



**Final**

## **Historical Radiological Assessment – Supplemental Technical Memorandum**

**Naval Station Treasure Island  
San Francisco, California**

**July 1, 2014**

Prepared for:

**Base Realignment and Closure  
Program Management Office West  
Naval Facilities Engineering Command  
San Diego, California**

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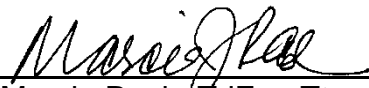
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**REVIEW AND APPROVAL**

Project Manager:  Date: July 1, 2014  
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## ACRONYMS AND ABBREVIATIONS

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μCi	Microcuries
AEC	Atomic Energy Commission
AN/PDR	Army Navy/Portable Detector Radiation
AOI	Area of Interest
Br	Bromine
BRAC	Base Realignment and Closure
CCSF	City and County of San Francisco
CDPH	California Department of Public Health
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COC	Chemical of concern
cpm	Counts per minute
Cs	Cesium
CSM	Conceptual Site Model
DRMO	Defense Reutilization and Marketing Office
DTSC	Department of Toxic Substances Control
FOSL	Finding of suitability to lease
FOST	Finding of suitability to transfer
FS	Feasibility study
FSS	Final status survey
GGIE	Golden Gate International Exposition
HPS	Hunters Point Shipyard
HRA	Historical radiological assessment
HRASTM	Historical radiological assessment supplemental technical memorandum
IDW	Investigation-derived waste
IR	Installation Restoration
IRP	Installation Restoration Program
K	Potassium
LCS	Landing Craft Ship
LLRW	Low-level radioactive waste
LLRO	Low-level radiological object
m <sup>2</sup>	Square meter
MARSSIM	Multi-Agency Radiation Survey and Site Investigation Manual

## ACRONYMS AND ABBREVIATIONS (CONTINUED)

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MDC	Minimum detectable concentration
Na	Sodium
NARA	National Archives and Records Administration
NAVSTA TI	Naval Station Treasure Island
Navy	Department of the Navy
NDRC	National Defense Research Committee
NRDL	Naval Radiological Defense Laboratory
NTCRA	Non-time-critical removal action
PAH	Polycyclic aromatic hydrocarbon
PCB	Polychlorinated biphenyl
pCi/g	Picocurie per gram
Ra	Radium
RADIAC	Radiation Detection, Indication, and Computation
RASO	Radiological Affairs Support Office
RCA	Radiologically Controlled Area
rem	Roentgen
RHB	Radiological Health Branch
ROD	Record of decision
SFUSD	San Francisco Unified School District
Shaw	Shaw Environmental, Inc.
Sr	Strontium
SU	Survey unit
SWDA	Solid waste disposal area
Tetra Tech	Tetra Tech EM Inc.
Th	Thorium
TI	Treasure Island
TIDA	Treasure Island Development Authority
USACE	U.S. Army Corps of Engineers
U.S.C.	<i>United States Code</i>
UST	Underground storage tank
VSP	Visual Sample Plan
WWII	World War II
YBI	Yerba Buena Island

## EXECUTIVE SUMMARY

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This technical memorandum supplements the findings of the “Final Treasure Island Naval Station Historical Radiological Assessment (HRA), Former Naval Station Treasure Island (NAVSTA TI), San Francisco, California,” (Weston Solutions, Inc. 2006). The intent of the HRA was to provide a comprehensive history of radiological operations by the Department of the Navy (Navy) and its contractors at NAVSTA TI before the time it was published in February 2006. This HRA Supplemental Technical Memorandum (HRASTM) documents the findings of additional investigation relative to historical operations involving use of and/or disposal of radioactive materials associated with the Treasure Island (TI) portion of former NAVSTA TI since the original HRA was completed. This additional investigation included research of historical records and review of reports documenting intrusive investigations conducted at NAVSTA TI after the HRA was published. Yerba Buena Island, part of NAVSTA TI, was not included in the original HRA and is not included in this technical memorandum.

As a result of additional intrusive investigation after the HRA was developed, it was confirmed that some areas, including disposal areas, contained radiologically contaminated waste. Therefore, additional research was warranted to further understand the radiological materials that were found and disposal processes for the radioactive waste. Additionally, the conceptual site models (CSM) presented in the original HRA had to be updated and refined to address the origin and impact of the radiological material that was found. The updated CSMs, historical research, and a review of activities at TI since the original HRA was published are in this HRASTM. Research for this HRASTM included review of all past TI projects having a radiological component, aerial photographs, geological reports, field activity logs, base-wide soil sample and scanning locations for radiological materials, radioactive waste disposal records, and various efforts supporting establishment of TI-specific background values for radium (Ra)-226.

Naval operational history was reviewed for a complete assessment of radiological activities at TI. TI was divided into eight Areas of Interest (AOI) to facilitate review of areas of TI with aerial photos from different years in detail and side-by-side. Changes in land use were assessed to determine the potential for activities that may have resulted in radioactive contamination and migration pathways. This review was carried out in coordination with the Navy’s Radiological Affairs Support Office (RASO) and included a review of documents at the Navy’s RASO office in Yorktown, Virginia; files consisting of building plans and other drawings and documents in the Caretaker Site Office at Building 1; and documents from the former TI Museum related to the Golden Gate International Exposition (GGIE), currently in Building 449 on TI.

As a result of the research discussed in this HRASTM, activities identified involving the use and disposal of the radioisotopes Ra-226, cesium (Cs)-137, and thorium (Th)-232 which resulted in the designation of new radiologically impacted areas. Ra-226 is associated with such uses as radioluminescent paints and sources, Cs-137 with use in sealed sources, and Th-232 in optical coatings and glass.

Please see [Appendix A](#) for general discussion regarding nuclear health physics, including alpha and beta particles.

A radiologically impacted site is one that has, or had, the potential for radioactive contamination, based on historical information, in excess of natural background or fallout levels. The designation as radiologically impacted does not confirm that radioactive contamination is present, but only that the possibility exists and must be investigated. A non-impacted site is one not classified as impacted and with no possibility of containing residual radioactivity in excess of natural background or fallout levels. The new radiologically impacted areas identified in the HRASTM include:

- Building 3 and the associated sanitary sewer system were identified as impacted based on ship repair activities and the presence of a former optical shop in the building during World War II (WWII). Building 3 was previously identified in the HRA as non-impacted.
- Site 6, Building 570, and a surrounding laydown area were identified as impacted based on remedial activities in association with the Site 12 Solid Waste Disposal Areas (SWDA). These areas were not addressed in the HRA.
- A probable WWII era salvage yard was identified as impacted based on the potential for scrap metal recycling activities adjacent to former Building 327 during WWII.
- Both former sites of the training ship mock-up, known as the USS *Pandemonium*, were identified as impacted based on a reevaluation of existing data after the HRA. Note that one of the USS *Pandemonium* sites, the northwest site, is also designated as impacted in this HRASTM because of its location within the Site 12 housing area (another newly impacted site).
- A salvage yard known as Lot 69 was identified as impacted based on the handling of salvage materials in that area.
- A former storage area that includes Sites 30 and 31 was identified as impacted based on investigatory results obtained after the HRA.
- Building 342 and the associated outside storage yard were identified as impacted based on investigatory results obtained after the HRA.
- The area surrounding Building 461 and the building itself was identified as impacted based on the potential for contamination resulting from this building's use in conjunction with radiological training activities.
- A portion of a recreation field associated with a former gyro compass repair shop was identified as impacted because of potential impacts associated with the gyro compass repair function. Note that the recreation field is also designated as impacted in this HRASTM because of its location within the Site 12 housing area (another newly impacted site).

- This HRASTM expands the radiologically impacted area for the Site 12 SWDAs to include the entire Site 12 to account for investigatory results obtained after the HRA. The radiologically impacted area in Site 12 includes the soil and subsurface, but does not include the housing structures.

Sites designated as radiologically impacted in the prior HRA or in this HRASTM will be addressed following the recommended action protocols outlined in Section 7.4 of the 2006 HRA.

No further action is necessary to address the potential for radiological contamination at TI that are not designated radiologically impacted. No evidence has been found to warrant further radiological investigation of areas that are not impacted.

## **1.0 INTRODUCTION**

This Historical Radiological Assessment Supplemental Technical Memorandum (HRASTM) documents the findings of additional investigation relative to radiological operations and disposal at the Treasure Island (TI) portion of former Naval Station Treasure Island (NAVSTA TI) ([Figure 1](#)). Yerba Buena Island (YBI), part of former NAVSTA TI, is not included in the scope of this HRASTM. This HRASTM supplements the findings of the “Final Treasure Island Naval Station Historical Radiological Assessment (HRA), NAVSTA TI, San Francisco, California” (Weston Solutions Inc. 2006). The intent of the HRA was to provide a comprehensive history of radiological operations by the Department of the Navy (Navy) and its contractors at NAVSTA TI before it was published in February 2006. Additional details of the original HRA are discussed in [Section 2.3](#). The purpose, methodologies employed, and organization of this HRASTM are further discussed below.

### **1.1 PURPOSE**

The HRASTM format and content are designed to be responsive to concerns expressed by the California Department of Public Health (CDPH) and to augment the original HRA with new information obtained through additional research and from review and consideration of new data that became available through site investigations since the HRA was finalized. The new information was used to update conceptual site models (CSM) for radiologically impacted areas as requested by CDPH and to update the list of areas designated as impacted. The updated CSMs, research of historical documents, and a review of activities that occurred at TI since the original HRA was published are presented in this HRASTM. [Figure 2](#) shows all the areas that are considered radiologically impacted based on the results of the 2006 HRA and this HRASTM. Details regarding specific Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) investigations or remedial efforts after this HRASTM is issued will be documented in project-specific reports or additional technical memoranda.

A radiologically impacted site is one that, based on historical information, has, or had, the potential for radioactive contamination in excess of natural background or fallout levels. The designation as radiologically impacted does not confirm that radioactive contamination is present, but only that the possibility exists and must be investigated. A non-impacted site is one not classified as impacted and with no possibility of containing residual radioactivity in excess of natural background or fallout levels.

### **1.2 TECHNICAL MEMORANDUM PREPARATION METHODOLOGIES AND RESEARCH FINDINGS**

This section discusses investigative methodologies used to conduct research and the findings that resulted from that research.

### **1.2.1 Technical Memorandum Preparation Methodologies and Research Findings**

This HRASTM was prepared based on a thorough research effort and visual inspections of the facilities on NAVSTA TI. Research included all past projects under the NAVSTA TI Installation Restoration (IR) Program (IRP); review of records in archives including files from the former TI Museum in Building 449; NAVSTA TI and 12th Naval District Files at The National Archives and Records Administration (NARA) files in San Bruno and Riverside, California; as well as NARA files located in College Park, Maryland. Navy internal files were also reviewed at the Radiological Affairs Support Office (RASO) in Yorktown, Virginia, and internal files in the Caretaker Site Office at Building 1 on NAVSTA TI. In addition to the archival record reviews, extensive Internet searches were conducted and former NAVSTA TI personnel were located and interviewed.

The following historical radiological operations were reviewed during the HRA and reexamined for this HRASTM:

- Operational training of personnel on the calibration, maintenance, and operation of radiation monitoring instruments.
- Training personnel on radiological monitoring and decontamination of ships and airplanes.
- Berthing of Operation Crossroads ships, or other ships exposed to atomic fallout from subsequent aboveground atomic bomb tests, before those ships were given final radiological clearance.

Additional naval operations and other previously un-reviewed records were examined. Reviews were done for all projects having a radiological component in the NAVSTA TI IRP. This review included work at the Building 233 area and the associated sewer systems, Sites 6, 12, 31, 32, and 33, and other efforts supporting development of background values for radium (Ra)-226. Specific records that support findings in this document are referenced within the following text of this technical memorandum. The types of files reviewed to support this HRASTM included:

- The 2006 Final HRA and all associated references
- NAVSTA TI plan maps and files
- Archived photographs
- Aerial photographs
- Newspaper articles and guidebooks from the 1939-1940 Golden Gate International Exposition (GGIE)
- Real property records and correspondence

- NAVSTA TI, 12<sup>th</sup> Naval District, and other documents archived at NARA sites
- Historical base maps
- Copies of the NAVSTA TI base newsletter, the *Masthead*
- Geological reports for TI
- IRP documents
- Field activity logs, work plans and other materials associated with intrusive environmental remediation work

New information or files found during research that adds to the body of knowledge of former operations at NAVSTA TI and, in particular, operations related to the radiological history of NAVSTA TI, are further discussed below and have been included in [Appendix D](#) for reference. In addition, extensive web searches were conducted during the research of this HRASTM.

Archival research included locating and contacting people who had specific knowledge of radiological and related operations at NAVSTA TI. Archival documents were reviewed to compile a list of individuals who may have such knowledge, and commercial web search engines were used to locate those individuals. Interviews with individuals who were located and who consented to providing information have been included in [Appendix B](#) that provides details of the interviews that were conducted.

### **1.2.2 Technical Memorandum Research Findings**

The research identified new information that differs from the conclusions of the HRA in these areas:

- The 2006 HRA concluded that it was unlikely that low level radiological objects (LLRO) had been disposed of in the solid waste disposal areas (SWDA) located in Site 12, but recommended radiation monitoring during soil excavations in these areas. This HRASTM identifies the housing area within Site 12 as radiologically impacted. Radiation monitoring conducted during remedial activities after the HRA was published found that LLROs had been disposed of in the SWDAs. In addition, LLROs were found at various locations in the housing area. The CSM developed in conjunction with this HRASTM presumes the LLROs originated in the SWDAs and were moved away from the SWDAs by grading activities associated with construction of the housing areas.



- New findings demonstrate that ship repair activities occurred at NAVSTA TI during World War II (WWII), though the HRA concluded that "...NAVSTA TI's mission was training and not the maintenance and repair of ships..." While it is unclear precisely when these ship repair activities ceased, they were significantly reduced immediately after WWII. Repair activities were primarily done alongside Piers 11 through 16. Inside shop work was done in Building 3 (Navy 1946a).
- Potential areas have been identified where scrap metal from ship repair during WWII was processed or stored; these areas were designated as impacted. The ship repair generated scrap materials that were recycled. The probable locations for these recycling activities during WWII have been designated as impacted because, on other bases, these types of areas have historically been found to have radium contamination incidental to their operations.
- An area referred to as Lot 69 was identified as having been a Supply Department Salvage Yard. Salvage yards have often been linked with the potential for disposal of unregulated LLROs and have historically been found to have radium contamination incidental to their operations.
- Research identified the presence of an optical shop on the roof of Building 3. The optical shop had sinks that drained to the sanitary sewer system. The presence of such a shop is notable, as these shops have historically been found on other bases to have radium and thorium contamination associated with their operations. Radium and thorium were used for their radioluminescent properties in optical sighting devices and rangefinders during the WWII period.
- Remedial activities conducted at Site 12 after the 2006 HRA was published resulted in the creation of additional radiologically impacted sites — Site 6, Building 570, and its surrounding area.
- Research identified a radiological counting room in Building 342. The presence of a counting room suggests that samples may have been handled without encapsulation and warrants designating the building and associated exterior areas as radiologically impacted.
- A more conservative interpretation of existing data in the HRA resulted in designating both sites where a training ship mock-up, known as the USS *Pandemonium*, was located as impacted.
- An incinerator on the northern side of TI may have been used to dispose of LLROs.
- Building 168 and the surrounding area were identified as radiologically impacted as a result of a reevaluation of the potential for radiological contamination from operations in the building when it was used as a gyro compass repair shop.
- Two additional "rubbish" disposal areas were identified from older geotechnical reports; they are located in the Site 12 housing area that has been designated as radiologically impacted because LLROs were found in other debris disposal areas.

In addition to the above revised findings, research revealed additional detail regarding the radiological history of TI as discussed in the remainder of this document and below.

One particular focus of research was to obtain additional detail regarding the purpose and use of the radium foils that have been found buried in the SWDAs. About 75 radium foils have been found to date, as detailed in [Table 1](#). The foils typically read about 1 roentgen (rem) on contact with the LLRO and range between 12 to 15 millirem 1 foot away from the LLRO. The foils are about the size of a dime and are octagonal or hexagonal in shape, as can be seen in [Photo 1](#) below. The evidence suggests that they would have been buried in the SWDAs sometime between 1942 and 1955, when evidence of the SWDAs can no longer be found in photographs. The Society for the History of Navy Medicine and the curators of both the National Atomic Testing Museum in Las Vegas, Nevada, and the Museum of Science and Energy in Oakridge, Tennessee, were contacted to try to obtain additional information regarding the purpose and use of the radium foils found buried in the SWDAs at TI.

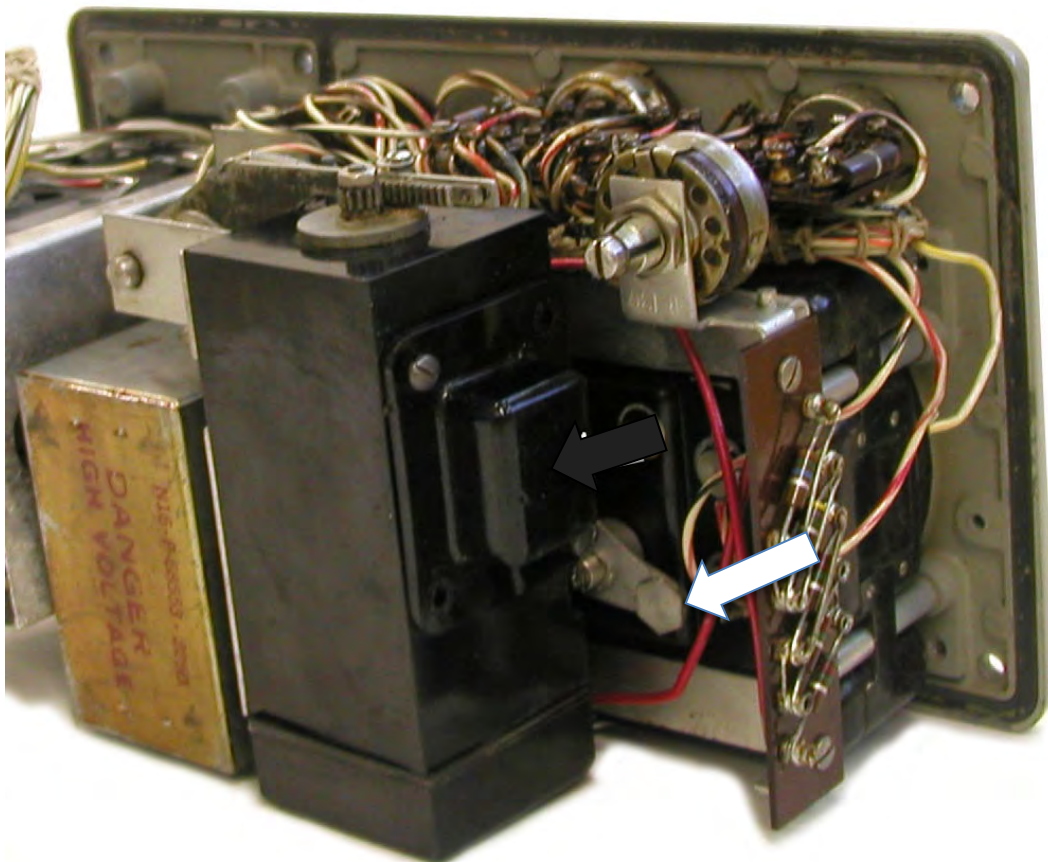


**Photo 1 Radium Foils**

Considering the amount of radioactivity associated with the foils, the most likely former use of the foils is as a calibration source for a high range gamma Radioactivity Detection, Identification and Computation (RADIAC) set, though the exact use of these foils cannot be confirmed with certainty. Research has identified one radiac set, an Army Navy/Portable Detector Radiation (AN/PDR)-18 that utilized high-level radium sources for calibration, as detailed in the Navy's instruction book for the radiac (Navy 1951a). This radiac and others like it would have likely been used in the Atomic Warfare School (later named the Nuclear, Biological and Chemical Warfare school) for training on TI (for a complete discussion of schools on TI see the HRA [Weston Solutions, Inc. 2006]). While the calibration source in the referenced instruction book does not exactly match the foils found in the SWDAs, the post-war 1940s was a period of intense development for radiation monitors and multiple manufacturers were developing many different models during that time frame. A later version of the RADIAC, an AN/PDR-18A, is shown in [Photo 2](#) which was obtained from the Oak Ridge Associated University's web site. In that photo

a check source of the approximate size and shape of the radium foils found buried in the SWDAs on TI can be seen. It is the conclusion of this HRASTM that the most likely use of the foils that have been found on NAVSTA TI would have been as calibration or check sources in association with a high-range radiac utilized in conjunction with the above schools. They were likely disposed of as excess in the early 1950s as radium use as check sources was phased out.

Other potential uses suggest by various parties that were investigated during research as potentially being related to the foils included a medical device, the radium plaque adaptometer (Navy 1943); the Metascope (National Defense Research Committee [NDRC] 1946); and the Icaroscope (NDRC Undated). All of these were eliminated as being associated with the foils as no evidence was found that any of these instruments were ever used at NAVSTA TI. The radium plaque adaptometer was used for testing the night vision of sailors and while it apparently used radium no evidence has been found that the radium was in the form of the foils. The Navy discontinued use of the radium plaque adaptometer in 1951 (Navy 1951c). Similarly, the Metascope, a device for detecting infrared waves, used radium in some models, but the radium was on gold foil unlike the foils found on NAVSTA TI. The Icaroscope was a device use for viewing objects against a bright background. It was originally developed for viewing attacking airplanes coming out of the sun. No evidence of the use radium foils in this device has been found.



**Photo 2 Hexagonal check source in AN/PDR-18A – white arrow**

### 1.3 TECHNICAL MEMORANDUM ORGANIZATION

A detailed review of the facility background was done using the information acquired through the file research and is presented in [Section 2.0](#). For this HRASTM, TI was divided into eight Areas of Interest (AOI) to allow the side-by-side comparison of aerial photographs from different times and to facilitate the discussion that focuses on the changes in land use as it relates to the likelihood of potential contamination and migration pathways. [Section 2.0](#) presents conclusions regarding the designation of specific areas as impacted or non-impacted by radiological constituents. [Sections 3.0 and 4.0](#) discuss the previous radiological operations and IRP activities on TI, and [Section 5.0](#) discusses the CSMs developed as part of this HRASTM to evaluate the potential releases of contamination in impacted areas. [Section 6.0](#) presents the findings and recommendations, and [Section 7.0](#) lists the references used in this report.

Figures and [Table 1](#) are provided at the end of the report. [Appendix A](#) provides general health physics information. [Appendix B](#) provides summaries of interviews conducted during research for the HRASTM. [Appendix C](#) provides comments received on the draft of this document and the Navy's responses to those comments. [Appendix D](#) contains the references used in the HRASTM, and is provided on DVD only.

## 2.0 FACILITY BACKGROUND

This section describes the NAVSTA TI facility, summarizes its history, and discusses the previous HRA.

### 2.1 FACILITY DESCRIPTION

NAVSTA TI is in the San Francisco Bay ([Figure 1](#)), at mid-span of the San Francisco-Oakland Bay Bridge. NAVSTA TI consists of two islands: YBI, a naturally occurring island, and TI, a manmade island built on submerged land ([Figure 1](#)). This HRASTM addresses the manmade portion of NAVSTA TI, referred to as TI. TI was divided into eight AOIs based on the nature of available photographic coverage and to facilitate refining the analysis and discussion in this HRASTM ([Figure 2](#)). The property on YBI has not been included in this HRASTM because CDPH concurred that areas on YBI subject to future property transfers are not radiologically contaminated (CDPH 2011b).

### 2.2 FACILITY HISTORY

Military activities at NAVSTA TI date back to 1866, before the construction of TI, when the U.S. government took possession of YBI for defensive fortifications. YBI was occupied by the U.S. Department of the Army until 1896, when the Navy assumed operations. The Navy operated the first West Coast naval training station on YBI until 1923, when these activities were transferred to an alternative location in San Diego, California. The portion of NAVSTA TI that is the subject of this HRASTM was built on submerged lands in San Francisco Bay.

When California came into the Union on September 9, 1850, it acquired title to the submerged land and tideland in San Francisco Bay. The land where NAVSTA TI was constructed is in the City and County of San Francisco (CCSF) and north of YBI. In 1933, the State of California granted the CCSF the parcel of land currently containing the NAVSTA TI for construction of a public airport, wharf and dock facilities, and for use as an airfield (Cal Stats of 1933 Chapter 912, August 21, 1933). At that time, seaplanes and land-based airplanes were regularly used in air transportation. The parcel of land (to be filled by dredge material) was a 4,500- by 8,000-foot rectangle. The CCSF was authorized to reclaim, fill, and raise the submerged land. The CCSF received the right to construct a bridge or causeway between the lands to be filled and YBI.

In 1935, the state granted the CCSF the right to use TI for expositions and fairs. From February 1936 through August 1937, the U.S. Army Corps of Engineers (USACE) conducted construction activities on the 403-acre, man-made TI on behalf of the CCSF in preparation for the GGIE. The Yerba Buena Shoals, a 735-acre reef extending north from YBI, was used as the foundation for this work. To build the island, the USACE constructed a perimeter of rock and filled it with millions of tons of silt dredged from the bay and delta (Lee 1969). The GGIE opened in early 1939 and ended in late 1940. The Navy reviewed documents from the GGIE and found limited evidence of the use or presence of radioactive materials during the period prior to Navy ownership of TI. The uses of radioactive materials were limited to the Hall of Science and do not warrant designating the former Hall of Science area as radiologically impacted, as is further discussed in [Section 2.2.3](#). This record was the only found regarding the use or presence of radioactive materials during the GGIE; however, it does not preclude the presence of radioluminescent materials in association with common items such as watches or on instruments associated with the Pan American Clippers.

In response to a request by the Navy, the CCSF leased NAVSTA TI to the Navy in 1941 for the duration of WWII. On February 7, 1942, under the authority of this lease, TI became a major naval station, processing approximately 12,000 military personnel per day for service overseas and on their return to the U.S. In parallel with operations under the lease, Congress enacted the Naval Appropriations Act, Public Law 441, 77th Congress. This act appropriated funds for the acquisition of TI. Congress also passed the Second War Powers Act of 1942, Public Law 507, 77th Congress, March 27, 1942. This act further broadened the Government's right to condemn land. The Government filed a complaint in condemnation and a declaration of taking on April 17, 1942, in the U.S. District Court in San Francisco, captioned “United States of America v 380 acres of tideland and submerged lands,” Civil No. 22164G. The state and the CCSF were named as defendants. Both the state and CCSF contested the condemnation that was ultimately settled, and the Final Judgment in the case was filed April 3, 1944, granting the government the lands described in the condemnation action in fee simple absolute.

During WWII, NAVSTA TI was used primarily for training, administration, housing, as an urgent care hospital, as a repair yard for small vessels, and other support services to the U.S. Pacific Fleet. After the war ended in 1945, the CCSF agreed to trade the deed for TI to the Navy in exchange for government-owned land south of San Francisco, where the San Francisco International Airport was eventually built. Major naval organizations at TI included the U.S. Naval Station itself, which provided varied support for elements of the U.S. Pacific Fleet and administers to the island's many tenant commands and units; Headquarters offices of the



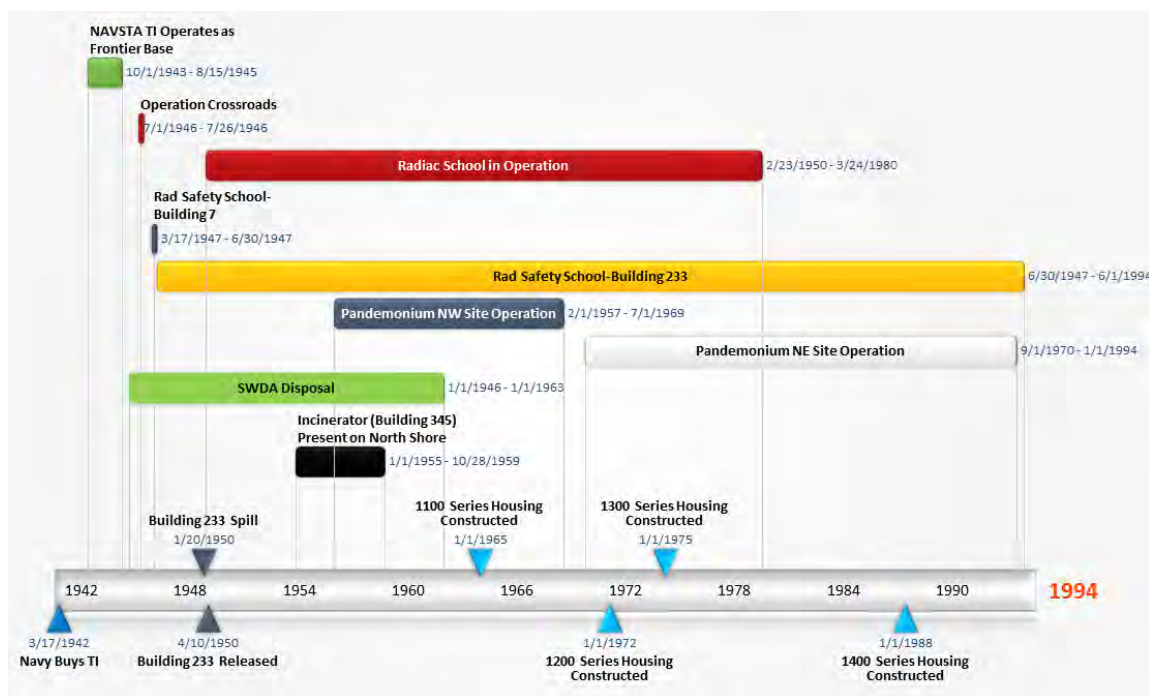
Commandant Twelfth Naval District and the Commander; Western Sea Frontier; the Navy Regional Naval Schools Command; the Navy Regional Finance Center; and the Naval Training Center.

