements. However, these distance requirements were derived for the storage of large quantities of CWM at a storage installation and may not be as applicable for small quantities of recovered CWM. The risk associated with storage of CWM is reduced at the Flamingo Bay area, which is less populated and downwind of the majority of the Water Island population.

8.4 Storage Facilities

The following paragraphs describe options for portable storage facilities that could be sited in the Flamingo Bay area and further describe the existing fixed facilities located on Water Island and St. Thomas.

8.4.1 Portable Storage Structures. Portable storage structures include those storage structures that are prefabricated and shipped to the site fully assembled or that can be erected with a minimum amount of work at the site. These facilities may also be reusable, depending on the extent of contamination and their ability to be decontaminated before they are relocated. Generic types of structures meeting these criteria and providing various levels of protection include the following:

a. *Fabric Structures (Type P1).* The fabric structure is a tent-like structure with a supporting metal framework. Fabric structures are capable of enclosing a large area, require a minimum of foundation preparation and setup time in the field, and can be designed with a negative-pressure ventilation system to contain gaseous leaks. However, it does not provide a great deal of intrinsic security.

b. *Prefabricated Hazardous Waste Storage Modules (Type P2).* The prefabricated hazardous waste storage module is a prefabricated, usually steel structure that can be supplied to meet a variety of waste storage needs, codes, and regulations. These modular storage units are available from various vendors and are used to store materials including flammables, various hazardous wastes, and medical wastes. These units incorporate features such as built-in false floors and sumps to contain any leaks or spills. They are available in a variety of shapes and sizes and are limited mainly by transportation and shipping considerations. They setup quickly, requiring a minimal amount of foundation work for most sites. Due to their heavy steel plate construction, many models provide a significant level of security.

c. *Prefabricated Class I Magazines (Type P3).* The type P3 prefabrication class I magazine is actually a variation of the type P2 prefabricated hazardous waste/flammable storage module described in the previous paragraph. Some vendors of prefabricated storage units have a hardened version of their structure available. This structure has the same metal (usually steel) skin construction, but the walls and roof are of a sandwich-type construction. The space between the inner and outer steel shell can be filled with sand, wood, or concrete to obtain the required blast resistance. Other features of this structure are as described with the type P2.

8.4.2 Fixed Structures. Fixed structures include structures which require significant foundation and field installation work when compared to the portable structures identified in paragraph 8.4.1. Several fixed structures are described in section 5 of the Generic report. Here, focus is placed on the configuration of the existing fixed storage structures and WWII bunkers already located on Water Island and St. Thomas.

Based on the dimensions and general configuration of the bunkers on Water Island, it is believed that they are a standard concrete arch magazine (type F5). This is an Army Standard Design storage magazine specified as magazine, concrete oval-arch, earth-covered, as shown on USACE drawings coded STD 33-15-74. This structure consists of a cast-in-place concrete arch enclosure with concrete sidewalls, a retaining wall, and blast door in the front and an earth cover over the arch. An example of the standard concrete arch magazine is shown in figure 8-2.

The WWII bunkers on St. Thomas were not inspected during the January site visit, but based on their description, it is believed they are similar to those on Water Island and would be of the F5 type.

8.4.3 Cost Comparison. The approximate (order of magnitude) costs of constructing interim storage facilities are provided in table 8-1. Because the facilities vary in size, the cost per square foot of storage area is included in table 8-1 to provide a meaningful cost comparison.

At FFS, the fixed facilities under consideration are already constructed. Costs associated with using a fixed facility would result from upgrading the roads to transport the CWM to these facilities and upgrading the facilities to meet Army, Federal, and territorial requirements. The cost in the table for the construction of fixed facilities is provided for informational purposes only.

Costs in table 8-1 are exclusive of security and fire protection systems. Also, they do not include engineering, design, and construction management. Demolition of fixed facilities and removal of portable facilities after their mission has been completed are not included in these estimates.

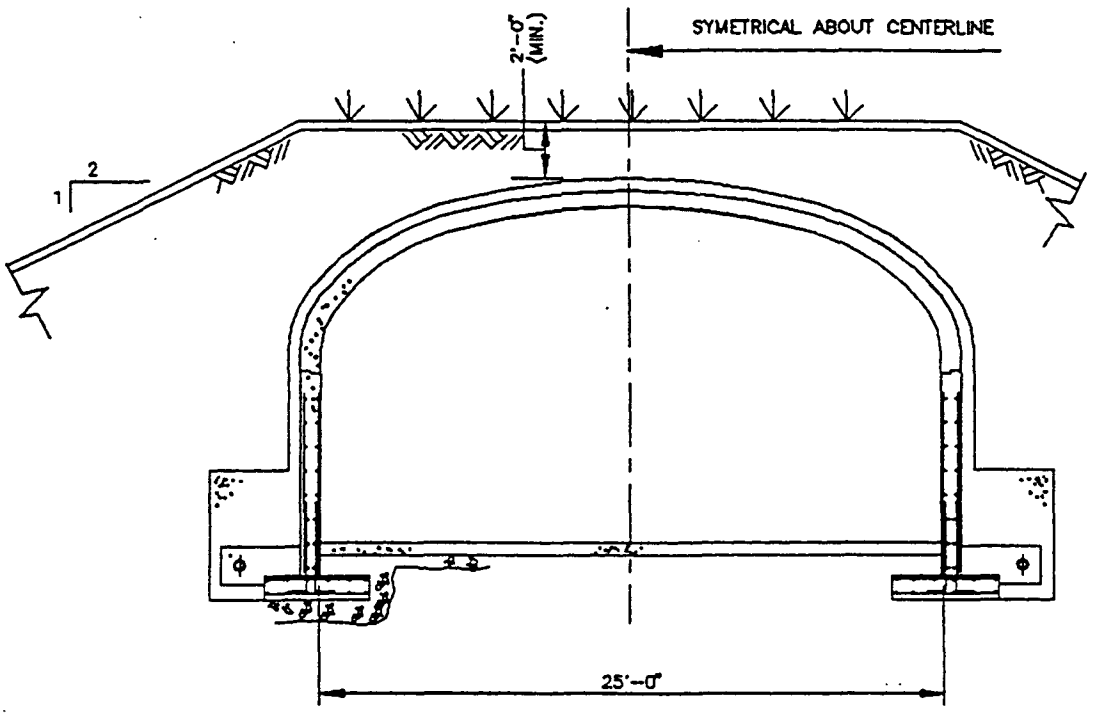


Figure 8-2. Type F5 Earth-covered Concrete Magazine (Cross-section)

Table 8-1. Cost Comparison of Interim Storage Facilities

Fixed or Portable	Type	Description	Storage Area Square Foot	Construction Cost ($ Thousands)	Cost per Square Foot ($)
Portable[1]	P1	Fabric structure[3]	720	9	13
Portable[1]	P2	Prefabricated hazardous waste storage module	144	20	139
Portable[1]	P3[2]	Prefabricated class I magazine	60	10	165
Fixed[4]	F1	Pre-engineered building	1440	98	68
Fixed[4]	F3	Low volume standard steel arch magazine	378	88	233
Fixed[4]	F5	standard concrete arch magazine	1700	256	151
Fixed[4]	F6	Government standard hazardous waste storage building	1440	243	169

NOTES:

1 Does not include site preparation.
2 Does not include fire protection system.
3 Explosion protection and bullet resistance not included.
4 Does not include demolition and site restoration.

In general, the portable facilities would have the advantage of being relocated and reused at another site or reused for storage of other hazardous materials. Also, if additional storage is required, additional modular units may be added without interrupting operation of the existing units.

Minimal lighting and electric power are assumed in the estimate. The estimate does include foundation cost and site work for fixed facilities, but these costs are not included for portable facilities because they vary over such a wide range.

8.4.4 Recommended Storage Structure. If a portable structure is selected for FFS, it is recommended that the prefabricated class I magazine (type P3) be selected because of the additional safety features it provides. A fragmentation analysis should be conducted on this facility if it is used to store explosively-configured items. In addition, the facility should be environmentally controlled at FFS.

8.5 Physical Security Analysis

The following paragraphs assess the threat and vulnerability of the interim storage facility to determine the physical security requirements of the recovered CWM at FFS. This physical security analysis is developed for possible interim storage sites on Water Island. If a decision is made to use the WWII bunkers on St. Thomas, the analysis could be modified to fit that situation.

8.5.1 Threat Assessment. The threat assessment developed for an interim storage facility at FFS utilizes the most recent Department of the Army (DA) unclassified postulated threat for chemical agents. It identifies threat profiles and compares them to threat categories to determine the postulated threat for each category.

Generally, DA guidance for the conduct of threat assessments specifies that liaison with local law enforcement agencies (LLEAs) and certain government investigative agencies be carried out to further define the types and level of threat confronting a specific facility or site. Because of the likelihood that it will be a year or so before FFS recovery operations will commence, this report considers threat categories based on the DA-postulated threat and observations made during the January 1993 site visit. When and if it is determined that CWM is to be recovered from Water Island, coordination with LLEAs and government agencies should confirm that no significant change in threat has developed during the period ensuing from the time of this scoping study to the time of initiation of recovery operations.

a. *Department of the Army-Postulated Threat.* There is no known DA-postulated threat statement for recovered CWM. In the absence of such a statement, the approved and unclassified postulated threat for chemical agents was chosen as a point of departure for assessing the threat. The following discussion is based on that postulated threat, which was concurred with by the Defense Intelligence Agency (DIA) on 28 October 1991 in response to DA's request for review and comment.

This postulated threat appears greater than that facing recovered CWM, largely on the basis that recovered CWM possesses limited value or utility to an adversary. Its monetary value is limited, if any, and its military use has likely degraded over time. Additionally, such materiel is generally recognized as being available in the open market. The materiel's chemical composition is well known, and an individual with the education and necessary equipment could produce limited quantities in a clandestine manner.

Currently, DA identifies the threat in terms of bulk-form chemical agents (categories I, II, III, and IV), research quantities (category V), and threat as it relates to internal sabotage, theft, or diversion of agent materiel.

While recovered CWM does not clearly fit into the five categories described in AR 50-6, it is considered to be similar for purposes of this assessment. Although AR 50-6 (Draft) treats the materiel as conventional category II explosives at the recovery site, it is noted that when moved to a chemical surety installation it regains its status as chemical surety materiel (CSM). There is no known or current Army-approved postulated threat for category II conventional explosives.

b. *Threat Profiles.* In general, an adversary can be described as posing a relatively low, moderate, or high threat to a target. At FFS, the target is the proposed interim storage facility on Water Island and profiling involves analysis of the following four factors:

- motivation,
- opportunity,
- skill and knowledge, and
- resources

In terms of the four criteria described, a low-level threat exists when an adversary has little motivation to carry out an attack or other factors limit that capability. A moderate threat exists when an adversary possesses some degree of motivation and some measure of the other criteria described. A high-level threat exists when an adversary combines a reasonably heightened motivation with resources, skill and knowledge, and opportunity.

c. *Threat Assessment.* The threat categories assessed included the following:

- criminal,
- terrorist,
- saboteurs,
- disaffected persons,
- protest groups,
- disgruntled employees,
- curiosity seekers,

- foreign intelligence services, and
- insiders,

Given the type of items which would most likely be recovered from Water Island, the assumption that they would most likely not be in a useful condition, and the relatively low level of attractiveness of likely deteriorated CWM to most of the groups listed above, the overall threat is considered to be in the low to moderate range.

8.5.2 Vulnerability Assessment

a. *Design-Basis Threat.* Design-basis threat involves comparing the postulated threat directed against an asset or protected area with existing and alternative protective measures, to develop an overall security system that reduces the threat posed to an acceptable level of risk.

In developing security for an interim storage facility on Water Island, security should be built on six fundamental elements:

- deterrence,
- delay,
- detection and assessment,
- neutralization,
- planning, and
- procedures.

Additionally, physical protective measures should be compared for the site, and a determination of the site's vulnerability should be assessed based on the presence or absence of those measures. These are grouped as follows and then compared with the threat categories to determine vulnerability.

- barriers,
- guard force,
- lighting,
- signing,
- access control,
- communications,
- locks and keys,
- intrusion detection and assessment, and
- supplementary measures.

In much the same fashion as the threat is assessed, the specific vulnerability for each of the identified measures can be low, moderate, or high. To reduce identified vulnerabilities, a combination of protective measures can be applied. For the most part, these incrementally contribute to eliminating or reducing an identified vulnerability.

A low degree of vulnerability exists when an adversary's capability is significantly reduced and the likelihood of the adversary's success is minimized. At this level, the adversary's motivation to act is minimal and his or her skill and knowledge is effectively countered. Additionally, opportunity to act is reduced or eliminated and the resources (such as equipment, time, and money) reasonably available to the adversary have been taken into account and countered by the measures employed.

Moderate vulnerability exists when the attacker possesses a reasonable capability to successfully act, when there is a fair likelihood of success, and when personal risk is acceptable. Such a situation exists when the adversary has a relatively high degree of motivation, possesses the skill and knowledge required to carry out the act, and has access to the resources and opportunities required.

A high degree of vulnerability exists when adversaries perceive themselves as having the opportunity, requisite skills and knowledge, required resources, and a reasonable expectation that the attack will be successful. Personal risk is viewed as being minimal and acceptable. Such situations arise most frequently when only minimal security measures are employed, when planning is ineffective, and when procedures are not documented.

b. *Deterrent Measures.* Deterrent measures are those that create the perception that an attack is likely to be unsuccessful, eroding an adversary's motivation and somewhat denying opportunity.

The interim storage facility would be vulnerable if fencing is not emplaced around it. Installation of a fence surrounding the storage area would provide a measure of deterrence to all threat categories except the insider. It would also provides a legal line of demarcation. Fencing of the storage facility should be consistent with DA's concept of providing concentric rings of security, beginning with the outer most boundary and working inward. The remoteness of Water Island and the fact that it is only accessible by water serves as a deterrent to intruders. Water Island can be accessed by the public ferry service from St. Thomas. This is not well known or very well publicized to the tourists on St. Thomas. The ferry service typically docks in the center of Water Island. Since there is no public transportation on Water Island, the individual would need to walk to the interim storage area, proposed to be located at the south or north end of Water Island. These sites are approximately one mile from the dock used by the ferry service.

c. *Delay Measures.* Delay measures afford protection by preventing the adversary's movement toward the target or by shielding the target from the intruder. They cause the attacker to use tools available within the area or which are brought from outside, and contribute to detecting an attack.

The likelihood of detecting and defeating an intruder increases with time. Similarly, an adversary may be dissuaded from an attack because it is likely to be unsuccessful or that the personal risk too great. Building in delay time as a part of the overall security system enhances the security of the target area, reduces an intruder's motivation, and aids in neutralizing an attack.

The interim storage structure may provide a degree of delay, especially from forced-entry attack by an adversary. This structure should be considered part of the overall protective system, although no specific structure has been identified. Open storage of materiel creates a significant vulnerability, which may be lessened to some minor degree by putting such materiel in locked containers; however, readily-available hand tools (such as bolt cutters) can defeat most lightweight metal containers.

Providing fencing, if properly installed, around the interim storage facility somewhat increases delay, but not significantly, by confronting the adversary with an additional barrier, both entering and leaving. In addition, fencing serves as a limiting boundary beyond which only authorized persons may proceed.

Since Water Island is open to the public, access to the Flamingo Bay area and the WWII bunkers at the north end of the island is not denied. The Sprat Bay area located at the north end of the island has no-trespassing signs, but this does not deter residents in that area. Access may be somewhat delayed since there is no public transportation on Water Island. Casual and curious individuals might not readily visit these areas of the island. The road network in the Flamingo Bay area is largely in disrepair and there are no beaches, only a landfill and trash dumps in the area. The absence of a barricade or gate at the south and north end of the island makes the areas vulnerable if an individual is aware of the interim storage of CWM and wants to access these areas of the island.

Lock-and-key control measures should be applied to the interim storage facility, as well as gates which provide access into the temporary storage area. The lack of controlled locks and keys enhances the intruder's motivation by reinforcing the perception that an attack will be successful. While locking hardware can provide varying delay time, depending on the hardware used, the absence of such locks and of controls over keys may serve as a motivator to an intruder and be seen as increasing his or her opportunity to achieve success. In the case of an insider, the lack of key-control procedures creates an unacceptable vulnerability.

d. *Detection and Assessment Measures.* Detection and assessment measures are designed to detect an adversary's presence and support a response to counter the identified threat. Detection measures range from simple and direct observation of the protected asset to sophisticated intrusion detection systems (IDS) with closed-circuit television monitoring at a remote location or in

proximity to the asset. Included in detection measures are badge-and-pass systems, which assist in the control and movement within and between areas.

Without continual surveillance or alarming of the proposed interim storage facility and without siting in such a way as to ensure direct observation of the facility's entranceway, detection of an intruder is assessed as having a probability equal to or approaching zero.

Should recovered CWM be discovered and temporarily stored at the site in an interim storage structure, controls over movement within the area would need to be instituted to decrease the vulnerability. In addition, a badging system, which identifies persons with authorized access to recovered CWM, would need to be instituted.

In general, the absence of detection measures at the proposed storage locations would lead to a high degree of vulnerability. Unless surveillance can be maintained on the structure, lighting employed to enhance surveillance, and movement-control applied for individuals involved with the recovered materiel and other aspects site operations, the storage facility would be highly susceptible to an adversary. Detection is critical to effectively counter the threat posed by insiders, criminals, and disaffected persons.

e. *Countermeasures.* Countermeasures are designed to defeat an adversary when detected and correctly assessed. They are incorporated into the overall security system for a protected area and include the response employed, degree of force authorized, means of communication, and any other supplementary measures. The absence of a means of effectively countering an adversary would pose an unacceptable risk to an operation, no matter how well developed other measures are.

   Overall, the absence of an effective, written plan to provide adequate communications and a response force in a timely manner, should an adversary attack be initiated, would create a significant vulnerability. While future security enhancements may make adequate provision for deterring, delaying, and detecting adversaries, the absence of a means of defeating the attacker is a critical deficiency in any security system. Should the system fail to provide such a means and should that fact be commonly known, then criminals and disaffected persons will see little personal risk and be even more motivated.

f. *Planning Measures.* To successfully manage security at a site, as required by Army regulations, an overall physical security plan should exist. This plan documents all security measures employed, provides copies of supporting procedures, and identifies contingency plans which may have been prepared for the site. The physical security plan will typically address barriers, lighting, guard orders and procedures, access controls and badging, lock-and-key control measures, and any supplementary measures employed.

Contingency planning, although desirable, cannot contemplate all possible events. If a particular event is known to be likely to occur, then a contingency plan should be prepared. Based on AR 50-6 (Chemical Surety) (Draft), only one such plan is apparently necessary: a Chemical Accident or Incident Response and Assistance (CAIRA) plan, which includes a security annex to it. Other contingency plans, which may be necessary in the future, depending on events, would be a civil demonstration and crowd control plan, and a security plan to support movement operations involving recovered CWM.

g. *Procedural Measures.* Procedural measures involve the internal procedures used in day-to-day security operations. Included within this category are written procedures for the lock-and-key control measures, badging, and guard orders. Such procedures, sometimes referred to as standard operating procedures (SOPs), are used by security and site operating personnel to ensure compliance with requirements contained in the physical security plan or elsewhere.

   The lack of procedures would pose a moderately-high vulnerability at the storage facility, because operating personnel would not have a ready reference to guide them in carrying out their duties. Any lock-and-key procedures should clearly spell out exactly who is authorized to be issued keys. Similarly, any badges used at the site should have in-place procedures for badge issue, recovery, and which badges permit access to various areas (for example, the interim storage facility).

h. *Accepted Risk.* Accepted risk is the concept acknowledging that absolute protection of an asset or an area is not possible on the basis that all occurrences cannot be foreseen. It recognizes that application of reasonable and cost-effective protective measures can reduce vulnerability to a level that minimizes risk and makes further improvements unnecessary.

8.5.3 Analysis of Physical Security Requirements. The following paragraphs analyze the Army's minimum physical security requirements for sites storing recovered chemical agent materiel. Paragraph 11-5.d. of AR 50-6 (Draft) adopts, by reference, the provisions of AR 190-11, Physical Security of Arms, Ammunition, and Explosives (AA&E), for recovered chemical agent materiel. In so doing, the Army has prescribed that such materiel will be afforded protection associated with category II conventional AA&E. This provides the basis for determining security requirements for such materiel, while being maintained in a field storage configuration for the recovered chemical agent materiel at formerly used defense sites (FUDS).

The Army's approach provides latitude and flexibility in storage of such materiel and is consistent with DoD policy with respect to security of conventional explosives. DoD Manual 5100.76-M (Physical Security of Sensitive Conventional Arms, Ammunition, and Explosives) acknowledges the need to tailor security to local conditions, based on practicality and cost, rather than specific security requirements described in the DoD

manual. Similarly, Paragraph 5-8.c. of AR 190-11 recognizes the need to provide flexibility for AA&E in temporary storage. While not defining the terms temporary or field storage, AR 190-11 prescribes broad requirements for such situations. These requirements are:

- perimeter barrier, either temporary or permanent;
- guard surveillance (post guards or onduty personnel);
- security lighting during hours of darkness or reduced visibility;
- inventory, accountability, and control;
- posted restricted area;
- access controls; and
- communications.

This analysis of physical security requirements examined requirements related to drained and undrained chemical munitions to ascertain whether different security requirements might be applicable to the two different types of munitions. From a policy standpoint, the Army does not differentiate between requirements for the two types of munitions, but instead treats both as recovered CWM. Therefore, for security purposes, both types of rounds should be treated in the same manner.

From a risk categorization standpoint, as outlined by both DoD 5100.76-M and AR 190-11, CWM recovered at FFS qualifies as sensitive; thus, this forms the basis for determining security requirements under the provisions of AR 190-11.

The requirements outlined in the following discussion are limited to physical protective measures.

a. *Barriers.* Category II storage areas are required to be surrounded by security fencing. This fencing, at the minimum level, should be type FE-5, with 6-foot-high fabric. USACE drawing 40-16-08 provides specific details of the FE-5 fence. This type of fence consists of a chain link design (galvanized, aluminized, or plastic coated woven steel) with a 2-inch mesh, 9-gauge diameter wire. In the case of FFS where no outer barrier exists, there should be two concentric fences around the interim storage facility, with a 30-foot distance between the two.

   Perimeter fences surrounding the protected area should have clear zones that extend 12 feet on the outside and 30 feet on the inside of the fence, assuming that available real estate permits. In addition, clear zones should be free of all obstacles and growth greater than 8 inches in height. The clear zone requirement may impact on the actual siting of any interim storage structure used for recovered CWM.

b. *Guard Force.* Security force requirements for recovered CWM storage areas can be kept to a minimal number, especially when coordination with local law enforcement is established. In the case of FFS, there is no local guard force

on Water Island. Communications should be linked with the guard force on St. Thomas to request backup, as required. The guard force at the interim storage facility may be either government or a contractor. Essentially, the guard force requirements entail ensuring that other functional areas (for example, lock-and-key control) addressed in this discussion are carried out in accordance with established written procedures, supporting and detailed in the physical security plan.

If continual surveillance of the storage area is not maintained by the presence of a guard, the interim storage structure should be checked by a security patrol on a periodic basis (usually every two hours). At FFS, it is recommended that a single guard be on duty on a continuous basis, 24-hours-per-day at the interim storage facility. This same guard service may also be used to provide security at nearby areas undergoing remediation. If continual surveillance is not employed, then an intrusion detection system (IDS) will be necessary during nonoperational periods; however, patrol checks should still be conducted at least once every 24 hours. Patrol checks may be conducted by either contract security, local law enforcement, or even site operating personnel. Given that operations within recovered CWM storage area will likely require a guard's presence for greater than 8 hours each day, continuous surveillance appears to be a more practical solution.

c. *Lighting.* At a minimum, security lighting should be provided for the exterior doors for all storage structures. The switches for the lighting should be installed so that they are not accessible to unauthorized individuals; thus, switches will require that they be protected and secured with locks, if located in an unprotected area (for example, placed on electrical poles within the protected area). In addition, lights should be protected by placing wire-mesh screens or protective lenses over the lighting source.

d. *Signing.* The outer perimeter fence installed around a recovered CWM storage area should have restricted-area signs placed at distances no greater than every 100 feet along the perimeter barrier. Specific wording of those signs should be in accordance with AR 190-13.

e. *Access Control.* Access, in terms of recovered CWM, should be controlled to a greater extent than that associated with conventional category II munitions. For example, AR 50-6 (Draft) requires that direct access to recovered chemical agent materiel be limited to personnel knowledgeable in the safety, security, custody, and accountability of chemical agents. This requirement sets the stage for establishing a badging system which aids in ensuring that only authorized persons are involved in the control, movement, and storage of such materiel.

While AR 50-6 (Draft) does not require that persons involved with recovered CWM be a part of the chemical-Personnel Reliability Program (PRP), it does

mandate the use of the two-person rule for access to materiel. This requirement is based on the need to ensure the safety of persons handling recovered materiel; however, the use of a badging system will serve as a means of enforcing this safety related requirement.

The two-person rule establishes the necessity to employ an A and B key-and-lock system for the interim storage structure. Under this approach, no single individual can have access to both keys for a storage structure; instead, two individuals should concurrently obtain the required keys and escort one another.

All gates into the interim storage area should be secured when not in use, unless continuously manned. Therefore, keys for gates into the area should be retained in the custody of the onduty guard.

Additionally, AR 190-11 requires that a pass, badge, access roster, sign-in and sign-out system, or some combination of these be used for admission to the storage area. The simplest and most direct approach would be to have each person authorized to work within the recovered CWM storage area be provided with a site-specific badge. For those authorized access to the interim storage area, a color-coded badge could be utilized. Visitors or other persons not requiring routine access to the storage area could be escorted by persons authorized in the storage area. This does not appear to violate the two-person rule, as it applies to access to the interim storage structure or when moving materiel to or from the structure.

f. *Communication.* Reliable and efficient primary and backup systems are required for external and internal communications. AR 190-11 requires that one of these be radio and that the communications system be established to provide notification of emergency conditions. Normally, radio and telephone provide the primary and secondary means of communication at sites.

g. *Keys and Locks.* Since access control imposes the two-person rule under the provisions of AR 50-6 (Draft) for recovered CWM, an A and B key-and-lock system should be instituted (although not prescribed by AR 190-11 for conventional AA&E). In its simplest form, this would require that two high security locks and hasps be placed on the interim storage structure entry doors and that no person be given access to both keys. Additionally, no individual could appear on the authorized list for keys to both A and B locks. Such an approach ensures the safety requirement of the two-person rule, while coincidentally improving security.

AR 190-11 requires that keys be issued only by the key custodian, although alternate key custodians are commonly assigned. As a practical matter, keys may be issued by a designated supervisor or guard when on duty, so long as the key control register requirement is met.

At a minimum, a key-operated, high-security padlock and hasp (MIL SPEC P-43607 and P43905) should be used for any operational door on the interim storage structure. Because of the A and B key-and-lock requirement, two such locks and hasps will be necessary. An alternative to using the high-security hasp, but one which provides somewhat greater security, is to use the U.S. Navy high-security shrouded hasp (MIL-H-291181). AR 190-11 permits use of the high-security shrouded hasp for category II storage structures, at the discretion of the individual responsible for the area being protected.

h. *Intrusion Detection and Assessment.* There are no specific requirements contained in AR 190-11 for the use of alarm systems on category II storage structures, so long as the structure is continuously manned or under constant surveillance. However, during periods when the site's vulnerability is perceived to have increased, unalarmed structures will be subject to increased guard checks during non-operating periods (for example, nights and weekends).

8.5.4 Analysis of Interim Storage Physical Security Measures. The following paragraphs address physical security measures recommended for the proposed interim storage facility at FFS. Minimum recommended security measures necessary to achieve an acceptable level of risk for the recovered CWM interim storage facility are provided. These measures should be taken as a whole to reduce potential vulnerabilities and consequently reduce the risk confronting the site.

The analysis of security requirements for recovered CWM is based largely on AR 50-6 (Draft). Chapter 11, paragraph 11-5.d., of that draft regulation adopts by reference the provisions of AR 190-11 for recovered CWM. In so doing, the Army has prescribed that recovered CWM will be afforded protection associated with category II conventional AA&E.

The recommended requirements, considered alternatives, and supplementary measures were developed using the guidelines of AR 190-11 and DoD 5100.76-M. Specifically, they were developed taking into account DoD's risk factors, which are the basis for categorizing an explosive or munition as sensitive. These factors are:

- utility,
- casualty and damage effect,
- adaptability, and
- portability.

a. *Barriers.* The interim storage facility area should be surrounded by two concentric fences. The recommended fence is a type FE-5, with 6-foot-high fabric, constructed in accordance with USACE drawing 40-16-08.

A double gate, sufficient to permit access by a medium size truck, should be provided on one side, preferably placed on a direct line with the interim storage structure's door. The gate should be of the same material as the fence and

should provide structural integrity equivalent to the fence itself. The gate should be secured, using a secondary padlock and chain, when no work is being conducted within the interim storage area. For safety reasons, the gate should be left unsecured when work is being conducted within the area.

Clear zones using this approach would extend 30 feet beyond the outer fence, 30 feet between the fences, and 30 feet on the inside of the inner fence. Additionally, two vehicle-access gates would be used and a vehicle trap should be provided. The cost for this approach would be more than twice that involved with the recommended FE-5 fence.

b. *Guard Force.* At a minimum, a guard should be posted at the interim storage site area and positioned to maintain continual surveillance on the doors of the storage structures. This same guard could serve as the primary means of controlling access into and out of the recovered CWM storage area. If feasible, it is recommended that the static post guard be assigned for intervals of no greater than 4 hours during nonoperational periods. In so doing, the monotony of the static post can be minimized and vigilance increased.

   An enclosed guard house, no less than 5 feet by 8 feet in size, should be provided for the security force. Such a guard house can be constructed, leased from a number of vendors, or purchased in a prefabricated form. Electric power for lighting should be included, as well as separate space for maintaining guard post orders (procedures), access rosters, and a key control sign-in and sign-out register.

c. *Lighting.* Security lighting, at a minimum, should be provided at the exterior doors for the interim storage structures at FFS. During periods of darkness, the illumination intensity should be no less than 1.0 footcandle at any point to a height of 8 feet on the vertical and to a horizontal distance of 8 feet from the entrance. Lighting may be affixed to the interim storage structures or mounted on a pole in proximity to the structures.

d. *Signing.* The outer perimeter fence should have restricted-area signs placed at 100-foot intervals along the entire perimeter barrier. The existing fence around the Flamingo Bay area should be similarly posted as well as any other fenced area undergoing remediation. Specific wording for these signs should be in accordance with paragraph 6-4.c. of AR 190-13. Additionally, restricted-area or other warning signs should be placed at all vehicle and pedestrian gates.

e. *Access Control.* Vulnerabilities associated with the FFS interim storage site can be significantly reduced by applying strict access-control measures. By combining access control with other recommended measures, only a limited number of persons will be authorized within the storage structure, or be permitted to move materiel within the storage area. Such access-control measures are especially important when considering the threat posted by the

insider, who would otherwise be permitted free movement within the storage area and the structure.

Access to recovered CWM should be controlled to a greater degree than normally associated with category II munitions and explosives. AR 50-6 (Draft) requires that direct access to recovered CWM will be limited to personnel knowledgeable in the safety, security, custody, and accountability of chemical agents. In addition, AR 50-6 (Draft) applies the two-person rule for access to the materiel itself.

These requirements can be best met by establishing a badging system, which readily aids in ensuring that only authorized persons are involved in the control, movement, and storage of recovered CWM.

Although AR 50-6 (Draft) does not establish a requirement that persons handling recovered CWM be in the chemical-PRP, it does mandate use of the two-person rule for access to the materiel.

f. *Communications.* Reliable communications is the basis for the security force ensuring that any threat which presents itself is dealt with promptly and effectively. While the security guard may detect an intruder's presence, without the ability to communicate that information and notify a designated response element, the guard's ability to neutralize the threat is limited.

   AR 190-11 requires that primary and backup forms of communication be provided; however, by Army policy one of these must be radio. Radio and telephone are generally considered to be the most usable forms of communication at a site such as FFS.

   The communications systems should be readily available to the guard force and should be tested on a periodic basis by supervisory personnel. Additionally, guards should test the communications systems at least once during each shift.

   A hand-held radio, operating on a frequency assigned to the site or the site's operating contractor, is the recommended primary means of communication during operating and nonduty periods. A telephone, located at the guard's post, is recommended as the backup means of communication.

g. *Locks and Keys.* Locking hardware applied to the interim storage structure can reduce vulnerability of the materiel to attack to an acceptable level. Using the proper locking hardware in conjunction with an effective key control program can deter attackers, provide significant delay-time leading to detection of the attacker, and ultimately cause the intruder to be defeated. Effective key control can significantly reduce vulnerability to insider attack, especially when used in conjunction with the two-person rule.

The A and B key-and-lock system is recommended for the doors for the interim storage structure. Although this approach is not required by AR 190-11, AR 50-6 (Draft) does call for the two-person rule to be used for safety reasons for those in contact with recovered CWM. On that basis, entry into the structure would be governed by the two-person rule and the A and B key-and-lock system enforces the requirement; thus, both safety and security is enhanced.

The A and B key-and-lock system requires that two high-security locks and hasps be placed on the interim storage structure's entry doors. No person is authorized access to both keys. Additionally, no individual could appear on the authorized list for keys to both A or B locks.

h. *Intrusion Detection and Assessment.* There are no specific requirements within AR 190-11 for the use of alarm systems for category II storage structures, so long as the structure is continuously manned or under constant surveillance. On this basis, a security guard with direct observation on the lighted doors of the storage structure adequately meets the regulatory requirement. This same security guard can exercise control of access and egress into the storage area, issue and receive keys, and maintain communications.

i. *Planning Measures.* Several planning requirements are supportive of reducing vulnerabilities to an acceptable level of risk associated with the interim storage structure area. These planning documents result from the conduct of a threat assessment (TA), leading to a vulnerability assessment (VA) and ultimately a physical security plan.

Both AR 50-6 (Draft) and AR 190-11 require development of these plans; however, the latitude provided in AR 50-6 (Draft) to adopt the requirements of AR 190-11 simplifies the overall planning needs for an interim storage area at FFS.

The threat has already been assessed for the interim storage area and is outlined in paragraph 8.5.1. An assessment of the site's vulnerability to the defined threats is addressed in paragraph 8.5.2. The recommended measures outlined in these paragraphs, including planning measures, are designed to reduce the defined vulnerability and achieve an acceptable level of risk. The threat and vulnerability assessments in this document are developed in response to the requirements of AR 190-11 and AR 190-13.

Both the threat and vulnerability assessments should be updated annually, as outlined in AR 190-11 and AR 190-13. Correspondingly, the physical security planning associated with the site should be revised, as required. Liaison with local and Federal law enforcement was not conducted in this analysis. This should be initiated prior to finalizing the threat and vulnerability assessment to determine if any known change to the postulated threat has occurred.

A site-specific physical security plan and supporting contingency plans are required to ensure a comprehensive and integrated security program for the interim storage area. Additionally, chapter 11 of AR 50-6 (Draft) requires that a CAIRA plan be prepared before operations at FFS are initiated involving recovered CWM.

The CAIRA plan requirements are outlined in DA Pamphlet (PAM) 50-6, CAIRA operations, 17 May 1991. Appendix P of DA PAM 50-6 details the requirements of the CAIRA plan, including required annexes, one of which involves physical security. Other annexes which are to be included are: task organization, notification procedures, fire and rescue support, evacuation procedures, medical support, public affairs, environmental monitoring, contamination control, and transport (removal) operations. AR 50-6 (Draft) requires that the CAIRA plan be provided to Headquarters, Department of the Army (HQDA) for final review prior to initiation of intrusive investigation or remediation/removal actions.

The operational physical security plan for the interim storage area serves to document the protective measures used at the site and internal procedures which apply to security operations on a day-to-day basis. AR 190-11 adopts by reference the requirements of AR 190-13 with respect to the physical security plan. AR 50-6 (Draft) requires that the final protective measures for a recovered CWM site (that is, the physical security plan) be approved by the first general officer in the chain of supervision. In the case of recovered CWM, it appears the Commander, U.S. Army Chemical Materiel Destruction Agency (USACMDA) would approve the site's final physical security plan.

This site physical security plan would address a range of protective matters. Among the topics required to be addressed would be access control measures, lock-and-key control, guard duties and responsibilities, response force arrangements, barriers, lighting, any identifications which might be employed, and communications. Also included either in the plan or by reference would be any existing contingency plans and coordination requirements with local and Federal officials. Guard post orders, notification procedures, emergency actions taken by the security force, and similar activities would be included as annexes.

j. *Procedural Measures.* A host of procedural matters are required for any physical security operation. These procedures ensure continuity and consistency and guide the day-to-day matters involved in ensuring a comprehensive and effective security program is in place for the recovered CWM interim storage area. While not all are required to be included in the physical security plan, most lend themselves to being annexes within the plan. The following paragraphs address some of the more common areas which would be addressed.

The guard posted at the interim storage site should have instructions addressing his or her responsibilities in terms of the storage area. Specifically, the post orders should include instructions for, but not limited to, the following:

- communications operations,
- response operations,
- notification responsibilities,
- lock-and-key control responsibilities,
- personal emergency response actions,
- hours of operation,
- vehicle access,
- individual access,
- badge and pass identification,
- prohibitions on personal property onpost,
- use of force, and
- bomb threat procedures.

The site security plan should show the location of fences, vehicle, and pedestrian gates; emergency evacuation routes from the area; and any gates associated with emergency evacuation. These should also be identified in terms of their hours of operation. Clear-zone requirements should be specified, as well as maintenance requirements for vegetation within the clear zone.

Badging for site operations should be addressed as an annex to the plan, including descriptions of badges used and areas to which those badges authorize the bearer to have access. Badge issuance procedures, photography requirements, and collection procedures upon termination should be included.

Access control measures employed, including checks of badges and visitor control measures, should be a separate annex to the physical security plan. This annex should also address vehicle access/egress procedures and any inspections or checks of vehicles or hand-carried personal property.

Lighting at the site, including location of switches and any required alternate lighting, should be fully discussed. This annex should detail hours of operation of lights, location of switches, and backup lighting sources.

Primary and backup communications should be specified in a separate annex. Details as to radio frequency (primary and alternate), communication checks (both radio and telephone), and supervisory tests should be delineated.

Emergency notification lists, detailing the name and work/home phone numbers of specific individuals, should be identified. For each individual, an alternate should be specified and phone numbers for these personnel provided.

8.6 Conclusions and Recommendations

The following paragraphs provide conclusions and recommendations for the interim storage facility at FFS in terms of facility type, siting options, and security requirements.

8.6.1 Interim Storage Facility. If a portable structure is chosen for the FFS interim storage facility, the prefabricated class I magazine (type P3) is recommended because of its superior safety. These storage modules could be used to store the relatively small amount of CWM potentially recovered at FFS. If, during the operation, additional storage is required, other modular units may be added without interruption to operation of the existing units. Upon completion of work at one site, the portable units have the advantage of being relocated and reused at another site.

The size of the facility cannot be specifically determined from the information obtained to date. However, it can be reasoned that initially two storage structures would be required at FFS. Since the items which may be recovered are unknown at this time, the two facilities would provide the capability of separating recovered CWM according to agent type or burstered and unburstered. A fragmentation analysis should be conducted of the selected interim storage facility to ensure it can safely store explosively-configured CWM.

If an existing fixed structure is preferred for interim storage of CWM at FFS, a structural analysis should be conducted to ensure it meets requirements to store recovered CWM. In addition, special provisions should be provided for proper venting and control of internal air in the fixed facilities. This would range from natural ventilation in the form of louvers to an activated closure of exhaust louvers upon detection of airborne contaminants or a mechanical air filter/scrubber device attached to an exhaust vent.

Based on RCRA requirements, the interim holding structure must be equipped with a secondary containment system to contain either 10 percent of the volume of the containers or the volume of the largest container, whichever is greater. The portable storage structure should be designed to hold hazardous liquids that may leak from the stored containers. In addition, it should be equipped with a sump or a berm that can contain the hazardous liquid. The facility should be of a material compatible with agent decontamination solution.

At FFS, the interim storage facility would need to be environmentally controlled. Storage of recovered CWM at ambient temperatures on Water Island would be at excessively high temperatures and may result in vapor buildup in intact munitions.

8.6.2 Siting Recommendations. Placing the interim holding facility in the Flamingo Bay area is attractive because it would be close to the sites where CWM would most likely be recovered. This location would simplify the transportation of recovered CWM to the interim holding facility. In addition, this area is located downwind of most Water

Island residents. Additional investigation is needed to identify an exact location for storage facilities in this area. Space is limited in this area, so it may be difficult to meet all of the siting requirements.

Army regulations that must be considered, if the interim holding facility is located in the Flamingo Bay area or the existing bunkers at the northern end of the island, are the separation distance requirements. The Flamingo Bay area and the WWII bunkers at the northern end of Water Island do not appear to have sufficient space to comply with the separation distance requirements in the Army regulations. The criteria for storage of chemical munitions are stated in AMC-R 385-131 and defined in AMC-R 385-100 but may not be directly applicable for recovered CWM.

To comply with 40 CFR 264.176, the interim holding structure containing reactive wastes must be located at least 50 feet from the facility property line. This requirement should be considered when identifying a possible site within the Flamingo Bay area.

The selected site for the interim storage facility will need to be reviewed by U.S. Virgin Island regulatory officials prior to finalization, since Water Island is within the first tier of the coastal zone.

8.6.3 Security. For purposes of determining security requirements for recovered CWM, AR 50-6 (Draft) adopts the majority of the Army's protective measures applied to conventional category II AA&E (for example, explosive munitions). The interim storage structure should conform to the requirements of DoD 6055.9-STD and AR 385-64.

Security lighting, at a minimum, should be provided for at the exterior doors for the interim storage structures at FFS.

Continuous guard surveillance should be provided at the interim storage site area and positioned to maintain continual surveillance on the doors of the storage structures. This same guard could serve as the primary means of controlling access into and out of the recovered CWM storage area.

Vulnerabilities associated with the interim storage site can be significantly reduced by applying strict access control measures. These requirements can be best met by establishing a badging system to aid in ensuring that only authorized persons are involved in the control, movement, and storage of recovered CWM. Although AR 50-6 (Draft) does not establish a requirement that persons handling recovered CWM be in the chemical-PRP, it does mandate use of the two-person rule for access to the materiel.

The physical security planning associated with the site should be coordinated with local and Federal law enforcement prior to finalization.

SECTION 9

TRANSPORTATION OPTIONS

9. TRANSPORTATION OPTIONS

This section presents the transportation options that are available for shipping chemical warfare materiel (CWM) from Water Island to an offsite location. Included is a summary of the site characteristics and assumptions which impact transportation at the Former Fort Segarra (FFS), a summary of generic techniques which may apply, an analysis of these techniques, and recommended transportation techniques for FFS.

9.1 Site Requirements and Assumptions

This section will present the transportation resources available on FFS and other assumptions which will be used in developing recommended transportation scenarios for FFS.

9.1.1 Road Transportation. There are both improved (that is, paved) roads and unimproved (that is, unpaved) roads located on Water Island. As discussed in section 2, these roads are maintained by the Water Island residents. The roads are typically asphalt or dirt and are typically 10 feet wide. Frequently travelled routes, such as to the main ferry dock, are paved and approximately 16 feet wide. Roads to test area 7, to the bunkers at test area 1, and to test areas 4 and 5 are narrow dirt roads. Roads near test area 6 and 7 are in some places very steep. Roads to test area 6 and in the Flamingo Bay area are paved or packed gravel. Figure 9-1 shows the road network on Water Island. Figure 9-2 shows some of the roads which are in the worst condition.

The rate of traffic on these roads is not of major concern, due to the relatively low population and the remote location of the areas of concern. Traffic on the roads is not significant although in most places the roads are so narrow that one vehicle needs to move on the shoulder to be passed by oncoming traffic. The Flamingo Bay area is the access point to the deep water dock, so there will be some vehicle traffic associated in this area. The deep water dock is the only dock on the island where vehicles and other heavy items can be moved onto Water Island. The roads near areas 4, 5, and 7 are infrequently traveled (approximately 0 to 1 vehicles per hour). The road near area 6 is more frequently traveled (approximately 3 to 4 vehicles per hour) since there are more residents in this area.

9.1.2 Air Transportation. There are no airports or constructed runways located on Water Island. Helicopters have landed on Water Island in the marina area but there is no pad constructed for this purpose. The Harry S. Truman Airport is the closest airport, located on St. Thomas approximately two miles by water from Flamingo Bay.

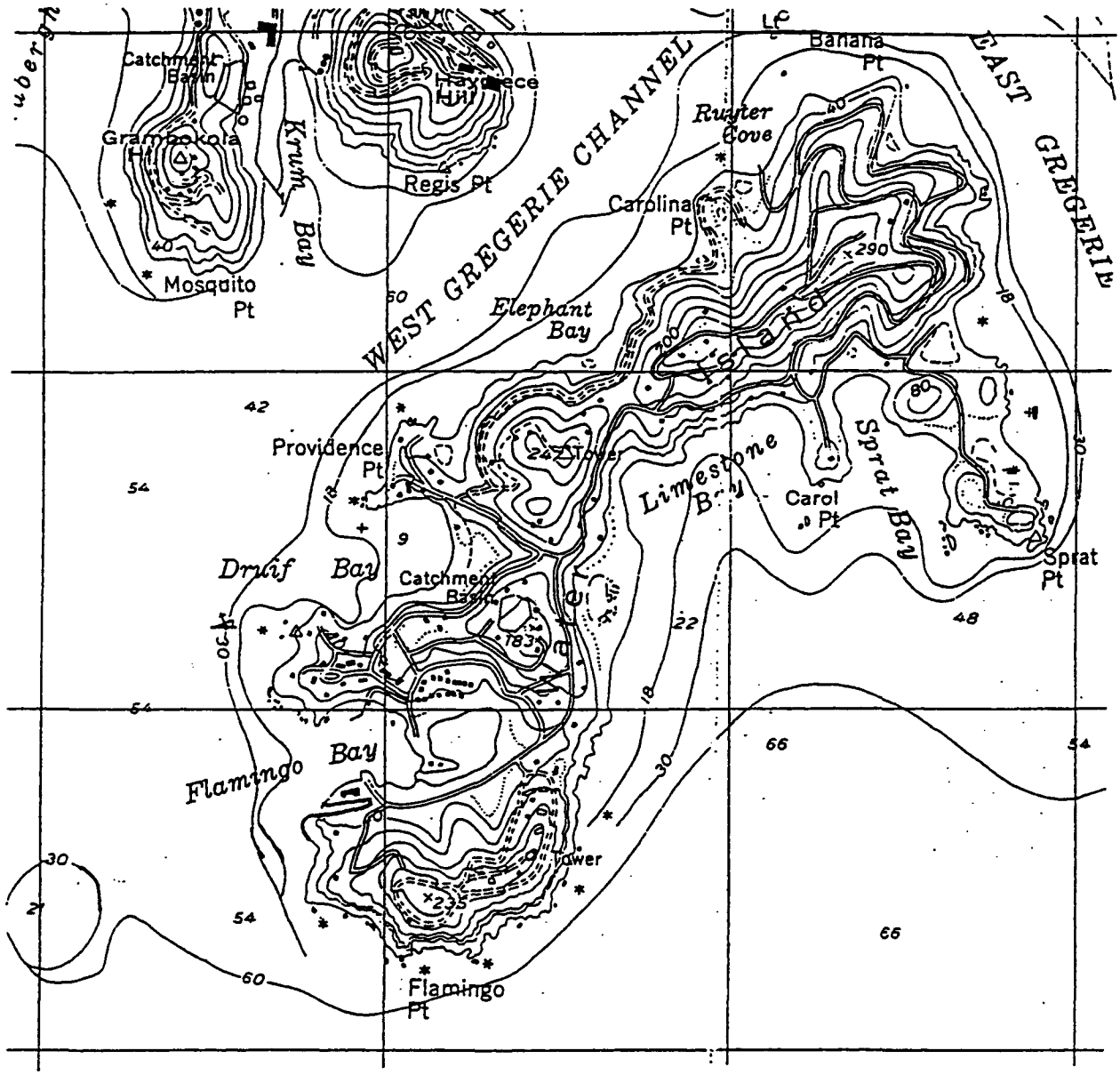


Figure 9-1. Road Network on Water Island





Figure 9-2. Road Conditions on Water Island

9.1.3 Ship Transportation. There are two shipping docks on Water Island. The ferry dock at the western center of the island is constructed of wood and cannot handle significant weight. It is used for passenger arrival and departure only. The trip from St. Thomas to Water Island takes approximately 7 minutes, and the ferry has approximately 5 scheduled round trips per day.

The second dock is located in deeper water in the Flamingo Bay area. Figure 9-3 is a photograph of the dock area. The deep water dock is the only area where heavy equipment can be barged onto the island. The access road to the deep water dock is not paved but does have a dense layer of gravel. The deep water dock is in disrepair and has not been dredged since Hurricane Hugo. Figure 9-4 is a navigation chart of the waters surrounding Water Island. According to these navigation charts and personnel interviews, the depth of the water at the Flamingo Bay dock is 8 to 10 feet (Better Boating Association, 1989) (Couter, 1993). The MV Saint is a barge owned by the Water Isle Hotel that is used to transport heavy equipment to the island. Although owned by the hotel, the barge is used by the entire island to bring aggregate, construction, and private vehicles to Water Island.



Figure 9-3. Flamingo Bay Dock Area

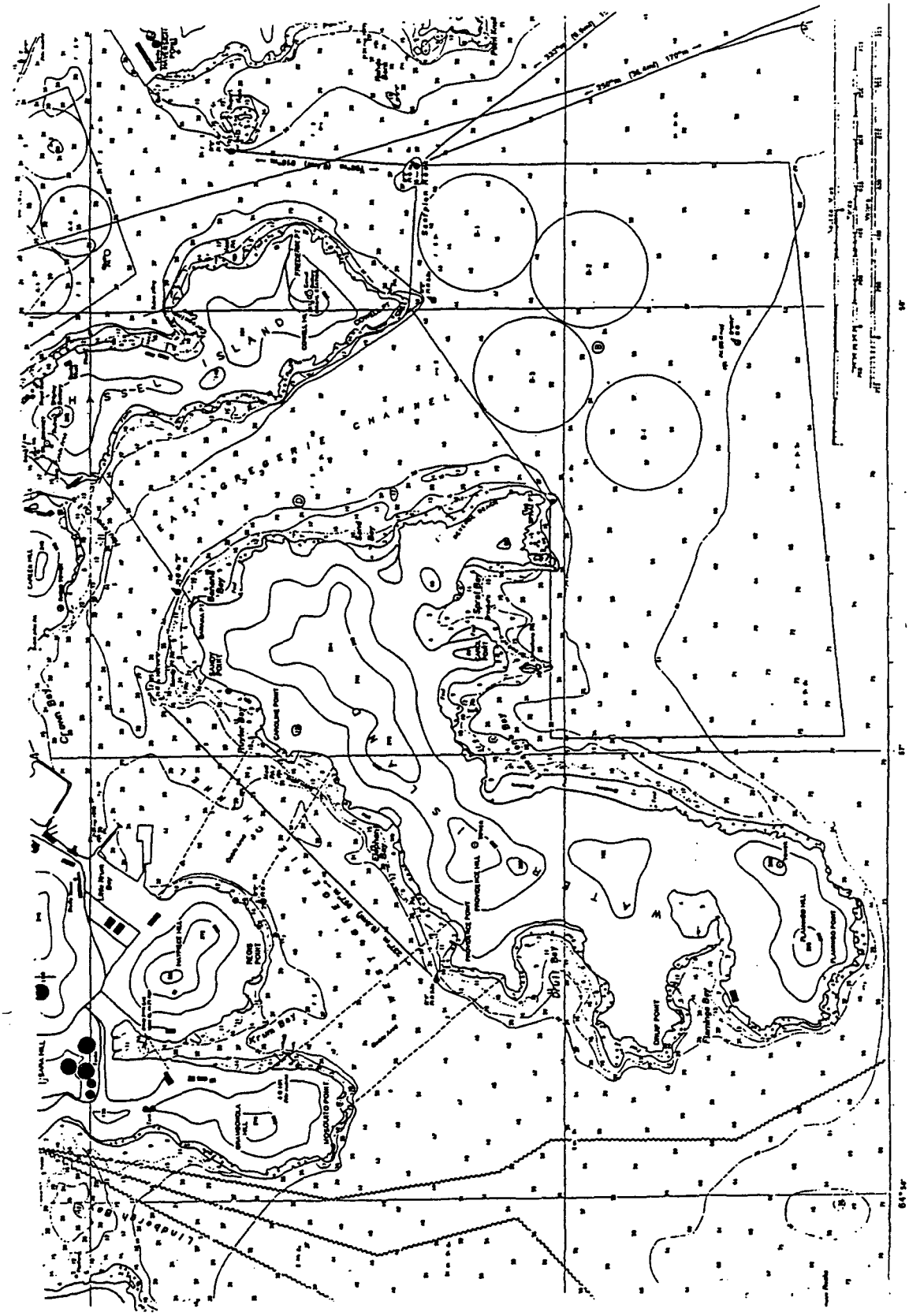


Figure 9-4. Navigation Chart (Better Boating Association, 1989)

9.1.4 Site Assumptions. Based on the above site information, it is assumed that air and water transport are the only available options for movement of recovered CWM from Water Island. The use of rail, road, air, or ship may be feasible for transporting the CWM to the final disposition site within the continental United States. The road network on Water Island should be used to stage and transport items to the transportation port. Prior to transportation, CWM should be identified and packaged in pre-approved shipping containers, as outlined in section 7. If, as expected, the quantity of items recovered at FFS is very small, the development of a transportation plan would be much different from the retrograde or stockpile program. In addition, since it is assumed that CWM is a non-surety hazardous waste, no armed escorts or other surety requirements will be involved. To the maximum extent feasible, transportation will be continuous (that is, except for required overnight stops, the cargo will not be stored or stopped until it reaches it final destination).

9.2 Summary of Transportation Options Presented in the Generic Site Scoping Study

Programmatic considerations for a deliberate move and four modes of transportation (road, rail, air, and water) are evaluated in section 6 of the Generic Site Scoping Study. This evaluation is based on information from documented transportation studies for the stockpile program and from hands-on experience conducting a stockpile move. A brief summary of each is given here.

9.2.1 Programmatic Considerations. Programmatic considerations are those that are common to all modes of transportation. They include the general planning and coordination activities that should, according to a panel of transportation experts involved in the stockpile program, be developed and executed prior to a stockpile move. These activities include the preparation of a transportation operating plan, a safety plan, a vulnerability analysis, a medical support plan, and an emergency response plan. Additional programmatic activities recommended by this panel include the determination of personnel required to be in the Army Chemical Personnel Reliability Program, the development and implementation of personnel training programs, the establishment of command and control procedures and a central office, and the selection of transportation routes. Specific discussions on these activities and their comparisons to the non-stockpile program are given in the Generic report.

9.2.2 Transportation Modes. Four modes of transportation are evaluated in the Generic report. In general, the section for each mode include discussions on programmatic considerations (such as route selection, safety plans, work crew selection, site-specific training, etc.), container loading and unloading procedures, manifesting cargo, predeparture activities, en route operations, and arrival activities. Specifics for each are given in their respective sections in the Generic report.

9.3 Analysis of Transportation Options Presented in the Generic Report

An extensive amount of time and resources have been allocated to conduct transportation studies for in the stockpile program. The non-stockpile program,

however, has not been afforded the same opportunity. The objective of the Generic report is to determine what is required by law and, in the absence of data, evaluate stockpile studies, reports, and experiences and consider whether they are applicable to the non-stockpile program. In doing this, however, it is essential to keep in mind that stockpile requirements should not be assumed for the non-stockpile program without proper data, obtained through specific studies, to support them. A brief summary of key topics discussed in the Generic report are summarized here.

9.3.1 Transportation Requirements for Hazardous Waste. The requirements for offsite transportation are clear. Because CWM is regarded as a hazardous waste, all regulations and requirements for shipping hazardous waste must be followed. This means that at the very minimum, the following requirements must be met:

- the hazardous waste must be packaged, at a minimum, in a container that meets Department of Transportation (DOT) regulations for packaging group I or II (see section 7);

- the generator of the hazardous waste must have a generator identification number before the hazardous waste can be shipped;

- the hazardous waste must be properly manifested for chain-of-custody purposes;

- the transporter must have a permit to haul that type of hazardous waste (this must also comply with territorial regulations regarding what can be transported on U.S. Virgin Islands roads and in what quantities); and

- the destination facility must have a permit and adequate storage space to accept the type of hazardous waste being shipped.

9.3.2 Other Considerations. In addition to these requirements, there are several factors to consider for offsite transportation. The location of the origin, destination, and the distance between are major factors. The longer the distance travelled, the greater the potential for an accident. Several transfers between modes of transportation may be required before the shipment reaches its final destination, also increasing the potential for an accident. Again, the potential for an accident increases as the number of transfers increases.

Past stockpile procedures have required that security of the cargo to be maintained throughout a planned move. This can vary from using armed escorts and custodial agents to restricting access to the cargo. For example, past experience during road transportation by the stockpile program for enhancing security was to close a specific road to other traffic until the cargo vehicles had passed. Security was also afforded through restricted air space during the transportation operation. Risks associated with the type of cargo, quantity of cargo, proximity to local population, protection afforded by the transportation container, and perceived threat to the cargo would need to be determined to support these kinds of recommendations for the non-stockpile program.

Emergency response capabilities are another factor that may influence the selection of a transportation mode. Distance to supporting medical facilities, proximity of response equipment to an accident, and the quantity of cargo contained in one mission will impact the risks involved with each mode, thus affecting mode selection.

Each of these factors (origin, destination, distance to be travelled, security, and safety factors) affect each mode of transportation. Programmatic considerations to reduce the risks associated with each are discussed in the respective sections of the Generic report.

9.4 Recommended Techniques at the Former Fort Segarra

The following paragraphs present the transportation options available for shipping CWM offsite. Information has been gathered from available maps, personal interviews, and site visits. Given that the areas of interest are located on an island, options for transportation in the immediate area are limited.

9.4.1 Road Transportation. Because the areas of interest are located on an island, road transport will need to be combined with another form of transportation. Based on the description of the roads and the relatively short distance in which the cargo would have to travel before transferring to another mode of transportation, it is feasible that these roads could support a ground move in their present condition. Special safeguard provisions would need to be made for areas where the roads are very steep. The actual transport vehicle may not be able to haul the cargo up the hills, and this may require shuttle operations with smaller all-terrain vehicles. If this is necessary, transportation in this manner would be affected by the size and weight of the container used to transport the CWM.

9.4.2 Air Transportation. Without a defined final destination for the cargo, air transportation can be perceived in two options, rotary-wing and fixed-wing aircraft. According to personal interviews, there is a small unpaved area near the Marina where helicopters have landed. It is feasible that work would be required to update the area to support a transportation plan for a rotary-wing aircraft. If rotary-wing transportation is not possible on Water Island, the CWM items would need to be shipped to St. Thomas or some other land mass with a runway. This is less desirable for two reasons. Additional cargo transfers of CWM would be required, and this would involve bringing the CWM into a more populated area.

In 1988, DOT granted the Department of Defense (DoD) an exemption (DOT-E 7573) allowing anything which can be shipped by land to be shipped by air as well, and also to be shipped by air in greater quantities than specified in 49 CFR 172.101. According to the Technical Escort Unit (TEU), any such package may go from any military installation to any military installation.

Should the Army decide to ship the cargo to its final destination by air from a civilian airport, and the cargo exceeds the limit allowable (100 kilograms) by air, a waiver may be needed.

9.4.3 Ship Transportation. The Flamingo Bay area is the most ideal area for shipment of CWM from Water Island. It is the location of the deep water dock and is also the recommended area for an interim storage facility. However, since the depth is only 8 to 10 feet, large ships would be precluded from coming into the bay to load cargo from the island. Another potential problem with this area is that one of the main shipping channels for cruise ships is through the West Gregerie Channel to Charlotte Amalie. However, water shipment of CWM coming in close proximity to cruise shipment may be able to be avoided since ships typically come in before dawn and dock at St. Thomas for the day.

9.5 Conclusion

Transporting CWM from an island presents a unique situation. One important factor in selecting a mode of transportation would be the number of cargo transfers required. The more the cargo is handled, the higher the probability for an accident. Therefore, the transport combination requiring the least amount of cargo handling is most favorable. Another important factor in selecting a mode of transportation is the size and weight of the transportation container. If the cargo is to be recovered from an area where steep roads provide the only access, the container must be compatible with the type of transport vehicle required.

Given these considerations, a transportation plan involving rotary-wing aircraft would seem most favorable. An example of the sequence of events for this type of plan would be:

a. load the cargo transportation container onto a wheeled vehicle and transport it to the helicopter loading area;

b. transfer the cargo transportation container to a helicopter; and

c. transport to the final destination or predesignated military installation for refueling and maintenance.

This transport combination only requires the cargo to be handled three times (loading, transfer, and unloading). It would not bring the cargo to St. Thomas, thereby relieving some concern from the local populace. It would not involve the civilian airport or loading docks on St. Thomas. Finally, in terms of resources, the helicopter loading area may not be as exhaustive as preparing a loading dock or a runway. A waiver would need to be obtained from DOT regulations to transport explosively configured CWM by rotary wing aircraft.

A final recommendation to select one mode or a combination of transport modes cannot be made before considering information from a risk and cost analysis.

Therefore, final selection of a transportation strategy for FFS should be made under the Comprehensive Environmental Response, Conservation, and Liability Act (CERCLA) process during evaluation of cleanup alternatives.

SECTION 10

ONSITE TREATMENT

10. ONSITE TREATMENT

Onsite treatment of recovered chemical warfare materiel (CWM) has many distinct advantages, including its being a final solution to the problems that CWM presents. Risks associated with transportation and extended storage are eliminated and complex regulatory interactions are avoided. Drawbacks, however, include the requirement for the development of a treatment system and costs associated with the temporary nature of a CWM recovery site.

This section addresses onsite treatment of recovered CWM at the Former Fort Segarra (FFS). Technologies included in this evaluation have been limited to those which could be fielded in 3 years or less. This requirement is necessary to achieve U.S. Army Corps of Engineers (USACE) remediation schedules established for FFS. A detailed description of these alternative technologies is included in section 7 of the Generic Site Scoping Study. This section discusses unique site treatment requirements for FFS, summarizes the generic treatment alternatives, presents the results of the technology evaluation from the Generic report, and discusses the potential treatment alternatives for FFS.

FFS has been identified as a type 3 burial site, which is a burial site containing small quantities of explosively- and non-explosively-configured CWM. An evaluation of treatment technologies suitable for a type 3 burial site like FFS is included in the Generic report. A type 3 burial site would require a system designed to treat explosively-configured munitions. The cutting or drilling step would need to be conducted within a system that could contain the blast from an accidental detonation. The chemical agent could be destroyed inside the cutting chamber or pumped to an external treatment system. The energetic material, scrap metal, and packing material could either be treated onsite or shipped to an offsite facility for treatment and ultimate disposal. This system, along with its ancillary support equipment, would also need to be mobile and could be mounted on the back of a truck or on mobile skids.

The onsite treatment alternatives described in section 7 of the Generic report did not address site-specific requirements that may affect implementation at a particular burial site. This omission was intentional since the purpose of the Generic report was to identify and rank technologies that could potentially be used at a wide variety of sites. Selection of the ultimate treatment approach for the FFS, whether no-action, offsite treatment, or onsite treatment, will be completed under the guidelines of the Remedial Investigation/Feasibility Study (RI/FS) approach of Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). It is therefore not the intent of this section to select the onsite treatment technology suitable for FFS. Rather, this section augments the information contained in section 7 of the Generic report with FFS-specific information that will affect the selection and implementation of an onsite

treatment technology. It is expected that the information contained herein and in section 7 of the Generic report would be used to support an RI/FS at FFS.

10.1 Generic Process Description

Table 10-1 lists the treatment technologies considered for the non-stockpile program in the Generic report. All of these treatment technologies require the same basic pre-treatment steps. These steps are described in this section.

The CWM overpack would be received at the unpack area from the interim storage structure. The overpack headspace is monitored for free agent, which would indicate chemical agent contamination within the overpack. If agent is detected, the packing material is removed and placed in decontamination solution. Otherwise, the packing material is placed in a temporary holding bin. The munition is manually removed from the overpack and loaded into the munition management device (MMD).

The MMD is a proposed modification of a commercially-available technology for processing recovered compressed-gas cylinders. The system is comprised of a primary vessel housing hydro-mechanical actuators and tools designed to manipulate and cut open the target munition. The munition (or overpack) is secured to the munition positioning system, which can move the munition along the length of the MMD beneath the cutting system to allow for multiple cuts. The system is also capable of rotating the target object along its longitudinal axis.

The Army is considering the development of three MMD systems. The MMD1 would be sized to disassemble CWM the size of a 500-pound bomb or smaller. It would not be equipped to handle explosively-configured CWM. The MMD2 would be the same size as the MMD1, but it would be equipped to handle explosively-configured CWM. The MMD3 would be for bulk items of the 500-pound bomb size or greater. It would not be equipped to handle explosively-configured rounds since bulk items are typically not explosively configured.

Once the target munition is cut open, the agent would be sampled and treated inside the cutting chamber or pumped to an external treatment system. Solidified agent is removed by the appropriate solvent or by a high-pressure spray nozzle.

Once the free agent is treated and removed or removed for external treatment, the appropriate decontamination solution is sprayed into the munition cavity and MMD interior to fully decontaminate all surface areas. Monitors will draw air samples to verify decontamination. The spent decontamination solution is pumped to the spent decontamination storage area. The remaining metal parts and explosive components would be removed from the MMD awaiting further processing.

For a type 3 site, the MMD would be housed within a mobile containment chamber (MCC) to provide secondary containment in the event of an explosion. The MCC is a steel cylindrical vessel mounted on a trailer and used for transporting or detonating explosives.

Table 10-1. Treatment Technologies

1	Neutralization*
2	Omnibus System/Internal Neutralization*
3	Biological Processes
4	Supercritical Water Oxidation*
5	Subcritical Wet Air Oxidation
6	Synthetica Steam Gasification*
7	Photochemical Methods
8	SYDOX Electrochemical Oxidation
9	Mediated Electrochemical Oxidation*
10	Liquid-Injection Furnaces
11	Multiple and Fixed Hearth Incineration
12	Gas or Fume Incineration
13	Fluidized Bed Incineration
14	Rotary Kiln Incineration*
15	Molten Salt Combusters*
16	Molten Iron Reactors*
17	Plasma Arc Reactors
18	Microwave Plasma Reactors
19	Infrared Thermal Process (SHIRCO)
20	Autoclave Pyrolysis
21	Westinghouse Plasma Cupola

* These technologies were retained following initial screening.

Once a sufficient number of munitions are disassembled in the MMD, the components would be decontaminated in the treatment process.

10.2 Unique Site Requirements for the Former Fort Segarra

Potential CWM burial sites vary in several ways which affect the implementation of a mobile onsite treatment system. These differences include the type and number of buried CWM expected, the location of the site (such as rural, urban, etc.), and the geophysical features of the site. The following paragraphs discuss some of the specific features of the FFS burial site which may influence the onsite treatment technology selection and how the selection is implemented.

10.2.1 Site Characteristics. FFS is unique in that it is a remote location with limited utilities available for the treatment process. Paragraph 2.2.7 describes the existing utilities on Water Island. If onsite treatment is selected, a generator would most likely be required to supply power to the treatment system. No backup system exists for the current power system. A single cable draws power from the U.S. Virgin Islands Water and Power Authority (WAPA) located on St. Thomas. Three-phase power is supplied to the Water Isle Hotel and single-phase power is supplied to all other areas of the island. There is no water supply on Water Island, but process water could be obtained in bulk from WAPA, who supplies bulk water to various customers on St. Thomas and Water Island. If incineration is selected, bulk fuel would also need to be supplied to the site. There is no existing source for natural gas or fuel on Water Island. Fuel for residents' vehicles is shipped over in containers on separate runs by the ferry service.

The Flamingo Bay landfill area is the most likely site for the treatment system. This site is relatively flat and is also downwind of most Water Island residents. It is also predominantly downwind of the St. Thomas population; winds are blowing away from residents 78 percent of the time and are relatively still 14 percent of the time. The Flamingo Bay area is approximately 4 feet above sea level. This would have to be considered when selecting a site for the disposal facility but would not impact the selection of a treatment technology.

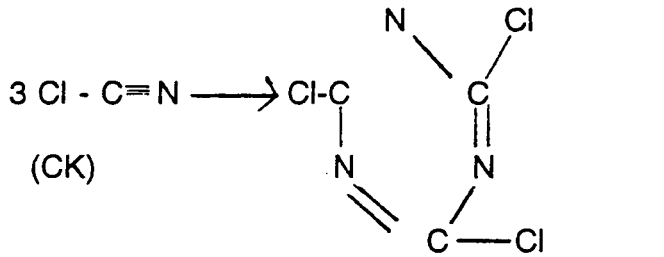
10.2.2 Agents Which May Require Treatment. Since FFS was a test site, nonstandard munitions and in some cases agents were stored on Water Island. Based on the background search, cyanogen chloride (CK), phosgene (CG), mustard agents (H, HD, and HQ), and tabun (GA) were involved in tests on the U.S. Virgin Islands. In addition, the mustard agent HT was stored on Water Island and the smokes HC and FS were involved in tests. Descriptions and properties of these agents are included in appendix G. Special considerations for the treatment of these agents are as follows.

a. *Sesquimustard.* HQ is an agent unique to FFS. It is a mixture of mustard and Q [1,2-bis(2-chloroethylmercapto)ethane]. HQ was developed by the British in 1939 but was never produced on a large scale. HQ as originally pursued because it had a lower melting point than pure mustard and was a more

powerful vesicant. In addition, HQ is less volatile and would persist much longer in the environment. In the United States, HQ was produced in the early 1940s on a small scale as a mixture of 76-percent mustard and 24-percent sesquimustard. The melting point of pure sesquimustard was 6.7°C (44°F). [The eutectic for mixtures of pure mustard gas and pure sesquimustard is 4.5°C (40°F) and 32-percent sesquimustard.] In some tests, sesquimustard tended to separate at the solid phase even in mixtures containing less than 10-percent sesquimustard. This was attributed to sesquimustard's low solubility (Army, 1948).

The possible presence of HQ complicates the disposal process because there is very little known about this agent. It may be assumed that decontaminants and monitors used for H-series agents could also be used for HQ since it was typically comprised of 76-percent mustard. The lack of information on HQ is further complicated since there is not a source of HQ to conduct laboratory tests to confirm these type of assumptions.

b. *Cyanogen Chloride.* Four CK bombs sampled in the surveillance tests during the San Jose project in the late 1940s were found to be largely solid. When CK is not stabilized, as was reported in San Jose Project Report Number (SJPRN) 135, CK will polymerize to form the solid cyanuric chloride. Impurities promote polymerization and this substance has explosive properties (Army, 1990). The following trimer reaction is involved in forming cyanuric chloride:



2,4,6 -Trichloro - 1,3,5 - triazine
(Cyanuric Chloride)

Properties of polymerized cyanogen chloride should be further reviewed to assist in the planning of the treatment process. Based on a preliminary literature search, cyanuric chloride is very reactive with water and many solvents. For example, when dissolved in methanol, cyanuric chloride reacted violently and uncontrollably with the solvent. This was attributed to the absence of an acid acceptor to prevent the initially acid-catalyzed (and later auto-catalyzed) exothermic reaction of all 3 chlorine atoms simultaneously. Additional information on the reactive properties of cyanuric chloride are contained in appendix Q. This information was obtained from Bretherick's handbook of chemical reactions.

Charcoal filters may become saturated, which is of particular concern with low molecular weight substances like CK. CK will break or penetrate a protective

mask canister or filter element more readily than most other agents. A very high concentration may overpower the filter. High dosages will break down its protective ability (Army, 1990). Certain charcoal impregnants increase the sorptive capacity of existing charcoals and should be considered for a treatment system at FFS.

c. *HC Smoke.* Based on personal interviews, the E23 smoke pots were reported to consist of HC smoke in the bottom half of the container with agent floating on the top half (Mains, 1993). The agent used in the smoke pot tests included HD, HQ, and GA. SJPRN 176 indicates that during the mustard smoke pot test, as much as 3800 cubic centimeters of HD remained in the pot after burning. Plans should be developed to be prepared to treat a smoke pot containing residual HC as well as one of the three tested agents. HC smoke mixture consists of grained aluminum (6 2/3 percent), zinc oxide (ZnO 46 2/3 percent), and hexachloroethane (C_2Cl_6 46 2/3 percent). If neutralization is selected as the treatment process, consideration should be given to the presence of aluminum in the residual HC. Some neutralization solutions react violently with aluminum and result in the formation of hydrogen gas. The chemical action involved with HC as a smoke is that the aluminum splits chlorine from chlorinated hydrocarbons, such as hexachloroethane, and produces heat, therefore setting off a self-propagating reaction.

   A second concern with the treatment of HC is that when it comes in contact with water (as would occur during neutralization), the smokes are formed. The water not only exerts its effects through hydrolysis but also by assisting the growth to effective size of hygroscopic smoke particles by a process of hydration (Army, 1975).

d. *FS Smoke.* Although not reported to have been used, FS was shipped off Water Island at the termination of the program. FS is composed of sulfur trioxide dissolved in chlorosulfonic acid. When FS is atomized in the air, the SO_3 quickly evaporates from the small drops and reacts with atmospheric moisture to form sulfuric acid vapor, which in turn condenses to form small drops of liquid or smoke particles. FS can be decontaminated with any alkali in solid or solution form (Army, 1975).

e. *Removal of Solidified Mustard.* During mustard disposal operations at Rocky Mountain Arsenal and Dugway Proving Ground [during the Drill and Transfer System (DATS) disposal operation], a hard mustard residue was discovered in the munitions, particularly when the munitions contained levinstein mustard. The consistency of these residues varied from semi-liquid (a mixture of liquid mustard and solids) to dry (completely solid with no apparent liquid). These items could not be drained. Analysis conducted on the mustard heel showed little evidence of polymer formation. The residue appeared to be primarily inorganic materials with a high concentration of total and free sulfur. Analyzed samples contained 28-percent mustard (Marshall, 1980).

Studies were conducted to determine the best method to dissolve the heel in support of the DATS operation. The DATS operation ultimately incorporated a recirculating stream of calcium hypochlorite (HTH) bleach to erode/dissolve the mustard residue. The procedure required heat treatment of the munition followed by draining (or verification that it cannot be drained), flushing with recirculating liquid, and collection of all removed solids (USATHAMA, 1980).

Although not incorporated into the DATS, dimethyl formamide (DMF) was also found to be a suitable solvent. Not only did it dissolve 70 percent of the solid, but any remaining solid was reduced to a fine powder (Pfau, 1979).

During thermal tests, the major portion of the heel was found to melt and flow when heated to 116°C (240°F). Any material not metal chloride could be made to vaporize rapidly when heated above 232°C (450)°F (Marshall, 1980).

At FFS, solidified mustard may be encountered. For all treatment alternatives except incineration, a method will need to be devised to remove the solidified mustard and dissolve the residue in solution. A more extensive literature search and tests should be conducted to identify the most appropriate methods in support of the non-stockpile program.

10.2.3 Munitions Which May Require Treatment. Munitions tested on the U.S. Virgin Islands included 100- to 1000-pound bombs and 5-gallon E23 smoke pots. In addition, surveillance tests were performed on a 4-pound particulate bomb containing inert material. Records indicate all of the particulate bombs were removed from the island once testing was complete; therefore, these items will not be addressed in terms of treatment alternatives. Demonstration tests were performed with 4.2-inch mortars. Additional CWM items removed at the close of the San Jose project on Water Island included ton containers filled with various agents, 4.2-inch mortars containing various agents as well those containing no agents but configured with high explosives, additional types of bombs, and 500-pound drums containing agent. Positive identification should be performed on any recovered 4.2-inch mortars to ensure that they do not contain high explosives prior to processing through the treatment facility.

Table 10-2 provides the length and diameter of the munitions tested or stored at Water Island. The MMD used at FFS should be sized to handle the 500-pound bomb at a minimum. In addition, the MMD should be contained in an MCC to disassemble explosively-configured CWM. Contingency plans should be developed to dispose of any ton containers or explosively-configured 1000-pound bombs. It is not known whether the 1000-pound bombs used in the surveillance tests were explosively configured.

The MMD at FFS should be equipped with two interchangeable munition handling devices. The first munition handling device would consist of rollers to hold cylindrical munitions (such as bombs or mortars) in place while accessing the agent. The second system would be designed to hold the smoke pot in place during the drilling

Table 10-2. CWM Dimensions

CWM Item	Tested (T) or Stored (S)	Length (inches)	Diameter
250-KG German bomb	S	64.5	14.5
M47A2, 100-lb bomb	S	50	8
M70, 115-lb bomb	T	51.5	11
M78, 500-lb bomb	T	59.25	19
M79, 1000-lb bomb	T	69.5	25.4
T-3 , 125-lb bomb	T	49.5	8*
E-52, 125-lb bomb	S	51.5	11
E-46, 125-lb bomb	S	51.5	11
500-lb drums**	S	35	26
4.2-inch chemical mortars	T	21	4.2
Ton containers	S	85.1	30.1
E-23 smoke pot	T	13	12.1

* This diameter does not include the tail span.

** Assumed to be a 55-gallon drum. These were used by the Army to store up to 700 pounds of agent (TM 3-250).

operation. Methods to access the agent and separate the explosives will depend on the munition type. Accessing methods are discussed in section 7 of the Generic report.

10.2.4 Monitoring Techniques. Much of the chemical agent used in tests at FFS were dyed DuPont red or yellow. This dye may interfere with some monitoring techniques. For example, many of the munitions processed at Dugway Proving Ground in the DATS contained dye. The dye, generally red or purple, interfered with a determination of color change on the M8 paper. On occasion with dyed agent, a color change in the paper would appear as a halo around the edges of the agent spot.

In these instances, the M8 paper was used as only an indicator, and distinction between nerve and non-nerve agents was accomplished by the enzyme ticket and tube tests (Ferrell and Daughdrill, 1980). For monitoring HQ, it is expected monitors which can detect any of the H-series agent could also be used here.

10.3 Summary of Generic Onsite Treatment Technologies

In the Generic report, onsite treatment alternatives were evaluated for the treatment of CWM at type 3 sites. Based on a review of existing and prior-use systems, a literature search, and an industrial technology review, twenty-one treatment alternatives were originally identified for the disposal of recovered CWM. It was not practical to evaluate all of the treatment technologies identified so evaluation criteria were established to conduct an initial screening. These initially proposed technologies were screened based on whether they were likely to be available within 3 years, could meet a minimum agent destruction and removal efficiency (DRE), were considered safe for the destruction of CWM (that is, could provide explosive and agent containment), and whether they were appropriate for type 3 burial sites. Table 10-1 lists the initial 21 treatment technologies which were considered. The eight treatment technologies which survived the initial screening are annotated by an asterisk. Detailed information on all 21 technologies and descriptions of systems to destroy recovered CWM are contained in the Generic report. The eight marked are considered appropriate for the FFS.

Methods to access the agent and separate the explosives will depend on the munition type. Accessing methods are discussed in section 7 of the Generic report.

10.3.1 Evaluation of Technology Alternatives. The evaluation and relative ranking of treatment technologies suitable for use at FFS are very similar to the evaluations done for a generic type 3 site in the Generic report. The results of that study are provided in the following paragraphs, including an explanation of the evaluation criteria used to rank the eight screened technologies and a discussion of the results of the evaluation. More detailed discussions are presented in the Generic report.

Ultimately, the cleanup of CWM from the FFS burial site will be governed by the requirements of CERCLA, and an RI/FS process will be required. Under the feasibility study requirements for a source-control action, alternative technologies must be

identified and evaluated according to nine specified criteria. The factors described in paragraph 10.3.1 and in table 10-3 do not match the CERCLA feasibility study criteria in name. However, they do encompass all of the requirements of the CERCLA feasibility study criteria with the exception of state acceptance and community acceptance. Therefore, the generic evaluation can be used as a basis for completing any subsequent evaluations under CERCLA at the FFS site.

The evaluation criteria used to rank the generic treatment technology systems were selected because they represent the major concerns associated with the destruction of chemical agents, namely safety, emissions, wastes, process performance, operability, transportability, probability of success, and cost. Relative scores ranging from 1 (least favorable) to 5 (most favorable) were assigned for each of the evaluation factors. Weightings were assigned to each criterion as a measure of their relative importance. The weighting given to each criterion are shown in table 10-4. The weighted score for each criterion is the product of the criterion score and the weight of the criterion.

a. *Safety.* Each treatment system was evaluated for both public and worker safety. Public safety concerns involve the hazards associated with releases of agent that may reach the site boundary, such as explosions, ruptures of high pressure equipment, or stack releases. Worker safety concerns involve hazards to personnel working in the immediate vicinity of the process. Many of the same issues involved with public safety also apply to worker safety. Further concerns involve the amount of manual contact with the contaminated materiels and the degree of remote operation. If the process has virtually no safety concerns, it was given a 5 in each category. Similarly, processes with greater concerns regarding safety were given lower scores.

   Safety concerns are considered to be one of the most important criteria and were given a weighting of 10. This was split evenly among public and worker safety.

b. *Emissions to the Environment.* This criterion assesses the degree of impact to the environment through permitted air or liquid emissions. Processes that emit large quantities of emissions are scored lower than those which emit no emissions. Similarly, processes that can only meet the maximum permissible emission levels as stated by law, as opposed to producing emissions which far exceeded those requirements, were also scored low.

   Safety was given the highest weighting above all others. Therefore, emissions to the environment, although considered to be a very important criterion, was given a weighting of 8.

c. *Solid or Liquid Wastes.* The amount of solid or liquid waste produced and the degree of treatment required for the waste was assessed. A process producing a large quantity of waste was given a low score. A process producing a waste requiring additional treatment was also given a low score. Processes that did not destroy the energetic material or packing material but left them as a

Table 10-3. Evaluation Criteria

A. Safety
   A1. Public safety
      1- Concerns regarding safety
      5- No safety concerns
   A2. Worker safety
      1- Concerns regarding safety
      5- No safety concerns

B. Emissions to environment
      1- Relatively large flow of maximum permissible emissions
      5- No emissions

C. Solid or liquid wastes
      1- Relatively large quantity requiring additional treatment
      5- Relatively small quantity suitable for landfill

D. Process performance
   D1. Agent destruction
      1- Less than 99.99 percent destruction efficiency
      2- 99.99 percent destruction probable
      3- 99.99 percent destruction demonstrated on chemical agents
      4- 99.9999 percent destruction probable
      5- 99.9999 percent destruction demonstrated on chemical agents
   D2. Energetic material chemical decontamination/destruction
      1- 3X chemical decontamination not likely
      3- 3X chemical decontamination
      4- 5X chemical decontamination
      5- Destruction
   D3. Metal parts decontamination
      1- 3X decontamination not likely
      3- 3X decontamination
      5- 5X decontamination
   D4. Packing Material Disposal
      1- 3X decontamination not likely
      3- 3X decontamination
      4- 5X decontamination
      5- Destruction

Table 10-3. Evaluation Criteria (Continued)

E. Operability
  E1. Complexity
    1- Relatively complex
    5- Relatively simple
  E2. Flexibility
    1- Major modifications required for munition/agent change
    3- Minor modifications required for munition/agent change
    5- No modifications required for munition/agent change
  E3. Operational requirements
    1- Large number of operators required
    3- Medium degree of required manual oversight
    5- Small number of operators required
  E4. Pretreatment requirements
    1- Major pretreatment requirements
    5- Minor pretreatment requirements

F. Transportability of process
  F1. Mobility
    1- Difficult to transport
    5- Fully mobile
  F2. Mobilization/demobilization
    1- Long set-up/tear down time
    5- Short set-up/tear down time

G. Probability of success
    1- Low probability of success
    5- High probability of success

H. Cost
  H1. Capital cost including developmental costs[1]
    1- High cost
    5- Low cost
  H2. Operating cost[2]
    1- High cost
    5- Low cost

Notes:

[1] Capital costs include developmental, equipment, material, engineering and site preparation costs.
[2] Operating costs include raw materials, utilities, labor, and waste disposal costs. The cost of maintenance material and labor is included.

Table 10-4. Evaluation Criterion Weightings

Criterion	Weighting
A. Safety	10
A1. Public safety	5
A2. Worker safety	5
B. Emissions to environment	8
C. Solid or liquid wastes	8
D. Process performance	8
D1. Agent destruction	5
D2. Energetic material chemical decontamination/destruction	1
D3. Metal parts decontamination	1
D4. Packing material disposal	1
E. Operability	7
E1. Complexity	2
E2. Flexibility	2
E3. Operational requirements	1
E4. Pretreatment requirements	2
F. Transportability of process	7
F1. Mobility	4
F2. Mobilization/demobilization	3
G. Probability of success	8
H. Cost	5
H1. Capital cost including developmental costs	4
H2. Operating cost	1

decontaminated waste were scored lower in this category. The criteria for wastes was given a weighting of 8 points.

d. *Process Performance.* These criteria measure the degree to which the treatment system can destroy or decontaminate the agents, energetic material, metal parts, and packing material. These criteria are a measure of the overall effectiveness of the treatment system and were given a total weighting of 10. For agent destruction the process scored 1 point for having a DRE of less than 99.99 percent. It was given 5 points if the process has demonstrated greater than 99.9999 percent destruction on chemical agents. For energetic material destruction, the process was given 1 point if the energetic material could not be 3X decontaminated, and it was given 3 points if it could. If the process could destroy the energetic material completely it was given 5 points. For metal parts, one point was given to the process if 3X decontamination of the metal parts was not likely and 5 points if the process could achieve 5X decontamination. For packing material, the process was given 1 point if the packing material could not be 3X decontaminated, 3 points if it could, and 5 points if it could be completely destroyed.

   The destruction of chemical agent was considered to be the most important performance measure and was given a weighting of 5 points out of the total 8. The treatment/destruction of energetics and the treatment of metal hardware and packing material were given weightings of 1 point each.

e. *Operability.* The sub-criteria under this general heading evaluate the system's operational features. A relatively simple system was given 5 points under the complexity criteria, a relatively complex system was given 1 point. The flexibility rating represents the degrees of equipment modifications, process alterations, or change in feedstock that may be necessary if either the type of munition or the type of agent to be processed is changed.

   The operational requirements rating measures the relative numbers of operators required to work the treatment system. If the system requires a large number of operators it was given 1 point, whereas a system with a smaller number of required operators was given 5 points.

   The pretreatment criterion measures the degree of processing and pretreatment of the various components of the CWM. Though the same basic initial processing equipment is envisioned to be used for all of the treatment systems, some treatment technologies will require a greater degree of processing. One point was given to those processes which require a large degree of pretreatment and 5 points was given to those technologies which do not.

   The operability criteria were given a total weighting of 7. Complexity, flexibility, and pretreatment criteria, being equally important, were given weightings of 2, while the operational requirements was given a weighting of 1.

f. *Transportability.* The two criteria under transportability are mobility and mobilization or demobilization. If a system can be easily transported, it was given 5 points. If not, it was given 1 point. Mobilization/demobilization measures the degree to which a process can be set up and operated and torn down and packaged for transportation. Systems which can be set up and torn down relatively quickly were given the full 5 points.

The transportability criteria were given a total weighting of 7. Mobility, thought to be somewhat more important than mobilization/demobilization, was given a weighting of 4.

g. *Probability of Success, State of Development, and Ability to Meet Project Schedule.* This criteria measures the relative degree of readiness characterized by each technology processing system. It was based on various factors such as the degree of commercialization of the process, whether or not the technology has been demonstrated on chemical agents, and the degree of technical concerns and level of future development work required to have the technology available within the project schedule of three years.

This criterion was felt to be fairly important and was given a weighting of 8.

h. *Cost.* The treatment systems were evaluated on the basis of capital costs and operating costs. The capital costs also included expected development costs needed to bring the technology to technical readiness. Since detailed cost estimates were not completed for the systems, these costs criteria are based only on engineering judgement and vendor information of the basic costs of each technology.

These criteria were felt to be the least important and were given a weighting of 5. Capital cost was given a weighting of 4 since it was considered to be more important than operating cost, which was given a weighting of 1 since these sites will have a limited operational time period.

10.3.2 Generic Recommendations. Table 10-5 provides the results of the generic technology evaluation effort. The evaluation results are based on subjective information and that a recommendation as to the optimal treatment technology for FFS can not be made. The purpose of this evaluation is to identify the most appropriate technologies for the non-stockpile program which warrant further investigation. The technologies further developed would than be evaluated on a site specific basis in the RI/FS process. A more site-specific analysis of these treatment technologies is contained in paragraph 10.4.

In the generic evaluation of alternatives, neutralization (external and internal) received the highest overall score. This treatment technology received a high score for safety; emissions were found to be minimal as compared to the other treatment alternatives; and the probability of success was rated high due to the Army's extensive experience with this treatment process. In addition, neutralization was found to be very adaptable

Table 10-5. Technology Evaluation Results

CRITERION	Weight of Criterion	External Neutralization		Internal Neutralization		Synthetica Gasification		Rotary Kiln		Molten Metal		MEO		Molten Salt		SCWO	
		Criteria Score	Weighted Score	Criteria Score	Weighted Score	Criteria Score	Weighted Score	Criteria Score	Weighted Score	Criteria Score	Weighted Score	Criteria Score	Weighted Score	Criteria Score	Weighted Score	Criteria Score	Weighted Score
A) Safety	10																
Public Safety	5	5	25	5	25	4	20	4	20	4	20	4	20	3	15	2	10
Worker Safety	5	4	20	4	20	4	20	3	15	3	15	3	15	2	10	2	10
B) Emissions	10	5	50	5	50	3	30	2	20	4	40	4	40	3	30	4	40
C) Solid/ Liquid Wastes	8	2	16	2	16	4	32	5	40	4	32	3	24	4	32	3	24
D) Process Performance	10																
Agent Destruction	5	4	20	4	20	4	20	5	25	4	20	4	20	5	25	4	20
Energetic Material	3	3	9	3	9	3	9	5	15	3	9	3	9	5	15	3	9
Metal Parts	1	3	3	3	3	5	5	5	5	3	3	3	3	3	3	3	3
Packing Material	1	2	2	2	2	5	5	5	5	2	2	2	2	5	5	2	2
E) Operability	7																
Complexity	2	4	8	4	8	3	6	2	4	2	4	1	2	2	4	2	4
Flexibility	2	3	6	3	6	4	8	4	8	4	8	5	10	4	8	5	10
Operational Req.	1	4	4	4	4	3	3	2	2	2	2	3	3	2	2	3	3
Pretreatment	2	3	6	3	6	3	6	2	4	3	6	3	6	2	4	3	6
F) Transportaability	7																
Mobility	4	5	20	5	20	4	16	2	8	3	12	3	12	2	8	4	16
Mob/Demobilization	3	3	9	5	15	3	9	1	3	3	9	4	12	2	6	3	9
G) Prob. of Success	8	5	40	4	32	4	32	5	40	3	24	3	24	3	24	2	16
H) Cost	5																
Capital Cost	4	4	16	4	16	3	12	2	8	3	12	3	12	2	8	1	4
Operating Cost	1	4	4	4	4	4	4	3	3	4	4	4	4	3	3	3	3
TOTAL		63	258	64	256	63	237	57	225	54	222	55	218	52	202	49	189

to a type 3 burial site because it can be relatively easily mobilized and is flexible in terms of treating a large variety of waste in small quantities. The major disadvantage of neutralization is that complete (5X) decontamination of metal parts and destruction of the explosives is not achieved. Decontamination (3X) of the items can be achieved such that the components can be transported offsite and further treated at a commercial (or Army) incinerator.

Steam gasification received the next highest score in terms of its ability to destroy recovered CWM at a type 3 burial site. The primary benefits to steam gasification is that there are mobile units in operation today and this treatment alternative rated high in terms of its process performance (that is, ability to decontaminate the agent, metal parts, and packing material). Synthetica's ability to treat CWM is primarily based on the manufacturer's claims and would need to be demonstrated.

Although incineration of the chemical agents has been selected as the preferred treatment of the United States chemical stockpile, this treatment alternative was not as attractive for a type 3 non-stockpile burial site. For the stockpile program, there are four incinerators used to destroy each waste stream, which involve large quantities of wastes resulting in few changeovers. For the non-stockpile program, rotary kiln incineration was found to be the most appropriate incinerator to destroy the agents, explosives, and packing material and decontaminate the metal parts. Even so, there are many difficulties in mobilizing a single incinerator to sites which may have a large variety of wastes in small quantities. Trial burns may need to be conducted at each site for each feed stream. Trial burns are very costly and time consuming. In addition, the individual waste streams will need to be separated and stockpiled such that they can be fed individually into the incinerator, making the pretreatment steps more complicated than some of the other treatment alternatives. Incineration would provide over 99.9999 percent destruction of the agent, total destruction of the explosives and packaging material, and 5X decontamination of the metal parts. No additional offsite treatment would be required.

After rotary kiln incineration, scores in descending order were molten metal, mediated electrochemical oxidation, molten salt, and supercritical water oxidation. The overall differences in the scores for these technologies were not significant. Molten metal scored low in the probability of success since it is still a developmental technology without any commercial installations. Mediated electrochemical oxidation is a complex technology with many treatment steps involved in the destruction of CWM. Molten salt incineration had similar problems to rotary kiln incineration. These technologies were also not rated as high in terms of safety and probability of success, since there is limited experience in the use of these technologies to destroy CWM. Supercritical water oxidation did not rate high due to safety concerns with treatment of chemical agents in a high-pressure environment. There are also many development problems with this treatment technology which must be resolved before it could be used to destroy agent at a type 3 site such as FFS. Developing this technology such that a unit is operational within the 3-year time frame is questionable.

The Generic report provides a more in-depth discussion of the evaluation results.

10.4 Technology Evaluation at the Former Fort Segarra

The results of a site-specific analysis of treatment technologies for FFS would differ somewhat from the evaluation in the Generic report due to the remoteness of the site and uniqueness of agents potentially requiring treatment. As mentioned previously, however, technologies selected for further development must be evaluated first on a program level since they must be adaptable to all type 3 burial sites. The technologies pursued for the non-stockpile program can then be evaluated on a site-specific basis under the RI/FS process at FFS.

In a site-specific evaluation for FFS, both the weighting criteria and the scoring of technology alternatives might be adjusted to more accurately reflect the site's unique nature. For example, the application of neutralization, synthetica steam gasification, mediated electrochemical oxidation, and supercritical water oxidation may not be as desirable at FFS due to the possible requirement to treat solidified CK and residual smoke in the smoke pots. As discussed in paragraph 10.2, when water or solvents mix with solidified CK, a violent reaction could result. Operations would need to be conducted in a very controlled environment. In addition, if residual smoke is present and mixed with water, smoke may be emitted through the stack during the steam gasification or mediated electrochemical oxidation treatment process. These factors would not eliminate the technologies but would need to be considered for FFS and further research may be required if that technology were adopted.

Other criteria which may be of greater importance at FFS than less remote type 3 burial sites is the transportability of the unit and the treatment technologies utility requirements. The neutralization process would be more desirable at FFS than other sites based on these criteria.

10.5 Soil and Groundwater Remediation

Soil and groundwater contaminated with CWM pose separate problems for the Army. The agents listed in section 2 may remain as untreated compounds or breakdown products from hydrolysis, oxidation, or other chemical or biological reactions in the soil or groundwater. The first problem is in identifying the risk posed by the contaminants. This is typically accomplished based on toxicity of the contaminants and their breakdown products and on the intended use of the land or water. The Site Monitoring Concept Study presents some of the data necessary to perform the requisite risk analysis and data gaps.

If levels of contaminants allowed in the soil and groundwater can be established for FFS, technologies capable of achieving those levels can be investigated. CERCLA requires consideration of alternative technologies during feasibility studies to provide data to decision makers in selection of a treatment technology. The Federal government actively pursues innovative technologies. A synopses of active projects is published by the U.S. Environmental Protection Agency (USEPA).

10.6 Recommendations for the Former Fort Segarra

Regardless of whether the treatment is conducted onsite or offsite, additional research should be conducted to develop treatment plans for possible recovered CWM at FFS due to the unique nature of items tested. For example, HQ was involved in some of the tests on FFS and could be potentially recovered. Very little information is available on this agent since it was experimental and never developed on a large scale. Since it is a mixture of mustard and sesquimustard, monitoring and decontaminating techniques for other H-series agents may be effective for HQ. It is recommended that, prior to initiating a remediation effort at FFS, techniques for H-series agents be reviewed for their applicability to agent HQ.

Based on background information, CWM containing solidified CK or mustard could also be recovered at FFS. Unstabilized CK, used in the San Jose surveillance tests, solidifies to form cyanuric chloride. It is recommended that further research be conducted to develop treatment techniques for solidified CK and mustard. Further research should also be conducted to better understand the reactive hazards associated with solidified CK.

CWM items as large as the 1000-pound bomb and one-ton containers were involved in tests at FFS. The 1000-pound bomb was involved in surveillance tests and most likely was not explosively configured. Currently, the Army is developing three MMDs for the treatment of various CWM items. These include the MMD1 for nonexplosive items under 500 pounds, the MMD2 for explosive items under 500 pounds, and the MMD3 for bulk nonexplosive items (over 500 pounds). The MMD at FFS should be sized at a minimum to handle a 500-pound, explosively-configured bomb. If CWM is recovered and onsite disposal is selected, the MMD2 should be developed to support a remediation effort at FFS. Contingency plans should be developed to dispose of ton containers or potentially explosively-configured 1000-pound bombs recovered at FFS.

It is recommend that potential presence of smokes HC and FS with residual agent be reviewed for potential complications in the treatment process.

The technologies pursued for the non-stockpile program should be evaluated on a site-specific basis under the RI/FS process at FFS. Unique site characteristics outlined in paragraph 10.2 should be considered during this analysis.

SECTION 11

QUALITATIVE ANALYSIS OF OTHER ALTERNATIVES

11. QUALITATIVE ANALYSIS OF OTHER ALTERNATIVES

This section presents a summary of potentially applicable cleanup alternatives for sites containing chemical warfare materiel (CWM) that require remediation. The evaluation presented is qualitative and is not intended to replace the evaluation of alternatives which is performed during the Remedial Investigation/Feasibility Study (RI/FS) for a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) site. The evaluation provides a preliminary analysis of the Former Fort Segarra (FFS) based on available information.

11.1 Minimal or No Intervention

The option of minimal or no intervention is in reality two potential options. Minimal intervention is a response action used to minimize the risk of potential release. No intervention is a case where risk to public health and the environment is negligible. There are substantial differences between the two options and therefore they will be treated separately.

11.1.1 No Intervention. The National Environmental Policy Act (NEPA) requires consideration of the no-action alternative. CERCLA complies with NEPA in this respect. Should the results of the RI/FS indicate there is no threat to public health or the environment, a Record of Decision (ROD) may be completed stating no further action is required at the site. The no-action alternative is normally the first alternative evaluated and is used as a comparison for the other alternatives. The no-action alternative requires the completion of a baseline risk assessment (BRA).

As discussed in paragraph 5.2, the BRA should be completed by the RI/FS contractor. It involves detailed information on the source of contamination, groundwater flow and usage, surface usage and anticipated usage, and other fate- and transport-type information. This data is not available for FFS at this time. Additionally, the expected risk of release from the site must be evaluated. This requires some knowledge of the amount of contamination and its condition. Again, however, this data is not available for FFS at this time.

A third area for which insufficient information exists is the environmental breakdown products of the agents potentially at the FFS and their toxicity, fate, and transport. It is possible that the risks associated with leaving the site in its current condition are less than those associated with a recovery and response action.

Items which are covered in the analysis of the no-action alternative will be described here. Care should be taken to ensure the BRA covers the items necessary to conclude an evaluation of this alternative as it forms the basis for all other evaluations.

Many of the action-type assessments are not considered for this analysis as there is no action.

11.1.2 Minimal Intervention. Minimal intervention efforts are directed toward reducing the risk by taking actions aimed at stopping or reducing the contamination migration. Little or nothing would be done to the source of contamination. Capping and pump-and-treat are two of the more common techniques. Stabilization methods are normally not included in discussions of minimal intervention as they are considered treatments of the contamination source.

As with the no-action alternative, more information is required on contaminant fate and transport. Actions taken would be in response to an actual or potential threat of contamination posing a health or environmental problem through migration to groundwater or through other pathways. The effectiveness of such systems would depend heavily on the situation at the site.

11.2 Excavation and Onsite Treatment

Excavation and onsite treatment would be the most decisive option available to the Army. It would involve excavation and recovery of CWM followed by immediate treatment of the chemical agent to a minimum 3X level, followed by any necessary post-treatment activities. Direct responsibilities for the U.S. Army Chemical Materiel Destruction Agency (USACMDA) for the CWM destruction would potentially be satisfied in the shortest period of time.

There are three distinct phases of operation which impact the safety of this option: the excavation phase, the transfer phase, and the treatment phase. Each are discussed separately and then a combined assessment is made.

11.2.1 Safety. During excavation, all safety-related activities provided in paragraph 4.3.1 apply. The situation at FFS should be approached on a cautious basis. Survey techniques should be combined to place a high confidence level to both identify CWM and provide worker and public safety. Historical surveys to date are fairly complete. With the exception of areas where there is large quantities of non-Department of Defense (DoD) waste, a magnetometer should provide sufficient data to identify potential CWM in the form of bombs, smoke pots, or other metal test remnants.

During each step of the survey process, prudent safety measures should be employed. The Flamingo Bay landfill and the former test areas on Water Island may present hazards beyond CWM-related hazardous waste risks. These should be taken into account when operating onsite to preclude spread of contamination, injury to site workers, and potential public safety risk from non-CWM related hazards.

Excavation techniques should be archeological-type excavations conducted by hand when within 1 foot of a potential or identified CWM item. Overburden removal can be accomplished using conventional excavation equipment. In the case of the Flamingo Bay landfill area, it is recommended that mechanized equipment be solely used.

Remote excavation techniques are not yet at a stage to present a safer alternative to manual excavation.

The transfer phase occurs when CWM is taken from the point of excavation and entered into the treatment system. This phase is the weakest link of the operation due to potential problems in matching rates. The excavation rate would have to match the treatment rate exactly. This would likely involve adjustment of the excavation schedule. Should process upsets occur, the excavation would have to enter a contingency operations phase as well.

The treatment phase would be difficult to prepare for under the excavation and treatment scenario. The system would require a design to handle CWM from a standpoint of only limited information. Risks could be reduced with significant background and survey information.

11.2.2 Security. Security for this alternative would likely be the best of any option in which the CWM remains onsite, either for destruction or storage. As the CWM is excavated it enters the treatment system and is destroyed, reducing the security risk. However, operations would still require security measures such as fencing, lighting, and guarding of the site.

11.2.3 Environmental Protection. Excavation and onsite treatment would adequately protect the environment by destroying the CWM. Sufficient safeguards should be incorporated into all phases of site operations ensuring environmental protection is maintained. If the BRA demonstrates a need for remediation, this option would conform to CERCLA guidance which indicates a preference for solutions where treatment is conducted onsite.

11.2.4 Cost. While it may appear that excavation and onsite treatment presents the lowest cost for a destruction alternative, this is not necessarily the case. Only when the treatment system is properly selected for the recovered items and only when the excavation rate closely matches the treatment rate would it be likely this option presents the lowest cost alternative. If the items to be recovered are relatively unknown (as with most cases), the system selected would likely be over-designed as a contingency measure. If excavation provides little or no CWM, the system emplaced would have been mobilized and demobilized for disposal of little or no CWM. Should excavation provide items for which the system was not designed, costly field alterations or a new system entirely would add significantly to the cost. The rate-of-processing issue discussed with the safety issues in paragraph 11.2.1 would likely require contingency procedures during excavation, which would add to the cost when implemented.

11.3 Excavation and Interim Storage Followed by Onsite Treatment

This option would be similar to excavation and onsite treatment (paragraph 10.2) but would include an intermediate step of storing recovered CWM onsite. The storage is envisioned to potentially last up to 3 years. This holding phase would allow investigation and recovery to be completed in the Flamingo Bay area and former test areas on Water Island, positive identification of the CWM, and development of a treatment system capable of handling all the materiel. While not as decisive as immediate treatment, it still includes the destruction step.

11.3.1 Safety. Excavation requirements remain the same as any other excavation option. Likewise, the transfer of CWM has the same risk items associated with it. In this option there are two transfer operations, one from excavation to storage and the other from storage to treatment. The onsite treatment phase of the operation should be safer than the immediate treatment option. The system selected for treatment can be determined when excavation is near completion and when identification of CWM is near or at completion. This serves to avoid the situation where the treatment system is incapable of handling a particular item.

There are two significantly different safety issues between this option and the immediate treatment option. Storage of the items presents a potential increase in risk, but identification prior to establishing a treatment system would reduce the potential risk. Storage, being a non-intensive operation, would likely present significantly less risk than the operationally-complicated treatment step. It would appear that the excavation and interim storage option would present less risk and be safer than the excavation and onsite treatment option discussed in paragraph 11.2.

11.3.2 Security. Interim storage presents the greatest security risk. Materiel is removed from the ground, identified, and stored onsite, making it a known and therefore vulnerable target. Adequate security measures can be taken to safeguard the material onsite. These measures should be implemented based on a site-specific vulnerability analysis. This analysis should be updated after positive identification of the CWM.

11.3.3 Environmental Protection. Environmental protection for the interim storage alternative is identical to environmental protection for the excavation and onsite treatment alternative (paragraph 11.2.3). There are no anticipated hazards associated with the storage of the materiel in an approved storage configuration. Again, CERCLA gives preference to onsite treatment alternatives.

11.3.4 Cost. The increased costs of a storage facility (including capital, installation costs, and operating costs) should offset cost risks associated with selection of a treatment alternative prior to positive identification. These risks are unable to be quantified at this time. Therefore, a similar cost should be associated with the excavation, interim storage, and onsite treatment alternative as with the excavation and onsite treatment alternative (paragraph 11.2).

11.4 Excavation and Movement for Offsite Treatment

Excavation and movement for offsite treatment involves the same requirements for extracting CWM from the ground. Following excavation, CWM is transported by the safest mode available to a military installation capable of receiving CWM into a secure, environmentally-acceptable facility. Based on the information in section 9 of this report, transportation modes off the island are limited to water and air. Containerization is not a significant problem and containers capable of meeting or exceeding Department of Transportation (DOT) requirements are available for shipping. From this standpoint, there are no impediments for CWM shipments from FFS to alternate sites for storage and final disposition.

However, two problems exist with this option. The CWM, classified as hazardous waste, may only be shipped to a RCRA-permitted facility. This could involve lengthy and costly administrative action as well as potential facility design and construction to meet regulatory requirements for storage. The second problem is that the final disposition will not likely be known. The requirements for ultimate disposal remain with the generator of the waste at the point of origin.

11.4.1 Safety. The excavation phase would require no additional safety requirements than the previous two options. The transportation phase does involve safety-related issues, but none of these issues would necessarily preclude shipment from the FFS from a safety standpoint.

11.4.2 Security. Site security would be similar to that expressed with excavation and onsite treatment (paragraph 11.2). Individual security concerns with the movement would be highly dependant on the mode of transportation selected and the route and destination. Security at the storage location should be included as part of the assessment of security of the CWM. This is also dependant on the final location for storage.

11.4.3 Environmental Protection. Environmental protection issues of the transportation alternative relate mainly to the final disposition of the CWM. If storage of the item is the final disposition, then the relative impact on the environment should be considered in relation to risks of release and the cost of maintaining sufficient environmental assessment. If treatment is the final disposition, the treatment method would likely have similar impact as an onsite treatment system.

This option does not receive the preferred status under CERCLA that onsite treatment receives, and would likely score lower under an RI/FS.

11.4.4 Cost. The cost of the transportation alternative depends heavily on the route of transportation, the final storage location and facility requirements, the length of storage, and the final disposition, either storage or treatment. This option would likely have the highest cradle to grave costs of any of the options.

It is recommended that, should excavation of CWM at FFS be required, the safer option of utilizing an interim storage facility should be exercised and that sufficient security be established to mitigate security concerns. This would provide a safe, environmentally sound, and cost-effective solution.

11.5 Recommended Site Scenario

It is recommended that the RI/FS process be conducted for FFS to provide the information required for a decision document.

The evaluation presented here is not intended to replace the process conducted during the RI/FS. The evaluation only provides a preliminary analysis of the situation based on currently available information. In accordance with CERCLA EPA Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA, EPA/540/G-89/004, Oct 1988, selected cleanup actions must:

- protect human health and the environment;
- attain applicable or relevant and appropriate requirements (ARARs) or provide grounds for invoking a waiver;
- be cost effective;
- utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent feasible; and
- satisfy the preference for treatment that reduces toxicity, mobility, or volume as a principal element.

Chapter 6 of EPA Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA provides detailed considerations the Environmental Protection Agency (EPA) recommends be taken into account during the RI/FS evaluation of alternatives.

SECTION 12

CONTINGENCY PLANNING

12. CONTINGENCY PLANNING

12.1 Background and Records Review

A number of potential accident scenarios can occur during geophysical surveys, excavation operations, and transport of chemical munitions. However, the contingencies evaluated in this report include only the leakage and detonation of a CWM item during excavation or movement. Since chemical munitions and chemical agents are considered hazardous wastes, remedial operations and emergency responses are subject to applicable or relevant and appropriate requirements (ARARs) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the Superfund Amendments and Reauthorization Act (SARA). Therefore, contingency equipment was identified for use by emergency response teams at the proposed excavation sites, after considering Federal and territorial government laws, regulations, and requirements.

For this report, existing Army documents relating to standard operating procedures (SOPs) for chemical accident/incident response and assistance and the roles, responsibilities, and equipment for basic contingency response teams, especially the Technical Escort Unit (TEU), were identified. Equipment available from commercial vendors or other sources is identified and analyzed. To provide the maximum protection for public health and the environment during contingency situations, new methods and devices, which are being developed for emergency response by the Chemical and Biological Defence Agency (CBDA) and may be used for suspect chemical munitions recovery projects, are also examined. Site-specific contingency equipment for the Former Fort Segarra (FFS) excavation site are recommended in section 13.

12.1.1 Current and Proposed Standards. To assess chemical and physical hazards, the Occupational Safety and Health Administration (OSHA) and other organizations have established several guidelines for industrial chemical substances, including the OSHA-enforceable standard permissible exposure limit (PEL). If the working environment contains a hazardous substance above this limit, workers are required to wear appropriate personal protective equipment (PPE).

Military chemical agents are toxic substances; a small amount of chemical agent may induce a serious chemical accident/incident. Currently, there are no OSHA-regulated safe-exposure limits for chemical agents. Only the Department of Defense (DoD) has its own standards.

Exposure criteria for certain chemical agents accepted by the Army are contained in DA PAM 385-61. For those agents without established standards, a zero or null value (the lowest numerical value that the best available state-of-the-art measurement

technology can detect) has been used by the Army as an official standard. For blister agents, if the detected concentration is above the PEL, air-supplied respirators should be used due to carcinogenic properties of the blister agent. Army control limits are recommended to be used as standards for the safe handling and treatment of nerve and blister agents during excavation and disposal processes.

12.1.2 Army Chemical Accident/Incident Emergency Response System. As defined in Army document FM-21, a chemical accident refers to any situation involving chemical surety materiel (CSM) which results in:

- injury to personnel or exhibition of physiological symptoms requiring more than standard first-aid procedures,
- offpost contamination by a chemical agent,
- property damage of $10,000 or more,
- an unintentional or uncontrolled release of a chemical agent that exceeds maximum agent concentration-time levels for exposure of unprotected personnel, and
- unusual interest by the public and news media.

The definition of a chemical incident is any situation that results in:

- unintentional exposure of personnel to a chemical agent;
- release of a chemical agent without exposure of personnel, which not was not reported as a minor leak or an accident;
- property damage ranging between $250 to $10,000;
- actual or attempted theft or diversion of chemical surety materiel; and
- actual or attempted penetration of a chemical exclusion area.

Chemical agents have long been controlled and handled by the Army, and the Army has established an emergency response system for chemical accident/incidents. Review of the Army emergency response system should help establish guidelines for an efficient contingency plan for chemical weapon recovery and disposal projects carried out within military bases or in the public domain.

It is the Army's policy that in case of an accident/incident involving the release of chemical agents from munitions, every effort should be made to prevent loss of life and minimize the hazardous effects of the chemical accident/incident. The required immediate actions include ensuring that all involved personnel take proper self-protection steps, rendering protection and first aid to contaminated individuals, and dialing an emergency number to report the accident/incident. If possible, the local fire department will respond with available forces to any chemical accident/ incident emergency to extinguish any fire, minimize fire and water damage, and rescue or direct the rescue of injured personnel.

At the same time, the Chemical Accident/Incident Contingency (CAIC) plan should be initiated. As an example, under the Aberdeen Proving Ground CAIC plan, emergency response teams for chemical accident/incidents will be immediately formed and

dispatched to the scene to control the chemical accident/incident. These teams are indicated in figure 12-1 and include a TEU alert team, a medical emergency response team specializing in treatment of chemical toxic exposure injuries, and a monitoring team composed of personnel from a military chemical laboratory. Other personnel and action teams will respond to the site or Chemical Accident/Incident Control Center (CAICC), as necessary by the Chemical Accident/Incident Control Officer (CAICO) or other applicable emergency plans. The control of emergency operations will be assumed by the commander of the Army area nearest to the chemical accident/incident. The Generic Site Scoping Study contains a detailed description of the emergency response system.

12.2 Generic Contingency Requirement

Based on the legal guidance given to the U.S. Army Chemical Materiel Destruction Agency (USACMDA) by the Test and Evaluation Command (TECOM) (memorandum, dated 31 August 1992), the recovery, transport, storage, and disposal of chemical weapon munitions fall within the scope of CERCLA; its amendment; the Resource Conservation and Recovery Act (RCRA); and the National Environmental Protection Act (NEPA). Although chemical agents are not listed as hazardous waste under the federal hazardous waste management regulations, the Army has generally considered chemical agents as hazardous waste because of their chemical reactivity. Thus, all activities performed during the recovery, transport, storage, and disposal of chemical weapon munitions are required to comply with Federal and territorial hazardous waste management regulations.

A number of potential accidents can happen during the excavation and movement of chemical munitions. To minimize effects from accidents, immediate emergency response with appropriate equipment is required. Two waste-related causes of contingencies, leakage of chemical agent and detonation of chemical munitions, will be discussed in the following paragraphs. The generic contingency requirements to deal with these accidents will be discussed, based on the applicable regulations, and on safety, security, and cost.

Both situations involve the release of dangerous chemical agents and may pose an immediate threat to human health and the environment. Due to the differences in released quantity and effective range, the contingency requirements for these two situations will be discussed separately. As a result, these discussions will provide guidance for establishing the site-specific contingency plan for handling chemical munitions at excavation sites.

12.2.1 Contingency Requirement for Chemical Warfare Materiel Leakage during Excavation. Chemical munitions may release their contents to the air or ground through a slow leak or an instantaneous release due to partial case failure or total case failure. In dealing with leaking chemical munitions, consideration should be given to personnel protection, area contamination, downwind vapor hazards, and safe and prompt measures for stopping and sealing the leakers.

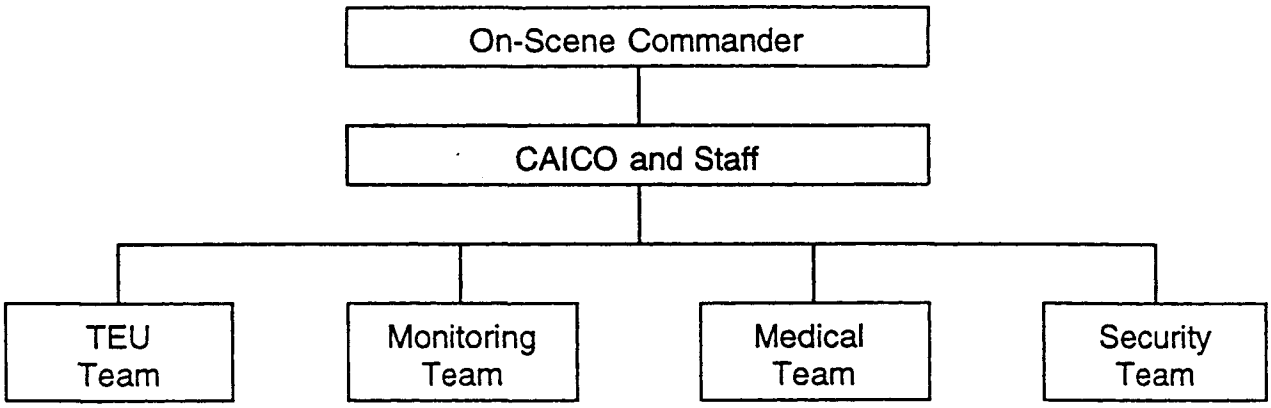


Figure 12-1. Emergency Response Organization Augmented by Specialized Teams

a. *Personnel Safety Requirements.*

(1) *Personnel Protective Equipment.* Chemical agents are classified as class A poison materials by the Department of Transportation (DOT). A chemical agent leak is capable of causing injury or impairment in the function of any part of the body through absorption, inhalation, or physical contact. As indicated in §1910.120 of Title 29 of the Code of Federal Regulations (CFR), emergency response operations for the release of hazardous substances are subject to all requirements described in part 1910 and part 1926. Under this requirement, all employees who work on a hazardous waste site and are exposed to hazardous substances and health and safety hazards, including emergency responders, are required to wear appropriate personal protective clothing and equipment.

As required in 29 CFR §1910.120, if chemical exposure levels will create a substantial possibility of immediate death, immediate serious illness or injury, or impair the ability to escape, positive-pressure, self-contained breathing apparatus (SCBA) or positive pressure air-line respirators equipped with an escape air supply should be used. (It should be noted that Army requirements for personnel protective equipment differ from OSHA. It is assumed here that OSHA standards will be used.)

In addition, if skin absorption of a hazardous substance may result in a substantial possibility of immediate death, immediate serious illness or injury, or impair the ability to escape, totally encapsulating chemical protective suits (OSHA level A protection) should be used.

The chemical protective clothing to be used by emergency personnel responding to leaking chemical munitions is required to meet the following requirements:

(a) The totally encapsulating suits should protect employees from the particular hazards and should be able to maintain positive air pressure capable of preventing inward test gas leakage of more than 0.5 percent.

(b) Proper selection of respirators should be made in accordance with the guidance of American National Standard Practices for Respiratory Protection Z88.2-1969.

(c) High purity compressed air and liquid air should be used for respiration. Breathing air should at least meet the requirements of the specification for grade D breathing air as described in Compressed Gas Association Commodity Specification D-7.1-1966.

(d) All compressed air cylinders used with SCBAs should meet DOT and National Institute for Occupational Safety and Health (NIOSH) criteria. The cylinders should be tested and maintained as prescribed in the Shipping Container Specification regulations of the DOT (49 CFR part 178).

(e) Breathing-gas containers should be marked in accordance with American National Method of Marking Portable Compressed Gas Containers to Identify the Material Contained, Z48.1-1954; Federal Specification BB-A-1034a, June 21, 1968, Air, Compressed for Breathing Purposes; or Interim Federal Specification GG-B-00675b, April 27, 1965, Breathing Apparatus, Self-Contained.

(f) More-detailed requirements for respiratory protection are listed under 29 CFR §1910.134.

(g) Equipment for eye and face protection should be in accordance with American National Standard for Occupational and Educational Eye and Face Protection and the requirements set in 29 CFR 1910.133.

(h) Safety-toe footwear for employees should meet the requirements specified in the American National Standards for Men's Safety-toe Footwear, Z41.11967.

(i) If gas masks are used, the requirements indicated in 29 CFR 1910.134 (g) should be followed.

(j) The detailed requirements for selection and use of PPE are described in 29 CFR 1910 (i). The level of protection provided by PPE should be increased when additional information on the site condition indicates that increased protection is necessary to reduce employees' exposures below PEL and published exposure limits for hazardous substance and health hazards.

(2) *Personnel Decontaminating Equipment and Decontaminants.* In addition to routine decontamination procedures, emergency decontamination procedures should be established for use during emergency situations. Appropriate decontaminating materials in sufficient quantities should be properly positioned at the site. This should include clean water for personnel decontaminating purposes. Designated personnel will be trained to operate decontamination equipment in the event of an emergency.

According to 29 CFR, decontamination should be tailored to the specific hazards of the site, the level of the hazard, and the employee's exposure to the hazard. Many factors, such as effectiveness, cost, availability, and ease of implementation, influence the selection of the decontamination method. From the health and safety standpoint, the decision should be made based on the method's effectiveness for the specific substances present and whether the method poses any health or safety hazards.

The decontamination standards used by the Army (FM 3-21) may serve as guidance for establishing an effective personal decontamination procedure for the chemical agent involved. Personal decontamination stations (PDSs), as standardized by the Army, may be used to decontaminate personnel found in or leaving from the suspected contaminated area in emergency situations.

(3) *Communication and Alarm Equipment.* As required by OSHA regulations, a reliable communication system to summon aid is needed in the emergency situation. This will include telephones, radios, or other means of communication for reporting emergencies. The communication equipment should be available at excavation sites and approved for safe use. A person who wears level A protective clothing should be equipped with personal communication equipment, such as a two-way radio.

An employee alarm system, which can be perceived above ambient noise or light levels, is needed at the site to provide warning for necessary emergency action to all employees in the affected portions of the workplace.

(4) *First-Aid Equipment.* As part of the site safety and control plan required by 29 CFR, an emergency treatment program should be established. It is necessary to make advance plans for emergency transportation, treatment, and decontamination at a nearby medical facility. Depending on the site's location and potential hazards, it may be necessary to identify medical facilities capable of sophisticated response to chemical agent exposure. Usually, the civilian medical facilities are not prepared to handle chemical agent casualties; therefore, the Army should provide the necessary training and equipment to establish the required capabilities locally.

(5) *Monitoring Requirements.* As a part of the employer's emergency response plan, a hazard monitoring plan should be developed. The use of monitoring equipment will assist the emergency response personnel in identifying and quantifying the contaminant and help the response personnel to select PPE, delineate areas where protection is needed, determine the need for specific medical monitoring, and assess the potential health effects of exposure. A detailed analysis of monitoring concepts for non-stockpile sites is provided in the Site Monitoring Concept Study.

Two kinds of monitoring equipment should be prepared, the non-agent detector and the agent detector. The non-agent detector will be used to detect flammable or explosive atmospheres, oxygen deficiency, certain gases and vapors, and ionizing radiation. These instruments have been summarized in tables 7-1 and 7-2 of Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities. A direct-reading instrument is recommended for rapidly detecting dangerous situations.

Besides the non-agent monitoring instruments, a device capable of detecting chemical agents should be prepared for emergency response involving chemical agents. Many chemical agent detection devices have been developed and used by the Army for handling chemical agents. The Site Monitoring Concept Study provides details on instruments and their use.

Detectors capable of providing early warning of chemical agent contamination, such as the CAM-M1 and the Miniature Continuous Air Monitoring System (MINICAMS), are recommended for use in emergency response situations to identify the agent and detect contaminated areas.

It should be emphasized that portable instrumentation used to evaluate hazardous material at the site should be demonstrated as being safe to use in those environments. The important consideration when choosing these instruments is that the device has the capability to

detect the compounds of interest. It is also important that the device is approved by national groups, such as Underwriters Laboratory (UL), Factory Mutual (FM), and the American National Standards Institute (ANSI) for the classes, divisions, and groups in which they will be used. To ensure personnel safety, it is recommended that only approved (FM or UL) instruments be used onsite and only in atmospheres for which they have been certified.

b. *Equipment Required for Hazardous Substance Control.* As codified in 40 CFR, subchapter J of SARA title III, when there is a release into the environment of a hazardous substance, pollutant, or contaminant that may present an imminent and substantial danger to the public health or welfare, notification to the appropriate authorities and appropriate removal action to abate, prevent, minimize, stabilize, mitigate, or eliminate the release are required.

The removal action should be taken as soon as possible and as efficiently as possible. It is very important that leaking munitions and containers be handled only by authorized personnel who are qualified in the appropriate procedure to be used. It is also important that the response personnel have appropriate PPE and equipment to mitigate a chemical agent incident safely. The required equipment will be discussed in section 13.

(1) *Area Control and Physical Security.* During the leakage incident, the area should be evacuated except for essential personnel who will perform emergency response activities. Access to the hot area should be restricted.

According to standards established by the Army, when it is unknown whether explosives are involved in a chemical accident or when the types or numbers of munitions cannot be determined, a restricted area of 450 meters in radius is normally established around the chemical accident site.

In addition to the 450-meter radius exclusion area, an initial downwind hazard area should be established. The size and the shape of this area will be determined from information obtained from the hazardous assessment. When the amount and or type of agent are unknown, the initial downwind hazard distance will be extended to 2000 meters downwind from the accident site. The area will be established by extending two radial lines at an angle of 20 degrees on either side of the primary wind direction. Then two buffer zones, extending from the edge of the initial exclusion area, are drawn to intersect the right and left radial lines (see figure 12-2). All unprotected personnel should be evacuated from this area. Where humans or animals have access to the release area, fences, warning signs, or other security or site control precautions equipment should be prepared.

(2) *Leak Sealing and Containment.* Leak sealing and packing of chemical munitions are part of normal practice procedures used by Army personnel where chemical agents are involved. The operational procedures have been described in Army technical manuals (TM 3-250, Storage, Shipping, Handling, and Disposal of Chemical Agents and Hazardous Chemicals) and other appropriate field manuals (FM 3-20, Technical Escort Operations).

Procedures to reduce or stop leakage and the subsequent contamination should begin as soon as possible. Leaks should be sealed with appropriate substances, such as plaster of paris bandage and tapes. Spills on the ground can be covered for a short time with dirt, plastic sheet, wood mats, or other materials.

(3) *Area and Equipment Decontamination.* The contaminated area and equipment should be completely decontaminated. Chemicals and other materials can be used to retard the spread or to mitigate its effects. Since the types of equipment, surfaces, and hazardous material to be decontaminated vary with each accident, the area and equipment decontamination will be carried out on a site-specific basis. The power-driven decontamination apparatus used by the Army would be useful for area and equipment decontamination in emergency situations involving leaking munitions.

Super tropical bleach (STB) is now a standard decontaminant used by the Army. Applied in a slurry paste, it will effectively decontaminate lewisite, liquid mustard, and V- and G-series agents. This decontaminant should be prepared and used for area and equipment decontamination during the chemical weapon recovery projects.

If STB is not available, the nonstandard decontaminant solution, calcium hypochlorite (HTH), is usually recommended to decontaminate lewisite, mustard, and V-series agents. This decontaminant can usually be obtained from a commercial laundry, drug store, or chemical firm.

One concern with the use of bleaching decontaminants is the potential for a violent reaction with mustard agents. Mixtures of STB and HD, for example, can produce a violent, fire-producing reaction.

Other standard decontaminants used by the Army include soap and detergent. It should be pointed out that soaps and detergents do not neutralize chemical agents. Therefore, the runoff solutions from the decontamination procedures may contain toxic chemical agents.

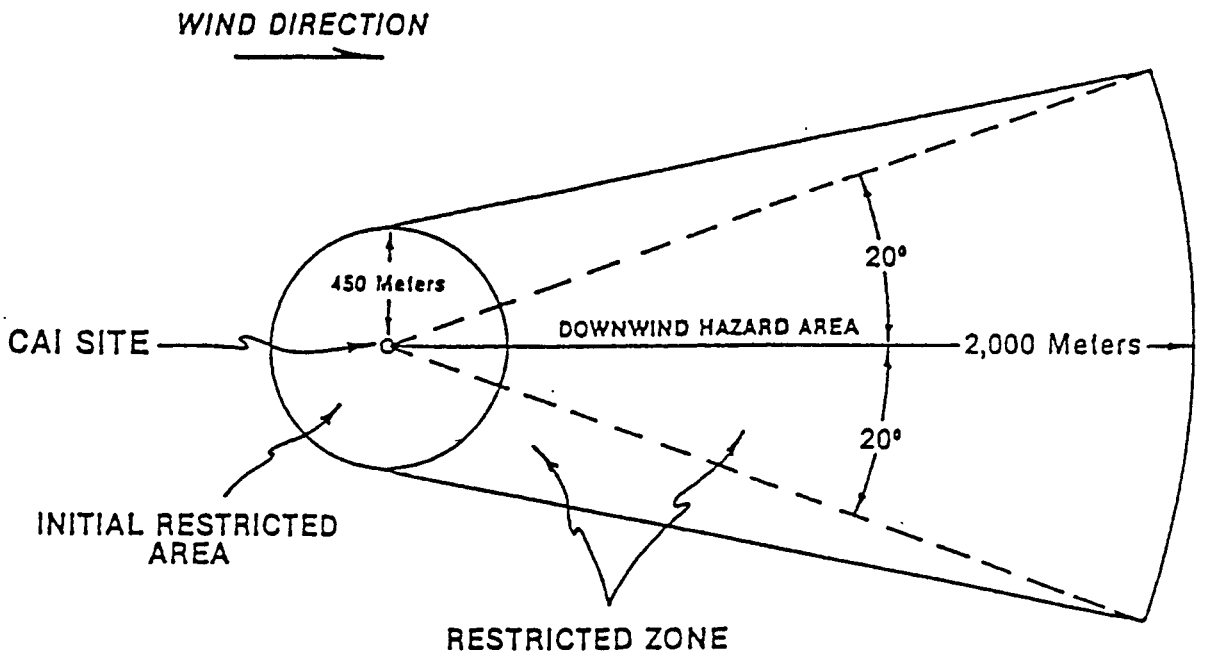


Figure 12-2. Initial Hazard Area Prediction (DA PAM 50-6)

Other nonstandard decontamination solutions, which are effective against one or several chemical agents, can be found in DA PAM 50-6. This document also mentions several natural decontaminants, including water, steam, adsorbents, and sealants. These natural decontaminants are effective in physically removing contamination or transferring the contaminant from one area to another, such as the absorbent material. Eventually, subsequent decontamination using neutralization or destruction methods are required.

During the decontamination procedure, nearby drainages should be protected to prevent contamination by runoff or runon solutions. If soil is contaminated, tools for excavation of highly contaminated soils may be required.

Containment, transportation, and disposal of waste resulting from emergency operations should be in accordance with applicable federal and territorial regulations.

As a minimum, equipment required for hazardous substance control should include those basic supplies and equipment for site security and control, leak sealing, spill control, area decontamination, and excavation, consolidation, or removal of highly contaminated soils.

12.2.2 Contingency Requirement for Detonation of a Chemical Agent-Filled Unexploded Ordnance during Excavation. There are two kinds of detonation: planned detonation and accidental detonation. Planned detonation refers to the emergency destruction of chemical munitions when a chemical munition is in such a sensitive condition that its movement will probably result in a detonation, or when a munition is in such a bad condition that it cannot be safely moved at all. Theoretically, such a munition should be destroyed *in situ*. If proper precautions and protective equipment are prepared prior to detonation, the effects of this kind of detonation will be reduced.

Accidental detonation is an explosion of chemical munitions without warning. Accidental detonation can result in severe hazards: physical hazards due to the fragmentation and chemical hazards due to the total release of the chemical agent. Although there is no warning time for accidental detonation, hazards from these accidents may still be greatly minimized if proper safety measures are applied, such as conducting fuze rendersafe action prior to major item handling.

In addition to the requirements discussed in paragraph 12.2.1, special requirements will be needed to reduce the hazards resulting from the detonation of chemical agent-filled munitions.

a. *Medical Emergency Service.* Accidental detonation of a chemical agent-filled munition may result in casualties suffering both physical injury or chemical agent-exposure injury. In an effort to prevent these from becoming fatalities, it

is important that a capacity exists within the potentially affected jurisdiction area to provide prompt medical care to such casualties.

b. *Unexploded Ordnance Containment.* A special barrier called vented suppressive shielding (VSS) has been developed to protect personnel and equipment from an explosive accident. It is a unique protective barrier that prevents blast pressure, fragments, and flame from injuring personnel or damaging buildings and equipment. Specially designed VSSs will protect against explosive material ranging from 14 ounces to 2500 pounds of TNT equivalent.

   If a chemical munition can be enclosed in such a protective device, the distribution of liquid agent and fragmentation due to the detonation will be considerably contained within the device. Thus, the hazardous effects can be reduced greatly. From the safety standpoint, this kind of device, coupled with an expandable plastic envelope, is recommended as contingency equipment for excavation of chemical munitions to deal with the effects from detonation.

c. *Public Protection.* Unlike a leaker from a chemical munition in which the involved agent may make a puddle that is slowly evaporated by the wind, forming an extended low concentration plume, an accidental detonation may result in a spontaneous total release of chemical agent in a munition. The explosive event creates a concentrated aerosol puff due to energetic release. Subsequently, the affected area may be much larger. In that case, public safety needs special consideration.

   The aerosols generated from detonation of a chemical bomb may be lifted and transported offsite by the wind. This downwind vapor hazard may pose a threat to the public. The density of aerosol particles in the area is one of the factors considered when selecting a protective method. Although the small particles may travel longer distances, their combined mass is less than that obtained from exposure from the large particles.

   There are three basic protective actions for reducing population exposure to chemical agent accidents of credible magnitude: evacuation, shielding, and individual protection. Evacuation from potential impact areas is a very effective response. Thus, it is the most appropriate response for those in areas close to the accident site. In-place shelter protective measures, on the other hand, would be appropriate for the public in areas farther away from the source of the hazard where chemical concentrations would be expected to be lower than in the areas that are evacuated.

   To protect the public, a reliable and effective public alert and notification system should be established or identified in local areas where chemical weapons are located. These systems will usually include commercial broadcast radio stations, television stations, and other means of communication. Techniques for estimating the downwind hazard distance from releases of chemical agents

should be prepared, such as the dispersion model D2PC currently used by the Army.

SECTION 13

CONTINGENCY EQUIPMENT

13. CONTINGENCY EQUIPMENT

This section identifies potentially applicable contingency equipment for use during remediation of chemical warfare materiel (CWM) at the Former Fort Segarra (FFS). Selecting appropriate contingency equipment for use at FFS should be based on the general CWM recovery program requirements and site-specific conditions. An assessment of the local emergency response capabilities has been performed to identify contingency equipment needs. These contingency requirements are based on regulatory requirements and should be revised as necessary when applicable regulation requirements change.

13.1 Site Requirements

During the recovery and disposal of chemical weapons, accidents involving the release of chemical agents from leaking munitions or detonation of chemical agent-filled munitions may pose a threat to the environment and human beings in the area. As required by Federal and U.S. Virgin Islands territorial regulations, contingency plans and emergency procedures must be prepared before conducting operations involving hazardous wastes including chemical munitions. Such plans would describe arrangements agreed to by local police department, fire departments, hospitals, contractors, and territorial emergency response teams to coordinate emergency services. The most expedient and practical means of managing the initial response is by using the local government emergency response resources and capabilities. Concurrently, the plans should also include a list of all emergency equipment required at the facility and identify an evacuation procedure for facility personnel and nearby population from the immediate effects of a chemical agent release.

13.2 Summary of Generic Contingency Equipment

Contingency equipment will be necessary to rescue and treat victims, protect response personnel, and mitigate contamination onsite. In determining contingency equipment, both the generic requirements and the site-specific situations should be considered. The generic contingency equipment required for excavation of chemical agent munitions has been discussed in the Generic Site Scoping Study. This includes: personnel protective equipment (PPE), monitoring equipment, first-aid equipment, decontamination equipment, site security and control equipment, leaker sealing devices, spill control devices, and communication systems.

13.3 Analysis of Contingency Equipment Requirements

As indicated in 29 CFR §1910.120, emergency response operations for the release of hazardous substances are subject to all the requirements described in part 1910 and part 1926. Under this requirement, all employees, including emergency responders,

who work on a hazardous waste site and who are exposed to hazardous substances and health and safety hazards are required to wear appropriate personnel protective clothing and equipment.

As required in 29 CFR §1910.120, if chemical exposure levels present will create a substantial possibility of immediate death, immediate serious illness or injury, or impairment of the ability to escape, positive-pressure self-contained breathing apparatus (SCBAs) or positive-pressure air-line respirators equipped with an escape air supply should be used.

In addition, if skin absorption of a hazardous substance may result in a substantial possibility of immediate death, immediate serious illness or injury, or impairment of the ability to escape, totally-encapsulating chemical protective suits [Occupational Safety and Health Administration (OSHA) level A protection] should be used.

As indicated in the background analysis at Section 2, a variety of chemical agents are suspected at the FFS site. These include the blister and nerve agents. Cyanide chloride (CK) and phosgene (CG) may also be encountered.

The M70 115 pound bomb, for example, was filled with distilled mustard (HD) and used during the tests. Mustard has a freezing point of 14°C (58°F). At room temperature, HD is an organic, oily liquid. It is a blister agent which injures the eyes, damages the lungs, and severely blisters the skin upon exposure. Studies have shown that this agent is very persistent on earth and solid surfaces. In water, although HD decomposes in approximately 1 hour, its decomposition product is as toxic as HD itself.

No immediately dangerous to life and health (IDLH) limit for mustard itself has been established by regulatory agents, but due to its carcinogenicity, respiratory protection is required if mustard is detected. Therefore, respirators should be prepared for emergency personnel who will respond to chemical agent accidents at the FFS site. Mustard can be detected by means of agent detectors such as the Miniature Continuous Air Monitoring System (MINICAMS) or Automatic Continuous Air Monitoring System (ACAMS), which will detect mustard at levels as low as 0.003 milligrams per cubic meter within 5 minutes. The effective decontaminants for HD include super-tropical bleach (STB) and calcium hypochlorite (H TH).

Sesquimustard (HQ), is a mixture of mustard and Q [1,2-bis(2-chloroethaylmercapto)-ethane]. HQ was developed by the British in 1939 but was never produced on a large scale. HQ was originally pursued because it had a lower melting point than pure mustard and was a more powerful vesicant. In the United States, Q was produced in the early 1940s on a small scale as a mixture of 76-percent mustard and 24-percent Q. The melting point of pure Q was 6.7°C (44°F). The eutectic for mixtures of pure mustard gas and pure Q is 4.5°C (40°F) and 32-percent Q (Army, 1948).

The physiological properties of pure Q were tested and found to be roughly five times as vesicant as mustard in solution. As far as vapor effects were concerned, due to

the relatively low vapor pressure of HQ, the burns from HQ were found to be more severe than those produced by HT, and less severe than those from mustard gas. (Army, 1948)

In physiological tests at the Edgewood Arsenal, Maryland, the American-made mix of HQ, 76/24, was found to be about twice as vesicant as mustard gas to the skin of the rabbit and man when applied undiluted. Drops of 11.6 milligrams penetrated single layers of impregnated 9-ounce cotton cloth with about 50 percent more effect (on rabbits) than drops of mustard gas of about the same weight (Army, 1948).

There is not a great deal of information on HQ since it was produced only on a small scale and never further developed. Studies may need to be initiated to develop standards and monitoring techniques for HQ. These studies would need to be largely theoretical since there is no HQ available for testing. Since HQ is 76-percent mustard, it is expected that monitoring equipment used to detect mustard could also be used to detect HQ. Some references (Army, 1948) indicate that the Q tended to separate as a solid phase due to its low solubility. If this is the case, there may be some difficulty in monitoring HQ. There are no monitoring standards established for HQ at this time (such as IDLH, etc.). Decontaminant solutions appropriate for H or HD would most likely be appropriate for HQ.

The nerve agent tabun (GA) was also used extensively in the tests. The nerve agents are fast acting lethal agents. Due to the high boiling points of these agents, they will not dissipate immediately if spilled. The hazard from nerve agents is primarily that of vapor inhalation. Liquid nerve agents are also hazardous by skin or eye contact and by ingestion. The IDLH limit for GA is 0.2 milligrams per cubic centimeter. Nerve agents can be detected by means of agent detectors such as the MINICAMS, which will detect mustard at levels as low as 0.001 milligrams per cubic centimeter within 5 minutes. STB is one of the effective decontaminants for nerve agents.

CK is a poisonous gas. Its boiling point is 14°C (57°F). Like other chemical agents, CK is classified by the Department of Transportation (DOT) as a poison A gas. CK is a severe irritant to both the eyes and throat. Inhaling small amounts of CK may cause effects similar to those found from inhalation of cyanide. There is no Federally-regulated permissible exposure limit (PEL) for this chemical, but the American Conference of Governmental Industrial Hygienists (ACGIH) has adopted a ceiling value of 0.6 milligrams per cubic centimeter for CK. Use of appropriate protective clothing with self-contained breathing apparatus (SCBAs) is recommended. HTH will be effective for decontamination of CK.

Test reports indicate that the CK involved in the surveillance tests was unstabilized. Four of the M78 bombs involved in these tests were found to be largely solid and testing was discontinued on these items. As discussed in section 2, the disposition of these bombs cannot be accounted for. Unstabilized CK polymerizes to from cyanuric chloride in a trimer reaction. This polymer is explosive and reacts violently with water. Foam or dry powder should be used to extinguish a fire involving solidified CK. Use of conventional decontamination solutions may result in a reaction with cyanuric chloride.

A study should be conducted to identify the most appropriate decontaminant. According to the Material Safety Data Sheet (MSDS) (appendix G), cyanuric chloride is a strong irritant on the skin, eyes, respiratory tract, and gastrointestinal tract after contact, inhalation, or ingestion. Intensive skin contact leads to contact dermatitis due to chemical burn. Recommended precautions are to wear full protective clothing and protective breathing equipment when handling.

Phosgene (CG) is a colorless gas with an odor similar to that of new-mown hay, grass, or green corn. CG readily condenses to a colorless liquid below 7.8°C (46°F). CG is a delayed-casualty agent causing fluid buildup in the lungs that can cause dryland drowning. During and immediately after exposure, coughing and wheezing are likely; however, exposure to low concentrations causes no ill effects for 3 hours or more.

In addition to a wide range of chemical agents involved, there are other site-specific conditions which should be considered in developing a contingency plan. Water Island is a resort area. As such, the health and safety of the public will be an important issue in the contingency plan. The peak tourism season for Water Island is from December to April. It may be recommended that the cleanup work not be conducted during this time. However, at other times of the year the temperatures can be as high as 32°F (90°C) or above. Wearing personal protective equipment (PPE) will put emergency response personnel at considerable risk of developing heat stress. As a result, the heat transfer characteristics of PPE become an important factor in selection.

Level A protection is needed to provide the wearer protection in areas where potential for contamination with undiluted agent exists, such as handling of leaking munitions. If agent is detected, SCBAs will be needed. The level B protection will protect the wearer from secondary contamination, such as during medical treatment of chemical casualty. Therefore, both level A and level B protection ensembles will be required in response to a chemical agent leak at FFS. It is recommended that a slung mask be worn during all excavation operations.

Monitoring equipment is required because it will assist the emergency response personnel to identify and quantify the contaminant and help the response personnel to select proper PPE, delineate areas where protection is needed, and determine the need for specific medical monitoring. Chemical agents can be detected by means of many agent detectors (such as the MINICAMS), which will detect mustard at levels as low as 0.003 milligrams per cubic centimeter within 5 minutes. Certain detectors for monitoring nonagent hazards may also be required based on OSHA regulations.

Based on safety considerations, an emergency/first-aid station capable of providing stabilization for patients requiring offsite treatment and general first aid should be provided. This station should be located in a clean area and provide a standard first-aid kit or equivalent supplies, plus additional items such as emergency/deluge showers, stretchers, drinking water, ice, emergency eye wash, decontamination

solutions, and fire-extinguishing blankets. The equipment and supplies listed in the Army document for onsite medical treatment of chemical agent exposure injuries (DA PAM 385-61) are recommended for this site.

A vehicle suitable for use as an ambulance should be readily available at the site whenever the excavation operation is in progress. At Water Island, this may be a boat on standby or a helicopter which could transport individuals quickly to St. Thomas or off the U.S. Virgin Islands for treatment. A minimum of two trained people knowledgeable in agent exposure symptomology, first aid, and cardiopulmonary resuscitation (CPR) should be present during the site operation and remain in the immediate access area. Liaison with local medical services, introducing military medical services, should be established. Telephone contact with medical experts should be made available.

As required by OSHA regulations, a reliable communication system to summon aid is needed in the emergency situation. This will include telephones, radios, or other means of communication for reporting emergencies. The communication equipment must be available at excavation sites and must be approved for safe use. A person who wears level A protective clothing should be equipped with personnel communication equipment, such as a two-way radio. The communication system at the site should be compatible and linked with the Virgin Island Territorial Emergency Management Agency (VITEMA) communication system.

An employee-alarm system, which can be perceived above ambient noise or light levels, is needed at the site to provide warning for necessary emergency action to all employees in the effected portions of the workplace.

A release of chemical agents into the environment will present an imminent and substantial danger to the public health or welfare. Therefore, it is essential that a variety of sealing and spill-control equipment be prepared for different unexpected cases to abate, prevent, minimize, stabilize, mitigate, or eliminate the release. Where humans or animals have access to the release area, fences, warning signs, or other security or site-control precautions equipment should be prepared. As a minimum, equipment required for hazardous substance control should include those basic supplies and equipment for site security and control, leak sealing, spill control, area decontamination, and excavation, consolidation, or removal of highly-contaminated soils.

The contaminated area and equipment should be completely decontaminated. Chemicals and other materials can be used to retard the spread or to mitigate its effects. Since the types of equipment, surfaces, and hazardous material to be decontaminated vary with each accident, the area and equipment decontamination should be carried out on a site-specific basis. The power driven decontamination apparatus used by the Army would be useful for area and equipment decontamination in emergency situations involving leaking munitions.

The effective decontaminants for agents suspected on FFS include STB and HTH. These decontaminants should be prepared in sufficient quantity prior to conducting any excavation operation at the site. It should be known that the decontaminant STB is used on surfaces specifically designed to survive its use. The use of this decontaminant for equipment decontamination in the non-stockpile program is not recommended unless careful consideration is made. During the decontamination procedure, nearby drainage should be protected to prevent contamination by runoff or run on solutions. If soil is contaminated, tools for excavation of highly-contaminated soils may be required.

13.4 Contingency Equipment for the Former Fort Segarra

Based on the site-specific situations and the generic requirements, the following contingency equipment is recommended as a minimum for the FFS site:

- personal protective equipment:
  - level A and B (with improved cooling features)
  - SCBAs, etc.

- monitoring equipment:
  - nonagent detector
  - agent detector

- first-aid equipment:
  - emergency eye washer
  - emergency showers
  - stretchers
  - first-aid kit
  - antidote injectors, etc.

- decontamination:
  - portable water
  - STB
  - HTH
  - soapy water
  - M258 personal decon kit
  - power-driven decontamination apparatus, etc.

- site security and control:
  - portable fire extinguisher and fire-control equipment
  - warning tapes, marking signs, barricades, etc.

- leaker sealing:
  - repair kit
  - non-sparking tools
  - portable lighting system or flashlights, etc.

- spill control:
  - plastic sheet and bag
  - absorbent socks
  - absorbent materials
  - overpack containers, etc.

The recommended equipment and supplies should be immediately available in case of an emergency, and trained personnel should be available to use this equipment. Some of the equipment may already be maintained by local emergency response teams. The capability of the local emergency response teams should be identified and the gaps between the required and existing equipment should also be addressed.

13.5 Local Emergency Response

In case of emergency, every effort should be made to prevent loss of life and minimize the hazardous effects from a chemical accident/incident. The required immediate actions include activating facility alarms, ensuring all involved personnel take proper self-protection steps (for example, mask, decontamination, and evacuation upwind); and rendering first aid and protection to contaminated individuals (for example, decontamination, removal of clothing, and immediate evacuation to the first-aid station by emergency vehicle). Immediate actions also required are to dial an emergency number to notify appropriate local authorities, including fire department and security alert team, and informing them of the accident/incident situation, location, agents involved, and the number of casualties, if any.

The immediate area will be evacuated in the event of a chemical agent leak. The area should be secured. Access to the area should be controlled using methods such as warning tapes, signs, barricades, or traffic cones. Only the emergency personnel, such as fire fighters and those needed for leaker removal and decontamination activities, should be allowed to enter the area until appropriate corrective actions have been accomplished and the area is certified to be within the specified safety levels. For chemical agent emergencies, the local emergency response teams should have access to proper PPE for suspected chemical agents. They should have training on how to handle accidents involving chemical agents.

Emergency response systems to deal with major disaster conditions, such as hurricanes which represent the greatest danger to the territory, have been well established on the U.S. Virgin Islands. VITEMA is the territory office of emergency management. It is the sole U.S. Virgin Islands government agency designated to supervise, administer, and coordinate disaster response and recovery operations. VITEMA has developed a complete Emergency Operations and Disaster Control Plan for emergency preparedness planning, administrative, training, and exercise purposes. The standing operating procedures (SOP) developed for the Emergency Operations Center (EOC) of VITEMA provides guidelines for staffing, activating, managing, and deactivating emergency operations.

Responsibilities of each involved agency during emergency situations are clearly defined in the Emergency Operations and Disaster Control Plan. For example, VITEMA will be responsible for communications, surveillance, warning, emergency operation centers, and volunteers. VITEMA will also assist with search and rescue, public information, shelter operation, and evacuation direction and control. The police department will provide assistance in evacuation, investigations, law enforcement, traffic control, search and rescue, etc, while the fire department will provide fire protection and assistance with land search and rescue, etc.

However, experience with hazardous material response on St. Thomas appears to be limited to handling chlorine gas leaks at water treatment plants only. Another concern for the local emergency response capabilities for chemical agent leaks is that the local emergency teams may not have enough PPE to respond adequately against chemical agent exposure nor enough emergency response equipment to handle hazardous chemical agents (McIntosh, 1993).

Emergency medical services may present a problem at the FFS site due to the lack of proper facilities and qualified medical service personnel. It may not be difficult for a local medical facility to furnish the required supplies for treatment of chemical agent-exposure casualties. However, it may be very difficult for a regional medical facility to provide qualified medical response personnel and special treatment areas for handling chemical agent-contaminated casualties. In addition, drugs appropriate for treatment of agent exposure cases are prescription drugs. Only trained and authorized personnel are allowed to administer such pharmaceuticals. The admission of chemical agent-contaminated victims may affect the medical facility's service to the community at large.

Water Island has no commercial services such as restaurants, stores, or motels. There are also no schools, hospitals, or nursing homes. Most of the public services are provided on St. Thomas. Emergency services are run by the U.S. Virgin Islands government's Department of Health. Ambulance service is also run by the U.S. Virgin Islands government. St. Thomas Hospital is the only operating hospital on St. Thomas, which has 160 beds and runs at 86- to 88-percent occupancy. The emergency ward of the hospital is a 10 to 12 bed facility with a decontamination room at the ambulance entrance. The decontamination room has a separate ventilation exhaust system to the roof and the drain in the decontamination room goes directly to the sewer system (McIntosh, 1993).

There are three levels of emergency technicians who are certified by the Health Department, with standards similar to those used by states in the continental United States. The intermediate-level emergency medical technicians and paramedics can administer antidotes and other drugs under appropriate protocols. Medical evacuation of injured and ill people on Water Island could be handled in several ways including ambulance boat and Medivac helicopter operated by the U.S. Virgin Islands government and helicopter owned by the National Guard if contingency medivac service is required.

To have sufficient medical support for the FFS project, much work needs to be done. If contingency is beyond the control capabilities of the local agency, higher levels of emergency medical service (EMS) resources should be considered and used, if necessary and available. The possible sources include the mobilization of Federal EMS resources through the National Disaster Medical System, the mobilization of military EMS through the military medical resources, and the state-level entity. The local medical emergency service personnel should have access to communication equipment, such as telephones, to consult appropriate experts on treatment of agent exposure victims in case of emergency at the FFS site. Proper transportation means (such as Medivac helicopters) should be available to transport chemical agent exposure casualties if necessary. As a minimum, an intermediate-level emergency medical technician and a dedicated boat for transporting injured workers from a suitable upwind dock should be included in contingency medical support during any intrusive operations on Water Island. A Memorandum of Agreement with either the U.S. Virgin Islands National Guard or the helicopter Medivac service in the U.S. Virgin Islands should be established for immediately transferring injured personnel for medical attention. An agreement should also be made with the St. Thomas Hospital for initial treatment and management of any chemical warfare agent casualties.

If an accident occurs during the excavation and transportation of chemical munitions which may affect the local population and require evacuation, the local government should have a well-established and reliable public alert and notification system. There appears to be a good public alert and notification system on St. Thomas, but this does not appear to extend to the residents on Water Island. The transportation problems for those special populations, such as the elderly and people who do not own or have access to proper transportation means, should be considered. No operations should be started until these problems are solved.

In general, the successful implementation of the proposed chemical weapons recovery project will require coordination with the local authorities. If the provisions in the site-specific contingency plan are implemented, the potentially hazardous effects of chemical agent leakage and munition detonation will be substantially reduced.

13.6 Recommendations for the Former Fort Segarra

Before cleanup activities begin, contingency equipment should be identified and made available to ensure the safety of site personnel and the public during the most probable event (MPE). In addition, the EMS resources capable of handling the emergency situation associated with an MPE should be identified and coordinated with site operations.

In general, the successful implementation of the proposed chemical weapons recovery project will require coordination with the local authorities. If the provisions in the site-specific contingency plan are implemented, the potentially hazardous effects of chemical agent leakage and munition detonation will be substantially reduced. It is recommended that agreements be established with the U.S. Virgin Islands government, National Guard, and local hospitals. A substantial amount of planning

and training of emergency response personnel will be required prior to responding appropriately to a chemical agent emergency.

It is also recommended that a study be initiated to identify decontaminants for HQ and cyanuric chloride. A foam or dry powder may be appropriated for cyanuric chloride since this chemical reacts violently with water. It is recommended that standards and monitoring techniques be developed for HQ prior to initiating a remediation effort.

SECTION 14

CONCLUSIONS

14. CONCLUSIONS

This Former Fort Segarra (FFS) Scoping Study identifies regulatory and technical issues associated with any potential effort to remediate chemical warfare materiel (CWM) problems at the FFS. Conclusions are organized by phase in accordance with the scoping study format.

14.1 Background Analysis

CWM activities on the U.S. Virgin Islands have been fairly well defined through the use of San Jose project test reports, progress reports, and personal interviews. Historical documents indicate that a limited number of CWM tests were conducted on the U.S. Virgin Islands. Water Island was the primary location for testing while some limited testing was performed at the west end of St. Thomas. Of the nine tests conducted, three involved the surveillance of CWM during storage, five involved the static firing of CWM, and one involved emitting phosgene (CG) to determine penetration characteristics of gasproof shelters.

The disposition of the CWM items is also fairly well defined. Records indicate that the majority of the CWM stored on Water Island was removed at the end of the San Jose project. However, records do not indicate the disposition of all items involved in the tests. Some of these items include four M78 cyanogen chloride (CK)-filled (500-pound) bombs involved in the surveillance tests, remnants from the M70 bomb tests, and the smoke pots.

Records and personal interviews indicate that no CWM testing or disposal operations occurred in former test areas 1, 2, 3, and 7. Therefore, it is recommended that no additional investigations be conducted in these areas.

Records and personal interviews indicate that tests were conducted at the southern end of Water Island at test areas 4, 5, 6, and 8. Based on personal interviews, the toxic storage yard was located adjacent to former test area 8 on Water Island. CWM was shipped to and removed from Water Island via the deep water dock in the Flamingo Bay area. A salt pond was located in this area in the 1950s. This is the only site where suspected CWM has been recovered from Water Island since the Army vacated the island in 1950.

The area of the toxic storage yard, former test area 8, and the northern portion of test area 6, have been significantly developed since the 1950s with no reported incident of encountering CWM. It is recommended that no further investigation be conducted in these areas. Photographs of test setups and personnel interviews indicate that tests conducted in former test area 4 were confined to the open area in the northern portion of the site. It is recommended that further investigations be conducted in this portion

of area 4. In addition, it is recommended that further investigations be conducted in the Flamingo Bay area, test area 5, and the open area near the shore of former test area 6.

Limited testing was conducted on the west end of St. Thomas. Based on the nature of the testing, it is not believed any residual CWM would remain on St. Thomas. It is recommend that no additional investigation be conducted in this area.

Many of the former test areas on Water Island have been used as residential landfills. For example, the old Flamingo Bay salt pond was used as a landfill from the 1950s until suspected CWM was uncovered in the area in 1966. Surface trash and discarded vehicles are present at the southern side of former test area 4 and in the Flamingo Bay area. The disposal of non-Department of Defense (DoD) trash in these areas will hinder the ability to recover and remediate buried CWM.

Based on local meteorology data, the wind is blowing away from populated areas 77.6 percent of the time and there is essentially no wind (that is, the wind is less than 3 miles per hour) 14.4 percent of the time. When planning an investigation or remediation effort on Water Island, consideration should be given to the prevailing winds.

14.2 Regulatory Requirements

A wide range of Federal, U.S. Virgin Islands, and DoD regulations are potentially applicable to govern site characterization and cleanup activities of FFS. Direction provided by the U.S. Army Chemical Materiel Destruction Agency (USACMDA) was to assume that Comprehensive Environmental Resource, Compensation, and Liability Act (CERCLA) requirements for hazardous waste sites would apply to FFS and be followed.

Water Island is a Federal facility owned by the Department of the Interior (DOI). Since Water Island is not on the National Priority List (NPL), authority to remediate the area as a CERCLA site could be obtained by DOI under section 122 of CERCLA. As an alternative, an agreement could be established between DoD and DOI under section 122 providing DoD the authority to carry out the response action. It is recommended that an agreement be established between DOI and DoD, providing DoD the authority to carry out the CERCLA response action.

An applicable or relevant and appropriate requirements (ARARs) evaluation is needed to select the most applicable requirement, particularly when a FFS remediation activity is governed by no specific regulation or by several conflicting regulatory requirements. The results of a preliminary ARARs evaluation has identified some primary Federal and territorial requirements that will govern CWM investigations and remediation efforts at FFS.

Since Water Island is owned by the DOI, DOI regulations will be applicable. The DOI has delegated control of Water Island to their Territorial and International Bureau. The bureau does not have any regulations concerning hazardous waste at this site.

Resource Conservation and Recovery Act (RCRA) regulations have not been delegated to the U.S. Virgin Islands. Therefore, the Federal RCRA requirements will apply.

Water Island is in the first tier of the coastal zone. The U.S. Virgin Islands government requires more extensive reviews and approvals for developers within the first tier of the coastal zone.

14.3 Risk Management

Risk management policies, procedures, and strategies must be developed for the FFS cleanup. The federal CERCLA, Occupational Safety and Health Administration (OSHA), and DoD requirements and guidance can provide the basis for developing a FFS-specific risk management program. The use of the CERCLA baseline risk assessment (BRA) and the DoD's hazard assessment processes will provide a comprehensive evaluation of risks associated with the site conditions and the hazards associated with handling, transport, and disposal of CWM.