In 1993, the Defense Base Realignment and Closure (BRAC) Commission recommended closure of NAVSTA TI pursuant to the Defense Base Closure and Realignment Act of 1990 (Pub. L. 101-510, Title XXIX, Title 10 *United States Code* § 2687 note). NAVSTA TI was closed on September 30, 1997. CCSF is the target recipient of remaining untransferred NAVSTA TI property. In general, many changes to NAVSTA TI have occurred from the start of construction in 1936 to the present. Many of the original exposition buildings no longer exist. The exposition center was replaced by numerous other buildings, parking areas and open space. Family housing replaced the ammunition storage area and former rubbish disposal areas documented in various geotechnical reports (Navy 1965; McCreary Koretsky Engineers 1965). Numerous piers were demolished, especially along the eastern side of NAVSTA TI. Only one major pier, constructed in the late 1980s in the southeast corner of TI, remains.

At the start of WWII, NAVSTA TI was designated a “Section Base” with limited repair capability. The designation and the repair capability were upgraded later in the war to a “Frontier Base,” and TI became one of the largest Frontier Bases by supplementing similar repair facilities around the bay area that were overloaded. The Frontier Base took on the important job of completely servicing inshore and offshore operations and voyage and transient repairs for all crafts up to and including 2,200-ton destroyers (Navy 1946a). Further evidence of the magnitude of repair work is provided by Masthead articles that refer to the amount of scrap metal from repair activities at 200,000 pounds per month (Navy 1945a) and the complete replacement of an engine room on LCS 119 (Landing Craft Ship) that was struck by a Japanese Kamikaze (Navy 1945b). Wartime recycling activities, particularly related to ship repair, have historically included radiological impacts to the locations, thus their evaluation in this HRASTM. In addition to ship repair work, evidence was found regarding an optical shop in association with the “Section/Frontier Base” (Navy 1944a, 1945c, 1951b, Undated). Former Navy optical shops at other bases have been found to contain residual radium and thorium contamination. The optical shop on NAVSTA TI was located on the roof of Building 3.

This HRASTM primarily differs from the conclusions of the 2006 HRA as it confirms the presence of LLROs at the SWDAs and at a few other locations within the housing area on TI and it finds that ship repair activities occurred at NAVSTA TI during WWII. After Victory Over Japan Day, August 15, 1945, the designation of Frontier Base was disestablished and NAVSTA TI was designated as a U.S. Navy Small Craft Facility whose previous functions continued on a reduced scale.

The timeline below provides an overview of milestones and operational periods of significance to the radiological history of NAVSTA TI:



**Note:** (1) The start and end dates for SWDA disposal are based on U.S. Environmental Protection Agency estimates (Weston Solutions, Inc. 2006). Other data suggest disposal in the SWDAs began prior to 1946 and disposal concluded circa 1956.

## 2.2.1 AOI 1: Seaplane Lagoon Area

AOI 1 consists of half of the causeway between TI and YBI and the land from California Avenue (formerly named 2<sup>nd</sup> Street) south toward the Seaplane Lagoon (Figure 3). The infrastructure improvements on the uplands in this parcel have not changed substantively since construction for the GGIE in 1939 and 1940, except Building 180 and piers that were built appurtenant to the uplands. Land between buildings in this parcel has remained developed with landscaping or paved surfaces throughout the Navy's ownership. One site in AOI 1 (Building 3) was identified in the HRA as a non-impacted site because, despite the historical storage of instrument check sources in the building, there were no reports the check sources had leaked in the building. This HRASTM concludes that, unrelated to those historical check sources, Building 3 is appropriately designated as radiologically impacted because of the magnitude of ship repair activities historically associated with this building during WWII and the presence of an optical repair shop on the roof of Building 3. Further discussion regarding Building 3 is provided below.

The primary structures in AOI 1 consist of Buildings 1, 2, 3, and 180. Building 1 functioned as an administration building during the GGIE and still does.

The Yerba Buena Club and "Treasure Garden" were built for the GGIE. The Yerba Buena Club was demolished and replaced with a parking lot soon after the end of the GGIE. The Treasure Garden was demolished and Building 180 was constructed in its place beginning in 1942

(see 4 June 1942 aerial photograph on [Figure 3](#)). Building 180 was initially used as a hangar and later for transportation shops. Building 2 was the “Hall of Air Transportation” during the GGIE and appears to have continued as a “hanger” through WWII (the building is labeled “Hanger” on a 1946 map [Navy 1976] and Pan American World Airways operated “clippers” from TI throughout the war). [Photos 3 and 4](#) depict the interior of Hangar 2 after the war and show that it remained as relatively open space (a radar facility was built in the building in 1953, and the building was used as a Naval Reserve facility in 1963).

Hangar 3 was the Palace of Fine and Decorative Arts during the GGIE. It is evident from the records reviews and [Photo 5](#) that Building 3 was configured to conduct inside shop work associated with the repair activities associated with the “Section/Frontier Base” operations. Building 3 has been designated as radiologically impacted in this HRASTM because of the potential for those historical ship repair activities to have involved radioactive deck markers and gauges painted with radioluminescent paint. Evidence was found regarding the potential for an optical shop associated with the “Section/Frontier Base” on NAVSTA TI (Navy Undated). Former Navy optical shops at other bases have been found to contain residual radium contamination. The optical shop was on the roof of Building 3 as shown on [Photo 6](#). The plan elevation and details show the presence of sinks and drains in the optical shop and these drains are considered impacted from the point of origin in the shop downstream to the sewer outfall. It is apparent that the 6-inch sanitary sewer line shown on [Photo 7](#) was added sometime after 1943 as it is not shown in earlier drawings. It is therefore likely added in association with the construction of the optical shop (Navy 1944a). As noted in the handwritten note on the plan elevation and details, the optic shop was demolished in 1969. Part of the drain line serving the shop was removed along with the shop, but the majority of the line leading to the pump station remains. There were a number of ship repair piers and two floating dry-docks by the war’s end that were dedicated to this activity (see [Figure 3](#), 20 February 1945 aerial photograph). Ship repair activities appear to have ceased sometime in the 1950s; however, it is not clear exactly when these activities ceased.

After WWII, the U.S. began aboveground tests of atomic weapons in the summer of 1946. After the two nuclear weapons detonations of the first of these tests, the Operation Crossroads test series, many of the target ships and support ships were contaminated with radioactive fallout. They were initially decontaminated near the test site by washing down and stripping paint above the waterline and then returned to the continental U.S. for additional decontamination and clearance from radiological restrictions. In the San Francisco Bay area, returning ships were surveyed and underbodies and sea water systems were decontaminated at Hunters Point Shipyard (HPS) and at Mare Island Naval Shipyard by sand blasting and flushing. A radiological history of the ships known to have berthed at NAVSTA TI was provided in the 2006 HRA. The HRA identified at least four Operation Crossroads ships were berthed at NAVSTA TI after they had been decontaminated at HPS and before they were given final clearance. Three of the ships were berthed at NAVSTA TI before they were given operational clearance and one was berthed at Yerba Buena Island, but after having been monitored for radiological contamination. The three TI piers identified as being used for berthing Operation Crossroads ships have all been demolished. The HRA concluded that there is no likelihood of contamination at TI as a result of the berthing of Operation Crossroads ships (Weston Solutions, Inc. 2006).

Even though the HRA did not identify any evidence that returning Operation Crossroads ships had been berthed at TI prior to decontamination, the potential remained a concern with the

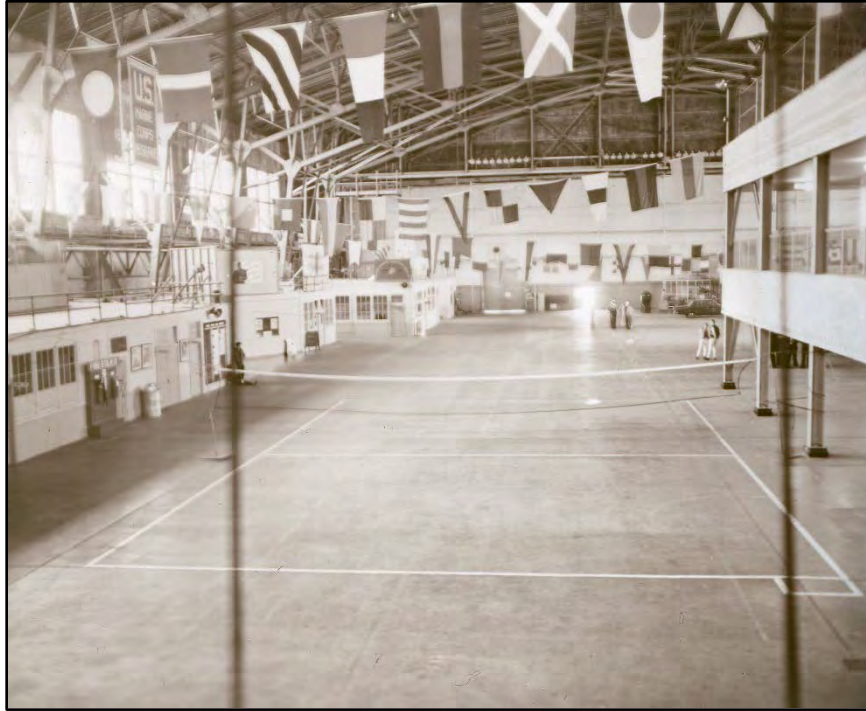


overseeing regulatory agencies. As a result, a key research area for this HRASTM was information related to the berthing of Operation Crossroads ships at TI and, in particular, any information that would indicate ships that had been contaminated in an aboveground atomic test either during Operation Crossroads or later tests. Twelfth Naval District records were reviewed for ship movements and berthing following aboveground tests, but no evidence counter to the conclusion of the HRA was found.

On February 25, 2014, an on-line news article asserted that a contaminated barge, YFNB-29, was repaired at NAVSTA TI based on a document the reporters had found during archival research. The evidence would suggest that the assertion is not correct, and this paragraph is included in the HRASTM to correct the record regarding the claim in the news article. As background, barge YFNB-29 was used as a platform to gather fallout resulting from Operation Redwing. Operation Redwing was a United States series of 17 nuclear test detonations from May to July 1956. The tests were conducted at Bikini and Enewetak atolls, and the general objective was to obtain data sufficient to characterize the fallout, interpret the aerial and oceanographic survey results, and check fallout-model theory. According to declassified reports, the Naval Radiological Defense Laboratory (NRDL) that was located at HPS was involved in the instrumentation and testing of fallout from the bomb tests. The source of the document (a drawing showing the locations and levels of radioactive contamination on the barge) is unclear; however, similar documents were found in the HPS archives for other vessels used in the Operation Redwing tests. There is no reference in the identified document to NAVSTA TI. It should be noted that NAVSTA TI had no radiological repair capability and, by 1956, ship repair capacity was limited. Furthermore, the Code 288 referred to in the title block of the document was a designation for a Hunters Point Naval Shipyard department, and the document and information contained within it implies that work on the barge would have been performed at HPS.



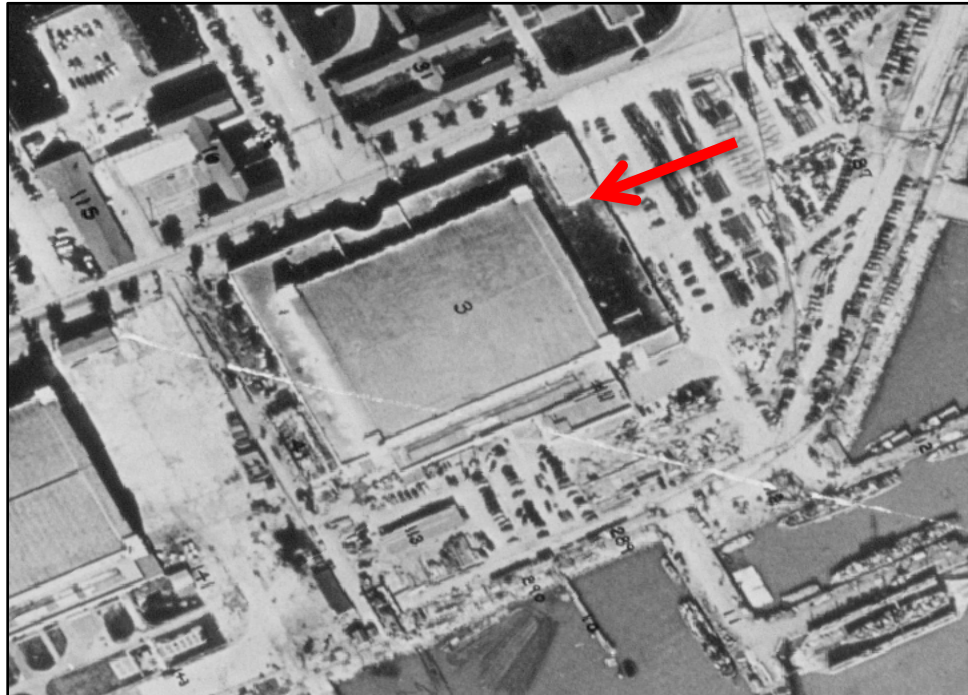
**Photo 3 Interior of Hangar 2, 1953, showing radar building**



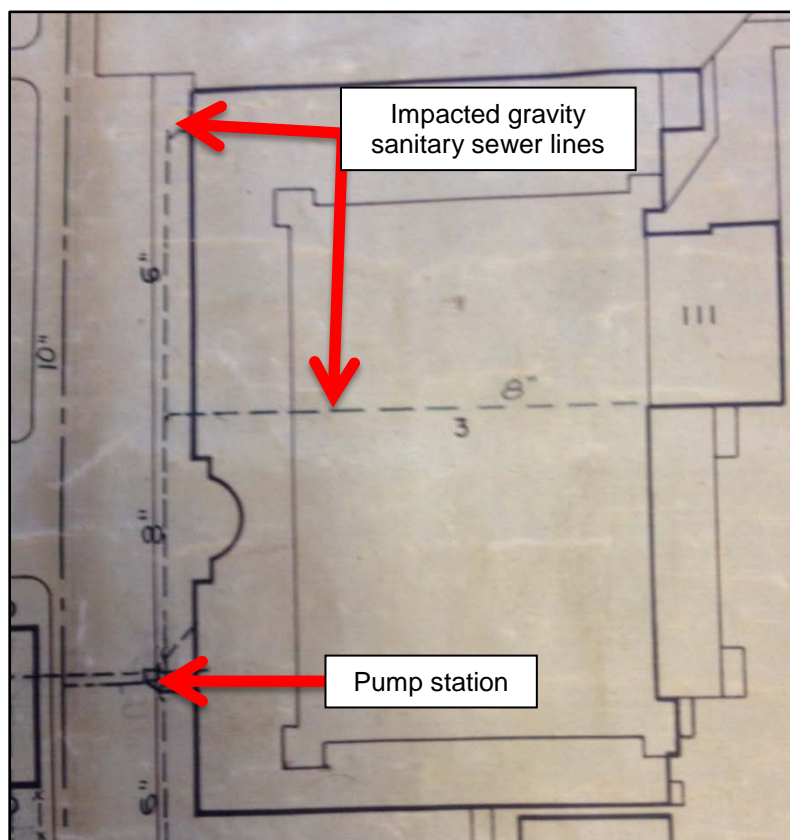
**Photo 4 Interior of Hangar 2, 1963, label on photo states “Naval Reserve”**



**Photo 5 Interior of Hangar 3 during WWII repair shop for Frontier Base**



**Photo 6 1945 photo showing the presence of the optical shop  
on the north corner of the Building 3 roof**



**Photo 7 Showing sanitary sewer line in 1946 drawing**



### 2.2.2 AOI 2: Former Hospital Area

AOI 2 consists of the former hospital area and is bounded by the Hospital Barracks and 5th Street to the north, by San Francisco Bay to the east, on the south by California Avenue (formerly 2nd Street), and by H Avenue to the west. Only one site in AOI 2 (Building 233) was identified in the HRA as a radiologically impacted site. The findings of this HRA<sup>TM</sup> for AOI 2 are consistent with those of the HRA.

AOI 2 is shown in [Figure 4](#) and is composed of three general areas: the hospital area, an open area associated with piers 15 and 16; and the waterfront (Federal Building area). Except for the Federal Building, the GGIE structures in this area ([Photo 8](#)) were demolished prior to 1942. By early 1942, the Lake of the Nations had been filled in and construction of the hospital buildings was nearing completion (see [Photo 9](#) and [Figure 4](#)). The Lake of the Nations was filled in before Navy operations began, and the footprint of the entire area was developed early in the war and before other Navy operations were expanded on the island. As a result, there is little likelihood that any debris associated with Navy operations would have been disposed of in this area or that any debris would have contained radioactive items associated with those later Navy operations. The Navy recently completed remedial action, including radiological surveys and samples, at the Waterline Replacement Area, Site 33 ([Figure 4](#)). Data support the conclusion that soil and asphalt samples from the five separate excavation areas at Site 33 are free of non-naturally occurring Ra-226 contamination. The excavation areas are also free of cesium (Cs)-137 and strontium (Sr)-90 contamination. Therefore, Site 33 was not classified as impacted in this HRASTM.



**Photo 8 1939 Map of GGIE showing the vicinity of the future hospital area**



**Photo 9 Early 1942 oblique aerial photo of AOI 2**

Building 233 was constructed in 1944 adjacent to the Federal Building (Building 7) and was used beginning in 1947 for the Radiation Safety School. Building 233 was the site of a radium sulfate spill in 1950, documented in the HRA, and was designated as impacted in the HRA. Building 233, the soil around the building, and storm sewers and a sanitary sewer line associated with the building, are currently being remediated. Building 233 has been demolished and building debris disposed of as low-level radioactive waste (LLRW) (Shaw Environmental, Inc. [Shaw] 2014). The soil around the building and parts of the foundation will be characterized and disposed of. A report will be issued documenting a Final Status Survey (FSS) for the site. AOI 2 was built out by the end of WWII and, because it was already developed by that time, there is little likelihood for debris to be disposed of in the AOI during that period. After the end of WWII through the end of the 1950s, there was little change in this area but, beginning in the 1960s and thereafter, structures were periodically demolished and replaced with open grassy areas, or in one case, a ball field. There is no evidence of any debris disposal in AOI 2 during this period or additional radiological activities other than those already documented in the HRA.

### **2.2.3 AOI 3: Island Core Area**

AOI 3 consists of the Island Core area and is bounded by 9th Street to the north, by H Avenue to the east, on the south by California Avenue, and by San Francisco Bay to the west. The HRA concluded that there were no radiologically impacted sites in AOI 3. The findings of this HRASTM for AOI 3 are consistent with those of the HRA.

As part of the research associated with this HRASTM, the Navy conducted web searches for documents from the GGIE and found limited evidence of the use or presence of radioactive materials during the period prior to Navy ownership of TI. Identified uses of radioactive materials included small quantities of irradiated sodium and polonium in cloud chambers, the use of “red spheres” of artificially produced radioactive material in an exhibit called the “radioactive

man,” and radium in a projection electroscope at the World’s Fair Hall of Science (University of California Berkeley 1940). The “artificially” produced isotopes of sodium and polonium had short half-lives, as would also be expected for the radioactive man red spheres. In addition, the quantities of radioactive material used for cloud chambers would have been de minimis. The radium used in conjunction with the projection electroscope would logically have been returned to the University of California after the GGIE ended. The Hall of Science itself was used as a barracks during the war years and was demolished after the war. The Hall of Science area does not warrant designation as a radiologically impacted site because the isotopes had short half-lives, were likely returned to the University of California after the GGIE, and the building itself was demolished in the 1940s.

During Navy operations, AOI 3 ([Figure 5](#)) was historically composed of barracks and administrative areas (Buildings 117, 118, 137, 139, 147, 148, 149, 150, 151, 152, 170, 171, 172, 173, 174, 175, 177, 178, and 179). The area was dominated by four large L-shaped halls during the GGIE ([Photo 10](#)). These halls were used as barracks, Buildings 452 and 453, during WWII, and additional barracks and other classroom room and administrative facilities were built around them during the war (see [Photo 11](#) and 1942 and 1947 aerial photographs on [Figure 5](#)). Following the war, the halls were demolished and the land was unused until the star barracks were built in the late 1960s. Available aerial photographs do not show the former footprint of the GGIE halls being used for laydown areas or debris disposal areas during the period from when the hall was demolished until construction of the star barracks. The fact that area was not used for laydown or debris disposal is to be expected, as these open areas were surrounded by barracks and administrative areas during this period, making it unlikely that such debris disposal would occur in an active area of the base.

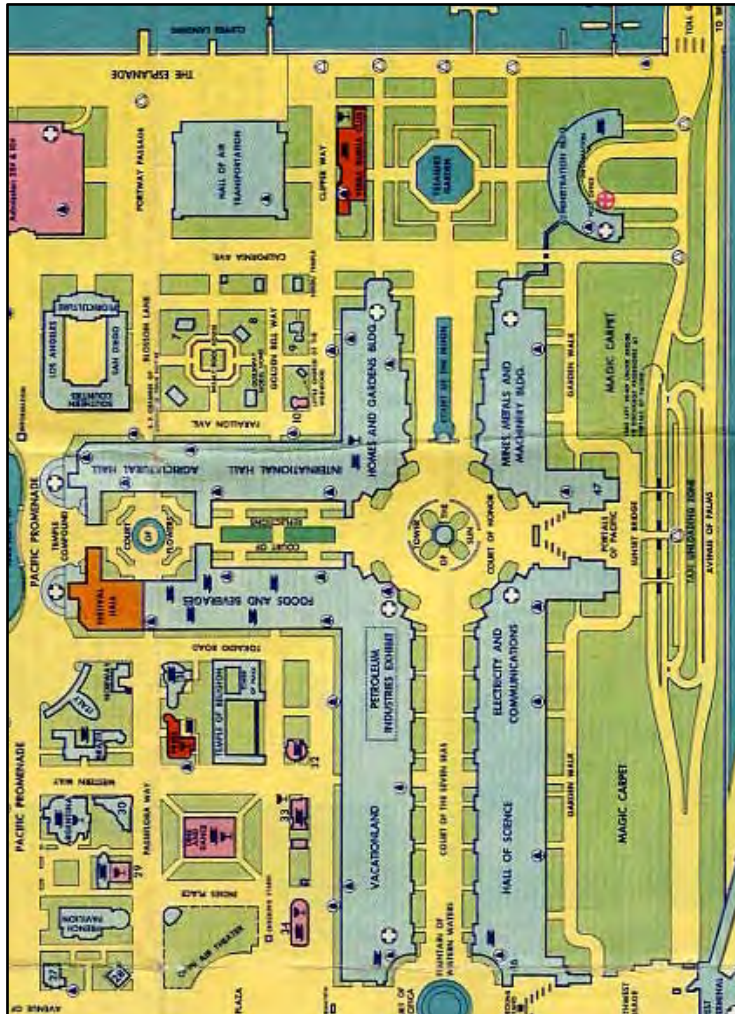


Photo 10 Map showing halls of GGIE



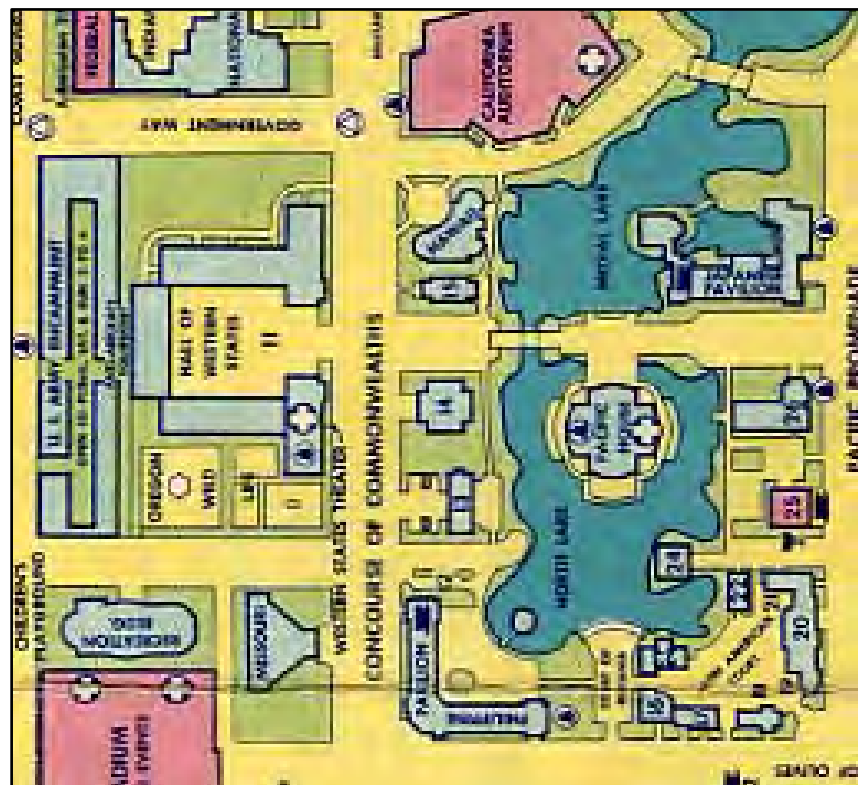
Photo 11 1943 photo of AOI 3



#### 2.2.4 AOI 4: Southwestern Community Area

AOI 4 consists of an area generally associated with community functions during former Navy operations. This area is bounded by 9th Street on the north, by San Francisco Bay on the east, on the south by 5th Street, and by H Avenue on the west. The HRA concluded that in AOI 4, there were two radiologically impacted sites, Buildings 343 and 344. This HRA<sup>STM</sup> finds that Building 342 in AOI 4 and a former salvage yard known as “Lot 69” should also be considered radiologically impacted.

AOI 4 is shown on [Figure 6](#). Immediately after the GGIE, the Lake of the Nations and all GGIE structures in this AOI were demolished, except the former Hall of Western States and U.S. Army Encampment facilities ([Photos 12 and 13](#)). During Navy operations, the area was historically composed of community related functions such as barracks, classrooms, athletic fields, tennis courts, a Navy Exchange, gymnasium, theatre, library, laundry, Enlisted Men's club, Chief Petty Officer club and a heating plant. A large supply warehouse, Building 260, dominated the site ([Figure 6](#)).