AR 385-10 and PM CML DEMIL Reg 385-1 prescribe system safety management concepts which could be adapted to the non-stockpile program. These procedures reflect those recommended by the American Institute of Chemical Engineers in their Guidelines for Hazard Evaluation Procedures, dated 1985. It is recommended that these standards and guidelines be followed when performing a risk assessment of the FFS remediation effort. To develop this risk assessment, the most probable event (MPE) and maximum credible event (MCE) should be defined. Examples of possible MPEs and MCEs are included in section 4. A Systems Safety Management Plan for the non-stockpile program is being developed. When it is complete, that document rather than PM CML DEMIL Reg. 385-1 should be used to determine the RAC for a site.

The primary purpose of any risk analysis is to identify the accidents with the highest probability of occurring with the worst potential consequences such that these accidents can be focussed on in developing mitigation measures to reduce the overall risk of the program. Once completed, the risk analysis should be used as a tool to reduce overall risk of the program. Some mitigation measures recommended for FFS might include confining operations to off-season tourism periods. In addition, it may be advisable to limit operations to when predominant winds are blowing away from populated areas.

Based on the San Jose Project reports, surveillance tests were conducted with unstabilized CK which in some cases had become largely solid. Unstabilized CK solidifies to form cyanuric chloride, which in some environments exhibits explosive characteristics. Further research should be conducted to determine the explosive

characteristics of solidified CK to better understand and mitigate against hazards associated with recovering or treating these items.

14.4 Baseline Assessment

A baseline assessment plays an important role in the CERCLA process by collecting sufficient information needed to support the selection of cleanup actions, including an evaluation of current and future risks estimated by a BRA. The baseline assessment is performed in two stages, a preliminary site characterization and a baseline investigation. The primary techniques used in the baseline assessment are monitoring the soil and groundwater and geophysical techniques. These techniques are used to minimize intrusive work to avoid unnecessary exposure to the hazardous materials potentially present at the site.

Baseline monitoring techniques consist of sampling and analysis methods to determine migration pathways at the site and identify the possible presence of CWM contamination. Very little existing information was identified regarding groundwater flows at Water Island. It is recommended that migration pathways be further identified during the preliminary assessment/site investigation (PA/SI) phase of the program. As recommended in paragraph 5.3, signature compounds or degradation products for the various agents tested or stored on Water Island should be further identified prior to initiating an investigation at the site.

Testing on Water Island is believed to have involved munitions fired by conventional electric blasting circuitry. These circuits were located outside the body of the munition and therefore have no metallic shielding. Due to the nature of this testing, the use of active geophysical survey instruments that generate a signal that can induce electricity in metal wires or components should be avoided. Passive instruments do not generate any signal. This will limit the types of detection equipment that can be safely employed at FFS.

Many of the areas which may require further investigation at FFS have been used as residential landfills. The ferrous material within these landfills can interfere with the ability of detection equipment to locate CWM. Calibrating equipment to consider unknown interference as background may skew the results of any sweep. This procedure may prevent the detection of small or light-cased munitions such as the smoke pots.

It is recommended that a combination of geophysical techniques and random surface sampling be conducted to further investigate former test areas 4, 5, and 6. At the Flamingo Bay area, it is recommended that monitoring wells be installed upgradient and downgradient of the old salt pond area to determine migration pathways and to determine if any CWM contamination is present and migrating from the salt pond area.

14.5 Excavation

If excavation is performed to recover CWM at FFS, there exists a variety of applicable mechanized and hand techniques. Geophysical techniques are available that could assist in identifying locations of buried CWM during excavation activities. The use of geophysical techniques to augment excavations will enhance safety and environmental protection during these operations. Based on a preliminary assessment, the preferred excavation strategy for the former test areas includes the use of magnetometers to perform nonintrusive surveys during excavation. Excavation would begin with mechanized equipment to within 1 feet of detected magnetic anomalies and would then involve the recovery of the CWM by archeological-type hand excavation techniques.

If excavation is conducted in the Flamingo Bay landfill area, a different excavation strategy using mechanized excavation equipment is recommended. Geophysical techniques would be of minimal use at the Flamingo Bay landfill due to the presence of metal scrap and vehicles reportedly buried in this area. Due to the large area of the landfill, archeological-type hand excavation techniques appears impractical. Since it is possible that explosive material is present in the landfill area and use of mechanized equipment is the recommended approach, consideration should be given to the use of explosive-protective shields while excavating in this area. It should be noted that excavation is typically not conducted in a landfill area when the benefits of the excavation are outweighed by the risk associated with the excavation to the public, the worker, or the environment. Risk associated with the excavation of possible CWM as well as non-DoD waste should be considered prior to excavating the landfill area.

14.6 Packaging

Packaging of CWM will be needed if FFS cleanup activities involve the recovery, interim storage, or transport of buried CWM. Department of Transportation (DOT) regulations specify the minimum packaging requirements for chemical munitions. The selection of appropriate packaging for recovered CWM involves classification of CWM as a hazardous waste and the desire to select a packaging system that ensures protection of the public and environment from the risks posed by the CWM. Specific packaging systems should be developed to meet or exceed DOT regulations and to meet the needs of the non-stockpile program.

14.7 Interim Storage

Interim storage of recovered CWM at FFS could be required for recovered CWM awaiting offsite transportation and disposal or awaiting onsite treatment. Numerous designs are available for fixed bunker (magazine-type) and portable structures. Initially, two storage units are recommended at FFS. Additional storage capacity could be provided if more storage is needed to separate incompatible waste or if the first storage units do not have the capacity for the CWM recovered. If a portable structure is chosen for the FFS interim storage facility, the prefabricated class I magazine (type P3) is recommended because of its superior safety. It is recommended that a

fragmentation analysis be conducted of the selected interim storage facility to ensure it can safely store explosively-configured CWM.

At FFS, three siting options were considered: use of existing World War II (WWII) bunkers at the north end of Water Island, use of existing WWII bunkers in the Krum Bay area on St. Thomas, or installation of a portable facility in the Flamingo Bay area on Water Island. Installation of a portable facility in the Flamingo Bay area was recommended primarily due to the close proximity of this storage structure to areas where CWM would most likely be recovered. This location is also downwind of populated areas based on the prevailing winds on Water Island. If a decision is made to site the interim storage facility in the Flamingo Bay area, additional investigation would be needed to identify an exact location for storage facilities. Space is limited in this area so it may be difficult to meet all of the siting requirements.

Army regulations that must be considered if the interim holding facility is located in the Flamingo Bay area or the existing bunkers at the north end of the island are the separation distance requirements. The Flamingo Bay area and the WWII bunkers at the north end of Water Island do not appear to have sufficient space to comply with the separation distance requirements in the Army regulations. The criteria for storage of chemical munitions are stated in AMC-R 385-131 and defined in AMC-R 385-100 but may not be directly applicable for recovered CWM.

In addition, specific recommendations for security measures for an interim storage facility at FFS are presented. To identify the passable security requirements for any proposed interim storage facility at FFS, a threat and vulnerability analysis was performed. The results of the preliminary threat assessment indicates that the overall threat is considered to be in the low to moderate range. The overall vulnerability of any proposed interim storage facility at FFS is moderately high based on existing conditions. Recommendations to reduce the vulnerability of a storage structure at FFS include surrounding the facility with two concentric fences, providing 30-foot clear zones between the fences and inside the inner fence; installing security lighting at the exterior door; and posting a guard to maintain continuous surveillance and control access to the storage facility. These recommendations were based on a preliminary analysis and should be coordinated with Army officials and local law enforcement officials prior to finalization.

14.8 Transportation

Federal, U.S. Virgin Islands, and DoD requirements restrict the transportation of CWM-type material. The transportation of recovered CWM from the FFS site is feasible by air or water shipment. The use of rail, road, air, or ship is feasible for transporting the CWM to the final disposal site within the continental United States. Regulatory restrictions for each transportation method varies. Hazardous waste requirements for packaging, placarding, manifesting, and using permitted hazardous waste haulers will apply for all modes of transportation. DOT requirements specify weight limitations for air transportation. DOT also prohibits the transportation of CWM by commercial

passenger and by cargo air transport in certain situations. DoD requirements specify limitations for transporting chemical surety materiel (CSM) by military aircraft.

Transporting CWM from an island such as Water Island presents a unique situation. One important factor in selecting a mode of transportation would be the number of cargo transfers required. The more the cargo is handled, the higher the probability of an accident. Therefore, the transport combination requiring the least amount of cargo handling is most favorable.

Given these considerations and the preliminary nature of the assessment which was conducted, a transportation plan involving rotary-wing aircraft would seem most favorable at FFS. This transport combination only requires the cargo to be handled three times (loading, transfer, and unloading). It would not bring the cargo to St. Thomas, thereby relieving some concerns from the local populace. It would not involve the civilian airport or loading docks on St. Thomas. A waiver would need to be obtained from DOT regulations to transport explosively configured CWM by rotary-wing aircraft. Finally, in terms of resources, the helicopter loading area may be more cost effective than constructing a loading dock or a runway. The selection of the transportation mode for transporting recovered CWM to the final disposal facility within the continental United States can be made once the disposal facility is selected.

A final recommendation to select one mode or a combination of transport modes cannot be made before considering information from a risk and cost analysis. Therefore, final selection of a transportation strategy for FFS should be made under the CERCLA process during evaluation of cleanup alternatives.

14.9 Treatment

It is possible that a FFS cleanup involving onsite treatment could be selected as a result of the CERCLA process. The evaluation of technologies in this report identified many treatment technologies that could be capable of treating CWM contamination. All the technologies that were evaluated for this report should be considered as candidate technologies and should be considered during the evaluation of remedial alternatives during the CERCLA Remedial Investigation/Feasibility Study (RI/FS) process. Evaluation of these treatment technologies could require treatability testing to be performed before a decision is made to select treatment as a preferred component of a FFS cleanup action.

Regardless of whether onsite or offsite treatment of recovered CWM is selected, additional research should be conducted to develop treatment plans due to the unique nature of items tested at FFS. For example, sesquimustard (HQ) was involved in some of the tests on FFS and could be potentially recovered. Very little information is available on this agent since it was experimental and never developed on a large scale. Since HQ is really a mixture of mustard (H) and Q [1.2-bis(2-chloroethyl-mercupto)-ethane], monitoring and decontaminating techniques for other H-series agents may also be effective for HQ. It is recommended that prior to initiating a

remediation effort on FFS, techniques for H-series agents be reviewed for their applicability to HQ.

Based on background information, CWM-containing solidified H or solidified CK could also be recovered at FFS. It is recommended that further research be conducted to develop treatment techniques for solidified CK and H. Further research should also be conducted to better understand the reactive hazards associated with solidified CK.

CWM items as large as the 1000-pound bomb and one-ton containers were involved in tests at FFS. The 1000-pound bomb was involved in surveillance tests and most likely was not explosively configured. Currently, the Army is developing three munition management devices (MMDs) for the treatment of various CWM items. These include the MMD1 for nonexplosive items under 500 pounds, the MMD2 for explosive items under 500 pounds, and the MMD3 for bulk nonexplosive items over 500 pounds. The MMD at FFS should be sized at a minimum to handle a 500-pound explosively-configured bomb. If CWM is recovered and onsite disposal is selected, it is recommended that the MMD2 be developed in time to support a remediation effort at FFS. Contingency plans should be developed to dispose of ton containers or explosively-configured, 1000-pound bombs potentially recovered at FFS.

14.10 Alternatives

The selection of cleanup actions at FFS should be conducted in accordance with applicable laws and requirements. Under CERCLA, cleanup actions are selected through an RI/FS process, in which available site information is evaluated and then cleanup action alternatives are identified, evaluated, and screened. A preliminary evaluation of selected cleanup actions has been performed. The evaluation does not replace the RI/FS process to evaluate cleanup alternatives, but provides a preliminary analysis of four alternatives using available site information. The results of this qualitative analysis of alternatives can provide some insight about the relative advantages and disadvantages of each.

14.11 Contingency Plans

Federal, U.S. Virgin Islands, and DoD requirements provide the basis for developing and implementing contingency planning activities and for selecting and using contingency equipment. The DoD requirements are considered applicable for potential FFS cleanup actions and can complement the federal and territorial requirements. The development of a contingency planning strategy for FFS should be performed at the time a cleanup action is selected and the cleanup design and implementation are being developed. The emergency response resources that will be responsible for managing emergencies such as those represented by the MPE must be identified and coordinated with site operations.

Additional study should be conducted prior to developing a contingency plan for FFS. For example, appropriate decontaminants for HQ and cyanuric chloride should be identified. A foam or dry powder may be appropriated for cyanuric chloride since this

chemical reacts violently with water. It is recommended that standards and monitoring techniques be developed for HQ prior to initiating a remediation effort. In terms of the local emergency response capabilities, agreements should be established with the U.S. Virgin Islands government, National Guard, and local hospital. A substantial amount of planning and training of emergency response personnel will be required prior to responding appropriately to a chemical agent emergency.

14.12 Conclusions

The FFS remediation effort should be performed in accordance with the requirements of a CERCLA hazardous wastes site investigation and cleanup. The FFS site characterization and cleanup effort needs additional site data, such as that required for a CERCLA remedial investigation, to determine the nature and extent of CWM contamination. In addition, a BRA should be performed to determine the risks posed by current site conditions to the public and environment. This effort should be followed by an evaluation of cleanup alternatives and the selection and regulatory approval of the appropriate cleanup alternative, and should be followed by the design and implementation of the cleanup. It is understood that these activities are the responsibility of the U.S. Army Corps of Engineers (USACE). However, USACMDA will provide assistance and will oversee the preparation and implementation of operational plans.

APPENDIX A

ACRONYMS/ABBREVIATIONS

APPENDIX A

ACRONYMS/ABBREVIATIONS

AC	hydrogen cyanide
ACAMS	Automatic Continuous Air Monitoring System
ACI	American Concrete Institute
ACGIH	American Conference of Governmental Industrial Hygienists
AEI	Architectural Engineering Instructions
AFB	Air Force Base
AHPA	Archeological and Historic Preservation Act
AISC	American Institute of Steel Construction
AMC	U.S. Army Materiel Command
ANSI	American National Standards Institute
AR	Army regulation
ARAR	applicable or relevant and appropriate requirement
BID	barricaded intraline distance
BRA	baseline risk assessment
CAA	Clean Air Act
CAIC	chemical accident/incident contingency
CAICC	Chemical Accident/Incident Control Center
CAICO	Chemical Accident/Incident Control Officer
CAIRA	Chemical Accident or Incident Response and Assistance
CBDA	U.S. Army Chemical and Biological Defense Agency
CEGS	U.S. Army Corps of Engineers Guide Specifications
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFR	Code of Federal Regulations
CG	phosgene
CK	cyanogen chloride
CONUS	continental United States
CSDP	Chemical Stockpile Disposal Program
CSM	chemical surety materiel
CWA	Clean Water Act
CWM	chemical warfare materiel
CZM	coastal zone management
DA	Department of the Army
DATS	Drill and Transfer System
DERP	Defence Environmental Restoration Program
DIA	Defense Intelligence Agency
DMF	dimethyl formanide
DoD	Department of Defense

DOI	Department of Interior
DOT	Department of Transportation
DRE	destruction and removal efficiency
EE/CA	engineering evaluation/cost analysis
EED	electroexplosive device
EO	executive order
EOC	emergency operation center
EMS	emergency medical service
EOD	Explosive Ordnance Disposal
ERDEC	U.S. Army Edgewood Research Development and Engineering Center
ESA	Endangered Species Act
FAA	Federal Aviation Administration
FFS	Former Fort Segarra
FM	field manual
FPEIS	Final Programmatic Environmental Impact Statement
FR	federal register
FS	FS smoke
FUDS	formerly used defense site
GA	nerve agent tabun
GB	a nerve agent (sarin)
GPR	ground-penetrating radar
H	mustard
HC	HC smoke
HD	distilled mustard
HQ	sesquimustard
HT	mustard-T mixture
HTH	calcium hypochlorite
IDLH	immediately dangerous to life and health
IDS	intrusion detection system
IHBD	inhabited building distance
IRA	interim response action
ISO	International Standardization Organization
LLEA	local law enforcement agency
MCC	mobile containment chamber
MCE	maximum credible event
MHE	material handling equipment
MINICAMS	Miniature Chemical Air Monitoring System
MMD	munition management device

MPE	most probable event
MSDS	material safety data sheet
MTA	Management and Technologies Associates, Inc.
NAVEODFAC	U.S. Naval Explosive Ordnance Facility
NAVEODETECHEN	U.S. Naval Explosive Ordnance Disposal Technology Center
NCP	National Contingency Plan
NEPA	National Environmental Policy Act
NEW	net explosive weight
NHPA	National Historic Preservation Act
NPL	National Priorities List
OCONUS	outside continental United States
OEW	ordnance and explosive waste
ONC	onsite container
OPSEC	operation security
OSHA	Occupational Safety and Health Act
PAED	public access exclusion distance
PA/SI	preliminary assessment/site investigation
PDS	personnel decontamination station
PEL	permissible exposure limit
PPE	personal protective equipment
PRP	personnel reliability program
RAC	risk assessment code
RCRA	Resource Conservation and Recovery Act
RFD	reference doses
RI/FS	remedial investigation/feasibility study
ROD	record of decision
RSD	risk-specific doses
SARA	Superfund Amendments and Reauthorization Act
SCBA	self-contained breathing apparatus
SDWA	Safe Drinking Water Act
SJPPR No.	San Jose Project Progress Report Number
SJPRN	San Jose Progress Report Number
SOP	standard operating procedure
SRC	single round container
SSC	secondary steel container
STB	super-tropical bleach
TBC	to-be-considered
TECOM	U.S. Army Test and Evaluation Command
TEGD	Technical Enforcement Guidance Document
TEU	Technical Escort Unit

TPDES	Territorial Pollution Discharge Elimination System
TR	technical report
UBID	unbarricaded intraline distance
USACE	U.S. Army Corps of Engineers
USACMDA	U.S. Army Chemical Materiel Destruction Agency
USAEDH	U.S. Army Engineer Division Huntsville
USEPA	U.S. Environmental Protection Agency
UXO	unexploded ordnance
VIC	U.S. Virgin Islands Code
VITEMA	U.S. Virgin Islands Territorial Emergency Management Agency
VSS	Vented Suppressive Shielding
WAPA	Water and Power Authority
WWII	World War II
WP	white phosphorus
WPCA	Water Pollution Control Act

APPENDIX B

FORMER FORT SEGARRA NEWSPAPER ARTICLES

The DAILY NEWS

17th YEAR — CHARLOTTE AMALIE, VIRGIN ISLANDS — FRIDAY, MARCH 19, 1948 — No. 2024

Chemical Unit Reported Ready To Move To V. I.

Unit To Acquire Sub Base, Water Island And Western End of Island

It has been reliably reported here that the Chemical Warfare Unit formerly located at San Jose, Panama, will be transferred to St. Thomas early next month. The Chemical corps will occupy the Submarine Base, Water Island and will negotiate for the Western end of the island, in a vicinity from Hope Estate to Botany Bay. About 250 workmen will be given employment shortly preparing the facilities for the unit. This

(Continued on Page 4)

Outlook For Tax Refund Poor, Hastie States

In a radio to the Acting Governor received here yesterday, Governor Hastie reported that he had a series of conferences with Congressional leaders on the Internal Revenue Tax refund bill for the Virgin Islands and the immediate outlook does not appear to be favorable for its passage. However, he stated, he is devoting every moment of his time and energy to ground favorable action by the committee.

Guide Anniversary Program Tonight

The Virgin Islands Progressive Guide will mark its 11th Anniversary and 10th Symposium by an elaborate program tonight at Emancipation Garden beginning at 8:30 o'clock. Immediately after the program in the Garden, there will be an anniversary dance at Normandie Pavilion at which Richards' Sextet will play.

It was also announced today that the Anniversary booklet which commemorates the event will be ready for distribution tonight.

AWAIT "BLUE BABY" OPERATIONS



THE FIRST "BLUE BABY" children from the same family, Frank Valentini, Jr., and his sister, Leonora, are shown at Johns Hopkins Hospital in Baltimore after their arrival from Lorraine, O. The youngsters are expected to undergo the Blalock operations to correct congenital heart malformations. More than 1,000 children have been saved from death by such surgery in the last three years. (International Soundphoto)

Army Engineers Inspect Harbor Here

Colonel Mason J. Young, Division Engineer, South Atlantic Division Corps of Engineers and H. J. Woodbury, Corps of Engineers, District Engineer, San Juan, together with a party of army engineers visited St. Thomas yesterday to inspect St. Thomas harbor and discuss coordination by the army engineers of the dredging project and harbor improvements to be carried on by the Federal Works Agency.

Air Field Landing Rafts In V. I. Revised

Acting Governor Morris F. De Castro on Wednesday issued Executive order No. 7 revising the charges for the use of the Bourne Field airport in St. Croix. Aircraft of less than 30,000 pounds, gross weight will be charged $5 per landing for a total number of monthly landing not to exceed nine. The price reduces gradually to $2.75 per landing for a total of 100 during the month.

The revised rates will be retroactive here from January 1, 1948, and in St. Croix it will become effective on April 1.

Art Exhibit at CAHS This Afternoon

An exhibition of work completed by the Public School Art class will be held today March 19, from 2:00 to 6:00 at the Charlotte Amalie High School. The public is cordially invited to attend.

This class, which is under the supervision of Instructor Alice Kean is an Extension Course of the Polytechnic Institute of Puerto Rico.

Registration for a course in Art Appreciation will be held on Friday, April 12, 1948, from 3:00 to 5:00 p. m. in the office of the Assistant Superintendent of Education

Confirmation At Reformed Church On Palm Sunday

Confirmation services will be held in the Dutch Reformed Church on Palm Sunday at 4:30 p.m. All members and friends of the congregation have been invited to attend.

Rev. Hardy Appointed Municipal Chaplain

Reverend C. E. Hardy of the Methodist Church in St. Thomas has been appointed Chaplain for the Municipality of St. Thomas and St. John, the Acting Governor announced today.

Police Officer Commended For Faithful Service

Retired After 31 Years Of Service

Sergeant Calixte Anduze of the Municipal Police Force of St. Thomas, a veteran of thirty years service in the Police Department has been retired from service, effective March 31. The Acting Governor on the behalf of the administration and the people has commended and congratulated Sergeant Anduze on his exceptional record of faithful and devoted service.

Holds Last Session On Caribbean Industrialization

After submitting their reports on present and potential industrialization of the Caribbean area and making various suggestions aimed at achieving coordination of industrialization in the area, the Panel of Experts meeting at Kent House last week held their last session on Friday.

Evening School Closes Today

The St. Thomas Evening School will close its activities for the Easter holidays on Friday, March 19, the assistant superintendent of Education announced today. Classes will reconvene on Monday April 5.

Engagement Of Miss Gertrude Lockhart To Lawyer Dudley Announced

At a birthday dinner at the Crystal Palace on Wednesday night the engagement of Miss Gertrude Lockhart, daughter of Mr and Mrs Herbert Lockhart of this city to Mr George H. T. Dudley prominent lawyer, was announced. Miss Lockhart is a teacher at the Charlotte Amalie High School.

Official Weather Bureau

St. Thomas, V.I.—8 a.m.

Pressure (Sea Level)	29.94
Maximum Temperature	82
Minimum Temperature	72
Wind: Direction	NE
Rain Fall	.12

CENTER THEATER

FRIDAY, March 19, at 4:30 and 8:30 p.m.

Republic's dramatic production starring the Academy Award Winner JAMES DUNN in "That Brennan Girl" co-starring MONA FREEMAN, William Marshall, June Duprez, Frank Jenks, Dorothy Vaughan

The picture based on the story by Adela Rogers St. John.

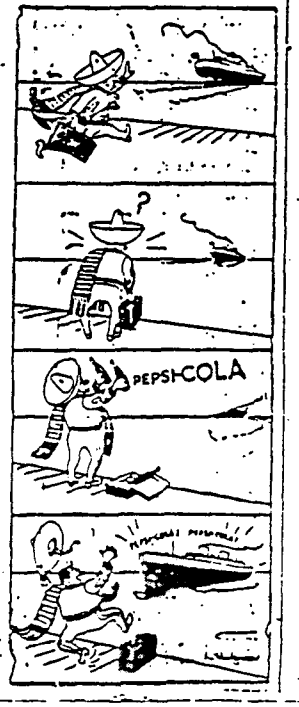
Also at 8:30 p.m. LATEST NEWSREEL and a SHORT FEATURE

Admission: Afternoon: 25c. and 40c. Evening: 30c., 45c. and 65c.

Tomorrow, Sat. March 20, Continuation of "ADVENTURES of CAPT. MARVEL" TWO WESTERNS

CARD OF THANKS

The several families of the late Henry Richards are grateful to everybody for the kind expressions of sympathy received in the loss of a loving Husband and Father. May he Rest in Peace.





Drink Coca-Cola Ice Cold

delicious and refreshing

5c

VALDEMAR A. MILLER, Distributor

CHEMICAL UNITED —

(Continued from Page 1)

report lacks confirmation by the War Department.

Acting Governor Morris de Castro stated today that he has no official information, but he believes that a favorable decision is in the making. He declined to comment on the information that the Unit is considering acquiring the western area.

Colonel Elliott of the Chemical Warfare Unit in Panama visited St. Thomas on Wednesday with eleven officers from Panama and Puerto Rico to inspect the facilities at the Submarine Base. At a luncheon conference with Acting Governor De Castro at Hotel 1829 at which were present the Chairman and General Manager of the St. Thomas Development Authority, Superintendent of Public Works and the Commissioner of Finance, detailed plans were discussed for use of these facilities. Following this conference Mr. De Castro reported that no final decision as to transfer of project has as yet been made.

NOTICE

Confirmation services will be held in the Dutch Reformed Church on Palm Sunday at 4:30 p.m. All members and friends of the congregation are cordially invited to attend.

NOTICE

Notice is hereby given to all parties concerned that Property No. 262 Hospital Ground, Saint Thomas, V.I., belonging to the Estate of CHARLES WILLIAMS, deceased, will be sold at public auction on March 30, 1948 at 10:00 a.m. at Fort Christian, St. Thomas, V.I.

ANNE R. WILLIAMS, Administratrix.

March 4, 1948

PRE-EASTER SALE

$1.00 Bargains

Saturday Only.

CECILE

ANNIVERSARY SALE

ONE DAY ONLY

SATURDAY, March 20th.

10 p.c. REDUCTION on all items

SALE BEGINS AT 9 A. M.

The Smart Shop

Opposite the Public Library

Are you visiting St. Thomas?

The Open Door

DINER & BAR

Offers you a splendid breakfast, lunch or a delicious American dinner. Also your most favorite drinks.

Locate opposite the Paper Doll Club.

The DAILY NEWS

18th YEAR — CHARLOTTE AMALIE, VIRGIN ISLANDS — SATURDAY, SEPTEMBER 1, 1948 — No. 3965

Only 274 Register For Draft In First 4 Days

During the first four days of the local registration for the new peacetime draft, the total registration in St Thomas amounted to 274 men. A high percentage of those who registered were aliens. It appears that possibly a large number of those who should be registered by now, particularly citizens, have not done so. Governor Hastie, State Director for the Selective Service, stated to the press today that "it is the duty of every male citizen of the United States, and every other male person residing in the United States, who, on the day or days fixed for the first or any subsequent registration is between the ages of eighteen and twenty-six, to present himself for and submit to registration." The only males between the ages of eighteen and twenty-six, not required to register are:

Commissioned officers, Warrant officers, Pay clerks, Enlisted men, and Aviation cadets of the Regular Army, Navy Air Force, Marine Corps, Coast Guard, Coast and Geodetic Survey, Public Health Service, Cadets of United States Military Academy, and United States Coast Guard Academy, Midshipmen of United States Navy.

While on Extended Active Duty members of the reserve components of Armed Forces of the Army, Navy, Air Force, Marine Corps, Federally Recognized Air National Guard and Coast Guard.

Reservists not on active duty are required to register.

The Governor further stated that for the benefit of those who have not registered, he believes it wise to advise that there are penalties for those who fail to register. Each person within the age limits of the registration is required by law to present himself for and

(Continued on Page 3)

Del Mar To Call Here Monday

The luxurious Delta Liner, "Del Mar" sailed from New Orleans on Thursday and will arrive here on Monday with 93 passengers bound for ports in South America. The vessel will dock at about 1 p. m. and will sail at 6 p. m. after bunkering at the West Indian Company Dock.

FDR's GRANDSON A POLIO VICTIM



TAKEN TOME YEARS AGO at Hyde Park, N. Y., this photo shows Curtis (Buzzy) Boettiger with his grandfather, the late President Franklin D. Roosevelt. Today, at the age of 18, Buzzy lies in a Los Angeles hospital stricken suddenly, as was the President, with poliomyelitis. The youth's physician announced that it "was not a serious case." (International)

Schools Open On Tuesday

Faced With Shortage Of Space, Equipment And Teachers

Public Schools throughout the Virgin Islands will be opened for the next school year on Tuesday, September 7. The public school population during the last school year was 2,374, but it is expected that this number will increase by several hundred due to the influx of students into the first grade. In the United States an estimated 500,000 children will be going to school for the first time and there, as here, authorities are faced by the problem of a teacher shortage. The local Department of Education has had a struggle to secure sufficient teachers to begin instruction in the High School and there are still several vacant positions on the school staff. Although there are many more students going to school, no provision has been made for increased facilities and equipment, due to the lack of funds, and it is expected that students will be handicapped by these factors even more than in the past few years as the situation has been becoming increasingly acute.

Army Takes Over Eight Estates On West Of Island

To Occupy On Year To Year Lease

Eight estates totalling approximately 2,095 acres were condemned last week by the Judge of the District Court for use by the San Jose Project. The estates are: Botany Bay, Bordeaux, Catharina's Hope, Fortuna Runnels,

(Continued on page 4)

Carenage-PAL,CAHS-Elks Olympics-Army Play Tomorrow

Tomorrow morning the Carenage softball team will face the Police Athletic League at the Ball Park. Carenage which is at present undefeated, leads Group A of the league, and if they win in their

(Continued on Page 4)

Albert Maduro Returns From U.S.

Albert Maduro, hardware and lumber merchant, returned here today from the United States. He had been away for four months on a pleasure and business trip that took him through several states on the East Coast and the Middle West.

Files Action To Have Seized Goods Returned

John Smuk [illegible] a warehouse on New Wharf has filed action in the District Court against Collector of Customs Carl Best and District Attorney Francisco Corneiro for the return of 137 cases of Chesterfield Cigarettes which were seized on the morning of April 17, 1948. The complaint states that the cigarettes were brought to the warehouse by Antonio de Jesus and that no violation of Customs laws occurred in the course of the landing of the goods.

It will be recalled that when police officers appeared on the

(Continued on page 4)

Benes, Former Czech President, Dies

Edvard Benes, former president of Czechoslovakia died yesterday, suffering from hardening of the arteries. It was [illegible] that the first [illegible] regime which forced [illegible] out of power, was to [illegible] the Cabinet under Communist Klement Gottwald. Part of the section deleted from the news reels was as follows: "I am doing this solely to prevent the civil war with which you threaten me and which you are capable of unleashing. However I believe the Czechoslovak people will understand my act and that on the first occasion the majority of them will prove that the methods which you use are foreign to them and that you have underestimated the moral maturity, the loyalty and democratic effort of our people."

The Communist government lauding his love and service to the Czech people, have decided that he must have a state funeral in Prague.

WEATHER FORECAST

Virgin Islands—Noon Today

Partly cloudy to occasionally cloudy with few light showers today. Partly cloudy tonight and Sunday. Moderate winds, Easterly to Southeasterly.

PAST 24 HOURS

Maximum Temperature	88
Minimum Temperature	77
Pressure Sea Level	30.00

CENTER THEATRE

4:30 — TODAY — 8:30
OUR BIG SATURDAY ACTION PROGRAM
"The Green Archer."
Chapters 9 and 10 also
The Latest CHARLES STARRET ACTION Western
PHANTOM VALLEY"
with
SMILEY BURNETTE
and
"DICK TRACY MEETS GRUESOME
starring
BORIS KARLOFF

DOLLAR DAY
SATURDAY, SEPT. 4
One Day Only
CECILE

NOTICE

The Cocktail Hour scheduled at Frank and Frank, Recreational Hall has been cancelled indefinitely.

THE MANAGEMENT

BASEBALL
Major League Standings

AMERICAN LEAGUE

Teams	W	L.	Pct.	G.B
Boston	71	48	.614	
New York	70	49	.614	
Cleveland	70	50	.583	1 1-2
Philadelphia	74	55	.570	1 1-2
Detroit	59	62	.488	16
St. Louis	47	75	.385	28 1-2

FILES ACTION TO HAVE---
(Continued from Page 1)

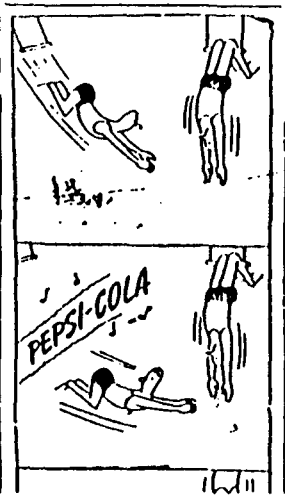
scene on the morning of April 17 the men who were transporting the cigarettes from the warehouse to the New Wharf fled and no one claimed ownership of the shipment.

John Smith who is represented by Atorney Jorge Rodriquez states that the merchandise was taken out of his possession without due regard for law.

CARENAGE, PAL, CAHS FLRS—
(Continue from page 1)

section they will play the winner of Group B. Group B is led by the West Side team which has remained undefeated for the two seasons. In the afternoon the High School will meet the Elks in the first game which will be followed by a tussle between the Olympics and the Army.

"Don't Say Rum
Say Cruzan"



ARMY TAKES OVER—
(Continue from page 1)

Gulthaab, Bethesda, Hope and Perserverance. The order granted immediate posession of the properties to the U. S. Army on August 27.

The terms of condemnation provides for a year lease for a period of five years. Compensation for use of the property will be fixed by the court.

LOST

Bunch of keys in vicinity of Synagogue Hill return to office of The Daily News
Reward

NOTICE

Remember the Special Week End Menu at — —
FRANK & FRANK
Recreation Hall

Just Arrived—

Distinctive stripes and white shirts by
"VAN HEUSEN"

For the first time — Gay Fashionable — Men's Pajamas by
"VAN HEUSEN"

Also smart-free action styled swim and sport shirts by
"JOCKEY"

Enjoy the best in comfort and styling at moderate prices

Hay's Store

Phone — — 266

CENTER THEATRE
SUNDAY, Sept. 5, 1918 at 4:30 and 8:15 p. m.
MONDAY, Sept. 6, 1918 at 4:30 and 8:30 p. m.

United Artist's brilliant adventure picture

"THE SWORD of the AVENGER"

The D

15th YEAR CHARLOTTE AM

Hastie Says P N Probe In District Atty.'s Hands

Directs D.A. To Take Proper Action Under The Law

The report, ordered and broadcast of the Council Committee on Investigation into the transaction of the Photo News with reference to publishing the proceedings of the Municipal Council has been placed in the hands of the District Attorney, Governor Hastie said today. At the same time the Governor announced that he had asked the District Attorney to represent the interest of the Municipality in the suit filed against the Chairman of the Council by the Editor of the Photo News.

The Governor further stated that the District Attorney will consider all evidence and will take whatever action he deems proper in accordance with the facts in fact as the inquiry reveals. With matters now in the hands of the District Attorney and a lawsuit pending, Hastie said he believes no expression on his part would be proper at this time.

Moorhead, Lindqvist Named Delegates

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The DAILY NEWS

19th YEAR — CHARLOTTE AMALIE, VIRGIN ISLANDS — SATURDAY, NOVEMBER 13, 1948 — No. 3118

Chamber Of Commerce Elects Officers For 1949

Officers for the coming year were elected by the St. Thomas Chamber of Commerce at a general meeting held last night at the Chamber Hall in. Leonard Brewer, lessee of Bluebeard's Castle Hotel and owner of Blackbeard's Inn, was elected President of the organization. Benjamin Bayne, associate owner of Virgin Islands Hotel now under construction, Vice President; Darwin Creque, Tax Assessor and Water Commissioner and owner of the

(Continued on Page 4)

Activities To Mark Nursing Progress Week

Plans have been completed by the Nurses of the Virgin Islands for the celebration of the Diamond Jubilee of American Nursing during Nurses Program Week which was proclaimed by the Governor. The week from November 14 to 20 will be marked with several activities by the various groups of local nurses.

The week's activities open on Sunday afternoon with an Evensong Service at All Saints' Church and close with an Anniversary Dance at Circle Pavilion on Saturday night.

Art League Displays Rembrant Etchings

In recognition of Art Week, the Art League will exhibit at the Public Library a collection of etchings by Remorant. They have been pulled from original plates on Japan paper of an edition of 500 in Paris, Quentin, 1680.

The display is made possible through the courtesy of Mrs. Thomas Hodges who won the [illegible] Contest sponsored by the Art League to begin what it hopes will later develop into a [illegible] Contributions of a [illegible] will be gladly accepted from any [illegible]

YOUNG AND OLD GREET BARKLEY



AT HIS HOME in Paducah, Ky., Vice-President-elect Senator Alben Barkley shakes hands with Mrs. Mary Dorian, life-long friend and school teacher. The two youngsters standing in front of the Senator are his grandchildren, Dorothy Alben, and Alben Jr. (International Soundphoto)

U.S. Caribbean Com. Members To Meet In P. R.

Over the week-end there will be a conference in Puerto Rico of the members of the U.S. delegation to the meeting of the Caribbean Commission in Guadeloupe next month. Governor Hastie plans to attend that meeting along with Ward Canaday and several other U.S. members of the Commission.

Woman Branded With Heating Iron

According to a police report, Cecilia Frett sustained burns on her neck which she claims were inflicted by Nette Olive. She stated that while visiting Mrs. Sarah Petersen in Curacao, Nette Olive, who lives in the same house, and instigated a quarrel. After the quarrel Nette Olive burned her with

(Continued on page 4)

Book Store Prepares Guide Book On V.I.

In order to meet a growing demand for information on the Islands and to comply with special requests of prominent local businessmen who have already taken advertising space, the Academy Book Store is now preparing a guide book on the Virgin Islands.

The work on this project is being done by Ruffo Martin, manager of Academy Book Store, who is compiling the information; Alberto Abbott, photographer of Academy

(Continued on Page 4)

Vet. Adm. Official Here On Inspection Trip

Col. David Paige, Regional Director of the Veterans Administration for the areas of Puerto Rico and the Virgin Islands is now in the Virgin Islands on routine inspection. His last visit here was about a year ago.

U. S. Army Studies Poisonous Gases In V. I.

Charlotte Amalie, V.I. Nov. 2 (NANA)—The United States Army allowed today, the release of information concerning the existence and purposes of the station for the study of poisonous gases, which has been established here, that for a long time had been kept secret.

"The San Jose Project", as the station is called, is at present in the process of reconstruction on the extreme southwestern part of the island, having been transferred here from Panama when the government there refused to renew the lease of bases to the United States.

The purpose of this station is to determine the effect of the gases, the efficiency of defense equipment against them and the qualities of the gases. At the same time experiments will be made with "biological weapons."

The installations are exceptional. They allow the creation at will of the meteorological conditions that may be necessary for any experiment. The island, on which has already been accumulated large quantities of poisonous gases is protected by installations of anti-aircraft artillery which were constructed during the war when the Submarine Base was active here. The buildings of the station were also constructed at that time and some have been transformed into laboratories, workshops, etc. Some of the warehouses that were used for the storage of torpedoes and ammunition are now

Continued on Page 4)

WEATHER FORECAST. VIRGIN ISLANDS

Mostly cloudy with showers and occasional thundershowers today. Partly cloudy tonight and Sunday. Fresh to moderate easterly to east-southeasterly winds.

NOON TODAY

Maximum Temperature	80
Minimum Temperature	75
Pressure Sea Level	29.99

The DAILY NEWS

20th YEAR — CHARLOTTE AMALIE, VIRGIN ISLANDS — SATURDAY, APRIL 1, 1950 — No. 2583

Flamboyant Hotel Opens Today

Flamboyant Hotel, a new type tourist resort comprised of a series of modern bungalows located on the point at the entrance of the harbor of St. Thomas will be opened today at 3 o'clock. Accommodations for approximately sixty guests are now ready and it is expected that by May 1 when the grand opening takes place the resort will accommodate 138 guests. The dining room and cocktail lounge has space for 225 persons.

Built completely with local labor the structures are ultra modern and utilizes the desirable aspects of the surroundings. A swimming pool will be completed in two weeks and other recreational facilities on the premises will be ready by that time, Jack M. Okean, manager, said today. The hotel is in a unique setting with a magnificent view of the town and is built around the harbor lighthouse. The construction work was directed by the owners Morningstar Hotels, Inc.

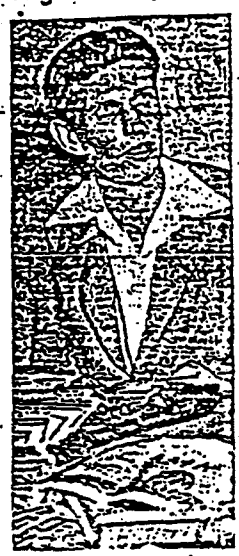
Mr. Okean said today that the hotel will serve regular dinners and will be opened as house. An orchestra will be available nightly for dancing

De Castro May Leave For Wash. Soon

Governor De Castro stated today that he might have to leave for Washington any moment to attend budget hearings. He has been advised that these hearings have already begun and that efforts are being made to have the hearings on the Virgin Islands budget delayed until around the middle of the month.

The Governor is working on the budgets for the two municipalities and was in conference with his staff yesterday discussing the fiscal affairs of the municipality.

Frightened by Haul



"IT SCARED me to death," admits George Roden, 22, of Boston, as he looks up from the $219,000 in bonds, stocks and gems stolen from the Hollywood home of philosopher Will Durant. "I was afraid someone would bump me off first," he added. Roden, recent Navy dischargee, allegedly confessed to having jimmied a safe in which the valuables had been kept. (International)

Funds Released For Seawall Here

Governor De Castro has been advised that the seawall funds which were frozen by the Bureau of the Budget have been released. Bids for the construction of the water front project will be advertised immediately and contract will be awarded at the end of the 45 days period. It was revealed today that the seawall

(Continued on Page 6)

Schooner "Flight" Offered For Sale

The yacht schooner "Flight", 50-foot overall, cargo capacity 38 tons, is offered for sale by the Virgin Islands Corporation. Sealed bids will be received by the company up to May 15, 1950.

San Jose Project Closes Sept. 1; 186 Workers Affected

Olivet To Calvary To Be Broadcast From Puerto Rico

Arrangements are now completed for the sacred cantata, Olivet To Calvary" to be broadcast from Radio El Mundo WKAQ from 10 to 11 o'clock, Good Friday night. The cantata will be heard at Memorial Church on Good Friday at 7:30 pm. The soloist will be Roy Wallace, tenor; Eduardo Hill, baritone; Lione Robles, baritone; Ena Ramsay, soprano; Janet Nicholas, soprano; Leona Benjamin, soprano. The Organist and Choir Director by courtesy will be Cyril Creque. "Olivet To Calvary" graphically depicts the last days on earth of our Lord Jesus Christ.

Plans Easter Benefit Dance For CHS

An Easter Benefit dance will be held at the Grand Hotel on April 10, 1950, to assist the class of 1950 of the Catholic High School to properly prepare and make a presentation of a program on the occasion of their graduation.

In June of this year the first fourteen seniors will be graduated. It is to assist in making this graduation the success which it deserves to be that the dance on April 10th at the Grand Hotel is being held. This is on Easter Monday night and already scores of persons are inquiring about the party and making reservations

(Continued on Page 6)

Airport Named In Honor Of Truman

The Municipal Council changed the name of Bourne Field Airport to Harry Truman Airport yesterday afternoon at its regular meeting. It also named the new Bethesda

(Continued on Page 6)

Unit To Be Discontinued; Not Transferred

Colonel Paul M. Smith, Commanding Officer of San Jose Project, announced yesterday that he had received information from the Secretary of the Army advising him that the San Jose Project will be discontinued September 1, 1950. He could not elaborate on the announcement, he said, as he was without information as to the reason. It was indicated that the withdrawal, however, is in line with the retrenchment policy of the U. S. Army.

The San Jose Project came to St. Thomas in the Spring of 1943 when it was forced to leave the island of San Jose off the coast of Panama. Establishing in the deactivated Submarine Base it employed 186 civilian workers who received an annual salary of $350,000. The unit has a budget of approximately one million dollars annually.

Colonel Smith, in a special press conference called for the purpose, made the announcement at about the same time that Governor De Castro announced the news to the heads of his department who were meeting at Government House on municipal budget matters. The colonel stated that for the next two months withdrawal will be gradual and will be completed by the end of October. He stated that he believes that the unit was being discontinued, not transferred to another location.

WEATHER FORECAST

Partly cloudy with scattered few showers today tonight and Sunday. Winds are moderate easterly.

NOON TODAY

Maximum Temperature 83
Pressure Sea Level 29.99
Minimum Temperature 70

Virgin Islands

Daily News

A Gannett Newspaper

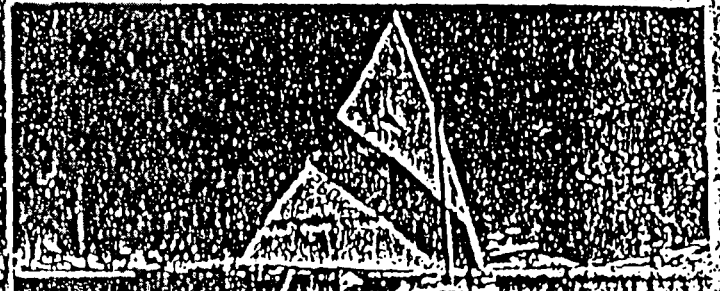
50th Year No. 12514 CHARLOTTE AMALIE, ST. THOMAS, U.S. VIRGIN ISLANDS TUESDAY, OCTOBER 9, 1979

25¢ ★★

WEATHER
No special weather features. Partly cloudy with a slight chance of showers mostly at night. Winds east to southeast 10-18 knots. Waves near 2 feet. Swells easterly 3-5 feet.

1950 Food Warfare Test By Army

Birds Charged



By JACK HILLHOUSE
Daily News City Editor

The U.S. Army conducted top secret biological warfare experiments with homing pigeons on an uninhabited island near St. Thomas during the summer of 1950, a Washington citizens group charged Monday.

These tests, unlike some others elsewhere, apparently affected the food chain but were not aimed directly at humans, the group's spokesman said.

The American Citizens for Honesty in Government (ACHG), a branch of the Church of Scientology, has been investigating Central Intelligence Agency and Army experiments with chemicals and drugs during the 1950s and 1960s.

Brian Anderson, director of the ACHG, told The Daily News that a declassified document found by this group describes the experiment. The report, dated 16 December 1950, is entitled "Feathers As Carriers of Biological Warfare Agents."

Long-time residents of St. Thomas have heard unconfirmed

(Continued on Page 15)



MAJOR CALLENDER in blow-up boat gets a push from a Boy Scout in the parade for Columbus Day holiday spirit at Columbus.

RAEHA WEMAN, age 5, floats in the cool waters of Magens Bay as the Virgin Islands honors seafarer Christopher Columbus.

Daily News Photos — Steven Rockstein

Ally

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Test

(Continued from Page 1)

rumors of some kind of experiments being conducted on an uninhabited island in this area.

The Army used infected homing pigeons and contaminated turkey feathers during a series of tests in upstate New York and the Virgin Islands to prove cereal rust epidemic could be spread as a biological warfare weapon, Anderson said.

The de-classified document said the Army Chemical Corps' Biological Department at Fort Detrick, Md., conducted the experiments.

By telephone, Anderson read the passage about this area. The report, as quoted, said, "In the third test, conducted at St. Thomas, Virgin Islands, four test plots covering 1,600 square feet each of Vicland oats were prepared approximately a half mile apart on an isolated island.

Four groups of pigeons, trained to return to their respective plots, were dusted with rust spores and liberated from an airplane about 100 miles away.

"The birds returning to the plots were allowed to remain on the plots for approximately two hours.

"Heavy infection resulted in all plots demonstrating that birds dusted with rust spores and released from aircraft will retain sufficient numbers of spores to initiate a cereal rust infection."

But the Army concluded that the problems of stockpiling the spores and using the birds would prevent this from being an effective weapon over enemy territory, Anderson reported.

"The facilities for this test were made available to the Chemical Corps by the Commanding General of the First U.S. Army," Anderson quoted the report.

"We are now calling for a U.S. Department of Justice investigation into the criminal aspects of the Army and CIA chemical and biological experiments on human populations," Anderson said.

"We are also asking the question why has the Department of Justice not conducted a full criminal investigation before because there is ample evidence that these experiments have caused civilian deaths and ruined lives."

Anderson said Congressman Ronald Dellums, D-Calif., a member of the House Armed Services Committee, is looking into the American Citizens for Honesty in Government (Scientology) charges.

Banks' Interest Rates Increasing

WASHINGTON (AP) - Banks soon will charge their best customers 15 percent interest, forcing many businesses to curtail hiring, cut back production and lay off workers, two leading economists said Monday following new anti-inflation moves by the Federal Reserve Board.

The board's actions guarantee a recession, said Otto Eckstein, head of Data Resources Inc. of Cambridge, Mass. But the truth is we need [illegible]

The forecasting firm has been predicting a recession with 7.75 percent unemployment, compared with a current 5.8 percent rate. "The board's actions risk something worse - unemployment possible in the eight percent to nine percent range," he said.

"The Federal Reserve Board ran out of options. No matter what we do, we'll get a recession," said Michael Evans of the Washington-based Evans Economics.

Evans said the sweeping tight-money moves adopted Saturday may prove inadequate in the fight against rampaging inflation. "The credit screws may have to be tightened further," he said.

Eckstein, who believe the nation has yet to enter a recession, welcomed the board's moves. "Bank loans have been growing at a 15 percent annual rate. They really cannot grow at more than five percent in the months ahead.

Recreation

(Continued from Page 8)

Alberto Olive[illegible]
St. Croix - Bob Owens, Wallace
Phillip, Lawrence George
Antonio Measo, Robert Wills
Primo Cangeni, Joseph Samuel
Lowell Dyer, Ralph Abraham
Lloyd Bolling, Graciano Belardo
Cyril Jules Phillip, Gene Hayes
Peter Quinn, Thomas Martin

announcements

NOTICE OF PUBLIC ZONING HEARING

The Committee of the Whole of the Thirteenth Legislature will hold a public hearing on the following applications for zoning changes in the district of St. Croix, in the Conference Room of the Legislature Building in Christiansted on Thursday, October 18, 1979 at 10:00 a.m. Anyone wishing to testify on the applications may do so by notifying the Office of the Assistant Executive Director of the Virgin Islands in St. Croix at 773-2121 [illegible]

about Common Dental Diseases, be sure to listen Monday evening, Oct. 15 at 8:30 on WSTA radio. Dr. Richard Lloyd will be the guest speaker.

Calendar of Events

Legal Notices

INVITATION FOR BIDS
ADDITION TO ARRIVAL BLDG. (2) TICKET AND WAITING FACILITY AT ST. THOMAS WATERFRONT ST. THOMAS, VIRGIN ISLANDS U.S.A.

Sealed Proposals for the furnishing of all labor, materials, services and equipment for Addition to Arrival Building (2) at St. Thomas Waterfront, St. Thomas, Virgin Islands will be received by the Virgin Islands Port Authority at the office of the Executive Director, St. Thomas, Virgin Islands, until 3:00 p.m. November 2, 1979, at which time all Proposals will be publicly opened and read aloud.

Bidders are invited to submit proposals on the Proposal Forms provided.

On and after October 1, 1979, copies of Plans, Specifications and other Contract Documents may be examined at the office of the Executive Director, Virgin Islands Port Authority, Harry S. Truman Airport, St. Thomas, Virgin Islands. Complete documents may be obtained from the office of the Executive Director, by payment of a deposit in the amount of $10.00 for each set. Payment for Plans and other Contract Documents must be made by check or money order payable to the Virgin Islands Port Authority. Cash will not be accepted. This deposit will be refunded only to Bidders submitting a formal Proposal upon receipt of unused Documents in good condition not later than ten

Legal Notices

PUBLIC NOTICE

Public Notice is hereby give[n] the Virgin Islands Port Auth[ority] that it proposes to change rates and charges for the us[e] its Marine Facilities effec[tive] November 1, 1979.

All interested persons, provided by Chapter 10, Sect[ion] 543 (12), Title 29, V.I.C. invited to attend the Pu[blic] Hearings to be heard at 7:00 p[.m.] on October 29th, 1979 in the Clearance Building at the Ha[rry] S Truman Airport, St. Thom[as] Virgin Islands and at 7:00 p[.m.] on October 30th, 1979 in the Clearance Building at [the] Alexander Hamilton Airport, [St.] Croix, Virgin Islands.

All persons attending will afforded an opportunity to heard and advise the P[ort] Authority Governing Boa[rd] through the designated Heari[ng] Officer, of their views a[nd] provide evidence in suppo[rt] thereof.

The Rate Study may be review[ed] at the Executive Director's Offi[ce] at Truman Airport; or at [the] Harbor Office, Charlotte Amali[e] St. Thomas.

In St. Croix the Rate Study ma[y] be reviewed at the Executiv[e] Director's Office, Hamilton Ai[r]port or at the Harbor Offic[e] Christiansted, St. Croix.

JOHN E. HARDIN[G]
Executive Directo[r]

NOTICE

Notice is hereby given that [an] order dated 2 October 1979 h[as] been issued by the undersigne[d] authorizing the name of th[e] Catamaran Gas Screw R. J. Spoo[n] official number 510 181, owned b[y] Richard L. Allen and F[ay] Jea[n] Allen, Tenants in Common wit[h] right of which Charlotte Amalie St. Thomas, V.I. is the home port t[o] be changed to [illegible] surv[ey] [illegible] shi[p] BAJAU

[illegible] Luz M. Sloan
[illegible]umentation Officer
By Direc[tion] (Officer in Charge

Bio Warfare Testing Seen Aimed At Oats, Not Humans

By CATHLEEN COGSWELL
Daily News Staff

The health of Virgin Islands residents was never endangered by biological warfare experiments conducted here in 1950 a New York Department of Agriculture plant pathologist advised [illegible]

Editorial Page 7

Dr. Carl Boothroyd Wilson, a professor at Cornell University's College of Agriculture, said Tuesday that cereal rust spores (symbiotic fungus to grains and grasses) but were not harmful to human beings.

According to declassified Army documents the contents of which were disclosed to United Press International and later to The Daily News by a concerned citizens group in Washington, and published over a week ago, the cereal rust spores were introduced into the territory's environment in 1950 during experiments with infected homing pigeons.

Four test plots of Vicland oats were cultivated one half mile apart on an undesignated uninhabited island near St. Thomas. Four teams of pigeons were trained to return to one of the 1,600 square-foot plots.

The pigeons were released from an airplane at distances of up to 100 miles from the grain.

The U.S. Army found the pigeons could transmit the blight since a sufficient number of the spores survived the lengthy flight.

Cereal rust experiments were conducted in the Virgin Islands and in New York, and were aimed at testing the food chain. They were not experiments directly involving human beings, said the group doing research in the declassified Chemical Corps documents.

But in a follow-up article United Press International quoted Acting Governor Henry A. Millin expressing grave concern that the experiments might have been conducted on Water Island, and wondering about an apparent increase in cancer among Virgin Islanders living near that island.

The Daily News sought out comments from several agriculturalists to learn more about cereal rust.

(Continued on Page 16)

Cereal Rust

(Continued from Page 3)

Source of the New York referred questions to Boothroyd. There is no correlation between any of the rust fungi and cancer, plant pathologist Boothroyd stated.

Two local scientists concurred with Dr. Boothroyd's contention that the cereal rust disease is not a carcinogenic agent.

Walker Knausenberger, with the College of the Virgin Islands Agricultural Extension Service, felt the issue of the rust fungi having contributed perhaps a rise in cancer was "so far removed from possibility I think it could be discounted."

Knausenberger explained that there was only one strain of cereal rust disease that can be lethal to human beings — ergot.

Ergot, he continued, attacks rye. If the contaminated grain is consumed, the fungus "causes neurological symptoms of spasms and eventual death."

But, Knausenberger hastily added, "These are not long-term chronic effects." Deaths resulting from the ingestion of this toxin occur relatively quickly.

The scientist believes the Virgin Islands was chosen because most grains are not cultivated locally, precluding the danger of the experimentally-induced epidemic spreading uncontrollably.

Knausenberger said the Army experimenters "used something (rust spores) innocuous to humans to test it. The agents (rust spores) they used are very unlikely to have caused any human illness."

John Gerber, a vegetable specialist with CVI's Agricultural Experiment Station, also felt the "victim" of the experiments was the Vicland oats and not people.

Data Sought On Biological Tests

[illegible] Secretary [illegible] has written U.S. Defense Secretary Harold Brown requesting detailed information on any and all testing or experimentation conducted in the Virgin Islands by the U.S. Government.

Brady took the action on behalf of Gov. Juan Luis who had directed Brady to follow through on Lt. Gov. Henry Millin's request that Brady handle the matter further. While in the territory in October Millin had expressed concern over the need for federal assurances that no impairment of health has occurred or presently exists from the testing [illegible]

In his letter to Secretary Brown, Brady noted that the U.S. Department of the Army conducted biological and chemical testing in the Virgin Islands in the 1940's and 1960's. He indicated that the islands of Water Island and St. Croix "were used as sites for testing mustard, a chemical blister agent, and an antidrop agent TX.

"While as loyal American Virgin Islanders support our national policy of military preparedness against all potential adversaries," Brady pointed out, "the use of the lands for the testing of substances that may be deleterious or dangerous to the health of our inhabitants is a matter of grave concern to this government and its people."

While in the territory in October coordinating a series of meetings between federal and local grants officials, Brady directed his Washington office to initiate inquiries into the testing that had been revealed by the American Citizens for Honesty in Government (ACHG), a mainland citizens group.

Upon returning to Washington, Brady contacted Major Gloria Redman of the Office of the Secretary of the Army for information on the matter, and subsequently met with ACHG Director Brian Anderson.

Brady pointed out in his letter to Secretary Brown that "while the information obtained from Major Redman on the two experiments conducted in the Daily News on Oct. 9 and 171 indicates no cause for alarm or belief that there was or exists any threat to the welfare of the people of the territory, more details of these and other experiments are necessary."

"The people of the Virgin Islands are entitled to know whether or not any harmful effects resulted or remain from any past chemical or biological experimentations," he specified, "and only through your bona fide compliance with this request such a judgement justifiably be made."

Children's Fiesta Parade On Jan. 5 In St. Croix

The St. Croix Committee for the International Year of the Child will organize this year's Children's Christmas Fiesta Parade in Christiansted, according to IYC Task Force member Nancy Miller in a government release.

The parade, scheduled for Saturday, Jan. 5, will be a joint effort of the Christiansted and Frederiksted Christmas Fiesta Committees and will highlight the theme "International Year of the Child."

"We strongly urge all schools, church groups, youth organizations, and other interested persons to participate," Ms. Miller stated, adding that prizes will be awarded to the top two troops, floupes, and floats.

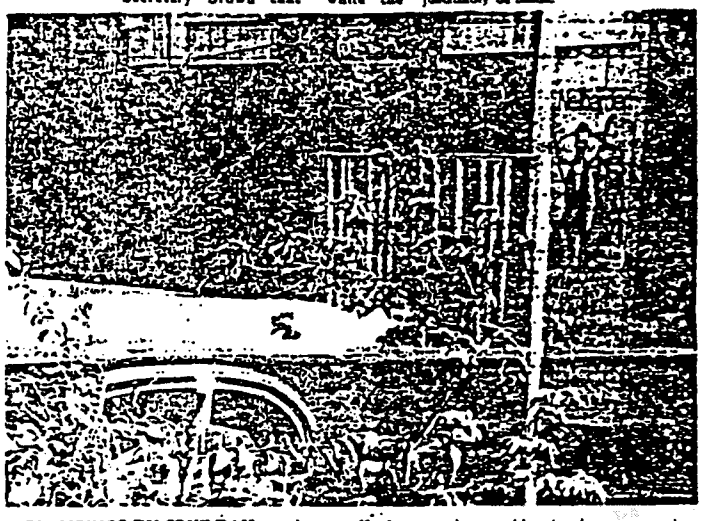
Each entry in a troop, floupe or float must select on of the following themes: The Child and Family, the Child and School, the Child and Leisure, the Child and Health, the Child and Work, or the Child and Law.

All groups should have music as part of their presentation and entries will be required to provide their own transportation, generators, etc. or find sponsors to provide them. If groups find it impossible to get the necessary equipment, contact us and we will attempt to help, Ms. Miller said.

"We want everyone to take part and make this year's children's parade the best ever. Let's end the International Year of the Child with a great celebration," she added.

"Be sure to notify us before Dec. 10 about your parade plans. Contact Beverly Smith at 773-3525 or Nancy Miller at 778-1200.

The next general meeting of the St. Croix Committee for the International Year of the Child will be Dec. 6, at 9, in the College of the Virgin Islands St. Croix campus Theater.



PLANTINGS BY CRUZ BAY merchants suffer from careless parking in the congested downtown area. Plants enjoy no official legal protection from assault and battery or assault and bumper. (Daily News Photo -Jadan)

Browne Reassigned To Aviation Activities

The reassignment of Vernon Mac Browne from manager of the Visitors Bureau on St. John, a position he held for four years, to manager of Aviation Activities for St. Thomas-St. Croix was announced Wednesday by G. Robert Simmons, Director of Tourism for the Department of Commerce.

In his new position, Mr. Browne will be responsible for maintaining contact with the airlines currently serving the U.S. Virgin Islands; assisting visitors upon arrival and departure from the Harry S. Truman Airport, where he will be stationed; working closely with the Port Authority; and supervising the daily activities of all personnel assigned to the Visitors Bureau at the Truman Airport on St. Thomas and the Alexander Hamilton Airport on St. Croix.

"This reassignment is a reflection of the department's growing concern over the deteriorating quality of air service being offered to both residents and visitors by the commuter carriers serving the territory," Commissioner Francis stated.

Browne and his wife, the former Marva Sprauve, currently reside on St. Thomas with their three children.

Millin Wants Action On Financing Bill

Lt. Gov. Henry A. Millin has sought the cooperation of Sen. William Harvey in having Bill No. 13-0300 brought to the floor of the Legislature for necessary action.

Millin stated that favorable action on this legislation, which was proposed by the governor, would open the door for financial institutions to provide financing, guaranteed by the Veterans Administration and FHA. He reminded Harvey, Chairman of the Labor and Veterans Committee, that Gov. Juan Luis has time and again urged the Legislature of vital necessity for prompt action on the bill which was submitted many months ago when interest rates were much lower.

Millin added that the Division of Banking and Insurance in the Lieutenant Governor's Office was instrumental in having a mortgage company established last year which unfortunately, because of internal dissension among the principals, failed. Nevertheless, efforts were continued, and the lieutenant governor assured Harvey that he remains confident that there are institutions willing and ready to provide the accomodation locally to which veterans are entitled, but which cannot be utilized until such time as the pending legislation is enacted.

SENATOR LEE

Senate Vice President Sidney Lee protested Wednesday the administration's action is not following the lawful procedures regarding purchases by the government even if they are below $1,000. The governor has stated that on so called smaller purchases there is too much paper work and loss of time involved in either negotiation or bidding.

Hear Ye! Hear Ye!

Two Policemen Acting Captains

Commissioner of Public Safety Milton C. Branch announced Wednesday the designation of Lieutenants Alvin Powell and Laurence Jackson as acting captains.

Capt. Powell, a 23-year veteran of the police force, is commander of Zone "A" which roughly covers the area between Frenchtown, Skyline Drive, Raphune Hill and Frenchman's Reef on St. Thomas.

Capt. Jackson, with 15 years experience, is commander of Zone "D", the island of St. John.

Both of the newly designated acting captains will continue in their present positions.

Taxi Deadline

The Department of Public Safety reminds taxi operators that the final day for inspecting and registering their vehicles is Nov. 30 and they are urged to visit the inspection lane before or on that Friday.

A Call To 915 Speeds Arrests

Another telephone call to 915 by a concerned citizen resulted in two juveniles being taken into protective custody while they were in the process of burglarizing the David Punta Apartments in Estate Elizabeth on Nov. 16, the Department of Public Safety announced Wednesday.

The burglary-in-progress was reported to police headquarters officer Kenneth Blake dispatched officers Robert Brady and Eunice Nibbs to the scene where they discovered the juveniles inside apartments.

Sgt. Monroe Steele and officer Ulysses Lettsome joined the first officers when summoned by Brady's radio request for back-up units.

The four policemen then covered all entrances and exits to the building and apprehended the burglars who were turned over to the youth investigation unit.

The department, in lauding the individual who made the call, urges all other concerned citizens to cooperate in a similar manner with the police in their fight against all types of crime.

HISTORY OF WATER ISLAND

Reprinted from Anniversary Issue of The Daily News of the Virgin Islands.

By WALTER H. PHILLIPS

Water Island is the fourth largest in size of the U. S. Virgin Islands, being about two and one half miles long and from one half to one mile wide. It is situated at the entrance to the harbor of St. Thomas and at the nearest point is about 3/8 miles off shore. The Island is very irregular in shape with many bays and penninsulas. The highest point is approximately 300 feet above sea level.

Water Island is the oldest of the Virgin Islands and the Water Island Formation is the oldest geologic formation – probably Lower Cretaceous, about 70 million years old. The Water Island Formation consists of about four fifths keratophyres which are brownish rocks and about one fifth spilites which are bluish rocks (commonly called Blue Bit or Blue Bitch). Both were lava flows deposited under water on the bottom of the ocean and later upheaved above the surface after solidification. There are small quantities of other rocks and minerals. Over long periods of time these rocks have decomposed, providing soil of varying thickness and composition. See Geology of St. Thomas & St. John, U. S. Virgin Islands. Dr. Thomas W. Donnelly.

The first known inhabitants were Arawak Indians. There were four Indian campsites on Water Island, none of which were very large. Evidence of their habitation is revealed by Indian artifacts, including shards of pottery, tools, piles of sea shells (contents consumed for food), charcoal and human bones. Per Dr. Ripley P. Bullen, Curator of Archeological Museum of Florida State Museum.

The English archeological magazine "Man" carries an account of a number of skeletons of Indians that were found on Water Island during excavation work in 1934 and 1935. Subsequent analysis of charcoal from these ndian settlements indicates that these Indians lived on er Island about 500 years ago. See "Man 1939" lished by The Royal Anthropological Institute, ndon, England.

It is not definitely known who the first white persons were who lived on Water Island. It is known that the pirates used to anchor in its bays out of range of the guns of the Danish Fort on St. Thomas and lie in wait for merchant vessels that were entering or leaving the port of St. Thomas.

Water Island gets its name from the fact that in the days of the "windjammers" this was one of the few places in the Caribbean which had fresh water ponds where the sailing vessels could replenish their fresh water casks. Both the pirates and merchantmen were accustomed to coming to Water Island for that purpose.

Letter Of Marque

There is a very interesting story about an early St. Thomas Danish Governor of somewhat doubtful integrity who was accustomed to selling letters of marque to the pirates, authorizing them to prey on Spanish shipping. One of these pirate ships bought such a letter and went to the Isthmus of Panama and crossed over to the Pacific Ocean on foot. There they captured a vessel and went up the coast looting Spanish towns.

They made their way back across the Isthmus and got in their own vessel and sailed away. Later they were captured and tried for piracy before an English Court in London. Their defense was that they were operating under a letter of marque from the Danish Governor of St. Thomas.

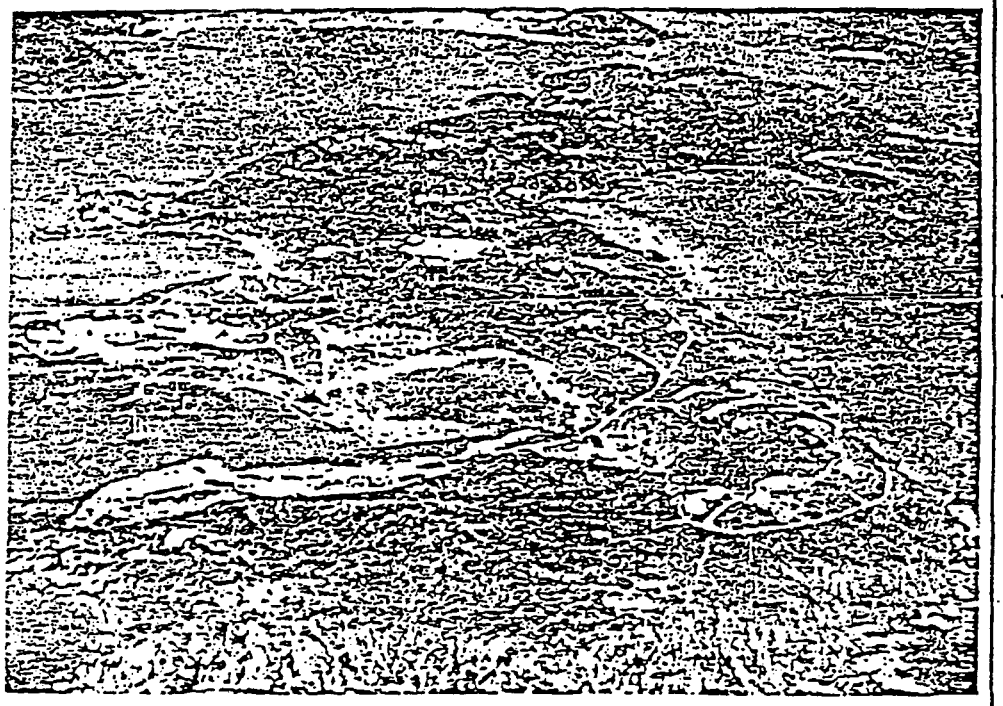
They produced the document, but as no one could read Danish, it was necessary to secure an interpreter. When translated the document was found to say that it "gave bearers permission to hunt goats on Water Island."

According to the story the pirates were duly hanged.

That there were white persons living on Water Island from an early time is indicated by the names on early maps such as Deruyter Bay, etc. Evidence of early habitation includes old Danish pottery and crockery, Dutch liquor bottles, and other remnants of European on.

e earliest mention of Water Island in the Danish d of land titles in St. Thomas occurs on Feb. 3, /, on which date the Executor of the estate of Captain Peter Tamaryn, a Negro, sold at auction a one half share of Water Island, including 29 Negroes and cattle for Rd 20,000 Danish currency to Captain Archibald Kerr. On the same day Captain Kerr sold the eastern one half share of Water Island to Baron Lucarde Bretton for 9,000 pieces of eight, Danish West Indian currency. On March 23, 1819 there was a deed from Kerr to Baron Bretton for the other half of Water Island. There were several transactions recorded and on June 2, 1830 Plantation La Providence with buildings on Water Island was sold to Joseph Daniel. On Oct. 17, 1851 there is a record of a deed to Joseph Daniel on 1/5 of the eastern part of Water Island called Caroline Lyst. On Dec. 1, 1859 another section was deeded to Joseph Daniel. Records of Recorders Office. St. Thomas. V. I.

This Joseph Daniel (the great grand-father of Christopher V. Daniel, for many years Collector of Customs in St. Thomas) was of Italian ancestry. He came to St. Thomas and Anglicised his name to Daniel from the Italian D'Anielli. He owned and operated a shipyard in St. Thomas harbor. During the War of 1812-14 the British occupied St. Thomas and used this shipyard to repair their ships and as headquarters for their efforts to suppress piracy. The story goes that when the British were leaving St. Thomas, in recognition of his services, they gave Joseph Daniel Water Island and made him a British subject. No record of this transaction is shown on the record of real estate transactions. It is not clear whether Joseph Daniel was the owner of Water Island under this British grant and was merely buying up adverse claims of other persons in the recorded transactions above mentioned from 1830 to 1859.



BIRD'S EYE VIEW of Water Island, the fourth largest island in the U. S. Virgin Islands.

Upon the death of Joseph Daniel Water Island passed to his five heirs but one of his sons, Christopher Daniel, administered the property as representative of the other heirs.

During the time the Daniel family owned Water Island there was a boat landing on Providence Point at the place where the present Ferry Dock is located. There was a large house of four or five rooms to the north of where the old cistern is located at the turn of the road leading from the Ferry Dock and opposite to the house (recently built) now owned by Tom and Mamy Ford. Francis Daniel, one of the sons of Joseph Daniel, who built the gas works in St. Thomas, built a house about 100 feet to the South of the cistern. The present ruins on the property owned by the Fords are the foundation and ovens of the house built by Francis Daniel but no trace of the first house to the north of the cistern remains as this was of wooden construction. Both of these houses were occupied by the Daniel family as summer homes.

Treasure On Island

There were many rumors of treasure being buried on Water Island by the pirates to preclude its capture by the British and American warships which were constantly on the lookout for the pirates. Several attempts to recover this South American gold were made but without success. In the 1890's a stranger purporting to be an Italian produced to Christopher Daniel (grandfather of Christopher V. Daniel) a rough chart of one of the bays of Water Island showing by a cross where a trunk containing doubloons had been buried by the stranger's father, who had been quartermaster of a pirate ship. The stranger suggested to Christopher Daniel that they join together and make an attempt to recover this buried treasure. But Christopher Daniel, remembering the several failures that had met previous attempts of this nature, declined to participate. However, he gave the stranger permission to go to Water Island and make what recognisance and search he deemed proper and a note was sent to the watchman who was constantly employed on Water Island to this effect, and the stranger was given permission to occupy one of the houses on the Island while he carried on his search. The stranger had a boat equipped with sail which he used to carry his food and other supplies from St. Thomas to Water Island. Several weeks went by and the watchman who came to town frequently reported that the stranger was still there. One day the watchman reported that the stranger had gone and that his boat had disappeared.

On the following Sunday Christopher Daniel organized a search party of 10 to 12 persons and went to the area where on the chart the treasure was supposed to be buried, which was on Flamingo Bay shore. There they found a sizeable excavation about 4 feet deep and in it the remains of an old leather trunk. When Christopher Daniel turned the trunk over, one gold doubloon dropped out on the ground. He figured that the treasure hunter had found the treasure and left one coin to indicate that he had found it. The weight of the coins had made an impress on the sides and bottom of the trunk and careful measurements were made of these, from which it was calculated that the value of the treasure was between $50,000 and $60,000, at the value of gold at that time which was $16 per ounce. It was presumed that the stranger had skipped out because under the Danish law, one half of any buried treasure that was found went to the Danish Crown. The stranger apparently made his way to Vieques, which was then under Spanish rule and from there he could easily get to Puerto Rico and from San Juan he could find passage on a ship plying between that port and Spain and Italy. In later years whenever

Christopher Daniel would tell the story, he would always produce this gold doubloon.

Turn Of Century

Around 1900 for several years a group of boys used to come over from St. Thomas to Water Island every year and spend the month of August. They just brought a few essentials and "lived off the land." There were about 16 boys in the group and they were divided into four units: one had rifles and would hunt goats, another group had shotguns and hunted doves, another would fish and catch lobsters and whelks, and the fourth ran the house. Sosthenes Behn known as "Bim," who later founded the International Telegraph and Telephone Company, was one of the boys. On one occasion the smallest boy ate some whelks which were only partly cooked and drank a considerable amount of gin. He soon developed a terrible pain in his stomach. Twelve boys manned the oars of the boat and rowed him to St. Thomas to Dr. Erickson. But it was without avail and the boy died. The doctor said the whelks being only partly cooked had been hardened by the gin and killed him. That was the last year that the boys went on their outing.

During the early 1900s the French Navy used Water Island for winter maneuvers when they were in these waters. Because of the Entente Cordiale between France and Russia, the Russians applied for and were granted the same permission. As a reward for permitting this use of Water Island, Christopher Daniel was made a member of the French Academy by France and a Knight of St. Stanislaus by the Czar of Russia. The information concerning the connection of the Daniel family was obtained from Christopher V. Daniel, who was born Dec. 12, 1887 and retired Dec. 31, 1957 having served as Collector of Customs in St. Thomas for many years and reduced to writing by the writer and later verified by Mr. Daniel.

In 1905 the West Indian Co., Ltd. (which was a subsidiary of the East Asiatic Co.) conceived the idea of making a business out of permitting foreign governments to use Water Island for maneuvers. Through their lawyer, Mr. Jorgensen, they made an offer of $21,000 for Water Island. Christopher Daniel did not wish to sell but was over-ruled by the other heirs and the sale took place. The United States bought the Virgin Islands, including Water Island, in 1917 and it was no longer possible for Water Island to be used as a training grounds for foreign naval vessels. The West Indian Co., Ltd. apparently made no attempt to develop Water Island and for many years nothing much happened. The information concerning this transaction was amplified by Christopher V. Daniel in a conversation between him and the writer shortly before Mr. Daniel's death.

On June 1, 1944, the United States Government, using its power of eminent domain, acquired title to Water Island for the sum of $10,000. This is an illustration of the fact that profits in real estate are not automatic as the West Indian Company, Ltd., having held Water Island for 39 years, sold it for less than half the sum they had paid for it.

The U.S. Government immediately began the construction on Water Island of an Army base known as Fort Segarra. An underground fort and some 33 buildings were under construction, as well as docks, roads, water sewer, and electric systems, when World War II ended. The end of the war brought the overnight end of construction. After the War Water Island was used by the Chemical Warfare Division for experiments with poison gases. Many goats and pigeons were kept on the Island for use in connection with testing these products. This operation was discontinued in 1950 and the last man was withdrawn and the Island abandoned at that time.

Leasing Island

Water Island was leased by the Army to the St. Thomas Development Authority, which was an instrumentality of the local Virgin Islands Government, on a five year lease which could be cancelled by the Army at any time. In March, 1951 Walter and Florida Phillips made a trip to the Virgin Islands, looking for a place to retire to, and learned from Isidor Paiewonsky that Water Island was available and that the Virgin Island Government wanted to see it developed.

They rented a small boat from Harry and Jean Harmon, in which Isiah Phillips, an employees of the St. Thomas Development Authority, took them over to Water Island. The Island was completely abandoned and looked quite desolate as it was during a drought. But they were impressed with the possibilities and commenced negotiations with the then Governor of the Virgin Islands, Morris De Castro and Mahlon Lindqvist, chairman of the St. Thomas Development Authority.

On Aug. 31, 1951, a Virgin Islands corporation called Water Island, Inc. was formed and on the same day a lease was signed covering Water Island. It was realized by both the Virgin Island Government officials and the lessees that this lease was not one under which Water Island could be really developed as it was for a short time and could be cancelled at any time by the Army.

Negotiations were begun to transfer Water Island from the Army to the Department of the Interior, so that a more workable deal could be worked out. The law authorizing the transfer of Water Island to Interior was signed by President Truman on July 11, 1952. On Dec. 10, 1952 a lease was signed with the Department of the Interior, leasing Water Island to Water Island, Inc. for a period of 20 years ending Dec. 31, 1972, with an ironclad option to renew for an additional period of 20 years, ending Dec. 31, 1992.

Plans for establishing a hotel and leasing sites for year round and vacation homes were prepared. Actual remodeling of the main building into offices, lobby, kitchen, dining room, etc. and of certain other buildings into hotel rooms was commenced on Sept. 22, 1953, and on Dec. 22, 1953, the Water Isle Hotel opened for business, which was somewhat of a record for shortness of time for this area. The business of the Hotel gradually expanded and sites weresubleasedto a number of people for vacation and retirement homes.

Water Island received nationwide publicity in a five page article with many color pictures which appeared in the Saturday Evening Post, Dec. 1, 1956. Another write up of Water Island was carried in Life Magazine, Jan. 12, 1962.

On Dec. 3, 1965 Water Island, Inc. sold the master lease on Water Island, its physical assets and its rights and obligations under the subleases to the Water Isle Hotel & Beach Club, Inc. whose president is Edward J. McArdle, who operates a large resort hotel outside of Chicago. An expansion program was commenced consisting of enlarging the main building, constructing three 3-story buildings containing hotel rooms and condominiums (villas).

Honeymoon Beach

One of the principal attractions of Water Island is Honeymoon Beach. When the Phillips came to Water Island, this beach extended for about 50 feet along the shore and about 10 feet back from the shoreline. The trees and brush were removed, 200 truck loads of rocks and gravel were hauled off, the beach stone was broken up with a bulldozer, the sand was sifted to remove the broken glass, a dredge removed the seaweed and deposited sand on the shore. Today Honeymoon Beach is a most beautiful Beach. It is especially good for families with children as it is a very safe beach.

Another important feature of the Island is the Water Isle Botanical Garden. This is a brainchild and hobby of the writer. Plants from all over the world have been brought in and established. It is a member of the International Association of Botanical Gardens and of the American Association of Botanical Gardens and Arboreta.

At the present time approximately 300 persons own homesites on Water Island. There are about 150 subleases on which 70 homes have been built. There is a hotel with about 113 rooms, and there are 22 villas and apartments.

Unique Community

Water Island is a unique community, composed of many different races, religious and political affiliations, and age groups. The people take an active part in church, civic and charitable activities. For example, Water Islanders contribute more per capita to the Boy Scouts than any other part of the Virgin Islands. The Water Island Civic Association, Inc. was formed to handle community problems.

The people on Water Island build and maintain their own roads, provide their own fire protection, garbage collection, etc. They receive little in the way of services from the Virgin Island Government, although they pay very substantial income taxes into the local Treasury. Water Island is probably the only area that pays more into the local government than it receives back in the way of services. Most of the residents are retired people who spend substantial amounts for building homes, purchasing equipment, supplies and services locally. They make little demand forservicessuch as schools, hospitals, welfare, etc. It is a mystery why the local government does not make greater efforts to attract more of this type of persons to the Virgin Islands.

Water Island represents the answer to the dream of many people. But it is not for everyone. If one works for regular hours in St. Thomas or has extensive social activities there, it presents problems. Whether a person likes Water Island or not depends in large measure on how much expense and inconvenience he or she is willing to assume in order to secure peace, quiet, tranquility and friendly neighbors.

The Water Isle Hotel consists of approximately 200 rooms, which include hotel rooms, apartments, and villas (the latter two have housekeeping facilities).

The Hotel is under the management of Ann and Sam Brown, whom you may remember from the Island Pantry. Under their management every effort is made to provide a friendly, comfortable homelike atmosphere. The cuisine consists of native and continental dishes, and luaus at the beach are served on occasion. Entertainment features native performers. The Island Pantry carries an extensive line of foods and supplies, including liquor at the same low prices as St. Thomas. There is also a Gift Shop with many duty free bargains. Sophisticated St. Thomas with all its shops and attractions is only a 5 minute boat ride away.

The Hotel is popular with business and professional people, retired persons, and others looking for a place to relax. It appeals to conventions and groups because they can be by themselves. It is especially attractive for families with children because of the safety of Honeymoon Beach.

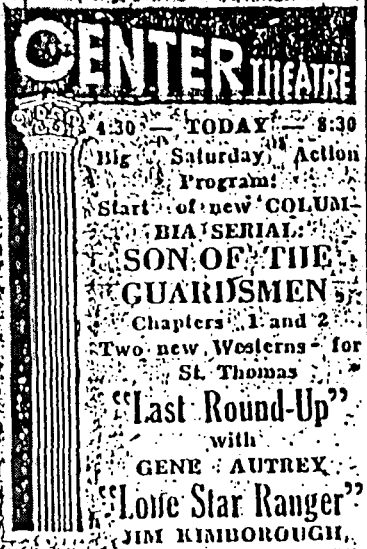
The seclusion and privacy, the excellent accomodations and food, the easy access to St. Thomas, and the warm and friendly management and employees combine to make Water Island an ideal and unforgettable vacation experience or place to retire.



MR. AND MRS. WALTER H. PHILLIPS



HONEYMOON BEACH



EAT AND GROW SLIM,

alcohol and the total solids they contain. Liquors makes some people flabby fat; others it keeps too thin. It usually adds to your weight. Besides, if you fill up on beer and liquor you do not eat the foods you need. So, best avoid them in a reducing regime.

Often it takes 3 to 4 weeks to see any reduction in weight even when the diet is rigidly followed. Failure to lose weight immediately is due to storage of water in the tissues. This, however, is temporary and a loss is bound to occur unless overweight is due to some other cause than simple indulgence in food. This is discouraging to those who look for the pounds to melt off over night and the diet is often often abandoned without a fair trial. So a sincere desire to lose weight is the most important requisite of a reducing program.

Once the desired weight is reached adjust your eating so that you will remain slim. Be sure to weigh yourself regularly so the pounds will not creep upon you as they will be just as hard to lose the next time.

U.S. ARMY STUDIES—

fitted with electric motors and other pieces of equipment that are required for the special work that is being conducted.

—Translated from El Mundo.

FOR SALE

Dodge Luxury Liner 1941 Sedan. Body newly painted, motor excellent running order, five good tires, good brakes. Any reasonable cash offer accepted. Owner leaving islands. Apply Daily News

BRANDS WOMAN—

(Continue from page 1)

several places and knocked her unconscious with a heating iron.

She was taken to the Municipal Hospital for treatment.

BOOK STORE PREPARES—

(Continue from page 1)

Photo Shop, who is soliciting advertising space and furnishing pictures; and J. Antonio Jarvis, who will handle the historical and other articles and make decorative and other drawings, maps and charts.

This book when finished will be a complete guide to the Islands with maps, charts, photographs, information for visitors, decorative illustrations, a brief historical sketch and a business directory.

CHAMBER OF COMMERCE—

Smart Shop, Treasurer; and George Conrad, owner of the Criterion Grocery, Secretary. The members of the new Executive Board are Mahlon Lindqvist, Victor Bornn, Ralph Paiewonsky, John J. Jouett, and Ira Smith.

FOR SALE

Walnut Dining Table (with extension leaf) and 4 Chairs upholdstered leather seats unused. Contact "Daily News" Office.

Just Arrived

Executive Steel Desks

And FILING CABINETS

(Fire Proof)

MAWSON & MAWSON

The DAILY NEWS

18th YEAR — CHARLOTTE AMALIE VIRGIN ISLANDS — FRIDAY, MARCH 11, 1949 — No. 5183

Smith Protests Proposed Transfer Of Roads To Army

Robert Smith, who with Richard Falck owns large properties in the western section of the island, yesterday stated in a letter to the Government Secretary that he wishes to "protest emphatically" against the ordinance proposed by the administration giving the San Jose Project jurisdiction over the roads on the Western end of St. Thomas. He asserted that this action would make the roads in the area unavailable to the public and to owners of property through or adjacent to which the roads run. Mr. Smith stated that he is willing to appear before any body appointed to investigate the matter and state his opposition to the proposed transfer of jurisdiction.

The Council has deferred action on this matter until the

(Continued on Page 4)

Downing, Brown Propose Resolution On V.I. Law Digest

A resolution expressing the appreciation of the Municipal Council of St. Thomas and St. John on behalf of the people to the law firm of Maas and Bailey for the compilation and publication of a Virgin Islands Law digest will be introduced at the next meeting of the Council by members Carlos A. Downing and Omar Brown.

The digest was included in the 1949 Martindale Hubbell Law Directory and has since by published by Maas and Bailey. This is the first time that a concise digest of all of the important laws of the Virgin Islands has been made.

Army, High School Quintets Clash Tonight

The C. A. H. S. quintet will meet the Army tonight at Bourne Field Recreation Hall. The High School has yet to win a game for the current Basketball League, while the Army squad has two defeats and one win to its credit.

Antilles Corp. Equipment Due To Arrive Soon

The Antilles Construction Corporation, a newly organized enterprise, which is owned and operated by Messrs. Brimble Sharp and Malling Holm, is expecting a large shipment of equipment from the United States within the next few days, and will soon be ready to begin construction operations. The Corporation filed a bid for the FWA road project here, and was underbid by the Hettinger Corporation. Antilles has also bid for the renovation and reconstruction work at the Berg homes, the contract for which will be let shortly.

George Brimble last week returned from the United States where he purchased and prepared for shipment a large variety of construction equipment and is now in Puerto Rico considering bidding on several more projects in the Federal public works program there.

Bolts Being Made For Sewer Project

Word was received today by Girvin and White, the contractors on the sewer and fire protection system, that the Monel metal bolts are now being fabricated for the completion of the pipe lines. It is expected that the bolts will arrive here by the end of March and that work will be resumed on the pipe line project early in next month. The work has been held up due to deficient materials since early in December 1948.

Emma Shalders, 84, Dies

Miss Emma Shalders, 84, passed away at her home this morning shortly after nine o'clock. Miss Shalders, who resided with Miss Marie Christen, was stricken with a heart attack on Wednesday.

A Funeral Mass will be held at the Roman Catholic Church

(Continued on Page 4)

Adm. Holds Exec. Hearing On New Budget

Government Secretary De Castro, Commissioner of Finance Louis Shulterbrandt and Director of Personnel Ullmont James have been holding hearings of Department heads this week on justification for the appropriations requested for their departments for the coming fiscal year. Hearings will continue into next week, Governor Hastie stated. Following these hearings the Governor will prepare a draft of budget for the fiscal year 1949-1950 for submitting to the Municipal Council on April 1, 1949.

Administrator for St. Croix Harry L. Taylor who is expected here on Monday for conference with the Governor on budget and other matters is holding similar hearings in that island.

Bar Assoc. Hears Alderman Carey At Caribbeau Hotel

The St. Thomas Bar Association met on Wednesday night at the Caribbeau Hotel. Among the members of the Bar at the meeting were Governor Hastie, Judge Moore, and Alderman Carey, Chicago Attorney and member of the City Council.

Alderman Carey gave a very interesting address to the Bar on legal and political matters, and expressed his pleasure in being on the island.

The Association, which meets monthly, discussed a series of matters affecting the welfare of lawyers in the community.

Harmon Leases Boathouse o Promote Sport Fishing

The old boathouse at the former Marine Barracks has been leased to Harry Harmon III for a new enterprise the Governor announced this morning. Mr. Harmon is preparing two boats to promote boating and sport fishing in this area.

Apollo Renovations Completed For March 15 Re-opening

The Apollo Theater, which was for years the principal recreation rendezvous of the community, has just finished undergoing extensive exterior and interior renovation. The Apollo will open on March 15, showing "Men of Two Worlds" to matinee and evening audiences.

The old balcony has been dismantled, leaving more space for seating on the lower floor and improving sound conditions in the theater. In addition to about 350 regular seats, 18 family-type logs boxes have been provided at the rear of the theatre. The interior walls of the theatre have been lined with fire-proof acoustic tile, as has the projection room. A ceiling designed to improve the acoustics of the theater has been installed in the formerly dome like roof. The screen has been made half again as larger as before. An additional amplifying unit and more powerful projection lamps have been installed. Ventilation will be improved through the use of a series of floor fans. The front of the building has also been considerably reconstructed.

(Continued on Page 4)

Air Maneuvers In V. I. Cancelled For Lack of Funds

The Second Marine Airwing which was scheduled to hold extensive maneuvers in St. Croix has been compelled to abandon this part of the mock operation on account of lack of funds, the local government has been advised.

WEATHER FORECAST
VIRGIN ISLANDS

Clear to partly cloudy with gentle variable winds today, tonight and Saturday.

PAST 24 HOURS

Maximum Temperature 84
Minimum Temperature 68

NOON TODAY

Pressure Sea Level 29.94

CENTER THEATRE
1:30 — TODAY — 8:30
Columbia's excellent drama
Double Life
starring
RONALD COLEMAN
SIGNE HASSO
EDMUND O'BRIEN
SHELLY WINTERS
RAY COLLINS
PHILLIP LOEB
Directed by
JOSEPH L. MANKIEWICZ

display as a historic relic; and erection of a new combined jail and penitentiary.

Other funds will be used for recreational facilities, improved telephone system, malarial control, abbattoir and cooling plant, and public market.

In addition, for St. Croix are pending projects for hospitals, sanitation and fire protection, recreational facilities, highways and roads, port, buildings, prison facilities, recreation telephones, public markets, malarial control and a municipal pier for Christiansted.

V. I. STARTS—

Continued from Page 3

The new land is most important to the harbor, whose main scenic attraction has been an obstacle to growth: Practically the whole capital sits on a hillside, there being little level area around the water front.

Some of the new school and hospital facilities will be built on the reclaimed land.

Other projects under way in St. Thomas and St John include:

Highways and roads, $831,360 in authorization and $214,669 in allocation; this will bring St. John its first cross-island road.

Street improvements: The $247,200 authorization for paving, resurfacing, widening, and improving streets as well as adding storms drains, is awaiting completion of the sewer water lines.

Cadastral survey: $35,000 has been allocated for the engineering survey of ownership, extent, and value of property.

Not to Be Remodeled

Public Buildings: $103,950 is the preliminary estimate of cost for remodeling the present hospital and reconverting it to the care of indigents; improvements in Government House, Administration Building, Public Works Building the publicly owned Bluebeard's Castle Hotel; restoration of the historic colonial military cemetery, and other items.

Prison facilities: $10[illegible],000 has been authorized to restore the old Fort Christian for partial use as police headquarters, court and detention quarters, and also for the Fort's

APOLLO UNDERGOES—

(Continued from Page 1)

Majority stock in the Apollo Theater is owned by the owners of Center Theater. The Apollo will specialize in action pictures and serials at very moderate prices.

EMMA SHALDERS DIES—

(Continued from Page 1)

tomorrow morning at ten o'clock following which the body will be interred at the Western Cemetery.

Miss Shalders survived by a niece, Mrs. Cyril Smith.

SMITH PROTEST—

Court takes action on proceedings in which the Army is seeking to secure the land in that area for chemical warfare experiments. Most of the land is owned by Smith and Faick.

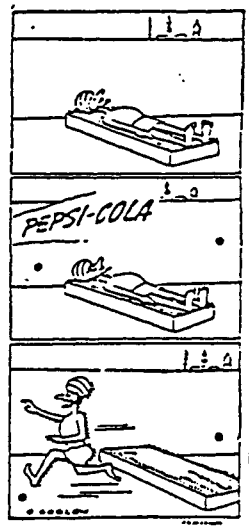
FUNERAL NOTICE

Friends and acquaintances of the Smith and Thraen families are invited to attend the funeral of their late Aunt and Godmother, tomorrow morning from the Roman Catholic Church thence to the Western Cemetery.

LORAND'S STORE
announces that in addition to the regular lines of Merchandise for
MEN — WOMEN — and CHILDREN
We have just received a most attractive assortment of
Ladies Dress Materials & Gents Suits
Visit us and be satisfied with the Materials, Styles, Workmanship, Prices, and you will be sure to make your EASTER PURCHASE
— LORAND'S STORE

LOST

Key-Ring and one key. Please return same to Daily News. Reward.



IN THE DISTRICT COURT OF THE VIRGIN ISLANDS
DIVISION OF ST. THOMAS AND ST. JOHN AT
CHARLOTTE AMALIE

In the matter of the Estate of)
HERMAN O. CREQUE, deceased.) Probate No. 5 — 1949

NOTICE

Notice is hereby given to all parties interested that the undersigned have been appointed Administrators C. T. A. of the above-entitled Estate.

Creditors of the Estate are requested to file their claims with the undersigned and debtors of the Estate are requested to make settlement of their accounts within six (6) months from the first publication of this Notice.

/s/ VALERIE MAWSON
/s/ HENRY O. CREQUE
/s/ CYRIL E. SMITH

Dated: February 18, 1949

NEW HERRNHUT

Many friends who visit this Station remark with wonder and pleasure upon the progress made in the rebuilding programme. Particularly so when it is learned that no wages have been paid for workmanship of any kind.

Cost of materials, however, must be met, and to continue to do this another Spend Day is fixed for March 31st. This will be similar to the one held on the same date last year. Dinners, at one dollar each, will be the main item, but there will be several other stalls, all with good things on them, arranged around the new Assembly Hall.

RUN-DOWN?
TRY
Cocomalt
...the Malted Food Drink that will help you feel well!
A weak, dragged-out feeling may be due to lack of essential nutritive elements in your daily diet. Drink a glass of Cocomalt three or more times a day. See how much better you feel in a few healthy days!
One ounce of Cocomalt in a glass full of milk increases the vitamin A content 25%. And one glass of Cocomalt daily gives you the necessary iron, phosphorus, calcium, and Vitamins B1 and D usually required.
Cocomalt is delicious and refreshing, too—ask for and insist upon this invigorating malted food drink—Cocomalt.
Cocomalt
THE MALTED FOOD DRINK

Just say:
Make mine RUPPERT

The DAILY NEWS

18th YEAR — CHARLOTTE AMALIE, VIRGIN ISLANDS — SATURDAY, APRIL 2, 1949 — No. 252

Mun. May Secure Surplus Generators For Power System

The Municipal Council this morning conferred with Government Secretary Morris F. De Castro with regard to information received here that five electric generators at an Army base in Trinidad will soon be declared surplus property. The Council suggested that attempts be made to get these generators, which it is said would be adequate for local needs, for operation by the Municipality, eliminating the necessity for the Power Authority to purchase current from the San Jose Project.

The members of the Council pointed out that if these electric generators can be secured at no cost to the Municipality, funds would still be needed for their installation. They asserted that if $100,000 is borrowed now it would make it difficult for an additional loan to be secured before the $100,000 is paid off, and suggested that no action be taken on the bill authorizing the borrowing of the $100,000 until it is known how much will be needed.

Government Secretary De Castro told the Councilmen that he will discuss the matter with Governor Hastie.

Officials, Press To Tour San Jose Project On Army Day

Governor Hastie, other prominent Government Officials, and representatives of the Press will tour the San Jose Project on Wednesday as the guests of Colonel Paul H. Smith, Commanding Officer of the Chemical Warfare Unit at the former Submarine Base. The group will visit the Army installation to witness a demonstration of the technical facilities of the Project both on the Caribbean and on Water Island, to inspect all parts of the base, and to have lunch as the Army's guests.

The tour was first suggested by General Waitt, head of the U. S. Chemical Corps, on his visit here last month shortly after there had been considerable discussion here concerning the possibility of harmful effects of chemical warfare experiments at the Project.

Tau Defeats Eskimos 50-35; Tau-Savan Play Tomorrow

The Tau basketeers defeated Igloo's Eskimos 50-35 at Bourne Field Recreation Hall last night. Tau remains in third place, trailing the league leading Amalians by three games.

The Army quintet, which was supposed to meet Savan tomorrow afternoon, announced yesterday that they are withdrawing from the league due to an insufficiency of players. An exhibition game between Tau and Savan will be staged in the place of Army-Savan contest. In their first half encounter Savan defeated Tau, and Savan is now in second place, having suffered two defeats.

Credit Facilities Committee Invites Verbal Testimony

The Committee on Virgin Islands Credit Facilities appointed by the Governor has received a great many returns to the questionnaires sent out to Post Office box holders in the islands. The Committee is now drawing up its recommendations to the Governor in regard to needed credit facilities but it feels that it should receive additional answers from recipients of the questionnaires who undoubtedly have a considerable interest in this subject but who have postponed their answers.

Since the Legislature is soon going into session the Committee asks the citizens to give prompt attention to the return of the questionnaires.

The Committee will be glad to give any individual a hearing if it is desired to give verbal and informal testimony. The Committee is also interested in Income Tax Withholding. Office next to Government House in Charlotte Amalie. (P. O. Box 494 — telephone 214.)

Mun. Council Enacts Measure Giving Tourist Board Fund

Overrides Governor's Veto On 2nd Priority Loan Measure

The Municipal Council of St. Thomas and St. John yesterday passed a bill to authorize a loan of $20,000 to the Tourist Development Board from the Municipal Insurance Fund, and providing for the placing into a special fund of all taxes collected on passenger tickets sold in the Municipality. The fund is to be used for the operating expenses of the Board.

The bill to authorize the granting of loans for construction and building repair purposes from the trust funds of the Municipality on second priority mortgages, which was passed early this month and vetoed by the Governor, was passed over the veto at yesterday's meeting. Loans from the trust funds are now granted on first priority mortgages.

The Council also passed a deficit appropriation for various departments of the Government, appropriated $1500 for new uniforms for the Community Band, and adopted a resolution expressing the appreciation of the people for the preparation without cost to the Municipality of a V. I. Law Digest by the law firm of Maas and Bailey.

Army To Show Military Equipment At Roosevelt Park

It is announced that on Army Day, Wednesday, April 6, 1949, between the hours of 9:00 a.m. and 3:00 p.m. there will be an exhibit at Roosevelt Park.

Equipment used at the San Jose Project will be featured. Among the items displayed will be various types of missiles used at the Project, chemical shells and bombs and items of protective equipment.

Competent military personnel from the Project will be on hand to explain the operation and use of the equipment.

The exhibit will be public and all are invited to attend.

Council Group Submits Report On Hettinger Inquiry

The Council's Investigating Committee yesterday submitted a report on its investigation of the employment policies of the Hettinger Construction Corporation to the Chairman of the Council. The Committee, which is comprised of Councilman Carlos Downing, Chairman, Roy P. Gordon and Earle B. Ottley, recommended that the legislation authorizing the Federal public works projects in the Islands be reviewed by the local Government and the Federal Works Agency with regard to the right of qualified natives to jobs on the projects, and that a Fair Labor Law be enacted to encourage collective bargaining among local workers.

At a hearing held by the Committee Thomas Mooney, District Engineer for the Federal Works Agency, stated that no contractor has any obligation to hire native workers. The Committee report held that under the legislation authorizing the projects, a contractor could in good faith hire non-residents only only when no qualified residents are available.

Air Conditioning Units Installed In Hospital Section

Air-conditioning units have been installed in the Operating Room and the Obstetrical Ward at the Municipal Hospital, it was announced today by Dr. John Moorhead, Chief Municipal Physician and Commissioner of Health. The Unit in the Operating Room has been in use for the past several weeks and has been performing successfully.

WEATHER FORECAST
VIRGIN ISLANDS

Partly cloudy to occasionally with scattered showers and moderate easterly winds today, tonight and Sunday.

PAST 24 HOURS

Maximum Temperature 84
Minimum Temperature 68
NOON TODAY
Pressure Sea Level 30.01

Government Secty. Office
St. Thomas, V.I.

The DAILY NEWS

15th YEAR — CHARLOTTE AMALIE, VIRGIN ISLANDS, WEDNESDAY, JUNE 1, 1949 — No. 2512

Gov. Vetoes Two Assembly Bills

A bill providing for uniform method of appointment and confirmation of all salaried officials and employees in the two municipalities and the Government of the Virgin Islands which was passed at the last session of the Legislative Assembly was vetoed this week by the Governor. Also vetoed was a bill authorizing the Governor to take necessary steps to participate in Federal-Aid programs.

The bill dealing with uniform method of appointment fails to receive executive approval because it retroactively required the confirmation of appointments heretofore made, regardless of whether such confirmation was legally required at the time the appointment was made. "This threat to the security of persons already appointed in accordance with the law as it existed at the time of appointment", the Governor stated; "is unfair and unjustified." The Governor also objected to restricting interim appointments to thirty days as in some cases the Municipal Councils fail to act within that time. He pointed out that if the legislature believes that an expansion of legislatur power to pass upon appointments is

(Continued on Page 4)

Rita La Fontaine To Appear In Concert

It was announced today that Miss Rita La Fontaine will appear in a concert July 15th accompanied by Miss Aimee Estornel. This concert is under the management of Bernard Law, Jr.

Miss La Fontaine has given her time generously to many local civic programs, through these programs she has acquired an enthusiastic St. Thomas public. This announcement therefore, should meet with the joy of the Islands's music lovers.

Senator Kerr Praise Presentation Of Delegates

According to information received here today from President of the Virgin Islands Company Norman S. Olson, Senator Kerr, chairman of the subcommittee conducting hearings on the Virgin Islands Company bill thanked the delegation from the Virgin Islands, Honorables Walter Hodge and Carlos Downing, for appearing at the hearings and for its "sound intelligent presentation". At the hearing were James P. Davis and Irwin Silverman of the Department of the Interior and Mr. Norman Olson. The delegates made individual presentation in support of the VICO bill.

Gov. Resubmits Pay Plan For Action By Coun.

The Governor yesterday resubmitted the pay plan to the Municipal Council for it action The plan was rejected by unanimous vote late last month.

Claiming that they hadn't sufficient time to consider it fully the members voted against the plan as they were under the law to act within thirty days or it would be considered approved. They have indicated their concern about inequalities in the salary scale and hope to effect a compromise with the executive before the end of the present month.

Council Chairman Issue Statement On Pay Plan

Honorable Roy P. Gordon, Chairman of the Municipal Council, today released the following statement to the press:

As the Pay Plan under the Merit System Law, once it is placed into effect, will not be subject to change or improvement, the Council's policy is that the Plan should receive the most careful consideration before it is put into effect. Plans are therefore under way to preserve to employees who receive increases under the Plan such increases, and to right as many as possible of the injustices brought to the attention of the Municipal Council at the public hearing of May 18, 1949, as existing in the Plan.

The Council's disapproval of the Pay Plan should not be taken as an act intended to discard the entire scheme, but rather as a very necessary step to give the Council much needed time to correct certain injustices contained in the Plan, and make it satisfactory to a larger ratio of employees now and in the years to come. If the Plan had not been disapproved, the Council would have no right to make any such adjustments, and it would go into effect exactly as the Adminstration said it should (on a take it or leave it basis) regardless of how many employees are disastisfied now or become hard-pressed in the future.

The time factor was paramount in this decision. The plan was submitted on April 30, to be approved or disapproved by May 30, a period of 30 days. With the Assembly in session until May 13, and several Assembly and other Council matters which had accumulated during the Assembly session to dispense with at the close of the session, it was humanly impossible during the already short period of 30 days to give such consideration to the Plan as would do the maximum good to the greatest number of employees. Since if the Council did not disapprove the Plan, according to the present law, it would mean the Council

(Continued on Page 4)

Army Asks For 11 Islands West Of Mainland

Stating that he is in favor of a request made by the Army to turn over to it eleven islands on the western part of St. Thomas, Governor Hastie today sent the proposal to the Council for its action. This request touched off a wave of indignation in City Hall this morning. Chairman Roy P. Gordon stated that this area is the principal fishing ground for scores of fishermen who make a living and support their families and if the Army intends to take them the Council will take the fight to Washington.

The islands requested by the army on revocable license are: Cricket Rock, Cockroach Island, Dutchman's Cap, Salt Cay, West Cay, Savannah Island, Flat Cay, Saba Island, Turtle Dove Cay, Kalkun Cay and Sula Cay. Several months ago the Army condemned the western part of the mainland of the islands and restricted it to civilian use.

Harleys In St. John Celebrate Golden Jubilee

Mr. and Mrs. Joseph Harley of East End, St. John, today celebrate their golden wedding jubilee. Captain Harley as he is known to businessmen in St. Thomas, has been inactive in recent years, because of a slight attack of paralysis. Mrs. Harley still enjoys good health.

The occasion is being celebrated by the relatives and friends of the well known couple.

WEATHER FORECAST

VIRGIN ISLANDS

Partly cloudy with widely scattered showers today, tonight and Thursday. Winds are moderate to occasionally fresh southeasterly.

PAST 24 HOURS

Maximum Temperature 86
Minimum Temperature 76
Pressure Sea Level 29.96

St. Thomas, V.I.

The DAILY NEWS

13th YEAR — CHARLOTTE AMALIE, VIRGIN ISLANDS — THURSDAY, JUNE 9, 1949 — No. 2518

DailyNews Editor Wins LibelSuit; Jury Gives Unanimous Verdict

Defense Attorney Makes Brilliant Presentation

Ottleys To Pay Costs of Suit

A jury of seven men and five women this morning at 1:45 rendered a unanimous decision of "Not Guilty" in the libel cases brought by Earle B. Ottley Councilman and Photo News reporter and his brother Randolph A. Ottley, editor and publisher of the Photo News for libel in the amounts of $3,000 and $5,000 respectively against Ariel Melchior, editor of The Daily News. The trial which began at ten o'clock yesterday lasted until early this morning. Jorge Rodrigues was the attorney for the plaintiffs and R. H. Leader was counsel for the defendant.

Both cases were tried at the same time. Randolph Ottley claimed that editorials appearing in The Daily News during August which made reference to his dishonesty in publishing the Council's proceedings, made him a nervous wreck and that he had to go to Puerto Rico and then to New York for treatment; that his friends shunned him and his clients distrusted him as a result. He explained that he suffered certain business losses and was even caricatured by one of his employees who drew a picture of him behind bars and displayed it on the door of his business place. He also claimed that his family suffered.

Earle B. Ottley who returned from New York for the trial told the court that as a direct result of the same editorials he suffered with insominia and had to receive treatment from two local doctors. He state that the writings had a terrible affect on his wife who became sick and had to go to the states where she is now being treated. Both men submitted

(Continued on Page 8)

Scott Named To Soil Conservation Board

Governor William Hastie yesterday nominated John P. Scott, local poultry farmer, as a member of Soil Conservation District Board, to serve in the place of Samuel Harthmann, who resigned several months ago. The Governor pointed out that as Henry Samuel, one of the members of the Board, is not in the Islands, the confirmation of Mr. Scott by the Municipal Council is necessary for the Board to carry on its business.

Work On Vaughn Hotel Slated To Begin Soon

Anthony Vaughn the owner of a site at East Point on which he plans to erect a hotel, visited St. Thomas this week and returned to Puerto Rico yesterday. Mr. Vaughn, it is said failed to secure a loan from the Reconstruction Finance Corporation for the erection of the hotel here. Difficulties in the

(Continued on Page 8)

Herman Sarno May Build Hotel Here

Owner of Chain In U.S. Seeking Site

Herman Sarno, owner of a chain of hotels in Washington, New York, Florida and Ashbury Park, who is visiting the Virgin Islands this week stated this morning that he is interested in establishing a hotel here. Mr. Sarno indicated that he has looked over many parts of the Islands and he is convinced that the Islands have a bright future before them.

Coming here primarily on vacation, Mr. Sarno became sufficiently interested in the business possibilities here in connection with the tourist trade that he is now considering acquisition of a site for the erection of a luxury hotel before returning to the United States.

Reverend Oleson Here For Summer

The Rev. Elmer Oleson from the First English Lutheran Church in San Juan, Puerto Rico, arrived yesterday to assist Rev. Jens Larsen of the Lutheran Church here during the summer months.

Army Control Of Cays Is For Safety of People, Col. Smith Says

Colonel Paul R. Smith, Commanding officer of San Jose Project, stated Tuesday afternoon in a conference with the editor of The Daily News that the sole purpose of the Army in seeking a lease on the small islands and cays off the western end of St. Thomas is to insure the safety of the people of St Thomas. The Colonel said that the Army has no intention of conducting operations of any description on these islands and cays. Since it is possible that at times certain offshore areas might be temporarily dangerous, it is obviously necessary that adequate safety measures be established, he added.

Stating that the people of St. Thomas may be assured that such safety measures as may be necessary will impose the very minimum restrictions of any sort consistent with the safety of all concerned. Colonel Smith expressed the belief that necessary safety measures will interfere little, if at all, with normal fishing activities in the waters concerned.

Colonel Smith was very understanding about the whole matter and indicated his desire to continue to cooperate fully with the people and the government of St. Thomas.

Bill Would Allow V.I. To Issue Bonds

Money Borrowed Would Be Used For Public Works

The House Committee on Public Lands by Representative Redden last week unanimously recommended to the House the approval of a bill introduced earlier in May by Representative Crawford to authorize the Government of the Virgin Islands or any municipality thereof to issue bonds and other obligations. The bill now goes to the floor of the House for action.

The bill, to which the Committee suggested minor amendments, would permit the Government of the Virgin Islands or either of the municipalities to incur bonded indebtedness to the extent of not more than ten percent of the aggregate tax valuation of the real and personal property within the areas governed by the issuing authority. The legislation provides that the funds raised by the issuance of the negotiable general obligation bonds and other obligations may be used to construct, improve, extend, better, repair, reconstruct, acquire, and operate any and all types of public works.

The passage of this bill by the Congress would insure the granting of a loan by the Reconstruction Finance Corporation for the St. Thomas Power Authority, and should leave the way open in the future for other public developments which could not be undertaken out of the current funds of the municipalities.

WEATHER FORECAST

VIRGIN ISLANDS

Partly cloudy to occasionally cloudy with few scattered showers today, tonight and Friday.
Winds are moderate to fresh easterly.

PAST 24 HOURS

Maximum Temperature 87
Minimum Temperature 77
Pressure Sea Level 30.06

The DAILY NEWS

20th YEAR — CHARLOTTE AMALIE, VIRGIN ISLANDS WEDNESDAY, MARCH 15, 1950 — No. 2675

Inauguration For New Gov. Set For Friday, March 24

Huge Parade And Colorful Ceremony Planned; Army & Navy To Participate

Tentative plans for the inauguration of Governor Morris F. de Castro, were made yesterday afternoon by the Inaugural Committee, whose Chairman is Honorable Omar Brown.

Recognizing the importance of the Interior in bringing about the appointment of Mr. de Castro, the Committee felt that every opportunity should be afforded officials of that Department to participate in the inaugural ceremonies. The committee therefore set Friday, March 24, 1950, as the date for the ceremonies to be held in St. Thomas. St. Croix will probably hold its ceremonies on Saturday, March 25, and St. John on Sunday, March 26.

It was the committee's desire to hold the ceremonies at a date closer to the 33rd anniversary of the Transfer of the Islands to the United States. However, this thought was abandoned in deference to affording outside guests an opportunity to be present.

Plans include an inaugural parade commencing at 9:00 o'clock a. m., in which military units of the Armed Forces will be asked to participate together with the Home Guard, Boys and Girls Scouts, Police, and political and civic organizations. The parade will assembly in the area at Bay Normandie and proceed along the road to the V. I. Distillers through main street around Lincoln School and North of the Ball Park thence into main street and then to the Emancipation Garden. In addition to the Community Band the committee is trying to have one or two military bands and a squadron of planes to add color to the occasion. Judge Herman E. Moore will administer the Oath of Office, following which speeches will be delivered.

Sub-committees have been named to handle the various phases of the celebration. The Program and Invitation Committee, headed by Judge Herman E. Moore, will take care of the ceremonies in the Garden

(Continued on Page 4)

Extends Greetings To King On Birthday

Upon the occasion of the birthday anniversary of His Majesty the King of Denmark on March 11th, the Acting Governor sent the following message to the Consul General for Denmark in St. Thomas "I bring you greetings today from the Government of the Virgin Islands on the occasion of the birthday anniversary of His Majesty, the King of Denmark. I know that the people of the Virgin Islands join in expressing the hope that His Majesty's democratic reign will be a long and prosperous one. To which Consul Hopfner replied as follows: "I thank you for your today's letter and very much appreciate the kind sentiments expressed on the occasion of His Majesty, King Frederik's birthday anniversary. I am sure that His Majesty will be very happy to learn of the continued warm feelings which I know exist to no lesser extent in Denmark towards the people of the Virgin Islands."

Bill To Extend Federal Vocation Program To V.I. Passed

The Acting Governor has been advised that the bill to extend the Federal Vocational program to the Virgin Islands passed the House of Representatives on March 9th. This bill which had already passed the Senate is on its way to the White House for signature.

Asks For Bread



A STRIKING coal miner in Canonsburg, Pa., Roman Rybarski lights his pipe after proposing that John L. Lewis and his UMW lieutenants sacrifice one pay check to buy food for hungry diggers. Rybarski declared the money could "buy us a lot of bread." Almost 400,000 men are out of the pits. (International)

Signs Statement On Federal Wage-Hour Law

Acting Governor Morris F. de Castro and Territorial Director Russell Sturgis of the Federal Wage and Hour Division have signed a joint statement in connection with the administration of the Federal Wage and Hour Act in the Virgin Islands. The statement reads as follows "The Administrator of the Wage and Hour and Public Contracts Divisions has delegated to the Governor of the Virgin Islands the authority to check through the Wage Commissioner, suspected violations of the Fair Labor Standard Act. The Wage Commissione is hereby authorized to enter and inspect establishments where he suspects violations of the Federal Act and to examine such records and interview such employees as he may consider necessary to determine whether or not a violation exists. When the Wage Commissioner finds that there is evidence of violation of the Federal Act, he will

(Continued on Page 4)

Foundation Offers Scholarship For Two

Mrs. Ruth Taussig, President of the Foresight Foundation which organization sent Victor Ebbesen to Syracuse University last year to pursue studies in the field of public administration has advised the Acting Governor that the foundation is contemplating selecting another person or possibly two for a year's training for the purpose of creating leadership in the islands in necessary fields of endeavor. Mrs. Taussig has stated that only candidates will be considered who would be suitable because of ability and the service they can render to the Virgin Islands. The administration has tentatively selected the fields of curriculum building, financial administration, hospital administration and zoning and town planning as important fields of endeavor. Persons who are interested in the scholarships to be provided by the Foresight Foundation within the fields just mentioned should submit their application to the Acting Governor within the next ten days, giving names, background and qualifications.

No Truth In Rumor, Commanding Officer Reports

A rumor going the rounds that the San Jose Project is scheduled to leave St. Thomas was dismissed today by the Commanding Officer Colonel Paul Smith who said that he had no official information to the effect, and indicated that the rumor is without foundation.

WEATHER FORECAST.

Partly cloudy with scattered early morning showers today tonight and Thursday.

Winds are moderate easterly.

NOON TODAY

Maximum Temperature 83
Minimum Temperature 71
Pressure Sea Level 30.64
Rainfall .03

APPENDIX C

SUMMARY OF THE SAN JOSE PROGRESS REPORTS

APPENDIX C

SUMMARY Of SAN JOSE PROJECT REPORTS

SJPRN	Time Covered	Status of Tests
61	1 Nov 47 to 31 Oct 48	No. 99: surveillance of VKL completed (in Panama). No. 89: surveillance of T3 125-pound bomb; ongoing.
62	1 Nov 48 to 30 Nov 48	No. 132: surveillance test of bomb, particulate, 4-pound, E-1; report distributed. No. 136: static firing of M70 bomb, HD-filled; phase I completed.
63	1 Dec 48 to 31 Dec 48	No. 136: static firing of M70 bomb, HD-filled; phases II through IV conducted. No. 135: surveillance of CK in M70, M78, and M79 bombs initiated.
64	1 Jan 49 to 31 Jan 49	No. 136: static firing of M70 bomb, HD-filled; phase V and VI conducted. No. 89: surveillance of 125-pound, T-3, H-filled bombs; ongoing.
65	1 feb 49 to 28 feb 49	No. 136: static firing of M70 bomb, HD-filled; phases VII and VIII conducted.
66	1 Mar 49 to 31 Mar 49	No tests conducted.
67	1 Apr 49 to 30 Apr 49	No. 135: surveillance of aged CK in M70, M78, and M79 bombs; ongoing.
68	1 May 49 to 31 May 49	No. 102: location of entrances to gasproof shelters; phase I initiated. Surveillance tests No. 89 and 135; ongoing.
69	1 June 49 to 30 June 49	No. 102: location of entrance to gasproof shelters; phase I complete. Surveillance tests No. 89 and 135; ongoing.
70	1 July 49 to 31 July 49	No. 176 static test of single E23 smoke pot, HD-filled; phase I complete.

71	1 Aug 49 to 31 Aug 49	No. 176: static test of single E23 smoke pot, HD-filled; all phases complete. No. 89: 125-pound, T-3, H/HD-filled; ongoing.
72	1 Sep 49 to 30 Sep 49	No. 166: static test in the open of a single E23 smoke pot, GA-filled; phase I complete. No. 102: location of entrances to gasproof shelters; phase II complete.
73	1 Oct 49 to 31 Oct 49	No. 166: static test of a single E23 smoke pot, GA-filled; phases II and III complete.
74	1 Nov 49 to 30 Nov 49	No. 166: static test of a single E23 smoke pot, GA-filled; phase IV complete. No. 168: static test of single smoke pot, GA-filled, on water with onshore winds; phases I, II, and III complete.
75	1 Dec 49 to 31 Dec 49	No. 168: static test of single E23 smoke pot, GA-filled, on water with onshore wind; phase IV complete.
76	1 Jan 50 to 31 Jan 50	No. 89: T-3 bomb; sampling complete.
77	1 Feb 50 to 28 Feb 50	No. 170: test of single E23 smoke pot, HQ-filled, functioned statically in open on land; phases I and II conducted.
78	1 Mar 50 to 31 Mar 50	No tests.
--	15 May 1950	Barge departed San Jose Island.

APPENDIX D

RECORD OF INTERVIEWS

Interview with Mr. Jimmie Mains, February 17, 1993.

Q. What was your rank and area of responsibility on Water Island?

A. Mr. Mains was a Toxic Gas Handler (MOS 383). He performed storage functions in a toxic gas yard on Water Island. Duties included arrangement of the storage area, transfer of agents from bulk containers to smaller containers for use in test operations, decontamination of contaminated areas, setting up toxic Chemical agent test facilities, and assisting laboratory personnel during and following such tests. In addition, Mr. Mains was responsible for the operation of the decontamination truck on Water Island and care of the test animals.

Q. How long and what years were you stationed on the U.S. Virgin Islands?

A. Mr. Mains joined the San Jose project in December 1947, two weeks before the contingent left San Jose Island and moved to Panama. Mr. Mains described the San Jose project in Panama where he was responsible for maintaining the munitions. The munitions were stored adjacent to the Chagres River. A guard station was set up at the cross road to Fort San Lorenzo. Chemical testing personnel stayed at Ft. Sherman and other personnel stayed at Ft. Clayton in Panama. Munitions were secured on Panama from January until May/June 1948 when the new test area was identified. No testing was conducted in Panama. Mr. Mains continued on to the Virgin Islands and he left the project in July 1950 after participating in the munition sea dump. During his tenure on the Virgin Islands, Mr. Mains was one of four military personnel who worked full time (40 hours per week) on Water Island. An office was set up adjacent to the toxic storage yard where the Water Isle Hotel is currently situated.

Q. To your knowledge, was there any chemical agent testing conducted on St. Thomas or was it all confined to Water Island? Describe any tests and the location.

A. Mr. Mains did not remember any testing conducted on St. Thomas. He remembered some details of the phosgene tests (which are recorded to have occurred on St. Thomas) but he could not remember the location.

Q. Were any chemical items stored on St. Thomas? If so, where?

A. No items were stored on St. Thomas. The only chemical agent work which occurred on St. Thomas was in the laboratory located near the finger piers in the old submarine base. Mr. Mains provided a photograph of the laboratory. The attached map of St. Thomas shows the location of the lab at that time. Mr. Mains believes that this building has been torn down since that time.

Q. Was there any chemical agent transfer operations conducted on St. Thomas? If so, where?

A. Not to his knowledge. Agent transfer operations were all conducted at the toxic storage yard on Water Island.

Q. Describe the support facilities on St. Thomas.

A. Two barracks were located on St. Thomas. Personnel were transported by boat to Water Island to support the testing. The laboratory to support the San Jose project was located on St. Thomas.

Q. Were any chemical items stored on Water Island? Were the items stored out in the open or in a building?

A. All chemical items were stored on Water Island near the road where the Water Isle Hotel is currently located. Bombs involved in the surveillance tests were stored outside. All other items were stored inside buildings. There office was located in close proximity to the toxic storage yard. The test animals were also stored in this area. Items in the storage yard were carefully maintained since the workers were in close proximity to this area. Valves were checked frequently and changed as required. No other leaks were identified in the chemical items. Transfer operations also occurred in this area. Vehicles to support the operation included a decon truck, 2 ½ ton truck and a 3 ¼ ton truck. These were the only vehicles on Water Island. The attached map of Water Island shows the location of the storage area and the office. Mr. Mains provided a photograph of the area on Water Island.

Q. Describe, as you remember, the tests which were conducted on Water Island.

A. Mr. Mains recalled the GA floating smoke pot tests and the phosgene tests. He described the floating smoke pots as a 5 gallon can which had smoke (HC) in the bottom half and GA floating on the top. Rows of pigeons and goats were placed in front of the smoke pots. The smoke pots were ignited and the dispersion pattern of the GA was recorded. Mr. Mains believed that all tests had occurred in close proximity to the Flamingo Bay dock. He believed that the GA smoke test that he had described had occurred in area 4 in the flat ground between the road and what used to be a fresh water pond (where the marina is currently located). Mr. Mains did not believe any tests had occurred on the North end of the island and had not been aware there had even been a road to that area. Tests were conducted downwind of the office area which would have placed them at the southern end of the island. Mr. Mains did not recall any mustard tests being conducted. He also did not recall a test where the smoke pots were functioned while on the water.

Q. What agents and munitions were involved in the testing?

A. Ton containers of phosgene were involved in the tests to determine how the gases penetrate gas proof shelters. Mr. Mains did not recall the location of these

tests. GA smoke pot tests occurred in area 4. Other agents stored on Water Island included GA filled German bombs, CK and AC filled bombs and NO2 filled containers.

Q. What was the disposal procedure for leaking munitions? Did it vary depending on agent? What was done with empty containers? Were they decontaminated and removed?

A. When a leaking munition/item was identified it was immediately repaired, i.e. valves were replaced, and the area was decontaminated as required. To his knowledge, no empty containers or agent filled containers were buried. The workers were very careful to insure there were no leaking containers or residual agent in the toxic storage yard since they understood the hazard and there office was located adjacent to this area.

Q. Describe cleanup procedures at the end of each test and at the end of the test mission on the Virgin Islands.

A. Standard practice during that era was to decontaminate and bury remnants from the tests. Mr. Mains could not recall if this was done on Water Island and he could not locate a possible burial site. Decontamination solutions that were used included soap and water, lime and DANC. He could not recall what happened to the dead goats and pigeons from the tests but suspected that they were placed in a pit, decontamination added and the items buried. Test areas were decontaminated after each test to insure that residual agent would not skew the results of follow-on tests. At the termination of the San Jose project all items, with the exception of excess burster charges, were removed from Water Island and either ocean dumped or sent back to the states for storage. At the end of the project, Mr. Mains was responsible for detonating excess burster charges. Hundreds of these items were detonated in area 4, between the road and the currently existing marina. Three boxes at a time were typically detonated. Mr. Mains was also involved in the sea dump of the chemical munitions. He provided a picture of the munitions on the barge being dumped.

Q. Describe the static firing procedures.

A. Mr Mains recalled that wires were connected to the items to remotely fire them. He believed they were electrically fired. If an item did not fire (it was a dud), they would check the connections and continue to work with the item until it was fired. To his knowledge, no duds were left behind or buried.

Q. Were chemically filled munitions fired from gun tubes, dropped from an aircraft, or fired as rockets? Were M23 landmines emplaced and then functioned by driving over them, etc?

A. Items were only statically fired. No landmines were involved in the tests.

Q. Were areas or equipment contaminated by spraying pure agent? If so, what was done with residual agent in spray tanks. Were any spray tanks jettisoned?

A. No spray tanks were involved in any tests. No areas were sprayed with agent.

Q. Were any variable time (radar fuzes) used to achieve air bursts?

A. There were no air bursts.

Q. Were any magnetic influence fuzes used with land mine testing?

A. There were no land mine tests.

Q. What decontaminating agent was used on site? What methods were used for neutralization?

A. A decon truck was situated in close proximity to each test. Soap and water, lime and DANC were the primary decontamination solutions.

Q. Were munitions shipped with the fill and explosive components or were they assembled on Water Island/St. Thomas? If not used, were the dissembled?

A. Munitions were shipped to Water Island without their explosives. Explosives were shipped separately. They were uploaded, as required, just before the tests.

Q. Why were numerous munitions and agents disposed of at sea? Were they not serviceable or too dangerous to transport?

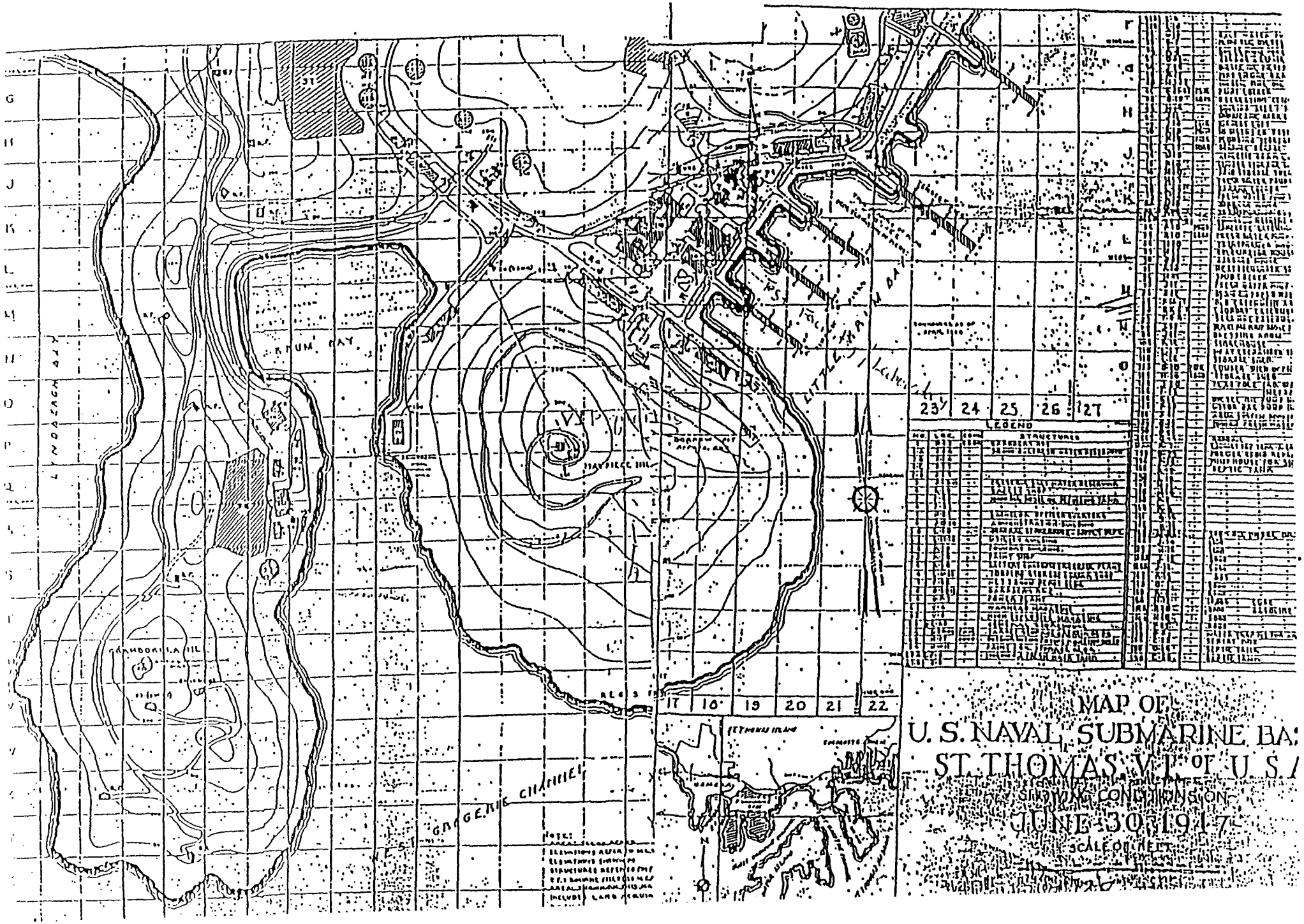
A. The munitions were in serviceable condition. They were dumped at sea because there was no longer any use for them and, similar to the problems we have today, they could not identify a site which would accept them.

Q. Were any WP filled munitions ever used?

A. No.

Q. Do you know how to get in contact with any one else who was involved in the San Jose project on the Virgin Islands?

A. Mr. Mains was the person who originally gave me Mr. Luke West and Mr. McAdory as additional personnel involved in the San Jose project. Both of these gentlemen have been contacted. In addition, he suggested we talk to Mr. George Murray and Dr. Spector from Fort McClellan. Although these men were not involved in the San Jose project, they have historical information on chemical testing in general. Mr. Mains also suggested that an ad be placed in the Army Echos, a publication for retired military, to identify additional contacts for the San Jose project.


LEGEND
MAP OF
U. S. NAVAL SUBMARINE BA
ST. THOMAS, V.I. OF U.S.A
JUNE 30 1917
SCALE OF FEET
LINDQUIST BAY
MAGAZINE HILL
GREGERIE CHANNEL
LITTLE HAM DA
23 24 25 26 27
17 18 19 20 21 22

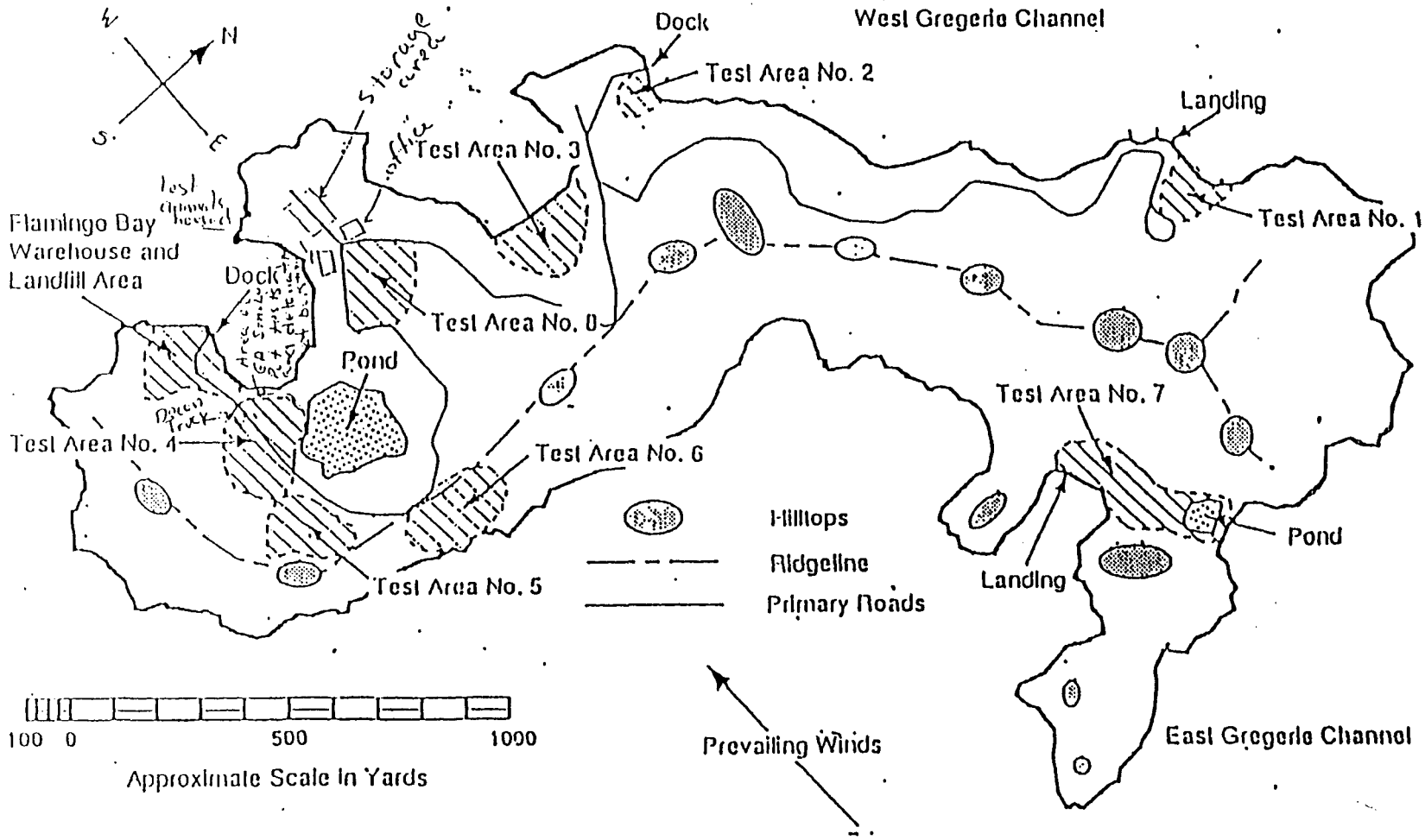


Figure 1

Water Island

SITE LOCATION MAP
WATER ISLAND, U.S.V.I.

FIGURE 1

Interview with Mr. Luke West, February 17, 1993

Q. What was your rank and area of responsibility on Water Island?

A. Mr. West was a Captain and a test officer during the San Jose Project. He was also a meteorologist and was responsible for photographing the test setups. Most of his involvement occurred on San Jose Island but he was involved in some tests on Water Island.

Q. How long and what years were you stationed on the U.S. Virgin Islands?

A. Mr. West joined the San Jose project during the testing on San Jose Island. When the contingent left San Jose Island and moved to Panama, Mr. West stayed behind in support of the reconnaissance mission. Mr. West continued on to the U.S. Virgin Islands and stayed until May 1949.

Q. To your knowledge, was there any chemical agent testing conducted on St. Thomas or was it all confined to Water Island? Describe any tests and the location.

A. Mr. West did not remember any testing conducted on St. Thomas.

Q. Were any chemical items stored on St. Thomas? If so, where?

A. No items were stored on St. Thomas.

Q. Was there any chemical agent transfer operations conducted on St. Thomas? If so, where?

A. Not to his knowledge.

Q. Were any chemical items stored on Water Island? Were the items stored out in the open or in a building? Locate the storage areas on the attached map.

A. All chemical items were stored on Water Island. Mr. West showed the location of this storage area on the map and it was near the road where the Water Isle Hotel is currently located. Some items were stored in buildings and some items were stored outside . All agent transfer operations occurred at the storage yard on Water Island and then the items were moved to the test area.

Q. Describe, as you remember, the tests which were conducted on Water Island. Locate the test area for each test on the attached maps.

A. Mr. West recalled the mustard M70 bomb tests and some GA tests that were conducted. Agent involved in these tests were dyed red or yellow to better identify the dispersion patterns. He remembered that they were conducted on the South

end of the island near the docks. He did not believe any tests had been conducted on the North end of the island due to the prevailing winds. He did remember that at one time there had been some plans to conduct tests at the North end of the island but he thought it had been limited to dropping bombs filled with simulant. These tests were never conducted.

Q. What agents and munitions were involved in the testing?

A. Mr. West remembered the tests with mustard filled M70 bombs and some GA tests. Other than that he could not recall many tests being conducted. Following tests on the San Jose Island, WWII had ended and there was not the same priority to complete these tests. For that reason, there was little testing conducted on Water Island. There were no arsenic compounds like lewisite involved in the tests or stored on Water Island.

Q. What was the disposal procedure for leaking munitions? Did it vary depending on agent? What was done with empty containers? Were they decontaminated and removed? Describe cleanup procedures at the end of each test and at the end of the test mission on the Virgin Islands.

A. Leaking munitions were repaired immediately. Items were not buried if they contained chemical agent. Following each test, the areas were decontaminated such that residual agent would not interfere with follow on tests. Remnants from tests were typically thrown in a pit, decontamination was added, a dirt cover was added, more decontamination solution was added and then dirt was used to fill the pit. Another method of disposal back in that era was to encapsulate the waste in concrete and ocean dump the waste. Mr. West could not recall if any of these practices were conducted on Water Island but he did feel fairly sure any thing buried was empty and would have been sufficiently decontaminated such that it would not present an environmental problem. Likewise he believed all items had been removed from the San Jose Island. During the testing on that island, unserviceable munitions were periodically taken out to sea and dumped. Pigeons and goats from the tests were burned in a pit on the San Jose Island. Mr. West was not sure how these test animals were disposed on Water Island. At the end of the project, all items were removed. Mr. West could not locate any potential burial sites either on the San Jose Island or Water Island.

Q. What decontamination agents were used on Water Island?

A. Mr. West recalled that lime, soap and water, and salt water were used to decontaminate GA. If there was gross contamination, DANC was used. If the contamination was on a vehicle, DANC was not used due to its highly corrosive nature.

Q. What happened to munitions which did not function (i.e., Duds).

A. If the item did not function, they would wait until they were sure it would not go off and then they would check the item, fix the problem and initiate the explosives again. The procedures in FM 5-25 were followed.

Q. Do you know how to get in contact with any one else who was involved in the San Jose project on the Virgin Islands?

A. Mr. West provided the name and address of Retired COL David Dick who was the Officer in Charge of the San Jose project toxic storage site when the toxics were moved from San Jose Island to Panama. In addition he gave some points of contact at Fort McClellan who had historical information on the San Jose project.

Interview conducted with Mr. Couter of Water Isle Hotels and Beach Clubs, January 14, 1993.

Question. Describe the events which occurred in 1966 when the two bombs were unearthed.

Answer. While excavating in the Flamingo Bay area, two metal bombs were unearthed. Because the area had been a salt pond, the soil has remained moist. The bombs surfaced when a draw line was being used during a "mucking" operation at an approximate 20 foot depth. The bombs could have been located anywhere above this depth. The bombs were the size of small butane tanks. Dimensions were estimated as 18 - 24 inches in diameter. Mr. Couter believed them to be 500 pound bombs. The Naval Ordnance Disposal Detachment at Roosevelt Roads was contacted and they removed the items from the site. Excavation in that area was discontinued.

Question. Was the concrete filled bomb located at the deep water dock one of the items uncovered at that time?

Answer. No. That bomb was washed up to shore during Hurricane Hugo. It was already concrete filled. It may have been filled by the army and used as an anchor during the San Jose project.

Question. Describe the use of the Flamingo Bay landfill area.

Answer. There was a salt pond in the Flamingo Bay area in the 1950's when the Island was first turned over to the Department of the Interior. Island residents used the salt pond as a dump area. Compacted vehicles and other trash were disposed in a single layer and covered with dirt fill. Subsequent layers of trash with a dirt cover were disposed of in this area until the salt pond was filled. The original salt pond was thought to have been about 10 feet deep. Trash was also burned in this area until 1982 when EPA regulations precluded open air burning. Mr. Couter recommended we obtain old aerial photographs which delineate the salt pond area such that we can determine where the buried trash would most likely be.

Question. What are the prospects for the Water Isle Hotel and Beach Club? Are there plans to re-open this hotel?

Answer. The Water Isle Hotel and Beach Club has not been repaired since it was damaged by Hurricane Hugo in 1989. Insurance money was collected to repair the damage. Plans are to repair the hotel once the lease issue has been resolved by the Department of the Interior. Mr. Couter said the required permits were applied for with the Government of the Virgin Islands but they have been denied. (According to other residents of the island and the Government of the Virgin Islands, this is not the case. The required permits have never been applied for.) Ninety employees were associated with the operation of the hotel. The Island residents are anxious for the Hotel to be repaired. When in operation, the hotel provided many services to the residents. These include a more regular ferry service to St. Thomas, a restaurant, and gasoline for the island vehicles.

Question. Describe the organization on Water Island. Is there some local entity which governs?

Answer. Water Island was leased in 1952 by the Department of the Interior to generate revenue for the Virgin Islands. The original agreement was a 40 year lease which ended in December 1992. Mr. Edward C. McArdle, owner of Water Isle Hotel and Beaches is the single major lease holder with the Department of the Interior. On the southern two thirds of the island, the major lease holder has subleased the island to individuals. On the northern third of the island, the major lease holder has subleased the land to the Sprat Bay Association which in turn subleased

further to individuals. These are two distinct areas of the island. The Sprat Bay area maintains its own roads and has its own private beaches. The main portion of the island sets a "tax" to the residents living in that area to maintain roads and provide other services. The Water Island Association assesses these taxes and they act as a committee to determine how the money should be spent. There is no means to enforce payment of the taxes levied so it is strictly voluntary. They estimate approximately 80% of the residents pay the required taxes. Mr. Couter described the Water Island Association as similar to a condominium association which has beautification committees and other committees to improve the standard of living for the residents.

Question. Several homes are under construction at this time. Is that normal?

Answer. There is increased construction right now because the people are concerned that unless they have a structure on the land they are leasing, they may not be offered the option to purchase the land.

Question. Describe utilities available on Water Island.

Answer. A reverse osmosis unit was used to supply water to the hotel when it was in operation. This unit was damaged during Hurricane Hugo and never repaired. The gun emplacement at the southern end of the island was sealed off and used to maintain the water supply for the hotel. The sealed off room is approximately 6 by 8 feet. Water was pumped to the gun emplacement building and gravity fed to the hotel. Individual homes have cisterns to catch rainwater. A sewage treatment plant to support the hotel was also damaged during Hurricane Hugo and never repaired. Individual homes use septic tanks for their sewage.

Question. Describe transportation to and from Water Island to include the ferry, other water access ways (to include the dock near Flamingo bay), helicopter landing pads, etc.

Answer. The ferry schedule was provided. It takes approximately 7 minutes to travel from Water Island to St. Thomas. There are approximately 5 round trips per day. Mr. Alex Donovan also operates the MV Saint. This barge is owned by the Hotel, but is used by the entire island to bring aggregate, construction and private vehicles to Water Island. The deep water dock is the only area where heavy equipment can be barged on island. The depth of the water at the deep water dock was 12 feet but since Hurricane Hugo it has been reduced to 8-10 feet. The ferry dock at the western center of the island is constructed of wood and cannot handle significant weight. There is a small area near the Marina area where helicopters have landed. It is not a paved area.

Question. Does the meteorology station still exist on Water Island?

Answer. It was destroyed during Hurricane Hugo.

Mr. Alex Donovan of Water Isle Hotels and Beach Clubs and a civilian on the San Jose Project.

Question. What was your position and area of responsibility during the San Jose Project?

Answer. I was a civilian on the San Jose project. My primary responsibility was to transport, by boat, military personnel from St. Thomas to Water Island.

Question. Do you know where the chemical items were stored to support the San Jose project?

Answer. Because of the dangerous nature of the items, they were scattered as much as possible. The majority of the items were stored on St. Thomas in the munition bunkers at the old Navy submarine base.

Question. Were there any storage areas on Water Island? Specifically were there any items stored out in the open to support the Surveillance tests?

Answer. I believe items were stored in an area which is currently used as a maintenance area to support the hotel. This area is just West and adjacent to the main hotel building. Goats and pigeons were also housed near where the hotel stands today. Scrap from the San Jose project was stored near the bunkers at test area 1. To his knowledge this did not include chemical agent munitions type waste.

Question. Did you transport any munitions to Water Island?

Answer. No. Chemical items were transported by military vessels. Mr. Donovan went on to say that he believed chemical agents were transferred to the munitions on St. Thomas near the WAPA building. He was not sure of the exact location but he suggested we talk to Mr. Osbourne Harvey, former chemist of the San Jose project. I indicated that I had been trying to get in contact with Mr. Harvey but had no success. Mr. Donovan said he thinks he may have passed away recently.

Question. Describe the tests which were conducted on Water Island.

Answer. The tests were secret and were not discussed by the military personnel on island.

Question. To your knowledge, was there any testing conducted on St. Thomas.

Answer. Not to my knowledge.

Question. Do you know how to get in contact with any one else who was involved in the San Jose Project on the Virgin Islands?

Answer. Edith Barns, a lawyer on St. Thomas, has a sister who was a civilian on the San Jose project. Other St. Thomas residence who were involved in the San Jose project include Greny Adams, previous Lt. Governor Henry Millens and a Mr. Morehead.

Interview with Ms. L.C. Keeler, President of Water Island Association, January 14, 1993.

Question. Describe the Water Island Association and the authority they have on Water Island.

Answer. The Water Island Association is comprised of elected officials. They levee taxes on the Water Island residents to maintain the roads and provide other services. They are voluntary taxes since there are no police on Water Island to enforce payment. Typically 80 percent of the taxes are paid. There are several committees to include finance, roads, beaches, coordination with the Virgin Island Government, lease hold resolution, safety, and noise (the airplanes flying to and from St Thomas fly over Water Island). They hold an association meeting annually. This years meeting is scheduled for January 23, 1993. They have requested a representative from the COE be present during the meeting.

Question. What are the residents feelings toward the Armys plans to investigate test areas from the San Jose project?

Answer. The residents primary concern is the lease issue right now. The land and structures have been assessed and the residents are concerned that the cost for the land is too high. In addition, areas on the island which are thought to be less desirable, have been assessed for a higher cost than the more desirable areas. The residents are interested in the Army plans on Water Island primarily because they are concerned it may delay turnover of the land to the residents. They want the Army to expedite their actions and are very interested in obtaining a schedule.

Question. What is the population on Water Island?

Answer. Ms. Keeler estimated during peak times there are approximately 200 residents on Water Island. About 50% of these people stay all year round. The peak population occurs in Mid January. The majority of the people are retired, however there is an ever increasing population of young people who work over on St. Thomas. There are a few residents that rent to tourists. This includes the Limestone Reef Terraces which has 10 rental units. There is also a bed and breakfast located on the island.

Question. What interface do you have with the Government of the Virgin Islands?

Answer. We are required to maintain our own roads. Very little services are provided from St. Thomas. Following Hurricane Hugo, electrical and telephone services were inoperative for several months. Emergency services are not provided by St. Thomas. Water Island is required to comply with Virgin Island regulations.

Question. Are there any other residents which we should talk to who were involved in the San Jose project.

Answer. Recommend you talk to Mr. Walter Phillips, the original lease holder in 1952 when the island was turned over to the Department of Interior.

At that time Ms. Keeler called Mr. Phillips and found that he was available. She accompanied me on the interview and subsequently provided a tour of the island.

Interview with Mr. Walter Phillips, original lease holder of Water Island, January 14, 1993.

Question. When did you first arrive on Water Island?

Answer. Mr. Phillips first came to Water Island in April/May of 1951. In 1951, he was requested to hire a watchman for the island because there was concerned that the island was being vandalized. In 1952, he and his wife carried cots on their backs to set up residence on Water Island.

Question. Were there any items left from the Army testing?

Answer. Not much. Most was cleared off the island. The Army is even looking in the wrong place if there were items left over. The area which was fenced off is not where items were left behind.

Question. Where should the Army be looking?

Answer. When we first arrived on Water Island, there were a few empty poison gas shells at the Flamingo Bay Warehouse Area. I don't know what happened to the empties. The navy was called in and they took them away. The army missed the area when they installed the fence. They should be looking closer to the shore. The Army should talk to Mr. George Perrot who was part of the Army Corp of Engineers at that time. He is currently a resident of St. Thomas. Very little testing was actually done on Water Island because the wind was so variable. Mr. Phillips does not expect the Army to find any thing and believes we are wasting a lot of money. Mr. Phillips went on to say he is very concerned about the lease situation. Apparently, he was involved in writing the lease in 1952 and it is now being interpreted differently from the original intent. He provided the attached draft letter to the Department of the Interior which vocalizes his concerns.

Telephonic interview with Mr. George Parrott, St. Thomas (809) 776-0236. January 25, 1993.

Question: What was your involvement during the testing on Water Island?

Answer: I was in the Signal Section of the Chemical Corp. I joined the Army in 1947 and was stationed in Panama and then I was transferred to St. Thomas. During that period I was a radio operator. I became upset a few months ago when I saw the reports in the newspaper about possible items left on Water Island after the testing. I even called Governor Ron DeLugo. Nothing was left unaccounted for. Everything was removed after the testing. Very little testing was done because the weather conditions were not right. Even during the operations in Panama, everything was removed after the testing was complete.

Question: Were you involved in the testing on Water Island?

Answer: No, but it was a very close nit organization and people talked. I was over on water island when the commander went over there because I was his radio operator. Many areas were restricted on Water Island.

Question: Where were the items stored?

Answer: The items were stored in the bunkers located in the subbase (near the WAPA building now) on St. Thomas.

Question: Were any items stored on Water Island.

Answer: Not to my knowledge.

Question: What activities besides storage occurred on St. Thomas?

Answer: There were no test activities. Pigeons, boa constrictors and goats were used on Water Island to test the effects of the agent. Once tests were completed, these animals were brought to the laboratory on St. Thomas.

Question: Do you know of anyone else who was involved in the testing.

Answer: No. Mr. Osbourne Harvey was the chemist on the job but he died three to four months ago. Most of the people who were involved in the project are now deceased.

APPENDIX E

TESTS PLANNED FOR THE SAN JOSE PROJECT ON THE U.S. VIRGIN ISLANDS

APPENDIX E

TESTS PLANNED FOR THE SAN JOSE PROJECT ON THE U.S. VIRGIN ISLANDS

89* Surveillance of bombs, chemical, 125-pound, T-3; H-filled and heresite-coated; and HD-filled, not coated.

92 Test on canisters M1 and M2 for collective protectors.

102* Location of entrances to gasproof shelters in relation to prevailing winds.

130 Static test of nine 4.2-inch chemical mortar shells, GA-filled, in the open.

132* Surveillance of bomb, particulate, 4-pound, E-1.

135* Surveillance of CK stored in M70, M78, and M79 bombs, and ton containers under tropical conditions.

136* Test of M70 bomb, HD-filled, in open and in area covered with vegetation, static fired, with onshore and offshore winds.

137 Test of M70 bomb, GA-filled, E46, static fired in open area.

138 Static test of nine German, 105-millimeter shell, GA-filled, in open.

139 Test of German 105-millimeter shell, GA-filled, fired from gun into open.

140 Static test of single German, 15-centimeter rocket, GA-filled, and nine German, 15-centimeter rockets in open.

141 Test of German, 15-centimeter rocket, GA-filled, fired from launcher into open.

142 Static test of nine German, 105-millimeter shells, GA-filled, in area covered by vegetation.

143 Test of German, 105-millimeter shell, GA-filled, fired from gun in area covered by vegetation.

144 Static test of German, 15-centimeter rocket, GA-filled, in area covered by vegetation.

145 Test of 15-centimeter rocket, GA-filled, fired in area covered by vegetation.

146 Test of 4.2-inch chemical mortar shell, GA-filled, fired into open area.

147 Test of 4.2-inch chemical mortar shells, GA-filled, fired statically in covered area (nine to be fired simultaneously).

148 Test of 4.2-inch chemical mortar shell, GA-filled, fired into area covered by vegetation.

149 Test of M33A1 spray tank, unthickened GA-filled, in open from low altitude.

150 Test of 125-pound chemical bomb, T3E2, GA-filled, with 35:1 burster ratio, dropped singly in open.

151 Test of 125-pound chemical bomb, T3E2, GA-filled, with 35:1 burster ratio, dropped in multiple into open area.

152 Test of single 125-pound chemical bomb, T3E2, GA-filled, with 35:1 burster ratio, fired statically in area covered by vegetation.

153 Test of 125-pound chemical bomb T3E2, GA-filled, with 35:1 burster ratio, dropped singly in covered area.

154 Test of 125-pound chemical bomb, T3E2, GA-filled, with 35:1 burster ratio, dropped in multiple into covered area.

155 Test of 125-pound T3 bomb, GA-filled, with burster modified as determined by Edgewood tests, dropped singly into open.

156 Test of 125-pound T3 bomb, GA-filled, with modified burster dropped in multiple into open.

157 Test of single 125-pound T3 bomb, GA-filled, with modified burster fired statically in area covered by vegetation.

158 Test of 125-pound, T3 bomb, GA-filled, with burster modified as determined by Edgewood test, dropped singly into covered area.

159 Test of 125-pound T3 bomb, GA-filled, with modified burster dropped in multiple into covered area.

160 Test of E45 chemical bomb, GA-filled, modified by Edgewood tests, dropped in open in small numbers.

161 Test of E45 chemical bomb, GA-filled, modified by Edgewood tests dropped in open in large numbers.

162 Test of modified E45 chemical bomb fired statically in area covered by vegetation (nine bombs to be fired simultaneously).

163 E45 modified, GA-filled, dropped in area covered by vegetation.

164 E45 modified, GA-filled, dropped into area covered by vegetation.

165 Test of E45 chemical bomb with various shaped charges, GA-filled, dropped in open in small numbers.

166* Test of single E23 smoke pot, GA-filled, functioned statically in area covered by vegetation.

167 Test of single E23 smoke pot, GA-filled, functioned statically in open.

168* Test of single E23 smoke pot, GA-filled, functioned statically on water with onshore wind.

169 Multiple test of E23 smoke pot, GA-filled, dropped from boat with onshore wind to simulate smoke.

170 Multiple test of E23 smoke pot, GA-filled, dropped from airplane with onshore wind to simulate smoke.

171 Test of 4.2-inch chemical mortar shell, GB-filled, fired statically in the open (nine to be fired simultaneously).

172 Test of 4.2-inch chemical mortar shell, GB-filled, fired from mortar into open.

173 Test of 125-pound, T3 bomb, GB-filled, with modified burster, dropped singly in open.

174 Test of E45 chemical bomb, GB-filled, with modified burster, dropped in small quantity in open.

175 Test of single E23 smoke pot, GB-filled, functioned statically in open on land.

176* Test of single E23 smoke pot, HD-filled, functioned statically in open on land.

177 Test of single E23 smoke pot, HT-filled, functioned statically in open on land.

178 Test of single E23 smoke pot, HN3-filled, functioned statically in open on land.

179* Test of single E23 smoke pot, HQ-filled, functioned statically in open on land.

180 Test of suit, protective, one piece, impermeable, E1R1, and related items under extreme heat load.

181 Test of gas casualty kit, treatment 1.

182 Test of agent first-aid kit.

183 Test of veterinary gas casualty outfit.

184 Operational scale test with German, KC 250 bombs, GA filled.

185 Test of single German, 250 kilogram, GA-filled bomb, fired statically in open under inversion or zero temperature gradient conditions.

186 Test of single German, 250-kilogram, GA-filled bomb, dropped into open and also into covered area under inversion or zero temperature gradient conditions.

* Tests actually conducted.

APPENDIX F

DIS-ESTABLISHMENT OF THE SAN JOSE PROJECT

7104

PLAN FOR DIS-ESTABLISHMENT OF THE SAN JOSE PROJECT 19 APR 1950

FEB 26 1959

TECHNICAL COMMAND

RYON

12 May 1950

MEMORANDUM TO: Chief, Technical Services Division
Chief, Munitions Division
Chief, Protective Division
Chief, Chemical Division
Chief, Engineering Division
Chief, Test Division

Reference memorandum from this office, dated 25 Apr 50, attached hereto are Annex A1, Plan B and Plan E, pertaining to the "Dis-Establishment of the San Jose Project", for your information and file.

E. H. Schwanke

Incls. 3

for W. R. CURRIE
Colonel, Cml C
Commanding

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CHEMICAL WARFARE LABORATORIES
ARMY CHEMICAL CENTER, MARY

PLAN FOR DIS-ESTABLISHMENT OF THE SAN JOSE PROJECT

SUMMARY OF THE PLAN

19 April 1950

1. Plans for the dis-establishment of the San Jose Project will be disseminated as occasion demands through the medium of published directives marked alphabetically. The inclosed Plan "A" entitled "Movement of Toxics from San Jose Project to the Zone of Interior" is the first such portion to be issued for implementation.

2. Recipients of the plans as published should retain the copies received for eventual incorporation in the final complete plan covering the entire operation.

3. Some plans will have as a portion thereof Annexes which will be numbered alphabetically to correspond to the basic plan itself.