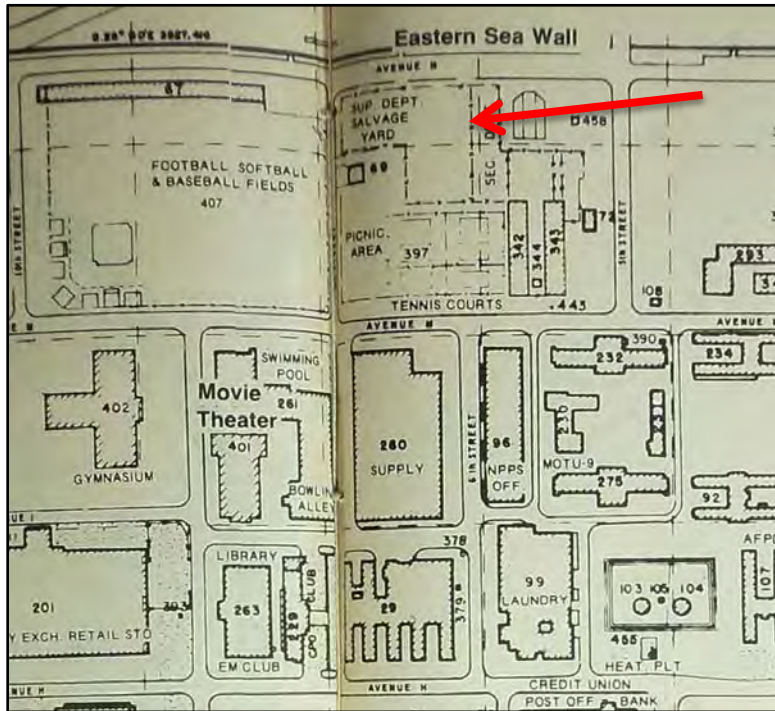
**Photo 12 Vicinity of AOI 4 during the GGIE**





**Photo 13 1942 photograph of AOI 4**

After WWII in 1948 and 1949, the former GGIE Hall of Western States and Army encampment were demolished and a picnic area and tennis courts were constructed in the footprint ([Figure 6](#)). Based on reviewed base maps, sometime between 1962 and 1968, a Supply Department salvage yard was established east of the tennis courts (see [Photo 14](#) and [Figure 6](#)). By 1996, this salvage yard area was referred to as Lot 69 and was listed as a Hazardous Waste Accumulation Area in the Spill Prevention Control and Countermeasures Plan. The northern, larger part of Lot 69 was the nonhazardous storage or staging area for furniture and non-hazardous tools waiting to be disposed of by the Defense Reutilization and Marketing Office (DRMO). South of the lot is a transfer station for solid waste. A general inventory of waste stored in the hazardous waste accumulation area consisted of waste oils, flammables, corrosives, and other regulated materials such as rags, latex paints, and empty paint and flammables containers. Because this area was used as a salvage yard and based on the lack of any other radiological information associated with this site, this HRASTM identifies this salvage yard (Lot 69) as impacted because salvage yards are often linked with the potential for disposal of unregulated LLROs.

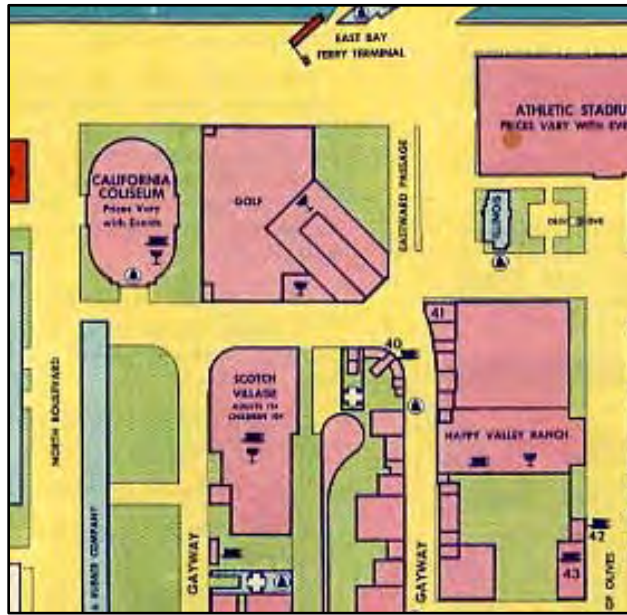


**Photo 14 1969 base map showing the Supply Department Salvage Yard**

This HRASTM identifies Building 342 and surrounding area (Figure 6) as impacted based on new information indicating that prior use of the building was as a radiological counting room. The counting room would have been used to process samples that may have been handled without encapsulation and warrants designating the building as radiologically impacted. Buildings 343 and 344 were identified as impacted in the HRA. An FSS was recommended for the storeroom in Building 343 and for Building 344. These FSS reports were completed in 2008 (Tetra Tech EC, Inc. 2008a, 2008b). The California Environmental Protection Agency's Department of Toxic Substances Control (DTSC) concurred with the unrestricted release of Buildings 343 and 344 on January 16, 2009, and the CDPH concurred with unrestricted use on November 12, 2008 (DTSC 2009). Based on the FSS reports for Buildings 343 and 344 and DTSC acceptance of unrestricted release of these buildings, no further action is required for these buildings at the time of this HRASTM. The radioactive materials license for the Buildings 342, 343, and 344 compound indicates that the paved area to the rear of the buildings was used for outdoor monitoring exercises with sealed sources. This area has been designated as impacted to allow for the possibility of outside spills or leaks.

## 2.2.5 AOI 5: Northeastern Community Area

AOI 5 consists of the area referred to as the "Northeastern Community Area" during Navy operations. This AOI is bounded by 13th Street on the north, by San Francisco Bay on the east, 9th Street on the south, and about a block west of H Avenue on the west (Figure 7). The HRA concluded that there were no impacted sites in AOI 5, and the findings of this HRASTM for AOI 5 are consistent with those of the HRA, except Building 570 and an associated outdoor storage area outside the building.



**Photo 15 Map of AOI 5 area during the GGIE**

After the GGIE, all the facilities shown in [Photo 15](#) were demolished and two parallel runways were constructed (see 1942 aerial photograph on [Figure 7](#)). Improvements consisting of a ball field, and related structures were completed so the entire site was developed with facilities by the end of the war (see 1947 aerial photograph on [Figure 7](#)). Based on a review of aerial photographs and the 1969 base map, the majority of the wartime structures remained in place in this AOI until the early 1970s when the old barracks began to be dismantled. A firefighting training school was constructed in the southeastern quadrant of this AOI in the late 1980s. File and aerial photograph reviews have not revealed the likelihood of any operations that would cause the area to be designated as impacted, except the Building 570 area discussed below.



**Photo 16 Portable gamma spectrometers in Building 570**

Building 570 and the surrounding fenced yard was designated as impacted in this HRASTM as a result of the handling and storage of radiologically contaminated items and soil samples (collected from other impacted TI sites) in the building and fenced yard area. Previous and current radiological subcontractors (such as New World Technology, Shaw Environmental, Inc. [now Chicago Bridge & Iron], Gilbane, and Environmental Management System) have used or currently use this area. Use of the area included handling samples from radiologically controlled areas (RCA) and the use of gamma spectrometers in Building 570 ([Photo 16](#) above). These spectrometers were used for quick-turnaround laboratory analysis of soil samples and LLROs found in the SWDAs. The LLROs and soil samples were stored in conex boxes (storage or shipping container) in the fenced compound surrounding Building 570. The use of this area to store radiological materials continues in association with the non-time-critical removal action (NTCRA) in the Site 12 SWDAs.

### 2.2.6 AOI 6: Sewage Treatment Area

AOI 6 consists of the area referred to as the “Sewage Treatment Area.” This area is bounded by San Francisco Bay to the north and east 13th Street on the south, and Avenue I (inclusive of Building 292) to the west ([Figure 8](#)). The HRA concluded that there were no impacted sites in AOI 6. The findings of this HRASTM differ from the HRA for AOI 6 by identifying four separate and contiguous areas as radiologically impacted. These four areas are discussed further below and include:

- The former USS *Pandemonium* Site II (NE),
- A potential salvage yard where metal recycling was done during WWII,
- An area referred to as the Site 6 RCA where radioactive materials associated with radiological remedial activities at Site 12 were handled and stored, and
- The area surrounding and including Building 461 that was constructed as part of a new damage control school complex in the late 1960s.

AOI 6 is shown on [Figure 8](#) and [Photo 17](#). The GGIE structures shown on [Photo 17](#) were demolished immediately after the GGIE, except for the warehouse (Building 62) shown in the upper right side of the photo, which is still there. As discussed in the HRA, the USS *Pandemonium* Site II (NE) was in AOI 6 after the USS *Pandemonium* was moved there in 1969 from the west side of the island (USS *Pandemonium* Site I, AOI 8). The HRA concluded that Site II (NE) was not impacted because:

*“Sealed Cs-137 sources were used for fallout simulation. Leak tests of the Cs-137 sources confirmed there was no leakage. The short-lived liquid isotopes decayed away within three months of last use (1969). There were no reports of instrument check source leakage.”*

Although no new information regarding this USS *Pandemonium* Site II (NE) location was found, the HRASTM more conservatively identifies this location to be impacted because of the



potential for contamination to have been spread there or in the surrounding area from the known use of instrument check sources consisting of bagged radium gauges. The use of these gauges was documented in the HRA (HRA reference TI-HRA-57). After the HRA, and unrelated to the USS *Pandemonium* Site II, a removal action was completed in 2009 at Site 32 that included the footprint of the USS *Pandemonium* Site II. This removal was done to address contaminants of concern that included polychlorinated biphenyls (PCB), dioxins, pesticides, total petroleum hydrocarbons, and metals. Much of the soil surrounding the USS *Pandemonium* Site II (NE) was removed during the removal action, including the foundation for the ship, to depths ranging from 2 to 12 feet below ground surface (Shaw 2011a). Radiological sampling was not part of this action, although some screening occurred when excavated soil was delivered to landfills. Landfills typically screen incoming truckloads of soil for radioactivity with sensitive portal monitors and will refuse loads if the delivery causes the portal monitor to sound an alarm. There are no reports that radiological portal monitors had sounded an alarm when the landfills accepted the waste from the removal action at Site 32. The HRASTM identifies the area generally bounded by Site 32 to be impacted, including the holding tanks that remain on site and were associated with the USS *Pandemonium* Site II (NE) operations, and a former office/training buildings (Buildings 461 and 462).

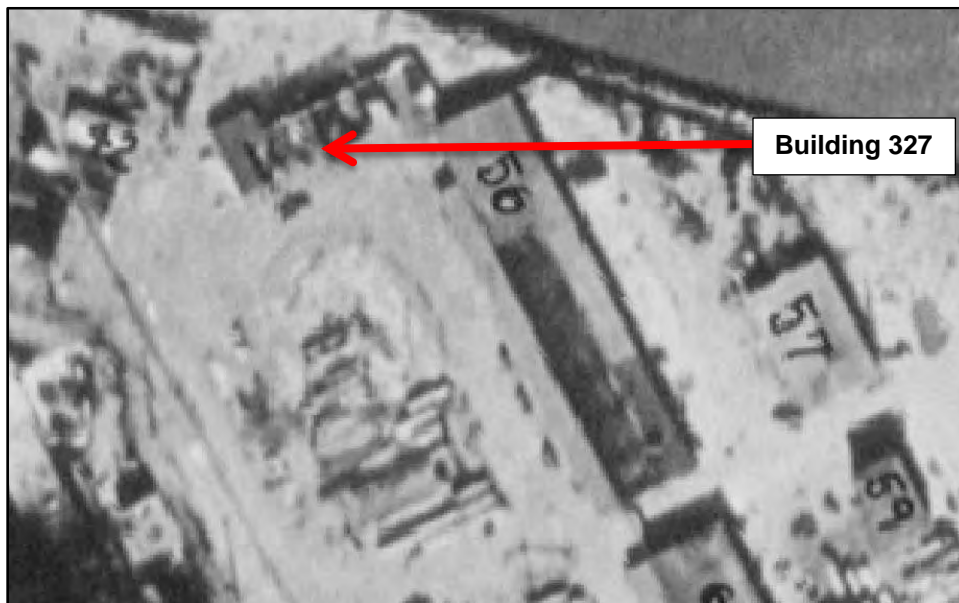


**Photo 17 Vicinity of AOI 6 during the GGIE**

As noted in [Section 2.2](#), ship repair was ongoing throughout WWII. Those activities generated significant amounts of scrap metal, as evidenced by a *Masthead* article that referred to the amount of scrap metal from repair as 200,000 pounds per month (Navy 1945a). This same article contained a photograph ([Photo 18](#)) showing in-progress salvage operations for scrap metal. Salvage yards are typically a concern at ship repair facilities, as there is a potential for impacted sites from processing waste that contains unregulated radioisotopes such as Ra-226. While it is not clear exactly where the salvage area was, it is likely that the area would have been in the open area just south of Building 327 that was identified as a "Salvage Building" in the HRA. [Photo 19](#) is a 1945 aerial photograph of this area and suggests that the area south of Building 327 is likely the pictured salvage yard based on the presence of the buildings in the background of [Photo 18](#). Therefore, this area has been designated as impacted in this HRASTM. As shown on [Figure 8](#), Building 327 was demolished in the 1960s and the impacted salvage yard area is now in the footprint of the sewage treatment plant that was constructed in 1961.



**Photo 18 Masthead photo showing welders cutting up scrap metal for salvage**



**Photo 19 Building 327 and probable salvage yard directly to the south**

The third area in AOI 6 to be designated as impacted in this HRASTM is Site 6, an area used for stockpiling, truck loading, and truck decontamination operations in association with previous trenching and removal actions in Site 12 (Figure 8). Based on a review of the work plans for the exploratory trenching and removal actions at Site 12, records indicate that the use of this impacted area for processing soil from the SWDAs began in 2007, after the HRA was finalized in 2006 (Shaw 2012b). Based on the work plans, the soil removed and investigation-derived waste (IDW) from prior trenching actions and removal actions in Site 12 were transported to Site 6 (IT Corporation 2001). During these operations, some potentially radiologically contaminated soil was reportedly transported from SWDA Westside (formerly named A&B) in Site 12 to the Site 6 area in an end loader bucket and in a manner that was not in conformance with established procedures. In response to this incident, the transportation routes were subjected to gamma walkover surveys (CDPH 2011a). Additionally, bins containing radioactively contaminated soil that were filled in Site 12 were emptied at Site 6 and resurveyed (Shaw 2013a, 2013b). This was due to elevated readings on the exterior of the bins which prevented their transport over public roads. Scanning of the material yielded numerous LLROs. Site 6 has since been treated as an RCA by the Navy and its contractors and is considered operationally impacted. Site 6 will be subjected to an FSS following its use as a low-level radiological waste storage area, which is being relocated north of the site. Part of the site is also associated with the historical recycling area to the east.

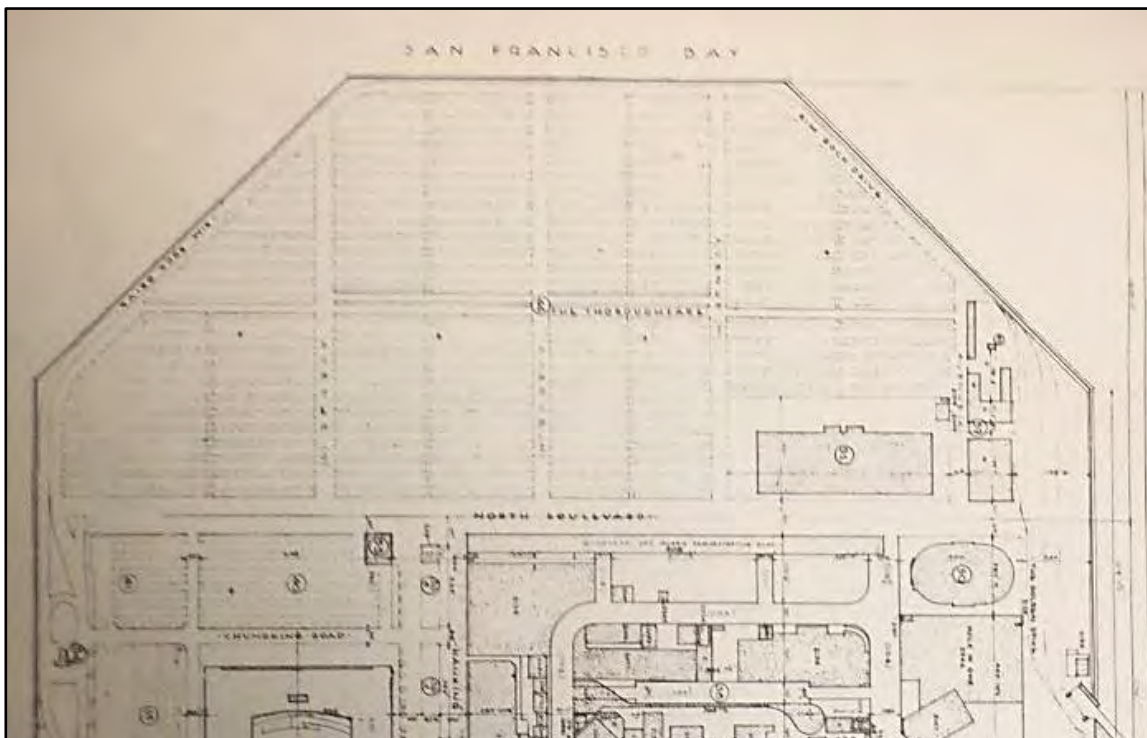
The fourth area in AOI 6 to be designated as impacted is Building 461 and the surrounding area that was constructed as part of a new damage control school complex in the late 1960s. This area was designated as radiologically impacted to account for the possibility that radioactive materials associated with the former USS *Pandemonium* training complex may have been used in or around the building.

### **2.2.7 AOI 7: Northern Housing Area of Interest**

AOI 7 consists of an area referred to as the “Northern Housing Area of Interest.” This area is bounded by 13<sup>th</sup> Street and a former runway on the south, by San Francisco Bay to the west and north, and by Avenue I to the east (Figure 9), and the area is wholly contained in Site 12. The HRA concluded that the SWDA areas within AOI 7 were radiologically impacted. The findings of this HRASTM differ from the HRA for AOI 7 by identifying the entire housing area (exclusive of the housing structures and the school complex along 12<sup>th</sup> Street) as radiologically impacted. In addition, this HRASTM provides additional detail regarding AOI 7, including the presence of additional rubbish disposal areas, a salvage yard, and a burn area, and details regarding grading and construction activities in AOI 7.

During the GGIE in 1939 and 1940, the area that now encompasses AOI 7 was unpaved and used for vehicle parking (Photo 20). The Navy constructed ammunition bunkers along the northern portion of AOI 7 after the Navy took over the lease of NAVSTA TI, as seen on the aerial photographs shown on Figure 9. The bunker complex was expanded further throughout the war, and in late 1944 a magazine was established on TI for servicing destroyers and smaller craft. This magazine continued in use until June 1946, when the function was turned over to facilities at Mare Island Naval Shipyard and Port Chicago, Concord Naval Weapons Station (Navy 1946b). It is unclear if the ammunition bunkers were used for ammunition storage after

June 1, 1946, but presumably at least some bunkers continued to be used to store blank rounds and other ordnance required for NAVSTA TI operations after WWII.



**Photo 20 Map of the GGIE showing the parking areas on the north end of TI**

In addition to the ammunition bunkers, the other important features in this area of Site 12 include a large recreation field along the southern boundary of AOI 7 (24 March 1947 aerial photograph ([Figure 9](#)), an incinerator ([Photo 26](#)), a historical burn area ([Figure 9](#)), portions of a former salvage yard area currently referred to as SWDA Bigelow Court, two former rubbish disposal areas, and SWDAs that were discussed in the HRA.

The CSM for the housing area provides that grading associated with construction of the housing disturbed and redistributed LLROs or contamination from the SWDAs to areas outside of the SWDAs and throughout the housing area. Housing structures themselves have not been impacted because movement of the LLROs would not have affected the structures themselves. Historical soil movement within the housing area was reviewed as part of this HRASTM. As seen on [Figures 9 and 10](#), the housing area was built in phases over time. The 1100 series housing area was constructed in 1965; the 1200 series housing area was constructed in 1972; the 1300 series housing area was constructed in 1974 and 1975; and the 1400 series housing area was constructed in 1988 (see timeline in [Section 2.2](#)). In particular, soil movement and grading associated with construction of the housing areas was reviewed. This review was conducted to better identify the process that may have distributed the LLROs from the SWDAs to areas outside of those SWDAs (Navy 1965).



The grading plans for the 1100 series and 1200 series housing areas that were constructed first in 1965 identify five features of interest: areas where rubbish disposal took place, areas covered by existing structures, areas covered by pavement, open areas, and areas outside of the fenced boundary lines of the housing project areas. A Navy record drawing provides grading instructions for the 1100 series (Building numbers 1101 through 1149, as shown on [Figure 9](#)) (Navy 1965) and a soil investigation provides recommendations for the 1200 series (Building numbers 1201 through 1254, as shown on [Figure 9](#)) (McCreary Koretsky Engineers 1965). The grading instructions for both the 1100 and 1200 series housing are the same and provided the following requirements that could have resulted in excavation of LLROs from the SWDAs or rubbish disposal areas and thus depositing them elsewhere within the footprint of the housing areas:

- **Areas where rubbish disposal took place:** This category includes the SWDAs along the perimeter of the island and two non-contiguous areas located within AOI 7, as shown on [Figure 9](#). According to the construction plans, these areas were to be excavated to an elevation not higher than +2 feet above sea level. The grade exposed by the excavation was then compacted by equipment, the rubbish thoroughly mixed with clean sand from adjacent excavations, after which it was to be replaced in the excavation by tamping with heavy equipment, and crushing to eliminate voids. Large pieces of debris that would not reduce to a small size by the weight of the equipment were to be removed. Rubbish was not to be placed within 2 feet of the base of foundations, and clean sand or earth from the bunker demolitions, was to be placed over the reworked fill and compacted. This process would have likely displaced some rubbish outside of the defined rubbish areas during the process of excavation, mixing, compaction, and refilling to grade. It is assumed that excavated materials would have been stockpiled within the project boundary shown in [Photo 21](#) for the 1100 series housing; and [Photos 22 and 23](#) for the 1200 series housing. These grading activities had the potential to distribute rubbish from the rubbish disposal areas anywhere within the combined project areas and contractors work and storage areas. In addition, recent work has found isolated cases where rubbish remains within 2 feet of the base of the foundations, despite the grading plan requirements.

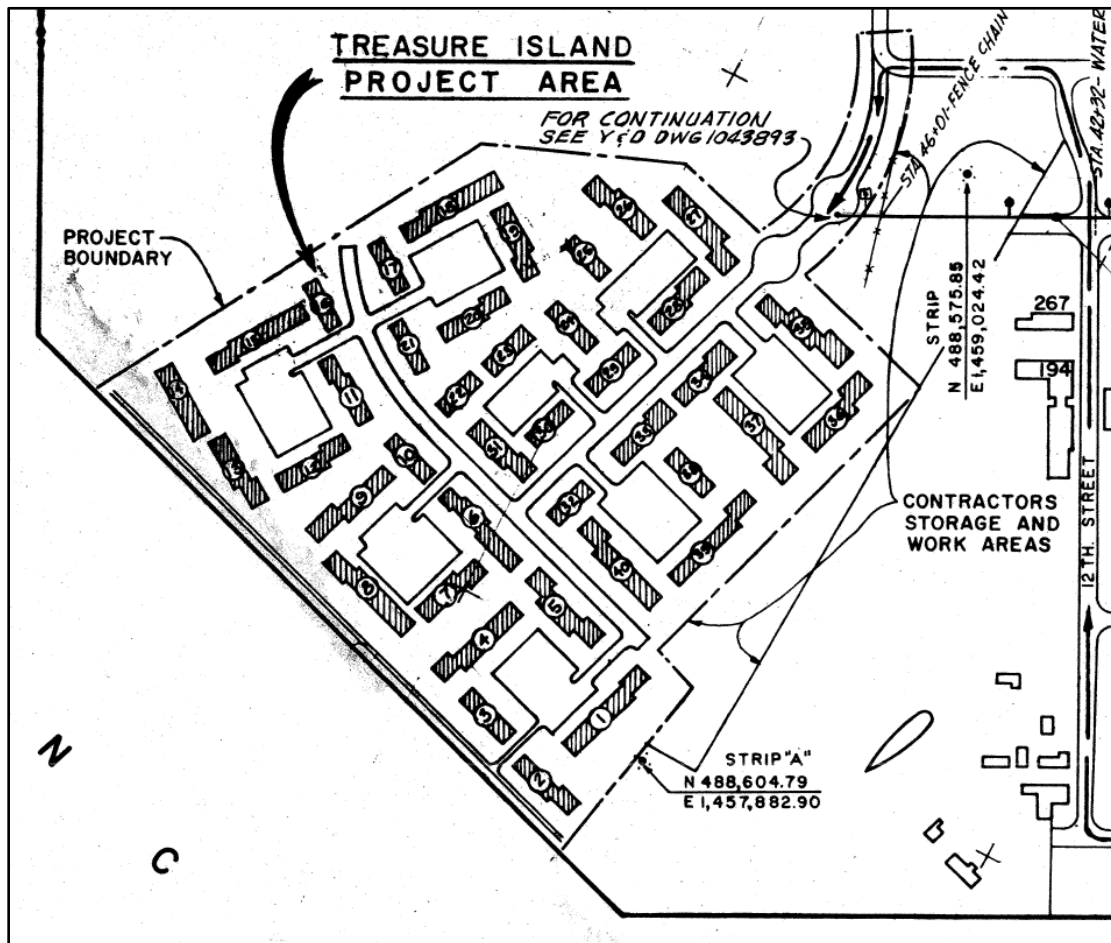


Photo 21 1100 Series housing project boundary and contractors storage and work areas (Navy 1965)