4. All plans published will be appropriately authenticated.

5. Upon completion of the writing of the plan, an Index will be furnished to each addressee on the Distribution List, whereupon final security classification will be given to the over-all plan together with an appropriate cover sheet.

6. Any questions that may arise with regard to information disseminated in the subject plan will be directed to the Office of the Chief, Chemical Corps, San Jose Project Liaison Officer, Bldg. T-7, Washington 25, D. C., Telephone number REpublic 6700, Extension 4904.

E. C. WALLINGTON
Brigadier General
Deputy Chief, Chemical Corps

INDEX

TO

PLANS

PLAN FOR THE DIS-ESTABLISHMENT OF THE SAN JOSE PROJECT

PLAN	TITLE OF PLAN	PAGE NO.
"A"	Movement of Toxics from the San Jose Project to Zone of Interior	
"B"	Movement of Military Personnel and their Dependents	
"C"	Movement of Civilian Personnel and their Dependents	
"D"	Disposition and Movement of all Experimental Supplies and Equipment	
"E"	Movement and Disposition of all Field and Laboratory Test Equipment	
"F"	Movement and Disposition of Technical Library and Technical Files	

ASSIFIED AFTER 12 YEARS

DISPOSAL INSTRUCTIONS
FOR TOXIC MUNITIONS STORED AT
SAN JOSE PROJECT, ST. THOMAS, V. I.

1. The following munitions will be dumped at sea in accordance with existing Army Regulations and plan furnished:

Agent	Quantity Filled	Quantity Empty	Nomenclature	Remarks
GA	110		Bomb, Chemical 250 KG German	
		50	Do Do 100 lbs, M-47A2	
		238	Do Do 115 lbs, M-70	
		40	Do Do 125 lbs, T-3	
HT		4	Drum, Chemical, 500 lbs	
HQ		4	Do Do 500 lbs	
HN		4	Do Do 500 lbs	
GA	1842		Shell, 4.2 Cml Mortar, M2	
FS	6		Do Do	Lot REA-4891-4
HD	16		Do Do	
HQ	18		Do Do	
HT	34		Do Do	
HE		245	Do Do	Lot PC-5359-16
		222	Do Do	Lot PC-5477-9
CK	124		Bomb, Chemical, 115 lbs, M-70	
CK	29		Do Do 500 lbs, M-78	
CK	8		Do Do 1000 lbs, ANM-79	

2. The following munitions will be shipped to the Army Chemical Center, Maryland, Attention: Technical Command:

Agent	Quantity Filled	Quantity Empty	Nomenclature	Remarks
HD	168		Bomb, Chemical, 115 lbs, T-3	
H	66		Do Do 115 lbs, T-3	

3. The following munitions will be shipped to Midwest Chemical Depot, Baldwin, Arkansas:

Agent	Quantity Filled	Quantity Empty	Nomenclature	Remarks
CG	118	3	1 Ton Containers	
H	90		Do Do	
HD	4		Do Do	
CG	52		Bomb, Chemical, 1000 lbs. AN-M-79	

ANNEX "A" (Cont)

4. The following items will be shipped to Deseret Chemical Depot, St. Johns, Utah marked for attention of Dugway Proving Ground:

Agent	Quantity Filled	Quantity Empty	Nomenclature	Remarks
GA	3		1 Ton Containers	
GA	2		Do Do	Type E
NO2	5		Do Do	
Butane	117	14	Do Do	
GA	40		Bomb, Chemical, 125 lbs. E-52	
GA	479		Do Do 125 lbs. E-46	

PLAN "C"

MOVEMENT OF
CIVILIAN PERSONNEL AND THEIR DEPENDENTS

1. Civilian Personnel Branch, Personnel Division, OCCmlC has on file Form 57 applications from all continental employees of the San Jose Project. This information will assist this office in aiding in any way possible their out-placement.

2. This office furnished to the Overseas Affairs Branch, Office of Secretary of the Army, a complete list of the names, addresses, and position qualifications of all civilians who are to be released from the San Jose Project. This list will aid the Overseas Affairs Branch, Office of Secretary of the Army, in the possible placing of any San Jose continental civilian personnel in other overseas positions for which they may be qualified. A review has been made of this list by Camp Detrick and the Army Chemical Center in order that they may select certain of these people for consideration in connection with appointments to fill existing vacancies requiring skills possessed by the individuals concerned.

3. The Civilian Personnel Branch, Personnel Division, has furnished and will continue to furnish appropriate Civil Service examination announcements to the Personnel Officer, San Jose Project, in order that this information may be made available to those continental employees who may desire to re-open these examinations. If the person in question files for the examination announcement and qualifies for the Civil Service position, he will be placed on an appropriate Civil Service register in order to fill future vacancies as they occur in the Government service.

4. The Civilian Personnel Branch has made contact with other Department of the Army agencies with the view towards utilizing the skills of these employees to fill vacancies that may occur in the other technical services.

5. The Civilian Personnel Branch, Personnel Division, will make every continuing effort to find appropriate positions in the Government service at large for those continental employees now on the payrolls of the San Jose Project. In such cases of appropriate governmental placement, the Commanding Officer, San Jose Project will be notified of any action taken by the Civilian Personnel Branch, Personnel Division, OCCmlC in order that transfer may be effected.

6. Continental Civil Service employees should be encouraged to continue their efforts in obtaining transfers or re-assignments, on their own initiative. In such cases the Commanding Officer, San Jose

PLAN "C" (Cont'd.)

Project will release any civilian Civil Service employee whenever he finds such employment.

7. If the Commanding Officer of San Jose Project finds that he can no longer utilize the ability of any continental Civil Service employee, he may terminate the employment agreement and make arrangements for the transportation of family, household goods, and the employee to the Continent in accordance with CFR T3.7-4c.

8. OUTPLACEMENT OF NATIVE EMPLOYEES

a. In order to aid in every way possible, the placement of the native civilian employee of your installation, it is suggested that the Commanding Officer, the Civilian Personnel Officer, or the Public Relations Officer address civic groups, Chambers of Commerce, and contact the employment services on the island, to inform them of the number and types of employees who will be available for employment elsewhere because of the closing of San Jose Project, and to enlist their aid in the placement of these employees.

b. It is recommended that the Civilian Personnel Office maintain sufficient information so as to aid any prospective employers in locating the proper employees of San Jose Project to fill their needs.

9. REGULATORY PHASES OF CLOSING CIVILIAN PERSONNEL OFFICES

a. The Civilian Personnel Branch, Personnel Division, OCCmlC, has furnished the Commanding Officer, San Jose Project with all regulations which are readily available at this time to aid the Civilian Personnel Office in the regulatory phases of closing out civilian personnel and payroll records of this installation.

AUTHENTICATED: 25 April 1950

E. C. WALLINGTON
Brigadier General
Deputy Chief, Chemical Corps

Full concurrences have been obtained.

DISTRIBUTION:

CG, Army Chemical Center, ATTN: Technical Command	6
CO, Deseret Chemical Depot	6
CO, Midwest Chemical Depot	6
Chief, Safety Office	1

PLAN "C" (Cont'd.)

DISTRIBUTION: (Cont'd.)

Exec. Officer, S&F Div.	1	
Office of the Comptroller	3	
Chief, Liaison Br., R&E Div.	1	
Chief, R&E Div., ACC, Md.	5	
Exec. Sec., Plans & Policy Council	20	
Chief, S&F Div., ACC, Md.	5	
CO, San Jose Project, St. Thomas, V.I. ..	5	& Stencil
CO, Technical Escort Detachment	1	

ANNEX "B"

REASSIGNMENT OF MILITARY PERSONNEL
(FINAL TABULATION)

To Headquarters, Army Chemical Center, Md.

Rank	Name	ASN	Br.	MOS	DDALV
Maj.	Schnelzle, Cornelius M.	031547	Cml C	7314	45
Capt.	Smith, Alton K.	01036033	Cml C	4841	30
Capt.	Dellinger, Lawrence M.	01844651	Cml C	(To continue Comp. Tour)	30
Capt.	Turner, Ralph S.	01037345	Cml C	7314	30
1st Lt.	Elsaesser, Louis O.	027936	Cml C	7314	30
WOJG	Bell, Joseph	W906622	USA	2123	30
WOJG	Buck, Robert L.	W906644	USA	2123	45

To 2d Cml Mortar Bn., Army Chemical Center, Md.

1st Lt.	Jankowicz, Bruno J.	01536061	Cml C	1413	35

To Student Detachment, Cml Corps School, Army Chemical Center, Md.
(For the purpose of attending the 5th Advanced Course at the Chemical Corps School, reporting date 1 September 1950)

Capt.	Dannenberg, Donald	040798	Cml C	2700	30

To Headquarters, Western Chemical Center, Tooele, Utah

Maj.	Ponder, Speers G.	041995	Cml C	7314	30
	(Authorize TDY of approx. 35 days at Hq. Army Cml Center enroute)				
Maj.	Shartle, Harold F.	0489599	Cml C	7130	30
Capt.	Crandell, Norman H.	01036925	Cml C	7314	45
Capt.	Benham, Sperry S.	01037037	Cml C	7314	30
Capt.	Hillhouse, Douglas P. P.	01038401	Cml C	4930	45
1st Lt.	Chaffee, Leroy E.	01036903	Cml C	4500	30
1st Lt.	Hensley, Elmer C.	01995447	Cml C	4930	30
1st Lt.	Houser, Richard A.	01036573	Cml C	2520	15
CWO	Triden, Jack E.	W903938	USA	2600	40

To 7001st Area Service Unit, Hqs. MDW, Gravelly Point, Washington 25, D.C.

Maj.	Kittel, William (NME)	0235907	Cml C	7314	21

ANNEX "B" (Cont'd.)

Rank	Name	ASN	Br.	MOS	DDALV
	To Headquarters, Camp Detrick, Frederick, Maryland				
1st Lt.	Strough, William B.	056129	Cml C	7314	30
	To Headquarters, Pine Bluff Arsenal, Arsenal, Arkansas				
CWO	Smith, Frank H.	W02124361	USA	2200	45

AUTHENTICATED: 2 May 1950

E. C. WALLINGTON
Brigadier General
Deputy Chief, Chemical Corps

DISTRIBUTION:

CG, Army Chemical Center, ATTN: Technical Command	6
CO, Deseret Chemical Depot	6
CO, Midwest Chemical Depot	6
Chief, Safety Office	1
Exec. Officer, S&P Div.	1
Office of the Comptroller	3
Chief, Liaison Br., R&E Div.	1
Chief, R&E Div., ACC, Md.	5
Exec. Sec., Plans & Policy Council	20
Chief, S&P Div., ACC, Md.	5
CO, San Jose Project, St. Thomas, V. I.	5 & Stencil
CO, Technical Escort Detachment	1

ANNEX "B1"

REASSIGNMENT OF ENLISTED PERSONNEL
OF SAN JOSE PROJECT

To 9710 TSU, Army Chemical Center, Maryland

NAME	SERIAL NO.	GRADE	MOS
Bothwell, Donon I.	RA17 003 488	E-7	0152
Campbell, Max E.	RA13 034 517	E-7	0502
→ Davis, Frank W.	RA 6 123 775	E-7	0502
Pross, Ludwig	RA 6 710 302	E-7	0502
Knowlton, James C.	RA14 263 880	E-6	0070
Grice, Charles L.	RA33 561 741	E-5	0114
Hardin, Thomas H.	RA37 719 240	E-5	0268
Hagan, Jack	RA20 224 576	E-5	0824
Newman, J. T.	RA37 105 979	E-5	0965
Hutchinson, Fred H.	RA37 671 410	E-4	0017
Williams, Clarence L.	RA38 072 419	E-4	0017
Taylor, Higgins Jr.	RA37 397 034	E-4	0965
Lewins, Lester H.	RA46 043 875	E-3	0014
Puterbraugh, Howard M.	RA13 278 214	E-3	0014
Rudd, Arthur J.	RA12 116 511	E-3	0014
Feryo, Joseph	RA15 269 161	E-3	0017
Gillis, John G	RA16 248 293	E-3	0118
Huff, Deryl E.	RA18 334 680	E-3	0118
Rogers, Oscar E., Jr.	RA38 788 576	E-3	0118
Scrivener, Albert	RA16 260 676	E-3	0345
Tate, Freeman L.	RA14 249 969	E-3	0345
Thompson, Hubert G.	RA35 769 833	E-3	0345
Weathersby, Eugene B.	RA19 330 885	E-3	0477
Richards, William B., Jr.	RA11 179 241	E-2	0118
Troute, William	RA15 040 946	E-2	0345
Woolsey, Lloyd L.	RA19 294 667	E-2	0345

To 2d Chemical Mortar Battalion, Army Chemical Center, Maryland

Kropley, Louis R.	RA35 317 494	E-5	0861
Ganczewski, Edward M.	RA12 111 646	E-3	0522
McGregor, Eldon I.	RA13 217 794	E-2	0522
Cain, Jerry L.	RA57 420 085	E-3	0979
Downing, Buster J.	RA18 288 624	E-2	0979
Tillson, Edward G.	RA32 048 064	E-5	0861

To Technical Escort Detachment, Army Chemical Center, Maryland

Grady, Graham M.	RA14 074 221	E-4	0786
Freeman, Malcolm	RA14 268 749	E-3	0405

PLAN "B1" (Cont'd.)

To Detachment No. 1, Army Chemical Center, Maryland

NAME	SERIAL NO.	GRADE	MOS
Gutek, Joseph B.	RA32 186 766	E-4	0118
Fidler, Jack C.	RA16 320 286	E-3	0405

To Camp Detrick, Frederick, Maryland (9766 TSU)

Blankenship, Basil R.	RA37 219 674	E-6	0870
Burk, Frederick C.	RA 6 846 425	E-5	0786
Jeffrey, Clinton R.	RA48 066 677	E-3	0786

To 9713 TSU, Pine Bluff Arsenal, Arsenal, Arkansas

Manoogian, Hagop	RA31 296 794	E-4	0060
Mullikin, Gene S.	RA15 047 683	E-4	0060

To 12th Chemical Maintenance Company, Pine Bluff Arsenal, Arsenal, Arkansas

Garner, William D.	RA18 331 787	E-3	0060

To 9770 TSU, Western Chemical Center, Tooele, Utah

Scott, Cooper B.	RA20 444 260	E-7	0502
Boley, Wilbur G.	RA33 646 453	E-7	0821
Christofferson, Harley W.	RA36 213 867	E-7	0821
Ellis, Marcus D.	RA34 928 840	E-6	0014
Wells, Clayton G.	RA 6 854 684	E-6	0677
Tilley, Robert L.	RA18 029 320	E-6	0819
Duncan, Frederick H.	RA 6 387 900	E-6	0821
Plucker, Glenn W.	RA 7 030 531	E-6	0824
Kochert, Walter J.	RA39 248 211	E-6	0859
Crowe, John J., Jr.	RA 6 387 767	E-6	0870
McGehee, Eugene M.	RA38 503 727	E-6	0870
Rouse, Samuel J.	RA 6 842 414	E-6	0870
Myers, Donald R.	RA17 173 261	E-5	0502
Scott, Edward D.	RA 6 148 989	E-5	0502
Joseph, Howard	RA35 640 562	E-5	0667
Mims, James W.	RA14 141 362	E-5	0677
Sarkkinen, Melvin E.	RA36 832 379	E-5	0877
Maack, Robert A.	RA17 060 303	E-5	0821
Swope, Kenneth	RA43 056 421	E-5	0821
Marino, Vincent J.	RA37 051 017	E-5	0824
McDufford, Ernest P.	RA 6 986 840	E-5	0824
Watson, Charles E.	RA12 106 063	E-5	0965
Hawkins, Howard L.	RA17 008 826	E-4	0014
King, Charles D.	RA43 001 851	E-4	0014

Plan "B1" (Cont'd.)

To 9770 TSU, Western Chemical Center, Tooele, Utah - (Cont'd.)

NAME	SERIAL NO.	GRADE	MOS
Finfrock, Kenneth E	RA20 606 067	E-4	0017
Hadley, William C.	RA42 102 780	E-4	0050
Farrell, Anthony R.	RA11 181 038	E-4	0060
Plante, Edward L.	RA11 174 918	E-4	0078
Douglas, Clyde E.	RA 6 914 000	E-4	0098
Temple, Donnie D.	RA16 224 151	E-4	0309
Doris, Frank J.	RA33 792 487	E-4	0345
Herrin, George W.	RA44 035 168	E-4	0345
Coffell, Charles W.	RA38 208 823	E-4	0383
Rogers, Alvin E.	RA34 281 153	E-4	0383
Parrott, George C	RA13 229 412	E-4	0641
Johnson, Carthin V.	RA35 954 935	E-4	0667
Bray, Oscar H.	RA13 064 512	E-4	0677
Horvath, John G.	RA12 340 723	E-4	0677
Nichols, William F.	RA34 920 924	E-4	0677
Norton, Dennis F.	RA12 028 930	E-4	0677
Hanlon, Thomas J.	RA31 208 668	E-4	0776
Massingale, George	RA14 301 405	E-4	0776
Bowser, Carl R.	RA13 235 505	E-4	0870
Fletcher, Ivy	RA38 742 921	E-4	0870
Albert, Joseph M., Jr.	RA12 112 870	E-4	0903
Blackburn, Carl C.	RA15 227 061	E-4	0931
Hutchinson, Clifton M.	RA 6 148 832	E-4	0965
Denning, Louis W.	RA37 213 845	E-4	1017
Brych, Roy E.	RA16 049 809	E-3	0014
Hendry, Samuel A., Jr.	RA34 731 773	E-3	0014
McPherson, John P.	RA13 301 135	E-3	0060
Mikula, Floyd J.	RA 6 648 269	E-3	0062
Munson, Daniel J.	RA18 307 525	E-3	1979
Pettit, George W.	RA39 492 209	E-3	0097
Morris, John D.	RA15 250 765	E-3	0275
Schoedler, George W.	RA 6 779 908	E-3	0283
Allen, Raymond O.	RA18 330 545	E-3	0345
James, Jimmie	RA14 269 536	E-3	0345
Liberatore, Anthony J.	RA13 300 482	E-3	0345
Perkins, Charles C.	RA 6 560 933	E-3	0345
Garrity, Francis C.	RA33 972 266	E-3	0383
Tamplin, Harold L.	RA15 414 857	E-3	0383
Williams, Clarence L.	RA38 528 840	E-3	0383
Hardy, Oliver D.	RA34 919 864	E-3	0522
Young, Robert T.	RA35 692 357	E-3	0522
King, Ralph I., Jr.	RA14 316 896	E-3	0630
Head, William E.	RA31 149 001	E-3	0641
McNeal, Maurice A.	RA46 006 643	E-3	0641
Carver, Edgar E.	RA15 409 043	E-3	0677
Coliette, Lewis D.	RA14 276 020	E-3	0677

PLAN "B1" (Cont'd.)

To 9770 TSU, Western Chemical Center, Tooele, Utah - (Cont'd.)

NAME	SERIAL NO.	GRADE	MOS
Collins, Willie R.	RA44 103 051	E-3	0677
Hamilton, Paul R.	RA15 420 381	E-3	0677
Jordan, Nathan W. N.	RA17 238 548	E-3	0677
Keebler, Henry R.	RA34 926 346	E-3	0677
Labrie, Joseph A.	RA11 172 152	E-3	0677
Montagnoli, Gregory	RA32 361 213	E-3	0677
Oxendine, Albertus	RA14 008 956	E-3	0677
Shores, Unior L.	RA34 207 634	E-3	0677
Salek, Edward M.	RA33 603 845	E-3	0820
Powers, Robert	RA11 176 935	E-3	0926
Rockwell, Ned M.	RA17 248 162	E-3	0965
Burgess, Charles A.	RA45 047 331	E-3	0979
Drawdy, Ralph H.	RA14 269 507	E-3	0979
Krutsick, Stanley J.	RA13 282 365	E-3	0979
Stone, Clyde H.	RA44 091 328	E-3	0979
Swett, Elvin W.	RA14 250 741	E-3	0979
Rowen, Joseph W.	RA14 333 285	E-2	0055
Brown, Lee E.	RA15 250 935	E-2	0345
McCullough, Wilbur A.	RA13 230 346	E-2	0345
Deegan, William E.	RA12 313 385	E-2	0383
Parsons, Clent E.	RA35 655 684	E-2	0383
White, William	RA35 998 520	E-2	0383
Calnon, James M.	RA11 142 947	E-2	0677
Fournier, Norman R.	RA31 432 717	E-2	0677
Parcel, Ralph N.	RA16 276 108	E-2	0677
Weadon, Paul T.	RA13 120 971	E-2	0677
Hayes, David H.	RA33 630 948	E-2	0835
Sarver, John M.	RA15 198 318	E-2	0965
Shackford, Richmond I.	RA31 450 079	E-2	0966
Szarek, Felix J.	RA11 011 959	E-2	1729
Haydostian, Steven	RA11 182 372	E-2	4784

To 7th Chemical Depot Company, Western Chemical Center, Tooele, Utah

Huston, William R.	RA12 266 235	E-3	0931

AUTHENTICATED: 2 May 1950

E. C. WALLINGTON
Brigadier General
Deputy Chief, Chemical Corps

APPENDIX G

CHEMICAL AGENTS STORED ON WATER ISLAND

This appendix contains the preliminary CW Agent Database. This database will be updated as material is obtained and is expected to be used during the engineering of systems for the destruction of recovered CW materiel.

Chemical Agent Database Sources

Chemical Agent Data Sheets, Edgewood Arsenal Special Report, EO-SR-74001, Dec. 1974.

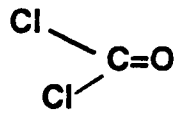
Explosive Ordnance Disposal Procedures, Army Field Manual 9-15.

Chemical Agent and Munition Disposal - Summary of the U.S. Army's Experience, Chemical Stockpile Disposal Program, Report No. SAPEO-CDE-15-87005, 21 Sep. 1987.

Potential Military Chemical/Biological Agents and Compounds - Army Field Manual 3-9 , 3-9, Navy Publication P-467, Air Force Manual 355-7, Dec. 1990.

Agent: CG, Phosgene

Chemical Name: Carbonyl chloride; phosgene
Chemical Formula: CCl_2O
Chemical Structure:



Physical Properties:

Molecular Weight: 98.92
Physical State: Colorless gas at room temperature.
Vapor Density, relative to air: 3.4
Liquid Density: 1.37 g/ml @ 20°C
Solid Density: N/A
Normal Freezing Point: -128°C
Boiling Point: 7.6°C
Vapor Pressure: 1,400 mm Hg @ 25°C; 1,173 mm Hg @ 20°C
Volatility: 4,300,00 mg/m^3 @ 7.6°C.
Viscosity: 0.27 centistokes @ 0°C
Solubility: Very slight solubility in H_2O with decomposition. Very soluble with almost all organic solvents, i.e. benzene, toluene. Unstable in some.
Heat of Combustion: 41.8 kcal/mole
Latent Heat of Vaporization: 59 cal/g
Latent Heat of Fusion: ?
Special Properties: Decomposes @ 800°C.
Flash Point: Does not flash.

General Information:

DOT Classification: Poison A
Corrosivity: No applicable corrosion in steel after 1 year @ 20°C. Not corrosive when dry.
Decontaminants: Water followed by DS2 or by 10% solution of caustic soda or sodium carbonate.
Stabilizers Commonly Used: Stabilize when dry.

Agent: CG (continued)

Reactions (Combustion, hydrolysis, pyrolysis, etc.):

Combustion:

$$CCl_2O + 1/2\ O_2 \rightarrow CO_2 + Cl_2$$

Hydrolysis:

$$CCl_2O + \underset{\text{acid}}{H_2O} \rightarrow 2\ HCl + CO_2$$

$$CCl_2O + \underset{4NaOH}{H_2O} \rightarrow 2NaCl + Na_2CO_3 + 2H_2O$$

$t_{1/2}$ = 0.25 seconds @ 13°C. No pH given.

Ordnance Configurations (Bombs, mortars, rockets, etc.):

4.2-in. Mortar, M2	6.3 lb CG	0.16 oz	explosives
500 lb Bomb, AN-M76	205.1 lb CG	2.3 lb	explosives
1,000 lb Bomb, AN-M79	414.7 lb CG	3.9 lb	explosives

Agent: CK

Chemical Name: Cyanogen chloride
Chemical Formula: CClN
Chemical Structure:

Cl-C≡N

Physical Properties:

Molecular Weight: 61.48
Physical State: Colorless gas or liquid.
Vapor Density, relative to air: 2.0
Liquid Density: 1.20 g/ml @ 10°C
Solid Density: N/A
Normal Freezing Point: -6.9°C
Boiling Point: 12.8°C
Vapor Pressure: 1,000 mm Hg @ 25°C
Volatility: 2,600,00 mg/m^3 @ 12.9°C.
Viscosity: N/A
Solubility: 6.9g/100g H_2O @ 20° C; will polymerize. Completely miscible with almost all common organic solvents, i.e. ether, alcohol. Many resulting mixtures are unstable.
Heat of Combustion: ?
Latent Heat of Vaporization: 103 cal/g. This is sufficiently high to provide a satisfactory pancaking effect.
Latent Heat of Fusion: 41.8 cal/g
Special Properties: Will polymerize in H_2O. Decomposes above 100°C. CK will stand for 30 days @ 65°C without excessive decomposition; polymerizes between 40 and 60 days to form $(CNCl)_3$, a solid. May explode.
Flash Point: Does not flash

General Information:

DOT Classification: Poison A
Corrosivity: No action on metals when stabilized. Attacks many common metals when stored unstabilized. Will polymerize. May explode.
Decontaminants: Aeration. NaOH solution or DS2.
Stabilizers Commonly Used: Lab sample - 5% anhydrous, powdered sodium pyrophosphate; propylene oxide; arsenic trichloride.

Agent: CK (continued)

Reactions (Combustion, hydrolysis, pyrolysis, etc.):

Combustion:

Not available

Hydrolysis:

$$CClN \xrightarrow[acid]{+H_2O} HCl + HOCN$$

pH 6.6-7.06 $t_{1/2}$ = 1.6 hr. @ 25°C
pH 4-6 $t_{1/2}$ = 58 hr. @ 40°C

$$CClN \xrightarrow[2NaOH]{+H_2O} NaCl + NaCNO + 2H_2O$$

pH 8 $t_{1/2}$ = 18 hr. @ room temperature
pH 7 $t_{1/2}$ = 180 hr. (tap water) @ room temperature

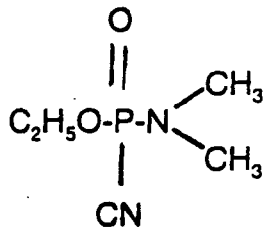
Ordnance Configurations (Bombs, mortars, rockets, etc.):

500 lb bomb, AN-M78	176.5 lb CK	2.3 lb explosives
1,000 lb bomb, AN-M79	414.7 lb CK	3.9 lb explosives

Stabilizers Commonly Used:

Agent: GA

Chemical Name: Ethyl N,N-dimethylphosphoramidocyanidate; Tabun
Chemical Formula: $C_5H_{11}N_2O_2P$
Chemical Structure:



Physical Properties:

Molecular Weight: 162.1
Physical State: Colorless to brown liquid.
Vapor Density, relative to air: 5.63
Liquid Density: 1.08 g/ml @ 25°C
Solid Density: N/A
Normal Freezing Point: -50°C
Boiling Point: 245°C
Vapor Pressure: 0.07 mm Hg @ 25°C
Volatility: 610 mg/m^3 @ 25°C.
Viscosity: 2.18 centistokes @ 25°C
Solubility: 9.8g/100g H_2O @ 25°C. 7.2g/100g H_2O @ 20°C. Readily soluble in most common organic solvents.
Heat of Combustion: 877 kcal/mole
Latent Heat of Vaporization: 79.6 cal/g @ 25°C
Latent Heat of Fusion: ?
Special Properties: Decomposes within 6 months @ 60°C. Complete decomposition in 3.25 hours at 150°C.
Flash Point: 78°C

General Information:

DOT Classification: Poison A
Corrosivity:

25	1/2HAl	$6.4x10^{-5}$in./yr.
35	1/2HAl	$0.4x10^{-5}$in./yr.
525	1/2HAl	$6.8x10^{-5}$in./yr.
615	TAl	$5.2x10^{-5}$in./yr.

Agent: GA (continued)

Decontaminants: 5-10% aqueous caustic. Bleach slurry, dilute alkali or solutions of DS2. In confined area-steam and ammonia, hot soapy water. May react to form cyanogen chloride in bleach slurry.
Stabilizers Commonly Used: None

Reactions (Combustion, hydrolysis, pyrolysis, etc.):

Combustion:

May produce HCN. Normal combustion products are CO_2, H_2O, NO_2, P_2O_5

Hydrolysis:

$C_5H_{11}N_2O_2P + H_2O \rightarrow C_3H_6NO_3P + HN(CH_3)_2$

$C_5H_{11}N_2O_2P + H_2O \rightarrow C_2H_6NO_3N(CH_3)_2 + HCN$

Acidic Hydrolysis: pH 7 $t_{1/2}$ = 8.5 hr. @ 20°C

pH 4-5 $t_{1/2}$ = 7 hr. @ 20°C

Basic Hydrolysis: Easily hydrolyzed in alkaline solutions; hydrolysis catalyzed by phosphate.

Ordnance Configurations (Bombs, mortars, rockets, etc.):

Agent: H, Levinstein Mustard

Chemical Name: 70% bis(2-chloroethyl)sulfide 30% higher MW polysulfides
Chemical Formula: $C_4H_8Cl_2S$
Chemical Structure:

$Cl\text{-}CH_2\text{-}CH_2\text{-}S\text{-}CH_2\text{-}CH_2\text{-}Cl$ (pure mustard)

Physical Properties

Molecular Weight: 159.08 (pure mustard)
Physical State: Amber to dark brown liquid
Vapor Density, relative to air: Generally exceeds 5.5
Liquid Density: 1.27 g/ml @ 25°C
Solid Density: N/A
Normal Freezing Point: 8°C
Boiling Point: Decomposes around 180°C
Vapor Pressure: Impurities tend to lower vapor pressure below 0.11 torr
Volatility: Approximately 920 mg/m^3 @ 25°C (reported for HD)
Viscosity: 3.95 centistokes at 25°C (HD)
Solubility: 0.092 g/100g H_2O at 22°C. Completely soluble in acetone, CCl_4, CH_3Cl, tetrachloroethane, ethylbenzoate, ether. Completely soluble in 92.5% ethanol above 28.6°C. Organics best solvent.
Heat of Combustion: 4500 cal/g
Latent Heat of Vaporization: 94 cal/g
Latent Heat of Fusion: 26.5 cal/g
Special Properties:
Flash Point: 105°C

General Information

DOT Classification: Poison A
Corrosivity: Brass rapidly corroded; cast iron poor
Decontaminants: Bleaching powder, DANC, DS2, sodium hypochlorite.
Stabilizers Commonly Used: Can be stabilized with acridine or naphthoquinoline.

Agent: H, Levinstein Mustard

Reactions(Combustion, hydrolysis, pyrolysis,etc)

Combustion

$C_4H_8Cl_2S + 7O_2 \rightarrow 4CO_2 + Cl_2 + 2H_2O + H_2SO_4 + 2HCl$

Hydrolysis

$C_4H_8Cl_2S + 2H_2O \rightarrow^{acid} (HOCH_2CH_2)_2S + 2HCl$ $t_{1/2}$= 5 min at 22°C; pH= unknown

$C_4H_8Cl_2S + H_2O \rightarrow^{base} (HOCH_2CH_2)_2S + 2Cl^-$ Rate unknown

Ordnance Configurations (Bombs, mortars, rockets, etc.)

M104 11.7 lb H	0.41 lb Tetrytol burster	No fuze
M110 11.7 lb H	0.41 lb Tetrytol burster	No fuze
Ton Container	1,700 lb H	

Agent: HD Distilled Mustard

Chemical Name: Diethyl,2,2-dichloride sulfide
Chemical Formula: $C_4H_8Cl_2S$
Chemical Structure:

$Cl\text{-}CH_2\text{-}CH_2\text{-}S\text{-}CH_2\text{-}CH_2\text{-}Cl$

Physical Properties

Molecular Weight: 159.08
Physical State: Pale yellow liquid
Vapor Density, relative to air: 5.5
Liquid Density: 1.27 g/ml at 25°C
Solid Density: Crystal - 1.37 g/cm^3 at 0°C
Normal Freezing Point: 14.45°C
Boiling Point: 217°C extrapolated
Vapor Pressure: 0.11 mmHg at 25°C
Volatility: 610 mg/m^3 at 20°C; 920 ms/m^3 @ 25°C
Flash Point: 105°C. Low enough to cause occasional ignition if explosive charges in the shell are too great
Viscosity: 3.95 centistokes at 25°C
Color: Yellow
Odor: Garlic-like
Solubility: 0.092g/100g H_2O at 22C. Completely soluble in acetone, CCl_4, CH_3Cl, tetrachloroethane, ethyl benzoate, ether. completely soluble in 92.5% ethanol above 28.6C. Best in organic solvents.
Heat of Combustion: 756.03 kcal/mol
Latent Heat of Vaporization: 94 cal/g
Latent Heat of Fusion: 26.5 cal/g
Special Properties:

General Information

DOT Classification: Poison A
Corrosivity: Brass rapidly corroded at 65C. 0.0001 inches/month at 65C on steel.
Decontaminants: Bleacher powder, DANC, DS2, sodium hypochlorite, fire
Stabilizers Commonly Used: Can be stabilized with acridine or naphthoquinoline

Agent: HD Distilled Mustard

Reactions (Combustion, hydrolysis, pyrolysis, etc.)

Combustion

$$2C_4H_8Cl_2S + 29O_2 \rightarrow 8CO_2 + Cl_2 + 5H_2O + 2H_2SO_4 + 2HCl$$

Hydrolysis

$$C_4H_8Cl_2S + 2H_2O \xrightarrow{acid} (HOCH_2CH_2)_2S + 2HCl \quad t_{1/2}= 5 \text{ min at } 22C; \text{ pH= unknown}$$

$$C_4H_8Cl_2S + H_2O \xrightarrow{base} (HOCH_2CH_2)_2S + 2Cl^- \quad \text{Rate unknown}$$

Ordnance Configurations (Bombs, mortars, rockets, etc.)

105 mm How, M60/HD	3.0 lb HD	0.3 lb	Tetrytol burster	M51A5 fuze
4.2" mortar	6.0 lb HD	0.14 lb	Tetrytol burster	M8, M51A5
Ton Container	1,700 lb HD			
155 mm How,	9.7 lb HD	10.2 lb	explosives	
155 mm How,	11.7 lb HD	0.83 lb	explosives	
1-Gal Land Mine	9.9 lb HD	0.1 lb	explosives	
155 lb Bomb, M70A1	60 lb HD	0.46 lb	explosives	

How = Howitzer

Agent: HQ

Chemical Name: Mixture of mustard and sesquimustard
Q(24%): 1,2-bis(2-chloroethylmercapto)ethane
H(76%): bis(2-chloroethyl)sulfide

Physical Properties

Molecular Weight:
Physical State: liquid
Vapor Density, relative to air:
Liquid Density:
Solid Density:
Normal Freezing Point: The freezing point of eutectic mixtures of H with pure Q (68/32) is 4.5 C
Boiling Point: 353 C (calc)
Vapor Pressure:
Volatility: Less than H. .0004 mg/l 25 C
Viscosity:
Solubility:
Heat of Combustion:
Latent Heat of Vaporization:
Latent Heat of Fusion:
Special Properties: The nonvolatile vesicant Q, in mixture with H, can provide a contamination of ground and materiel which would remain a potential contact hazard (but not a vapor hazard) for days under meteorological conditions where H would persist for a number of hours. In contact with the bare skin , Q is a more powerful vesicant.

Flash Point:

General Information

DOT Classification:
Corrosivity:
Decontaminants:
Stabilizers Commonly Used:

Agent: HQ

Reactions (Combustion, hydrolysis, pyrolysis, etc.)

Combustion

Hydrolysis

Ordnance Configurations (Bombs, mortars, rockets, etc.)



Agent: HT(60wt%HO and wt%T)

Chemical Name: 60% Bis(2-chloroethyl)sulfide; 40% Bis[2(2-chloroethylthio)ethyl] ether
Chemical Formula: $HDC_4H_8Cl_2S$ and $T\text{-}C_8H_{16}Cl_2OS_2$
Chemical Structure: T

$(ClCH_2CH_2SCH_2CH_2)_2O$

Physical Properties

Molecular Weight: HD - 159.08 T- 263.3 (189.4 average)
Physical State: Viscous liquid, clear to pale yellow
Vapor Density, relative to air: 6.92
Liquid Density: 1.269 g/ml @ 25°C
Solid Density: N/A
Normal Freezing Point: 0 to 1.3°C for 60/40 mixture
Boiling Point: Above 228°C. Not constant. H fraction is removed by distillation.
Vapor Pressure: 0.104 mm Hg @ 25°C
Volatility: 831 mg/m^3 @ 25°C
Viscosity: 6.05 centistokes @ 20°C
Solubility: Practically insoluble in H_2O. Soluble in most organic solvents.
Heat of Combustion: 5240 cal/g for 20 year old samples.
Latent Heat of Vaporization: No data. HD is more volatile than T. It boils off and the composition of the mixture changes.
Latent Heat of Fusion: ?
Special Properties: Decomposes 165° to 185°C.
Flash Point: About 100°C

General Information

DOT Classification: Poison A
Corrosivity: Pressure develops in steel.
Decontaminants: Bleach, DANC solution, D52 solution.
Stabilizers Commonly Used: ?

Agent: HT

***Reactions* (Combustion, hydrolysis, pyrolysis, etc.)**

Combustion

See data on HD.

Hydrolysis

See data on HD.

Ordnance Configurations(Bombs, mortars, rockets,etc)

Ton Container 1,700 lb HT

M2Al (4.2 in Mortar) 5.8 lb HT 0.14lb Tetryl burster M8 fuze

7246016 POLYSCIENCES INC 30C 00272 CHW-7/-25

POLYSCIENCES, INC.
MATERIAL SAFETY DATA SHEET

Approved by the U.S. Department of Labor as "Essentially Similar" to Form LSB-005-41

FOR HAZARDOUS PRODUCTS USED IN PLACES OF EMPLOYMENT

SECTION I NAME AND PRODUCT

Chemical Name, Trade Name, Synonyms	Cat. No.
CYANURIC CHLORIDE	01830

FORMULA

$C_3Cl_3N_3$

MANUFACTURER: *POLYSCIENCES, INC.*	PHONE NUMBER: *(215)D13-6484*
STREET ADDRESS: *PAUL VALLEY INDUSTRIAL PARK*	DATE: 1/82
CITY, STATE, ZIP CODE: *WARRINGTON, PA. 18976*	

SECTION II INGREDIENTS	%	TLV UNITS

SECTION III PHYSICAL DATA

BOILING POINT	190°C/295°F	% VOLATILE BY VOLUME	
VAPOR PRESSURE	2.7 mbar at 70°C/158°F	COLOR AND ODOR	white/yellowish pungent odo
VAPOR DENSITY	1.32g/ml	PHYSICAL STATE	solid.
SOLUBILITY IN WATER	Insoluble in cold water Very soluble in hot or warm water.	MELTING POINT	146°C/295°F

SECTION IV EXPLOSION AND FIRE HAZARD DATA

FLASH POINT	FLAMMABLE LIMITS	
Not combustible	LEL	UEL

EXTINGUISHING MEDIA
Use foam or dry powder type extingers. Do not use water to fight fire.

SPECIAL FIRE FIGHTING PROCEDURES

UNUSUAL FIRE AND EXPLOSION HAZARDS

PROBLEM HARD COPY

SECTION V HEALTH HAZARD DATA

THRESHOLD LIMIT VALUE

EFFECTS OF OVEREXPOSURE Strong irritant effect on skin, eyes respiratory tract and gastointestinal tract after contact, inhalation or ingestion. Intensive skin contact leads to contact dermatitis due to chemical burn.

EMERGENCY AND FIRST AID PROCEDURES See page 3.

SECTION VI REACTIVITY DATA

STABILITY	**UNSTABLE**		**CONDITIONS TO AVOID**
	STABLE		

INCOMPATABILITY *(Materials to avoid)*

HAZARDOUS DECOMPOSITION PRODUCTS

HAZARDOUS POLYMERIZATION	**MAY OCCUR**		**CONDITIONS TO AVOID**
	WILL NOT		

SECTION VII SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED

WASTE DISPOSAL METHOD Put material in a container which can be tightly sealed. Wash away remaining material with large amounts of water. If not recyclable, dispose of in accordance with local state and federal regulations.

SECTION VIII SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION *(Specify type)*

Ventilation	**LOCAL EXHAUST**	**SPECIAL**
	MECHANICAL *(General)*	**OTHER**

PROTECTIVE GLOVES	**EYE PROTECTION**

OTHER PROTECTIVE EQUIPMENT

SECTION IX SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING & STORING

Keep tightly sealed in a cool, dry place (under 20°C/70°F).

Wear full protective clothing and protective breathing equipment when handling.

OTHER PRECAUTIONS

Do not allow material to contaminate water sources, sewers or soil.

PROBLEM HARD COPY

POLYSCIENCES, INC. - MATERIAL SAFETY DATA SHEET

CYANURIC CHLORIDE Cat. No. 01830

Section V (continued)

EMERGENCY AND FIRST AID PROCEDURES:

EYES: Immediately rinse with plenty of water for several minutes and apply a neutral eye salve. If badly irritated, Call a physician.

SKIN: Wash affected skin with plenty of water. Apply a soothing salve to irritated or burned skin. Call a physician.

INGESTION: Call a physician.

INHALATION: If dust is inhaled, give patient 5% solution of sodium bicarbonate to inhale. Repeat several times for 15 minutes intervals every half hour. If irritating cough occurs, call a physician.

CLOTHING: Remove contaminated clothing immediately and wash affected skin with plenty of water. Hang contaminated clothing in the fresh air.

ENCLOSED AREAS: Provide mechanical ventilation. Use full protective clothing and protective breathing equipment.

APPENDIX H

CHEMICAL MUNITIONS STORED ON WATER ISLAND

Munitions Specification Package for Former Fort Segarra

The following pages present the munitions specification packages for those chemical warfare items associated with the operation of Former Fort Segarra (FFS). CWM is divided in this package by those items involved in tests on the US Virgin Islands versus those additional items removed from Water Island during the dis-establishment of the San Jose project.

- CWM involved in tests
  - US Type Classified Items
    - M70 115lb aerial bomb
    - M78 500lb aerial bomb
    - M79 1,000lb aerial bomb
  - US Experimental Items
    - T3 and T3E2 125lb aerial bomb
    - E23 Oil Floating Smoke Pot

- CWM removed from the US Virgin Islands
  - US Type Classified Items
    - M47A2 100lb aerial bomb
    - M2 and M2A1 4.2inch mortar
  - US Experimental Items
    - E46 115lb aerial bomb
    - E52 125lb aerial bomb
  - Foreign Items (German)
    - 250kg aerial bomb

NOMENCLATURE: 115 lb Chemical Bomb (Gas), M70A1

TABULATED DATA:

Length: 51.5 inches including nose fuze and tail fin assembly

Diameter: 8 inches

Fin Span: 11 inches

Type Fill and Fill Weight:

Mustard (H): 60 lbs (10% void)
Distilled Mustard (HD): 61.75 lbs (5% void)
Tabun (GA): Unknown
Cyanogen chloride (CK): Unknown

Total Weight with Fill:

H Filled: 145.49 lbs
HD Filled: 147.14 lbs

Markings:

Two green bands on central portion of bomb with gray background

Description:

The M70A1 bomb is an aerial bomb that is fin stabilized and cylindrical in shape with an ogive nose and conical tail section. The bomb is equipped with a burster well running axially the entire length of the bomb and forms the press fit closure for the filling aperture which is at the nose or ogive of the bomb. The burster well is also threaded to facilitate the installation of the nose fuze after the burster has been inserted into the burster well.

Explosive Train:

The explosive train consists of:

(1) Nose Fuze: AN-M158
(2) Burster: M10

The quantity of each explosive component is unknown.

ENGINEERING DATA:

Construction:

Main Body:	Seamless steel tubing
Fin Assembly:	AN-M102A1, 5.6 lbs
Wall Thickness:	0.125 inches to 0.244 inches

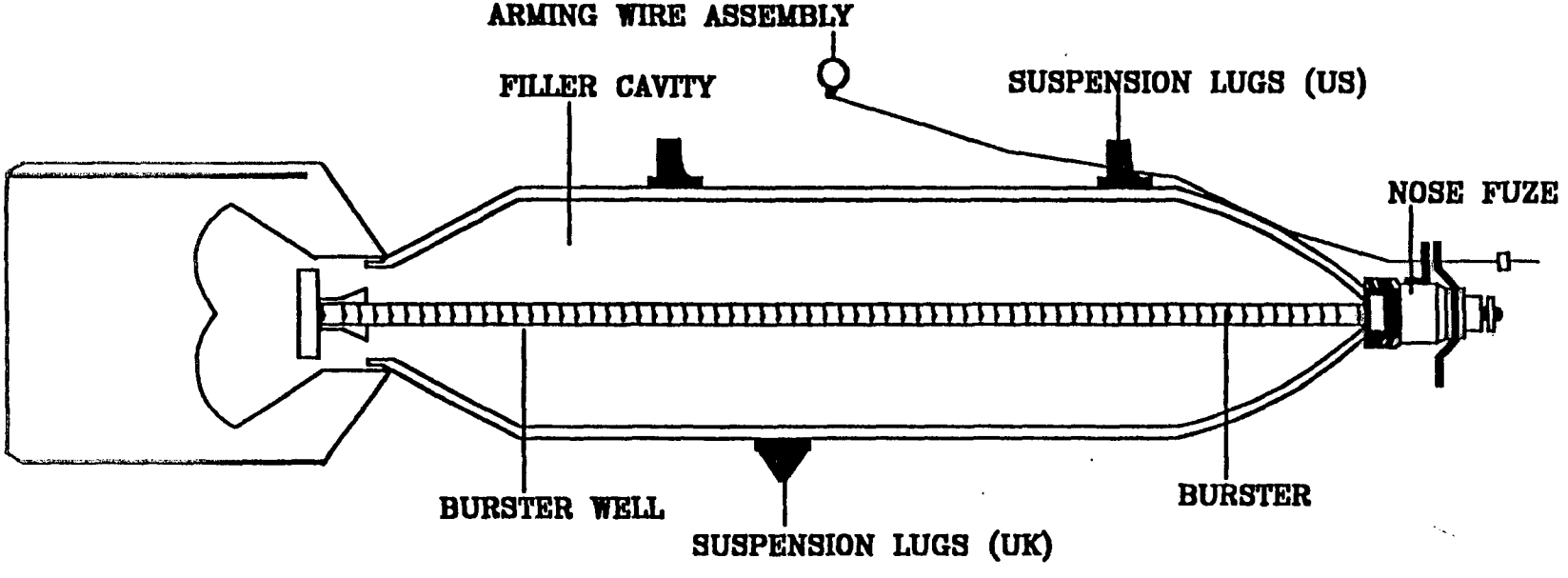
REFERENCES:

1. Gregg, Arthur B.,1st LT, Cml. C. and Bertrand C. Kriete, 1st LT,Cml. C., Technical Division Memorandum Report No. 1277, Preliminary Tests of the 125-LB Chemical Bomb, T3, 5 November 1946.

2. Chief of the Bureau of Naval Weapons, Aircraft Bombs, Fuzes, and Associated Components, NAVWEPS OP 2216 (Volume 1), 1 August 1960.

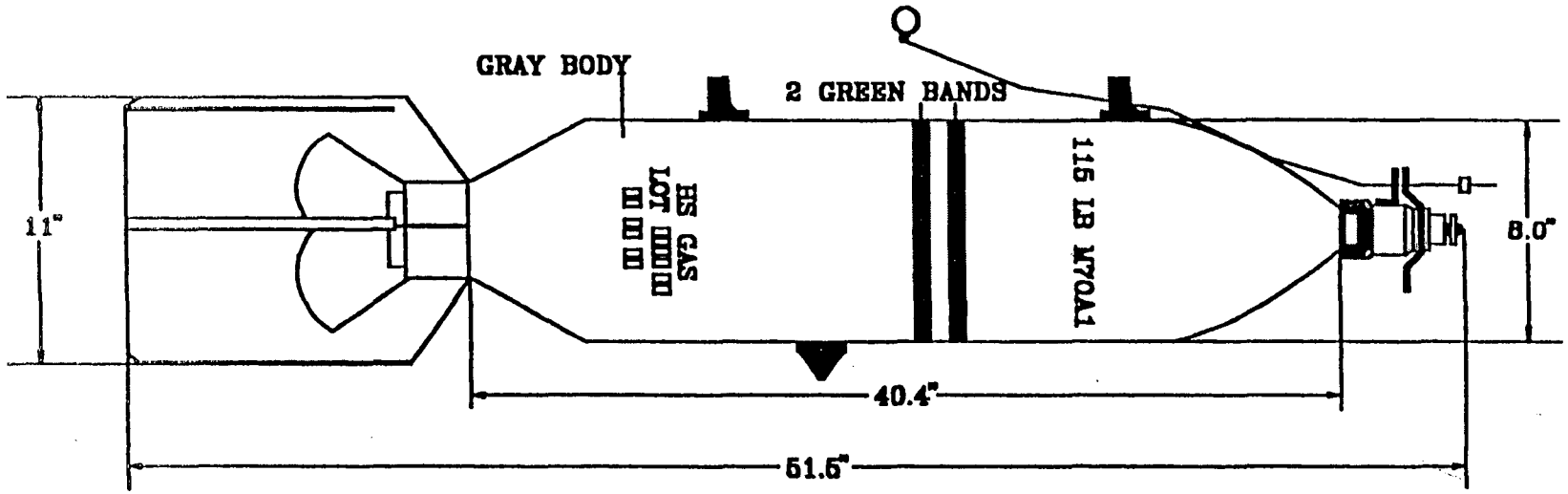
AMERICAN 115–LB M70A1 CHEMICAL (GAS) BOMB

CROSS SECTION



AMERICAN 115–LB CHEMICAL (GAS) BOMB, M70A1

Front View



NOMENCLATURE: Bomb, Chemical, 500 lb (CG and CK) AN-M78

TABULATED DATA:

Length: 59.25 inches including the nose fuze and tail fin assembly

Diameter: 14.18 inches

Fin Span: 18.94 inches

Fill Type and Fill Weight:

Phosgene (CG): 205 lbs
Cyanogen Chloride (CK): 176 lbs
Hydrocyanic acid (AC): 100 lbs
Mustard (H): Unknown

Total Weight with Fill:

CG Filled: 495 lbs
CK Filled: 466 lbs
AC Filled: 359 lbs
H Filled: Unknown

Markings:

The overall color is gray with one single green band at the nose, one at the middle, and one at the tail end identifying the bomb as a non-persistent gas bomb. Bomb nomenclature and lot number are stencilled on the body in green.

Description:

The 500 pound AN-M78 bomb is an aerial bomb that is fin stabilized and cylindrical in shape with an ogive nose and conical tail. The body of the bomb is a one piece steel construction with a burster well extending the entire length of the bomb. The burster well is threaded at the forward end to receive the nose fuze and at the aft end to receive the adapter booster and tail fuze.

Explosive Train:

The explosive train consist of:

(1) Nose Fuze: M163, M164, M165, AN-M103A1, AN-M139A1, AN-M140A1, AN-M166 (variable time (VT))
(2) Burster: AN-M15
(3) Adapter Booster: M115 or M115A1
(4) Tail Fuze: AN-M101A2

The quantity of each explosive component is unknown.

ENGINEERING DATA:

Construction:

Main Body:	Forged steel
Fin Assembly:	Length: 13.9 inches
	Width: 18.9 inches
Wall Thickness:	0.3 inches

REFERENCES:

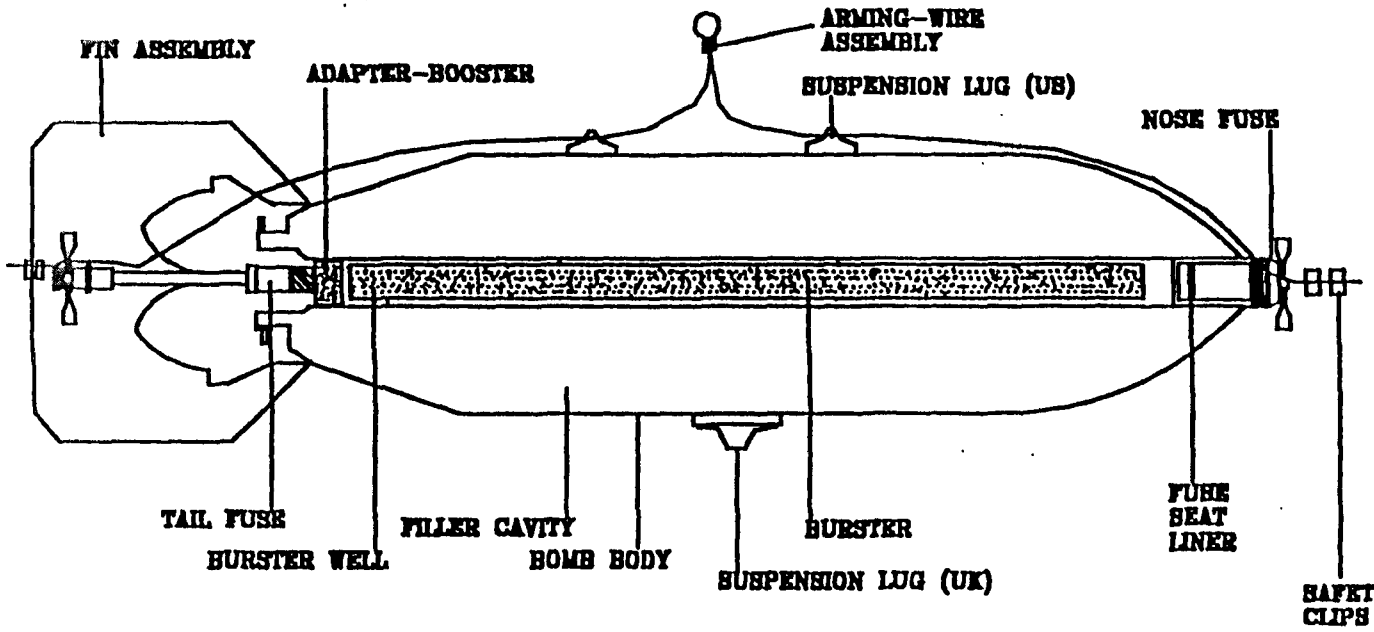
1. TM 3-400

2. Chief of the Bureau of Naval Weapons, Characteristics of Biological and Chemical Munitions and Delivery Systems, NAVWEPS Report 8566, July, 1966.

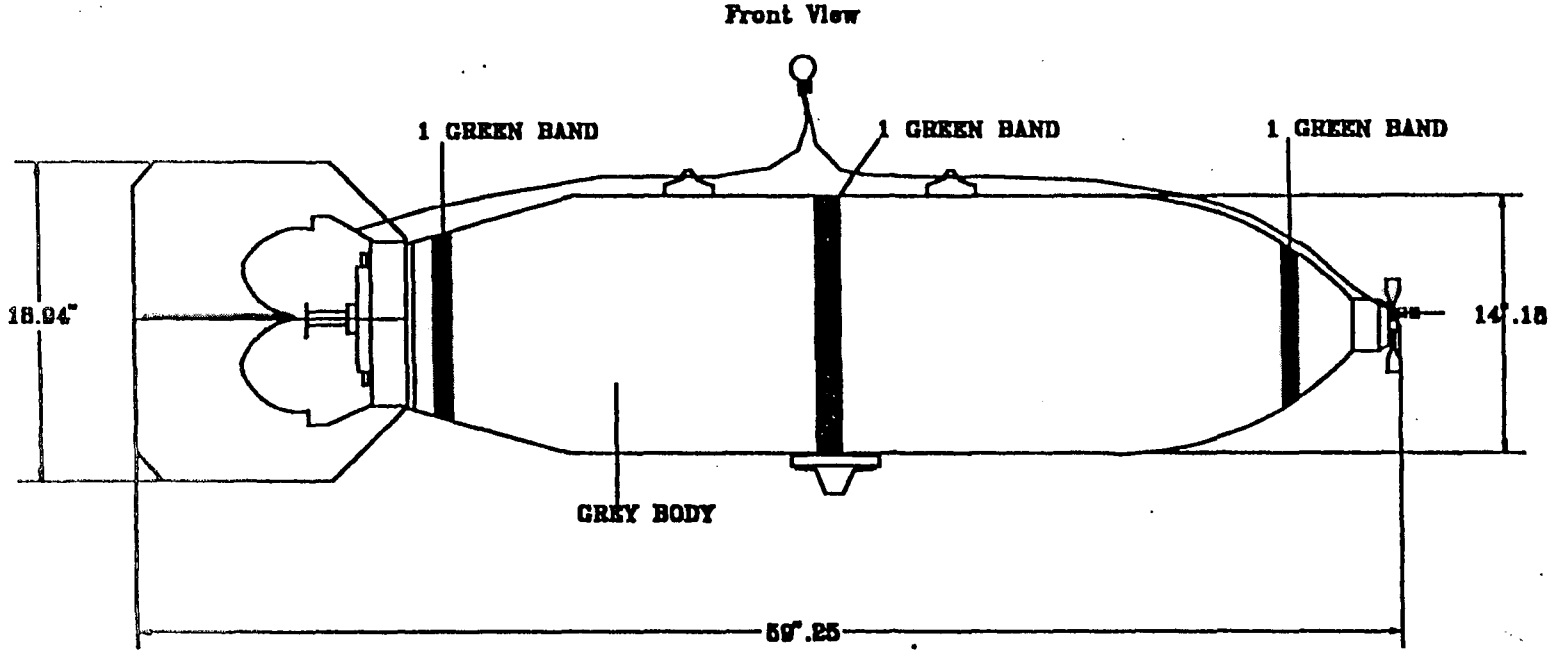
3. Chief of the Bureau of Naval Weapons, Aircraft Bombs, Fuzes, and Associated Components, NAVWEPS OP 2216 (Volume 1), August, 1960.

AMERICAN 500-LB CHEMICAL (GAS) BOMB AN-M78

Cross Section View



AMERICAN 500–LB CHEMICAL (GAS) BOMB AN–M78



NOMENCLATURE: Bomb, Chemical 1,000 lb (CG, C AC) AN-M79

TABULATED DATA:

Length: 69.5 inches including the nose fuze and the tail fin assembly

Diameter:

Bomb Body	18.8 inches
Fin Span	25.4 inches

Type Fill and Fill Weight:

hydrogen cyanide (AC):	195.01 lbs
phosgene (CG):	415.01 lbs
cyanogen chloride (CK)	351.01 lbs

Total Weight with Fill:

Filled with AC:	717.0 lbs
Filled with CG:	92.7 lbs
Filled with CK:	873.0 lbs

Markings:

The overall color is gray with one or two colored bands around the body to indicate the type of filler used.

Description:

The AN-M79 1,000 pound chemical bomb is an aerial bomb that is fin stabilized and cylindrical in shape with an ogive nose and conical tail. The bomb body is a one piece cast steel construction with a burster well that extends the entire length of the bomb. The burster well is threaded at each end to accommodate a nose fuze, a burster, an adapter booster and a tail fuze.

Explosive Train:

The explosive train consist of:

(1) Nose Fuze: M163, M164, M165, AN-M103A1, AN-M139A1, AN-M140A1 and AN-M168 Variable Time (VT).
(2) Burster: AN-M16
(3) Adapter Booster: M115A1
(4) Tail Fuze: M162, AN-M102A2

The quantity of each explosive component is unknown.

ENGINEERING DATA:

Construction:

Main Body:	Cast steel
Fin Assembly:	Length 18.5 inches
	Width 25.4 inches
Wall Thickness:	.38 inches

REFERENCES:

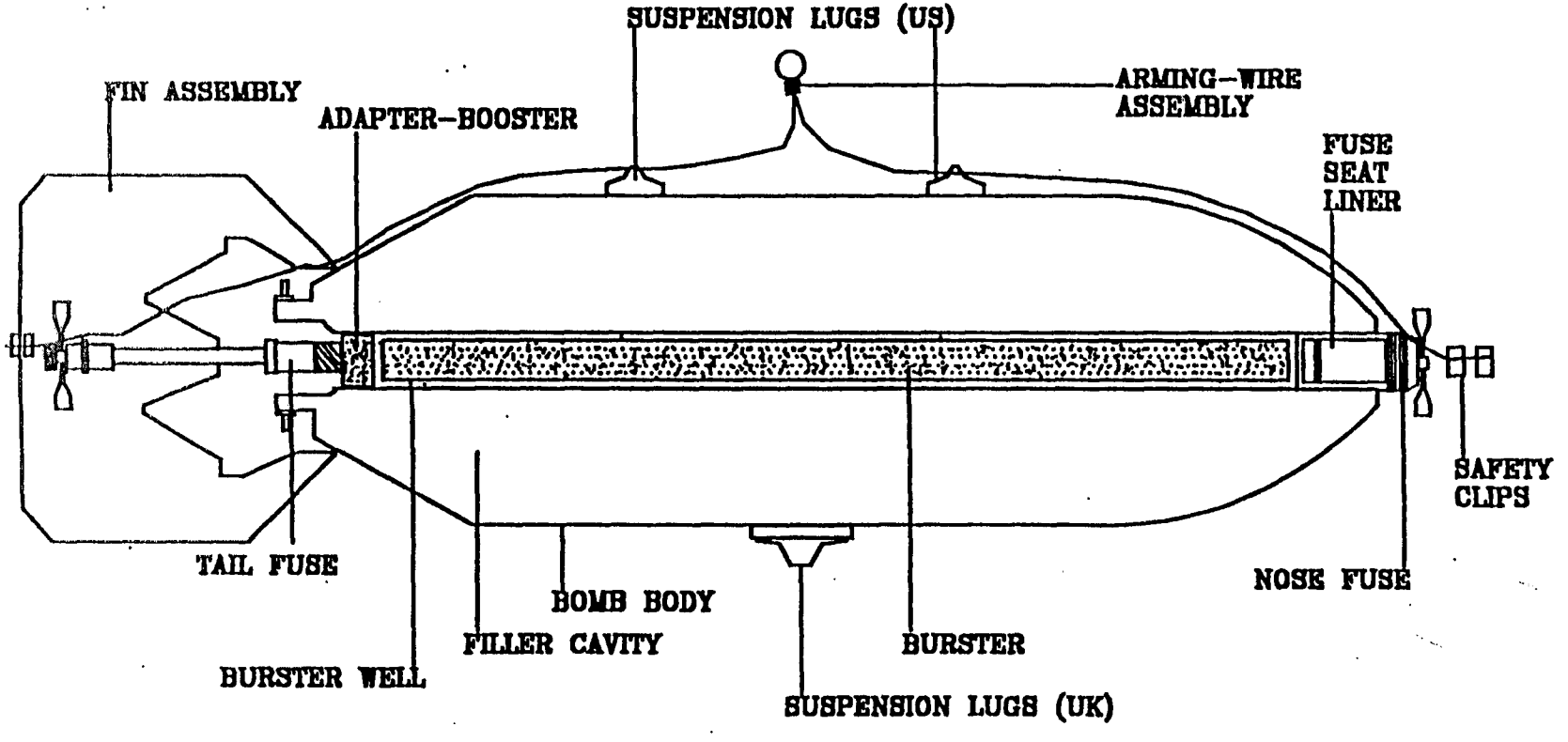
1. TM 3-400

2. Chief of the Bureau of Naval Weapons, Characteristics of Biological and Chemical Munitions and Delivery Systems, NAVWEPS Report 8566, July 1966.

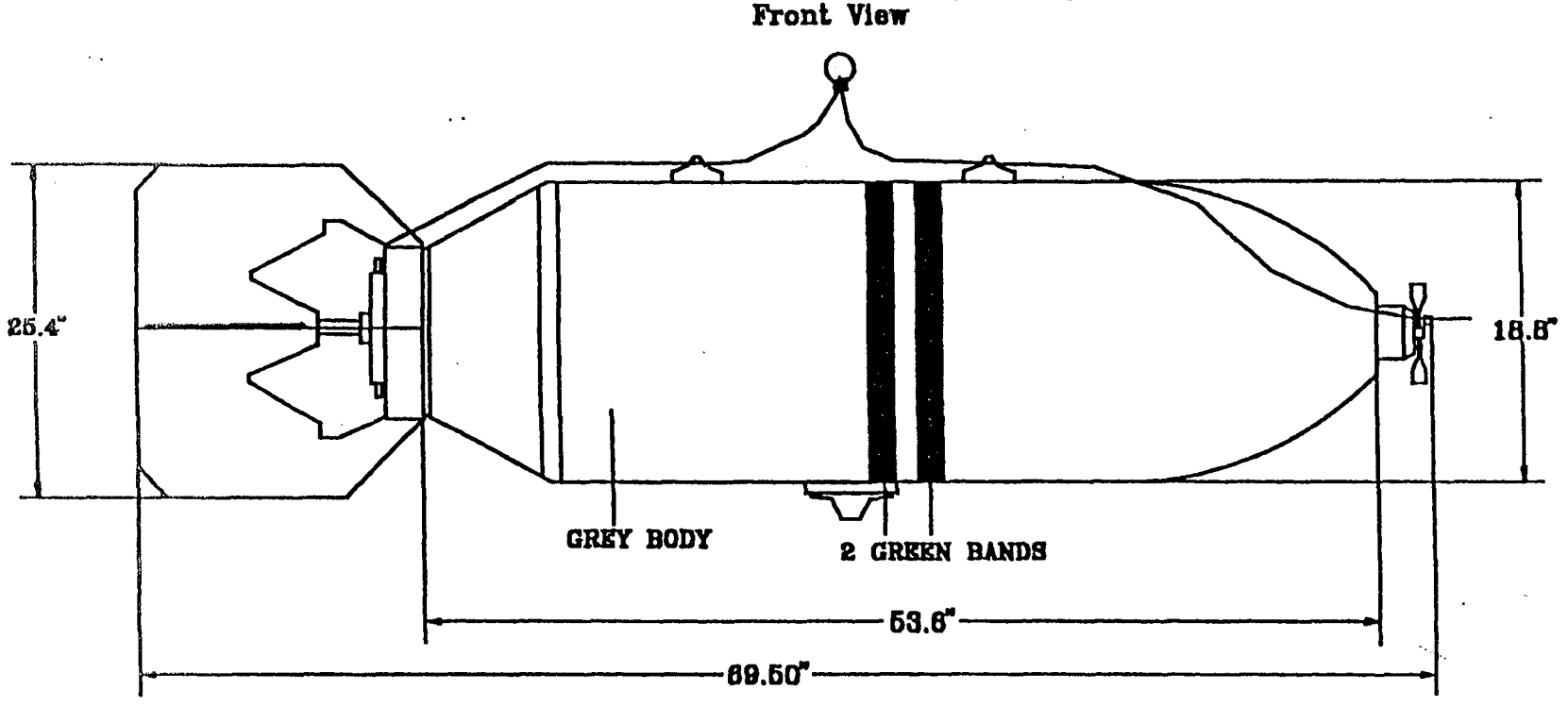
3. Chief of the Bureau of Naval Weapons, Aircraft Bombs, Fuzes and Associated Components, NAVWEPS Report OP 2216 (Volume 1), August 1960.

AMERICAN 1000-LB CHEMICAL (GAS) BOMB, AN-M79

Cross Section View



AMERICAN 1000-LB CHEMICAL (GAS) BOMB, AN-M79



NOMENCLATURE: Bomb, gas, persistent (H) 125 lb T3

TABULATED DATA:

Length: 49.5 inches

Diameter: 8 inches

Tail Span: Unknown

Type Fill and Fill Weight:

Filled with Distilled Mustard (HD): 60.2 lbs (5% void)
Filled with Mustard (H): 60.1 lbs (10% void)
Filled with Tabun (GA): unknown

Total Weight with Fill:

144.32 lbs

Markings:

Unknown

Description:

The T3 and the T3E2 bomb was type classified as the M113, bomb, gas persistent HD 125 lb. The bomb is an aerial bomb similar to the M70/M70A1. The bomb is fin stabilized and cylindrical in shape with an ogive nose and conical tail section. The bomb consist of a 1/4 inch thick steel casing with a burster well located on the longitudinal center line of the bomb. The burster extends only 30 inches along the center line of the bomb. The bomb is equipped with an adapter booster along the longitudinal center line at the aft end of the bomb. The adapter booster well at the aft end facilitates a shape charge to insure detonation of the main change.

Explosive Train:

The explosive train consist of:

(1) Nose Fuze: M103A1 with a booster (T51 nose fuze as an alternate)
(2) Burster: T17
(3) Adapter Booster: T3E1

(4) Shape Charge: Number unknown
(5) Tail Fuze: AN-M100A2, M112A1 (alternated)

The quantity of each explosive component is unknown.

ENGINEERING DATA:

Construction:

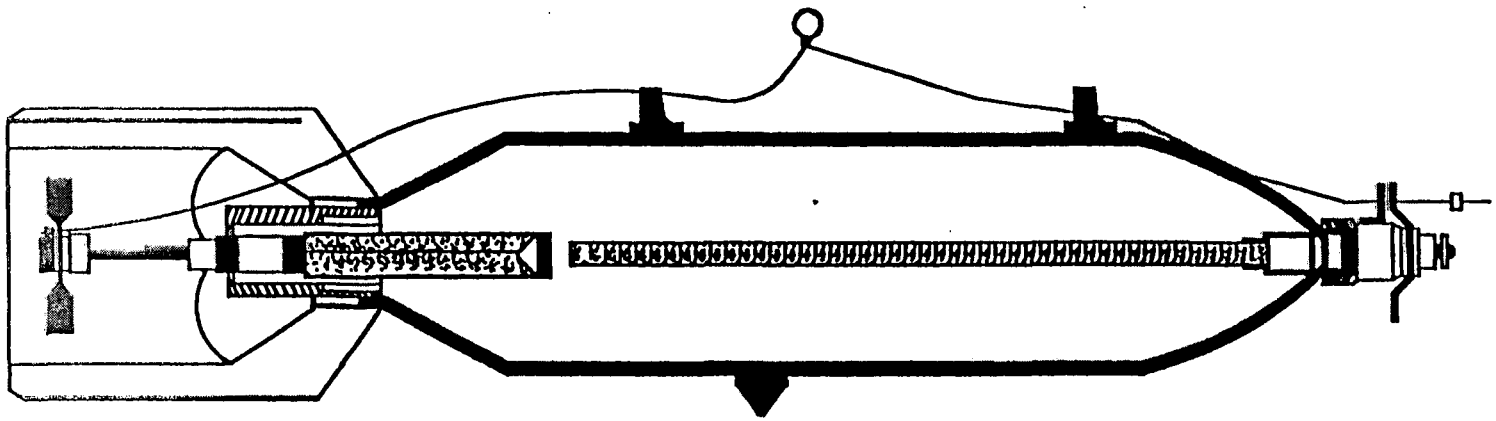
Main Body:	Unknown
Fin Assembly:	Unknown
Wall Thickness:	1/4 inch forged steel

REFERENCES:

1. Preliminary Tests of the 125 lb Chemical Bomb T3, Report No. 1277, November 1946.

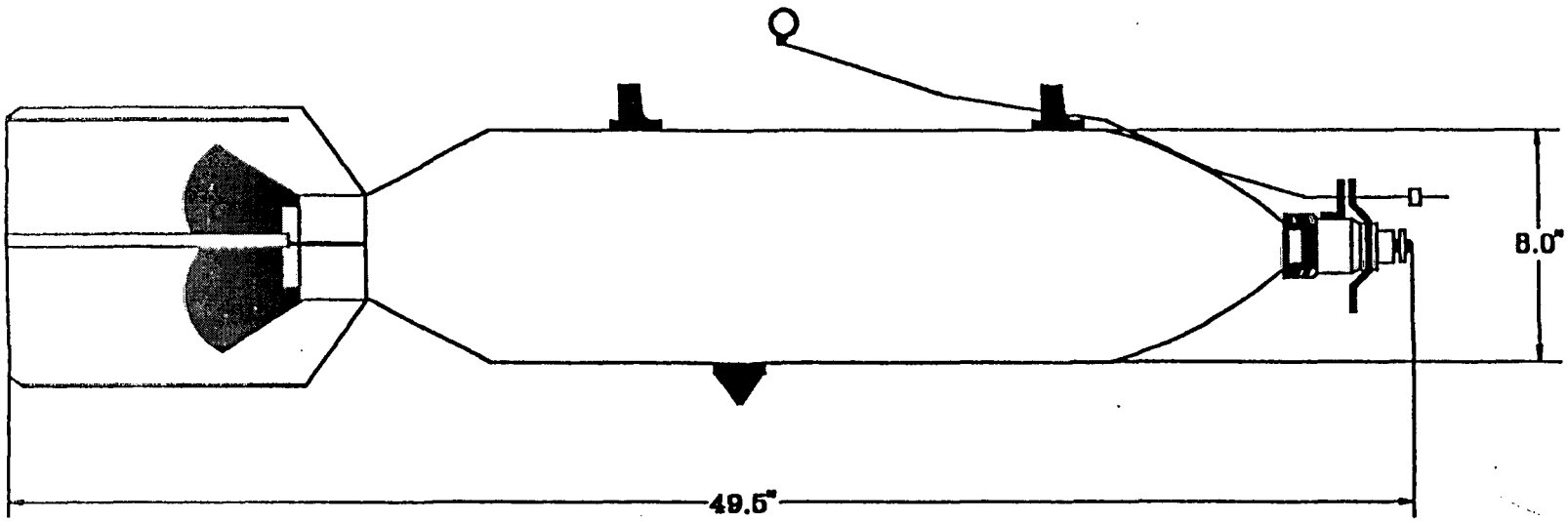
AMERICAN 115-LB T3 CHEMICAL BOMB (EXPERIMENTAL)

Cross Section View



AMERICAN 115–LB T3 CHEMICAL BOMB (EXPERIMENTAL)

Front View



NOMENCLATURE: Pot, smoke, oil, E23

TABULATED DATA:

Height: 13 inches

Diameter: 12 1/16 inches

Type Fill and Fill Weight:

Distilled mustard (HD): 18.6 lbs

Total Weight with Fill:

Unknown

Markings:

Unknown

Description:

The smoke pot consists of the following components: (1) a 5-gallon-capacity metal container 12-1/16 inches in diameter by 13 inches high, (2) a fuel block; (3) an oil chamber; (4) a container top, (5) a modified M204 bouchon fuze, and (6) a 15-second burning time delay train. The complete smoke pot weighs approximately 55 pounds. When the fuel block (ammonium nitrate and charcoal) is ignited by the ignition element which is attached to the end of the above mentioned delay train, hot gaseous combustion products are formed. These are passed through a venturi tube, the restricted portion of which is provided with a branch line that extends to the bottom of the oil chamber. The oil (Diol 55) contained in the chamber is thereby drawn into the venturi and vaporized by the hot gases. The oil vapor or combustion gases are ejected through a series of holes in the container top into the atmosphere where condensation occurs causing a dense cloud. The smoke pot satisfactorily met engineering tests and was classified limited standard on 30 July, 1945.

This experimental item was used for tests on San Jose Island. in those tests, the smoke pot was filled with HD and dyed with Dupont oil red. The munitions were statically fired and allowed to burn for 7-12 minutes.

Explosive Train:

Unknown

ENGINEERING DATA:

Construction:

Pail:	Steel
Fuze Assembly:	Modified M204 bouchon fuze with a 15 second burning-time delay train.
Explosive Components:	None

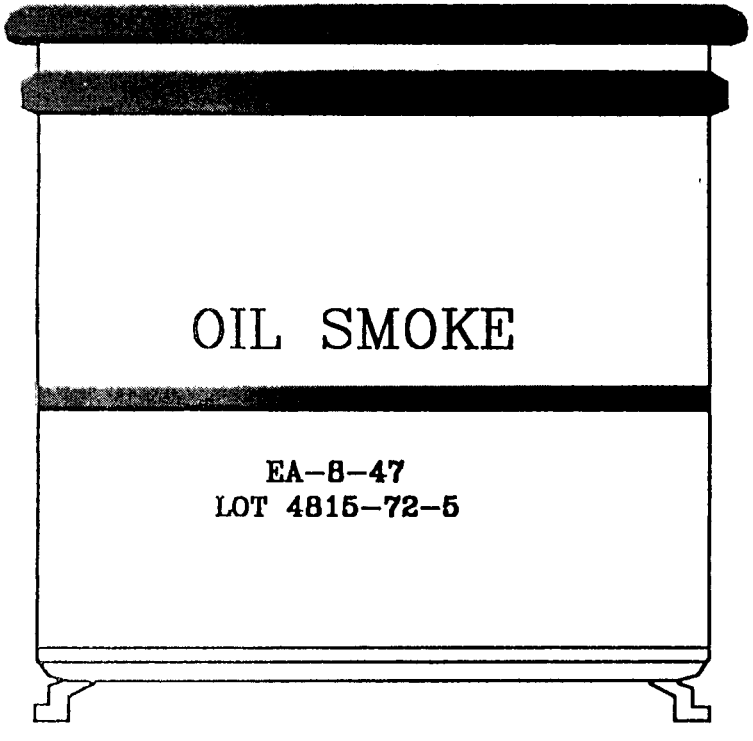
REFERENCES:

1. Department of the Army, Office of the Chief, Chemical Corps. Disposition of Chemical Corps Items. Washington, D.C. 15 September, 1948.

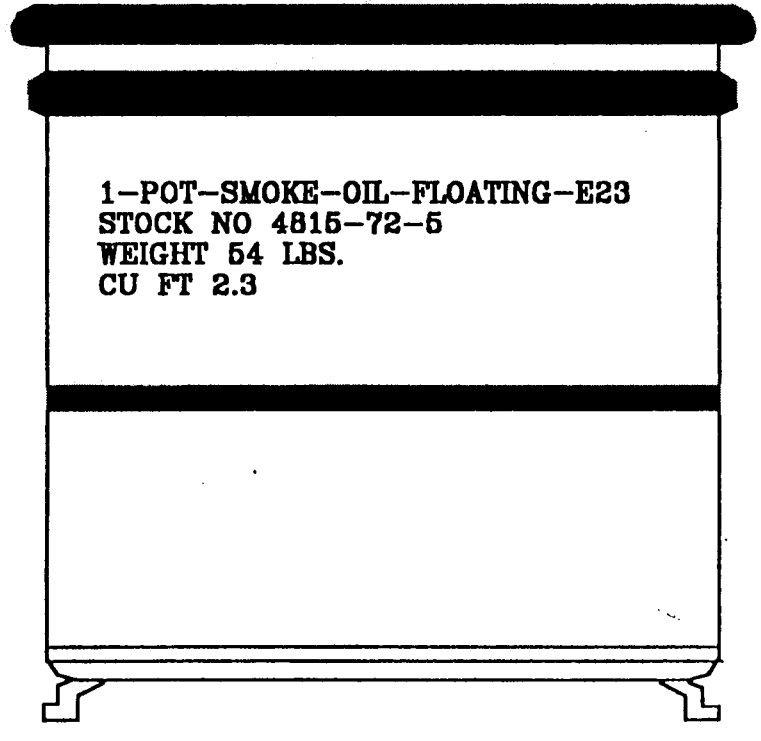
2. Finklestein, Leo, Chemical Research and Development Laboratories. History of Research and Development of the Chemical Warfare Service in World War II (1 July 1940 - 31 December 1945), Volume 22, Part III, Screening Smokes, Army Chemical Center, Maryland, August 1962.

AMERICAN E23 OIL FLOATING SMOKE POT

Front View

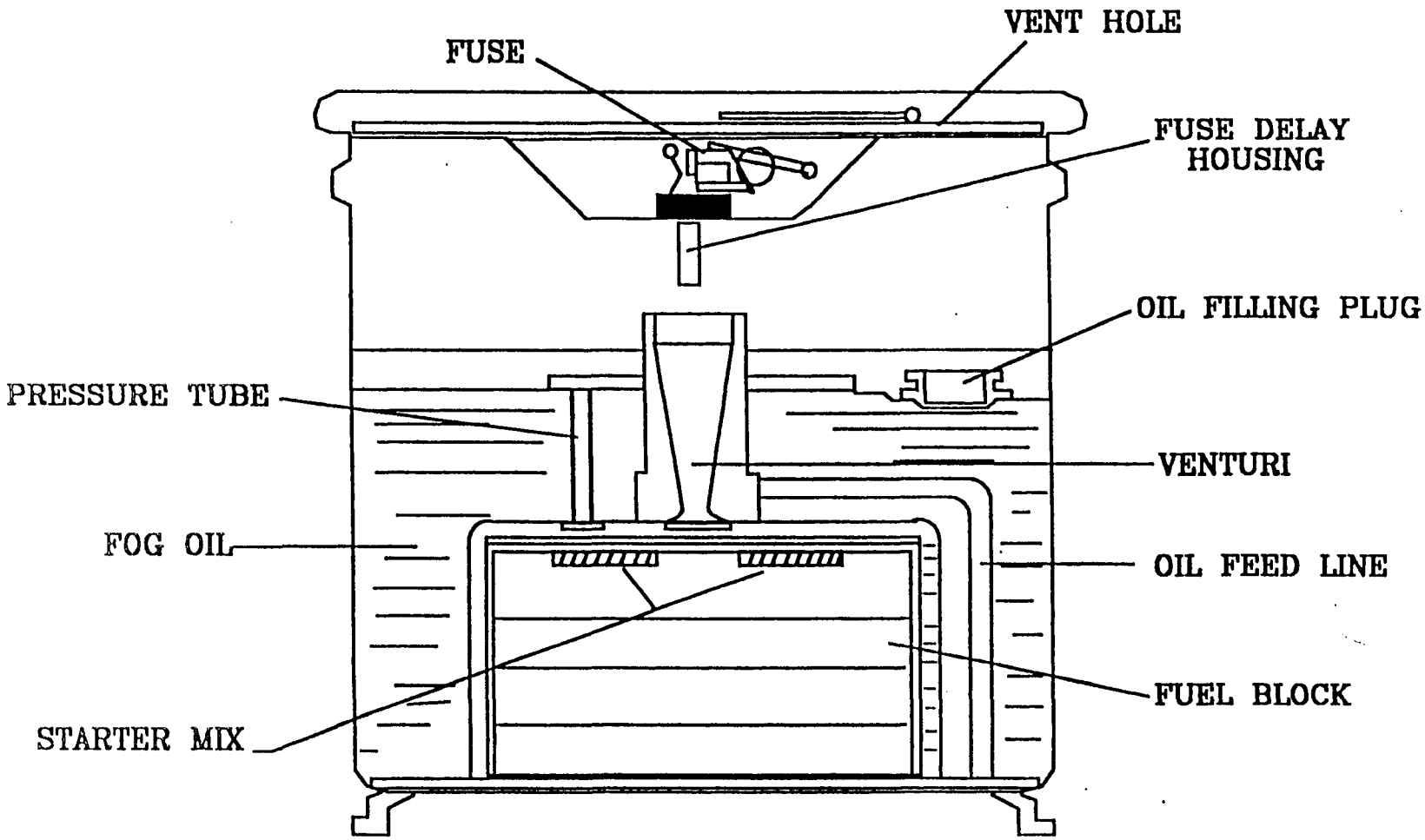


Back View



AMERICAN E23 OIL FLOATING SMOKE POT

Cross Section View



NOMENCLATURE: Bomb, Chemical, 100 lb (H), M47A2

TABULATED DATA:

Length: 48.9 inches

Diameter: 8.1 inches

Type Fill and Fill Weight:

Sulfur Mustard (HS): 68.5 lbs
Mustard (H): 73 lbs
Tabun (GA): Unknown

Total Weight with Fill:

Mustard (H): 94.5 lbs

Markings:

Gray body with two green bands and green stenciling.

Description:

The predecessor to this munition, the M47A1 bomb consisted of a cylinder that was 8.1 inches in diameter and approximately 48.9 inches long, composed of 1/16 inch sheet metal with a hemispherical nose closure and conical tail closure. The bomb was equipped with box-type stabilizing fins with a span of 11 inches. A burster well which extended throughout the length of the bomb case was screwed into the adapter in the nose of the bomb.

The design of the M47A2 was refined by (1) incorporating of a vent plug near the nose in order to relieve gas pressure built up during storage, and (2) using sharper threads on the fuze adapter to prevent leakage. Also the tail fin was increased 3 inches to provide greater flight stability. Subsequent versions of this munition, the M47A3 and M47A4, were never stockpiled.

Nose Fuze

Model No.:	AN-M126 (Alternate)	AN-M159 (Preferred)
Overall Length:	3.12 inches	3.24 inches
Protrusion from Bomb:	2.28 inches	2.4 inches
Firing Action:	Impact	Impact
Firing Delay :	Instantaneous	Instantaneous
Arming Type:	Delayed	Delayed
Total Weight:	1.16 pounds	.65 pounds
Booster Charge	Not Applicable	Small Tetryl Column
Type:	---	Unknown
Weight:	---	Unknown
Detonator		
Type:	M29	Unknown
Weight:	Unknown	Unknown
Vane		
Span:	3.9 inches	3 inches
Number:	2	2

Burster

Model No.:	M4
Diameter:	1.13 inches
Length:	37.94 inches
Type tube:	Unknown
Explosive type:	Tetryl
Explosive weight:	1.5 pounds
Lead cup type:	Not Applicable
Lead cup weight:	Not applicable

REFERENCES:

1. Department of the Army, Office of the Chief, Chemical Corps, Disposition of Chemical Corps Items, Washington, D.C., 15 September, 1948.

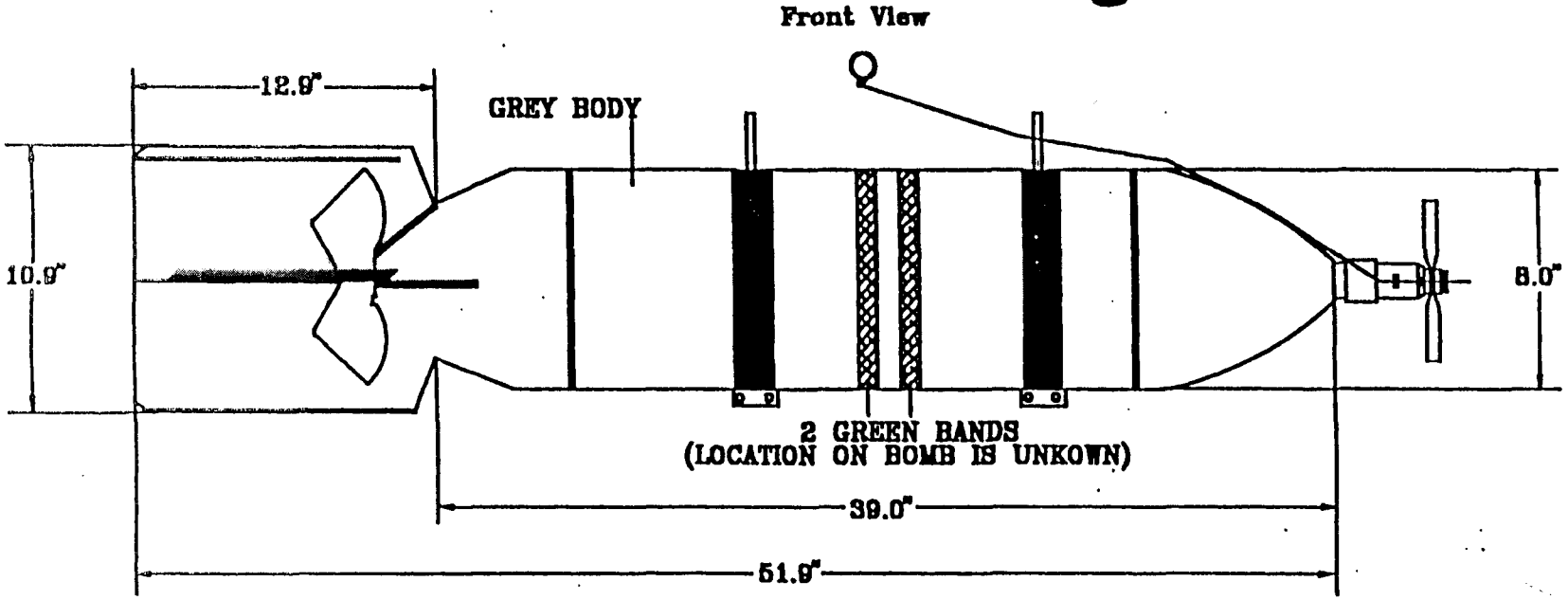
2. Chemical Corps Technical Committee Action, Item 19301, Edgewood Arsenal, MD, 12/10/42.

3. Chief of the Bureau of Naval Weapons, Aircraft Bombs, Fuzes, and Associated Components, NAVWEPS OP 2216 (Volume 1), August 1960.

4. NAVWEPS OP 2212 Vol. 1. Aircraft Bombs, Fuzes and Associated Equipment.

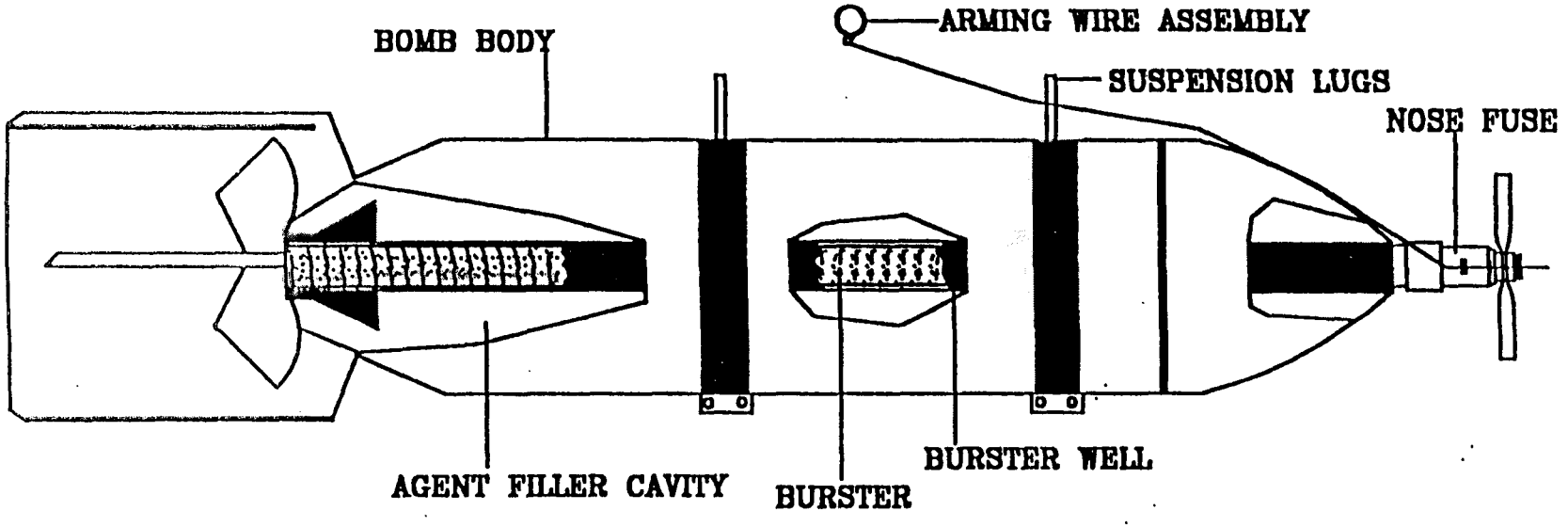
5. FM 3-6. Employment and Characteristics of Air Chemical Munitions. October 1946.

AMERICAN 100-LB M47A2 CHEMICAL BOMB



AMERICAN 100-LB M47A2 CHEMICAL BOMB

Cross Section View



NOMENCLATURE: Cartridge, Mortar, 4.2

TABULATED DATA:

Length: 21.01 inches with fuze

Diameter: 4.19 inches

Type fill and Fill Weight:

HD:	6.0 lbs	H:	6.20 lbs
CK:	5.00 lbs	CNB:	5.45 lbs
WP:	7.50 lbs	FS:	7.50 lbs
CG:	6.25 lbs	HT:	5.75 lbs
CNS	7.00 lbs	HE	7.08 lbs
PWP:	7.5 lbs	GA:	Unknown
CG:	6.25 lbs		

Total Weight with Fill:

HD:	23.50 lbs	CG:	23.80 lbs
H:	23.70 lbs	HT:	23.30 lbs
CK:	22.60 lbs	CNS:	23.17 lbs
CNB:	21.62 lbs	HE:	26.20 lbs
WP:	24.91 lbs	PWP:	24.91 lbs
FS:	Unknown	GA:	Unknown

Markings:

HD:	Gray Body with 2 Green Bands and Green Markings
H:	Gray Body with 2 Green Bands and Green Markings
HT:	Gray Body with 2 Green Bands and Green Markings
CK:	Gray Body with 1 Green Band and Green Markings
CG:	Gray Body with 1 Green Band and Green Markings
CNB:	Gray Body with 1 Green Band and Green Markings
CNS:	Gray Body with 1 Green Band and Green Markings
WP:	Gray Body with 1 Yellow Band and Yellow Markings
PWP:	Gray Body with 1 Yellow Band and Yellow Markings
HE:	Olive Drab with Yellow Markings
FS:	Unknown
GA:	Unknown

Description:

The complete round consists of a projectile body, a PD fuze with an integral burster, and a tail assembly. The body contains a perforated vane assembly welded to the inside of the body and is designed to accommodate the burster tube that extends from the fuze. The tail assembly consists of a pressure plate and rotating disc, a propelling charge, a cartridge container and ignition cartridge, and a striker nut assembly.

Explosive Train:

The explosive train consists of:

(1) Point Detonating Fuze: M8 (agent), M567(HE)
(2) Tetryl Burster: M14 (agent), M35(WP/PWP)
(3) Black Powder: Unknown
(4) Booster: M13 (WP/PWP)

The quantity of each explosive component is unknown.

ENGINEERING DATA:

Construction:

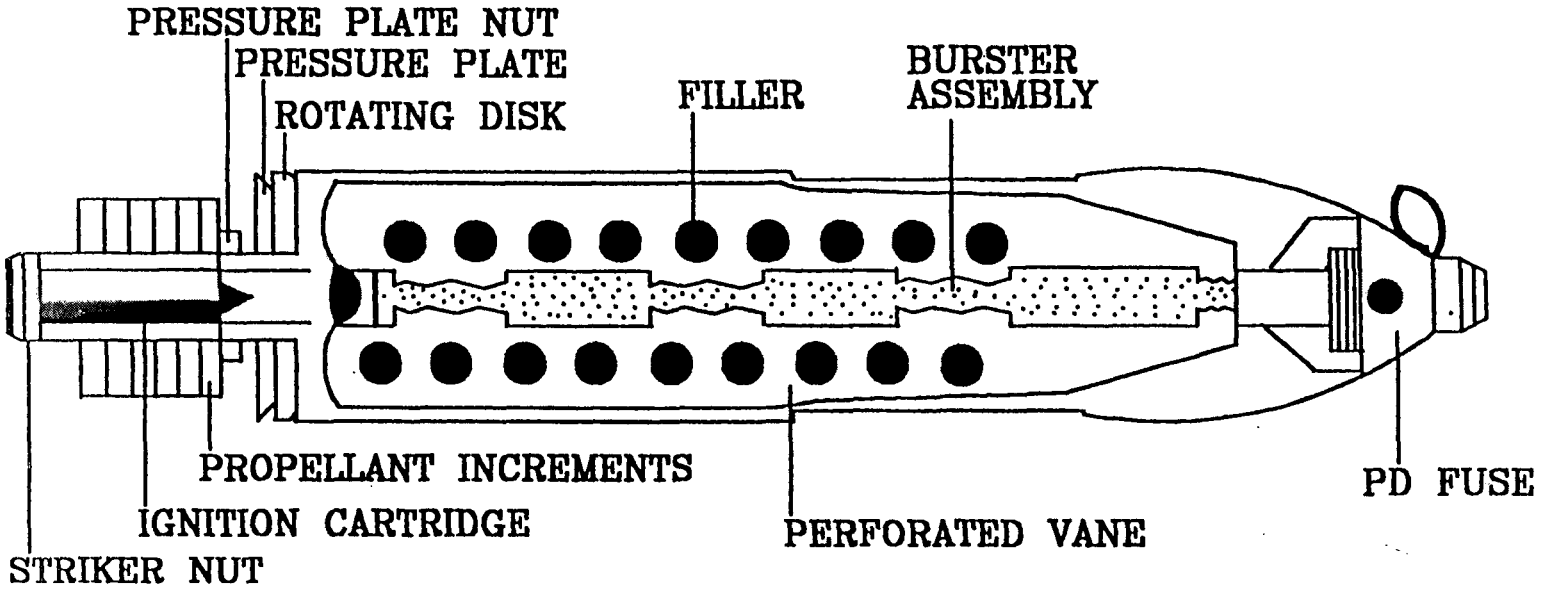
Cartridge:	Steel
Fuze Assembly:	Aluminum or Steel
Wall Thickness:	Unknown

REFERENCES:

1. SC 1305/30-IL
2. TM 43-0001-28
3. TM9-1015-215-12
4. TM9-1300-251-20
5. TM9-1320-241-12

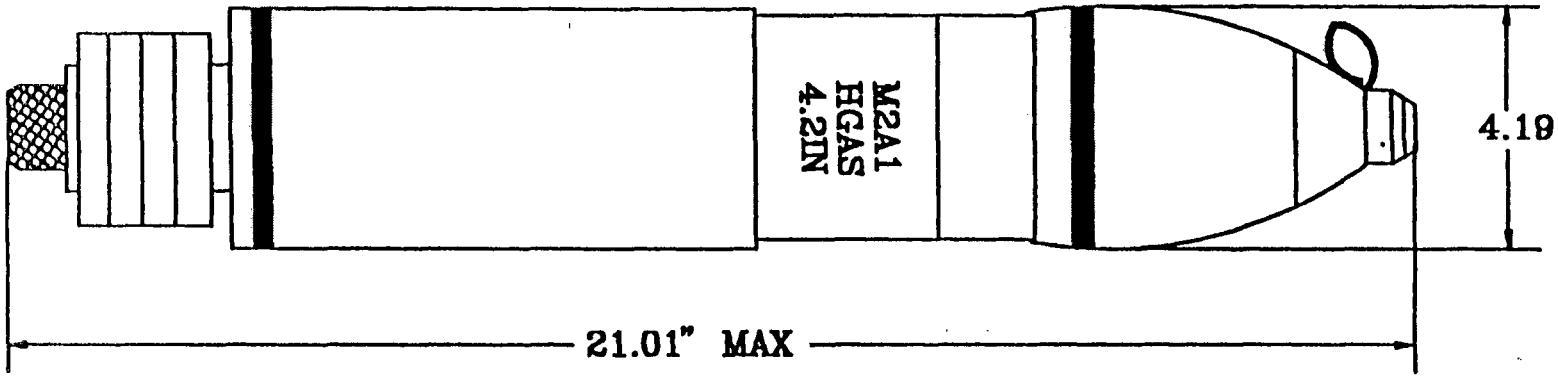
AMERICAN 4.2–INCH: GAS, M2A1 AND M2

Cross Section View



AMERICAN 4.2–INCH: GAS, M2A1 AND M2

Front View



NOMENCLATURE: 115 lb Chemical Bomb, E46 (Modified M70)

TABULATED DATA:

Length: 51.5 inches including nose fuze and tail assembly

Diameter: 8 inches

Fin Span: 11 inches

Type Fill and Fill Weight:

Tabun (GA): 49 lbs

Total Weight with Fill:

115 lbs

Markings:

Unknown (Experimental Model)

Description:

The E46 bomb is an aerial bomb that is fin stabilized and cylindrical in shape with an ogive nose and conical tail section. The bomb is equipped with a burster well running axially through the entire length of the bomb and forms the press fit closure for the filling aperture which is at the nose or ogive of the bomb. The burster well is also threaded to facilitate the installation of the nose fuze after the burster has been inserted into the burster well. According to test reports, this munition is a modification of the M70 aerial bomb used for experimental testing. The nature of the modification is unknown.

Explosive Train:

The explosive train consists of:

(1) Nose Fuze: M103
(2) Burster: M10

The quantity of each explosive component is unknown.

ENGINEERING DATA:

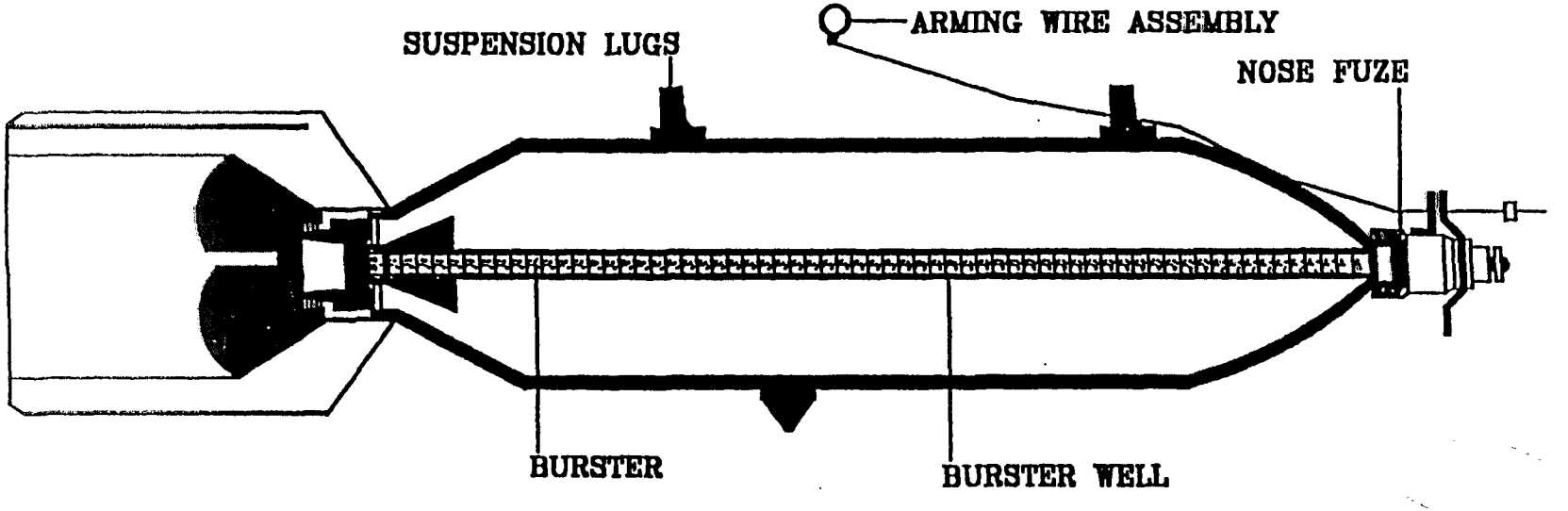
Construction: Unknown.

REFERENCES:

1. Dugway Proving Ground, UT. Static Test of 115 Pound Bomb E46 (M70), GA Filled. Report No. TCR-2, undated.

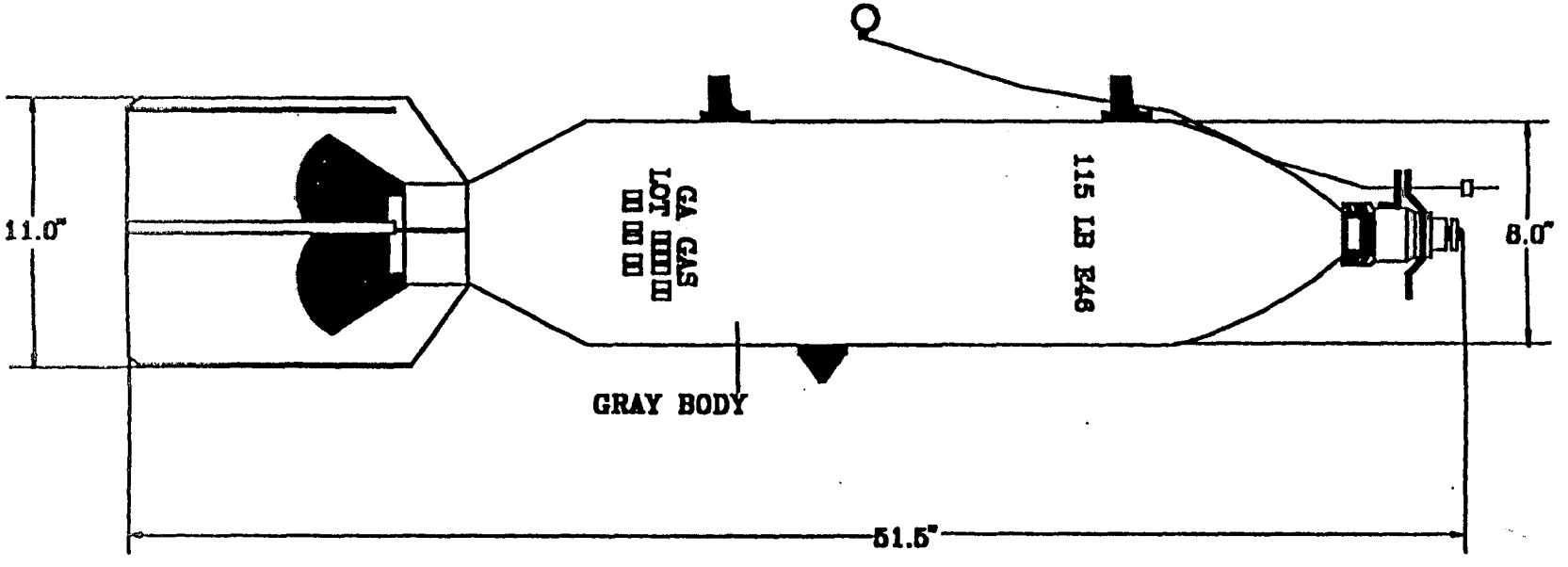
AMERICAN 115–LB CHEMICAL BOMB, E46

Cross Section View



AMERICAN 115–LB CHEMICAL BOMB, E46

Front View



NOMENCLATURE: 125 lb Chemical Bomb, Gas, E52 (Modified M70)

TABULATED DATA:

Length: 51.5 inches including nose fuze and tail fin assembly

Diameter: 8 inches

Fin Span: 11 inches

Type Fill and Fill Weight:

Tabun (GA): 45 lbs

Total Weight with Fill:

GA: Unknown

Markings:

Unknown (Experimental Model)

Description:

The E52 bomb, a modified version of the M70 aerial bomb, is fin stabilized and cylindrical in shape with an ogive nose and conical tail section. The bomb is equipped with a burster well running axially through the entire length of the bomb and forms the press fit closure for the filling aperture which is at the nose or ogive of the bomb. The burster well is also threaded to facilitate the installation of the nose fuze after the burster has been inserted into the burster well. According to test reports, this munition is a modification of the M70 aerial bomb used for experimental testing. The nature of the modification is unknown.

Explosive Train:

The explosive train consists of:

(1) Nose Fuze: M103
(2) Burster: Unknown

The quantity of each explosive component is unknown.

ENGINEERING DATA:

Construction:

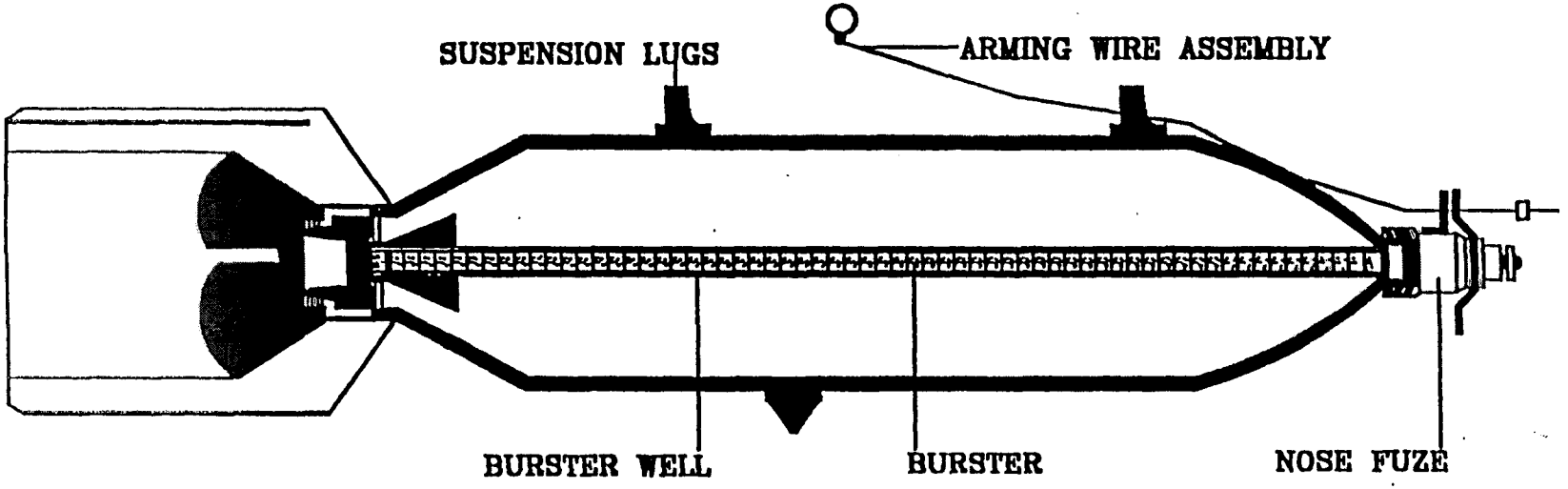
Main Body:	Unknown
Fin Assembly:	Unknown
Wall Thickness:	0.125 to 0.244 inches

REFERENCES:

1. Comparison of 125 LB Chemical Bomb T2 and the 115 LB Chemical Bomb, M70 TDMR902, November 1944.

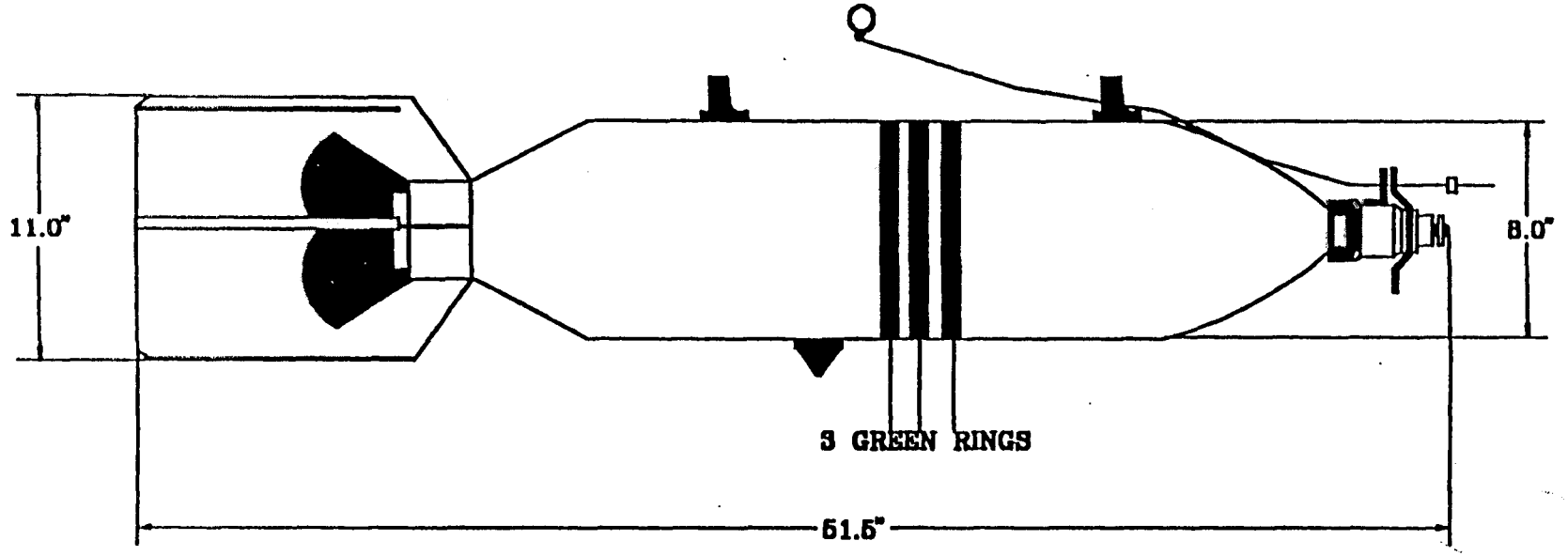
AMERICAN 125-LB CHEMICAL BOMB, E-52

Cross Section View



AMERICAN 125–LB CHEMICAL BOMB, E–52

Front View



NOMENCLATURE: KC 250 IIIGr 250kg Bomb (German)

TABULATED DATA:

Length: 64.5 inches

Diameter: 14.5 inches

Type Fill and Fill Weight:

Tabun (GA): 206 lbs

Total Weight with Fill:

335 lbs

Markings:

The overall color is tan or field gray, with the number "6181" stamped and three green rings stencilled on the nose. On the forward end of the mid section of the body there is a number "14-4.6 Kg" and also a "G or Ga-6181"[2] which is stencilled in black. On the aft end of the mid section there are three green rings stencilled with an alpha-numeric code "KC 250 III Gr" stencilled in black. On the aft section there is number "55" (circled) which is stencilled in white or black.

Description:

All German chemical bombs of the 250 Kg size used identical casings. Only the fill, markings and fuzes were different. The casing consists of a section to which a rounded nose section and a pointed tail section of sheet steel are welded. There is only one fuze pocket. A central exploder tube runs the length of the bomb case. Two baffles are welded to the body where the sections are welded together. The wall thickness is 1/16". A standard eye-bolt may be screwed into the side or nose for suspension. The tail is 21.5 inches long and 24 inches wide made of sheet steel. Four sheet steel vanes are secured directly to the body cone. Bar struts are used.

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[2] NOTE: If the bomb is stencilled "GA" or "Ga" instead of "G", the filling contains 20% chlorobenzene.

Explosive Train:

The explosive train consists of:

(1) Aerial burst fuze

The quantity of each explosive component is unknown.

ENGINEERING DATA:

Construction:

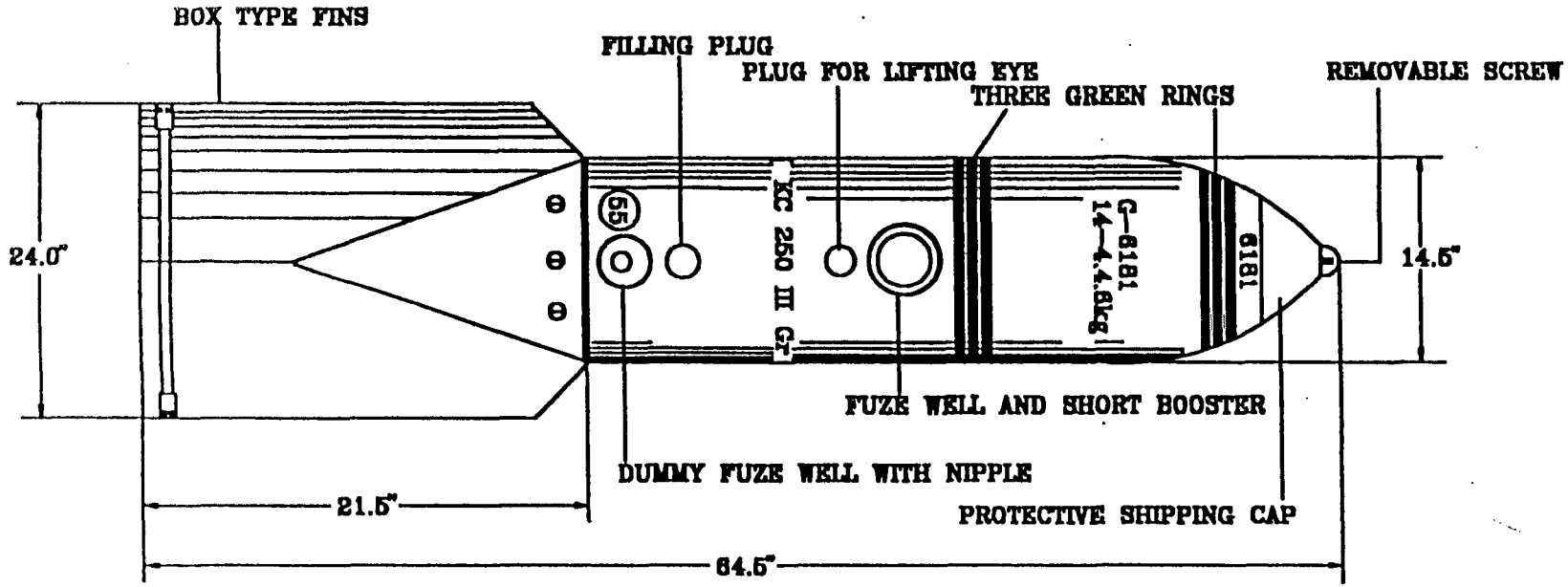
Main Body:	Steel
Fin Assembly:	Sheet Metal, 21.5 inches x 24 inches
Wall thickness:	1/16 inches

REFERENCES:

1. German Explosive Ordnance. Bombs, Fuzes, Rockets, Land Mines, Grenades and Ignitors, TM9-1985. 1953.

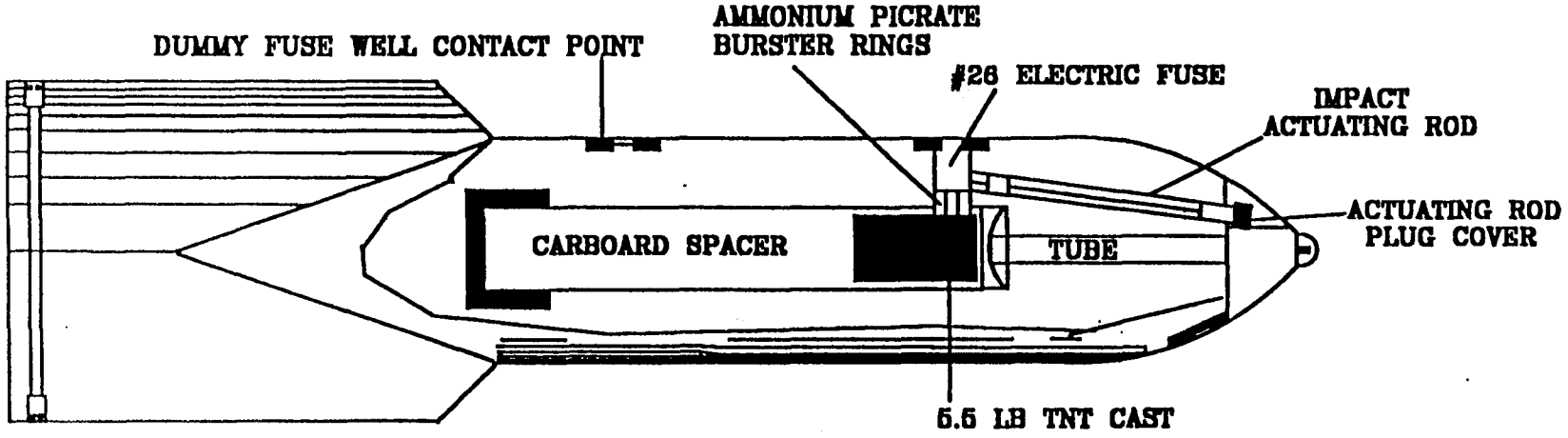
GERMAN 250 kg. AERIAL CHEMICAL BOMB
THREE GREEN RINGS (GA FILLED)

Front View



GERMAN 250 kg. AERIAL CHEMICAL BOMB
THREE GREEN RINGS (GA FILLED)

Cross Section View



APPENDIX I

POPULATION DISTRIBUTION BY AGE AND TOURIST INDICATORS

1990 U.S. VIRGIN ISLANDS CENSUS OF POPULATION AND HOUSING: STF1A
BASIC POPULATION CHARACTERISTICS

Island: St. Thomas
B.N.A.: 9616
Block Group: 1

TABLE P10: Persons In Each Age Group

AGE GROUP	TOTAL
Under 1 Year	1
1 and 2 Years	1
3 and 4 Years	1
5 Years	0
6 Years	2
7 to 9 Years	2
10 and 11 Years	3
12 and 13 Years	3
14 Years	1
15 Years	0
16 Years	2
17 Years	1
18 Years	1
19 Years	1
20 Years	4
21 Years	1
22 to 24 Years	3
25 to 29 Years	18
30 to 34 Years	14
35 to 39 Years	16
40 to 44 Years	29
45 to 49 Years	9
50 to 54 Years	9
55 to 59 Years	9
60 and 61 Years	5
62 to 64 Years	7
65 to 69 Years	11
70 to 74 Years	10
75 to 79 Years	2
80 to 84 Years	2
85 Years and Over	4

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1990 U.S. VIRGIN ISLANDS CENSUS OF POPULATION AND HOUSING: STF1A
BASIC POPULATION CHARACTERISTICS

Island: St. Thomas
B.N.A.: 9616
Block Group: 1

TABLES P1 and P5: Population and Sex

MALE	FEMALE	TOTAL POPULATION
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1990 U.S. VIRGIN ISLANDS CENSUS OF POPULATION AND HOUSING: STF1A
BASIC POPULATION CHARACTERISTICS

Island: St. Thomas
B.N.A.: 9605
Block Group: 1

TABLES P1 and P5: Population and Sex

MALE	FEMALE	TOTAL POPULATION
241	275	516

Island: St. Thomas
B.N.A.: 9605
Block Group: 2

TABLES P1 and P5: Population and Sex

MALE	FEMALE	TOTAL POPULATION
254	240	494

Island: St. Thomas
B.N.A.: 9605
Block Group: 3

TABLES P1 and P5: Population and Sex

MALE	FEMALE	TOTAL POPULATION
154	158	312

Island: St. Thomas
B.N.A.: 9605
Block Group: 4

TABLES P1 and P5: Population and Sex

MALE	FEMALE	TOTAL POPULATION
161	144	305

Island: St. Thomas
B.N.A.: 9605
Block Group: 5

TABLES P1 and P5: Population and Sex

MALE	FEMALE	TOTAL POPULATION
339	338	677

Island: St. Thomas
B.N.A.: 9605
Block Group: 6

TABLES P1 and P5: Population and Sex

MALE	FEMALE	TOTAL POPULATION
387	378	765

Island: St. Thomas
B.N.A.: 9605
Block Group: 7

TABLES P1 and P5: Population and Sex

MALE	FEMALE	TOTAL POPULATION
189	184	373

1990 U.S. VIRGIN ISLANDS CENSUS OF POPULATION AND HOUSING: STF1A
BASIC POPULATION CHARACTERISTICS

Island: St. Thomas
B.N.A.: 9605
Block Group: 1

ABLE P10: Persons In Each Age Group

AGE GROUP	TOTAL
Under 1 Year	7
and 2 Years	18
3 and 4 Years	15
5 Years	7
6 Years	12
7 to 9 Years	23
10 and 11 Years	17
12 and 13 Years	20
14 Years	12
15 Years	10
16 Years	13
17 Years	11
18 Years	8
19 Years	12
20 Years	11
21 Years	16
22 to 24 Years	28
25 to 29 Years	34
30 to 34 Years	27
35 to 39 Years	26
40 to 44 Years	42
45 to 49 Years	67
50 to 54 Years	40
55 to 59 Years	15
60 and 61 Years	5
62 to 64 Years	10
65 to 69 Years	2
70 to 74 Years	5
75 to 79 Years	1
80 to 84 Years	1
85 Years and Over	1

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Island: St. Thomas
B.N.A.: 9605
Block Group: 2

TABLE P10: Persons In Each Age Group

AGE GROUP	TOTAL
Under 1 Year	7
1 and 2 Years	11
3 and 4 Years	15
5 Years	7
6 Years	7
7 to 9 Years	27
10 and 11 Years	20
12 and 13 Years	20
14 Years	6
15 Years	6
16 Years	14
17 Years	4
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18 Years	:	6
19 Years	:	5
20 Years	:	5
21 Years	:	5
22 to 24 Years	:	17
25 to 29 Years	:	22
30 to 34 Years	:	40
35 to 39 Years	:	51
40 to 44 Years	:	68
45 to 49 Years	:	48
50 to 54 Years	:	26
55 to 59 Years	:	11
60 and 61 Years	:	5
62 to 64 Years	:	8
65 to 69 Years	:	13
70 to 74 Years	:	9
75 to 79 Years	:	8
80 to 84 Years	:	0
85 Years and Over	:	1

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Island: St. Thomas
B.N.A.: 9605
Block Group: 3

TABLE P10: Persons In Each Age Group

AGE GROUP		TOTAL
Under 1 Year	:	0
1 and 2 Years	:	6
3 and 4 Years	:	12
5 Years	:	3
6 Years	:	3
7 to 9 Years	:	22
10 and 11 Years	:	12
12 and 13 Years	:	21
14 Years	:	6
15 Years	:	8
16 Years	:	2
17 Years	:	6
18 Years	:	3
19 Years	:	4
20 Years	:	5
21 Years	:	1
22 to 24 Years	:	7
25 to 29 Years	:	16
30 to 34 Years	:	25
35 to 39 Years	:	31
40 to 44 Years	:	37
45 to 49 Years	:	33
50 to 54 Years	:	9
55 to 59 Years	:	17
60 and 61 Years	:	3
62 to 64 Years	:	2
65 to 69 Years	:	9
70 to 74 Years	:	2
75 to 79 Years	:	6
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80 to 84 Years : 1
85 Years and Over: 0

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land: St. Thomas
B.N.A.: 9605
Block Group: 4

TABLE P10: Persons In Each Age Group

AGE GROUP		TOTAL
Under 1 Year	:	3
1 and 2 Years	:	8
3 and 4 Years	:	8
5 Years	:	5
6 Years	:	5
7 to 9 Years	:	13
10 and 11 Years	:	8
12 and 13 Years	:	9
14 Years	:	2
15 Years	:	5
16 Years	:	1
17 Years	:	2
18 Years	:	7
19 Years	:	9
20 Years	:	4
21 Years	:	2
22 to 24 Years	:	8
25 to 29 Years	:	12
30 to 34 Years	:	32
35 to 39 Years	:	33
40 to 44 Years	:	43
45 to 49 Years	:	25
50 to 54 Years	:	16
55 to 59 Years	:	16
60 and 61 Years	:	2
62 to 64 Years	:	4
65 to 69 Years	:	7
70 to 74 Years	:	10
75 to 79 Years	:	1
80 to 84 Years	:	4
85 Years and Over	:	1

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Island: St. Thomas
B.N.A.: 9605
Block Group: 5

TABLE P10: Persons In Each Age Group

AGE GROUP		TOTAL
Under 1 Year	:	5
1 and 2 Years	:	16
3 and 4 Years	:	16

5 Years	:	11
6 Years	:	13
7 to 9 Years	:	42
10 and 11 Years	:	16
12 and 13 Years	:	12
14 Years	:	8
15 Years	:	6
16 Years	:	13
17 Years	:	11
18 Years	:	8
19 Years	:	14
20 Years	:	7
21 Years	:	8
22 to 24 Years	:	15
25 to 29 Years	:	56
30 to 34 Years	:	81
35 to 39 Years	:	79
40 to 44 Years	:	75
45 to 49 Years	:	55
50 to 54 Years	:	38
55 to 59 Years	:	30
60 and 61 Years	:	6
62 to 64 Years	:	13
65 to 69 Years	:	8
70 to 74 Years	:	4
75 to 79 Years	:	5
80 to 84 Years	:	3
85 Years and Over	:	3

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land: St. Thomas
B.N.A.: 9605
Block Group: 6

TABLE P10: Persons In Each Age Group

AGE GROUP		TOTAL
Under 1 Year	:	9
1 and 2 Years	:	17
3 and 4 Years	:	23
5 Years	:	9
6 Years	:	8
7 to 9 Years	:	25
10 and 11 Years	:	17
12 and 13 Years	:	15
14 Years	:	8
15 Years	:	9
16 Years	:	6
17 Years	:	7
18 Years	:	7
19 Years	:	8
20 Years	:	7
21 Years	:	10
22 to 24 Years	:	21
25 to 29 Years	:	77
30 to 34 Years	:	75
35 to 39 Years	:	98
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40 to 44 Years	:	38
45 to 49 Years	:	71
50 to 54 Years	:	67
55 to 59 Years	:	29
60 and 61 Years	:	13
62 to 64 Years	:	20
65 to 69 Years	:	16
70 to 74 Years	:	7
75 to 79 Years	:	11
80 to 84 Years	:	2
85 Years and Over:		5

Island: St. Thomas
B.N.A.: 9605
Block Group: 7

TABLE P10: Persons In Each Age Group

AGE GROUP		TOTAL
Under 1 Year	:	4
1 and 2 Years	:	13
3 and 4 Years	:	10
5 Years	:	4
6 Years	:	4
7 to 9 Years	:	5
10 and 11 Years	:	8
12 and 13 Years	:	7
14 Years	:	2
15 Years	:	7
16 Years	:	3
17 Years	:	4
18 Years	:	1
19 Years	:	2
20 Years	:	2
21 Years	:	6
22 to 24 Years	:	14
25 to 29 Years	:	39
30 to 34 Years	:	48
35 to 39 Years	:	54
40 to 44 Years	:	38
45 to 49 Years	:	31
50 to 54 Years	:	15
55 to 59 Years	:	17
60 and 61 Years	:	1
62 to 64 Years	:	9
65 to 69 Years	:	12
70 to 74 Years	:	5
75 to 79 Years	:	5
80 to 84 Years	:	1
85 Years and Over:		2

What was just printed was for Summary Level: 150

1990 U.S. VIRGIN ISLANDS CENSUS OF POPULATION AND HOUSING: STF1A
BASIC POPULATION CHARACTERISTICS

Island: St. John
B.N.A.: 9501

TABLES P1 and P5: Population and Sex

MALE	FEMALE	TOTAL POPULATION
508	527	1035

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Island: St. John
B.N.A.: 9502

TABLES P1 and P5: Population and Sex

MALE	FEMALE	TOTAL POPULATION
1210	1259	2469

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Island: St. Thomas
B.N.A.: 9601

TABLES P1 and P5: Population and Sex

MALE	FEMALE	TOTAL POPULATION
1241	1231	2472

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Island: St. Thomas
B.N.A.: 9602

TABLES P1 and P5: Population and Sex

MALE	FEMALE	TOTAL POPULATION
1485	1840	3325

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Island: St. Thomas
B.N.A.: 9603

TABLES P1 and P5: Population and Sex

MALE	FEMALE	TOTAL POPULATION
2650	3109	5759

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Island: St. Thomas
B.N.A.: 9604

TABLES P1 and P5: Population and Sex

MALE	FEMALE	TOTAL POPULATION
1530	1456	2986

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Island: St. Thomas
B.N.A.: 9605

TABLES P1 and P5: Population and Sex

MALE	FEMALE	TOTAL POPULATION

Island: St. Thomas
B.N.A.: 9606

TABLES P1 and P5: Population and Sex

MALE	FEMALE	TOTAL POPULATION
831	814	1645

Island: St. Thomas
B.N.A.: 9608

TABLES P1 and P5: Population and Sex

MALE	FEMALE	TOTAL POPULATION
1542	1800	3342

Island: St. Thomas
B.N.A.: 9609

TABLES P1 and P5: Population and Sex

MALE	FEMALE	TOTAL POPULATION
910	1043	1953

Island: St. Thomas
B.N.A.: 9610

TABLES P1 and P5: Population and Sex

MALE	FEMALE	TOTAL POPULATION
1371	1537	2908

Island: St. Thomas
B.N.A.: 9611

TABLES P1 and P5: Population and Sex

MALE	FEMALE	TOTAL POPULATION

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Island: St. Thomas
B.N.A.: 961199

TABLES P1 and P5: Population and Sex

MALE	FEMALE	TOTAL POPULATION
2	1	3

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Island: St. Thomas
B.N.A.: 9612

TABLES P1 and P5: Population and Sex

MALE	FEMALE	TOTAL POPULATION
2288	2467	4755

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Island: St. Thomas
B.N.A.: 9613

TABLES P1 and P5: Population and Sex

MALE	FEMALE	TOTAL POPULATION
2135	2507	4642

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Island: St. Thomas
B.N.A.: 9614

TABLES P1 and P5: Population and Sex

MALE	FEMALE	TOTAL POPULATION
2282	2411	4693

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Island: St. Thomas
B.N.A.: 9615

TABLES P1 and P5: Population and Sex

MALE	FEMALE	TOTAL POPULATION
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land: St. Thomas
N.A.: 9616

TABLES P1 and P5: Population and Sex

MALE	FEMALE	TOTAL POPULATION
101	71	172

U.S. Virgin Islands Ani . Tourism Indicators

BUREAU OF ECONOMIC RESEARCH - U.S.V.I. DEPT. OF ECONOMIC DEVELOPMENT & AGRICULTURE
P.O. BOX 6400 - ST. THOMAS, U.S. VIRGIN ISLANDS 00802 V (809) 774-8784

	1970	1980	1983	1984	1985	1986	1987	1988	1989	1990	1991	Annual % Change 5 Year	Annual % Change 1 Year
VISITOR ARRIVALS (thousands unless noted otherwise)													
Total visitors	1,011.6	1,333.3	1,213.7	1,264.8	1,315.6	1,654.4	1,917.8	1,881.4	1,763.9	1,866.4	1,942.7	3.5	4.1
Tourists	372.4	380.0	345.0	369.5	411.6	463.1	541.8	555.5	506.7	521.5	511.8	2.4	-1.9
Excursionists	639.2	953.3	868.7	895.3	903.9	1,191.3	1,376.0	1,325.9	1,257.3	1,344.9	1,430.9	4.0	6.4
Air excursionists	200.5	145.9	130.0	132.4	130.0	154.4	180.6	185.2	168.9	173.8	170.6	2.4	-1.9
Cruise passengers	251.1	691.5	633.7	657.5	678.9	941.9	1,100.4	1,106.1	1,062.5	1,119.6	1,214.5	5.5	8.5
Other	187.6	115.9	105.0	105.5	95.0	95.0	95.0	34.6	25.8	51.5	45.8	-0.1	-11.2
Air visitors, tourists & exc.	572.9	525.9	475.0	501.9	541.6	617.5	722.4	740.7	675.5	695.4	682.4	2.4	-1.9
Number of cruise ships	502	883	715	789	790	1,109	1,242	1,121	1,106	1,142	1,240	2.5	8.6
St. Thomas/St. John:													
Air visitors, tourists & exc.	415.5	392.7	360.6	382.9	426.6	476.1	545.2	556.4	483.6	513.7	505.7	1.6	-1.6
Cruise passengers	230.3	635.1	603.5	605.4	651.6	827.2	955.9	1,062.0	1,026.3	1,117.2	1,208.4	8.1	8.2
Number of cruise ships	445	821	678	728	729	939	1,064	1,059	1,064	1,140	1,216	5.4	6.7
St. Croix:													
Air visitors, tourists & exc.	157.4	133.2	114.4	119.0	115.1	141.4	177.2	184.3	191.9	181.7	176.8	5.1	-2.7
Cruise passengers	20.8	56.4	30.2	52.0	27.4	114.8	144.5	145.9	68.6	13.1	28.9	2.6	119.9
Number of cruise ships	57	62	37	61	61	170	178	170	75	14	49	22.6	250.0
VISITOR EXPENDITURES (millions of dollars)													
Total expenditures	129.6	304.3	356.3	440.1	507.4	509.8	639.4	659.6	673.6	704.3	708.1	7.2	0.5
Tourists	103.6	221.9	263.1	308.8	365.4	386.6	401.4	411.6	497.6	515.6	506.3	5.8	-1.8
Excursionists	26.0	82.4	93.2	131.3	142.0	123.2	238.0	248.0	176.1	188.8	201.8	16.5	6.9
Day-trip by air	8.0	13.5	14.9	20.8	21.0	15.3	28.7	29.3	21.2	22.0	21.6	12.8	-1.8
Cruise passengers	10.5	58.1	66.2	92.0	105.6	96.8	191.9	212.3	151.2	159.4	173.7	18.9	8.9
Other	7.5	10.8	12.1	18.5	15.4	11.1	17.5	6.3	3.7	7.3	6.5	7.9	-11.2
SELECTED TOURISM-RELATED EMPLOYMENT (number of jobs) [a]													
Total tourism-related employment	-	7,200	6,890	7,190	7,620	8,390	9,580	9,800	9,320	8,640	8,830	1.3	2.2
Hotels & other lodging places	2,816	3,040	2,650	2,700	3,140	3,420	4,170	4,430	4,180	3,460	3,460	1.1	0.0
Gift shops	-	1,960	2,130	2,120	2,130	2,290	2,400	2,510	2,320	2,370	2,370	0.8	0.0
Eating & drinking places	-	1,550	1,650	1,870	1,860	2,100	2,370	2,240	2,260	2,380	2,480	3.6	4.2
Transportation by air	-	650	460	500	490	580	640	620	560	430	520	-0.9	20.9
SELECTED TOURISM-RELATED IMPORTS (millions of dollars) [b]													
Total tourism-related imports	-	78.0	66.4	75.5	84.6	96.0	119.6	137.9	123.7	139.8	-	11.2	13.0
Alcoholic beverages	-	27.5	17.9	14.1	12.4	17.6	20.8	21.8	25.5	31.8	-	21.3	24.4
Cameras	-	3.1	2.8	4.5	4.5	6.4	5.2	4.6	3.6	3.7	-	-1.7	2.8
China	-	4.9	1.8	2.3	2.5	3.1	4.4	4.4	4.7	3.9	-	11.1	-16.4
Crystal	-	2.0	3.2	2.7	2.5	1.9	2.4	1.2	3.7	3.5	-	32.9	-4.9
Jewelry	-	17.7	22.8	28.8	39.2	44.6	57.7	68.6	63.7	71.6	-	13.5	12.3
Leather goods	-	0.9	1.0	1.7	1.2	1.7	1.5	1.3	2.2	2.1	-	15.2	-5.0
Linen	-	5.3	2.0	2.4	2.6	2.2	1.4	1.9	3.8	2.2	-	8.0	-42.1
Perfume	-	5.7	5.2	6.7	5.9	6.2	7.1	8.5	8.5	9.7	-	10.9	14.6
Watches	-	10.9	9.6	12.5	13.7	12.2	19.3	25.6	8.0	11.3	-	10.5	41.1

NOTES

U.S.V.I. Bureau of Economic Research (BER) is the source for all data except the following: [a] U.S.V.I. Bureau of Labor Statistics; [b] Foreign Trade Division, U.S. Bureau of the Census; [c] St. Thomas/St. John - Jan Komives, St. Croix - "UPDATE", Central Listing Service. [-] denotes data not available. Additional detail regarding methodology and definitions is available from BER upoon request. Some figures may not add due to rounding. All data subject to revision.

	1970	1980	1983	1984	1985	1986	1987	1988	1989	1990	1991	Annual % Chi 5 Year	Annual % Chi 1 Yea
HOTELS AND OTHER TOURIST ACCOMMODATIONS													
Total rooms/units	3,599	5,102	4,640	4,542	4,693	4,861	5,161	5,291	5,478	4,791	4,875	0.3	1.7
Number of hotels	-	65	56	56	54	57	59	57	56	49	49	-2.7	0.0
Hotel rooms	-	3,457	3,213	3,118	3,202	3,591	3,914	3,988	4,123	3,575	3,623	0.5	1.3
Condominium/other units	-	1,645	1,428	1,424	1,491	1,270	1,247	1,303	1,355	1,216	1,252	-0.1	2.9
Occupancy rate (percent)	-	64.0	60.5	62.3	66.3	64.9	64.2	62.3	60.9	62.5	58.9	-	-
St. Thomas/St. John:													
Total rooms/units	2,253	3,485	3,318	3,238	3,289	3,499	3,686	3,848	4,026	3,611	3,686	1.2	2.1
Number of hotels	-	30	30	29	29	31	32	31	31	29	30	-0.2	3.4
Hotel rooms	-	2,415	2,325	2,229	2,351	2,673	2,826	2,914	3,056	2,738	2,818	1.2	2.9
Condominium/other units	-	1,070	993	1,009	939	826	861	934	970	873	868	1.2	-0.6
Occupancy rate (percent)	-	68.2	64.1	64.4	69.1	65.5	65.1	62.1	59.8	62.3	59.6	-	-
St. Croix:													
Total room/units	1,346	1,617	1,323	1,304	1,404	1,362	1,475	1,443	1,452	1,180	1,189	-2.3	0.7
Number of hotels	-	35	27	27	25	26	27	26	25	20	19	-5.8	-5.0
Hotel rooms	-	1,043	888	889	852	918	1,089	1,074	1,067	837	805	-1.8	-3.8
Condominium/other units	-	575	435	415	553	444	387	369	385	343	384	-2.4	11.8
Occupancy rate (percent)	-	53.3	51.7	56.5	58.3	63.1	62.2	62.9	61.5	63.3	56.5	-	-
HOTEL GUESTS BY ORIGIN (total number and percent shares of total)													
Total hotel guests (no.)	-	263,522	237,430	242,277	265,586	300,994	578,296	699,778	634,004	398,210	401,585	13.5	0.8
U.S.V.I. residents (percent)	-	5.1	3.9	5.0	3.5	3.5	3.9	4.3	7.1	7.1	6.8	-	-
Non-residents (percent)	-	94.9	96.1	95.0	96.5	96.5	96.1	95.7	92.9	92.9	93.2	-	-
U.S. mainland	-	74.4	82.9	83.7	86.7	86.8	87.4	87.5	84.9	80.6	80.1	-	-
Chicago	-	13.0	13.0	13.3	13.3	13.4	12.8	14.1	15.4	13.3	13.2	-	-
Los Angeles	-	12.0	12.1	9.4	8.5	9.6	10.1	10.2	9.5	9.2	9.4	-	-
Miami	-	10.9	17.5	15.0	15.7	15.0	14.8	15.2	14.1	16.3	14.8	-	-
New York City	-	29.5	30.9	35.4	39.4	39.0	40.1	38.3	36.0	31.8	32.6	-	-
Washington, D.C.	-	9.1	9.4	10.6	9.7	9.8	9.7	9.8	10.0	9.9	10.2	-	-
Puerto Rico	-	10.5	7.2	6.1	5.6	4.7	4.7	4.2	4.2	6.0	5.7	-	-
Other West Indies	-	1.3	1.8	1.3	1.0	0.9	0.6	0.5	0.5	0.8	0.9	-	-
Canada	-	1.3	1.1	1.0	1.0	0.8	0.8	0.7	0.8	0.8	1.0	-	-
Europe	-	5.2	2.1	1.6	1.3	1.7	1.7	2.0	1.8	2.2	2.2	-	-
Central/South America	-	1.7	0.7	0.7	0.6	0.8	0.5	0.5	0.5	0.8	0.9	-	-
Other areas	-	0.4	0.5	0.5	0.4	0.8	0.2	0.3	0.3	1.8	2.4	-	-
REAL ESTATE (c)													
Number of homes sold	478	317	250	276	330	486	382	447	278	455	251	-4.7	-44.8
Average home sales price ($)	34,971	96,189	106,158	105,093	116,323	133,432	153,067	175,208	205,249	175,734	210,732	10.4	19.9
Number of condominum sales	324	375	196	295	363	455	386	519	412	276	197	-12.6	-28.6
Average condo. sales price ($)	46,873	92,006	109,281	100,763	90,113	112,620	135,386	151,850	187,128	168,778	157,717	7.8	-6.6
St. Thomas/St. John:													
Number of homes sold	296	128	114	119	151	218	148	196	149	157	124	-7.9	-21.0
Average home sales price ($)	30,259	115,547	138,509	116,431	137,192	163,602	184,386	231,922	240,892	236,048	263,720	10.4	11.7
Number of condominum sales	88	264	113	174	164	244	190	311	230	169	147	-4.8	-13.0
Ave. condo. sales price ($)	46,574	103,056	139,253	113,853	126,426	135,272	143,202	154,077	190,806	171,341	163,890	4.5	-4.3
St. Croix:													
Number of homes sold	182	189	136	157	179	268	234	251	129	298	127	3.9	-57.4
Average home sales price ($)	42,635	83,079	79,040	96,500	98,718	108,891	133,258	130,922	164,081	143,957	158,996	8.8	10.4
Number of condominum sales	236	111	83	121	199	211	196	208	182	107	50	-21.6	-53.3
Ave. condo. sales price ($)	46,985	65,725	68,475	81,940	60,186	86,426	127,809	148,521	182,481	164,731	139,568	12.4	-15.3

APPENDIX J

MIXING-HEIGHT DATA

Mixing ... Puerto Rico.

Instructions and Format

The data offered in the SCRAM mixing height data files are comprised of data provided by the National Climatic Data Center in their 'Twice Daily Mixing Height Data' format (TD9689). The format of the records has been modified to correspond to that required by the RAMMET and PCRAMMET preprocessor programs. Also, the first and last records of each file have been added to conform to the requirements of these preprocessor programs. RAMMET and PCRAMMET also require that the meteorological input data sets contain no missing values. Since missing data values are found within the original data sets, the missing values have been filled as prescribed in "Procedures for Substituting Values for Missing NWS Meteorological Data for Use in Regulatory Air Quality Models". The filled data values can be identified by a type code of "3" or "4", in column 12 (for morning mixing height values) or column 30 (for afternoon mixing height values). See the format description below.

The files are in .TXT format and can be accessed using the (D)ownload and (P)rotocol options. The parameters and the format of the records in these files are as follows:

Field Position	Parameter Name
1-5	National Weather Service Station Number
6-7	Year
8-9	Month
10-11	Day
12	AM Type 1 = No Precipitation. 2 = Precipitation occurred at two or more observation times with the intensity of light, or at one observation time with the intensity of moderate or heavy during the hours 1000-2100 LST for the afternoon or during the hours 2200 (previous day)-0900 LST for the morning. 3 = (afternoon) The maximum temperature selected between 1200-1600 LST is less than the surface temperature of the 1200Z RAOB temperature. (morning) The minimum temperature selected between 0200-0600 LST plus 5 degrees Celsius is less than the surface temperature of the 1200Z RAOB temperature. 4 = Missing
13	Blank
14-17	AM Mixing Height above surface (whole meters).
18-21	Wind Speed in meters per second averaged through the mixing depth (surface wind only if mixing depth < 150 meters). The average is determined from the 1200Z RAWIN. The average of the hourly surface wind speeds during 2200-0600 LST was used in place of the surface wind speed in the RAWIN. For Type 3, wind speeds were averaged from the surface through 4000 meters.
22-25	Average surface wind speed (meters per second).
26-29	Blank
30	PM Type (see AM Type)
31	Blank
32-35	PM Mixing Height above surface (whole meters).
36-39	Wind Speed in meters per second averaged through the mixing depth (See AM Wind Speed).
40-43	Average surface wind speed (meters per second).

Note that RAMMET and PCRAMMET only use the data in columns 1-11, 14-17, and 32-35.

It should be noted that the computation of mixing height requires both an upper air sounding and hourly surface temperature values. Most National Weather Service upper air sites coexist with an hourly surface site. However, when this is not the case, the closest hourly surface site has been chosen for the mixing height computations. If the sites do not coexist, the state download menus of mixing height data list both the site of the upper air sounding (labeled "UA") and the site of the surface temperature data (labeled "SFC T").