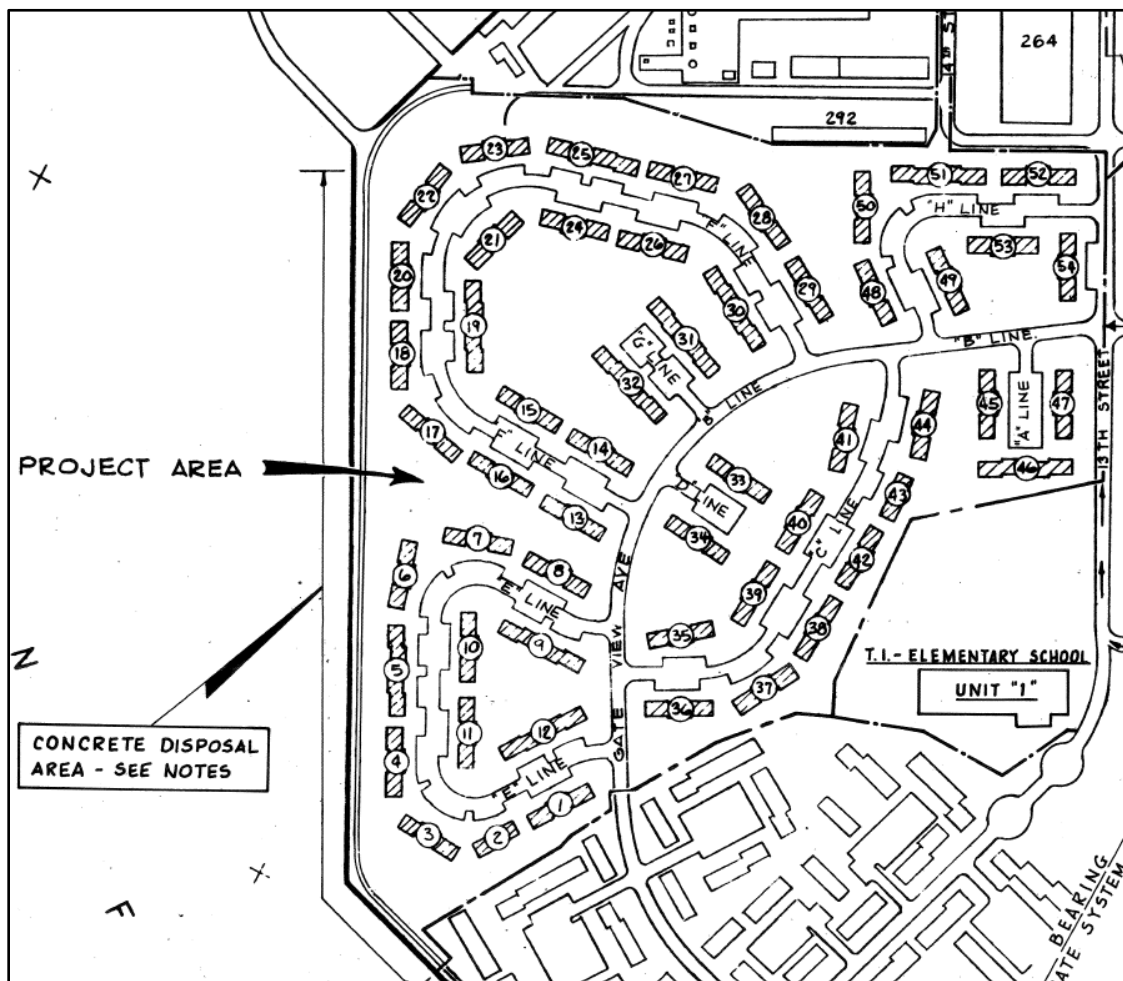
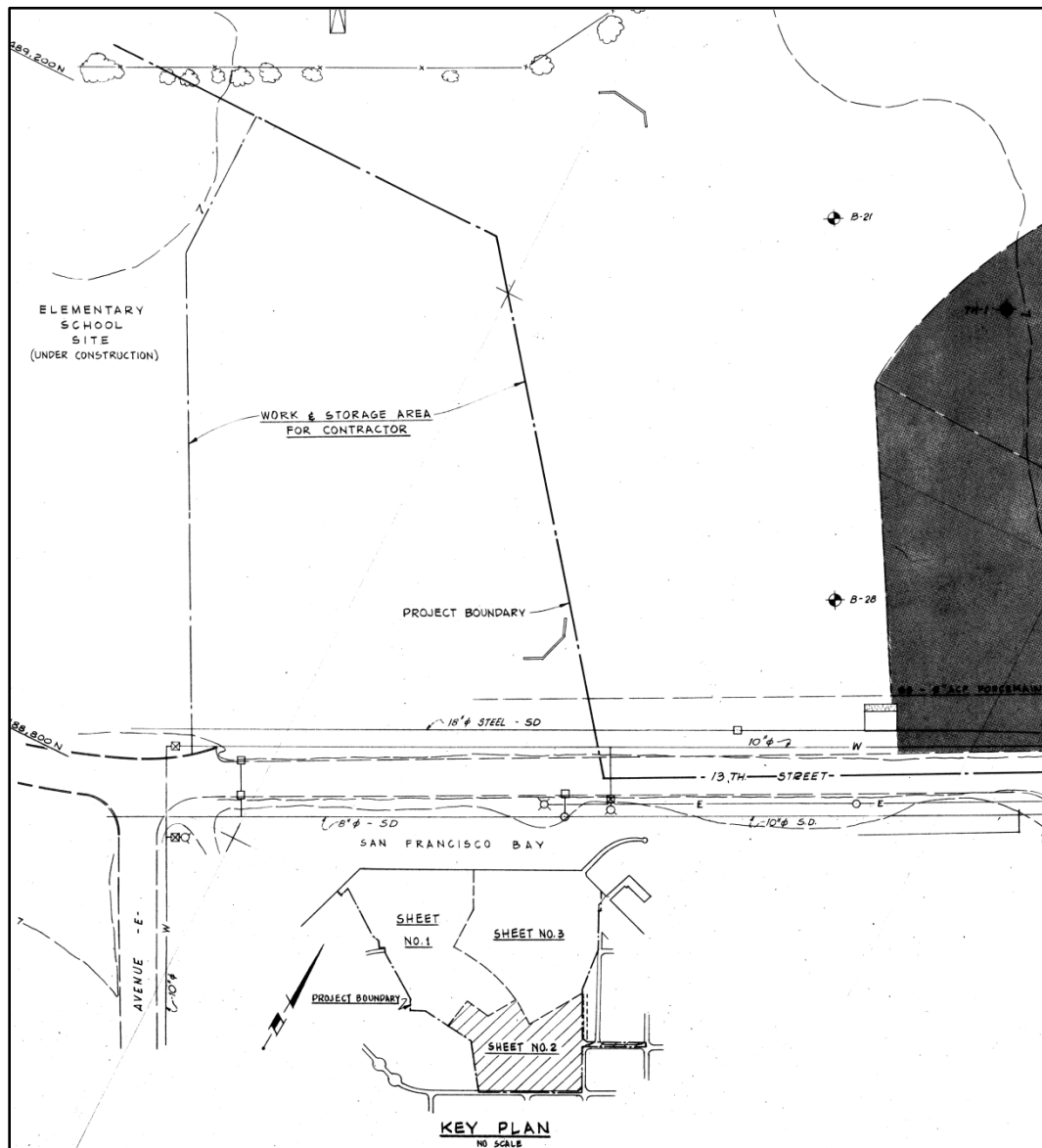


Photo 22 1200 Series housing project boundary (Navy 1968)



**Photo 23 1200 Series housing contractors storage and work areas (Navy 1968)**

- Areas covered by existing structures:** This category refers to the ammunition bunkers formerly located in AOI 7. There were two sets of bunkers on the property: small bunkers built immediately after the Navy acquired the property in early 1942 (Photo 24), and larger pile-supported bunkers built in 1944 (Photo 25). The concrete portion of the bunkers was to be either removed from the site, broken into pieces not exceeding a 1 foot maximum dimension, and placed in reworked fills at a depth not less than 2 feet below the base of foundations; or broken into pieces smaller than a cubic yard and deposited along the seawall adjacent to the 1200 series housing (Navy 1968). Earth materials obtained from bunker demolition were allowed to be placed in fills (Navy 1965). Because the larger bunkers were supported by piles, the plans called for digging down at least 6 feet around the bunkers and breaking or cutting off the pilings. These excavations within the rubbish disposal areas had the potential to bring rubbish to the surface.



**Photo 24 1942 Aerial photograph showing smaller ammunition storage bunkers  
on the north end of the Island**

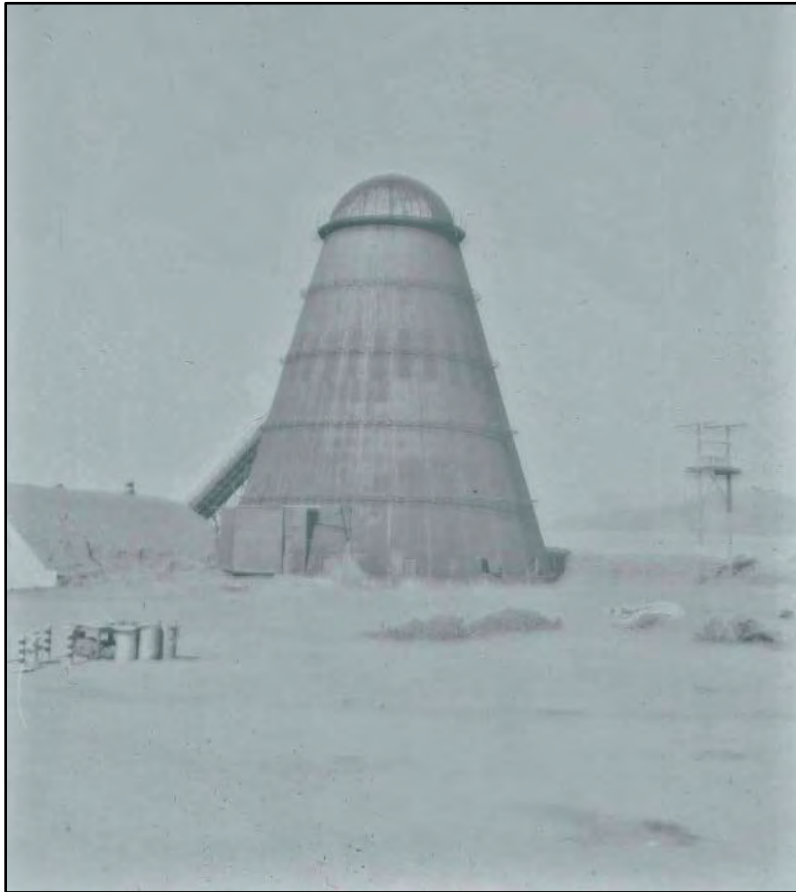


**Photo 25 1942 Aerial photograph showing larger ammunition storage bunkers on the north end of the island**

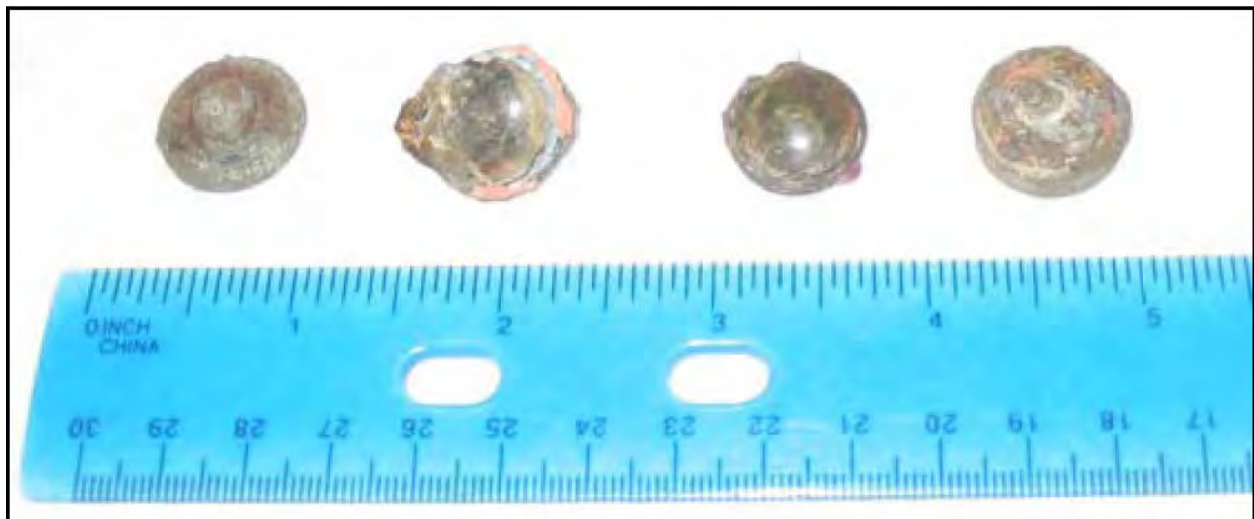
- **Areas covered by pavement and open areas:** These areas were addressed in the same manner as “Areas where rubbish disposal took place” discussed above (be excavated to an elevation not higher than +2 feet above sea level. The grade exposed by the excavation was then compacted by passage of equipment...).
- **Areas outside of the fenced boundary lines of the housing project area:** A former elementary school is located in the south-central portion of AOI 7. The school consists of an open area and Buildings 33-E, 33-F, 33-G, and 33-H. This area has not been impacted because it has functioned as a playing field since the early 1940s. Aerial photographs show that it remained undisturbed after construction of the 1100 series housing part because the project boundary between the 1100 series housing and the current school site was fenced and prevented housing grading from disturbing the future school site. After construction of the 1100 series housing, Buildings 33-E and 33-F of the elementary school were constructed and then the 1200 series housing was built along the northern and eastern boundaries of the school site. Once again, fenced boundaries prevented grading from adjacent housing site from impacting the school site south of the 1200 series housing.



A large incinerator, identified as Building 345 and shown in [Photo 26](#), was present from approximately 1951 to 1952 (Navy 1952) until October 28, 1959, when it was demolished, according to Navy property records (Navy 1959). The incinerator was located in the same footprint as SWDA North Point (formerly named 1231/1233) and, more specifically, close to the foundation of housing unit 1231. There is no evidence that LLROs may have been disposed of in the incinerator, but disposal of such LLROs in incinerators has been noted at other military sites from the same era. For this reason, research associated with this HRASTM focused on obtaining more information regarding disposal of incinerator ash. No information could be found regarding disposal of the ash, and no evidence was found regarding disposal of the ash on TI. This HRASTM concludes it is likely the incinerator ash was disposed of offsite and it is unlikely that LLROs were disposed of in the incinerator. This conclusion is based on the fact that the quantity of ash created by an incinerator the size of Building 345 and operated for 9 years would have been significant; however, no evidence of significant ash disposal has been found on TI. In addition, if LLROs were disposed of in the incinerator, then the ash would contain radioactivity, and it is reasonable to expect that incidental ash containing radioactive contamination from incinerator operations would have been spilled in the immediate area of the incinerator. That ash would be visible in excavations, would result in an increase in area radiation levels, and LLROs found in the area would show evidence of being charred or burned. However, the opposite was found, supporting the conclusion that radioactive material was unlikely to have been disposed of in the incinerator. Ash has not been found in excavations associated with exploratory trenching conducted in 2003 (with the exception of one notation of burned wood and ash in the excavated spoils from 0 to 2 feet from trench 1229F-1) (Shaw 2004) or during NTCRA trenching conducted in 2007 (Shaw 2012b). In addition, no general increase in background radiation readings was noted in the 2007 NTCRA. Furthermore, the LLROs that were found in the general area of Building 1231 (two LLROs found at a depth of 6 inches to 1 foot below ground surface) showed no evidence of charring, as can be seen in [Photo 27](#) from the post-construction summary report for SWDAs Bayside (formerly named 1207/1209) and North Point (Shaw 2012b).



**Photo 26 Photograph of incinerator**

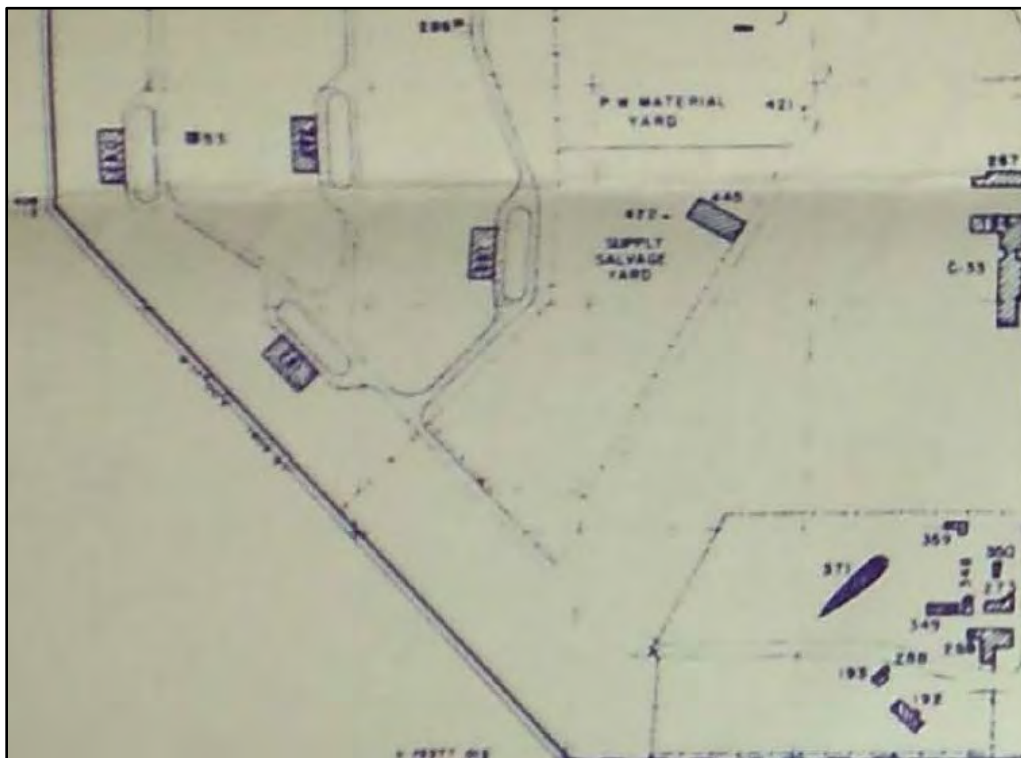


**Photo 27 Low-level radiological objects found at  
SWDAs Bayside and North Point in 2007**

Also within AOI 7 were playing fields and a storage/salvage yard. The playing fields were in the southeastern corner and remained in use until housing was constructed in 1969 (see 1947 and 1968

aerial photographs on [Figure 9](#)), making it unlikely that any disposal activity would have taken place on the playing fields. In 2009, the Navy conducted a gamma walkover survey of the common area in the North Point Drive housing loop (Navy 2009). All gamma readings during the survey were within background levels, except at one location between Buildings 1244 and 1246. A metallic object about 4 inches round and 1.5 inches deep was thought to be a radioactive gauge and was discovered between the housing units, in the footprint of the former ball field. This gauge likely was transported from a SWDA during construction associated with the housing area.

The storage/salvage yard was in the southwestern corner of AOI 7 and remained in use until housing was constructed in 1966 (see 1947 aerial photograph on [Figure 9](#)). The 1947 aerial photo shows this storage/salvage yard being used for storage; a 1962 base map clearly labels it as a “Supply Salvage Yard” ([Photo 28](#)). As discussed in a *Masthead* news article, the salvage yard would “receive large, prefabricated sections of steel decking, gun platforms, etc., from the repair and overhaul work at the Industrial Shops” in addition to other scrap steel (Navy 1945a). Salvage yards are typically a concern at ship repair facilities, as there is potential for impacted sites from processing waste containing unregulated radioisotopes such as Ra-226. No records could be found to suggest this area served as a salvage yard during the period when ship repair was ongoing (WWII). This use is evidenced by the fact that a structure is pictured in the immediate background of the salvage yard during the WWII period ([Photo 18](#)), and there were no such structures in the area of this storage/salvage yard during the WWII period ([Figure 9](#), 1947 photo inset).



**Photo 28 Supply Salvage Yard shown in 1962 base map**

Site 12, named the Old Bunker Area and often referred to as the TI housing area, contained a historical burn area (Figure 9). This historical burn area contained wood burn debris near the surface adjacent to Building 1203 (see the trench log for trench 1203A-1 [Shaw 2004]). Site 12 currently contains two-story residential buildings (about 900 housing units) that were constructed with slab-on-grade foundations, with back yards and four to eight residential units per building (Figure 9). Site 12 is flat, consisting of open grassy areas between buildings, paved roads, and parking areas. In 2002, the site boundary was expanded to include all existing residential areas that are encompassed by AOI 7 and AOI 8. Although all of Site 12 has been designated as impacted and further investigation will be done throughout Site 12, various lines of evidence exist to suggest the movement of LLROs outside of the SWDAs by grading was limited within AOI 7 as follows:

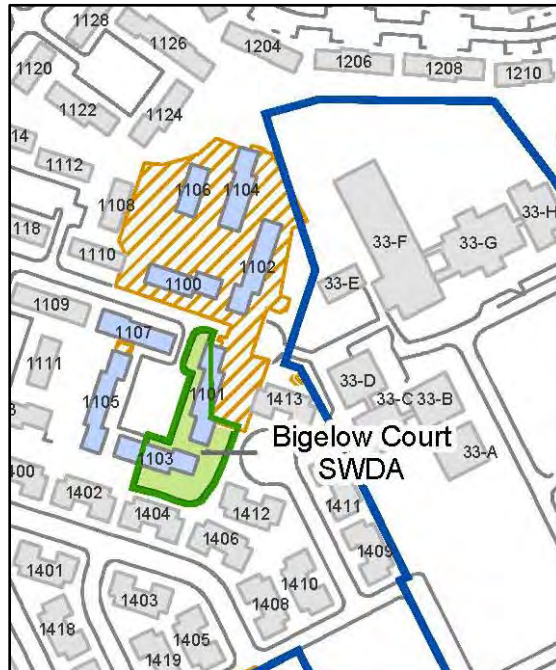
- Only 12 (2 percent) of the 610 recovered LLROs have been found outside of the footprint of the SWDAs.
- The footprint of the former playing fields was developed early in the Navy's occupancy and remained in use until housing was constructed in the 1960s. The continuity and type of use limit the possibility of debris disposal prior to grading associated with construction of housing.
- There is no evidence that the footprint of the former storage/salvage yard in Site 12 was a salvage yard during the WWII period when ships were repaired at NAVSTA TI.
- Site 12 was subjected to extensive trenching operations that included radiological screening in 2003 (Shaw 2004). The screening consisted of monitoring the removed soils with a gamma scintillation detector. Once soils were excavated, all four sidewalls of the trench were also monitored and gamma readings were recorded on the trench log forms (Shaw 2003). No data points related to excavated material have indicated the presence of radioactive contamination that would be considered above ambient or would warrant further characterization or concern for worker protection based on the monitoring and action levels prescribed in project procedures. These gamma readings were intended to monitor the immediate health and safety of Shaw's workers in the field and were essentially qualitative. The scope of the Site 12 investigation did not include radiological concerns with respect to site remediation (which would have required the collection of much higher-quality data and be based on more rigorous assessments of risk) (Shaw 2005). Although these data cannot be used to conclusively eliminate the possibility of radiological contamination or characterize subsurface conditions within Site 12, they provide qualitative information on the absence of radiological contamination or LLROs.



- Based on a 1945 aerial photograph, Site 12 also contains portions of an approximately 175,000-square-foot former storage yard overlapping Halyburton Court and SWDA Bigelow Court (TriEco-Tt 2012) (portions of SWDA Bigelow Court are also found in AOI 8). The identity of specific materials stored at the former storage yard prior to the construction of housing is not known. SWDA Bigelow Court is a debris disposal area planned for a remedial action in 2014. However, the former storage yard differs from the SWDAs because waste was not intentionally disposed of in this area. Results from sampling in 2000 indicated soils in the former storage yard area contained PCBs and polycyclic aromatic hydrocarbons (PAH) at concentrations in excess of the action levels protective of human health. Based on these results, the Navy performed a removal action in the former storage yard area. Excavations were from 2.5 to 4 feet deep in the footprint shown in [Photo 29](#) (purple cross-hatched area). While no screening for radiological material was done, the excavated soil was replaced with clean soil from an off-base source. The excavation was not backfilled completely to the final grade because additional removal is necessary in the area near Building 1100. There will be additional excavation in the SWDA Bigelow Court area, as shown in [Photo 30](#) (green area), because in previous investigations between 1995 and 2003, concentrations of dioxins, lead, and PAHs exceeded their action levels and these chemicals of concern may pose a threat to current and future residents and utility workers. There will be screening for radiological materials during the removal action.



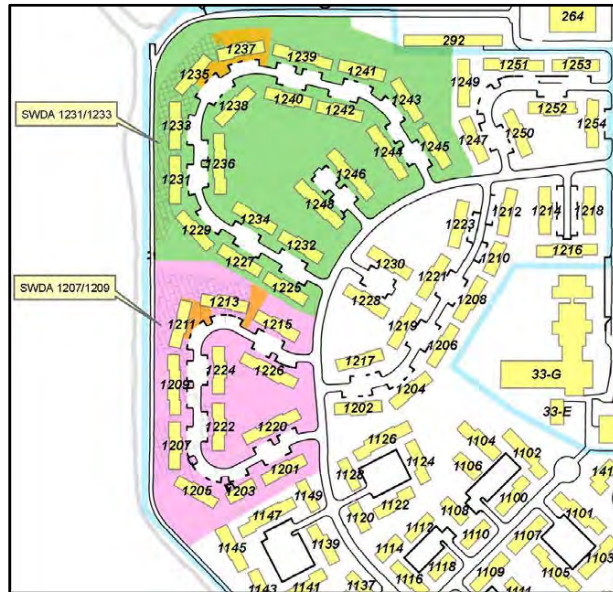
**Photo 29 Showing excavated areas at Halyburton and SWDA Bigelow Courts**



**Photo 30 Showing planned excavation area (green) at SWDA Bigelow Court and adjacent to previous Halyburton Court excavation area (gold)**

- In 2009, the Navy conducted gamma walkover surveys of the North Point and Bayside areas outside of the areas of the SWDAs of Site 12 ([Photo 31](#)). One point source anomaly was discovered during these surveys between housing units 1244 and 1246 that are outside the SWDAs. A gauge was removed from within 1 foot of the ground surface for disposal. No other anomalies were discovered outside the existing SWDAs during those surveys (Navy 2009).



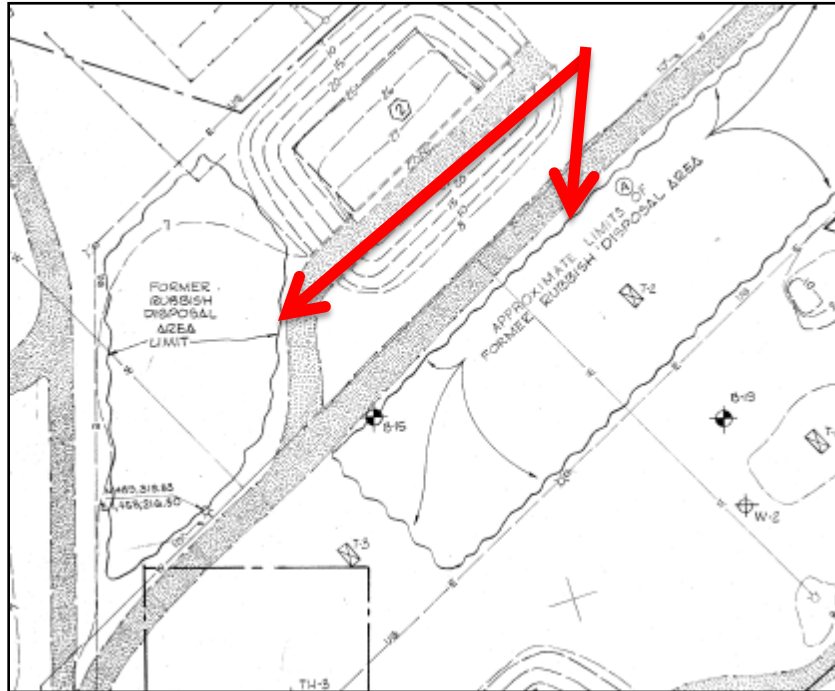


**Photo 31 Showing North Point (green) and Bayside (pink) areas subjected to gamma walkover surveys**

- In 2011, the California Department of Public Health Radiological Health Branch (CDPH RHB) conducted field surveys on April 5 to 7, 2011, outside of the Site 12 RCAs that were established in association with remedial activities at the SWDAs (CDPH 2011a). The CDPH RHB did not identify any anomalies around the SWDAs other than five areas immediately adjacent to the RCA, where dose levels exceeding public exposure standards were identified. The Navy's contractor immediately expanded the fenced area to include the areas of elevated readings in the RCA. The Navy conducted additional investigations between May 30 and June 5, 2013, of the five anomalies identified by the CDPH RHB in April 2011 (Tetra Tech EC, Inc. 2014). During the investigation, a small fragment of a radioactive foil was recovered at one of the five locations and approximately 3 inches below the ground surface; no other LLROs or areas of elevated soil contamination were found. The recovered LLRO was moved to a designated storage container within the Building 570 compound and is pending off-site disposal (Tetra Tech EC 2014).
- In 2013, CDPH RHB conducted field surveys in open areas outside of housing in Site 12 between March 11 and 22 and identified five anomalous locations with readings above background (CDPH 2013). The Navy immediately conducted additional investigation at those five locations on March 20 and 21, 2013. During the investigation, LLROs were recovered at two of the five locations at 6 inches and 10 inches below ground surface. Both LLROs were moved to a designated storage container within the Building 570 compound and are pending off-site disposal (Tetra Tech EC, Inc. 2014). No LLROs or areas of elevated soil contamination were found associated with the other three elevated locations identified by CDPH RHB (Tetra Tech EC, Inc. 2014).

- The Navy is currently conducting a radiological survey of accessible land areas, including private fenced back yards and paved roadways in Site 12 and selected transportation routes in and near Site 12. Excluded from the scope of the survey are the fenced areas containing SWDAs and vertical structures. While these surveys and related analysis are under way, nine discrete locations with elevated readings were further investigated and LLROs were recovered from the housing area.
- The Navy is currently conducting a surface and subsurface sampling program for the 1400 series housing in Site 12 to develop a definitive and comprehensive data set to determine if the site is impacted by historical Navy radiological activities. The 1400 series housing site was divided into 10 survey units (SU) following Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM) guidelines, ranging from 6,381 square meters (m<sup>2</sup>) to 9,325 m<sup>2</sup> of total area. Visual Sample Plan: A Tool for Design and Analysis of Environmental Sampling (VSP), Version 6.5 (Pacific Northwest National Laboratory 2013), was used to develop a sampling plan for the 10 site SUs. A total of 480 samples have been analyzed by gamma spectroscopy. Each Ra-226 result was compared with the project screening criterion of 1.69 picocuries per gram (pCi/g), and none of the results exceeded the screening criterion (report in preparation).

Two new non-contiguous “Rubbish Disposal Areas” were identified during research associated with this HRASTM ([Photo 32](#)). Review of historic exploratory trenches exposed loose rubbish buried approximately 4 feet below grade (McCreary, Koretsky Engineers 1965; Navy 1965). The recommendation of the geotechnical report was to remove the rubbish to an elevation of not higher than  $\pm 2$  feet, project datum, mix the rubbish with clean sand, and compact the mixture by tamping with heavy equipment. Rubbish disposal areas are considered radiologically impacted based on the correlation between rubbish disposal and LLROs found at other such sites on TI.