Station	Yr	Mo	Day	Arr Type	Arr min	Wind speed	avg sun wind speed	Dep type			
116418812312					1411	7.0	2.5	1	1411	7.2	6.0
116418901012					894	6.4	2.2	1	1115	7.3	6.1
116418901021					921	5.4	0.9	1	1094	5.4	5.6
116418901032					530	3.5	0.6	1	1694	4.2	4.9
116418901041					454	1.1	0.7	1	1356	3.0	4.2
116418901051					938	2.4	1.3	1	1536	3.9	3.1
116418901061					779	5.1	1.0	1	1199	6.3	4.8
116418901071					623	5.4	2.2	1	1161	5.6	5.5
116418901081					796	7.1	2.6	2	1013	6.5	6.4
116418901091					1531	8.0	4.5	1	1037	9.3	6.7
116418901101					985	7.9	2.7	1	1339	5.8	5.6
116418901112					148411	.4	4.7	2	148411	.2	9.1
116418901122					983	9.5	3.6	2	983	8.0	5.0
116418901131					1285	9.5	5.1	1	1202	8.8	7.7
116418901141					996	5.0	3.2	1	1178	5.9	6.2
116418901151					1407	8.8	4.3	1	1282	8.3	6.9
116418901161					918	6.1	0.4	2	1084	7.4	5.9
116418901172					783	6.9	2.2	1	1096	6.6	6.1
116418901181					1208	6.8	2.0	1	2282	7.7	6.3
116418901191					1420	7.2	3.4	1	1283	8.1	5.3
116418901202					905	6.8	3.1	1	1251	7.5	5.6
116418901211					623	4.4	1.2	1	1575	6.0	5.1
116418901221					1183	8.3	2.6	1	149111	.1	7.8
116418901231					958	8.5	3.3	1	1345	6.4	6.7
116418901241					1005	5.4	1.5	1	1532	5.1	5.1
116418901251					628	3.6		1	1283	5.5	5.8
116418901261					718	4.0		1	1170	6.7	5.1
116418901271					907	2.9		1	1508	4.3	4.4
116418901281					529	3.2		1	1314	5.6	4.8
116418901292					1357	6.5	1.6	1	1534	7.4	5.3
116418901301					1003	7.0	1.4	1	1586	7.7	6.2
116418901311					724	5.8	1.2	2	1054	6.3	5.1
116418902011					528	5.6	0.6	2	1393	7.4	5.3
116418902021					1440	7.3	3.5	1	1468	7.2	6.3
116418902031					1986	7.5	4.3	1	1526	5.6	5.0
116418902041					1088	3.6	1.5	1	1398	7.8	5.8
116418902051					1084	5.8	2.2	1	1663	8.3	5.3
116418902062					1053	8.3	3.4	1	105310	.8	6.8
116418902071					179012	.3	6.7	1	164210	.3	6.0
116418902082					1311	9.9	6.3	1	1311	8.9	7.6
116418902092					1563	7.8	3.3	2	1392	7.3	6.1
116418902101					986	6.1	1.8	1	1170	5.2	4.9
116418902112					1008	6.1	0.8	1	1268		5.6
116418902121					811	5.4		1	1316	4.7	4.8
116418902132					1792	7.2	2.8	1	1364	8.1	4.9
116418902141					2012	9.4	4.4	1	141111	.6	6.9
116418902152					157111	.6	6.2	2	1571	9.5	7.7
116418902162					906	5.3	0.7	2	1234	9.1	6.6
116418902172					771	8.1	2.5	2	611	5.7	3.0
116418902181					914	6.6	2.4	1	1483	8.2	6.4
116418902191					700	6.1	2.1	1	974	4.5	5.8
116418902201					579	5.1	2.2	1	1058	4.5	6.0
116418902211					938	8.1	2.1	1	938	9.2	6.2
116418902221					1027	8.4	2.9	1	1531	8.2	8.2

116418902231	987	6.0	2.3	1	1601	6.5	6.3
116418902241	676	5.1	1.4	1	1130	5.4	5.0
116418902251	1001	1.5	0.7	1	1458	3.4	4.6
116418902261	615	1.6	0.7	2	1047	2.5	3.7
116418902272	960	2.7	2.0	1	1199	6.2	5.5
116418902281	977	7.2	2.2	1	1170	7.4	6.8
116418903011	1036	6.0	2.1	1	1557	6.9	4.9
116418903021	983	7.1	1.9	1	1725	6.5	6.6
116418903033	916	8.4	2.0	1	1641	8.2	7.1
116418903041	849	8.5	2.3	1	1994	9.2	7.9
116418903051	862	7.2	1.9	1	1166	8.7	6.5
116418903062	1378	7.2	3.4	2	1186	8.5	7.7
116418903071	760	6.0	1.2	1	1400	7.4	6.3
116418903081	1044	6.6	2.1	1	1731	6.9	6.2
116418903092	1581	6.2	2.3	1	1774	5.3	5.8
116418903101	846	3.6	0.8	2	458	4.9	3.1
116418903111	447	3.9	1.1	1	1469	8.9	6.0
116418903121	1285	7.6	2.2	2	315	2.8	3.4
116418903132	853	1.8	1.5	1	508	3.2	2.5
116418903142	877	2.6	1.3	1	1115	5.4	4.5
116418903152	1152	6.6	0.8	1	1152	7.1	5.5
116418903162	1594	6.4	2.8	1	1594	7.3	5.9
116418903171	1137	7.0	3.1	2	1369	6.4	5.6
116418903181	988	7.3	2.9	1	1346	6.3	5.9
116418903191	1543	5.5	1.8	1	2180	4.0	4.2
116418903201	937	3.1	1.6	1	1634	3.6	3.7
116418903211	1150	3.3	1.6	1	1558	5.0	4.2
116418903221	838	3.2	1.5	1	1394	4.5	4.0
116418903231	1126	4.0	1.5	1	1423	6.0	4.5
116418903241	975	4.9	1.3	1	1594	7.2	5.0
116418903251	1172	7.1	1.9	1	1172	7.5	5.6
116418903262	1212	5.7	1.5	1	1678	6.3	5.7
116418903271	874	5.9	1.3	1	1506	6.8	5.3
116418903281	1310	6.2	1.3	1	1941	6.0	5.1
116418903292	1157	6.0	1.8	1	1724	6.3	4.8
116418903301	1115	3.7	1.6	1	1557	6.5	4.4
116418903311	936	4.4	0.8	1	1317	4.3	6.1
116418904012	919	1.9	0.9	1	1353	4.9	4.1
116418904021	1152	5.8	2.1	1	1268	6.0	6.0
116418904031	1536	8.4	4.9	1	1374	8.5	6.7
116418904041	1235	7.8	4.5	1	1465	7.2	6.0
116418904051	1109	6.5	3.4	1	1471	7.4	6.4
116418904061	835	5.8	2.0	1	1491	6.9	6.2
116418904071	805	6.3	1.8	1	1959	5.8	5.0
116418904081	1038	5.5	2.8	1	1865	6.3	6.0
116418904091	1294	7.7	2.5	1	1720	8.5	6.5
116418904101	1003	8.5	3.4	2	249	5.4	4.6
116418904111	1171	7.9	2.7	1	1672	7.1	7.1
116418904122	1261	6.0	3.5	1	1692	7.2	6.9
116418904131	1095	6.6	3.0	1	1239	6.6	4.6
116418904141	1132	5.7	1.6	1	1805	5.5	6.3
116418904152	980	5.7	0.9	1	1706	7.7	5.9
116418904161	1031	7.5	2.1	1	1411	7.6	6.7
116418904171	1163	6.8	2.1	1	1383	7.1	5.8

116418904181	849	4.0	0.8		1	1867	6.4	6.2
116418904191	1560	4.5	1.9		1	2060	4.4	6.2
116418904201	68				1	1629	5.1	5.5
116418904211	943	3.9	0.3		1	2124	6.2	4.7
116418904221	1166	5.5	2.1		1	2362	4.5	5.5
116418904231	1079	4.8	2.5		1	2182	3.0	3.9
116418904241	927	3.9	1.5		1	1481	4.9	5.8
116418904251	1297	4.9	1.5		1	1440	4.6	4.7
116418904261	1215	4.0	2.1		1	1641		4.7
116418904274	1099				4	1608		
116418904281	984	4.5	2.0		1	1575	6.3	5.9
116418904291	880	4.3	1.5		2	1352	5.3	5.6
116418904302	902	5.7	2.3		1	1486	6.0	5.4
116418905011	857	6.3	2.1		1	1565	6.3	7.3
116418905021	989	5.5	1.9		1	1467	7.3	6.2
116418905031	1326	6.4	2.1		1	1654	4.2	5.9
116418905041	1101	4.9	0.9		1	1490	7.7	6.9
116418905051	1041	6.2	2.3		1	1529	8.4	5.4
116418905061	1105	6.1	2.8		1	1566	7.2	5.9
116418905072	824	4.3	1.6		1	1074	6.9	4.6
116418905081	806	3.9	0.6		1	1613	4.4	4.7
116418905091	530	1.5	0.6		1	1384	3.9	5.1
116418905101	1384	3.7	1.1		1	2123	1.3	3.9
116418905111	937	2.8	2.5		1	1747	1.8	3.7
116418905121	901	0.3	1.3		1	1217	3.6	5.4
116418905131	941	1.7	1.5		1	1589	5.4	5.8
116418905144	1037				4	1552		
116418905154	1132				4	1516		
116418905161	1228	6.1	1.9		1	1479	4.8	5.6
116418905171	974	3.5	1.5		1	1250	4.1	4.8
116418905181	753	2.5	2.0		1	1093	5.4	5.7
116418905191	809	2.2	1.4		1	1491	5.2	5.5
116418905201	1182	4.3	1.8		1	1325	3.8	5.4
116418905211	957	3.0	1.6		1	1399	4.2	4.5
116418905221	1043	3.9	0.9		1	1447	6.1	4.3
116418905231	1110	6.9	2.0		1	1610	7.4	7.0
116418905241	1030	6.0	2.1		1	1745	5.5	7.3
116418905251	1224	5.2	1.5		1	1562	5.9	5.9
116418905261	976	4.4	1.3		2	648	2.9	4.1
116418905272	1049	6.1	2.0		2	1621	6.9	5.1
116418905282	1166	7.7	2.4		2	1420		3.7
116418905291	682	4.5	0.4		1	801	7.4	5.7
116418905302	1071	4.5	1.1		3	674	7.5	4.1
116418905311	879	5.9	0.4		2	548	4.0	5.1
116418906012	886	4.8	1.5		2	1194	3.9	5.1
116418906022	1012	4.8	2.2		2	905	5.1	4.5
116418906032	864	4.4	2.0		1	864	5.2	4.5
116418906041	656	4.0			1	945	6.3	5.8
116418906051	886	6.0	2.2		1	1565	6.6	5.7
116418906061	1326	8.2	2.7		1	1261	8.0	6.9
116418906072	1349	7.2	2.0		1	1406	7.3	6.6
116418906081	1268	6.8	2.4		1	1268	7.7	5.9
116418906091	1068	5.4	2.2		1	1187		6.2
116418906101	1325	8.1	2.3		1	1325	8.3	6.4

116418906112	1535	8.4	5.8	1	1164	8.4	6.0
116418906121	1461	9.5	4.0	1	1305	8.4	4.9
116418906131	1146	6.7	3.5	1	1146	6.9	5.7
116418906141	1582	7.5	3.0	1	1582	7.0	4.5
116418906151	1580	6.6	3.7	1	1398	6.9	5.7
116418906161	1299	6.1	2.2	1	1487	7.6	6.9
116418906171	1237	6.6	1.6	1	1400	5.2	4.7
116418906181	965	4.0	0.6	1	1277	6.6	5.5
116418906191	888	6.0	1.5	1	1387	5.3	6.0
116418906201	1069	4.6	1.5	1	1556	5.3	4.3
116418906211	893	5.2	1.5	1	1324	5.6	5.3
116418906221	1091	3.6	0.7	1	1305	5.3	5.6
116418906231	1152	3.2	0.9	1	1474	5.3	6.3
116418906241	900	4.5	0.3	1	1571	6.3	6.0
116418906251	872	3.8	0.6	1	1395	3.7	3.9
116418906261	937	1.8	1.4	1	1306	5.1	5.6
116418906271	986	4.5	1.8	1	1219	4.5	4.9
116418906281	1221	5.0	2.3	1	1553	7.1	5.5
116418906291	1128	5.6	1.8	1	1498		6.2
116418906301	1284	6.4	2.3	1	1627	6.8	6.0
116418907011	1343	6.0	2.3	2	1343	6.3	5.3
116418907022	916	2.3	0.7	2	1038	6.6	3.5
116418907031	992	4.7	0.3	1	1092	7.8	5.3
116418907041	1057	6.3	2.1	1	1356	7.5	6.6
116418907052	621	4.4	1.1	2	194	3.7	2.6
116418907062	597	5.9	2.2	1	1350	8.6	6.4
116418907072	756	8.9	3.2	2	756	5.9	4.6
116418907081	901	5.4	1.9	1	90110.1		6.7
116418907091	1226	7.9	2.3	1	1051	7.3	5.3
116418907102	1275	6.4	2.7	1	1275	6.1	5.5
116418907111	1013	4.9	1.9	1	1143	5.0	5.5
116418907121	589	5.2	2.4	1	1159	6.1	5.8
116418907132	971	4.4	1.4	1	1235	5.2	5.8
116418907141	820	2.7	0.6	1	1230		6.0
116418907151	1119	6.3	1.6	1	1572	7.0	5.8
116418907161	1283	6.9	2.1	1	1461	7.7	6.4
116418907171	1474	6.9	1.4	1	1740	7.3	5.8
116418907181	893	5.3	1.8	1	1470	6.0	5.8
116418907192	865	4.2	1.8	1	1524	6.3	5.8
116418907201	1334	6.7	2.1	1	1488	6.1	5.8
116418907211	1016	5.8	2.2	1	1100	6.5	5.9
116418907222	1162	7.3	2.0	1	1474	7.8	4.3
116418907232	1115	7.4	2.2	1	1252	9.0	5.6
116418907241	970	8.0	2.8	1	1370	7.3	5.8
116418907251	1082	6.0	2.3	1	1365	6.6	4.7
116418907261	1067	5.7	1.6	1	1411	7.4	5.1
116418907272	1009	6.7	1.8	2	1342	6.9	5.3
116418907281	1007	6.7	1.2	1	1088	6.0	4.5
116418907291	1354	5.7	1.9	1	1513	6.0	6.0
116418907301	1385	5.3	2.0	1	1519	7.8	5.3
116418907312	835	6.0	1.6	1	1176	9.8	4.8
116418908011	1101	7.7	4.0	1	1252	7.2	6.3
116418908021	1211	3.8	1.6	1	1588	6.1	5.3
116418908031	1427	5.0	2.2	2	1116	6.8	4.1

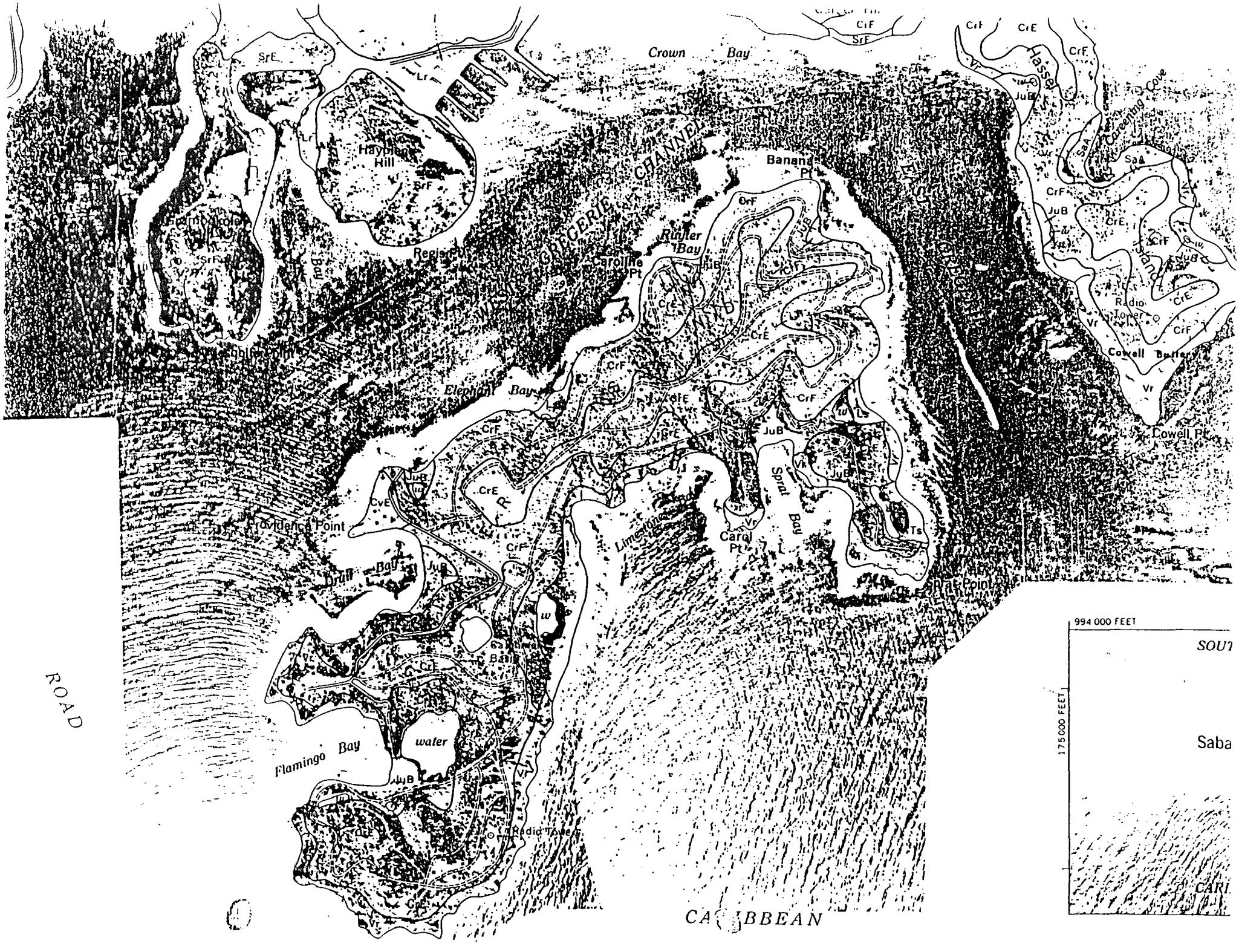
116418908042	884	3.8	2.8	1	1318	6.1	5.6
116418908051	591	3.5	2.2	2	1481	2.5	3.5
116418908061	677	6.0	1.9	1	1461	4.1	5.3
116418908071	933	1.8	1.2	1	1199	4.8	5.1
116418908081	963	5.4	1.9	1	1369	5.5	5.0
116418908091	961	4.4	1.5	1	1535	6.2	5.7
116418908101	1083	4.8	2.1	1	1595	5.5	4.1
116418908111	968	3.6	1.0	1	1154	3.9	2.6
116418908121	636	2.6	0.6	1	742	4.9	4.1
116418908131	763	3.5	1.8	1	1476	4.8	3.9
116418908141	1004	5.2	1.5	1	1555	6.3	5.1
116418908151	1089	6.2	1.8	1	1473	5.9	5.5
116418908161	1034	6.3	2.1	1	1326	7.6	5.6
116418908172	891	3.1	1.1	2	417	3.5	4.0
116418908182	748	4.9	1.2	2	864	4.1	3.9
116418908192	846	4.9	2.0	1	1387	8.1	7.5
116418908202	739	4.6	2.1	1	1207	5.9	4.3
116418908211	1531	3.2	1.6	1	1469	2.9	3.2
116418908222	1061	2.8		1	1061	[redacted]	4.7
116418908231	800	6.6	1.9	2	988	[redacted]	4.6
116418908241	834	4.2	1.8	1	1391	6.4	4.2
116418908252	688	4.8	1.5	1	1268	5.5	5.0
116418908261	762	4.5	1.6	1	1300	5.7	4.9
116418908271	1092	3.7	1.9	1	1321	4.4	3.6
116418908281	654	5.6	1.6	1	1230	6.4	5.4
116418908291	813	5.2	2.5	2	510	6.0	3.6
116418908302	836	5.4	2.3	1	1061	6.6	5.6
116418908312	1265	6.7	3.6	1	1458	6.3	5.9
116418909011	864	6.0	1.8	1	1284	6.3	6.3
116418909021	965	4.8	1.9	1	1409	7.6	6.6
116418909031	852	6.4	1.8	1	1047	8.0	7.3
116418909041	1107	7.0	3.6	1	1107	7.9	4.5
116418909051	1649	8.2	3.2	1	1760	7.3	4.5
116418909064	1168			4	1413		
116418909071	687	1.0	1.0	2	1067	2.4	3.5
116418909081	645	0.8	0.3	2	1397	2.4	4.3
116418909091	664	1.8	0.3	2	957	3.4	3.5
116418909102	1125	4.0	1.2	2	1268		4.2
116418909112	648	3.1	1.5	1	648	6.7	4.3
116418909121	876	6.3	1.8	1	1346	7.5	6.1
116418909132	1088	6.8	2.3	1	1327	5.3	5.9
116418909141	622	3.7	2.0	2	1331	5.9	3.9
116418909151	962	5.3	1.8	1	1442	5.9	5.3
116418909161	869	5.5	1.8	2	1314	7.4	4.6
116418909171	1593	6.6	2.5	1	106815.1		5.8
116418909184	1199			4	1056		
116418909194	805			4	1044		
116418909201	411	2.9	2.1	2	1032	3.0	4.3
116418909211	796	3.1	2.4	1	1232	2.8	5.3
116418909221	773	2.0	1.2	1	1064	4.4	4.3
116418909232	747	6.3	3.0	2	373	1.8	2.2
116418909242	635	3.4	2.6	1	1193	2.5	5.3
116418909252	612	4.7	7.2	1	941	7.9	6.9
116418909262	1304	6.6	2.5	1	1531	6.6	6.2

116418909272	892	4.3		1	1284	4.9	5.8
116418909281	937	3.4	0.4	1	1233	5.1	6.0
116418909291	618	3.7	1.6	1	1785	4.4	4.3
116418909301	901	4.0		1	1261	5.6	6.7
116418910014	913			4	1267		
116418910021	926	3.2		1	1273	4.3	5.9
116418910031	883	2.8	1.3	1	1458	1.9	4.7
116418910041	601	2.7	2.1	1	1442		4.5
116418910054	674			4	1484		
116418910064	746			4	1527		
116418910074	819			4	1569		
116418910081	892	3.6	1.0	1	1612	5.5	4.6
116418910092	851	4.4	1.9	1	1391	5.2	5.6
116418910101	1036	3.7	1.6	1	1750	5.8	6.0
116418910111	997	5.2	2.2	1	1444	6.9	6.1
116418910121	1114	5.5	2.1	1	1629	5.9	6.3
116418910132	933	4.3	2.3	1	1528	6.9	5.3
116418910142	933	4.3	2.0	1	1250	3.2	4.6
116418910151	805	4.5	0.4	1	1525	4.9	5.3
116418910161	766	3.4	0.4	1	1467	4.2	5.0
116418910171	718	3.0	0.5	1	1100	2.6	4.4
116418910181	463	1.5	1.2	1	1292	3.3	4.3
116418910191	621	1.5	0.5	1	1295	5.3	5.9
116418910201	1091	2.5	1.1	1	1369	3.7	5.3
116418910211	638	2.0	0.9	2	1169		4.7
116418910224	644			4	1271		
116418910231	651	1.5	1.3	2	1373	2.6	4.2
116418910241	854	1.2	0.6	1	1083	3.3	4.2
116418910251	1280	3.1	2.7	1	1359	3.0	4.2
116418910261	980	2.0	1.8	1	1245	4.3	5.1
116418910271	903	4.6	2.3	1	1444	4.2	5.0
116418910281	1083	2.5	2.1	2	1083	3.5	5.1
116418910292	938	3.0	1.5	2	1199		4.3
116418910301	978	4.3	1.9	2	729	4.9	3.6
116418910311	499	4.0	1.9	1	1064	6.0	5.8
116418911012	1001	5.2	3.3	1	1178	5.6	5.4
116418911021	1379	5.2	1.5	1	1483	5.8	4.8
116418911031	1234	4.3	3.7	1	1378	4.4	5.1
116418911041	648	4.6	2.2	1	1089	7.6	5.6
116418911052	800	5.4	0.9	1	1226	6.4	5.4
116418911061	1145	5.1	2.4	1	1145	5.9	4.5
116418911071	866	4.3		1	1283	5.9	5.1
116418911082	717	5.2	2.2	1	1137	5.5	5.1
116418911092	1169	2.3	3.1	1	1283	5.7	5.5
116418911101	704	4.7		1	1258	6.4	5.9
116418911112	962	2.7	0.5	1	1350	7.2	6.4
116418911122	1107	6.1	3.4	1	1242	7.6	5.3
116418911132	1696	7.7	4.8	1	1568	8.4	6.2
116418911141	1006	6.7	3.2	1	1260		6.1
116418911154	893			4	1338		
116418911161	780	5.0	2.2	1	1417	5.4	4.8
116418911172	810	3.4	0.5	1	1045	7.0	5.1
116418911182	851	6.0	1.6	1	1160	8.5	6.5
116418911191	718	7.5	3.1	2	955	8.2	6.7

116418911201	841	5.6	1.8		1	1212	5.1	6.1
116418911211	650	3.3	1.8		1	1585	2.4	4.8
116418911221	524	3.7	1.6		1	904	6.1	5.1
116418911231	978	4.0	3.0		1	1514	6.6	6.4
116418911241	827	5.0	0.3		1	1351	4.7	4.7
116418911252	989		0.3		1	1227	6.2	5.4
116418911261	807	5.0	2.0		1	1252	6.2	5.1
116418911271	986	5.4	1.0		1	1284	7.6	5.8
116418911281	973	8.1	3.1		1	1407	7.2	5.9
116418911291	103	2.1	2.1		1	1201	5.7	5.5
116418911301	795	4.0	2.0		1	1503		4.5
116418912011	377	1.2	1.1		1	1567	4.0	4.6
116418912021	845	3.9	0.4		1	1635	5.0	6.3
116418912031	398	3.6	1.3		1	1821	4.3	3.7
116418912041	465	1.6	2.2		1	1814	2.9	4.1
116418912051	509	2.1	2.2		1	1290	3.8	4.4
116418912061	577	3.3	1.6		1	1704	5.7	3.7
116418912071	998	6.5	2.3		1	1452	6.7	5.1
116418912081	1206	6.9	2.2		1	1321	7.2	5.4
116418912091	779	5.0	1.5		1	1323	3.6	3.6
116418912101	1205	2.6	1.6		1	1544	3.2	3.9
116418912111	925	2.2	1.5		1	1262	4.8	3.3
116418912121	966	3.3	1.3		1	1119	4.2	4.2
116418912131	772	4.0			1	1444	3.8	4.7
116418912141	615	3.3	1.1		1	1319	4.3	4.1
116418912151	957	1.7	1.3		1	1159	3.3	3.1
116418912162	783	4.0	1.5		1	1405	6.9	5.1
116418912171	774	4.8	0.9		1	1397	6.5	5.4
116418912181	1072	4.1	2.2		2	958	6.3	5.7
116418912192	659	2.0	0.7		1	1568		5.1
116418912201	837	5.0	1.3		1	1313	6.0	5.3
116418912211	359	1.0	0.4		1	2225	5.3	5.5
116418912221	291	1.0			1	1385	5.1	4.8
116418912231	715	5.7	1.0		1	1176	4.4	4.8
116418912241	522	2.4	0.7		1	1880	5.8	4.6
116418912251	712	1.9	2.1		1	1797	4.0	3.6
116418912261	400	2.6	0.7		1	2338	5.4	5.6
116418912271	984	4.3	0.3		1	1594	5.6	4.7
116418912281	809	6.5	1.4		1	1280	7.0	4.9
116418912292	623	6.3	3.4		1	1266	5.9	3.9
116418912302	747	4.5	1.8		1	1168	6.3	5.5
116418912311	729	3.2	1.3		2	1155		5.3
116418912311	729	3.2	1.3		2	1155		5.3

APPENDIX K

SOILS ON WATER ISLAND


Crown Bay
Hassel
Careening Cove
Banana Pt
Haypiece Hill
Registry
Caroline Pt
Ruyter Bay
Elephant Bay
Providence Point
Drill Bay
Flamingo Bay
water
Radio Tower
Cowell Pt
Spratt Bay
Carol Pt
Limestone
Spratt Point
Saba
CARIBBEAN
ROAD
994 000 FEET
175 000 FEET
SOUT
Saba
CARI

Soil and map symbol	Depth to--		Depth from surface	Classification		
	Bedrock	Seasonal high water table		USDA texture	Unified	AASHO
	In.	Ft.	In.			
Aguilita: AgB, AgC2, AgD, AgE, AgF.	4-14	10+	0-10	Gravelly clay loam	GC	A-2 or A-4
			10-60	Soft limestone	CL	A-6
Aguirre: AuA	60+	10+	0-60	Clay	CH	A-7
Coamo: CaB	60+	10+	0-8	Clay loam	CH or MH	A-7
			8-24	Clay	CH	A-7
			24-40	Clay loam	CH or MH	A-7
			40-60	Gravelly clay loam, clay loam, and gravel.		
Cobbly alluvial land: Cb[1,2]	60+	10+				
Cornhill: CoA	60+	10+	0-9	Gravelly clay loam	CL or ML	A-4
			9-18	Clay loam	CH	A-7
			18-30	Clay	CH	A-7
			30-48	Gravelly clay	CL or ML	A-6
Cramer: CrC, CrE, CrF, CsE2, CsF, CvE.	10-20	10+	0-9	Gravelly clay loam	GM or ML	A-7
			9-19	Clay and gravelly clay	CL	A-7
			19	Volcanic mudstone.		
Descalabrado: DeD, DeE, DeF.	10-20	10+	0-10	Clay loam	MH or CH	A-7
			10-19	Silty clay loam	ML or CL	A-7
			19	Volcanic rock.		
Diamond: DlB, DlC2---- For Limestone rock land part, see Limestone rock land.	8-16	10+	0-10	Clay loam	ML or CL	A-6
			10-14	Loam	ML or CL	A-4
			14	Limestone.		
Dorothea: DoE, DoF	24-37	10+	0-6	Clay loam	MH or CH	A-7
			6-19	Clay	MH or CH	A-7
			19-36	Clay loam	MH or CH	A-7
Fraternidad: FcA, FcC2.	60+	10+	0-23	Clay	CH	A-7
			23-43	Clay	CH	A-7
			43-62	Clay	CH	A-7
Fredensborg: FrA, FrB, FrC2.	10-20	10+	0-20	Clay, silty clay loam	MH or CH	A-7
			20-50	Silt loam, soft marl, and limestone	CL	A-6
Glynn: GyB, GyC2	60+	10+	0-12	Clay loam	CL	A-7
			12-30	Clay, clay loam	CH	A-7
			30-59	Clay loam, sandy loam, and clay	CH	A-7
Hesselberg: HeA	10-20	10+	0-12	Clay	MH	A-7
			12-17	Clay	MH	A-7
			17-18	Limestone	GM	A-1
			18	Limestone.		
Isaac: IsD2, IsE, IvD	20-72	10+	0-11	Gravelly clay loam	GM or ML	A-7
			11-19	Clay	CL	A-7
			19-36	Clay loam	CL	A-7
			36	Volcanic rock.		

See footnotes at end of table.

Percentage passing sieve--				Permeability	Available water capacity	Reaction	Shrink-swell potential
). 4	No. 10	No. 40	No. 200				
				In./hr.	In./in. of soil	pH	
55-65	45-55	45-55	30-40	0.63-2.00	0.15-0.20	7.9-8.4	Moderate.
99	97	82	56	0.63-2.00	0.10-0.15	7.9-8.4	Moderate.
100	100	90-100	75-95	0.06-0.20	0.10-0.15	7.4-8.4	Very high.
80-90	75-85	70-80	65-75	0.63-2.00	0.15-0.20	6.6-7.3	Moderate.
85-95	80-90	75-85	70-80	0.20-0.63	0.15-0.20	7.4-8.4	Moderate.
80-90	75-85	70-80	65-75	0.63-2.00	0.15-0.20	7.4-8.4	Moderate.
75-85	70-80	65-75	70-80	0.20-0.63	0.15-0.20	7.4-8.4	Moderate.
100	100	90-100	70-80	0.20-0.63	0.15-0.20	7.4-8.4	Moderate.
100	100	90-100	75-95	0.06-0.20	0.15-0.20	7.4-8.4	Very high.
75-85	70-80	70-80	75-85	0.20-0.63	0.15-0.20	7.4-8.4	Moderate.
65-75	60-70	55-65	45-55	2.00-6.30	0.15-0.20	6.1-7.3	Moderate.
90-100	80-90	65-75	55-65	0.63-2.00	0.15-0.20	6.1-7.3	Moderate.
85-95	85-90	80-90	70-80	0.20-0.63	0.15-0.20	6.1-7.3	Moderate.
100	100	90-95	65-75	0.63-2.00	0.10-0.15	6.1-7.3	Moderate.
100	100	90-100	70-80	0.63-2.00	0.15-0.20	6.6-7.3	Low.
100	100	85-95	60-75	2.00-6.30	0.10-0.15	7.4-8.4	Low.
100	100	90-100	65-75	0.63-2.00	0.15-0.20	5.6-6.5	Moderate.
100	100	90-100	70-80	0.20-0.63	0.15-0.20	5.6-6.5	Moderate.
100	100	90-100	65-75	0.63-2.00	0.15-0.20	5.6-6.5	Moderate.
95-100	90-100	80-90	75-85	0.06-0.20	0.15-0.20	7.4-8.4	High.
100	100	90-100	85-95	0.06-0.20	0.15-0.20	7.4-8.4	Very high.
100	100	90-100	80-90	0.06-0.20	0.15-0.20	7.4-8.4	Very high.
99	90-100	85-95	75-85	0.20-0.63	0.15-0.20	7.4-8.4	High.
99	95-100	80-90	56-70	0.63-2.00	0.10-0.15	7.9-8.4	Moderate.
96	90-100	80-90	65-75	0.20-0.63	0.15-0.20	6.6-7.8	Moderate.
99	99	95-100	85-95	0.20-0.63	0.15-0.20	6.6-7.8	High.
99	95-100	90-100	80-90	0.63-2.00	0.15-0.20	7.4-8.4	High.
98	95-100	85-95	80-90	0.63-2.00	0.10-0.15	6.6-7.8	High.
99	99	90-100	90-100	0.63-2.00	0.10-0.15	6.6-7.8	High.
50-60	40-50	25-35	15-25	---	---	---	
65-75	60-70	55-65	45-55	2.00-6.30	0.15-0.20	6.1-7.3	Moderate.
90-100	80-90	65-75	55-65	0.63-2.00	0.15-0.20	6.1-7.3	Moderate.
85-95	70-80	65-75	55-65	0.63-2.00	0.15-0.20	6.1-7.3	Moderate.

Soil and map symbol	Depth to--		Depth from surface	Classification		
	Bedrock	Seasonal high water table		USDA texture	Unified	AASHO
	In.	Ft.	In.			
Jacana: JaB, JaC, JaD--	20-36	10+	0-9	Clay loam	MH or CH	A-7
			9-17	Clay loam	MH or CH	A-7
			17-26	Gravelly clay	ML or CL	A-7
			26-29	Volcanic rock.		
Jaucas: JuB[1]	60+	1-4	0-60	Sand	SM or SP	A-2
Lavallee: LaB	60+	10+	0-18	Gravelly clay loam	CL or ML	A-4
			18-48	Very gravelly loam	GC	A-2 or A-4
Leveled clayey land: Lc[2].	60+	10+				
Leveled marly land: Lm[2].	60+	10+				
Leveled rocky land: Lr[2].	At surface.	10+				
Limestone rock land: Ls[2].	0-10	10+				
Made land: Ma[1,2]	60+	5+				
Magens: MgF	60+	10+	0-10	Silty clay loam	MH	A-7
			10-42	Clay	MH	A-7
			42-84	Clay loam	ML or CL	A-6
Parasol: PaB, PaC	60+	10+	0-13	Clay loam	ML or CL	A-7
			13-24	Clay	MH or CH	A-7
			24-40	Clay loam	ML or CL	A-7
			40-80	Saprolite.		
Pozo Blanco: PbC, PbD--	60+	10+	0-13	Clay loam	CH	A-7
			13-18	Silty clay loam	CH	A-7
			18-48	Loam	CL	A-6
Rock land. No estimates.						
San Anton: SaA, SaC[1]	60+	5+	0-9	Clay loam	MH	A-7
			9-32	Gravelly clay loam	CL or ML	A-6
			32-50	Clay loam	MH	A-7
Sion: ScB, ScC	10-20	10+	0-17	Clay loam	MH or CH	A-7
			17-50	Soft limestone and marl	CL	A-6
Southgate: SgE, SgF, SrF.	10-20	10+	0-7	Clay loam	MH	A-7
			7-18	Gravelly loam	GC	A-2 or A-4
			18	Volcanic rock.		
Tidal flats: Tf[1,2]	60+	0-3				
Tidal swamp: Ts[1,2]	60+	0-1				

See footnotes at end of table.

OF THE SOILS--CONTINUED

Percentage passing sieve--				Permeability	Available water capacity	Reaction	Shrink-swell potential
No. 4	No. 10	No. 40	No. 200				
				In./hr.	In./in. of soil	pH	
85-95	85-90	80-90	70-80	0.20-0.63	0.15-0.20	6.1-7.3	High.
85-95	85-90	80-90	70-80	0.20-0.63	0.15-0.20	6.1-7.3	Moderate.
100	100	90-95	65-75	0.63-2.00	0.10-0.15	6.1-7.3	Moderate.
100	100	85-95	5-15	6.30-20.0	0.05-0.10	7.4-8.4	Very low.
75-85	70-80	65-75	70-80	0.20-0.63	0.15-0.20	6.1-7.3	Moderate.
55-65	45-55	45-55	30-40	0.63-2.00	0.10-0.15	6.6-7.8	Low.
100	100	95-100	85-95	0.63-2.00	0.10-0.15	5.1-6.0	Low.
100	100	90-100	75-95	0.63-2.00	0.15-0.20	4.5-5.5	Low.
100	100	90-100	70-80	0.63-2.00	0.10-0.15	4.5-5.5	Low.
-100	90-100	80-90	60-70	0.63-2.00	0.10-0.15	5.1-5.5	Moderate.
100	100	80-90	58-70	0.20-0.63	0.15-0.20	6.6-7.3	High.
100	100	70-80	51-60	0.63-2.00	0.10-0.15	6.6-7.8	Moderate.
100	100	90-100	70-80	0.63-2.00	0.10-0.15	6.6-7.8	Moderate.
100	100	95-100	85-95	0.63-2.00	0.15-0.20	7.4-8.4	Moderate.
100	100	85-95	60-75	0.63-2.00	0.10-0.15	7.4-8.4	Moderate.
85-95	85-95	80-90	70-80	0.63-2.00	0.15-0.20	6.1-7.3	Moderate.
75-85	70-90	65-75	70-80	0.63-2.00	0.10-0.15	6.6-8.4	Low.
100	100	90-100	70-80	0.63-2.00	0.15-0.20	7.4-8.4	Moderate.
99	90-100	85-95	75-85	0.20-0.63	0.15-0.20	7.4-8.4	Moderate.
99	97	75-85	56-65	0.63-2.00	0.10-0.15	7.9-8.4	Moderate.
85-95	85-95	80-90	70-80	0.63-2.00	0.15-0.20	5.1-6.0	Moderate.
55-65	45-55	45-55	30-40	2.00-6.30	0.10-0.15	5.6-6.5	Low.

TABLE 5.--ESTIMATED PROPERTIES

Soil and map symbol	Depth to--		Depth from surface	Classification		
	Bedrock	Seasonal high water table		USDA texture	Unified	AASHO
	In.	Ft.	In.			
Victory: VcD, VcE------	60+	10+	0-22	Clay loam----------	MH or CH	A-7
Volcanic rock land: Vr[2].	0-6	10+				

[1]Subject to flooding.

OF THE SOILS--CONTINUED

Percentage passing sieve--				Permeability	Available water capacity	Reaction	Shrink-swell potential
No. 4	No. 10	No. 40	No. 200				
				In./hr.	In./in. of soil	pH	
100	100	90-100	65-75	0.63-2.00	0.15-0.20	5.6-6.5	Moderate.

[2]Material variable. Onsite determination is necessary.

APPENDIX L

LISTING OF THREATENED SPECIES ON THE U.S. VIRGIN ISLANDS

Compiled by the Division of Fish and Wildlife (DPNR), the UVI Cooperative Extension Service, Eleanor Gibney (Caneel Bay), Gary Ray (U. of Wisconsin) and William Mclean (UVI).

Scientific Name	Common Name	Distribution/Remarks
PLANTS		
Federal List		
Buxaceae		
Buxus vahlii	Vahl's boxwood	Endangered, St.X. - May be extinct
Rutaceae		
Zanthoxyllum thomasianum	Prickly Ash	Endangered, St.T., St.J.
Virgin Islands List		
Agavaceae		
Agave eggersiana	Egger's agave	St.X.
Aizoaceae		
Cypselia humifusa		St.T., St.J.
Aquifoliaceae		
Ilex urbanii	Urban's holly	St.J., Tortola
I. sideroxyloides	Central Amer. oak	St.J.
Bromeliaceae		
Tillandsia lineatispica	Pinon	Rare bromeliad, St.J., St.T.
Cactaceae		
Mammilaria nivosa	Wooly nipple	St.X., St.J., St.T., offshore cays
Opuntia triacantha		Buck Is. (St.X.), St.T.
Celastraceae		
Maytenus cymosa		St.X., St.T.
Convolvulaceae		
Operculina triquetra		St.X., St.T. endemic
Euphorbiaceae		
Croton fishlockii		Recent St.J. sightings
Fabaceae		
Erythrina eggersii	Egger's Cockspur	St.T., St.J., St.X.
Galactia eggersii	Egger's galactia	St.T., St.J.
Malpighiaceae		
Malpighia woodburyana	Cowage cherry	St.T., St.J., offshore cays
M. infestissima (=pallens)	S tinging bush	St.X.
M. linearis		All VI
Malpighia sp.		Similar to M. coccigera, St.J.
Byrsonima sp.		New species?, St.J.
Malvaceae		
Psidium amplexicaule		St.J.
Psidium sp.		St.J., new species?
Sida eggersii		N. offshore cays?
Myrtaceae		
Calyptra thes thomasiana	St. Thomas lidflower	Fed. endang. soon, St.T., St.J.
Eugenia sp.		Recent St.J. sightings

Olacaceae		
Schoepfia schreberi		St.T., St.J., St.X.
Orchidaceae		
Brassavola cucullata		St.T.
Epidendrum bifidum		
E. ciliare		
E. cochleatum		
Habenaria alata		St.T.
Oncidium prionochilum		
O. variegatum		
Polystachya concreta		St.T., Virgin Gorda
Ponthieva racemosa		
Prescottia oligantha		
P. stachyoides		
Spiranthes elata		
Tetramicra canaliculata		
T. canaliculata alba		End. subsp., Water Is.
Vanilla barbellata	Vanilla orchid	
Piperaceae		
Peperomia myrtifolia	Myrtle-leaved Peperomia	St.J., St.X.
Polygonaceae		
Coccoloba rugosa		May be extinct in VI
Rubiaceae		
Catesbaea melanocarpa		St.X.
Machaonia woodburyana		New St.J. sightings
Sapotaceae		
Manilkara bidentata	Bulletwood	St.T., St.J.
Solanaceae		
Solanum mucronatum		confused taxonomy, St.T., St.J.
S. conocarpum		Last seen 1900
Urticaceae		
Pilea richardii	Richard's clearweed	St.T.
Verbenaceae		
Callicarpa ampla	Capa rosa ...	info needs update
Nashia inaguensis		St.X.
Zygophyllaceae		
Guaiacum officinale	Lignum vitae	W.I., High hort. demand

ANIMALS

Federal List

Chelonia mydas	Green turtle	Threatened, Resident, breeding
Eretmochelys imbricata	Hawksbill turtle	Endangered, Resident, breeding
Dermochelys coriacea	Leatherback turtle	Endangered, Migrant, breeding
Pelecanus occidentalis	Brown pelican	Endangered, Resident, breeding
Falco peregrinus	Peregrine falcon	Endangered, Winter migrant
Epicrates monensis granti	VI Tree boa	Endangered, Resident, breeding
Ameiva polops	St. X. ground lizard	Endangered, Resident, breeding
Sterna dougallii	Roseate tern	Threatened, migrant, breeding

Virgin Islands List

Mabuya mabouia	Slipperyback skink	Resident, breeding
Otus nudipes newtoni	VI Screech owl	Resident, breeding
Chordeiles gundlachii	West Indian nighthawk	Resident, breeding?
Anthracothorax dominicus	Antillean mango	Resident, breeding?
Podiceps dominicus	Least grebe	Resident, breeding?
Sterna antillarum	Least tern	Migrant, breeding
Phaethon lepturus	White-tailed tropicbird	Resident, breeding
Ardea herodius	Gt. blue heron	Resident, breeding
Casmerodius albus	Great (common) egret	Resident, breeding
Egretta thula	Snowy egret	Resident, breeding
Nycticorax nycticorax	Black-cr. night heron	Resident, breeding
Ixobrychus exilis	Least bittern	Resident, breeding?
Anas bahamensis	Bahama duck	Resident, breeding
Oxyura jamaicensis	Ruddy duck	Peripheral resident
Rallus longirostris	Clapper rail	Resident, breeding
Fulica caribea	Caribbean coot	Resident, breeding
Charadrius alexandrinus	Snowy plover	Resident, breeding?
Catoptrophorus semipalmatus	Willet	Resident, breeding
Puffinus lherminieri	Audubon shearwater	Migrant, breeding
Aratinga pertinax	Brown-throated parakeet	Resident, breeding
Columba leucocephala	White-crowned pigeon	Resident, breeding
Geotrygon mystacea	Bridled Quail dove	Resident, breeding
Myiarchus stolidus	Stolid flycatcher	Resident, breeding
Noctilio leporinus	Fisherman bat	Resident, breeding
Stenoderma rufum	Red fruit bat	Resident, breeding
Brachyphylla cavernarum	Cave bat	Resident, breeding
Order Antipatharia	Black coral	Marine benthic, high demand
Epinephelus itajara	Jewfish	Marine

The above list represents plants and animals occuring in the US Virgin Islands which are protected by either the US Endangered Species Act of 1973 or the VI Endangered and Indigenous Species Act of 1990 (Act No. 5665). This list is promulgated under Act 5665, Section 104(g) and may be revised as new information becomes available.

_____

Roy E. Adams, Commissioner, DPNR

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Date

APPENDIX M

COMMENTS TO MANAGEMENT AND TECHNOLOGIES ASSOCIATES, INC. WORKPLAN

Memorandum For: Theresa Gegen

From: John Bulger

Date: November 7, 1992

Subject: Former Fort Segarra Work Plans

As requested, attached are the consolidated USACMDA and SAIC comments to the Former Fort Segarra Work Plans. It is SAIC's opinion that the MTA work plans are not in accordance with Federal environmental requirements and provisions have not been made to handle Chemical Warfare Materiel as hazardous waste.

If agreeable, we would like to hand carry the Old O-Field work plan and provide it to MTA at the Huntsville review meeting. Please let us know if we can be of any further assistance.

Copies Furnished:

Chuck Heyman
Craig Myler
Peggy Thompson

SAIC
An Employee-Owned Company

REVIEW OF

DRAFT WORK PLANS

FOR THE FORMER FORT SEGARRA

The following are comments to the Management and Technologies Associates, Inc (MTA) Former Fort Segarra Draft Work Plans. These plans include a proposed Site Specific Work Plan (SSWP), a Safety, Health and Emergency Response Plan (SHERP), a Chemical Data Acquisition Plan (CDAP), a Property Management Plan, a Quality Control (QC) Plan, a Work, Data, and Cost Management Plan (WDCMP), a Defense Reutilization Marketing Office (DRMO) Turn-in Plan, a Sampling, Analyzing, and Relocating Non-DoD Debris Plan, and a Site Specific Environmental Protection Plan for Remediation of Sites in the U.S. Virgin Islands and Puerto Rico.

Comments are divided into three sections. Section I provides general comments which are applicable to all plans. Section II provides formatting suggestions for each plan based on the US EPA document *Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA, October 1988.* Section III provides specific comments for each plan.

1.0 Section I. General Comments.

1.1 These plans do not support a Remedial Investigation/Feasibility Study (RI/FS) and eventual Record of Decision (ROD) as required under CERCLA. The contractor has provided plans to remediate the site up to and including the point where vegetation is replaced. There is no process where the site is first investigated and then a decision is made as to how or if the site is to be remediated. In accordance with this general comment, the soil and groundwater sampling sections should be expanded to support this decision making process. Sections describing excavation and transportation of UXO/OEW should be deleted since these are future actions not included in the current effort and are dependent on the outcome of the site characterization phase.

1.2 The organizational structure for the planned efforts on Water Island should be clearly defined to include federal agencies. Accordingly, if an agreement has been reached between the Department of Interior and the Army Corp of Engineers for Rights of Entry on Water Island, this should be provided as a reference as well as any cooperative agreements between EPA and the Government of the Virgin Islands for possible remediation actions.

1.3 The plans furnished indicate that non-DOD waste will be held on Water Island awaiting Government guidance. This should be coordinated with the Government of the Virgin Island's and DOI and then reflected in the plans as to the final disposition of the non-DOD waste. The plans should also address the final disposition of DOD waste found during this site characterization phase since there is a 500 pound concrete filled bomb on Water Island already and additional items may be discovered during sweeps and non-DOD waste movement.

1.4 The work plan requires assistance from Technical Escort Unit (TEU) for handling Chemical Surety Material (CSM). Recommend that this term be changed to Chemical Warfare Materiel (CWM) throughout the documents for correctness and consistency. A detailed description/plan of TEU's efforts should be included with these plans.

1.5 From the text of the plans, MTA indicates that any CWM contaminated items and/or material as not being their responsibility. If CWM items are discovered during this site characterization phase, a detailed plan that addresses all aspects of recovery, handling, localized remediation, etc. for CWM must be prepared by MTA and supplemented with plans for other organizations that could be involved such as TEU. It is recognized as indicated in para 1.1 above, that excavation and the associated soil remediation should not be part of these plans at this time. However, a strategy needs t be developed, by the Government organizations involved, for the next phase of site characterization which is scheduled to start in Mar 93 and would include these type of activities. Accordingly, it is recommended that a meeting, chaired by Huntsville Div., be held in the Feb 93 time frame to develop the strategy.

1.6 Plans for handling CWM that may be found on the surface are lacking. At Raritan work commenced on this type of action since CEHND came on line and stated that it was highly unlikely that items would be found on the surface. This assumption was valid for that area since the surface had been swept visually and with magnetometers several times in the past. Therefore all found items would be treated as an unexpected "emergency" find and handled by TEU. However, this same assumption can not be made for the Former Fort Segarra. Plans must be in place to deal with found suspect CWM prior to work starting on site. It is unrealistic to plan that TEU will step in and handle any CWM finds at FFS as an emergency.

1.7 The tone of the entire Work Plan makes one assume the most hazardous material that could be found at the site is unexploded ordnance rather than CWM.

1.8 Provisions should be made for the containment, storage and removal of hazardous waste. Sampling techniques should be established to categorize wastes. Decontamination fluids should be containerized and not disposed of without proper pre-disposal sampling. In addition, a plan must be established to sample excavated soils. The results of the sampling will indicate if the soils may be reused on the property or removed by a licensed waste hauler for offsite disposal. Brush and other

debris removed from the area during onsite operations should be treated in the same manner.

1.9 Recommend MTA be given a copy of the site-specific work plan entitled *Containment and Treatment of contaminated Groundwater at Old O-Field, Aberdeen Proving Ground, Maryland.* This document lays valuable groundwork for remediation actions involving CWM. In particular, the emergency procedures, monitoring procedures and PPE levels are applicable to the FFS remediation efforts.

1.10 Based on the history of FFS, recommend if any unexploded ordinance is uncovered, it is assumed to be chemical filled and TEU assistance requested.

1.11 Plans are deficient in terms of emergency procedures if CWM is uncovered. The downwind hazard distance for the Most Probable Event (MPE) and Maximum Credible Event (MCE) should be estimated in accordance with DA PAM 50-6 and emergency response plans should be developed for these events. Consideration should be given to shutting down roads and/or evacuating personnel in close proximity to the test areas during their remediation. As a minimum, a warning system should be established in the event CWM is detected. In MTA's plans, local emergency response personnel are called in if CWM is detected. If this is to happen, the local emergency response and hospitals must be trained to deal with a CWM emergency. MTA personnel on site should have some capability of treating these casualties. At a minimum, appropriate decontamination, first aid supplies including Nerve Agent Antidote Kits (NAAK), and a person trained in first aid for agent casualties should be available.

1.12 During the recent review of plans for Former Raritan Arsenal, we recommended that NSCM contractors be required to develop separate medical support plans for each site. The generic content of such medical support plans has been previously provided to you, and we would strongly encourage CEHND to require MTA to develop a medical support plan consistent with this guidance (Reference Memorandum, SFIL-CMS, 23 Nov 92, Subject: Medical Support Requirements for NSCM Activities. This document is provided at enclosure 1 to these comments.).

1.13 Reports are disjointed in terms of agent monitoring. The CDAP has SOP's on DAAMS, the work plan indicates the M18A2 will be used and the SHERP indicates the ACAMS and the M18A2 will be used. Recommend during all intrusive operations a continuous agent air monitor be used which monitors to the Time Weighted Average (TWA) level for workers. In addition, low level monitors (ACAMS or MINICAMS) should be used to monitor to IDLH levels. The DAAMS should be used as a backup to the ACAMS or MINICAMS since both are subject to interference. Equipment capable of analyzing the sorbant tube (such as a VIKING) should be available on site for quick response.

1.14 Mustard is the only agent addressed throughout the plan. The nerve agents that were used on Water Island could be unearthed and should be of equal if not higher concern. The hazards, monitoring plan, and mitigation plan for each agent must be included in the plans.

1.15 Chemical agent degradation products should also be analyzed for in the soil and groundwater samples. Typically thiodiglycol is used to characterize mustard, isopropyl methyl phosphonic acid and methyl phosphonic acid indicate G-series nerve agents.

1.16 In the workplan, MTA identified four additional sites in which OEW/chemical agent filled ordnance may be buried. These include:

- Flamingo Bay Harbor
- Boundary shorelines of Test Area Nos 7 and 2 and the Flamingo Bay Warehouse and Landfill Area
- Salt water tidal pools around Water Island
- Tunnels at the Old Fort (air monitoring only).

The rationale for including these sites should be provided and the Army must make a determination as to whether this is warranted. How will these areas be investigated?

1.17 MTA's list of potential munitions on Water Island is incomplete. They should be provided a copy of the 1950 Army memorandum concerning the *Dis-Establishment of the San Jose Project* which lists the munitions removed from Water Island at the conclusion of the project. This document is provided as enclosure 2 to these comments.

1.18 Standard Operating Procedures (SOP's) for any applicable onsite field operations should be included in an Attachment section of the Work Plan or the SHERP. The SOP's should include but are not limited to procedures for confirming ordnance and explosive waste (OEW) to be safe, procedures for operating field instruments, maintaining a field log book, soil and vegetation sample collection, sample shipment, chain-of-custody procedures, decontamination procedures, and field screening methods.

1.19 According to the Scope of Work issued by the Army, the contractor did not prepare Plans which satisfy the objectives of the Scope of Work. The contractor was responsible for classifying the land, assisting with public meetings, preparing a plan for hazardous and toxic waste sampling, preparing an Engineering Cost Estimate, and preparing and submitting reports. These aspects were not fully addressed. In addition, the contractor added tasks to their scope including locating, identifying, and disposing of UXO/OEW. These tasks are not part of the objective.

1.20 The SSHP/SHERP provided to accompany the SSWP was written by Ebasco, Inc. and therefore there is a lack of continuity between this document and the other plans. The SSHP/SHERP was written as a generic Health and Safety Plan for work performed at test areas 1 through 8.

1.21 The Community Relations section of the *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA, October 1988,* recommends that "at a minimum, the plan must provide for a site mailing list, a conveniently located place for access to all public information about the site, an opportunity for a public meeting when the RI/FS report and proposed plan are issued, and a summary of public comments on the RI/FS report and proposed plan". Public notification of the availability of the SSWP is required upon finalization of these documents. In addition, the Scope of Work requires that the contractor assists with public meetings. The "public" should be defined. Is the effected public limited to people on Water Island or does it include people on nearbly islands (i.e., St. Thomas)?

1.22 MTA should obtain a copy of the Virgin Island Codes and associated regulations. Certain plans and approvals are required prior to disturbing the land. In addition, most of these sites are within close proximity to the shore and wetland/coastal management regulations may apply.

1.23 Personnel responsibilities and authorities should be included in the same document, not spread across several. For example, the Work, Data, and Cost Management Plan (WDCMP) describes the authority of the IHT and the QC personnel but the duties of the IHT and the QC personnel are described in the SHERP and in the QC plan without reference to the WDCMP.

1.24 All plans should have their pages numbered.

2.0 Section II. Suggested Formats

In order for these plans to be more effective, it is recommended that the organizational structure follow the industry accepted format for remedial investigation/feasibility studies (RI/FS) work plans as outlined in Tables 2-3, 2-4 and Appendix B of the US EPA document *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA, October 1988.* Based on these Guidelines, the work plans should be structured as follows.

2.1 Suggested Format for The RI/FS Work Plan

Executive Summary

Introduction

Site Background and Setting
Initial Evaluation
Type and volumes of waste present
Potential pathways of contaminant migration/preliminary public health and environmental impacts
Preliminary identification of operable units
Preliminary identification of response objectives and remedial action alternatives

Work Plan Rationale
DQO needs
Work Plan approach

RI/FS
Costs and Key Assumptions
Schedule
Project Management
Staffing
Coordination
References

Appendices.

2.2 Suggested Format for the Sampling and Analysis Plar (SAP)

Recommend this plan be divided into a Field Sampling Plan (FSP) and Quality Assurance Project Plan (QAPP)

2.2.1 Field Sampling Plan

Site Background
Sampling Objectives
Sample Location and Frequency
Sample Designation
Sampling Equipment and Procedures
Sample Handling and Analysis

2.2.2 Quality Assurance Project Plan

Title Page
Table of Contents
Project Description
Project Organization

QA Objectives for Measurement
Sampling Procedures
Sample Custody
Calibration Procedures
analytical Procedures
Data Reduction, Validation, and Reporting
Internal Quality Control
Performance and Systems Audits
Preventative Maintenance
Data Assessment Procedures
Corrective actions
Quality Assurance Reports

2.3 Suggested Format for The Health and Safety Plan (SSHP/SHERP)

- The name of the site health and safety officer and the names of key personnel and alternates responsible for the site safety and health.
- A health and safety risk analysis for existing site conditions, and for each site task and operation.
- Employee training assignments.
- A description of personal protective equipment to be used by employees for each of the site tasks and operations being conducted.
- Medical surveillance requirements.
- A description of the frequency and types of air monitoring, personnel monitoring, and environmental sampling techniques and instrumentation to be used.
- Site Control measures.
- Decontamination procedures.
- Standard operating procedures for the site.
- A contingency plan that meets the requirements of 29 CFR 1910.120(I)(1) and (I)(2).
- Entry procedures for confined spaces.

3.0 Section III. Specific Comments.

3.1 Specific Comments regarding the Site Specific Work Plans.

A comprehensive Site Background and Setting section should be summarized in the SSWP. This section should include but is not limited to a description of each test area, the buildings currently on the property, the proximity of the site to surrounding wetland areas, the site accessibility to the public, the groundwater flow direction, the site geology and hydrology, and a figure depicting the site and abutting properties. Information applicable to this section can be found in the previously written *Final - Draft Work Plan for OEW Remediation at Former Fort Segarra Water*

Island, U.S.V.I. prepared for the U.S. Army Corps of Engineers by Ebasco Services, Inc. dated March 5, 1992.

The field log book is not mentioned in the SSWP. Reference to a bound, field logbook should be located in one section of this document. It is recommended that there be a separate section outlining the general use of a field log book in the SSHP/SHERP, CDAP, and Sampling, Analyzing, and Relocating Non-DoD Debris Plan.

The SSWP is a comprehensive list of field tasks to be accomplished at Water Island. The SSWP does not address the proposed methods to perform the field activities. The methods, including Standard Operating Procedures should be expanded.

The project schedule should be outlined in the SSWP. Schedules for personnel training on the use of equipment should be outlined in the SSSHP/SHERP.

An Emergency Response Plan should be included in the SSWP.

Page 1, paragraph 1.1: Reference is made to the SSSHP and CDAP as Attachments II and III, respectively. The CDAP is not labelled as Attachment III and an Attachment I could not be located.

Page 1, paragraph 1.2.1: Project objectives should be re-written based on the general comments and the Army Scope of Work. It should be noted that if ordinance is uncovered, it is most likely to contain CWM. The statement that the objective is to locate UXO/OEW is misleading.

Page 9, paragraph 3.2.2: The use of a portable cellular phone has the potential for a security problem. Recommend the acquisition of a phone with at least 10 channels to abate this situation.

Page 10, Paragraph 3.3.2.2: A reference is made to a "Wyle" work crew. What is that and how does it fit into the reporting structure?

Page 11, paragraph 3.3.6: Will the Quality Control Specialist be responsible for calibration/QA/QC of the low level chemical monitors that will be required to support work at Fort Segarra?

Page 13, paragraph 3.4.4 and 3.4.5: These positions should have additional qualifications such as QC background and safety experience/training. The UXO Supervisor should be a different person from the Quality Control Specialist and the Site Safety Officer.

Page 13, paragraph 3.4.7: The First Aid/CPR Attendant should have knowledge of treating a person potentially contaminated with CWM. At a minimum, he should know how and when to administer the Nerve Agent Antidote Kit.

Page 14, paragraph 4.0 Equipment: Most of these sections refer to Appendices which are not

available. It is common industry practice to attach any operating instructions or manuals for field equipment to the SSWP in the Appendices section. All equipment to be used in the field should be listed in the Work Plan with a brief description of the equipment, its purpose in the field, calibration methods, and background levels. A section should be included on decontamination monitoring equipment.

Page 14, paragraph 4.3.1 and 4.3.2: Active magnetometers, GPR and communications equipment may trigger explosives on electric fired munitions. Provisions should be made to use passive magnetometers. Magnetic and acoustic precautions should be observed. Precautions should be taken and contingency plans prepared for using electronic transmitting equipment or exposed antenna leads. Site specific sampling equipment and explosive sensitive sampling methods such as non-sparking tools, non-conductive clothing, and shock/friction sensitive sampling methods should be addressed in the Work Plan and the SHERP. There is no mention of precautions to be used during geophysical work and this health and safety aspect should be addressed.

Page 15, paragraph 4.4: This section should be expanded to outline Chemical Monitoring Equipment or Air Monitoring Equipment.

Page 17, paragraph 5.1: This information should include time estimates for the work described, where available.

Page 18, paragraph 5.1.2 Second subpara. It does not appear to make sense to move all debris from other areas to what could potentially be the most contaminated area on the island. Recommend one staging area be established where-in the material only needs to be moved once. Provisions for the storage of hazardous waste should be identified. At each site, soil which is potentially contaminated should be segregated from "clean" soil. Potentially contaminated soil should be stored in a bermed area which is covered with plastic.

Page 19, paragraph 5.2.1.2: This paragraph does not make sense.

Page 19, paragraph 5.2.2.1: All personnel working on site must meet the requirements of DA Pam 40-8.

Page 20, paragraph 5.2.3 Task 3 - Equipment Preparation: The plan does not indicate when Precision and Accuracy Studies will be conducted for low level chemical agent monitoring equipment.

Page 20, paragraph 5.2.4.1: Topo surveys have already been conducted for these sites.

Page 21, paragraph 5.2.4.4: Magnetometer sweeps should be done prior to installing fences. The fence must be labeled IAW applicable Federal, State and local laws.

Page 22, paragraph 5.3.2 Task 2 - Site Establishment: This paragraph should include a discussion of required monitoring that needs to occur at the entrance to an exit from one zone

to the other.

Page 24, paragraph 5.3.3.3: See general comment on air monitoring. Sample screening for agent prior to shipment to labs for analysis needs to be addressed. Verification that items are free of contamination needs to be done on materials removed from clean-up areas. Criteria to determine items are agent free and who will certify items needs to be determined. This section seems to imply that the SSO will actually conduct the monitoring. Please clarify. It does not appear that the UXO escort (as opposed to any sort of escort) is required if the SSO is required to have seven years EOD experience.

Page 25, paragraph 5.3.3.6: Define "appropriate actions."

Page 25, paragraph 5.4: Recommend a pre-operational safety survey be conducted which would be a "dry-run" walk-thru that is performed before the actual task is initiated to better assess the safety status of the people who will do the tasks. A pre-operational survey should also be conducted prior to subsurface investigation.

Page 25, paragraph 5.3.3.9: FM 9-15 is obsolete and only applies to combat. Recommend the draft AR 385-61 and DA PAM 385-61 be followed for chemical decon procedures.

Page 26, paragraph 5.3.4: How will the disposition of materials be determined? 3X materials must be handled in accordance with AR 50-6.

Page 27, paragraph 5.3.4.5: What will happen if the GPR sweep indicates excavation may be required?

Page 27, paragraph 5.3.4.6: What is the objective of the soil sampling. This should be defined upfront. Is it to characterize the site? Soil samples should be screened for all suspected chemical agents, not just mustard. In addition, the soil should be analyzed for chemical agent breakdown products. Samples that are found to contain mustard still must be shipped to the laboratory.

Page 27, paragraph 5.3.4.7: Will TEU be called in if CWM is identified? What emergency procedures will be taken? CWM/UXO items should be photographed and a report produced for each item found. See general comment on air monitoring.

Page 27, paragraph 5.3.4.8: Please define CWM contamination.

Page 28, paragraph 5.3.4.13: This section should address CWM personal and equipment decontamination.

Page 29, paragraph 5.3.5.4: Will an onsite capability be present to analyze results of soil sampling to determine if there is the presence of agent?

Page 29-30, paragraph 5.3.5.5: If CWM is detected, backup monitors should be used to confirm the presence of CWM. What are the emergency procedures? What level of Personnel protective equipment will be used? M18A2 Chemical Detector Kits are not sensitive enough to ensure worker safety. Recommend the use of ACAMS or MINICAMS for air monitoring with confirmation being done on DAAMS tubes.

Page 30, paragraph 5.3.5.7: It is unlikely that even safe UXO/OEW will be moved to the Roosevelt Roads Naval Station for disposal. The temporary storage of these materials will most likely remain on Water Island until the final disposition is decided.

Page 31, paragraph 5.3.4.11: Requirements for reporting the identification of chemical agents or alarms on monitoring equipment should be identified. Requirements for reporting accidents, incidents, and releases to the Army, local authorities, etc., should also be addressed in this plan.

Page 31, paragraph 5.3.6.1: How will individuals working on the site know that they have encountered CWM?

Page 32, paragraph 5.3.7.2: This whole paragraph should be deleted from the workplan along with all mention of excavation at this stage.

Page 34, paragraph 5.4.3: What will be the disposition of equipment that comes in contact with CWM, i.e., 3x material?

Page 35, paragraph 5.4.5.2: Recommend Cholinesterase levels be re-checked and compared to the baseline. Medical certification must be IAW DA Pam 40-8.

Page 36, paragraph 5.5: MTA identified four other areas as potential targets for dumping OEW of CWM. They need to expand how they plan to investigate the Flamingo Bay Harbor and salt water tidal pools and Tunnels at the Old Fort. What is the basis for selecting these sites for initial investigation?

Page 36, paragraph 5.5.1.1: If GPR indicates anomalies under the tennis courts, will these be dug up?

3.2 Specific Comments regarding the Safety, Health and Emergency Response Plan

Page 1.0: The SSHP/SHERP provided to accompany the SSWP was written by Ebasco, Inc. and therefore there is a lack of continuity between this document and the other Plans. The SHERP was written as a generic Health and Safety Plan for work performed at test areas 1 through 8. It is recommended that a revised SSHP/SHERP be prepared which provides all the pertinent information to the site and applies to MTA, Inc. personnel.

Page 2, paragraph 1.2: Change AR 50-6-1 to AR 190-59. In addition, this work should be done

in accordance with local or U.S. Virgin Island Territorial Regulations, OSHA regulations, CERCLA requirements, and AR 365-61 Army Toxic Chemical Agent Safety Program and DA PAM 385-61 Toxic Chemical Agent Safety Standards. Potentially applicable Virgin Island Codes are as follows:

12 V.I.C.§2 Protection of Indigenous Endangered and Threatened Fish, Wildlife and plants
12 V.I.C.§3 Trees and Vegetation Adjacent to Water courses
12 V.I.C.§7 Water Pollution Control
12 V.I.C.§9 Air Pollution Control
12 V.I.C.§13 Environmental Protection
12 V.I.C.§21 Coastal Zone Management
19 V.I.C.§56 Solid and Hazardous Waste Management
23 V.I.C.§9 Fire Prevention Code (Includes storage and transport of explosives.
23 V.I.C.§10 Emergency Telephone No.
23 V.I.C.§12 Emergencies and Major Disasters
29 V.I.C.§5 Public Planning and Development, Building Codes

Page 3, paragraph 1.3: When will the Fire/Police/Ambulance be asked to respond? Will they be prepared to respond to an emergency involving CWM?

Page 3, paragraph 1.4: Tasks states that soil samples will be collected but does not mention sampling of debris or water as requested in the Department of Army Statement of Work.

Page 4, paragraph 2.1: A more complete listing of items on FFS can be obtained from a memo outlining the disposition of these items. Some of these items may not have been involved in testing on Water Island but they have been stored there.

Page 5, paragraph 2.2: See comment above

Page 8, paragraph 3.0: The site specific personnel listed do not match the personnel resumes listed in the CDAP. New OSHA regulations now require onsite health and safety personnel to have Blood Borne Pathogens training and this is not listed in the requirements sections. If changes to the field team are made or training is performed, a revised addendum should be issued.

Page 11, line 9: The text states that the "UXO Safety Supervisor is responsible for health and safety relating to chemical agent" however, this person has no demonstrated chemical agent safety background.

Page 11: This page references a "site specific SHERP". When will that document be available?

Page 13, paragraph 4.1: Materiel Safety Data Sheets should be included for each of these items. Possible breakdown products should be listed and the MSDS for these chemicals should be included. It should be noted that mustard is a carcinogen. Add CG to the list of chemical

agents. Other records show that CG (phosgene) was present on Water Island and it would be prudent to be aware of the hazards of the materiel.

Page 14, Table 1: This table does not contain the most up-to-date terminology or information concerning agent standards. The Army has recently re-characterized these agent standards as "Airborne Exposure Limits" in DA PAM 40-8 and 40-173. The General Population Airborne Exposure Limits for HD and L are 0.0001 mg/m3 (HD) and 0.003 mg/m3 (L), taken as 72-hour TWA. The Worker Airborne Exposure Limit for L is 0.003 mg/m3 (measured as L, and taken as an 8-hour TWA). The source emission limits for GA and GB are 0.0003 mg/m3; for mustard 0.003 mg/m3 (for non-combustion sources) and 0.03 mg/m3 (for combustion sources or stacks); and for lewisite, 0.03 mg/m3 (measured as lewisite). All source emission limits are ceiling values, not one hour TWA. The Army has also established worker and general population airborne exposure limits for GA which are identical for those for GB. The sources for these changes is DA Pam's 40-8, 40-173, and AR 385-61 (recently released to the field in draft form by the authority of the Director of Army Safety Center). Since there are no records of VX being on Water Island, VX should be removed from this table. Also, similar information should be provided for CK, CG and PCBs.

Page 16, Section 4.2.2: Some of the hazards listed in the section have mitigating measures provided and some do not. The section should be consistent and provide identification and mitigation for all hazards.

Page 17, paragraph 4.2.5: ACGIH guidelines are not appropriate for use in establishing work rest cycles for encapsulating protective clothing. The ACGIH Threshold Limit Values (TLV's) only apply to light summer clothing, and ACGIH has stated that heat exposure TLV's for special clothing should be established by an expert. The contractor should be directed to use heat stress guidelines developed by NIOSH/OSHA/USCG/EPA for hazardous waste site activities, specifically Table 8-10 of the Department of Health and Human Services (NIOSH) Publication No. 85-115, Oct 85, Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities.

Page 18, paragraph 4.2.6: If, in the opinion of the industrial hygienist, workers will likely be exposed to excessive steady-state noise levels, provisions should be made to enter these workers into a hearing conservation program in compliance with 29 CFR 1910.95. This would include baseline audiometric evaluations.

Page 18, paragraph 4.2.7: This paragraph indicates that "The products of the decontamination procedure will not contain hazardous materials." This is a serious assumption which should not be made unless all products associated with decontamination are sampled and the analysis reviewed. Until that time, all decontamination products should be treated as though they were contaminated with hazardous materials. In addition, the first sentence is not valid. Some contamination will not be visible.

Page 18, paragraph 4.2: Include hazards from severe weather conditions and other natural

hazards.

Page 19, Table 2. Activity Hazard Analysis. CWM hazard should be added. PPE and monitors should be listed as the mitigation measure. Table 2 does not provide sufficient detail to be a useful hazard reduction document. The table is insufficient to describe the hazards likely to be encountered, and the actions taken to mitigate or abate the hazard. Moreover, it does not appear that the mitigation measures are matched up properly to the hazards. For example, in at least 4 instances, the mitigation measure keyed to the hazard of "heat stress" is "avoid snakes." More attention should be given to heat stress prevention, along the lines described in the Department of Health and Human Services Publication No. 85-115, Oct 85, Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities.

Page 21, paragraph 5.4: Site specific hazard training needs to include first aid for chemical agent exposure.

Page 22, paragraph 5.8: All visitors on site should be restricted from the exclusion zones or, if they must enter the exclusion zones and are under the supervision of experienced site workers must have a minimum of 24 hours OSHA training and one day of on the job training. Project officers, even if they visit the site infrequently, should have completed the 40 hour OSHA training, three day on the job training requirement.

Page 24, paragraph 6.0: Level D should include a slung mask or escape pack to be used in the event CWM is detected. Level A suits specially designed to prevent agent penetration should be available in the event of a CWM emergency. This plan should be more specific in terms of the types and brands of PPE to be used. Not provided for review were the "Corporate PPE Program" and "Corporate Respirator Protection Program." We need to review these documents before we can assess the adequacy of those program elements.

Page 24, paragraph 6.1: This section indicates that "if chemical agent is detected" personnel protection levels will be upgraded based on action levels in Table 3. Table 3 is for dust detection and the levels cannot be applied to mustard or other chemical agents. No mention is made as to how the contractor will confirm positive ACAMS alarms for HD or nerve agents. This needs to be addressed. Also, M9 respirators are not authorized for use by contractor personnel in this program. Only NIOSH/OSHA approved respirators may be worn.

Page 26, Table 3: Action levels for chemical agents should be included in this table.

Page 28, Level B: In other sections of the document (p. 24 and p. 32), the contractor states that when CWM is found, the rest of the work on the site will be done in Level B. Yet here it indicates that Level B work is not anticipated for the site. Procedures need to be developed in advance for any Level B operations. Moreover, the contractor should ensure that OSHA Level B equipment is available onsite for emergency rescue operations in the event this is required.

Page 32, Paragraph 7.0: This section should indicate that monitoring will be conducted to

evaluate personnel exposure. This section does not address what agents will be monitored, the frequency of monitoring in non-intrusive operations, what background readings are acceptable, the best available monitoring equipment, and procedures if action levels are exceeded. Contaminated dust is mentioned as a potential hazard, therefore dust monitoring should also be performed onsite.

Page 32, paragraph 7.1: Recommend DAAMS tubes be used as a backup measure to verify any ACAMS alarms. This section contradicts paragraph 6.2 in terms of protective clothing. This section should indicate what agents will be monitored for.

Page 32, paragraph 7.2: Since ACAMS can only detect one agent type at a time, multiple ACAMS may be needed. The section should be modified to reflect this.

Page 33, paragraph 7.3: Describe personnel monitoring equipment. The frequency of physiologic monitoring should be conducted as specified in Table 8-10 of the DHHS publication 85-115. The concept of "adjusted temperatures" must be specifically addressed to ensure that the contractor is not simply relying on dry bulb temperatures.

Page 33, paragraph 7.4: The content of these examinations is hazard specific, and requires the contractor to furnish the examining physician a complete inventory of chemical, biological and physical exposure hazards, along with relevant medical surveillance documents. Note that, since GB and GA will be part of the potential exposure hazards, the contractor must (as a minimum) conduct both preplacement and termination Red Blood Cell Cholinesterase (RBC-ChE) assays on all contractor employees with exposure potential. This can be arranged through USACMDA. DA Pam's 40-8 and 40-173 detail the relevant medical surveillance guidance.

Page 35, paragraph 8.2: Recommend the exclusion zone be referred to as only that throughout the documents (delete reference to restricted work zone).

Page 38, paragraph 10: Personnel decontamination procedures should be established in the event there is contamination. The proposed methods to perform decontamination of equipment, personnel, and machinery should be included. Decontamination should be performed in a centralized decontamination area or on a decontamination pad where decontamination fluids can be containerized. The contractor must be advised that only 5 percent sodium hypochlorite is authorized for skin decontamination for chemical agents.

Page 39, paragraph 10.2: Equipment Decontamination and Disposal of Contaminated Materials states that "Discarded protective clothing will be disposed of in plastic bags." Those plastic bags will contain potentially hazardous waste and should be containerized and properly disposed of by a licensed waste hauler along with containerized excavated soils and decontamination fluids. Decontaminating heavy equipment with a steam cleaner until no signs of visible contamination remain will not work for CWM contamination.

Page 39/42/43 are not consistent. Specify level B or level C.

Page 41, Table 4, Section 1: Define where the equipment will be decontaminated. Indicate how containment of washing liquids will be accomplished.

Page 44, last line: Provide the consequences for violating these forbidden practices.

Page 46, paragraph 11.4: Have appropriate VI personnel been consulted to determine if any utility lines are in the vicinity of the test sites? Electrical wiring and apparatus safety procedures will be conducted in accordance with OSHA Standard 29 CFR 1926, Subpart K, Not 29 CFR 1910.137(2).

Page 49, paragraph 11.6 Excavations and 12.0 Unexploded Ordinance should be removed. These tasks are not listed in the Scope of Work provided by the Army.

Page 53, paragraph 11.9: What will the procedures be if the fire is believed to involve CWM?

Page 55, lines 1 & 2: An individual with significant hypertension should not be allowed to wear OSHA level A or B protective equipment, unless under good control and authorized by the local medical authority. Diastolic hypertension in excess of 100mm Hg is a relative contraindication to wearing such equipment.

Page 57, paragraph 11.10.6 See previous comments regarding heat stress.

Page 58, paragraph 11.13: This paragraph should be modified to read "Vector Borne Diseases," and discuss the preventive measures (to include immunization or chemophylaxis) for all vector borne diseases which may be endemic on Water Island or the Virgin Islands. The contractor needs to obtain a disease surveillance report from the CDC in order to assess these threats and provide such information. For example, diarrheal diseases or arthropod-borne diseases may be more of a threat than ticks.

Page 60, paragraph 11.14: The USACE Safety and Health Requirements manual should be available on site.

Page 61, paragraph 12: Based on the history of Water Island, and specifically, the test areas undergoing remediation, recommend all uncovered UXO's be assumed to be CWM. MTA should backoff at that point and TEU should be called in to make a determination.

Page 61, paragraph 12.3: Define "Technical Support Team" referenced in this section.

Page 62, paragraph c.6: Add the word "storm" to the end of this sentence.

Page 73, paragraph 13: Address emergency procedures if a chemical hazard is present. Address re-entry procedures should an alarm be sounded. Address procedures if CWM is identified, i.e., security, notifications, etc. The chain of command in the event of an emergency should be outlined. Who provides medical care if a person is contaminated with CWM?

Page 73, paragraph 13.1.1: An injury in the RWZ must necessitate decontamination steps be performed before transportation to the support zone and/or to a medical facility. Otherwise, other personnel including those people who would render medical assistance are at risk of being exposed to chemical contamination.

Page 74, paragraph 13.1.2: The contractor has not adequately addressed the requirements for onsite contingency medical care. Given the remoteness of the site, delays in evacuation, and the uncertain nature of medical care availability on St. Thomas, the contractor will require onsite medical capability beyond first aid.

Page 78-79, paragraph 13.1.12 and 13.1.13: The requirements for medical supplies and equipment and medical evacuation are not sufficiently addressed or detailed to ensure that injured or ill employees will be cared for. The contractor should be encouraged to explore the possibility of contracting for onsite and contingency medical care in a more comprehensive manner.

3.3 Specific Comments regarding the Chemical Data Acquisition Plan

The CDAP does not address the collection of data from near real time monitors such as can be accomplished using the ACAMS or MINICAMS. These instruments are capable of monitoring at TWA levels which would provide data on contamination and also address worker safety. According to the Scope of work issued by the Department of the Army, the "CDAP shall explain the methods and techniques the contractor shall use in the sampling of soils, debris, and water. This sampling plan shall include methods the contractor will use to ensure accurate sampling is done. It will also describe the methods to be employed for decontamination of equipment to prevent cross contamination of samples. The CDAP should be revised to expand the accurate sampling methods for soil and water and include sampling of debris.

Page 3, paragraph 3.1: Other chemical agents are an equal or greater health hazard than mustard. Monitoring should not be limited to mustard. Chemical agent should be monitored to the ceiling value level for nonagent workers and the general population. See Table 2-4 of AR 385-61. What onsite monitoring capability will MTA/SRI have? Will they need to stop work until a soil sample is analyzed. What kind of turnaround will they have?

Page 3, paragraph 3.2: Standards should be included for other possible agents on Water Island to include CG (phosgene).

Page 5, Figure 4-1: Project Organization is blank. Include figure in final report.

Page 6, paragraph 5.2.1: What is the purpose of this soil sampling. It is too sparse to provide a determination as to the contamination of the site. How deep are soil samples taken? What chemicals will the soil be analyzed for? Proposed locations should be depicted on a figure. Are there certain depressions or other site characteristics which warrant concentrated sampling? The

need to field screen samples for the presence of agent is not addressed in the procedures. Methods for analyzing for agent and degradation products are available through the U.S. Army Toxic and Hazardous Material Agency.

Page 6, paragraph 5.2.2: Background Samples mentions sample collection, but does not state if quality control samples such a trip blanks, sample duplicates/replicates, rinsate samples, and/or other QA/QC samples will be collected from the site.

Page 6, paragraph 5.3: General Information and Definitions described sample packaging and shipment. This is general information which should be provided in a SOP which should be attached to the CDAP.

Page 7, paragraph 5.4.1.2.1: describes the preparation of decontamination solutions. All information regarding decontamination should be in the SSSHP/SHERP.

Page 7, paragraph 5.4.1.2.2: There are no guidelines for the placement of monitoring equipment nor does the plan address the type of equipment to be used. Responsibility for the operation of the low level monitoring equipment needs to be identified. The note indicates "If monitoring device(s) detect mustard at any time", what level of detection is being used as the action level?. "Mustard" should be changed to "chemical agent" since other than mustard was tested on Water Island.

Page 7, paragraph 5.4.1.2.4 and 5.4.2.2.4 are descriptions of sample bottle labelling. This information should be provided in an SOP which should be attached to the CDAP.

Page 8, paragraph 5.4.1.2.6 and 5.4.2.2.6 describe affixing labels to the correct bottle after soil and water sample collection. It is common industry practice to pre-label bottles to avoid this problem.

Page 8, paragraph 5.4.1.2.9 and 5.4.2.2.9 recommend using inert plastic for sampling equipment. Plastic coming in contact with sample material could introduce semivolatile organic compounds into the sample.

Page 8, paragraph 5.4.1.2.15 and 5.4.2.2.15 state "Combine all used decontaminant with used washing solution to decontaminate residual chemical agent in the washing solution. Allow mixture to stand overnight to ensure complete decontamination. Dispose of mixture by pouring slowly, with liberal dilution by running water, into a drain connected to a sanitary sewer line or as otherwise required by local, state, or federal law." Provisions should be made for the containment, storage, and removal of decontamination fluids, excavated soils, and used personal protective equipment. Decontamination fluids should be containerized and not disposed of without proper pre-disposal sampling. A storm water permit would need to be applied for and if approved, the liquids may be released to the municipal water treatment system. 12 V.I.C.§7.185 (g)(1) Prohibits the discharge of any radiological, chemical or biological warfare agent.

Page 9, paragraph 5.4.2: What is the purpose of the sampling of standing water? What will it be analyzed for? Recommend standing water and groundwater be sampled and analyzed at each test area and down gradient from the test areas. These samples should be analyzed for chemical agents and their degradation products. Methods for analyzing for agent and degradation products are available through the U.S. Army Toxic and Hazardous Material Agency.

Page 9, paragraph 5.4.2.2.4 describes using paper towels or other disposable material to dry off containers. The paper towels or disposable material used to dry sample bottles or other materials which are potentially hazardous must be containerized with other PPE and disposed of by a licensed waste hauler.

Page 12, paragraph 6.0 Sample Chain of Custody, Packaging and Transportation should be an SOP, attached to the CDAP.

Page 12, paragraph 6.1.3 Preservation states that the only means of preservation will be blue ice. This section should address what temperature is necessary to maintain preservation based on the analytical procedures.

Page 12, paragraph 6.2: Samples must be shipped IAW DOT standards. How long are samples viable, how fast must they be shipped?

Page 12, paragraph 6.3 Chain of Custody should reference Annex C which depicts the Chain of Custody forms.

Page 14, paragraph 7.2 Soil Sample Preparation and 7.3 Water Sample Preparation present information which is not applicable to the CDAP. This information should be included in a Scope of Work which is issued to the laboratory.

Page 19, paragraph 9.0: Add the following references: AR 190-59, Chemical Agent Security Program, AR 190-61, Chemical Agent Safety Program, and applicable U.S. Virgin Island Codes.

Annex E SRI Quality Assurance/Quality Control Plan should be removed from the CDAP and included in the response to the Scope of Work received from the laboratory.

3.5 Specific Comments regarding the Property Management Plan (PMP)

The proposed PMP submitted by MTA, Inc., does not include all of the information requested in the Scope of Work. The PMP does not provide lists of field and office equipment, equipment sources, expected costs, and price quotes.

Appendix B " Control of Property in Possession of Contractors" referenced in Section 2.0 References could not be located. In Section 5.0 Accountability a second Appendix B

Government Property Tracking Log is referenced.

The documents comprising Appendix A Job Site Inventory Record, Appendix B Government Property Tracking Log, Appendix C (no title), Appendix D (no title) should be labelled.

3.6 Specific Comments regarding the Work, Data, and Cost Management Plan (WDCMP):

Data and cost management are not discussed in this report.

Figures 1 and 2 were not referenced in the text.

Page 4, paragraph 1.6: Provide reporting requirements and subcontractors involved in this work. Information on the chain of command between the COE, MTA and the subcontractor should be provided in greater detail than in figure 2. In addition, it appears to contradict figure 1 in the site specific work plan.

Locating, identifying, and disposing of UXO/OEW by excavation or other means should not be addressed in any of the MTA, Inc. documents and mention of it should be removed from the WDCMP. Section 5.3 through Section 9.0 of the WDCMP describes the flagging of surface OEW, debris, and subsurface anomalies for removal by excavation by UXO/OEW Team 3. These sections also describe staging areas and transporting UXO/OEW. Performance of these tasks would initiate response actions not previously established. Excavation and movement of UXO/OEW or potentially contaminated soil would be in direct conflict of CERCLA.

Section 5.5 Clearing of UXO/OEW/Team 3 states that the "UXO Technician will also identify the status of the item". The procedures for identifying the status of the UXO should be included in an SOP in the SSWP.

3.7 Specific Comments regarding the Quality Control (QC) Plan:

According to the Scope of Work provided by the Department of the Army, the Quality Control Plan "should include, as a minimum: 1) equipment testing and calibration, 2) performing and documenting QC field inspections, 3) monitoring proper functioning of all electronic equipment, and 4) OEW identification briefings." The QC Plan provided by MTA, Inc. should be revised to include the above topics in the text. In addition, this plan should be formatted in accordance with CERCLA guidance documents as indicated in previous comments.

The Audit section presents information regarding QC Audits but does not address nonconformance or corrective actions which should also be included in the Quality Control Plan.

The pages of the document should be numbered.

Section 1, Premobilization Phase: The information provided in this section does not describe the QC activities that will occur, rather it describes the standards and qualifications for various activities. This section should be rewritten to explain what QC activities will occur during this phase.

Section 2, Mobilization Phase: Provide the frequency in which these inspections will occur.

Section 3, Remediation Phase, Paragraph 3.3 and 3.4: Indicate what authority the Safety Supervisor or IHT have to prevent unsafe actions. QC personnel should have authority to prevent/stop actions that are not in accordance with procedures, not necessarily unsafe actions. That should be the responsibility of everyone; especially the safety staff.

Section 3, paragraph 3.4: Packaging, transporting, and disposal of UXO/OEW should not be included in the QC Plan as it is not part of the scope.

Annex A: AR 190-59 Chemical Agent Security Program and AR 385-61, Army Toxic Chemical Agent Safety Program should be added to this list.

Annex B should be included before completion of the review.

The following procedures are missing or blank: QC Procedure 1.3.1, 2.2.1, 2.3.1, 2.4.1, 3.2.1, 3.3.1, 3.4.1, 3.5.1, 3.6.1, 3.7.1, 3.8.1, 3.9.1, 3.10.1, 4.1.1, 4.2.1, 4.3.1, 4.4.1.

The following procedures list "Specific tools/equipment used in this operation include but are not limited to:" and there is no accompanying list of equipment. If there are no tools/equipment then the statement should be removed or "none" should follow the statement. QC Procedure 2.2.1, 2.4.1, 3.3.1, 3.4.1, 3.5.1, 3.6.1, 3.7.1.

QC Procedure 2.1.1: AR 190-59, Chemical Agent Security Program, should be added to the list of Standards and References.

QC Procedure 2.3.1: AR 190-59, Chemical Agent Security Program, should be added to the list of Standards and References.

QC Procedure 3.4.1: CWM should be included as a hazard to which exposure should be limited.

QC Procedure 3.8.1 Inspecting Project Documentation, subsection SOPs states that "QC personnel will compare actual site operations with procedures". Standard Operating Procedures are not provided for comparison, but are designed to be followed during field work.

QC Procedure 3.10.1: MTA should research local environmental regulations and include applicable requirements as standards to be used in the QC inspection.

3.8 Specific Comments regarding the Site Specific Environmental Protection Plan:

Page 1, paragraph 1.0: This plan indicated MTA is undertaking OEW remediation at the FFS. This is misleading since in actuality it is chemical agent munitions which are expected. The referenced plans for the protection of architectural, historical, cultural, and ecological resources should be provided for review prior to incorporation in a final document. The Virgin Island Codes should be referred to in terms of laws governing environmental protection. Certain plans and approvals are required prior to disturbing the land. In addition, most of these sites are within close proximity to the shore and wetland/coastal management regulations may apply.