**Photo 32 Two rubbish disposal areas**  
(Note: The lower rubbish disposal area is only partially shown)

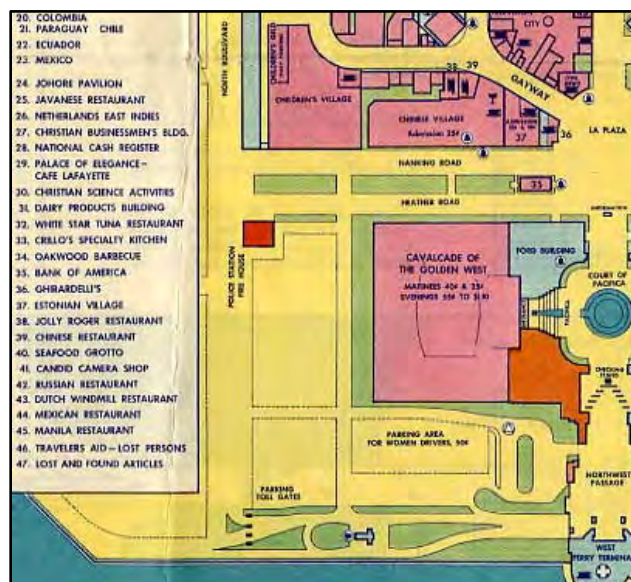
## 2.2.8 AOI 8: Southern Housing Area

AOI 8 consists of an area referred to as the “Southern Housing Area,” bounded by Avenue F to the east, 9<sup>th</sup> Street on the south, and San Francisco Bay to the west (Figure 10). The HRA concluded that the SWDA areas within AOI 8 were radiologically impacted sites. The findings of this HRASTM differ from the HRA for AOI 8 by identifying the entire housing area (exclusive of the footprint surrounding Building 157, a fire station) as radiologically impacted. In addition, this HRASTM provides additional detail regarding AOI 8 including an approximately 175,000-square-foot former storage yard overlapping SWDA Bigelow Court (portions of SWDA Bigelow Court are also located in AOI 7). The HRASTM also designates a former gyro compass repair shop, and a former storage area including Sites 30 and 31 as radiologically impacted. During the GGIE in 1939 and 1940, the northern portion of the area that now encompasses AOI 8 was unpaved and used for vehicle parking, the southern portion of the site was an attraction called the Cavalcade of the Golden West, and the southeastern portion contained part of the amusement park known as the “Gayway” (Photo 33). After the Navy took over the lease of NAVSTA TI, all the GGIE structures in AOI 8 were demolished, except Buildings 155 and 166 (the northernmost buildings of the GGIE exhibit palaces), and a runway was constructed over the northern portion of the site (see 1942 aerial photograph on Figure 10). The AOI was developed or was otherwise in use for laydown areas by the end of the war (see 1947 aerial photograph on Figure 10).

Buildings 156, 224, and 225 were used as gun sheds and a garage. Therefore, it is presumed that the open areas in the southwest quadrant of AOI 8 would have been used for laydown or parking

areas related to these functions during WWII, except the open area around Buildings 269 and 273 that was used for chemical warfare training. The area north of this quadrant and south of the runway appears to have been used for parking. None of these functions or areas was found to have supported activities that would cause them to be designated as radiologically impacted. One open area in the general location of Sites 30 and 31 can be seen on [Figure 10](#) in use as an outdoor storage or laydown area in the 1947 aerial photograph. By 1963, the USS *Pandemonium* Site I (NW) is visible in the aerial photograph, and a number of buildings have been demolished. The 1975 and 2000 aerial photographs show the progression of housing construction on the site. By 2000, all GGIE structures in AOI 8 were demolished and only two WWII era structures remain, Buildings 225 and 257.

This HRASTM considers the former USS *Pandemonium* Site I (NW) as a radiologically impacted area based on a more conservative interpretation of existing information in the 2006 HRA. In addition, this area would also be considered impacted as a result of historical grading activities associated with the housing. Historical aerial photographs show the exhibit structures in AOI 8 were removed after the GGIE ended in 1940. The Navy used the area as a fenced storage area during and after WWII, until it was developed as an elementary school in the 1960s. In April 2002, an as-built drawing from 1989 was discovered indicating that the Navy Public Works Center installed an 8-inch water line down the middle of 11<sup>th</sup> Street. A note on the as-built drawing for the water line project identified an “old trash dump.” Subsequently, a multi-phase investigation and removal action at Site 31 was conducted to delineate the nature and extent of the buried debris. The removal action at Site 31 included monitoring for radiological contamination and a detection of Ra-226 in the sidewall of the excavation was discovered. The detection was the only instance of radiological contamination noted. This HRASTM includes a former storage area around Sites 30 and 31 as a radiologically impacted area.



**Photo 33 AOI 8 during the GGIE**

As discussed in the HRA, the USS *Pandemonium* Site I (NW) was originally in AOI 8, as shown in the 1963 aerial photograph on [Figure 10](#). The training ship mock-up was first put into service

in 1957 and remained in service at this location until July 1969. The gravel-surfaced fenced-off training area was approximately 400 by 600 feet. The area was ultimately regraded and housing was constructed after the USS *Pandemonium* Site I (NW) was relocated in 1969. According to the geotechnical report associated with the housing, it was speculated that the holding tanks used to store contaminated water from training activities were likely "...broken down below grade. While the tank walls have been broken down below grade, it is possible that the base slabs and lower wall portions were left in place and backfilled" (Lowry & Associates 1971).

The radioactive water containing short-lived isotopes was initially allowed to soak into the soil. Later, radioactive water from the decontamination training was collected in the two sub-grade concrete tanks and stored until the short-lived isotopes had decayed. When the radioactivity was within allowable limits, the water was discharged to the San Francisco Bay through a 6-inch pipe. Decontamination training initially used only sealed sources of Cs-137 to simulate radioactive fallout. In 1963, a radioactive material license was granted by the Atomic Energy Commission (AEC) to also use short-lived liquid radioisotopes (bromine [Br]-80, Br-82, sodium [Na]-24, and potassium [K]-42) to more realistically simulate radioactive fallout. Survey instruments containing radioactive check sources were used during the training exercises. The Cs-137 sealed sources were leak tested and were demonstrated to be intact. Because of the short life of the Br-80, Br-82, Na-24, and K-42 isotopes, and because there were periodic leak checks of the Cs-137 sealed sources, this site was designated as non-impacted in the HRA. As noted above, this HRASTM considers the USS *Pandemonium* Site I (NW) area as a radiologically impacted area based on both grading associated with construction of housing and a more conservative estimate that the documented use of unlicensed instrument check sources could have resulted in a spread of contamination. Previous Navy RASO technical assistance visits noted the practice of using non-regulated radium devices as check sources (HRA reference TI-HRA-57), so this HRASTM assumes that such a practice was likely the case at both USS *Pandemonium* Site I (NW) and Site II (NE) locations and may have resulted in a release of radioactive contamination.

At the time of the HRA, no radioactive material had been found in the SWDAs, and the HRA recommended "radiation monitoring during soil excavation of the known solid waste disposal areas." After the 2006 HRA, LLROs were found in each of the SWDAs, with the exception of the SWDA Bigelow Court debris disposal area (which is currently under investigation), confirming the report of radiological disposal at TI. The referenced report is a geotechnical report containing the statement that "discussions with station personnel during our investigation revealed that portions of the proposed construction area have been used for the disposal of debris...and that radioactive and poisonous wastes had been buried west of the abandoned landing strip in a future construction area" (McCreary Koretsky Engineers 1965). No other reports have been found that specifically suggest disposal of radiological waste at Treasure Island. This HRASTM designated the Site 12 housing area (exclusive of the footprint surrounding Building 157, a fire station) as radiologically impacted because, consistent with the CSM, grading associated with construction of housing could have distributed LLROs away from the SWDAs and into the housing areas.

In June 2010, radiological screening was done on a sidewall of an open excavation at Site 31. Elevated count rates were detected (11,000 counts per minute [cpm]) with a contact static



reading of 20,000 cpm. The laboratory background count rate for the detector (Ludlum 44-10) used in the scan survey was 4,517 cpm. After the static reading, approximately 3 inches of soil were removed from the excavation sidewall. A second contact static reading yielded 40,000 cpm. On April 26, 2011, three soil samples were collected near the radiological anomaly at Site 31. Analytical results indicated Ra-226 was present at concentrations exceeding the cleanup goal of background + 1 pCi/g above the mean background concentration in the reference background area; the highest of the three samples collected was 10.8 pCi/g of Ra-226. The remaining excavated material as well as previously stockpiled soil from the excavations was all radiologically scanned. The five gallon bucket of material containing the elevated samples was the only LLRW discovered during the removal actions.

Based on the elevated readings, Site 31 was designated as radiologically impacted; adjacent Site 30 and historical storage yards north and south of Sites 30 and 31 are designated by this HRASTM as radiologically impacted (Shaw 2012a). The entire area is planned for a final status survey.

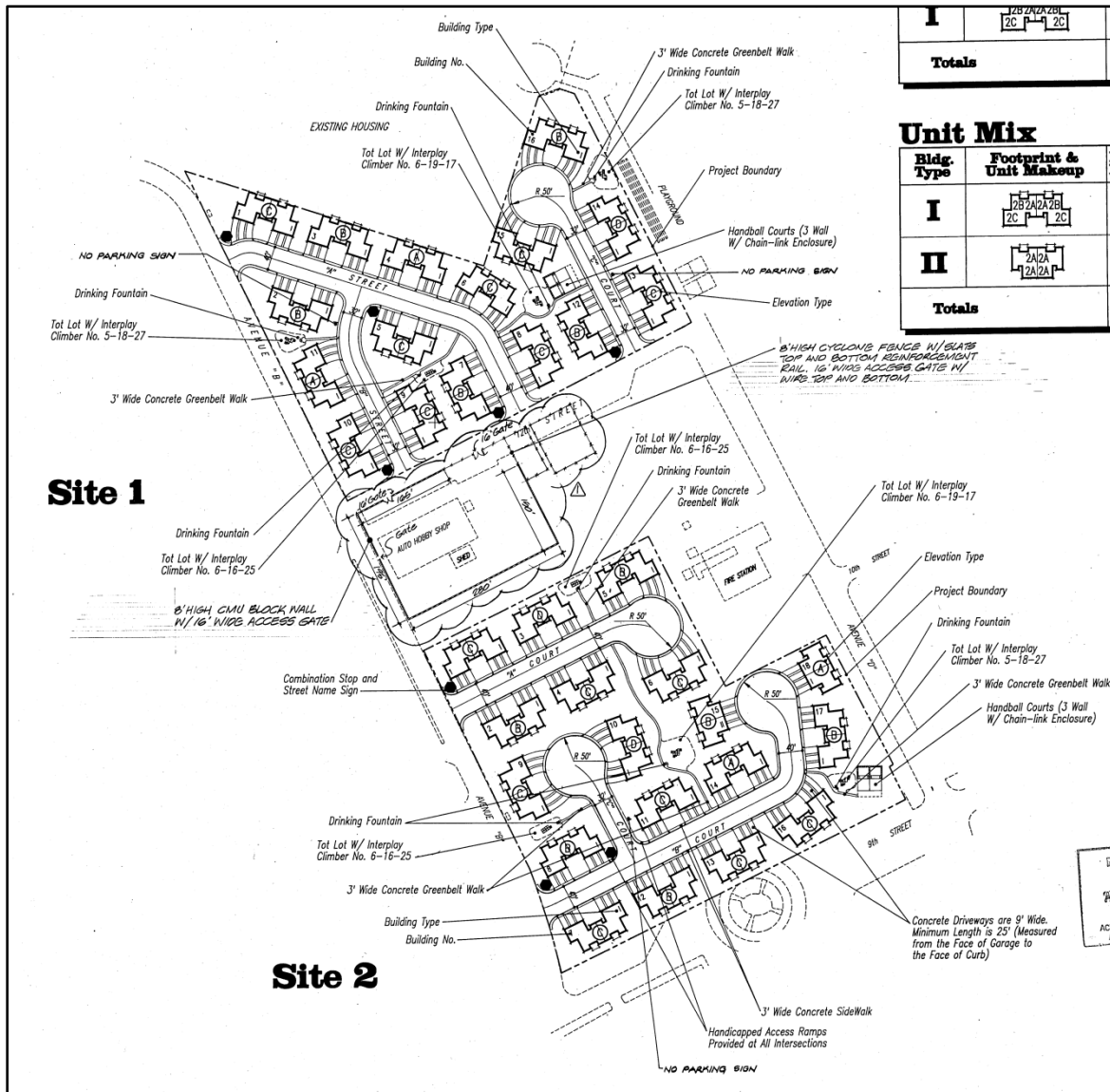
At the time of the GGIE, a portion of the current recreation field area in the southernmost section of AOI 8 contained Building 168 that was exposition Palace G (General Motors Building). With the exception of Building 168, no known activities occurred on the recreation field that would cause it to be designated as radiologically impacted. A Navy sanitary sewer system map from that period indicates that Building 168 was not serviced by the sanitary sewer system (Navy 1944b) and, therefore, no sinks, drains, or toilets are presumed to have existed in the building.

After the GGIE, Buildings 304, 305, 306, and 326 were constructed on the current site of the recreation field. All buildings have since been demolished. Buildings 304 and 305 were restrooms, Building 306 was a supply office and storage area, and Building 326 was a storage building and gun shed (Weston Solutions, Inc. 2006). After the Navy occupied the property in 1941, Building 168 was used as a gyro compass repair shop from 1942 to about 1948 (see [Photo 42](#)). During that time, it is likely that materials painted with radioluminescent paint containing Ra-226 were handled. In 2011, the CDPH RHB collected radiological soil samples and conducted surveys of the current recreation field (CDPH 2012), and as a follow up, the Navy collected soil samples in February 2012 within the recreation field (TestAmerica 2012). Both the CDPH RHB and Navy investigations concluded that additional sampling was warranted based on laboratory analysis indicating elevated levels of Ra-226 and Th-232. Therefore, the area is designated as radiologically impacted as part of the larger housing area as shown on [Figure 10](#).

Although all of Site 12 has been radiologically impacted, the Building 157 area that lies within it has not been impacted. Building 157 is located in AOI 8 and has not been impacted because there is neither any evidence that would indicate it as having been affected by grading associated with the housing nor is there other evidence that radiological materials were used with the footprint of Building 157 area. The following lines of evidence support the conclusion that the Building 157 area was not used for burial of rubbish and not impacted by grading associated with construction of housing in Site 12:



- The Building 157 area did not lay within the project boundaries for construction of housing in Site 12, as shown in [Photos 21, 22, and 34](#) and as shown in the construction as-built drawings (Navy 1965, 1968, 1975, 1988). As a result, it is unlikely that grading activities would have affected Site 20.



- The Building 157 area that occupies a rectangular footprint in the south eastern portion of the housing in AOI 8 was built during WWII and is currently fenced. That same fence line can be seen in Photo 35 just prior to the construction of the 1400 series housing. The fact that the fence line was in place prior to the construction of the housing and that it remains in place today makes it unlikely that grading activities associated with the construction of housing would have impacted the fire station.



**Photo 35 Fenced Compound surrounding Fire Station, Building 157**

### **2.3 HISTORICAL RADIOLOGICAL ASSESSMENT (HRA)**

The Final HRA for NAVSTA TI was published in February 2006 (Weston Solutions Inc. 2006). The HRA provided a comprehensive history of radiological operations by the Navy and its contractors at NAVSTA TI. The HRA was prepared pursuant to the Navy's IRP that encompasses the Navy's BRAC Program, and in accordance with CERCLA and the Superfund Amendments and Reauthorization Act of 1986. The format and content of the HRA followed the guidelines for an HRA established in the Multi-Agency Radiation Survey and Site Investigation Manual (TI-HRA-3).

The primary purpose of the original HRA was to designate sites as radiologically impacted or non-impacted. A radiologically impacted site is one that has, or at one time had, the potential for radioactive contamination, based on historical information, in excess of natural background or fallout levels. In many instances, designation as radiologically impacted does not confirm that radioactive contamination is present, but only that the possibility exists and must be investigated. Sites that were designated as radiologically impacted in the original HRA are shown on [Figure 2](#).

A non-impacted site is one, based on historical documentation or results of previous radiological survey information, where there is no reasonable possibility for residual radioactive contamination. If new historical information becomes available or contamination is found at a non-impacted site, the site would be re-designated as radiologically impacted.

To designate sites as radiologically impacted or non-impacted, the HRA defined the extent of past radiological operations, assessed the likelihood of potential contamination and potential contamination migration pathways, and recommended future actions. Historical radiological operations examined at NAVSTA TI included:

- Training personnel on the calibration, maintenance, and operation of radiation monitoring instruments.
- Training personnel on radiological monitoring, and decontamination of ships and airplanes.
- Berthing of Operation Crossroads ships before the ships were given final radiological clearance or other ships exposed to atomic fallout from subsequent aboveground atomic bomb tests.

Overall, the HRA's review of previous radiological activities, cleanup actions, and release surveys did not identify any imminent threat or substantial risk to human health or the environment of NAVSTA TI or the local community.

### **3.0 PREVIOUS RADIOLOGICAL OPERATIONS**

This section describes the previous use and disposal of materials during radiological operations at NAVSTA TI.

#### **3.1 USE OF RADIOACTIVE MATERIALS**

The island was divided into logical AOIs as shown on [Figure 2](#) to investigate the possibility that debris containing radiological materials (such as radioluminescent devices or contaminated debris) was inadvertently or intentionally disposed of on the upland portion of the TI property. Each of these AOIs was reviewed chronologically by reviewing aerial photographs to determine if there was an opportunity during that time for any debris disposal that could contain radioactive materials. [Figures 3 through 10](#) were developed to show each AOI at different times with respect to development of the area. The results of that aerial photograph review are discussed in [Section 2.0](#).

New information was discovered during research for this HRA<sup>TM</sup> that ship repair took place at NAVSTA TI during the WWII period. In association with ship repair, an optical shop was operated in Building 3. It is likely that unregulated radioactive materials including Ra-226 and thorium (Th)-232 were handled in association with those repair activities. Radiologically contaminated soil and LLROs were discovered to have been disposed of in the SWDAs in Site 12 based on intrusive investigations conducted after the final HRA. In addition, LLROs have been found outside of the SWDAs in various locations within the housing area at Site 12. The locations of LLROs found outside of SWDAs to date are shown on [Figure 11](#).

## **3.2 DISPOSAL PRACTICES FOR RADIOACTIVE MATERIALS**

As documented in the HRA, licensed radioactive materials were properly disposed of at a site off of NAVSTA TI. Based on new information obtained since the final HRA, it is clear that unregulated radioactive material or debris containing unregulated radioactive material was buried in the locations designated as radiologically impacted SWDAs in the HRA. This new information is based on the results of radiological surveys and removal actions in the SWDAs as well as the recommendation in the HRA. Based on elevated gamma scan readings in an excavation at Site 31, the potential exists that unregulated radioactive material or debris containing unregulated radioactive material was disposed of at Site 31, which raises the possibility that additional disposal sites may exist.

## **4.0 RECENT REMEDIATION ACTIVITIES/PRACTICES**

This section addresses work that was done at newly designated radiologically impacted sites and non-impacted sites since the final HRA. Newly identified radiologically impacted sites are discussed in [Section 4.1](#). Sites designated as non-impacted in the HRA are in [Section 4.2](#) and, if appropriate, an updated status is provided. Radiological work done outside the identified radiologically impacted and non-impacted sites is discussed in [Section 4.3](#).

### **4.1 RADIOLOGICALLY IMPACTED SITES**

This section addresses work done at sites designated as radiologically impacted. This section includes sites designated as radiologically impacted at the time of the HRA and sites that were designated as radiologically impacted as part of the HRASTM evaluation. These sites include the former Building 233; Buildings 343 and 344; the entirety of Site 12 and SWDAs Westside, Bayside, and North Point; Building 3 and the associated sanitary sewer system downstream of Building 3; Building 570; former USS *Pandemonium* Sites I and II; a probable former salvage yard site; a waste and clean soil stockpile/loading and decontamination site; a former storage area (Sites 30 and 31); Building 342; a former supply department salvage yard (Lot 69); and Building 461.

#### **4.1.1 Radiologically Impacted Sites Identified in the HRA**

This section addresses work at sites designated as radiologically impacted at the time of the HRA. These sites include the former Building 233, Buildings 343 and 344, and SWDAs Westside, Bayside, and North Point.

##### **4.1.1.1 *Building 233***

Building 233 was the location of the RADIAC Instrument Calibration School. In 1950, a spill of radium sulfate was reported in one of the laboratories in Building 233. Students unknowingly tracked the radiological material throughout the building before the spill was discovered. The NRDL decontaminated and cleaned up the building. Although the floor was decontaminated at the time, the Navy has performed remedial activities and surveys to ensure the 1950 cleanup

meets current standards. Contamination was found throughout the building, which has been demolished and disposed of as LLRW. At the time this report was prepared, the building and foundation have been removed, surface contamination was remediated, and the existing contamination related to storm drains and sewer lines associated with the former building is being characterized. A characterization and FSS work plan will summarize details regarding the site remediation.

A radiological assessment of Building 233 was done and a survey report was issued (Tetra Tech EC, Inc. 2008c). The scoping survey indicated that at least some of the building interior, exterior, and piping was radiologically impacted. It was recommended that the piping be removed and fully surveyed for release during building demolition. A scoping survey of the building completed in September 2007 found contamination under paint in interior areas and areas of elevated readings outside the building. The building was demolished in January 2011 and, at the time of this HRASTM, the Navy is preparing to perform the FSS and complete characterization and remediation of the sanitary and storm sewer systems associated with the building and the surrounding area in accordance with MARSSIM (Revision 1 August 2000).

#### **4.1.1.2      *Buildings 343 and 344***

Building 343 is one of the three buildings that made up the RADIAC school from the 1950s to the 1970s. The closeout survey by the Navy in a storeroom of Building 343 detected two alpha wipe survey points above release limits. Although these survey points were decontaminated, the HRA found that they had not been adequately investigated and recommended an FSS for the building. Building 344 was the location of a 1988 investigation of contamination in a waste container. The radioactive contamination was cleaned up and disposed of at a location off of NAVSTA TI. Surveys demonstrated that the areas were decontaminated to meet the Navy standards at the time. The HRA recommended an FSS for Building 344.

A MARSSIM FSS of Buildings 343 and 344 occurred in September 2007. In 2008, FSS reports were prepared for Buildings 343 and 344 (Tetra Tech EC, Inc. 2008a, 2008b). The survey reports regarding Buildings 343 and 344 indicated that the results for both buildings met the release criteria and the buildings could be released for unrestricted use. DTSC and CDPH concurred that unrestricted release for Buildings 343 and 344 was appropriate (DTSC 2009).

#### **4.1.1.3      *SWDAs Westside, Bayside, and North Point***

An NTCRA began in March 2007 at SWDAs Westside, Bayside, and North Point (Shaw 2007a, 2012b). During the NTCRA, several hundred radiological items ranging in Ra-226 content from 0.4 to 6,400 microcuries ( $\mu\text{Ci}$ ) were found in all of the SWDAs. [Table 1](#) lists all LLROs found in Site 12 to date. All LLROs found have either sent off site or are being held pending disposal off site at a low-level radioactive waste disposal site. LLROs are retained on TI until sufficient quantities have been collected and shipment logistics have been arranged. Additional remediation of SWDAs Bayside and North Point is necessary to support free release of the area. As part of this HRASTM, all of the Site 12 housing area that includes SWDAs Westside, Bayside, and North Point was designated as radiologically impacted (see [Section 4.1.2.10](#)).



## **4.1.2 Radiologically Impacted Sites Identified in this HRASTM**

This section addresses work at sites not designated as radiologically impacted at the time of the HRA, but that were subsequently designated as radiologically impacted in this HRASTM. These sites include Building 3, Building 570, both former USS *Pandemonium* Sites I and II, a probable former salvage yard site, a waste and clean soil stockpile/loading and decontamination site, a former storage area (Sites 30 and 31), the asphalted area outside and east of Building 342, the former supply department salvage yard (Lot 69), Building 461 and the area surrounding, and all of the TI housing area the includes former USS *Pandemonium* Site I (NW), Building 168 (a former gyro compass repair shop), SWDA Bigelow Court debris disposal area, a burn area, and two non-contiguous rubbish disposal areas.

### **4.1.2.1 Building 3**

Building 3 was designated as non-impacted in the HRA, and it was subsequently designated as impacted in this HRASTM. In association with other IRP work, a treatability study was done to evaluate cleanup alternatives for contaminated groundwater at Site 21 and operated between August 2005 and August 2010 (Shaw 2011b). Site 21 was originally a 400- by 75-foot-wide area along the shoreline. The site boundary was expanded to include portions of Building 3 and the open area between the building and the shoreline because a dip tank to clean aircraft parts was reportedly located at the southeastern corner of Building 3. The treatability study report was completed in March 2011. A record of decision (ROD) was completed in February 2013, and groundwater monitoring is ongoing. The Site 21 work is not expected to have affected the radiological status of this building. Building 3 has now been designated as radiologically impacted based on the extensive ship repair efforts that occurred in the building during WWII and the presence of the optical shop on the northeastern corner of the roof. The adjacent Building 111 has not been designated as radiologically impacted, as that building's use was restricted to a fire station and firehouse. Since the designation of Building 3 as radiologically impacted, the Navy has conducted a survey of the building roof where the former optical repair shop was located and surveys of the interior of the sanitary sewer system associated with the prior optical shop. The preliminary results of the roof survey and interior of the sanitary sewer system found no surface radiological contamination (report in preparation).

### **4.1.2.2 Building 570**

Building 570 was not identified in the HRA as a radiologically impacted or non-impacted site. Building 570 has been used as an office trailer and laydown area by Navy contractors (Shaw Environmental Inc., Tetra Tech, Environmental Management Services, New World Technology, and Gilbane) in association with remedial activities on NAVSTA TI, including those at Site 12. Building 570 and the surrounding storage yard is now designated as radiologically impacted as discussed in [Sections 2.2.5 and 5.2.3](#) because removal actions in the Site 12 S WDAs that occurred after the HRA involved LLROs and radiologically contaminated soil. Soil samples were stored and counted in the Building 570 area and LLROs were stored in conex boxes in the smaller fenced yard of Building 570 ([Photo 36](#)).





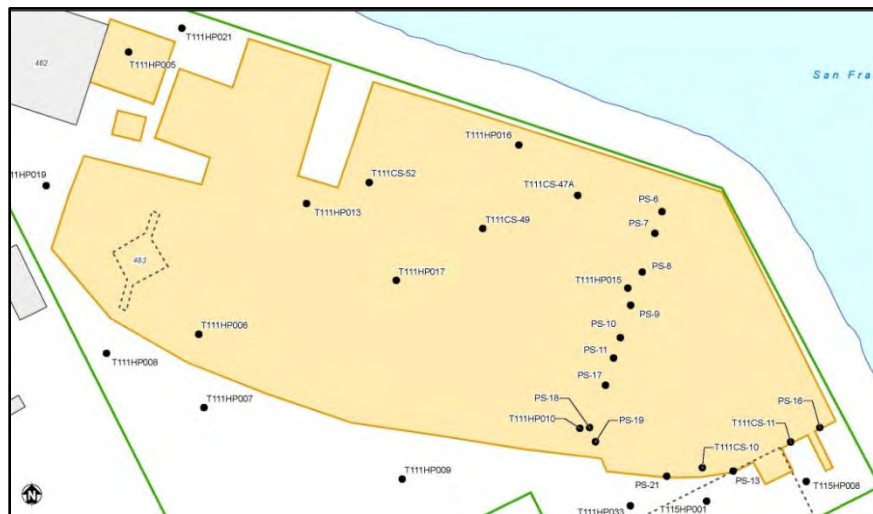
**Photo 36 Conex boxes used for storage of LLROs  
in the Building 570 compound**

#### **4.1.2.3 USS Pandemonium Site II (NE)**

The USS *Pandemonium* Site II (NE) was designated as a non-impacted site in the HRA. No radiological related work has been conducted at the site of the USS *Pandemonium* Site II (NE) (Figure 8) since the HRA. The former training and storage area includes Buildings 461, 462, and 463 (see Figure 8, AOI 6) and is mostly in Site 32. The area has been used as a parking area for vehicles and forklifts, a storage area for hazardous materials and hazardous wastes, a tear gas training area, and as storage for former training facilities. A concrete pad, north of Building 463, formerly held an electrical transformer. The USS *Pandemonium* Site II (NE) is now considered radiologically impacted based on a more conservative estimate of the potential for contamination to have resulted from unlicensed instrument check sources or failure to comply with procedures. The site was also used for radiological decontamination training. The Damage Control School that included a previous site for the USS *Pandemonium* was relocated from the northwestern area (see Section 4.1.2.10.4) to the northeastern area of the base in March 1970. The USS *Pandemonium* Site II (NE) was removed from the training site and sold for scrap metal prior to the HRA.

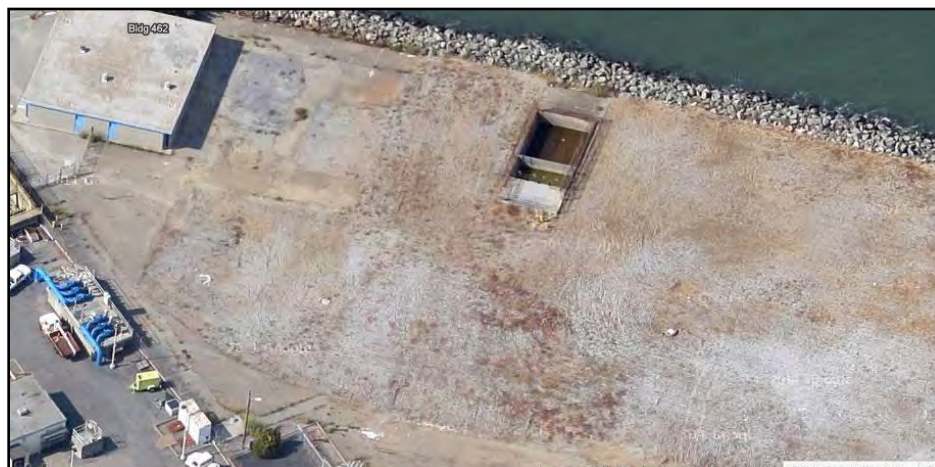
After the 2006 HRA was issued, a remedial investigation report for Site 32 recommended a feasibility study (FS). A PCB remediation that also addressed arsenic under the Toxic Substances Control Act was done at Site 32 in March 2010. During this removal, the bulk of the remaining USS *Pandemonium* (NE) infrastructure was removed and portions of the site were excavated between 2 and 12 feet deep (Photo 37). A pproximately 790 t ons of Class 1 (hazardous) soil was excavated from Site 32 and taken to the Chemical Waste Management, Inc., facility in Kettleman City, California. Approximately 12,700 tons of Class 2 (nonhazardous) soil was excavated from Site 32 and disposed of at the Altamont Landfill in Livermore, California. Concrete and asphalt was broken up and recycled. No liquid waste (wastewater) was generated during field activities; soil excavated from below the water table was dried before it was transported off-site (Shaw 2011a). Radioactive isotopes were not chemicals of concern at the

time of the removal action; however, during excavation work and as a health and safety procedure at that time, the contractor did periodic radiological scans on the hands and feet of personnel and on rubber tires of heavy equipment demobilizing from the site. All scans were done with a Ludlum Model 3 survey meter with a Ludlum 449 or Eberline HP-260 probe. No elevated radiation was detected (Shaw 2011a).



**Photo 37 Site 32 excavation footprint (Tan shaded area)**

The former USS *Pandemonium* (NE) holding tanks and discharge piping are all that remains of the former ship mock-up and associated infrastructure (Photo 38). This site is currently being characterized with a scoping survey consisting of a gamma walkover survey and solid samples from the holding tanks. The preliminary results of the Site 32 asphalt areas and holding tanks found no surface radiological contamination pending the results of holding tank wall samples (concrete) that were collected in areas of elevated alpha counts (report in preparation).



**Photo 38 USS *Pandemonium* Site II holding tanks after interim removal action in 2011**

#### **4.1.2.4 Former Salvage Yard Site**

The Former Salvage Yard was not identified in the HRA as a radiologically impacted or non-impacted site. No radiological related or other IRP work has been conducted at the Former Salvage Yard site (Figure 8) since the HRA. The site is considered radiologically impacted based on the historical propensity for former salvage yards that handled industrial debris to be radiologically contaminated. The former WWII era salvage yard is in the footprint of the current wastewater treatment plant, as shown in Photo 39 and overlaps the open area directly north of the plant (Site 6).



**Photo 39 Current photo of TI waste water treatment plant**

#### **4.1.2.5 Waste and Clean Soil Stockpile/Loading and Decontamination Site**

The Waste and Clean Soil Stockpile/Loading and Decontamination Site was not identified in the HRA as a radiologically impacted or non-impacted site. The Waste and Clean Soil Stockpile/Loading and Decontamination Site was used as a laydown area by a Navy contractor in association with remedial activities on NAVSTA TI, including those at Site 12. This area is also known as the Site 6 RCA. As discussed in Sections 2.2.6 and 5.2.3, after the HRA, removals in the Site 12 SWDAs involved removal of LLROs and radiologically contaminated soil. Both contaminated and clean soil associated with the Site 12 removals were transported to the Waste and Clean Soil Stockpile/Loading and Decontamination Site temporary storage and, in the case of contaminated soil, repacked for shipment. In late 2012 and early 2013, intrusive activities associated with the aboveground storage tank and UST 240 were conducted within the Site 6 area at NAVSTA TI. A corrective action involving an excavation up to 8 feet in depth was

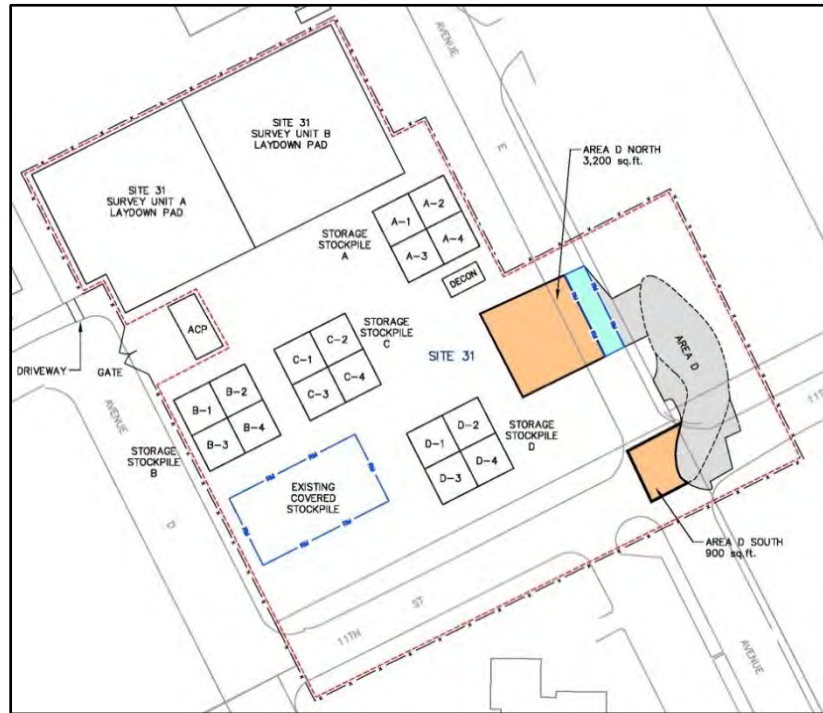


conducted and 800 cubic yards of soil was excavated and screened for radioactivity. This excavation was conducted utilizing radiological controls because Site 6 had been radiologically impacted (Engineering/Remediation Resources Group, Inc. 2013). During the corrective action, no radiation readings were found above background levels or above the specified release criteria for excavated soil.

#### **4.1.2.6      *Former Storage Areas and Sites 30 and 31***

The Former Storage Areas and Sites 30 and 31 were not identified in the HRA as radiologically impacted or non-impacted sites. The Former Storage Area consists of the combined footprints of Sites 30 and 31 ([Figure 10](#)) and areas north and south of the IR sites. No radiological or other intrusive activities related to the IRP have occurred at Site 30 or the areas north and south of the IR sites since the HRA; however, radiological scoping surveys are planned for the former storage areas and Site 30 in 2014. A time-critical removal action was performed at Site 30 in July 2002. The objective was to remove debris-contaminated soil from areas that (1) were not already covered with a substantial pavement barrier, (2) contained concentrations of lead exceeding the residential preliminary remediation goal of 400 milligrams per kilogram, or (3) contained dioxin toxicity equivalence concentrations exceeding the guideline of DTSC's School Property Evaluation and Cleanup Division of 19.5 nanograms per kilogram. A total of approximately 200 cubic yards of soil was removed from Site 30 during this removal action.

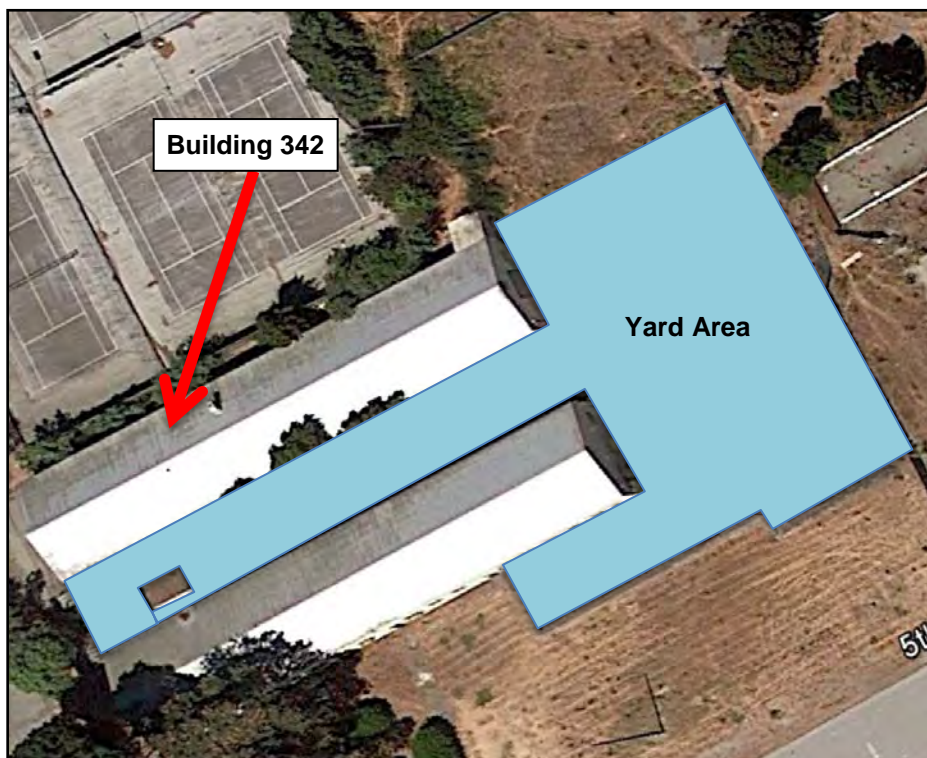
The FS report for Site 31 was finalized in March 2007. The proposed plan/draft remedial action plan was finalized on September 18, 2008, and the public meeting was held on October 7, 2008. The record of decision/remedial action plan was finalized on August 5, 2009. A final soil remediation work plan was submitted January 28, 2010. The soil remediation field work (referred to as Phase I) began in February 2010 and continued through July 2010. This work involved removing soil in the footprints shown in [Photo 40](#). The site is considered radiologically impacted based on the historical propensity for former salvage yards that handled industrial debris to be radiologically contaminated. Elevated radioactivity above background was discovered in the remedial excavation. Laboratory testing confirmed the presence of non-naturally occurring Ra-226, possibly from a deteriorated metal object (though no physical LLRO was observed in the sample). The results of this investigation will be reported in the forthcoming remedial action completion report and FSS for Site 31.



**Photo 40 Site 31 Phase II excavation areas (colored portions)**

#### **4.1.2.7 Building 342**

Building 342 was identified in the HRA as a non-impacted site. It is a metal, one-story building built on a concrete foundation, completed in 1951. As originally configured, this building of approximately 8,000 square feet contained three laboratories of equal size. The building was used for instrument calibration and instruction. Laboratories were used to conduct training exercises and calibrate instruments with sources in fixed locations. The radiation beams from the sealed sources were controlled in specific directions. As stated in the HRA, periodic leak tests of all sealed sources were required by operational procedures. The use of the building was gradually reduced, and the last use of radioactive sources was in 1972. No leakage was reported; however, this HRASTM recommends the building and the fenced yard area outside of the building be considered impacted based on the possibility that prior use may have resulted in contamination ([Photo 41](#)). No intrusive work has been done at the site of Building 342 since the HRA, but radiological surveys are planned for 2014/2015.



**Photo 41 Building 342 and associated yard area**

#### **4.1.2.8      *Former Supply Department Salvage Yard (Lot 69)***

The former supply department salvage yard (Lot 69) was not identified as a radiologically impacted site in the HRA. No records of the storage, release, or disposal of LLROs on Lot 69 were found during the research for this HRASTM. This HRASTM identifies Lot 69 as being radiologically impacted because of its former use as a salvage yard and experience with other salvage yard facilities. No intrusive work has been done at Lot 69 since the HRA, but radiological surveys are planned for 2014/2015.

#### **4.1.2.9      *Building 461 Area***

Building 461 was identified in the HRA as a non-impacted site. Building 461 was constructed in 1970 and is part of the newer Damage Control School complex that included Buildings 462 and 463 and the training ship mockup, USS *Pandemonium*, after it was moved from the northwest corner of NAVSTA TI. The building was used for Damage Control School classrooms, office space, fire training, and storage of RADIAC instruments with attached check sources that were maintained in the building for use during decontamination exercises on the USS *Pandemonium* (Weston Solutions, Inc. 2006). No check source leakage was reported. This HRASTM recommends the building and surrounding area be considered impacted based on the possibility that training operations may have resulted in residual radioactive contamination. No intrusive work has been done at the Building 461 area since the HRA, but radiological surveys of the building are planned for 2014.



#### **4.1.2.10 Site 12 Housing Area**

The HRA concluded that it was unlikely that LLROs had been disposed of in the SWDAs located in Site 12, but recommended radiation monitoring during soil excavations in these areas. This HRASTM identifies the entire footprint of the housing area as radiologically impacted, with the exception of Site 20, as discussed above in [Section 2.2.8](#). The vertical structures (buildings, carports, utility poles, and fences) within Site 12 have not been radiologically impacted. Radiologically contaminated soil and LLROs were discovered to have been disposed of in the SWDAs in Site 12 based on intrusive investigations conducted after the final HRA. In addition, LLROs have been found outside of the SWDAs in various locations within the housing area in Site 12. The locations of LLROs found outside of SWDAs to date are shown on [Figure 11](#). As discussed in [Sections 5.2.1 and 5.2.3](#), CSMs have been developed to account for the LLROs that have been found, presumably resulting from Repair/Solid Waste Disposal and optical shop operations or from spills or contamination from handling contaminated soils from Site 12 SWDAs. These CSMs are shown on [Figures 12, 13, and 16](#). The CSMs address the potential for radioactive contamination originating at the SWDAs that then was spread during grading associated with housing construction or during transport of contaminated soil through Site 12.

After the HRA was published, the following work has occurred within Site 12 to either radiologically characterize or address radiological issues within the site. (The gyro compass repair shop and SWDA Bigelow Court debris disposal area are discussed separately in the following subsections.)

- The CDPH RHB conducted towed array gamma surveys of roadways and areas outside of the Site 12 RCAs that were established in association with the remedial activities at the SWDAs on April 5 to 7, 2011 (CDPH 2011a). This survey found five locations immediately outside of a controlled area with dose rates significantly greater than the annual radiation dose limit (100 millirems/year) for the public; CDPH RHB did not identify any other anomalies around the SWDAs. The Navy immediately adjusted the RCA boundary to include the elevated CDPH readings within the RCA. The CDPH RHB survey also found areas on the roadways of Site 12 with elevated gamma radiation levels that were not previously identified by the Navy as potentially impacted areas. CDPH RHB recommended further investigation of the elevated gross gamma levels found on the streets of Site 12 and the diffused elevated areas of gross gamma measurements around the perimeter of the RCA to characterize the source isotopes.
- The CDPH RHB conducted surveys in open areas outside of housing units in Site 12 in March 2013 (CDPH 2013). As discussed above in [Section 2.2.7](#), those surveys identified five locations with elevated readings. The Navy immediately investigated the five locations, and LLROs were recovered from two of the locations; no LLROs were found at the other three locations identified by CDPH RHB (Tetra Tech EC, Inc. 2014).

- The Navy conducted a radiological survey of accessible land areas, including private fenced back yards and paved roadways in Site 12 and selected transportation routes in and near Site 12. Nine discrete locations with elevated readings in the housing area were further investigated and LLROs were recovered. These gamma walkover surveys are designed to be protective of the public and identify whether any LLROs exist that contribute an unacceptable dose. In addition, the interiors of the housing units are being scanned to determine if LLROs are present beneath the slab foundations. The Navy commenced scanning of the interiors of the housing units in June 2014 and is planned to end in September 2014. The Navy is also conducting a surface and subsurface sampling program for the 1400 series housing in Site 12 to develop a definitive and comprehensive data set to determine if the site is impacted by historical Navy radiological activities. Background surface soil samples were collected from 20 random non-impacted locations at TI. These 20 samples were analyzed for Ra-226 using gamma spectroscopy; the mean Ra-226 concentration in these 20 soil samples is 0.69 pCi/g. The soil screening criterion for Ra-226 is 1 pCi/g above the mean reference area background Ra-226 concentration. To ensure sufficient sampling densities, the 1400 series housing site was divided into 10 SUs following MARSSIM guidelines, ranging from 6,381 m<sup>2</sup> to 9,325 m<sup>2</sup> of total area. The software program VSP, Version 6.5 (Pacific Northwest National Laboratory 2013), was used to develop a sampling plan for the 10 site SUs. A total of 480 samples were analyzed by gamma spectroscopy. Each Ra-226 result was compared with the project screening criterion of 1.69 pCi/g. None of the results exceeded the screening criterion (report in preparation).

Within Site 12 are specific areas that warrant designation as radiologically impacted for reasons in addition to the potential for grading to have spread contamination originating from the SWDAs. These areas are the gyro compass repair shop, SWDA Bigelow Court debris disposal area, rubbish disposal areas, and a burn area. These areas are further discussed in the subsections that follow. [Figure 18](#) provides information on the amount of “cut” or “fill” resulting from grading activities in Site 12.

#### **4.1.2.10.1 Gyro Compass Repair Shop and Recreation Field**

At the time of the GGIE, a portion of the current recreation field area contained Building 168 that was the exposition building Palace G (General Motors Building). After the GGIE, Buildings 304, 305, 306, and 326 were constructed on the current site of the recreation field. All buildings in that area have since been demolished. Buildings 304 and 305 were restrooms, Building 306 was a supply office and storage area, and Building 326 was a storage building and gun shed (Weston Solutions, Inc. 2006). After Navy assumed occupancy of the property in 1941, Building 168 was used as a gyro compass repair shop from 1942 to about 1948 ([Photo 42](#)). During that time, it is likely that materials painted with radioluminescent paint containing Ra-226 were handled. The gyro compass shop was subsequently demolished. A Navy sanitary sewer system map reviewed from that period indicates that Building 168 was not serviced by the sanitary sewer system (Navy 1944b) and, therefore, no sinks, drains, or toilets are presumed to have existed in the building.

In 2003, the Navy investigated debris and chemicals of concern (COC) in soil in the common areas of Site 12 of NAVSTA TI, including the 9th Street recreation field. The original scoped investigation was done from August 4, 2003, through September 16, 2003, and subsequent step-out investigations occurred on October 15 and 16, 2003. The scope of work included excavating 581 exploration trenches, seven step-out trenches, and seven step-out hand auger locations, logging the trenches for debris sampling, and analyzing soil for COCs, backfilling and restoring trench locations, and sampling, profiling, and disposing of IDW. This investigation was not intended to address the potential for radiological isotopes as a COC, but for health and safety reasons, a sodium iodide scintillation detector for measuring gamma radiation was passed over the excavation sidewalls and excavated spoils to measure gamma radiation levels. An action level of two times background was established for imposing additional control measures in the Site Health and Safety Plan Addendum (Shaw 2003), and no trenches in the recreation field exceeded that limit (Shaw 2005).

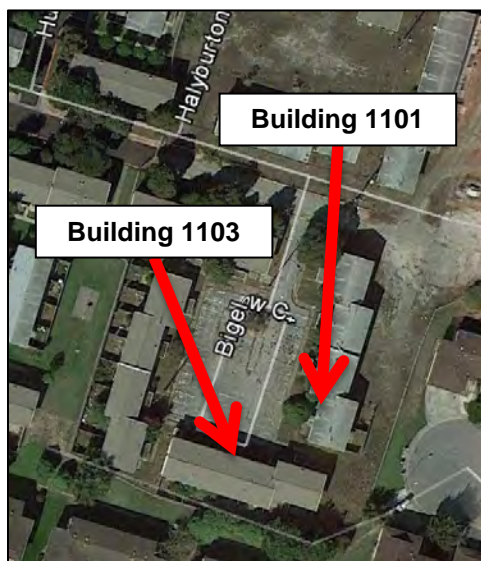


**Photo 42 Location of impacted area of recreation field**

The recreation field was used as an area to establish background radiation levels. As a result, in 2011, the CDPH RHB collected radiological soil samples and conducted surveys of the area (CDPH 2012). In February 2012, the Navy collected soil samples in the recreation field (TestAmerica 2012). Both the CDPH RHB and Navy investigations concluded that additional sampling was warranted based on laboratory analysis indicating elevated levels of Ra-226 and Th-232.

#### 4.1.2.10.2 SWDA Bigelow Court Debris Disposal Area

Based on a 1945 aerial photograph, Site 12 c contains an approximately 175,000-square-foot former storage yard overlapping Halyburton and SWDA Bigelow Courts (TriEco-Tt 2012). The identity of specific materials stored at the former storage yard prior to the construction of housing is not known. No evidence of debris disposal was found during prior excavations in the Halyburton Court area. Bigelow Court was designated as an SWDA; however, that designation is now viewed as inappropriate as the term “SWDA” has evolved to imply that household or industrial waste was intentionally disposed of in the area. The only waste found in SWDA Bigelow Court was limited construction debris. SWDA Bigelow Court is planned for a remedial action of non-radiological contaminants of concern in 2014. That remedial action will consist of additional excavation in the SWDA Bigelow Court area, as shown in [Photo 29](#) (green area), because concentrations of dioxins, lead, and PAHs exceeded their action levels in previous investigations between 1995 and 2003, and these COCs may pose a threat to current and future residents and utility workers. Because the SWDA Bigelow Court area was designated as a SWDA and construction debris was found in the subsurface, SWDA Bigelow Court would be identified as radiologically impacted for those reasons alone in addition to the potential for LLROs to be present from grading ([Photo 43](#)). In preparation for the remedial action in this area, two residential buildings (1101 and 1103) have been demolished ([Figure 10](#)). Radiological surveys were conducted in both buildings prior to demolition. An elevated reading was recorded on the concrete slab floor in one unit at Building 1101. This elevated reading indicated the potential presence of a LLRO beneath the slab. Because of this discovery and other public concerns regarding subsurface radiological contamination, the Navy announced its intent to conduct interior surveys of all of the Site 12 housing units to ensure the safety of the residents. The Navy commenced scanning of the interiors of the housing units in June 2014 and is planned to end in September 2014.



**Photo 43 Radiologically impacted area of SWDA Bigelow Court**

#### **4.1.2.10.3 Rubbish Disposal Areas and Burn Area**

Two non-contiguous “Rubbish Disposal Areas” and a separate “Burn Area” were identified during research associated with this HRASTM. Exploratory trenches exposed loose rubbish buried approximately 4 feet below grade (McCreary, Koretsky Engineers 1965; Navy 1965). These rubbish disposal areas and the burn area are shown as radiologically impacted areas on [Figure 9](#). The recommendation of the geotechnical report was to remove the rubbish to an elevation of not higher than  $\pm 2$  feet, project datum, mix the rubbish with clean sand, and compact the mixture by tamping with heavy equipment. These areas have been identified as radiologically impacted based on the correlation between rubbish disposal, burning, and LLROs found at other such sites on TI. In addition to the rubbish disposal areas, the TI housing area contained a historical burn area ([Figure 9](#)) discussed above in [Section 2.2.7](#). This historical burn area contained wood burn debris near the surface adjacent to Building 1203 (see the trench log for trench 1203A-1; Shaw 2004). No intrusive excavation work has been done in any of these areas since the HRA.

#### **4.1.2.10.4 USS Pandemonium Site I (NW)**

The USS *Pandemonium* Site I (NW) was designated as non-impacted in the HRA. Since the HRA, radiological intrusive work has been done in the portion of SWDA Westside that overlies the USS *Pandemonium* Site I (NW) ([Figure 10](#)). The entire USS *Pandemonium* Site I (NW) is now considered radiologically impacted based on a more conservative estimate of the potential for contamination to have resulted from unlicensed instrument check sources or failure to comply with procedures regarding leak checking of licensed sources.

### **4.2 RADIOLOGICALLY NON-IMPACTED SITES**

This section addresses work completed since the final HRA at sites designated as radiologically non-impacted in the HRA. Sites that were designated non-impacted in the HRA and that are designated as radiologically impacted in this HRASTM are discussed in [Section 4.1](#).

#### **4.2.1 Former Pier 13**

Pier 13 was demolished well before the time of the HRA, so no additional work has been done there since the HRA.

#### **4.2.2 Former Building 7 West Wing**

Building 7, including the west wing, was demolished, and no additional work has been done there since the final HRA.

#### **4.2.3 Former Pier 21**

Pier 21 was demolished well before the time of the HRA, so no additional work has been done there since the HRA.

#### **4.2.4 Former Buildings 226 and 228**

Building 226 and 228 were two identical Bachelor Officer's Quarters. They were multi-story, "E"-shaped structures constructed about 1944. Building 226 was demolished by 1966, and Building 228 was demolished by 1968 (Weston Solutions, Inc. 2006). No IRP intrusive work has been done at the locations of the former Buildings 226 and 228 since the HRA.

#### **4.2.5 Former Building 273**

Building 273 was a small, single-story building (Quonset hut type) on a concrete foundation with a concrete and wood superstructure and a corrugated iron roof. It was built in 1944 and was identified on maps and Public Works data as the Chemical Warfare School Decontamination Building. The building was demolished in 1977, and the site was redeveloped with multi-family housing. No intrusive IRP work has been done at the former location of Building 273 since the final HRA.

### **4.3 OTHER SIGNIFICANT RADIOLOGICALLY-RELATED WORK**

This section presents other significant radiological work done after the final HRA.

#### **4.3.1 Site 12 Trenching**

The Navy did trenching and sampling throughout Site 12. These trenching investigations began concurrently with the HRA, but the analysis was not completed until after the final HRA was published. The results of the trenching are briefly summarized here because of their significance with respect to the radiological status of Site 12. Although these data cannot be used to conclusively eliminate the possibility of or characterize subsurface conditions within Site 12, they provide qualitative information on the absence of radiological contamination. The Navy excavated 581 exploration trenches, seven step-out trenches, and seven step-out hand auger locations to evaluate potential risks to human health and to make decisions about further remediation at Site 12 (Shaw 2004). The trenching investigation specifically excluded areas previously remediated or that were scheduled for future remediation (the SWDAs) and streets, sidewalks, and parking areas. During the investigation, the trenches and excavated soil were surveyed in the field for gamma radiation for health and safety reasons. As each trench was excavated, a Shaw technician used a Ludlum Model 44-10 2- by 2-inch sodium iodide scintillation counter to take field readings of the trench sidewalls and the excavated soil. The low levels of radioactivity found in these surveys were determined to be caused by natural soil materials (Shaw 2005). While the trenching work was not sufficient or intended to be the basis for radiological release of the site, the extensive nature of the trenching and the fact that the health and safety radiological scanning of the trench sidewalls, bottoms, and removed material found no issues of concern support the fact that higher reading LLROs such as the octagonal foils are not widespread in the soil within the housing area.



### 4.3.2 CDPH Scans Outside of the Site 12 SWDAs

The CDPH RHB performed scans in areas near the SWDAs, but noted the scans were cursory and were not intended to support conclusions. The survey consisted of a towed array that used 2- by 2-foot sodium-iodide detectors with global positioning system capabilities. The survey was done to assess the radiation exposure along publicly accessible roads in Site 12 and to ensure there are no health and safety risks. The CDPH RHB also did gamma walkover surveys in intervals around the fence line of the RCA at Site 12 (CDPH 2011a). During the gamma walkover survey, CDPH RHB identified five locations with elevated counts — four outside the fence and one under the fence that constituted the RCA for SWDA Westside. The Navy expanded the fence line to encompass these areas in the expanded boundaries of the RCA. Eighty-four out of thousands of locations had been identified above the background level on the roadways, and CDPH considered the elevated locations to be representative of naturally occurring isotopes found in asphalt.