Page 2, paragraph 2.0: The referenced layout plans for each site should be provided for review prior to incorporation in a final document.

Page 3, paragraph 4.0: The method of stockpiling the soil and covering it should be included in these sections. If onsite contamination is present, reuse of material may be prohibited by CERCLA. Compacting the soil could also prevent proper natural irrigation of the soil. Local wetlands regulations should be consulted.

Page 4, paragraph 5.0: The wastewater must be containerized until sampled to determine proper disposal.

Page 5, paragraph 7: All hazardous waste must also be stored IAW Federal and local laws.

This plan should include a section outlining cleanup procedures for a spilled material (i.e., oil/gas from junked cars, liquids from abandoned tanks or a chemical agent spill).

3.9 Specific Comments regarding the Sampling, Analyzing, and Relocating Non-DoD Debris Plan:

This plan does not address sampling or analyzing non-DoD debris.

The non-DOD debris will potentially be hazardous waste. The plan should address methods to analyze each type of waste to characterize and determine if there is CWM contamination. The definition of DOD vs non-DOD debris should be provided.

SFIL-PMS (50q)

MEMORANDUM FOR Program Manager Non-Stockpile Chemical Materiel

SUBJECT: Medical Support Requirements for Non-Stockpile Chemical Material (NSCM) Activities

23 NOV 1992

1. Recent review of site-specific work plans, safety and health plans, and emergency response documents have suggested that the NSCM program might benefit from the development of a standardized medical support plan. This document could then be adapted or tailored by contractors to meet site-specific requirements.

2. Our office has developed a generic medical support plan for the NSCM program, using the latest regulatory standards and guidance promulgated by the Occupational Safety and Health Administration and the Department of Army (enclosure). Included is a list of medical supplies and equipment which may be required on site for contingency medical support.

3. Request you provide this document to the appropriate U.S. Army Corps of Engineers district offices for use in the development of site specific medical support plans for NSCM activities.

4. My point of contact for this office is MAJ(P) Roger G. McIntosh, MC, Occupational Medicine Officer, DSN 584-1981.

encl

Robert B. Perry
Chief
Risk and Surety Management Division

THE GENERIC MEDICAL SUPPORT PLAN FOR THE NON-STOCKPILE CHEMICAL MATERIEL PROGRAM

1. Introduction. The identification, excavation, clean-up and disposal of non-stockpile chemical materiel (NSCM) poses a number of unique occupational health hazards to workers. The purpose of this document is to provide the U.S. Army Corps of Engineers, the Program Manager for NSCM, and contractors guidance on how to develop a comprehensive medical support plan that will encompass existing regulatory requirements and ensure the continued good health of the NSCM workers . The U.S. Army Chemical Materiel Destruction Agency recognizes that:

a. this generic medical support plan will need to be tailored to meet site-specific NSCM requirements, and

b. medical support plans are dynamic documents which must be modified to accommodate changes in policies, doctrine, or public law.

For these reasons, we recommend the establishment of procedures to ensure that this generic plan (or any subsequent site-specific modification thereto) is reviewed on an annual basis.

2. Purpose. The purpose of the NSCM Generic Medical Support Plan is to describe the medical support functions at each NSCM site, and to specify the policies, operational concepts, personnel requirements, and program elements necessary for the provision of appropriate medical support. A list of references is provided in Appendix A.

3. Medical Support Functions. Each NSCM site contractor will establish a comprehensive Occupational Health Program (OHP) in compliance with applicable OSHA and Department of Army standards to prevent, diagnose, and treat occupational illnesses and injuries sustained in the performance of official duties. The contractor will incorporate all personnel directly supervising, supporting, or conducting NSCM operations into the OHP. Specific program elements required for supporting and implementing the OHP are provided in paragraph 7.

4. Policies. The implementation of each NSCM occupational health program will be governed by the following policies:

a. NSCM workers will be provided routine occupational health services by contract medical personnel in accordance with applicable OSHA or Department of the Army standards.

b. The scope of occupational health services provided by the NSCM contractor shall include efforts to prevent, diagnose or treat occupational illnesses and injuries. The contractor shall not provide definitive diagnosis or treatment of non-occupational injuries or illnesses. The only exception to this latter policy is in an emergency where immediate medical attention is necessary to prevent loss of life, to preclude permanent injury which would result if treatment were delayed, or to relieve suffering until the employee can be placed under the care of his/her own personal physician.

c. Upon the request of the NSCM contracting officer's representative (normally a member of the U.S. Army Corps of Engineers or the Office of the Program Manager for Non-Stockpile Chemical Materiel), the USACMDA Occupational Medicine Officer shall act as a task manager to monitor the contractor's compliance with OSHA standards or Department of Army Occupational Safety and Health Regulations. USACMDA reports or recommendations will be provided only to the NSCM contracting officer's representative (COR) and not directly to the contractor.

d. Contingency Army Medical Department response capability for chemical accidents or incidents will be provided on a resource available basis. The scope and extent of such back-up medical support must be established in memoranda of agreement between the U.S. Army Corps of Engineers, USACMDA, U.S. Army Chemical and Biological Defense Agency, and U.S. Army Health Services Command.

5. Operational Concepts.

a. The NSCM contractor will provide an onsite medical response capability, using personnel who have been appropriately trained and equipped to handle the potential immediate chemical casualties generated at the site as a result of the most probable event (MPE). The MPE is the worst potential mishap most likely to occur during site characterization, excavation, transportation, disposal or clean-up which could result in the release of agent and personnel exposure. The MPE is site-specific and must be based upon a job site hazard analysis.

b. An onsite medical response capability is required during any routine or emergency operation which could result in the exposure of personnel to chemical agent. For medical planning purposes, the number and type of medical personnel required on site is determined by the job site hazard analysis and the number and types of casualties anticipated as part of the MPE. As a minimum, a State or National Registry of Emergency Medical Technician-certified emergency medical technician, with special training in chemical warfare agent casualty care, will be available at each site during all site characterization, excavation, transportation or disposal operations, along with a vehicle designated for use in patient transport.

c. The medical supplies and equipment available on site must be sufficient to care for the casualties likely to be generated during the MPE. A list of suggested supplies and equipment is provided in Appendix B. The contract physician overseeing the occupational health program should freely add or delete from this list, based upon the contingencies anticipated and the level of medical care to be provided on site.

d. From a hazard analysis standpoint, the maximum credible event (MCE) is the single worst event that could occur at any time, with maximal release of agent from a munition, bulk container, or process as a result of an unintended, unplanned or accidental occurrence. The MCE, though less likely to occur than the MPE, may generate types and numbers of casualties beyond the capability of the on site health care provider(s). For this reason, medical contingency plans, in the form of Memoranda of Agreement (MOAs), are essential to ensure that treatment will be provided expeditiously and in an organized fashion.

e. The contracting officer or his/her representative shall ensure that appropriate MOAs are developed with civilian medical treatment facilities, ambulance companies, and regional or state emergency medical services officials. This will ensure that appropriate outside resources will be available in the event of a chemical accident or incident. Each MOA should describe in detail the types of chemical materiels to which workers might be exposed, the type of training to be provided to health care providers of the receiving hospital, the agency responsible for providing this training, and the frequency of refresher training. MOAs should also specify how casualties will be transported to local hospitals, by whom, and any contingency plans for casualty evacuation. If pre-positioned antidotes are required for effective treatment, provisions for this should be addressed in the MOA.

6. Training.

a. The COR must ensure that members of the on site medical response team complete a program of instruction on the medical management of chemical agent casualties which may be encountered as part of the site-specific MPE. The USACMDA Occupational Medicine Officer shall be the approval authority for all such programs of instruction considered, developed or used by the NSCM contractor.

b. The COR will also ensure that annual training is provided to NSCM workers which addresses signs and symptoms of relevant chemical agent exposure, chronic health effects (if any), self aid, buddy aid, casualty decontamination procedures, and methods for certification of casualties as free from contamination. In addition, all NSCM personnel working on site must receive the initial 40-hour hazardous substance training and the annual 8-hour refresher training per 29 Code of Federal Regulations 1910.120.

7. NSCM Occupational Health Program.

a. General. In order to comply with requirements established in AR 40-5 and 29 CFR 1910.120, each NSCM contractor shall have a designated physician overseeing the site specific medical surveillance and occupational health program. The purpose of the OHP is to ensure suitable job placement of employees, to monitor health hazards in the workplace, and to maintain and promote good health through primary, secondary and tertiary preventive measures. Occupational health services include the provision of emergency and follow-up care for those employees with occupational illnesses and injuries.

b. Occupational Health Services. The following occupational health services will be provided by the NSCM occupational health program:

(1) Job-related medical surveillance examinations (AR 40-5, Chapter 5, paragraph 5-9; Department of Defense (DoD) 6055.5-M, Occupational Health Surveillance Manual, Chapters 2 and 3; Department of Health and Human Services (NIOSH) Publication No. 81-123, Occupational Health Guidelines for Chemical Hazards; DHHS (NIOSH) Publication NO. 85-115, Chapter 5; 29 CFR 1910.120, subpart (f); DA PAMs 40-8 and 40-173, Chapter 4 and Appendix B). These include pre-assignment, annual and termination examinations. The content of these examinations is hazard-specific, and requires that the NSCM contractor provide the examining physician a complete inventory of chemical, biological and physical exposure hazards, along with the relevant medical surveillance documents.

(2) Red Blood Cell Cholinesterase Monitoring if the potential for nerve agent exposure is present (see special provisions for contractor personnel in DA PAM 40-8, Chapter 4, paragraph 4-8b).

(3) Treatment of occupational illnesses and injuries (AR 40-5, Chapter 5, paragraph 5-10; DA PAMs 40-8 and 40-173, Chapter 4, paragraph 4-7 and Appendix D).

(4) Hearing conservation (AR 40-5, Chapter 5, paragraph 5-16; and 29 CFR 1910.95).

(5) Vision conservation and provision of optical inserts for protective masks (AR 40-5, Chapter 5, paragraph 5-15; TB MED 506; DA PAMs 40-8 and 40-173, Chapter 2, paragraph 2-4c).

(6) Reproductive hazard surveillance (AR 40-5, Chapter 5, paragraph 5-20).

(7) Medical evaluation of respirator wearers (29 CFR 1910.134, subpart (b)(10); AR 11-34; TB MED 502, Chapter 2, paragraph 2-10; TB MED 509, Chapter 8; DA PAMs 40-8 and 40-173, Appendix B, paragraph B-1c(2)).

(8) Urine Drug Screening (under provisions of Public Law 100-690, Anti-Drug Abuse Act of 1988, subtitle D; and Public Law 100-71).

(9) Medical evaluation of workers for placement and maintenance in the chemical personnel reliability program, if handling chemical surety materiel (AR 50-6, Chapter 3, paragraph 3-9 through 3-19; Chapter 6, paragraph 6-3g)

c. Health Care Administrative Services. The following administrative elements will be established by designated contract physician in support of the OHP:

(1) Establishment and maintenance of medical records. The designated contract physician will be the medical records custodian for NSCM workers. These records will be treated as private and confidential information and will be complete enough to provide data for use in health maintenance, treatment, epidemiologic studies, and in helping the government and contractor with program evaluation and improvement. The medical record will contain sufficient information to identify the patient, support the diagnosis, justify the treatment, and document additional follow-up care or referrals. The physician's written opinion for all medical examinations will as specified in 29 CFR 1910.120, subpart (f)(7) and DA PAMs 40-8 and 40-173, Chapter 4, paragraph 4-6. For NSCM workers

handling chemical surety materiel, chemical personnel reliability medical record screening will be accomplished per AR 50-6, Chapter 3, paragraph 3-15, and these records will be identified per AR 40-66. The contractor shall be required to maintain all occupational health records for the duration of the worker's employment plus 30 years.

(2) Documentation of training provided to medical response team members in support of on site contingency care.

(3) Documentation of hazard communication training, to include the potential exposure hazards to mustard and nerve agents (if within the hazard inventory).

d. Industrial Hygiene Services. The contractor will maintain an industrial hygiene surveillance program at the NSCM sites using the services of a qualified industrial hygienist. The industrial hygienist will perform the following services:

(1) Establish a program document and industrial hygiene implementation plan (TB MED 503, Chapter 3, paragraph 3-2).

(2) Develop a comprehensive health hazard inventory based on periodic worksite evaluations of chemical, physical and biologic hazards (TB MED 503, Chapter 3, paragraph 3-2b), and provide it to the designated contract physician for use in establishing a hazard-specific medical surveillance program.

(3) Design risk assessment codes and implement appropriate hazard abatement actions in coordination with the safety officer (TB MED 503, Chapter 3, paragraphs 3-2d and e).

(4) Provide the recordkeeping for all qualitative and quantitative exposure measurements and ensure at least annual review of these results by the designated contract physician (TB MED 503, Chapter 3, paragraph 3-2f; DA PAMs 40-8 and 40-173, Chapter 2, paragraph 2-5).

(5) Provide appropriate support to the hearing conservation and vision conservation programs (TB MED 503, Chapter 3, paragraphs 3-2i and j).

(6) Establish a respiratory protection program for both chemical agent and other industrial hazards at the NSCM site (29 CFR 1910.134; 29 CFR 1910.120, subpart (c)(5) and Appendix A; AR 385-64, Chapter 11, paragraph E4; AR 11-34; TB MED 502; TB MED 503, Chapter 3, paragraph 3-2h; DA PAMs 40-8 and 40-173, Chapter 2, paragraph 2-4).

(7) Provide technical expertise within the hazard communication program (29 CFR 1910.1200; TB MED 503, Chapter 3, paragraph 3-21).

APPENDIX A

1. Department of Defense 6055.5M, July 1982 with Change 2, Occupational Health Surveillance Manual.

2. Department of Health and Human Services (NIOSH) Publication No. 81-123, January 1983, Occupational Health Guidelines for Chemical Hazards.

3. Army Regulation (AR) 11-34, 15 February 1990, The Army Respiratory Protection Program.

4. AR 40-5, 15 October 1990, Preventive Medicine.

5. AR 40-66, 20 July 1992, Medical Record Administration.

6. AR 50-6, 12 November 1986, Chemical Surety.

7. Department of Army Pamphlet (DA PAM) 50-6, 17 May 1991, Chemical Accident/Incident Response and Assistance Operations.

8. DA PAM 40-8, Occupational Health Guidelines for the Evaluation and Control of Occupational Exposure to Nerve Agents GA, GB, GD, and VX.

9. DA PAM 40-173, 30 August 1991, Occupational Health Guidelines for the Evaluation and Control of Occupational Exposure to Mustard Agents H, HD, and HT.

10. TB MED 502, 15 February 1982, Respiratory Protection Program.

11. TB MED 503, 15 March 1985, Industrial Hygiene Program.

12. TB MED 506, 15 March 1981, Occupational Vision.

13. TB MED 509, 24 December 1986, Spirometry in Occupational Health Surveillance.

14. Department of Health and Human Services (NIOSH) Publication Number 85-115, October 1985, Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities.

15. Title 29, Code of Federal Regulations, Part 1910, Occupational Safety and Health Standards.

APPENDIX B

Suggested Medical Supplies and Equipment:

A. First Aid

a. dry burn pad (4 ea)
b. blanket (1 ea)
c. cooling pack (4 ea)
d. rubbing alcohol (1 ea)
e. hydrogen peroxide (1 ea)
f. betadine scrub (1 ea)
g. surgipad dressing (10 ea)
h. rolled bandage gauze (kerlex-12 ea)
i. pad (nonadherent) (1 pckg)
j. first aid dressing (7 ea)
k. bandage muslin compressed (7 ea)
l. dressing sponges 2 x 2 (2 boxes)
m. dressing sponges 4 x 4 (1 box)
n. alcohol preps (2 boxes)
o. petrolatum gauze (3 x 18 (1 box)
p. ammonia inhalant solution (2 boxes)
q. 1/2" tape (6 ea)
r. 1" tape (3 ea)
s. 3" tape (1 ea)
t. hand-wrist splint (1 box)
u. exam gloves (1 box)

B. Emergency Treatment (specific for chemical hazards)

a. Oropharyngeal airways (6 ea)
b. Mark I kits (10 ea)
c. Sodium nitrite injection, USP 300 mg/10 ml (4 ea)
d. Sodium thiosulfate injection, USP 12.5 gr, 50 ml (4 ea)
e. Portable oxygen cylinder (2 each)
f. Non-rebreather oxygen masks and tubing (4 each)
g. British anti-lewisite injection, 10% in oil (2 each)
h. Sterile water (4 bottles ea)
i. Suction apparatus, oropharyngeal with catheters (1 ea)
j. Pocket masks (3 ea)
k. Bag valve masks (2 each-no pop-off valves)
l. Resuscitator, hand powered, intermittent pos pres (1 ea)
m. IV catheters, 16, 18, and 20 guage (5 ea)
n. IV solutions (ringer's lactate, D5W) (3 ea)
o. semi-rigid cervical collars (3 ea)
p. backboards with head immobilizer (1 half and 1 full length)
q. air splint set for extremities (1 set)

APPENDIX N

PRELIMINARY APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS LISTING

APPENDIX N

PRELIMINARY APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS LISTING

The laws, rules and regulations cited in this document are an overview of the possible law which may apply to a specific site or project. This is a preliminary checklist to begin the evaluation of the specific legal requirements for a specific project. Before a specific project goes forward and when the full parameters of the project are known, each law, rule, and regulation noted in this applicable or relevant and appropriate requirements (ARARs) list should be reviewed to determine its applicability.

Preliminary Applicable or Relevant and Appropriate Requirements Listing

Standard, Requirement, Criteria, or Limitation	Citation	Description of Requirement	Comment
Federal Laws			
Occupational Safety and Health Act (OSHA)	29 U.S.C. §§ 651-678 (1991, as amended)	Regulates worker health and safety.	Under 40 CFR § 300.38, requirements of OSHA apply to all response activities under the National Contingency Plan (NCP).
OSHA - general industry standards	29 CFR § 1910 (1991)	Specifies the 8-hour time-weighted average (TWA) concentration for various organic compounds. Training requirements for workers at hazardous waste operations are specified in 29 C.F.R. § 1910.120.	Proper respiratory equipment will be worn if it is impossible to maintain the work atmosphere below the concentration. Workers performing activities must have completed specific training requirements.
OSHA - safety and health standards	29 CFR § 1926 (1991)	Specifies the type of safety equipment and procedures to be followed during site remediation.	All appropriate safety equipment will be onsite. In addition, safety procedures would be followed during onsite activities.
OSHA - record keeping, reporting, and related regulations	29 CFR § 1904 (1991)	Outlines the record keeping and reporting requirements for an employer under OSHA.	These requirements apply to all site contractors and subcontractors and must be followed during all site work.
Clean Air Act (CAA)	42 U.S.C. §§ 7401 - 7671q (1991, as amended)		
	40 CFR § 61 (1991)	General	
CAA - Standards	40 CFR § 61.223 (1991)	Establishes national primary and secondary ambient air quality standards.	May be applicable or relevant and appropriate if excavation equipment exhaust and fugitive dust contribute significantly to air quality ranking for region.
		Implementation plans.	
Clean Water Act (CWA), also referred to as the Federal Water Pollution Control Act of 1972	33 U.S.C. §§ 1251-1387 (1991, as amended)	Establishes water quality standards for surface waters and pretreatment standards for wastewaters released to publicly-owned treatment works (POTWs).	Applicable if wastewater from a treatment facility discharges to a POTW.

Preliminary Applicable or Relevant and Appropriate Requirements Listing (continued)

Standard, Requirement, Criteria, or Limitation	Citation	Description of Requirement	Comment
National Pollutant Discharge Elimination System (NPDES)	40 CFR Parts 122-125 (1991)	Requires permits for the discharge of pollutants from any point source into United States waters. The Act defines a point source as any discernible conveyance from which pollutants are or may be discharged. Effluent limitations must protect beneficial uses of water.	Remedial actions which would discharge a pollutant into surface waters would enter into the NPDES regulatory framework. A permit is not required for onsite Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) response actions, but the substantive requirements would apply. Offsite discharges would require a permit.
Water quality standards regulation	40 CFR Part 131 (1992)	Provides chemical-specific numeric criteria for toxic pollutants for states that have not fully complied with the requirements of the CWA.	
Navigable water discharge	40 CFR § 440.34(b) (1991)	There shall be no discharge of process wastewater to navigable waters.	If any discharge to surface water took place, these standards would be relevant and appropriate.
Transportation of hazardous materials	40 CFR §§ 1801-1819 (1991, as amended)	Establishes requirements (for example, packaging, labeling, and placarding) for the transportation of hazardous materials offsite.	Applicable to transportation offsite.
Radon/Radon Progeny Measurement Proficiency Program	EPA-520/1-87-001	U.S. Environmental Protection Agency (USEPA) criteria program to qualify individuals to complete radon/radon progeny measurements.	Relevant and appropriate to radon measurements.
Hazardous Materials Transportation Act (HMTA) of 1974, as amended by the Hazardous Materials Transportation Uniform Safety Act (HMTUSA) of 1990	49 U.S.C. §§ 1801 through 1819 (1991, as amended); regulations promulgated: 49 CFR §§ 100 - 180		Statute.

Preliminary Applicable or Relevant and Appropriate Requirements Listing (continued)

Standard, Requirement, Criteria, or Limitation	Citation	Description of Requirement	Comment
HMTA - definitions	49 CFR § 171	Defines of hazardous materials, wastes, substances, reportable quantities, etc.	Must be used to determine applicability of specific hazardous materials or waste transportation requirements, regardless of destination.
HMTA - shipping requirements	49 CFR § 172	Provides information and requirements addressing shipping paper descriptions, marking and labeling of packages, placarding of vehicles, and emergency response information.	
HMTA - shipping papers	49 CFR § 172, Subpart C	Shipping papers.	Shipping paper and manifesting requirements must be identified for all shipments.
HMTA - hazardous material provisions	49 CFR § 172.101	Table of hazardous materials and special provisions. Table to determine requirements for hazardous materials shipments.	Must be used to determine which specific hazardous materials and hazardous waste transportation requirements will apply, in accordance with the definitions in 49 CFR § 171.
HMTA - hazardous shipping papers	49 CFR §§ 172.201-203	Shipping paper requirements must be met for all hazardous materials and hazardous waste shipments.	Shipping paper information communication requirements may be fulfilled in the hazardous waste manifest, if one is required.
HMTA	49 CFR § 172.204	Shipper's certification requirements.	The shipping papers must be certified by the shipper [Department of Defense (DoD) in this case]. Shipper certification may also be included in manifest.
HMTA - manifests	49 CFR § 172.205 (1991)	Hazardous waste manifest.	In accordance with 40 CFR 262.20, a hazardous waste manifest must be prepared by the shipper, signed by the shipper and carrier, carried by the carrier, and distributed as required.

Preliminary Applicable or Relevant and Appropriate Requirements Listing (continued)

Standard, Requirement, Criteria, or Limitation	Citation	Description of Requirement	Comment
HMTA - marking	49 CFR §§ 72.300 - 172.338) (1991)	Marking.	
HMTA - special handling	49 CFR § 174.700 (1991)	Special handling requirements for class 7 (radioactive) material.	Contains specific rail requirements.
HMTA - cleaning vehicles after use	49 CFR § 174.715 (1991)	Cleanliness of cars after use.	
HMTA - leakage and spills	49 CFR § 174.750 (1991)	Incidents involving leakage.	
HMTA - transporter standards	49 CFR § 263 (1991)	Standards applicable to transporters of hazardous waste.	USEPA has adopted certain Department of Transportation (DOT) regulations governing the transportation of hazardous materials. DOT regulations in 49 CFR are fully applicable to their activities and enforceable by DOT. Except for transporters of bulk shipments of hazardous waste by water, a transporter who meets all applicable parts of 49 CFR §§ 263.11 and 263.31 will be deemed to be in compliance with this part. Regardless of DOT's action, USEPA retains its authority to enforce these regulations.
HMTA - general	49 CFR § 263, subpart A (1991)	General.	A transporter must not transport hazardous wastes without receiving a USEPA identification number from the Administrator. A transporter who has not received a USEPA identification number may obtain one by applying to the Administrator using USEPA form 8700-12. Upon receiving the request, the Administrator will assign a USEPA identification number to the transporter.

Preliminary Applicable or Relevant and Appropriate Requirements Listing (continued)

Standard, Requirement, Criteria, or Limitation	Citation	Description of Requirement	Comment
HMTA - manifest	49 CFR § 263, subpart B (1991)	The manifest.	The generator is responsible for properly and completely filling out the manifest. For mixed waste, the DOT basic description must be entered for both the radioactive constituents and the constituents that make the contents a hazardous waste. When the generator signs the manifest, he signs the generator certification. A transporter may not accept hazardous waste from a generator unless it is accompanied by a manifest signed in accordance with this subpart. The driver for each transporter must also complete certain section of the manifest and return a signed copy to the generator before leaving the generator's property. A transporter who delivers a hazardous waste to another transporter or to the designated facility must distribute the manifest to the accepting transporter or designated facility.
HMTA - discharges	49 CFR § 263, subpart C (1991)	Hazardous waste discharge.	
HMTA - immediate action requirements	49 CFR § 263.30 (1991)	Immediate action.	In the event of a discharge of hazardous waste during transportation, the transporter must take immediate action to protect human health and the environment (for example, notify local authorities, dike the discharge area).

Preliminary Applicable or Relevant and Appropriate Requirements Listing (continued)

Standard, Requirement, Criteria, or Limitation	Citation	Description of Requirement	Comment
HMTA - discharge cleanup	49 CFR § 263.31 (1991)	Discharge cleanup.	A transporter must clean up any hazardous waste discharge that occurs during transportation, or take such action as may be approved by Federal, State, or local officials so that the hazardous waste discharge no longer presents a hazard to human health or the environment.
National Historic Preservation Act	16 U.S.C. § 470 (1991, as amended) 40 CFR § 6.301(b) (1991) 36 CFR § 800 (1991)	Requires Federal agencies to take into account the effect of any Federally-assisted undertaking or licensing on any district, site, building, structure, or object that is included in or eligible for inclusion in the National Register of Historic Places (NRHP).	Consultation required.
Archeological and Historical Preservation Act	16 U.S.C. § 469 (1991, as amended) 40 CFR § 6.301(c) (1991)	Establishes procedures to preserve historical and archeological data which may otherwise be destroyed through alteration of terrain as a result of a Federal construction project or a Federally-licensed activity or program.	Consultation required.
Historic Sites, Buildings, Objects, and Antiquities Act	16 U.S.C. §§ 461-469 (1991, as amended) 40 CFR § 6.301(a) (1991)	Requires Federal agencies to consider the existence and location of landmarks on the National Registry of Natural Landmarks to avoid undesirable impacts on each landmark.	Consultation required.
Fish and Wildlife Coordination Act	16 U.S.C. §§ 661-668ee (1991, as amended) 40 CFR § 6.302(g) (1991) 50 CFR § 27 (1991)	Requires consultation when Federal department or agency proposes or authorizes any modification of any stream or other water body, and adequate provision for protection of fish and wildlife resources. Lists actions prohibited in areas belonging to National Wildlife Refuge System.	Requirement applicable if remedial actions cause stream modification. Consultation required. Site is not in the National Wildlife Refuge System.

Preliminary Applicable or Relevant and Appropriate Requirements Listing (continued)

Standard, Requirement, Criteria, or Limitation	Citation	Description of Requirement	Comment
Endangered Species Act	16 U.S.C. §§ 1531-1544 (1991, as amended) 50 CFR § 200 (1991) 50 CFR § 402 (1991)	Requires action, including consultation with Department of Interior, to conserve endangered species within critical habitats upon which endangered species depend.	Endangered species may be present on the site. Consultation required.
	50 CFR § 10 (1991)	Regulates the taking, possession, transportation, sale, purchase, barter, exportation, and importation of wildlife. Lists wildlife species.	No taking of wildlife will occur under alternatives proposed.
Dredge or fill requirements (§ 404)	40 CFR Parts 230 and 231 (1991)	Requires permits for discharge of dredged or fill material into United States waters, including wetlands.	Jurisdictional wetlands may be present onsite.
	33 CFR §§ 320-330 (1991)	General regulatory policies on permitting.	
Chemical agent standards - U.S. Public Health Service	Federal Register Vol. 53, No. 50, pg. 8504-8507	U.S. Public Health Service Chemical Agent Standards.	
Safety and Health Standards	29 CFR 1925	Safety & health standards	
National Environmental Policy Act (NEPA)	40 CFR 1500	NEPA	
National Ambient Air Standards	40 CFR 50	National Ambient Air Quality Standards.	
Implementation plans	40 CFR 52	Approval of implementation plans.	
Reportable quantities - hazardous substances	40 CFR 116-117	Reportable quantities for hazardous substances.	
Water quality planning and management	40 CFR 130	Water quality planning and management.	

Preliminary Applicable or Relevant and Appropriate Requirements Listing (continued)

Standard, Requirement, Criteria, or Limitation	Citation	Description of Requirement	Comment
Resource Conservation and Recovery Act (RCRA)	40 CFR 260-280	RCRA	
National Contingency Plan (NCP)	40 CFR 300	National Contingency Plan.	
CERCLA cleanup standards	42 U.S.C. 9621	CERCLA cleanup standards.	
DOT - shipping containers	49 CFR 178	DOT - shipping containers.	
Exemption to bombs from hazardous waste shipment requirements	DOT-E-7573	Exemption to bombs from hazardous waste shipment requirements.	
Exemption to DOT regulations for chemical or biological agent transportation	PL 91-441 sec. 506 (b)(4)	Exemption to DOT regulations for chemical or biological agent transportation.	
Non-bulk packaging	49 CFR 212	Non-bulk packaging.	
Transportation tracking	49 CFR 213	Transportation tracking	
Transportation - power brake law	49 CFR 232	Transportation - Power Brake Law.	
Exemption from some transportation requirements	DOT-E-9822	Exemption from some transportation requirements.	Class A poisons. Research and development (R&D) samples.
<u>Virgin Islands</u>			
Planning and natural resources	Virgin Islands Code, Title 3	Administrative organizational requirements and structure.	Creates the Department of Planning and Natural Resources, which has responsibility for fish, wildlife, vegetation, water resources, air and water pollution, flood control, sewer, archaeological and historical resources, coastal zone management, environmental protection, land use, and earth removal.

Preliminary Applicable or Relevant and Appropriate Requirements Listing (continued)

Standard, Requirement, Criteria, or Limitation	Citation	Description of Requirement	Comment
Wildlife	Virgin Islands Code, Title 12, Chapter 1 and 2	Controls hunting, fishing, and endangered species.	Prohibits disturbing any indigenous or endangered wildlife species and damage to growth of mangroves.
Trees and vegetation adjacent to watercourses	Virgin Islands Code, Title 12, Chapter 3	Prohibits cutting of damaging vegetation within 25 feet of the edge of any watercourse.	
Water resources	Virgin Islands Code, Title 12, Chapter 5	Regulates all aspects of ground and surface water as a emergency condition.	Licensing of well drillers is required. Specifications on wells are also provided. Record keeping and logging are required.
Water pollution control	Virgin Islands Code, Title 12, Chapter 7	Implements the Federal Water Pollution Control Act. Strictly controls discharges into the Islands water resources.	Specific requirement to obtain a permit to discharge chemical or biological warfare agent into the waters of the Virgin Islands. An exemption for work under CERCLA is specified.
Air pollution	Virgin Islands Code, Title 12, Chapter 6	Controls the release of pollutants into the air.	
Fishing	Virgin Islands Code, Title 12, Chapter 9A	Prohibits the discharge of any substance which destroys or injures fish.	Declares that all bodies of water within its jurisdiction belong to the Virgin Island government. This included streams, lagoons, and ponds, except privately owned ponds under 50 acres.
Open shoreline protection	Virgin Islands Code, Title 12, Chapter 10	Controls the construction of any structure within the shoreline area.	Also controls filling and dredging.
Environmental protection	Virgin Islands Code, Title 12, Chapter 13	Controls changing the land which would change watershed conditions.	Regulates changes which would affect erosion, sediment deposition, filling, gutting, drainage, and pollution dispersion. Requires an earth-change plan.
Coastal zone management	Virgin Islands Code, Title 12, Chapter 21; Title 29, Chapter 3	Implements Federal Coastal Zone Management Act of 1972.	Regulates activities within the coastal zone which is fully defined by coastal zone maps.

Preliminary Applicable or Relevant and Appropriate Requirements Listing (continued)

Standard, Requirement, Criteria, or Limitation	Citation	Description of Requirement	Comment
Health - waste	Virgin Islands Code, Title 19, Chapter 52	Regulates hazardous waste, waste transportation, and recovery.	
Drinking water	Virgin Islands Code, Title 19, Chapter 51	Regulates drinking water and possible pollution of the drinking waster supply.	
Sanitation and sewage	Virgin Islands Code, Title 19, Chapter 53 and 55	Regulates sewage disposal and waste collection systems	
Solid waste transportation	Virgin Islands Code, Title 19, Chapter 56	Regulates transportation of Waste	
Solid waste disposal, resource recovery	Virgin Islands Code, Title 19, Chapter 56A and 71	Regulates Solid Waste Disposal, and Resource Recovery	
Cemeteries	Virgin Islands Code, Title 19, Chapter 59	Regulates Cemeteries	Cemeteries may not be disturbed
Highways and roads	Virgin Islands Code, Title 20	Regulates all aspects concerning roadways.	
Fire and explosives	Virgin Islands Code, Title 23, Chapter 9	Provides for requirements for transportation of explosive materials.	
Navigation and harbor master	Virgin Islands Code, Title 25, Chapter 1 and 7	Regulates the use of water in and around the Virgin Islands.	Prohibits disposal of pollutants into the waters of the Virgin Islands.
Zoning, land use planning, and building codes	Virgin Islands Code, Title 29, Chapter 3, 5, and 10	Regulates any use or structure placed upon the land.	
<u>DoD requirements: DoD regulations</u>			
Transportation - personnel certification and training	AMC-R-350-9	Personnel training and certification - transportation.	
Army Material Command safety manual	AMC-R-385-100	Army Materiel Command safety manual.	
Safety regulations for chemical agents	AMC-R-385-131	Safety regulations for chemical agents.	
Containers - shipping	AMC-R-700-103	Containers - shipping.	

Preliminary Applicable or Relevant and Appropriate Requirements Listing (continued)

Standard, Requirement, Criteria, or Limitation	Citation	Description of Requirement	Comment
Respiratory protection program	AR 11-34	Respiratory protection program.	
Health - hazardous assessment program	AR-40-10	Health - hazardous assessment program.	
Chemical surety program objectives	AR-50-6	Chemical surety program objectives.	
Chemical agent security program	AR 50-6-1	Chemical agent security program.	
Hazardous cargo - water transportation	AR 55-228	Hazardous cargo - water transportation.	
Chemical contamination material sureability	AR-70-71	Chemical contamination material sureability.	
Interservice responsibility for explosive ordnance disposal	AR 75-14	Interservice responsibility for explosive ordnance disposal.	
Responsibility and procedures for explosive ordnance disposal	AR 75-15	Responsibility and procedures for explosive ordnance disposal.	
Aircraft carrying hazardous material	AR-95-27	Aircraft carrying hazardous material.	
Meteorological support for the U.S. Army	AR 115-10	Meteorological support for the U.S. Army.	
Topography	AR 115-11	Army topography.	
Environmental protection	AR 200-1 Chapter 1	Army responsibilities for environment.	
Research and development programs	AR 200-1 Chapter 2	Research and development programs.	
Water research management programs	AR 200-1 Chapter 3	Water research management programs.	

Preliminary Applicable or Relevant and Appropriate Requirements Listing (continued)

Standard, Requirement, Criteria, or Limitation	Citation	Description of Requirement	Comment
Air pollution abatement	AR 200-1 Chapter 4	Air pollution abatement.	
Hazardous material management program	AR 200-1 Chapter 5	Hazardous material management program.	
Waste management programs	AR 200-1 Chapter 6	Solid waste and hazardous waste management program.	
Noise abatement programs	AR 200-1 Chapter 7	Noise abatement program.	
Spill contingency planning and response	AR 200-1 Chapter 8	Oil and hazardous substance spill contingency, planning, control, and emergency response.	
Environmental restoration programs	AR 200-1 Chapter 9	Environmental restoration program.	
Asbestos management programs	AR 200-1 Chapter 10	Asbestos management program.	
Radon	AR 200-1 Chapter 11	Radon.	
Other environmental programs	AR 200-1 Chapter 12	Other environmental programs.	
DoD environmental policy	AR 200-2 Chapter 1	DoD environmental policy.	
National Environmental Protection Agency - Army	AR 200-2 Chapter 2	National Environmental Protection Agency responsibility and decision process.	
Environmental effects of Army actions	AR 200-2 Chapter 3	Records and documents.	
Categorical exclusions	AR 200-2 Chapter 4	Categorical exclusions.	
Environmental assessment	AR 200-2 Chapter 5	Environmental assessment.	
Environmental impact statements	AR 200-2 Chapter 6	Environmental impact statements.	
Public involvement	AR 200-2 Chapter 7	Public involvement.	

Preliminary Applicable or Relevant and Appropriate Requirements Listing (continued)

Standard, Requirement, Criteria, or Limitation	Citation	Description of Requirement	Comment
Environmental effects of major Army actions	AR 200-2 Chapter 8	Environmental effects of major Army actions.	
Army regulations, chemical warfare classifications	AR-380-86	Chemical warfare classification.	
Safety programs	AR 385-10	Army safety program.	
Transportation accident prevention and emergency response	AR 385-14	Transportation accident prevention and emergency response involving conventional munitions and explosives.	
Transportation chemicals	AR 385-31	Transportation chemical.	
Accident reporting and records	AR 385-40	Accident reporting and records.	
Coordination with DoD Explosive Safety Board	AR 385-60	Coordination with DoD Explosives Safety Board.	
Toxic Chemical Agent Safety Program	AR 385-61	Toxic Chemical Agent Safety Program.	
Ammunition and explosive safety standards	AR 385-64	Ammunition and explosive safety standards.	
Historic preservation	AR 420-40	Historic preservation.	
Water supply and wastewater	AR 420-46	Water supply and waste water.	
Solid and hazardous waste management	AR 420-47	Solid and hazardous waste management.	
Environmental control equipment policy	AR-700-115	Environmental control equipment policy.	
Hazardous material information systems	AR 700-141	Hazardous material information systems.	
Hazardous material packaging	AR 700-143	Hazardous material packaging.	

Preliminary Applicable or Relevant and Appropriate Requirements Listing (continued)

Standard, Requirement, Criteria, or Limitation	Citation	Description of Requirement	Comment
Occupational health guidelines for evaluation and control of occupational exposure to nerve agent.	DA PA 40-8	Occupational health guidelines for evaluation and control of occupational exposure to nerve agents.	
Decontamination solutions	DA PA 50-6	Decontamination solutions.	
Environmental quality goods	DA poster 200-12	Environmental quality goods.	
Military supply and transportation evaluation procedures	DoD 4000.23m	Military supply and transportation evaluation procedure.	
Military supply and transportation evaluation procedures	DoD 4000.25-3m	Military supply and transportation evaluation procedure.	
DoD contractors safety manual for explosives	DoD 4145.26-m	DoD contractors safety manual for explosives.	
DoD ammunition and explosive safety standards	DoD 5154.4-8	DoD ammunition and explosives safety standards.	
DoD hazardous materials information systems	DoD 6050.5-L and LR	DoD hazardous materials information systems.	
U.S. Army Corps of Engineers	EM 385-1-1	U.S. Army Corp of Engineers.	
Floodplain executive order	EO 11988	Floodplains executive order.	
Wetlands executive order	EO 11990	Wetlands executive order.	
Chemical data quality management for hazardous waste remedial activities	ER 1110-1-263	Chemical data quality management for hazardous waste remedial activities.	
Nuclear, biological, and chemical (NBC) decontamination	FM-3-5	NBC decontamination.	

Preliminary Applicable or Relevant and Appropriate Requirements Listing (continued)

Standard, Requirement, Criteria, or Limitation	Citation	Description of Requirement	Comment
Chemical compounds	FM-3-9	Chemical compounds.	
Technical Escort Operations	FM-3-20	Technical escort operation.	
Chemical accident contamination central field operations	FM 3-21	Chemical accident contamination central field operation.	
Chemical field manuals	FM 3.3 - .21	Chemical field manuals.	
Well drilling	FM 5-166	Well drilling.	
Topography surveying	FM 5-232	Topography surveying.	
Explosive and demolitions	FM 5-250	Explosive and demolitions	
Field manual - ordnance	FM 9-Series	Field manual - ordnance.	
Transportation	FM 55-Series	Transportation.	
Health assessments	PA 40-578	Health assessments.	
Environmental impact analysis	PA 200-1	Environmental impact analysis.	
Operation of the toxic exposure aid station	SAREA PA 385-1	Operation of the toxic exposure aid station.	
Chemical material storage	SB-3-30	Chemical material storage.	
Biological storage	SB-3-30-2	Biological storage.	
Ammunition surveillance procedures	SB 742-1375	Ammunition surveillance procedure.	
Technical bulletins - chemicals	TB-3-Series	Technical bulletins - chemicals.	
Safety and service	TB 385	Safety and service.	
Facility engineering - performance standards	TB 420	Facility engineering - performance standards.	

Preliminary Applicable or Relevant and Appropriate Requirements Listing (continued)

Standard, Requirement, Criteria, or Limitation	Citation	Description of Requirement	Comment
Water supply - health controls	TB Med. 576	Water supply - health controls.	
Chemical weapons and material escort	TEU Reg. 50-1	Chemical weapons and material escort.	
Technical manuals - chemical	TM-3-Series	Technical manuals - chemical.	
Chemical, biological, and radiological decontamination	TM 3-220	Chemical, biological and radiological decontamination.	
Hazardous chemical storage, shipping, and transportation	TM 3-250	Hazardous chemical storage and shipping/transportation.	
Chemical agent alarms	TM 3-6665-329	Chemical agent alarm	
Chemical agent alarm monitoring	TM 3-6665-331	Chemical agent alarm monitoring.	
Chemical agents	TM-3-6665-Series	Chemical agents.	
Surveying	TM-5-200	Surveying.	
Geology	TM-5-545	Geology.	
Natural resources land management	TM-5-630	Natural resources land management.	
Natural resources forest management	TM-5-631	Natural resources forest management.	
Entomology handbook	TM-5-632	Entomology handbook.	
Natural resources fish and wildlife	TM-5-633	Natural resources fish and wildlife.	
Soil waste management	TM-5-634	Solid waste management.	
Natural resources outdoor recreation and culture	TM-5-635	Natural resources outdoor recreation and culture.	
Engineering weather data	TM-5-785	Engineering weather data.	

Preliminary Applicable or Relevant and Appropriate Requirements Listing (continued)

Standard, Requirement, Criteria, or Limitation	Citation	Description of Requirement	Comment
Cost estimating - construction	TM-5-800-2	Cost estimating - construction.	
Project development	TM-5-800-3	Project development.	
Historical preservation - administration	TM-5-801-1	Historical preservation - administration.	
Historical preservation - maintenance	TM-5-801-2	Historical preservation - maintenance.	
Environmental protection planning	TM-5-803-2	Environmental protection planning.	
Land use planning	TM-5-803-8	Land use planning.	
Transportation planning	TM-5-803-9	Transportation planning.	
Water supply - source	TM-5-813-1	Water supply - source.	
Water supply - treatment	TM-5-813-3	Water supply - treatment.	
Sanitary landfills	TM-5-814-5	Sanitary landfills.	
Hazardous material land disposal	TM 5-814-7	Hazardous material land disposal.	
Evaluation criteria - water pollution	TM-5-814-8	Evaluation criteria - water pollution.	
Air pollution - incinerators	TM-5-815-1	Air pollution - incinerators.	
Drainage	TM-5-820-4	Drainage.	
Protective clothing chemical operation.	TM 10-277	Protective clothing chemical operation.	
Series - environmental control systems.	TM-55-1915	Series - Environmental control systems.	
Explosive Ordnance Disposal procedures	TM 60 Series	Explosive ordnance disposal procedures.	

Preliminary Applicable or Relevant and Appropriate Requirements Listing (continued)

Standard, Requirement, Criteria, or Limitation	Citation	Description of Requirement	Comment
Storage, shipping, handling, and disposal of chemical agent and hazardous chemicals	TM-250	Storage, shipping, handling, and disposal of chemical agents and hazardous chemicals.	
Air Force Regulations:		Air Transportation	
Air Transportation	19-9	Air Transportation	
Air Transportation	55-14	Air Transportation	
Air Transportation	55-18	Air Transportation	
Air Transportation	71-4	Air Transportation	
Air Transportation	76-38	Air Transportation	
Air Transportation	86-14	Air Transportation	

U.S.C. United States Code
CFR United States Code of Federal Regulations
TM Technical manual
AR Army regulations
FM Field Manual
TB Technical Bulletin
AMC-R Army Material Command regulations

APPENDIX O
APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS LISTING BY WORKPHASE

Applicable or Relevant and Appropriate Requirements Listing by Workphase

Standard, Requirement, Criteria, or Limitation	Baseline Assessment	Excavation	Packaging	Interim Storage	Transportation	Onsite Treatment	Citation
Federal laws							
Occupational Safety and Health Act (OSHA)	X	X	X	X	X	X	29 U.S.C. §§ 651-678 (1991, as amended)
OSHA - general industry standards	X	X	X	X	X	X	29 CFR § 1910 (1991)
OSHA - safety and health standards	X	X	X	X	X	X	29 CFR § 1926 (1991)
OSHA - Record keeping, reporting, and related regulations	X	X	X	X	X	X	29 CFR § 1904 (1991)
Clean Air Act (CAA)				X		X	42 U.S.C. §§ 7401 - 7671q (1991, as amended); 40 CFR § 61 (1991)
CAA - standards				X		X	40 CFR § 61.223 (1991)
Clean Water Act (CWA), also referred to as Federal Water Pollution Control Act of 1972 (as amended)	X	X		X		X	33 U.S.C. §§ 1251-1387 (1991, as amended)
National Pollutant Discharge Elimination System (NPDES)	X	X		X		X	40 CFR Parts 122-125 (1991)
Water Quality Standards regulation				X		X	40 CFR Part 131 (1992)
Navigable water discharge				X		X	40 CFR § 440.34(b) (1991)
Transportation of hazardous materials					X		40 CFR §§ 1801-1819 (1991, as amended)

Applicable or Relevant and Appropriate Requirements Listing by Workphase (continued)

Standard, Requirement, Criteria, or Limitation	Baseline Assessment	Excavation	Packaging	Interim Storage	Transportation	Onsite Treatment	Citation
Radon/Radon Progeny Measurement Proficiency Program							EPA-520/1-87-001
Hazardous Materials Transportation Act (HMTA) of 1974, as amended by the Hazardous Materials Transportation Uniform Safety Act (HMTUSA) of 1990					X		49 U.S.C. §§ 1801 through 1819, (1991, as amended); regulations promulgated: 49 CFR §§ 100 - 180
HMTA - definitions					X		49 CFR § 171
HMTA - shipping requirements					X		49 CFR § 172
HMTA - shipping papers					X		49 CFR § 172, subpart C
HMTA - hazardous material provisions					X		49 CFR § 172.101
HMTA - hazardous *shipping papers*					X		49 CFR §§ 172.201-203
HMTA - shippers certificate					X		49 CFR § 172.204
HMTA - manifests					X		49 CFR § 172.205 (1991)
HMTA - marking					X		49 CFR §§ 72.300 - 172.338 (1991)
HMTA - special handling					X		49 CFR § 174.700 (1991)
HMTA - cleaning vehicles after use					X		49 CFR § 174.715 (1991)

Applicable or Relevant and Appropriate Requirements Listing by Workphase (continued)

Standard, Requirement, Criteria, or Limitation	Baseline Assessment	Excavation	Packaging	Interim Storage	Transportation	Onsite Treatment	Citation
HMTA - leakage and spills					X		49 CFR § 174.750 (1991)
HMTA - transporter standards					X		49 CFR § 263 (1991)
HMTA - general					X		49 CFR § 263, subpart A (1991)
HMTA - manifest					X		49 CFR § 263, subpart B (1991)
HMTA - discharges					X		49 CFR § 263, subpart C (1991)
HMTA - immediate action requirements					X		49 CFR § 263.30 (1991)
HMTA - discharge cleanup					X		49 CFR § 263.31 (1991)
National Historic Preservation Act							16 U.S.C. § 470 (1991, as amended); 40 CFR § 6.301(b) (1991); 36 CFR § 800 (1991)
Archeological and Historical Preservation Act							16 U.S.C. § 469 (1991, as amended); 40 CFR § 6.301(c) (1991)
Historic Sites, Buildings, Objects, and Antiquities Act							16 U.S.C. §§ 461-469 (1991, as amended); 40 CFR § 6.301(a) (1991)
Fish and Wildlife Coordination Act							16 U.S.C. §§ 661-668ee (1991, as amended); 40 CFR § 6.302(g) (1991); 50 CFR § 27 (1991)

Applicable or Relevant and Appropriate Requirements Listing by Workphase (continued)

Standard, Requirement, Criteria, or Limitation	Baseline Assessment	Excavation	Packaging	Interim Storage	Transportation	Onsite Treatment	Citation
Endangered Species Act							16 U.S.C. §§ 1531-1544 (1991, as amended); 50 CFR § 200 (1991); 50 CFR § 402 (1991); 50 CFR § 10 (1991)
Dredge or fill requirements (§ 404)				X		X	40 CFR Parts 230 and 231 (1991); 33 CFR §§ 320-330 (1991)
Chemical agent standards - U.S. Public Health Service	X	X	X	X	X	X	Federal Register Vol. 53, No. 50, pg. 8504-8507
Safety and health standards	X	X	X	X	X	X	29 CFR 1925
National Environmental Policy Act (NEPA)				X	X	X	40 CFR 1500
National ambient air standards				X		X	40 CFR 50
Implementation plans				X	X	X	40 CFR 52
Reportable quantities - hazardous substances	X	X		X		X	40 CFR 116-117
Water quality planning and management				X		X	40 CFR 130
Resource Conservation and Recovery Act (RCRA)				X		X	40 CFR 260-280
National Contingency Plan (NCP)	X	X	X	X	X	X	40 CFR 300

Applicable or Relevant and Appropriate Requirements Listing by Workphase (continued)

Standard, Requirement, Criteria, or Limitation	Baseline Assessment	Excavation	Packaging	Interim Storage	Transportation	Onsite Treatment	Citation
Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) clean-up standards		X		X		X	42 U.S.C. 9621
Department of Transportation (DOT) - shipping containers					X		49 CFR 178
Exemption to 47A3, bombs from hazardous waste shipment requirements					X		DOT-E-7573
Exempt to DOT regulations for chemical or biological agent transportation					X		PL 91-441 sec. 506 (b)(4)
Nonbulk packaging					X		49 CFR 212
Transportation tracking					X		49 CFR 213
Transportation - power brake law					X		49 CFR 232
Exemption from some transportation requirements					X		DOT-E-9822
<u>Virgin Islands Laws</u>							
Planning and natural resources	X	X		X		X	Virgin Islands Code, Title 3
Wildlife	X	X		X		X	Virgin Islands Code, Title 12, Chapter 1 & 2

Applicable or Relevant and Appropriate Requirements Listing by Workphase (continued)

Standard, Requirement, Criteria, or Limitation	Baseline Assessment	Excavation	Packaging	Interim Storage	Transportation	Onsite Treatment	Citation
Trees and vegetation adjacent to watercourses	X	X		X		X	Virgin Islands Code, Title 12, Chapter 3
Water courses	X	X		X		X	Virgin Islands Code, Title 12 Chapter 3
Water pollution control	X	X		X		X	Virgin Islands Code, Title 12, Chapter 7
Air pollution				X		X	Virgin Islands Code, Title 12, Chapter 6
Fishing	X			X		X	Virgin Islands Code, Title 12, Chapter 9A
Open shoreline protection	X	X		X		X	Virgin Islands Code, Title 12, Chapter 10
Environmental protection	X	X		X		X	Virgin Islands Code, Title 12, Chapter 13
Coastal zone management	X	X		X		X	Virgin Islands Code, Title 12, Chapter 12, and Title 29, Chapter 3
Health - waste				X	X	X	Virgin Islands Code, Title 19, Chapter 52
Drinking water	X	X		X		X	Virgin Islands Code, Title 19, Chapter 51
Sanitation and sewage				X		X	Virgin Islands Code, Title 19, Chapters 53 and 55
Solid waste transportation					X		Virgin Islands Code, Title 19, Chapter 56

Applicable or Relevant and Appropriate Requirements Listing by Workphase (continued)

Standard, Requirement, Criteria, or Limitation	Baseline Assessment	Excavation	Packaging	Interim Storage	Transportation	Onsite Treatment	Citation
Solid waste disposal, resource recovery						X	Virgin Islands Code, Title 19, Chapters 56A and 71
Cemeteries							Virgin Islands Code, Title 19, Chapter 59
Highways and roads	X	X		X	X	X	Virgin Islands Code, Title 20
Fire and explosion	X	X	X	X	X	X	Virgin Islands Code, Title 23, Chapter 9
Navigation and harbor master	X	X		X	X	X	Virgin Islands Code, Title 25, Chapters 1 and 7
Zoning, land use planning, and building codes	X	X		X		X	Virgin Islands Code, Title 29, Chapters 2, 5, and 10
<u>Department of Defense (DoD) Requirements: DoD regulations</u>							
Transportation - personnel certification and training					X		AMC-R-350-9
Army Material Command safety manual	X	X	X	X	X	X	AMC-R-385-100
Safety regulations for chemical agents	X	X	X	X	X	X	AMC-R-385-131
Containers - shipping			X		X		AMC-R-700-103
Respiratory Protection Program	X	X	X	X	X	X	AR 11-34
Health - Hazardous Assessment Program	X	X	X	X	X	X	AR-40-10

Applicable or Relevant and Appropriate Requirements Listing by Workphase (continued)

Standard, Requirement, Criteria, or Limitation	Baseline Assessment	Excavation	Packaging	Interim Storage	Transportation	Onsite Treatment	Citation
Chemical surety program objectives	X	X	X	X	X	X	AR-50-6
Chemical Agent Security Program	X	X	X	X	X	X	AR 50-6-1
Hazardous cargo - water transportation					X		AR 55-228
Chemical contamination material sureability	X	X	X	X	X	X	AR-70-71
Interservice responsibility for explosive ordnance disposal	X	X	X	X	X	X	AR 75-14
Responsibility and procedures for explosive ordnance disposal	X	X	X	X	X	X	AR 75-15
Aircraft carrying hazardous material					X		AR-95-27
Meteorological support for the U.S. Army	X	X		X		X	AR 115-10
Topography	X	X		X		X	AR 115-11
Environmental protection	X	X		X		X	AR 200-1 Chapter 1
Research and development programs		X		X		X	AR 200-1 Chapter 2
Water research management programs							AR 200-1 Chapter 3
Air pollution abatement				X		X	AR 200-1 Chapter 4
Hazardous material management program	X	X	X	X	X	X	AR 200-1 Chapter 5

Applicable or Relevant and Appropriate Requirements Listing by Workphase (continued)

Standard, Requirement, Criteria, or Limitation	Baseline Assessment	Excavation	Packaging	Interim Storage	Transportation	Onsite Treatment	Citation
Waste management programs				X		X	AR 200-1 Chapter 6
Noise abatement programs				X		X	AR 200-1 Chapter 7
Spill contingency planning and response	X	X		X	X	X	AR 200-1 Chapter 8
Environmental restoration programs	X	X		X		X	AR 200-1 Chapter 9
Asbestos management programs							AR 200-1 Chapter 10
Radon							AR 200-1 Chapter 11
Other environmental programs							AR 200-1 Chapter 12
DoD environmental policy	X	X	X	X	X	X	AR 200-2 Chapter 1
NEPA - Army	X	X	X	X	X	X	AR 200-2 Chapter 2
Environmental effects of army actions	X	X		X	X	X	AR 200-2 Chapter 3
Categorical exclusions	X		X				AR 200-2 Chapter 4
Environmental assessment	X	X		X		X	AR 200-2 Chapter 5
Environmental impact statements		X		X	X	X	AR 200-2 Chapter 6
Public involvement	X	X		X	X	X	AR 200-2 Chapter 7
Environmental effects of major army actions		X		X	X	X	AR 200-2 Chapter 8
Army regulations chemical warfare classifications	X	X	X	X	X	X	AR-380-86
Safety programs	X	X	X	X	X	X	AR 385-10

Applicable or Relevant and Appropriate Requirements Listing by Workphase (continued)

Standard, Requirement, Criteria, or Limitation	Baseline Assessment	Excavation	Packaging	Interim Storage	Transportation	Onsite Treatment	Citation
Transportation accident prevention and emergency response					X		AR 385-14
Transportation chemicals					X		AR 385-31
Accident reporting and records	X	X	X	X	X	X	AR 385-40
Coordination with DOD Explosive Safety Board	X	X	X	X	X	X	AR 385-60
Toxic Chemical Agent Safety Program	X	X		X		X	AR 385-61
Ammunition and explosive safety standards	X	X	X	X	X	X	AR 385-64
Historic preservation							AR 420-40
Water supply and waste water		X		X		X	AR 420-46
Solid and hazardous waste management		X		X		X	AR 420-47
Environmental control equipment policy	X	X		X		X	AR-700-115
Hazardous material information systems	X	X	X	X	X	X	AR 700-141
Hazardous material packaging			X				AR 700-143
Occupational health guidelines for evaluation and control of occupational exposure to nerve agent.	X	X	X	X	X	X	DA PA 40-8

Applicable or Relevant and Appropriate Requirements Listing by Workphase (continued)

Standard, Requirement, Criteria, or Limitation	Baseline Assessment	Excavation	Packaging	Interim Storage	Transportation	Onsite Treatment	Citation
Decontamination solutions	X	X	X	X	X	X	DA PA 50-6
Environmental quality goods		X		X		X	DA poster 200-12
Military supply and transportation evaluation procedures					X		DoD 4000.23m
Military supply and transportation evaluation procedures					X		DoD 4000.25-3m
DoD contractors safety manual for explosives	X	X	X	X	X	X	DoD 4145.26-m
DoD ammunition and explosive safety standards	X	X	X	X	X	X	DoD 5154.4-8
DoD hazardous materials information systems	X	X	X	X	X	X	DoD 6050.5-L and LR
U.S. Army Corps of Engineers	X	X		X		X	EM 385-1-1
Floodplain executive order		X		X		X	EO 11988
Wetlands executive order		X		X		X	EO 11990
Chemical data quality management for hazardous waste remedial activities	X	X		X		X	ER 1110-1-263
Nuclear, biological, and chemical (NBC) decontamination	X	X	X	X	X	X	FM-3-5
Chemical compounds	X	X	X	X	X	X	FM-3-9
Technical escort operations			X		X		FM-3-20

Applicable or Relevant and Appropriate Requirements Listing by Workphase (continued)

Standard, Requirement, Criteria, or Limitation	Baseline Assessment	Excavation	Packaging	Interim Storage	Transportation	Onsite Treatment	Citation
Chemical accident contamination central field operations	X	X	X	X	X	X	FM 3-21
Chemical field manuals	X	X	X	X	X	X	FM 3.3 - .21
Well drilling	X	X		X		X	FM 5-166
Topography surveying	X	X		X		X	FM 5-232
Explosive and demolitions	X	X	X	X	X	X	FM 5-250
Field manual - ordnance	X	X	X	X	X	X	FM 9-Series
Transportation					X		FM 55-Series
Health assessments	X	X	X	X	X	X	PA 40-578
Environmental impact analysis	X	X		X		X	PA 200-1
Operation of the toxic exposure aid station	X	X	X	X	X	X	SAREA PA 385-1
Chemical material storage				X		X	SB-3-30
Biological storage				X		X	SB-3-30-2
Ammunition surveillance procedures		X		X		X	SB 742-1375
Technical bulletins - chemicals	X	X	X	X	X	X	TB-3-Series
Safety and service	X	X	X	X	X	X	TB 385
Facility engineering - performance standards				X		X	TB 420
Water supply - health controls				X		X	TB Med. 576

Applicable or Relevant and Appropriate Requirements Listing by Workphase (continued)

Standard, Requirement, Criteria, or Limitation	Baseline Assessment	Excavation	Packaging	Interim Storage	Transportation	Onsite Treatment	Citation
Chemical weapons and material escort					X		TEU Reg. 50-1
Technical manuals - chemical	X	X	X	X	X	X	TM-3-Series
Chemical, biological and radiological decontamination	X	X	X	X	X	X	TM 3-220
Hazardous chemical storage shipping and transportation					X		TM 3-250
Chemical agent alarms		X		X		X	TM 3-6665-329
Chemical agent alarm monitoring		X		X		X	TM 3-6665-331
Chemical agents	X	X	X	X	X	X	TM-3-6665-Series
Surveying	X	X		X		X	TM-5-200
Geology	X	X		X		X	TM-5-545
Natural resources land management							TM-5-630
Natural resources forest management							TM-5-631
Entomology handbook							TM-5-632
Natural resources fish and wildlife							TM-5-633
Soil waste management				X		X	TM-5-634
Natural resources outdoor recreation and culture							TM-5-635

Applicable or Relevant and Appropriate Requirements Listing by Workphase (continued)

Standard, Requirement, Criteria, or Limitation	Baseline Assessment	Excavation	Packaging	Interim Storage	Transportation	Onsite Treatment	Citation
Engineering weather data	X	X		X		X	TM-5-785
Cost estimating - construction		X		X		X	TM-5-800-2
Project development	X	X		X		X	TM-5-800-3
Historical preservation administration							TM-5-801-1
Historical preservation - maintenance							TM-5-801-2
Environmental protection planning							TM-5-803-2
Land use planning							TM-5-803-8
Transportation planning					X		TM-5-803-
Water supply - source				X		X	TM-5-813-1
Water supply treatment				X		X	TM-5-813-3
Sanitary landfills				X		X	TM-5-814-5
Hazardous material land disposal				X		X	TM 5-814-7
Evaluation criteria - water pollution		X		X		X	TM-5-814-8
Air pollution incinerators						X	TM-5-815-1
Drainage		X		X		X	TM-5-820-4
Protective clothing chemical operation	X	X	X	X	X	X	TM 10-277
Series - environmental control systems		X		X		X	TM-55-1915

Applicable or Relevant and Appropriate Requirements Listing by Workphase (continued)

Standard, Requirement, Criteria, or Limitation	Baseline Assessment	Excavation	Packaging	Interim Storage	Transportation	Onsite Treatment	Citation
Explosive Ordnance Disposal procedures	X	X	X	X	X	X	TM 60 Series
Storage, shipping, handling, and disposal of chemical agent and hazardous chemicals	X	X	X	X	X	X	TM-250
Air Force Regulations:							
Air transportation					X		19-9
Air transportation					X		55-14
Air transportation					X		55-18
Air transportation					X		71-4
Air transportation					X		76-38
Air transportation					X		86-14

X - ARAR applies to activity denoted
U.S.C. - United States Code
CFR - United States Code of Federal Regulations
BNA - Bureau of National Affairs

APPENDIX P

EARTH-CHANGE PLAN PERMIT APPLICATION

GOVERNMENT OF THE VIRGIN ISLANDS OF THE UNITED STATES

DEPARTMENT OF PLANNING AND NATURAL RESOURCES

Division of Permits
Nisky Center, Suite 231
Charlotte Amalie
St. Thomas, USVI 00802
(809) 774-3320

6003 Anna's Hope
Christiansted, St.Croix
Virgin Islands 00820-4433
(809) 773-1082/3450

EARTH CHANGE PERMIT APPLICATION

_____
PERMIT NUMBER

1. OWNER/APPLICANT INFORMATION
   - A. OWNER: _____
     ADDRESS: _____
     TEL. # _____
   - B. AUTHORIZED AGENT: _____
     ADDRESS: _____
     TEL # _____
   - C. DESIGNER: _____
     LIC. # _____
     TEL: # _____
   - D. EQUIPMENT OWNER: _____
     ADDRESS: _____
     TEL # _____

2. PROPERTY DESCRIPTION
   LEGAL DESCRIPTION: _____
   ESTATE: _____
   GENERAL LOCATION: _____
   QUARTER: _____ ISLAND: _____
   LOT SIZE: _____
   ZONING DISTRICT: _____
   COASTAL ZONE MANAGEMENT: TIER I ____ TIER II _____
   SOIL TYPE (s) _____

3. PROPOSED ACTION(S) CIRCLE THOSE THAT APPLY

A. LAND CLEARING	E. LAND SUBDIVISION
B. CONSTRUCTION	F. TREE REMOVAL/PLANTING
C. EXCAVATION	G. CUT AND FILL
D. ROAD BLDG./REPAIR	H. OTHER (DESPAIR)

   I. BRIEFLY DESCRIBE THE TOTAL SCOPE, INCLUDING THE END RESULT OF PROPOSED DEVELOPMENT(S). _____
   _____
   _____
   _____
   _____
   _____

4. BUILDING AND CONSTRUCTION SPECIFICATIONS
PLEASE REFER TO THE ATTACHED HANDOUT(S) WHICH THE SPECIFICATIONS THAT MUST BE SUBMITTED IN ORDER FOR YOUR APPLICATIONS TO BE CONSIDERED COMPLETE. (THREE COPIES OF DRAWINGS REQUIRED FOR SITE AND FLOOR PLANS.) PREFERRED SCALE IS 1" = 20" OR 1" = 10'.
IN ADDITION, PLEASE PROVIDE THE FOLLOWING INFORMATION:
LOWER FLOOR FINAL ELEVATION: _____
ELEVATIONS OF LOT CORNERES: _____
CISTER OVERFLOW PIPE(S) INVERT ELEVATION: _____
SEPTIC TANK TOP ELEVATION: _____

5. REQUIRED SUBMITTALS
A. SUBMIT ONE (1) COPY OF THIS APPLICATION WITH THE FOLLOWING MAPS FOR EVALUATION. PLOT TO SCALE THE SITE LOCATION ON ALL MAPS, AS AVAILABLE.

1. OFFICIAL ZONING MAP
2. FEMA FLOOD INSURANCE MAP
3. SURVEY OR PLOT
4. WATER RESOURCES MAP
5. SEDIMENT REDUCTION PROGRAM MAP
6. SOIL SURVEY - SOIL MAPS
7. COPY OF DEED

6. SIGNATURE BLOCK

I/WE HEREBY CERTIFY THAT TO THE BEST OF OUR KNOWLEDGE, ALL INFORMATION SUBMITTED IS ACCURATE AND CURRENT. I/WE ACKNOWLEDGE THAT THIS APPLICATION WILL BE REVIEWED FOR COMPLETENESS AND COMFORMITY WITH THE VI ZONING CODE PRIOR TO PROCESSING. IT IS ALSO EXPRESSLY ACKNOWLEDGED THAT THE COMMENTS OF THE VI SOIL & WATER CONSERVATION DISTRICT ARE ONLY A RECOMMENDATION TO DPNR. FINAL AUTHORITY AND RESPONSIBILITY FOR EARTH CHANGE PERMITS REST WITH DPNR.

OWNER: _____ APPLICANT/AGENT: _____

DATE: _____ DATE: _____

_____
CERTIFICATE OF ARCHITECT, ENGINEER, OR LAND SURVEYOR

DATE: _____ LICENSE #: _____

7. VIRGIN ISLANDS SOIL & WATER CONSERVATION DISTRICT COMMENTS:
A. SOIL TYPE (s): _____
B. OTHER INFORMATION: _____
C. FINDINGS/CONCLUSIONS: _____
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D. RECOMMENDATIONS: _____

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_____ _____

AUTHORIZED OFFICIAL DATE

8. DEPARTMENTAL USE ONLY

A. COMMENTS: _____

_____

_____

_____

_____

_____ _____

INSPECTOR DATE

_____

FEE RECEIPT

B. VERIFICATION OF ELEVATIONS

__SATISFACTORY __UNSATISFACTORY

9. APPROVAL/DENIAL

THIS PERMIT APPLICATION IS __APPROVED __DENIED

_____ _____

DISTRICT DIRECTOR OF PERMITS DATE

CONDITIONS OF APPROVAL.

NO _____ YES _____ (See #11).

10. NOTE TO ALL APPLICANTS

TO FACILITATE FIELS INSPECTION AND PERMIT REVIEW OF THE APPLICATION, THE SITE BOUNDARIES AND AREAS OF IMPACT SHALL BE VISIBLY FLAGGED AND MARKED (EXAMPLES: MARKING S.E CORNER, SOUTHERN BOUNDARY OF DRIVEWAY, ECT.). A PLAQUE OR SIGN INDICATING THE ESTATE AND PLOT NUMBER SHALL BE PLACED IN A VISIBLE LOCATION FROM THE ROAD OR RIGHT-OF-WAY.

EVERY PERMIT ISSUED BY THE DPNR SHALL EXPIRE BY LIMITATION AND BECOME NULL AND VOID IF THE BUILDING OR THE WORK IS NOT COMMENCED 12 MONTHS FROM THE DATE OF THE ISSURANCE, OR OF THE BUILDING OR WORK IS SUSPENDED OR ABANDONED AT ANY TIME AFTER THE WORK IS COMMENCED FOR A PERIOD OF 12 MONTHS. AN EXTENSION OF TIME MAY BE GRANTED BY THE DISTRICT DIRECTOR OF PERMITS.

IT IS THE RESPONSIBILITY OF THE APPLICANT, PROPERTY OWNER OR EQUIPMENT OWNER TO NOTIFY THE DPNR PERMIT OFFICE 48 HOURS BEFORE COMMENCING ACTIVITY OR WORK.

11. CONDITIONS OF APPROVAL

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shall contain at least the following information unless any specific required information is waived by the Zoning Administrator as not relevant or necessary to determine that the provisions of this subchapter have been met.

A site plan of the property, in duplicate, to a scale not to exceed twenty (20) feet to one (1) inch prepared by a registered engineer, architect or land surveyor, illustrating the proposed development of the property and including the following:

1. Topographical features showing present grades and any proposed grades if present grades are to be altered. When required by the Zoning Administrator, contours not greater than five (5) feet shall be shown;

2. Property boundary lines and dimensions including any distinguishing platted lot lines within the property;

3. Location and dimensions of buildings, including height in stories and feet and including total square feet of ground area coverage of all existing and proposed buildings;

4. Location and dimensions of all driveways and entrances and maximum yard dimensions and, where relevant, relation of yard dimensions to the height of any side of a building or structure;

5. Location and dimensions of parking stalls, access aisles, and total area of lot coverage of all parking areas and driveways;

6. Location and dimensions, including height clearance, of all off-street loading areas;

7. Location, designation and total area of all usable open space, including use of any paved areas as distinguished from sodded or other landscaped areas;

8. Location and height of fences, walls including retaining walls or screen planting, and the type or kind of building materials or planting used;

9. Proposed surface drainage;

10. Location of easements or other rights-of-way;

11. Location and designation of any open storage space;

12. The use of existing and proposed buildings, including the number of dwelling units in any building and the number of bedrooms in each dwelling unit in any building occupied or proposed to be occupied by more than two (2) dwelling or apartment units. This shall be supplemented by a summary schedule of all existing or proposed dwelling types set forth in the Table of Density Regulations of this subchapter;

13. In residential buildings, any existing or proposed commercial accessory uses as permitted by this subchapter shall be located and designated;

14. The total floor area in any commercial or mixed commercial-residential building which is governed by this subchapter by a floor area ratio (F.A.R.) factor. If a mixed commercial-residential occupancy, the location and total floor area of any commercial part of the building governed by a floor area ratio shall be shown;

15. Any information pertaining to a use conditionally permitted, where necessary to determine that the conditions for that use are met, or any information necessary to determine that the amount of off-street parking required by this subchapter is met.

A location map, in duplicate, at a scale not to exceed two hundred (200) feet to one (1) inch showing, at least, the uses of all property across the street or alley from or adjoining the boundary of the subject property, including the following:

1. All streets, alleys or other public rights-of-way, public parks and places and all lot and lot lines, streams, gulf, waterways and easements;

2. All structures and the principal use of each structure, including the kind of residential, business, commercial, industrial or waterfront use;

3. All parking areas as may be significant to the application in question.

Any other information as may be required by the Zoning Administrator to determine that the application is in compliance with this subchapter shall be furnished upon demand, including but not limited to flood plans, elevations, profiles, perspectives or any other material necessary to a complete understanding of this application.

A statement in writing signed by the applicant stating that the information as shown on said plans is true and correct. Any failure to comply with the provisions of this subchapter shall be good cause to refuse the issuance of any permit and/or to revoke any permit which may have been issued for any building or use of land.

Any application properly submitted under this section shall be acted upon by the Zoning Administrator within sixty (60) days

APPENDIX Q

REACTIVE PROPERTIES OF CYANURIC CHLORIDE

REF: BRETHERICK'S HANDBOOK OF CHEMICAL REACTIONS.

Thermally unstable at 22°C, and explosive in the gas phase at pressures above 27–62 mbar.

See other ACYL HYPOHALITES

676. Heptafluoroisopropyl hypofluorite

[22675-68-9] C_3ClF_7O

$(F_3C)_2CFOCl$

Schack, C. J. *et al.*, *J. Amer. Chem. Soc.*, 1969, **91**, 2904

Material condensed at –95°C may suddenly decompose completely and vaporise.

See other HYPOHALITES

677. Chlorocyanoacetylene (Chloropropynenitrile)

[2003-31-8] C_3ClN

$ClC{\equiv}CC{\equiv}N$

Hashimoto, N. *et al.*, *J. Org. Chem.*, 1970, 35, 675

Avoid contact with air at elevated temperatures because of its low (unstated) ignition temperature. Burns moderately in the open, but may explode in a nearly closed vessel. Presence of mono- and di-chloroacetylenes as impurities increases the flammability hazard, which may be reduced by addition of 1% of ethyl ether.

See other HALOACETYLENE DERIVATIVES

678. Sodium 1,3-dichloro-1,3,5-triazine-2,4-dione-6-oxide

[2893-78-9] $C_3Cl_2N_3NaO_3$

$\overline{N{=}C(ONa)NClCO.NClCO}$

Preparative hazard

See 1,3,5-Trichloro-1-3-5-triazinetrione: Cyanuric acid, etc.

'Fi-Clor 60S', Brochure NH/FS/67.4, Loughborough, Fisons, 1967

This compound (sodium dichloroisocyanurate), used in chlorination of swimming pools, is a powerful oxidant and indiscriminate contact with combustible materials must be avoided. Ammonium salts and other nitrogenous materials are incompatible in formulated products. The dibromo analogue, used for the same purpose, will behave similarly.

See other N-HALOIMIDES

679. 2,4,6-Trichloro-1,3,5-triazine (Cyanuric chloride)

[108-77-0] $C_3Cl_3N_3$

$\overline{N{=}CClN{=}CClN{=}CCl}$

HCS 1980, 925

1. Anon., *Loss Prev. Bull.*, 1979, (025), 21–22
2. *See entry* SELF-ACCELERATING REACTIONS

Of the factors associated with the high reactivity of cyanuric chloride (high exothermicity, rapid hydrolysis in presence of water-containing solvents, acid catalysed reactions, liberation of up to 3 mol hydrogen chloride/mol of chloride, formation of methyl chloride gas with methanol, formation of carbon dioxide from bicarbonates), several were involved in many of the incidents recorded [1] (and given below). The acid catalysed self acceleration and high exothermicity are rated highest [2]. It is also a mildly endothermic compound (ΔH_f° (s) +91.6 kJ/mol, 0.49 kJ/g).

Acetone, Water

Anon., *Loss Prev. Bull.*, 1979, (025), 20

The chloride was to be purified by dissolution in dry acetone, but in error, acetone containing 40% of water was used. The acid-catalysed exothermic hydrolysis reaction of the chloride accelerated to runaway, and gas and vapour evolution ruptured the vessel, leading to fire and explosion.

See Methanol, *also* Water, both below

See other GAS EVOLUTION INCIDENTS, SELF-ACCELERATING REACTIONS

Allyl alcohol, Sodium hydroxide, Water

Anon., *Loss Prev. Bull.*, 1974, (001), 11; 1979, (029), 21

When aqueous sodium hydroxide was added to a mixture of the chloride and alcohol at 28°C instead of the normal 5°C, a rapidly accelerating reaction led to rupture of the bursting disc and a gasket, and subsequently to a flash-fire and explosion.

See Methanol, *also* Water, both below

2-Butanone, Sodium hydroxide, Water

Anon., *Loss Prev. Bull.*, 1979, (025), 21

The total product of a batch containing a chlorotriazine, water, sodium hydroxide and 2-butanone had not been discharged from the 11,000 l vessel when a further 1.5 t of cyanuric chloride was charged ready for the next batch. The ensuing rapid exothermic hydrolysis led to eruption of the reactor contents, ignition and explosion of butanone vapour, and damage of 3M dollars.

Dimethylformamide

Anon., *BCISC Quart. Safety Summ.*, 1960, 35, 24

Cyanuric chloride reacts vigorously and exothermically with DMF after a deceptively long induction period. The 1:1 adduct initially formed decomposes above 60°C with evolution of carbon dioxide and formation of a dimeric unsaturated quaternary ammonium salt. Dimethylformamide is appreciably basic and is not a suitable solvent for acyl halides.

See other INDUCTION PERIOD INCIDENTS

Dimethyl sulfoxide

See Dimethyl sulfoxide: Acyl halides

2-Ethoxyethanol

Anon., *Loss Prev. Bull.*, 1979, (025), 20

Alcoholysis of the chloride on the plant scale was effected at 40°C (with brine cooling) by adding portions to the alcohol alternately with finely crystalline disodium phosphate to neutralise the hydrogen chloride produced. On one occasion, use of coarsely crystalline sodium phosphate (of low surface area) reduced the rate of neutralisation, the mixture became acid, and a runaway exotherm to 170°C developed leading to eruption of vessel contents. On another occasion, accidental addition of sodium sulfate instead of phosphate led to a similar situation beginning to develop, but an automatic pH alarm allowed remedial measures to be instituted successfully.

See other NEUTRALISATION INCIDENTS

Methanol

Anon., *ABCM Quart. Safety Summ.*, 1960, **31**, 40

Cyanuric chloride dissolved in methanol reacted violently and uncontrollably with the solvent. This was attributed to the absence of an acid acceptor to prevent the initially acid catalysed (and later auto-catalysed) exothermic reaction of all 3 chlorine atoms simultaneously.

Methanol, Sodium hydrogencarbonate

Anon., *Loss Prev. Bull.*, 1979, (025), 19

A crust of residual cyanuric chloride left in a reactor from a previous batch reacted with the methanol (usually charged first) to form hydrogen chloride. When the base was added (usually before the chloride), vigorous evolution of carbon dioxide expelled some of the solvent. In a second incident, accidentally doubling the charge of cyanuric chloride but not the base, led to the development of free acid (which auto-catalyses the reaction with methanol), and a runaway reaction developed causing violent boiling of the solvent, methyl chloride evolution and damage to the plant.

See Methanol, above *See other* RUNAWAY REACTIONS

Sodium azide

See 2,4,6-Triazido-1,3,5-triazine (reference 2)

Water

MCA Case History No. 1869

A reaction mixture containing the chloride and water, held in abeyance before processing, developed a high internal pressure in the containing vessel. Hydrolysis (or alcoholysis) of the chloride becomes rapidly exothermic above 30°C.

See Allyl alcohol, *also* Methanol, both above

See related ACYL HALIDES *See other* ENDOTHERMIC COMPOUNDS

APPENDIX R

LIST OF REFERENCES

APPENDIX R

LIST OF REFERENCES

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