In addition to the April 2011 surveys, the CDPH RHB conducted field surveys in open areas outside of housing in Site 12 in 2013 (CDPH 2013). As discussed above in [Section 2.2.7](#), those surveys identified five locations with elevated readings ([Figure 11](#)). The Navy immediately investigated the five locations, and LLROs were recovered from two of the locations; no LLROs were found at the other three locations identified by CDPH RHB and excavated soil was characterized and disposed of (Tetra Tech EC, Inc. 2014).

### 4.3.3 Site 33

The Waterline Replacement Area, Site 33, was not addressed in the 2006 HRA. However, investigatory activities later found buried debris at the site. Therefore, Site 33 was radiologically characterized during the remedial action in 2012 ([Figure 4](#)). The characterization included gamma scans and static surveys of the soil and asphalt. Samples were collected and analyzed that demonstrated the concentration of Ra-226 was less than the release criterion. Sampling was also conducted for Cs-137 and Sr-90. Concentrations of Cs-137 were less than the laboratory minimum detectable concentration (MDC) in every sample. The laboratory MDCs for Cs-137 are less than or in the range of Cs-137 fallout concentrations in surface soil samples collected from undisturbed, non-impacted, background locations in California (McArthur and Miller 1989). In addition, concentrations of Sr-90 were less than the laboratory MDC in every sample. Based on the characterization of radionuclide soil and asphalt samples from five separate excavation areas at Site 33, it was confirmed that Site 33 is free of Ra-226, Cs-137, and Sr-90 contamination (Shaw 2012b).

## 5.0 CONCEPTUAL SITE MODEL

The purpose of this section is to discuss the CSM for radiologically impacted sites. A CSM is an effective tool for defining site dynamics, streamlining any future risk evaluations, and developing any further actions at a site. The purpose of the CSM is to aid in understanding and describing potential exposure pathways that may be at a site. A CSM typically includes:

- Suspected sources and types of contaminants
- Contaminant release and transport mechanisms
- Affected media
- Rate of contaminant release and transport (if possible)
- Known and possible routes of migration
- Known and potential exposure pathways
- Known and potential human and ecological receptors

While the HRA did not specifically identify CSMs in association with the radiologically impacted sites, the elements of a CSM were discussed in Section 7.3 of the HRA.

## **5.1 EXISTING CONCEPTUAL SITE MODEL**

Section 8.3.1 of the HRA discussed impacted sites, either under specific subheadings in the text or in the section narrative.

## **5.2 UPDATE TO CONCEPTUAL SITE MODEL**

This HRASTM developed CSMs in the form of flowcharts and figures to better communicate the postulated mechanism that may have disposed of or distributed radioactive materials or contamination on the site. The radiologically impacted sites identified in the HRA were based on the potential for contamination or LLROs to be present because of former spills (such as Building 233 and associated sewer drain), former storage of radioactive material (such as at Buildings 342, 343, and 344), and the potential on-site disposal and dispersion of unregulated radioactive materials in Site 12.

The research done for this HRASTM identified that, contrary to the findings of the HRA, ship repair activities occurred at NAVSTA TI during the WWII period and the potential for radiologically impacted areas exists at NAVSTA TI in association with those activities. This HRASTM provides a CSM for Repair/Solid Waste Disposal Operations/activities associated with the former optical repair shop to address the potential for these activities to have impacted the site. CSMs are provided (1) to account for spills such as the one that occurred at Building 233, or that may have occurred at either of the USS *Pandemonium* locations; and (2) to account for the potential for spills to have occurred in association with remedial activities within Site 12 where radioactive waste and contaminated soils have been disposed of. Each of these CSMs is discussed further in the subsections below.

## **5.2.1 CSM for Repair/Solid Waste Disposal Operations**

A CSM has been developed to account for radioactive waste that may have resulted from Repair/Solid Waste Disposal and optical shop operations. This CSM is shown in [Figure 12](#) in the form of a flowchart and pictorially in [Figure 13](#). The CSM addresses the potential for radioactive contamination at Building 3 in AOI 1 ([Figure 3](#)), the potential for radioactive contamination at a potential former salvage yard in AOI 6 ([Figure 8](#)), and both the LLROs and contamination found in the SWDAs in AOIs 7 and 8 ([Figures 9 and 10](#)).

### **5.2.1.1 Suspected Sources and Types of Contaminants**

The potential radionuclides of concern at Building 3 in AOI 1 ([Figure 3](#)) include both Ra-226 and Th-232. Ra-226 may have been present in Building 3 in the form of gauges or deck markers found on hull plating or for components such as gauges associated with ship repair. Ra-226 and Th-232 have been commonly found in optical repair shops in conjunction with radioluminescent painted pointers in rangefinders, thorium oxide in optical lenses, or thorium fluoride used in treating the surfaces of optical lenses.

Significant waste would have been generated during repairs in addition to the potential handling of LLROs from repairs in Building 3 (see [Section 2.2.6](#)). This waste may have included LLROs such as deck markers or gauges that could have been disposed of on site. Radioactive waste-contaminated soil and LLROs have been identified during previous investigations, and the greatest concentrations are localized in the four SWDAs ([Figures 9 and 10](#)). LLROs have been found in areas adjacent to these SWDAs because of the grading and site preparation for construction of the housing units, including mixing and spreading the solid waste material with fill and surface soil in and outside the known SWDAs. Ra-226 is the radionuclide of concern, and the items found in these areas included radioactive foils, buttons, deck markers, gauges and other debris. The deck markers and gauges are likely related to waste from ship repair during WWII. Based on the research conducted to date, the source of the radioactive foils and buttons is unclear; however, the source of the deck markers found in the SWDAs was likely related to ship repair. Scrap metal salvage yards represent other areas potentially impacted by LLROs associated with ship repair ([Figure 6](#)).

### **5.2.1.2 Affected Media**

Media affected by the suspected sources and types of contaminants from the Repair/Solid Waste Disposal and optical shop operations CSM include structures, surface soil, sanitary sewers, subsurface soil, and groundwater.

### **5.2.1.3 Contaminant Release, Transport Mechanisms, and Known Migration Routes**

The potential contaminant release and transport mechanisms from the CSM for Repair/Solid Waste Disposal Operations ([Figure 12](#)) are spilling and dumping, dispersion during waste processing, leaching from disposal areas, and contaminant infiltration and migration through the

soil. The areas that are now referred to as SWDAs were created as a result of debris dispersion during earthwork operations prior to construction of the housing at Site 12 (Figures 9 and 10). This re-grading spread the localized contaminant-containing soil over the ground surface and potentially in areas away from the original sources. Consequently, soil contamination was observed in Site 12 during previous investigations.

#### **5.2.1.4 Human Receptors and Exposure Pathways**

Potential human receptors that may be present at the radiologically impacted sites were identified as follows, in conjunction with the CSM for Repair/Solid Waste Disposal Operations (Figure 12) and the 2011 T I/YBI Redevelopment Land Use Plan prepared for the Treasure Island Development Authority (TIDA):

- Building 3 (Figure 3): commercial/industrial workers and construction workers.
- Potential Former Salvage Yard (Figure 8): commercial/industrial workers and construction workers.
- SWDAs (Figure 9 and 10): residents, commercial/industrial workers (in the event an alternative commercial/industrial land use is implemented), recreational users, and construction workers.
- Former Storage Yard (Sites 30 and 31) (Figure 10): residents, commercial/industrial workers (in the event an alternative commercial/industrial land use is implemented), recreational users, and construction workers.

#### **5.2.1.5 Ecological Receptors and Exposure Pathways**

NAVSTA TI has poor quality terrestrial wildlife habitat because the island is predominantly covered with urbanized areas. The areas identified as radiologically impacted do not contain significant habitat, so no significant impacts to ecological receptors was identified. However, if quality terrestrial wildlife habitat is constructed in the future, the owner would be required by Site 6-related land use restrictions to evaluate the suitability of that habitat for wildlife.

### **5.2.2 CSM for Incidental Release in Association with Training Operations**

A CSM was developed to account for radioactive contamination that may have resulted from potential incidental releases in association with training/operations. This CSM is shown on Figure 14 in the form of a flowchart and pictorially for three specific sites (Building 233 and USS *Pandemonium* sites) on Figures 15 and 16. The CSM addresses the potential for radioactive contamination in AOI 2 (Building 233, Figure 3), the potential for radioactive contamination in AOI 4 (Buildings 342, 343, and 344, Figure 5), AOI 6 (former USS *Pandemonium* Site II, Figure 8), and AOI 8 (former USS *Pandemonium* Site I, Figure 10).

Building 233 was identified as radiologically impacted in the HRA, and a pictorial CSM is provided as Figure 15. The building has since been demolished and remedial activities are

ongoing. Similarly, Buildings 343 and 344 were identified as radiologically impacted in the HRA and were subsequently surveyed and released for unrestricted use. The locations of former USS *Pandemonium* Sites I and II are discussed below.

#### **5.2.2.1 Suspected Sources and Types of Contaminants**

The potential radionuclides of concern for USS *Pandemonium* Sites I and II (AOIs 6 and 8 on [Figures 8 and 10](#)), are Cs-137 associated with sealed sources and Ra-226 associated with radioluminescent gauges used as check sources. Both of the former USS *Pandemonium* locations were identified as non-impacted in the HRA; however, as discussed in [Sections 2.2.6 and 2.2.8](#), this HRASTM has designated them as radiologically impacted based on a re-evaluation of existing information.

#### **5.2.2.2 Affected Media**

Media affected by the suspected sources and types of contaminants from the CSM for Incidental Releases from training operations include structures and buildings, surface soil, subsurface soil, discharge piping, and groundwater.

#### **5.2.2.3 Contaminant Release, Transport Mechanisms, and Known Migration Routes**

The CSM for potential contaminant release and transport mechanisms from the potential incidental releases in association with training and operations are the dispersion of loose surface contamination from handling of the gauges that are documented for use as check sources at the USS *Pandemonium* Site II (NE) in AOI 6. (It is presumed that similar check sources were used at the USS *Pandemonium* Site I [NW] in AOI 8; however, no records to that effect have been located.)

#### **5.2.2.4 Human Receptors and Exposure Pathways**

Potential human receptors that may be present at the radiologically impacted sites were identified as follows, in conjunction with the CSM for Incidental Releases from Training/Operations and based on the 2011 TI/YBI Redevelopment Land Use Plan prepared for TIDA:

- Building 233 ([Figure 4](#)): residents, recreational users, and construction workers.
- USS *Pandemonium* Site I (NW) ([Figure 10](#)): residents, commercial/industrial workers (in the event an alternative commercial/industrial land use is implemented), recreational users, and construction workers.
- USS *Pandemonium* Site II (NE) ([Figure 8](#)): commercial/industrial workers and construction workers.

### **5.2.2.5      *Ecological Receptors and Exposure Pathways***

The receptors and exposure pathways are the same as those for the CSM described in [Section 5.2.1.5](#).

### **5.2.3      *CSM for Spills/Contamination Resulting from Handling of Contaminated Soils from Site 12 SWDAs***

A CSM has been developed to account for radioactive contamination that may have resulted from spills or contamination from handling contaminated soils from Site 12 SWDAs. This CSM is shown on [Figure 17](#) in the form of a flowchart. The CSM addresses the potential for radioactive contamination originating at the SWDAs to have been spread during transport through Site 12, or in handling at the Building 570 area in AOI 5 ([Figure 7](#)), and the potential for radioactive contamination at the Waste and Clean Soil Stockpile/Loading and Decontamination Site in AOI 6 ([Figure 8](#)).

#### **5.2.3.1      *Suspected Sources and Types of Contaminants***

The potential radionuclide of concern for the Building 570 area and the Waste and Clean Soil Stockpile/Loading and Decontamination Site is Ra-226 based on the radioisotopes found in soil and LLROs previously removed from the SWDAs in Site 12. These areas are newly identified as radiologically impacted based on the known handling of radioactive materials originating in the Site 12 SWDAs. The discovery of LLROs in the SWDAs occurred after the HRA was published.

#### **5.2.3.2      *Affected Media***

Media affected by the suspected sources and types of contaminants from the CSM for Spills/Contamination Resulting from Handling of Contaminated Soils from Site 12 include roadways and surrounding surface soil.

#### **5.2.3.3      *Contaminant Release, Transport Mechanisms, and Known Migration Routes***

The potential contaminant release and transport mechanisms from this CSM are dispersion of loose surface contamination during handling, hauling, and storing contaminated soil and LLROs originating in the Site 12 SWDAs.

#### **5.2.3.4      *Human Receptors and Exposure Pathways***

Potential human receptors that may be present at the radiologically impacted sites were identified based on the 2011 TI/YBI Redevelopment Land Use Plan prepared for the TIDA as follows:

- Building 570 area ([Figure 7](#)): recreational users and construction workers.



- Waste and Clean Soil Stockpile/Loading and Decontamination Site ([Figure 8](#)): commercial/industrial workers and construction workers.

### **5.2.3.5      *Ecological Receptors and Exposure Pathways***

The receptors and exposure pathways are the same as those for the CSM described in [Section 5.2.1.5](#).

## **6.0      FINDINGS AND RECOMMENDATIONS**

This section provides findings and recommendations for sites designated as radiologically impacted in the HRA or in this HRASTM. Additional data requirements are presented and property suitable for transfer is identified

### **6.1      RADIOLOGICALLY IMPACTED SITES**

This section provides findings and recommendations for sites designated as radiologically impacted in the HRA or in this HRASTM. The findings and recommendations in this section were developed in conformance with Sections 7.3 and 7.4 of the HRA that provides background and guidance on assessing media, migration pathways, and recommendations (Weston Solutions, Inc. 2006).

#### **6.1.1      Radiologically Impacted Sites Identified in the HRA**

This section provides findings and recommendations for sites designated as radiologically impacted in the HRA. Changes, if any, in the following categories are noted: Site Description, Former Uses, Current Uses, Radionuclides of Concern, Previous Radiological Investigations, Contamination Potential, Potential Migration Pathways, and Recommended Actions. Where information is unchanged from the HRA, it is not repeated.

##### **6.1.1.1      *Building 233***

Building 233 is the former location of the RADIAC Instrument Calibration School. The CSM presented in [Section 5.2.2](#) applies to this location. In the HRA, Building 233 and the Building 233 drain lines were presented separately as radiologically impacted. The HRA recommended a characterization survey of both floors of the building and the crawl space beneath it. Scoping surveys of the sanitary drains were recommended to include the first sanitary sewer manhole downstream from Building 233.

A final scoping survey report was issued for the building and the associated drain lines in January 2007. The scoping survey for the drain lines indicated that at least some of the building piping is radiologically contaminated. It was recommended that the piping be removed and fully surveyed for release during building demolition. The building was demolished in January 2011. At the time of this HRASTM, the Navy is completing characterization, remediation, and an FSS for the building footprint, exterior areas and associated storm drains, and the sanitary sewer

system associated with the building and the surrounding area. Investigation of Building 233 since the 2006 HRA identified radiological contamination throughout the building and surrounding areas, in the storm drains and sanitary sewer system, and this HRA<sup>TM</sup> identified those sewer systems downstream of Building 233 as radiologically impacted (see [Figure 2](#)).

As a result of the information obtained from the field work completed to date, no changes to the subcategories of information for Building 233 in Section 8.3.1.5 of the HRA are necessary. However, the boundaries of the impacted area have been expanded to account for new findings from the investigation to date. The new boundaries have been established to include the open areas bounded by the former Building 7 and the adjacent roadways (4<sup>th</sup> street and Avenue M). These boundaries are intended to incorporate the likely area that would have been established as an RCA boundary during the cleanup of the 1950 spill. These boundaries also contain a storm drain inlet near Building 233 that was found to be contaminated, as well as the sanitary sewer lines and storm drain lines that lead from the building.

#### **6.1.1.2      *Buildings 343 and 344***

Buildings 343 and 344 are two of the three buildings that made up the RADIAC school from the 1950s through the 1970s. The HRA recommended that Buildings 343 and 344 undergo an FSS. Radiological surveys for Buildings 343 and 344 were done in September 2007, and the FSS reports were issued in 2008. The Buildings 343 and 344 survey reports identified that Buildings 343 and 344 survey results met the release criteria, and the buildings could be released to unrestricted use. DTSC and CDPH concurred that unrestricted release for Buildings 343 and 344 was appropriate, so no further action is required for these buildings. As a result of the information obtained from the work completed to date, no changes to the subcategories of information for Buildings 343 and 344 in Sections 8.3.1.2 and 8.3.1.3 of the HRA are necessary.

The third building, that was historically associated with the RADIAC school, Building 342, is discussed further in [Section 6.1.2](#), below.

#### **6.1.1.3      *Site 12***

The HRA identified the contamination potential from solid waste disposal or incineration and recommended radiation monitoring during excavation of identified SWDAs. After results from an ongoing, non-time-critical removal action and other investigations had been received, the SWDAs were found to be contaminated with LLROs or contamination containing Ra-226. In addition, some of those LLROs and contamination were likely spread outside of the SWDAs elsewhere in the housing area. As a result of the information obtained from the field work completed to date, all of Site 12 has been radiologically impacted, with the exception of a firehouse area (Building 157). The CSM that applies to this area is discussed in [Section 5.2.1](#). The new boundaries have been established to include all of Site 12 because grading affected the entire site. As-built plans indicate that grading would not have extended beyond the Site 12 boundaries, as those project boundaries were fenced. The firehouse area has not been impacted because existing fencing visible in aerial photographs would have precluded that area from being altered by grading. The following changes have been made to the subcategories of information for Site 12 that were in Section 8.3.1.4 of the HRA:

**Site Description** - What is now known as Installation Restoration 12 on the northern end of NAVSTA TI was once a disposal area for trash and debris. Discrete solid waste disposal areas have been identified. Parts of Site 12 were used for storage of ammunition in bunkers and also for the disposal and incineration of refuse. Later, portions of the site were used for material storage. Beginning in the 1960s, the area was developed for military housing. It is believed that over the course of development of the northern portion of the island for residential use, some of the debris and ash has been incorporated into fill material or otherwise scattered as a result of site grading operations (TI-HRA-91). General waste disposal took place around and in-between bunkers. Waste disposal operations continued until approximately 1963. Intrusive investigation has identified the presence of LLROs and contamination containing Ra-226 (Weston 2006).

**Contamination Potential** – Change “Unlikely” to “Likely”

**Contaminated Media**

Surface Soil – Change “None” to “Medium”

Subsurface Soil – Change “None” to “High”

Groundwater – Change “None” to “Low”

**Potential Migration Pathways**

Groundwater – Change “None” to “Low”

Subsurface Soils – Change “None” to “High”

**Recommended Actions** – Change “Perform radiation monitoring during soil excavation of the known solid waste disposal areas.” to “Complete a characterization survey and remediate known areas of radiological contamination and complete a gamma walkover survey for areas outside of radiologically impacted SWDA boundaries in Site 12. Complete an FSS after remediation is complete.”

## **6.1.2 Radiologically Impacted Sites Identified in this HRASTM**

This section provides findings and recommendations at sites that were not designated as radiologically impacted at the time of the HRA, but were designated as radiologically impacted in this HRASTM. These sites include Building 3, Building 570 area, former USS *Pandemonium* Sites I (NW) and II (NE), three former salvage yard sites, a waste and clean soil stockpile/loading and decontamination site, a former storage area that includes Sites 30 and 31, and Building 342, the area surrounding Building 461, an area currently used as a playground formerly used as a gyro compass repair shop, SWDA Bigelow Court debris disposal area (Photo 58), and two separate non-contiguous areas formerly used as rubbish disposal areas (Photo 59). Sewer lines are discussed under potential migration pathways for each of the impacted areas below. Where storm or sanitary sewers are identified as potential migration pathways, only those portions of the sewer lines located within the footprint of the radiologically impacted area are considered impacted unless shown otherwise on Figures 2 through 10.

### 6.1.2.1 **Building 3**



**Photo 44 Northeast side of Building 3**

**Site Description** – Building 3 is one of the original buildings constructed on TI for the 1939 GGIE. It is a large general warehouse building with both arched and flat roofs. The building covers approximately 145,000 square feet. This building was designated as non-impacted in the HRA. An optical repair shop was located on the roof of the northern corner of the building. The CSM that applies to this building is discussed in [Section 5.2.1](#). The boundaries for the impacted site have been established to be contiguous with the perimeter of the building based on the fact that if contamination exists, it would most likely have been deposited during shop activities within the building. The sanitary sewer leading from the former optical repair shop has also been radiologically impacted to account for the potential that non-regulated radiological substances could have been disposed of in the drains.

**Former Uses** – Palace of Fine and Liberal Arts, port control office, ships repair shops, optical repair shop, training school, and equipment repair. The Damage Control HT “A” school administration and offices maintained radiation survey instruments with check sources. There were no reports of leaking check sources.

**Current Uses** – Leased out for multiple uses.

**Potential Radionuclides of Concern** – Ra-226 from ship repair, and Ra-226 and Th-232 from the former optical repair shop.

**Previous Radiological Investigations** – None

**Contamination Potential** – Likely the drains leading from the former optical repair shop; unlikely for the remainder of the building.

### **Contaminated Media**

Surface Soil – Low  
Subsurface Soil – Medium  
Sediment – High  
Surface Water – None  
Groundwater – None  
Air – None  
Structures – Low  
Drainage Systems – High

### **Potential Migration Pathways**

Surface Soil – None  
Subsurface Soil – Medium  
Sediment – High  
Surface Water – None  
Groundwater – None  
Air – None  
Structures – Low  
Drainage Systems – High

**Recommended Actions** – Scoping survey of floor spaces and investigation of sanitary and storm sewer drains downstream of the former optical repair shop to the outfalls. Scoping survey of building roof, former location of optical shop, and any remaining access routes to the optical shop.





**Photo 45 Location of Building 3**

**6.1.2.2 Building 570**



**Photo 46 Building 570 area and location**



**Site Description** – Building 570 was constructed in 1988. It is a single story slab-on-grade metal building. The building covers approximately 3,000 square feet. This area was not identified as radiologically impacted in the HRA, but is now identified as radiologically impacted to account for the potential that it has been operationally impacted in association with other remedial activities. The CSM that applies to this site is discussed in [Section 5.2.3](#). The boundaries of the site are based on the existing fenced perimeter shown in [Photo 46](#).

**Former Uses** – Operations training facility

**Current Uses** – The Building 570 area has been used as an office trailer and laydown area by the Navy in association with remedial activities on NAVSTA TI, including those at Site 12. As discussed in [Sections 2.2.5 and 5.2.3](#), removals in the Site 12 SWDAs after the HRA involved LLROs and soil contaminated with radiological constituents. Soil samples were stored and analyzed for radioisotopes in the Building 570 area. LLROs were stored in conex boxes in a smaller fenced yard in the Building 570 area.

**Potential Radionuclides of Concern** – Ra-226

**Previous Radiological Investigations** – None

**Contamination Potential** – Likely

**Contaminated Media**

- Surface Soil – Low
- Subsurface Soil – None
- Sediment – None
- Surface Water – None
- Groundwater – None
- Air – None
- Structures – Low
- Drainage Systems – Low

**Potential Migration Pathways**

- Surface Soil – Low
- Subsurface Soil – None
- Sediment – None
- Surface Water – None
- Groundwater – None
- Air – None
- Structures – Low
- Drainage Systems – Low

**Recommended Actions** – Conduct an FSS of structures and yard.

### 6.1.2.3 *USS Pandemonium Site II (NE)*



**Photo 47** *USS Pandemonium Site II (NE)*

**Site Description** – The *USS Pandemonium* training ship was moved to the northeast corner of NAVSTA TI in 1969, where it remained until it was demolished in 1996. The training ship was part of the new Damage Control School complex that included Buildings 461, 462, and 463. Access to the area was by the tear-gas decontamination building (462). An 8-foot-high fence separated the training area from the rest of the island. The CSM for this site is discussed in [Section 5.2.2](#). Use of the mock-up ship ended in 1992, though the mock-up remained until 1996. The training ship was used to simulate radioactive fallout using short-lived isotopes, as discussed in [Section 2.2.6](#), and Cs-137 sources for fixed locations. (A short-lived isotope is one with such a short half-life that it decays to a negligible quantity in a matter of hours or perhaps days.) Two below-grade concrete holding tanks collected the wash-down water when short-lived isotopes were decontaminated in the *USS Pandemonium*. The wash-down water was released to the bay through a 6-inch pipe after sufficient time transpired for the isotopes to have decayed away. Ra-226-containing gauges were used as check sources during training, as discussed in [Section 2.2.6](#). The *USS Pandemonium* Site II (NE) was designated as non-impacted in the HRA. As discussed in [Section 2.2.6](#), this site was part of a removal action completed in 2009 at Site 32. The removal was done to address contaminants of concern that included PCB, dioxins, pesticides, total petroleum hydrocarbons, and metals. The boundaries for this site include the interior of Building 461 and are otherwise contiguous with Site 32, except on the southeastern end where the boundary is established by the presence of a former building. The area west and north is also impacted, as discussed below, and the area to the east is the San Francisco Bay.

**Former Uses** – Damage Control School decontamination training area (after July 1969). Although the mock-up ship remained until 1996, the use of the mock-up ended in 1992. No radiological-related work has been conducted at the site of the former *USS Pandemonium* Site II (NE) ([Figure 8](#)) since the HRA. Decontamination training used sealed sources of Cs-137 to simulate radioactive fallout and also used short-lived liquid

radioisotopes (Br-82, Br-80, Na-24, and K-42) to more realistically simulate radioactive fallout. Survey instruments containing radioactive check sources were used during the training exercises. The Cs-137 sealed sources were leak tested and demonstrated to be intact. The licensed check sources were also required to be leak tested on a periodic basis; however, unlicensed check sources would not have required leak testing. No reports of leakage were found during the HRA and this HRASTM. The short-lived isotopes were last used at this location in 1972 and have decayed away and are no longer present.

**Current Uses** – None

**Potential Radionuclides of Concern** – Ra-226, Cs-137

**Previous Radiological Investigations** – None

**Contamination Potential** – Unlikely

**Contaminated Media**

- Surface Soil – Low
- Subsurface Soil – Low
- Sediment – None
- Surface Water – None
- Groundwater – None
- Air – None
- Structures – Low
- Drainage Systems – Low

**Potential Migration Pathways**

- Surface Soil – Low
- Subsurface Soil – Low
- Sediment – None
- Surface Water – None
- Groundwater – None
- Air – None
- Structures – None
- Drainage Systems – Low

**Recommended Actions** – Complete a scoping survey of the subsurface soil and former holding tanks, structures, and ground surface in the USS *Pandemonium* Site II (NE) area and a gamma walkover survey of the roadways and areas not previously subject to gamma walkover surveys.



**Photo 48 Location of former USS *Pandemonium* Site II (NE)**

#### **6.1.2.4 Former Salvage Yard**



**Photo 49 Location of Former Salvage Yard**

**Site Description** – As noted in [Section 2.2](#), ship repair was ongoing throughout WWII. Those activities generated significant amounts of scrap metal, which was potentially processed in the open area and south of Building 327 that was identified as a Salvage Building in the HRA. The CSM for this salvage yard is discussed in [Section 5.2.1](#). Building 327 was demolished in the 1960s, and the radiologically impacted area is now beneath the footprint of the sewage treatment plant that was constructed in 1984. This area was not identified as radiologically impacted in the HRA. The boundaries for the area have been established to be contiguous with the outline of the sewage treatment plant, which overlays the former Building 327 area. The southern portion of the sewage

treatment plant has also been included in the footprint of the impacted area because soil from the former salvage yard could have been displaced anywhere within the footprint of the sewage treatment plant during construction.

**Former Uses** – Salvage

**Current Uses** – The area is now the site of the NAVSTA TI sewage treatment facility.

**Potential Radionuclides of Concern** – Ra-226

**Previous Radiological Investigations** – None

**Contamination Potential** – Unlikely

**Contaminated Media**

Surface Soil – Low  
Subsurface Soil – Low  
Sediment – None  
Surface Water – None  
Groundwater – None  
Air – None  
Structures – Low  
Drainage Systems – Low

**Potential Migration Pathways**

Surface Soil – Low  
Subsurface Soil – Low  
Sediment – None  
Surface Water – None  
Groundwater – None  
Air – None  
Structures – None  
Drainage Systems – Low

**Recommended Actions** – Complete a scoping survey of the ground surface in the sewage plant area.



#### 6.1.2.5 Waste and Clean Soil Stockpile/Loading and Decontamination Site



**Photo 50 Waste and Clean Soil Stockpile/Loading and Decontamination Site**

**Site Description** – The Waste and Clean Soil Stockpile/Loading and Decontamination Site is an open area in AOI 6 (Figure 8) and shown in Photo 50. This area was not identified as radiologically impacted in the HRA. The CSM for the area is discussed in Section 5.2.3, and the boundaries of the impacted area have been established to include the open areas between Site 12 and the sewage treatment plant, except for the fenced area between Site 6 and 12 to the south. This entire area is deemed as potentially operationally impacted in association with remedial activities.

**Former Uses** – A number of WWII-era training and administrative buildings were located in this area. All buildings were demolished.

**Current Uses** – The Waste and Clean Soil Stockpile/Loading and Decontamination Site is currently used by a Navy contractor in association with remedial activities at Site 12 on NAVSTA TI. Contaminated and other soil removed from the SWDAs has been repackaged and stored in the area for off-site disposal.

**Potential Radionuclides of Concern** – Ra-226

**Previous Radiological Investigations** – In-process surveys have been conducted in association with Navy operations related to the stockpiling of soil from Site 12 removal actions.

**Contamination Potential** – Likely

**Contaminated Media**

Surface Soil – Low  
Subsurface Soil – Low

Sediment – None  
Surface Water – None  
Groundwater – None  
Air – None  
Structures – None  
Drainage Systems – Low

#### **Potential Migration Pathways**

Surface Soil – Low  
Subsurface Soil – None  
Sediment – None  
Surface Water – None  
Groundwater – None  
Air – Low  
Structures – None  
Drainage Systems – None

**Recommended Actions** – Complete an FSS of the ground surface in the Waste and Clean Soil Stockpile/Loading and Decontamination Site.

#### **6.1.2.6 USS Pandemonium Site I (NW)**



**Photo 51 USS Pandemonium Site I (NW)**

**Site Description** – This radiologically impacted site is wholly contained within Site 12, which has been separately impacted as discussed above; however, it also warrants and is further discussed in this section. The USS *Pandemonium* training ship was constructed in 1956. The CSM for this area is discussed in [Section 5.2.2](#). The training ship was commissioned for use in February 1957 and remained in service in the northwest corner until July 1969. The fenced-off, gravel-surfaced training area was approximately 400 by 600 feet. The area enclosed eight buildings, two old aircraft, the USS *Pandemonium*

mock-up ship, and a paved road. During testing of the radioactive spreader device for short-lived isotopes, the radioactive water was allowed to soak into the soil. Later, radioactive water from the decontamination training was collected in two below-grade concrete tanks and stored until the short-lived isotopes had decayed. When the radioactivity was within allowable limits, the water was discharged to the bay through a 6-inch pipe. The USS *Pandemonium* Site I (NW) was moved from this area in 1969 to the northeast corner of NAVSTA TI. The location of the former USS *Pandemonium* Site I (NW) has since been converted into multiple family military housing units. As discussed in [Section 2.2.8](#), the former holding tanks have likely been partially demolished, leaving the floor of the tank. The USS *Pandemonium* Site I (NW) was designated as non-impacted in the HRA. The boundaries for this site are as shown on [Figure 2](#); however, the boundaries are approximate because the site lies with the impacted area of Site 12.

**Former Uses** – Nuclear, Biological, and Chemical Warfare School. Decontamination training area. Decontamination training initially used only sealed sources of Cs-137 to simulate radioactive fallout. In 1963, a radioactive material license was granted by the AEC to use short-lived liquid radioisotopes (Br-82, Br-80, Na-24, and K-42) to more realistically simulate radioactive fallout. Survey instruments containing radioactive check sources were used during the exercises. The Cs-137 sealed sources were leak tested and demonstrated to be intact. The licensed check sources were required to be leak tested on a periodic basis; however, unlicensed check sources would not have required leak testing. No reports of leakage were found during the HRA and this HRASTM. The short-lived isotopes were last used at this location in 1969, have decayed away, and are no longer present. It is likely that check sources such as the gauges containing Ra-226 may have been used during training. This site is adjacent to and contiguous with SWDA Westside, discussed in [Section 6.1.1.3](#).

**Current Uses** – Multi-family housing

**Potential Radionuclides of Concern** – Ra-226, Cs-137

**Previous Radiological Investigations** – None

**Contamination Potential** – Unlikely

**Contaminated Media**

- Surface Soil – Low
- Subsurface Soil – Low
- Sediment – None
- Surface Water – None
- Groundwater – None
- Air – None
- Structures – Low
- Drainage Systems – Low

### Potential Migration Pathways

Surface Soil – Low  
Subsurface Soil – Low  
Sediment – None  
Surface Water – None  
Groundwater – None  
Air – None  
Structures – Low  
Drainage Systems – Low

**Recommended Actions** – Complete a scoping survey of the subsurface soil and former holding tanks, structures, and ground surface in the USS *Pandemonium* Site I (NW) area and a gamma walkover survey of the roadways and areas not previously subject to gamma walkover surveys.



**Photo 52** Location of former USS *Pandemonium* Site I (NW)

#### 6.1.2.7 Former Storage Area and Sites 30 and 31



**Photo 53 Storage yard area circa 1945**

**Site Description** – The Former Storage Area that includes Sites 30 and 31 is a former open area in AOI 10 ([Figure 10](#)) and shown in [Photo 53](#). The area is composed of two former storage areas north and south of Sites 30 and 31 and the IRP sites that are discussed further below. This area was not identified as radiologically impacted in the HRA. The CSM that applies to this area is discussed in [Section 5.2.1](#). The boundaries for the area are based on the historical extent of storage area according to a review of aerial photographs.

**Storage Area North of Site 31.** This area was bordered by a runway to the north, avenues D and E to the west and east, and Site 31 to the south. The site, appearing as bare soil in a 1942 aerial photo, can be seen being used as a laydown area adjacent to the runway ([Figure 10](#), June 1942 photo). It currently contains elementary school buildings and paved surfaces.

**Site 30.** Currently referred to as the Daycare Center, it is south of the TI Elementary School, at the corner of Avenue D and 11<sup>th</sup> Street. As part of the environmental baseline survey prepared to support leasing the daycare center, the Navy reviewed a 1989 as-built drawing of the water lines in the area. The drawing noted the comment “buried trash” along 11<sup>th</sup> Street. In 2002, a series of investigations identified various types of wastes (including buried burned debris associated with historical practices) that contained lead at concentrations exceeding the site soil screening level. Based on these findings, the Navy completed a time-critical removal action in July 2002. Additional burned debris was found, and analytical results for soil samples showed the presence of dioxins, lead,



arsenic, and vanadium. The Navy continued to investigate the area to delineate the extent of the burned debris and dioxin contamination. Some of the soil containing burned debris was not accessible and could not be removed. In January 2003, the Navy installed a 6-inch concrete pad adjacent to the daycare center to cover the 1,400-square-foot area around and between the locations that contain elevated concentrations of dioxin in the subsurface soil. The concrete pad is a protective barrier to prevent contact with the soil.

**Site 31.** The formerly asphalt-covered playground south of the TI Elementary School is referred to as the former South Storage Yard and is at the corner of Avenue E and 13<sup>th</sup> Street. In 2002, the Navy investigated the area because of its former use as a storage yard and because of the reference to an “old trash dump” noted on a 1989 as-built drawing for the 11<sup>th</sup> Street water line replacement project. An initial investigation found construction and burned debris. The initial investigation of the soil found lead, PCBs, and dichlorodiphenyltrichloroethane with concentrations above the site soil screening levels. These chemicals may have been associated with fuel leaks or other releases from items that were stored in the former storage yard area. The site was designated as a CERCLA site in September 2003. The ROD was finalized on August 5, 2009. A final soil remediation work plan was submitted on January 28, 2010, and the soil remediation field work (referred to as Phase I) began in February 2010 and continued through July 2010. The Navy prepared another work plan for Phase II soil remediation work in January 2012 after an excavation sidewall was discovered with Ra-226 readings above background. This work plan added Ra-226 as a radioisotope of concern. At the time of this HRASTM, the Navy has finished the soil remediation at Site 31 and the site has been restored and radiologically down posted. The remedial action completion report is being prepared.

**Storage Area South of Site 30.** This area was bordered by Site 30 to the north, avenues D and E to the west and east, and 9<sup>th</sup> street to the south. The site, appearing as bare soil in a 1942 aerial photo, can be seen being used as a laydown area (Figure 10, March 1947 photo). It currently contains a number of bungalows and paved surfaces.

**Former Uses** – Site 30 was undeveloped until the Navy’s former Daycare Center was built in 1985. After NAVSTA TI closed, the TI Daycare Center was leased to the CCSF under a finding of suitability to lease (FOSL) on July 29, 1997. The daycare center opened on March 17, 2003. Site 31 was used during the 1970s as a storage yard; however, the nature of and operations at the storage yard are unknown. In the late 1970s, the area was paved over and developed as a playground for the elementary school. Based on the FOSL and the restrictions it identified, the Navy entered into a lease agreement with the San Francisco Unified School District (SFUSD) on May 13, 1996, for the elementary school and associated playground. The school had originally been constructed by SFUSD in approximately 1968 when the military housing was built and was operated under a previous agreement with the Navy until the 1996 lease agreement.

**Current Uses** – The northern portion of the storage area is currently occupied by the elementary school. Site 30 remains in use as a Daycare Center. Site 31 is currently fenced, is undergoing remediation, and being used as a laydown area associated with the remediation. The southern portion of the former storage area is a parking lot and contains several bungalows and a large paved parking lot.

## **Potential Radionuclides of Concern – Ra-226**

**Previous Radiological Investigations** – The northern and southern portion of the storage area – None; Site 30 – None; Site 31 – NTCRA. During the Phase I removal action, a small volume of soil with elevated radioactivity suggesting the presence of non-naturally occurring Ra-226 was discovered in the sidewall of the Site 31 excavation. Laboratory testing confirmed the presence of Ra-226 at concentrations exceeding the cleanup goal (document forthcoming). The contaminated soil was removed and no LLROs were found in association with the elevated background.

## **Contamination Potential – Likely**

### **Contaminated Media**

- Surface Soil – Low
- Subsurface Soil – Low
- Sediment – None
- Surface Water – None
- Groundwater – None
- Air – None
- Structures – None
- Drainage Systems – None

### **Potential Migration Pathways**

- Surface Soil – Low
- Subsurface Soil – Low
- Sediment – None
- Surface Water – None
- Groundwater – None
- Air – None
- Structures – None
- Drainage Systems – None

**Recommended Actions** – Complete an FSS after remediation is finished.



**Photo 54 Former storage yard location (including Sites 30 and 31)**

#### **6.1.2.8      *Building 342***



**Photo 55 Building 342 area**

**Site Description** – Building 342 was constructed in 1951. It is a single story, slab-on-grade approximately 8,000-square-foot metal building and a fenced yard area alongside of and to the rear (east) of the building ([Photo 55](#)). This area was not identified as radiologically impacted in the HRA. The 1972 license description states that “Building 342 houses two labs belonging to RADIAC Maintenance School and one lab

that belongs to Underway Replenishment School. Lab #1 is not in use. Lab #2 contains RADIAC storage spaces, a workshop and a counting lab. Lab #3 contains equipment for demonstrating underway replenishment [sic] techniques.” The HRA designated 342 as non-impacted because, as stated in the HRA, nothing but sealed sources was used inside and outside of the building and in the fenced yard area. However, classifying the site as radiologically impacted is warranted because the license says there was a counting room (Navy 1972) and because of the possibility that unlicensed sources may have been used in training by the Navy. The boundaries for the site are based on impacting the entire interior of Building 342 and the associated fenced yard area surrounding the eastern ends of Buildings 342 and 344, [Photo 41](#).

**Former Uses** – RADIAC instruction, counting, and RADIAC calibration.

**Current Uses** – None, unoccupied

**Potential Radionuclides of Concern** – Ra-226, Cs-137

**Previous Radiological Investigations** – None

**Contamination Potential** – Low

**Contaminated Media**

- Surface Soil – Low
- Subsurface Soil – Low
- Sediment – None
- Surface Water – None
- Groundwater – None
- Air – None
- Structures – Low
- Drainage Systems – Low

**Potential Migration Pathways**

- Surface Soil – Low
- Subsurface Soil – Low
- Sediment – None
- Surface Water – None
- Groundwater – None
- Air – None
- Structures – None
- Drainage Systems – Low

**Recommended Actions** – Do a scoping and an FSS of the structure, and a scoping survey of the sanitary sewer line that services the building out to the nearest sump.

#### 6.1.2.9 Former Supply Department Salvage Yard (Lot 69)



**Photo 56 Location of Former Salvage Yard (Lot 69)**

**Site Description** – As noted in [Section 2.2](#), sometime between 1962 and 1968, a Supply Department Salvage Yard was established east of the tennis courts (see above [Photo 56](#) and [Figure 6](#)). By 1996, this salvage yard area was referred to as Lot 69 and was listed as a Hazardous Waste Accumulation Area in the Spill Prevention Control and Countermeasures Plan. The northern, larger part of Lot 69 was the nonhazardous storage or staging area for furniture and nonhazardous tools waiting to be disposed of by the DRMO. South of the lot is a transfer station for solid waste. A general inventory of waste stored in the hazardous waste accumulation area consisted of waste oils, flammables, corrosives, and other regulated materials such as rags, latex paints, and empty paint and flammable containers. this HRASTM identifies this salvage yard (Lot 69) as impacted because salvage yards are often linked with the potential for disposal of unregulated LLROs; this conclusion is reached because this area was used as a salvage yard and based on the lack of any other radiological information associated with this site. The CSM for this yard is discussed in [Section 5.2.1](#). The boundaries of the site are based on the existing fence line.

This area was not identified as radiologically impacted in the HRA.

**Former Uses** – Salvage

**Current Uses** – The area is now used as a storage area for nonhazardous materials.

**Potential Radionuclides of Concern** – Ra-226

**Previous Radiological Investigations** – None



**Contamination Potential – Unlikely**

**Contaminated Media**

Surface Soil – Low  
Subsurface Soil – Low  
Sediment – None  
Surface Water – None  
Groundwater – None  
Air – None  
Structures – None  
Drainage Systems – Low

**Potential Migration Pathways**

Surface Soil – Low  
Subsurface Soil – Low  
Sediment – None  
Surface Water – None  
Groundwater – None  
Air – None  
Structures – None  
Drainage Systems – Low

**Recommended Actions** – Perform a scoping survey of the ground surface in the salvage yard area.

#### 6.1.2.10 **Building 461 Area**



**Photo 57 Location of Building 461**

**Site Description** – Building 461 and the area around it was identified in the HRA as a non-impacted site. Building 461 was constructed in 1970 and is part of the Damage Control School complex that included Buildings 462 and 463 and the training ship mockup, USS *Pandemonium*, after it was moved from the northwest corner of NAVSTA TI. The building was used for Damage Control School classrooms, office space, fire training, and storage of RADIAC instruments with attached check sources that were maintained in the building for use during decontamination exercises on the USS *Pandemonium* (Weston Solutions, Inc. 2006). There were no reports of leaking check sources. However, this HRASTM recommends the building and associated area be considered impacted based on the possibility that unlicensed Ra-226 check sources may have been used or stored on site. No intrusive work has been done at the site of Building 461 since the HRA. The CSM for this site is discussed in [Section 5.2.2](#), and the boundaries for site consist of exterior walls for Building 461.

**Former Uses** – Training

**Current Uses** – Leased to TIDA.

**Potential Radionuclides of Concern** – Ra-226

**Previous Radiological Investigations** – None

**Contamination Potential** – Unlikely

### **Contaminated Media**

Surface Soil – Low  
Subsurface Soil – Low  
Sediment – None  
Surface Water – None  
Groundwater – None  
Air – None  
Structures – None  
Drainage Systems – Low

### **Potential Migration Pathways**

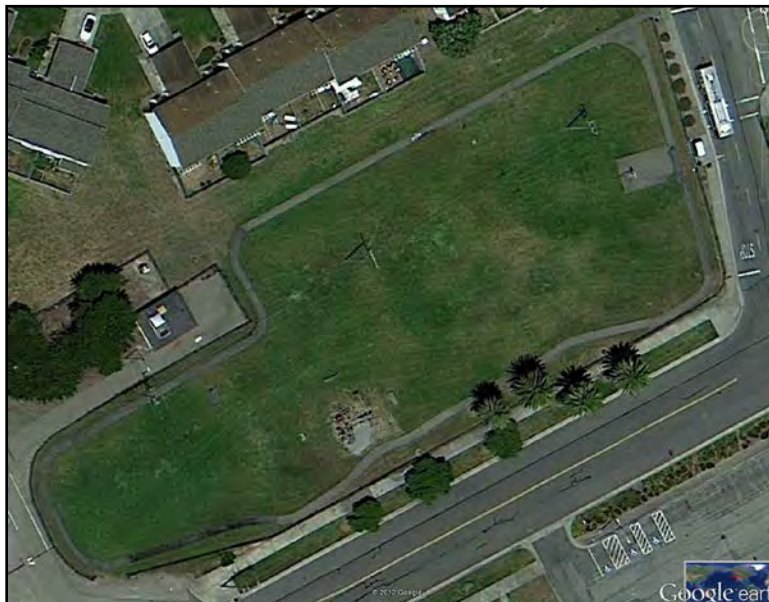
Surface Soil – Low  
Subsurface Soil – Low  
Sediment – None  
Surface Water – None  
Groundwater – None  
Air – None  
Structures – None  
Drainage Systems – Low

**Recommended Actions** – Perform an FSS of Building 461 and the surrounding ground surface.

#### **6.1.2.11 Site 12 Other Radiological Impacted Sites**

This section provides findings and recommendations for sites located within Site 12 (that has now been classified as radiologically impacted) that would otherwise be designated as radiologically impacted in this HRASTM based on site history independent of the potential for LLROs to be present as a result of grading. These sites include the former USS *Pandemonium* Site I (NW) ([Photo 51](#)), an area that is currently a playground that was formerly used as a gyro compass repair shop ([Photo 42](#)), an area formerly associated with debris disposal and referred to as SWDA Bigelow Court ([Photo 59](#)), and two separate non-contiguous areas formerly used as rubbish disposal areas ([Photo 60](#)), and a burn area.

#### 6.1.2.11.1 Gyro Compass Repair Shop and Recreation Field



**Photo 58 Recreation field located at southern end of housing area**

**Site Description** – At the time of the GGIE, a portion of the current park area ([Photo 58](#)) contained Building 168 that was exposition building Palace G (General Motors Building). With the exception of Building 168, no known activities occurred on the recreation field that would have caused it to be designated as radiologically impacted.

After the GGIE, Buildings 304, 305, 306, and 326 were constructed on the current site of the recreation field. All buildings have since been demolished. Buildings 304 and 305 were restrooms, Building 306 was a supply office and storage area, and Building 326 was a storage building and gun shed (Weston Solutions, Inc. 2006). After the Navy occupied the property in 1941, Building 168 was used as a gyro compass repair shop from 1942 to about 1948. During that time, it is likely that materials painted with radioluminescent paint containing Ra-226 were handled. The gyro compass repair shop was subsequently demolished. A Navy sanitary sewer system map reviewed from that period indicates that Building 168 was not serviced by the sanitary sewer system (Navy 1944b) and, therefore, no sinks, drains, or toilets are presumed to have existed in the building. The absence of sinks in the building is further evidence that painting with radioluminescent paint was unlikely in this building. The rest of the site remained open space until it was developed as the recreation area in association with the nearby housing in 1974. Records indicate that the recreation field was likely developed by NAVSTA TI personnel (Navy 1974). At that time, 1.5 inches of topsoil was brought in along with sufficient soil to build a 5-foot-tall soil mound in the area of the current basketball court. This mound, along with several concrete slabs, was apparently removed in 1988 when the basketball court was constructed. This HRASTM identifies the portion of the recreation field associated with elevated gamma readings and the former footprint of the gyro compass repair shop as impacted because CDPH RHB requested this area be designated as impacted based on elevated radiation levels. There also is lack of sufficient radiological information associated with

this site to explain the levels. This area was not identified as radiologically impacted in the 2006 HRA. The CSM for this site is discussed in [Section 5.2.1](#) and the boundaries of the impacted area are consistent with the footprint of the former gyro compass repair shop.

**Former Uses** – GGIE (General Motors Building), gyro compass repair shop

**Current Uses** – Recreation field

**Potential Radionuclides of Concern** – Ra-226, Th-232

**Previous Radiological Investigations** – In 2003, the Navy investigated debris and COCs in soil in the common areas of Site 12, including the 9<sup>th</sup> Street recreation field. The original scoped investigation was done from August 4, 2003, through September 16, 2003, and subsequent step-out investigations were done on October 15 and 16, 2003. The scope of work included excavating 581 exploration trenches, seven step-out trenches, and seven step-out hand auger locations, logging the trenches for debris sampling, and analyzing soil for COCs, backfilling and restoring trench locations, and sampling, profiling, and disposing of IDW. This investigation was not intended to address the potential for radiological isotopes as a COC, but for health and safety reasons, a sodium iodide scintillation detector for measuring gamma radiation was passed over the excavation sidewalls and excavated spoils to measure gamma radiation levels. An action level of two times background was established for imposing additional control measures in the site health and safety plan addendum (Shaw 2003), and no trenches in the recreation field exceeded that limit (Shaw 2005).

In 2011, the CDPH RHB collected radiological soil samples and conducted surveys of the recreation field (CDPH 2012), and in February 2012, the Navy collected soil samples in the recreation field (TestAmerica 2012). Both the CDPH RHB and Navy investigations concluded that additional sampling was warranted based on laboratory analysis indicating elevated levels of Ra-226 and Th-232.

**Contamination Potential** – Unlikely

**Contaminated Media**

- Surface Soil – Low
- Subsurface Soil – Low
- Sediment – None
- Surface Water – None
- Groundwater – None
- Air – None
- Structures – None
- Drainage Systems – Low

**Potential Migration Pathways**

- Surface Soil – Low
- Subsurface Soil – Low
- Sediment – None
- Surface Water – None



Groundwater – None  
Air – None  
Structures – None  
Drainage Systems – Low

**Recommended Actions** – Perform a scoping survey including soil sampling of the ground surface in the impacted area.

#### 6.1.2.11.2 SWDA Bigelow Court Debris Disposal Area



**Photo 59 SWDA Bigelow Court Area**

**Site Description** – SWDA Bigelow Court was identified in the HRA as a non-impacted site. The site is a former storage yard that overlapped both the Halyburton Court and SWDA Bigelow Court area; see [Section 4.1.2.10.2](#). Halyburton Court was the subject of a previous removal action for non-radiological contaminants of concern, and the SWDA Bigelow Court area is the site of a planned future removal action to address concentrations of dioxins, lead, and PAHs that exceed action levels. Because the SWDA Bigelow Court area has been designated as a debris disposal area, it is identified as radiologically impacted in this HRA. The CSM for this site is the same as the surrounding housing area and is discussed in [Section 5.2.1](#). Buildings 1101 and 1103 have been demolished and the Navy has begun excavating areas planned for removal based on non-radiological contamination. The boundaries of the SWDA Bigelow Court Area are based on the prior excavations for chemical contamination conducted in this area.

**Former Uses** – Storage Yard

**Current Uses** – Housing, leased to TIDA

**Potential Radionuclides of Concern** – Ra-226

**Previous Radiological Investigations** – None

## **Contamination Potential – Likely**

### **Contaminated Media**

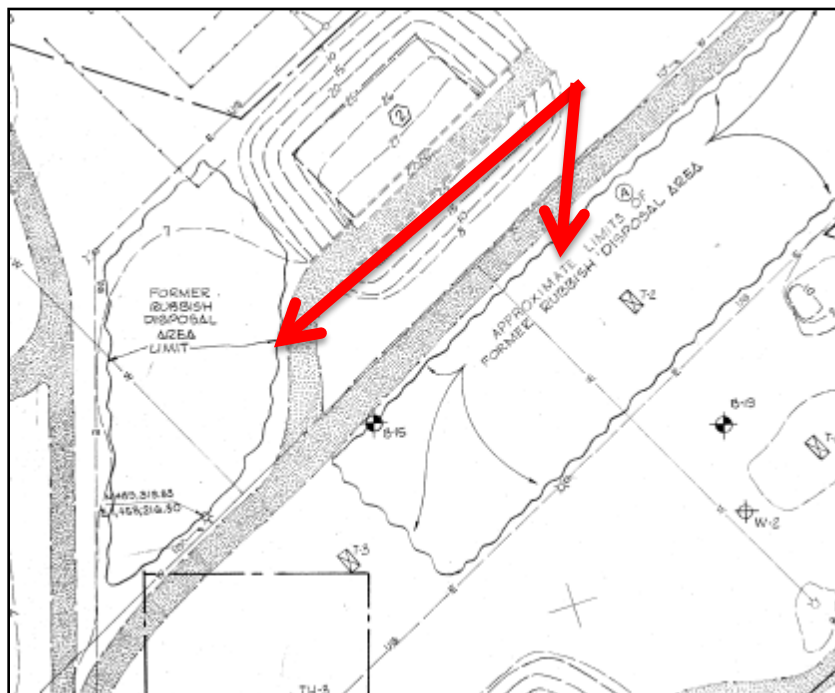
Surface Soil – Medium  
Subsurface Soil – Medium  
Sediment – None  
Surface Water – Low  
Groundwater – Low  
Air – None  
Structures – None  
Drainage Systems – Low

### **Potential Migration Pathways**

Surface Soil – Medium  
Subsurface Soil – Medium  
Sediment – None  
Surface Water – None  
Groundwater – None  
Air – Low  
Structures – None  
Drainage Systems – Low

**Recommended Actions** – Do radiological monitoring of future removal action and a FSS of the ground surface of the excavation.

### 6.1.2.11.3 Two Rubbish Disposal Areas and a Former Burn Area



**Photo 60 Two rubbish disposal areas**

**Site Description** – Two non-contiguous “Rubbish Disposal Areas” and a separate “Burn Area” were identified during research associated with this HRASTM. Exploratory trenches exposed loose rubbish buried approximately 4 feet below grade (McCreary, Koretsky Engineers 1965; Navy 1965). These rubbish disposal areas and the burn areas are shown as radiologically impacted areas on [Figure 9](#). The recommendation of the geotechnical report was to remove the rubbish to an elevation of not higher than  $\pm 2$  feet project datum, mix the rubbish with clean sand, and compact the mixture by tamping with heavy equipment. These areas have been identified as radiologically impacted based on the correlation between rubbish disposal, burning, and LLROs found at other similar sites on TI. In addition to the rubbish disposal areas, the TI housing area contained a historical burn area ([Figure 9](#)) discussed above in [Section 2.2.7](#). This historical burn area contained wood burn debris near the surface adjacent to Building 1203 (see the trench log for trench 1203A-1; Shaw 2004). The CSM for these areas is discussed in [Section 5.2.1](#), and the boundaries are based on the historical geotechnical reports.

**Former Uses** – Rubbish disposal

**Current Uses** – Housing, leased to TIDA

**Potential Radionuclides of Concern** – Ra-226

**Previous Radiological Investigations** – None

**Contamination Potential** – Likely

### **Contaminated Media**

Surface Soil – Low  
Subsurface Soil – Moderate  
Sediment – None  
Surface Water – Low  
Groundwater – Low  
Air – None  
Structures – None  
Drainage Systems – Low

### **Potential Migration Pathways**

Surface Soil – Low  
Subsurface Soil – Low  
Sediment – None  
Surface Water – None  
Groundwater – Low  
Air – Low  
Structures – None  
Drainage Systems – Low

**Recommended Actions** – Perform radiological monitoring of future removal action and a scoping survey of the ground surface and subsurface soils.

## **6.2 FINDING OF SUITABILITY TO TRANSFER AREAS**

The purpose of a finding of suitability to transfer (FOST) is to identify property that is environmentally suitable for transfer and to identify any specific notices, restrictions, or covenants that are required. All areas of NAVSTA TI subject to the prior HRA and this HRASTM are suitable for transfer with respect to potential impacts on human health and the environment from exposure to radiological contamination, provided (1) they have not been designated as radiologically impacted in either of these documents, and (2) they are clear of other CERCLA issues that would prevent transfer. Only Buildings 343 and 344 have reached regulatory closure for radiological concerns, as they have been released for unrestricted use (DTSC 2009). Therefore, these “radiologically impacted” buildings are suitable for transfer. No radiological related notices, restrictions, or covenants are required for the FOST areas.

No further action is necessary to address the potential for radiological contamination at areas on TI that are (1) not designated as radiologically impacted, or (2) designated as non-impacted in both the HRA and this HRASTM. The probability that contamination would pose an unacceptable human health risk is minimal and no evidence has been found to warrant further investigation of those areas in areas that are not designated as radiologically impacted or are designated as non-impacted.

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