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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Prepared under:
Naval Facilities Engineering Command
Contract Number N62473-11-D-2205
Delivery Order 0038

TRIE-2205-0038-0158

Final

Historical Radiological Assessment – Supplemental Technical Memorandum
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San Francisco, California

Contract Number N62473-11-D-2205

PREPARED FOR:

DEPARTMENT OF THE NAVY

REVIEW AND APPROVAL

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

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^2	Square meter
MARSSIM	Multi-Agency Radiation Survey and Site Investigation Manual

ACRONYMS AND ABBREVIATIONS (CONTINUED)

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.	*United States Code*
UST	Underground storage tank
VSP	Visual Sample Plan
WWII	World War II
YBI	Yerba Buena Island

EXECUTIVE SUMMARY

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. T he 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. R esearch 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, 12th 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.

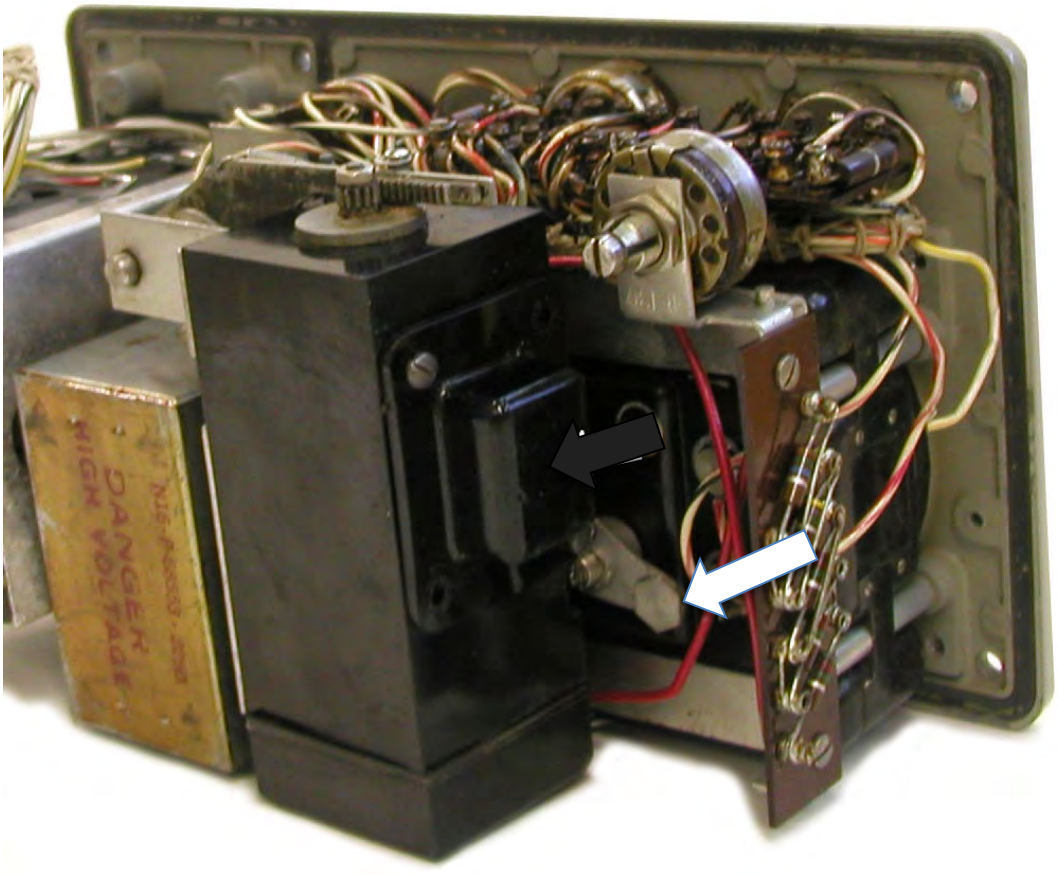


Photo 2 Hexagonal check source in AN/PDR-18A – white arrow

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

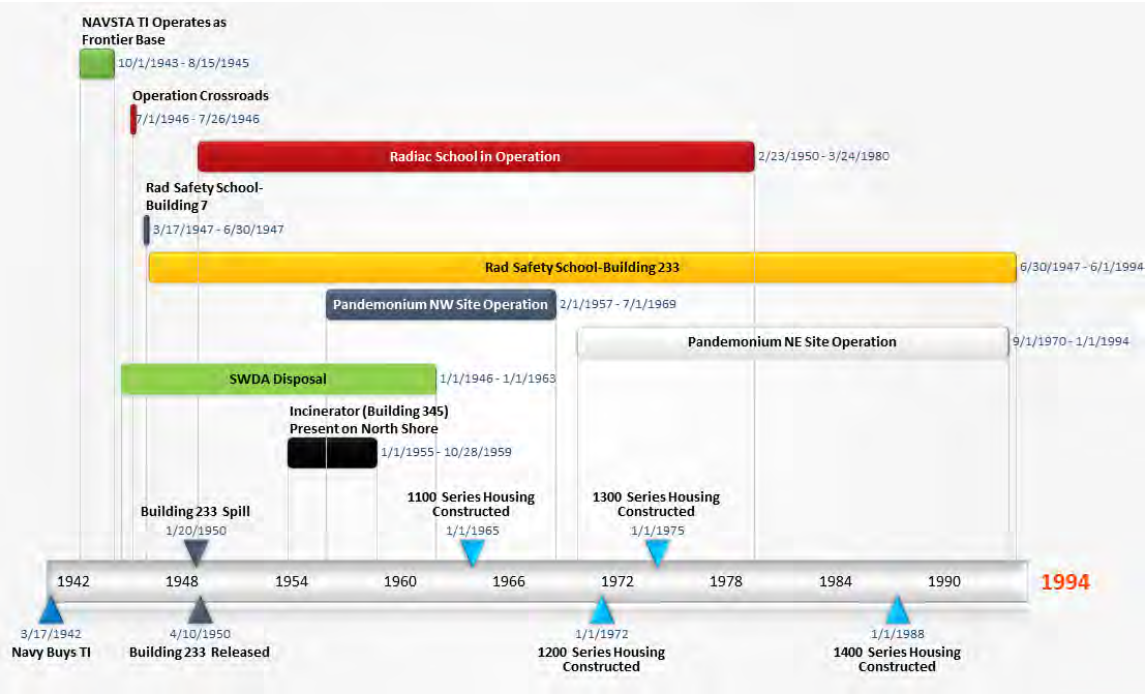
Commandant Twelfth Naval District and the Commander; Western Sea Frontier; the Navy Regional Naval Schools Command; the Navy Regional Finance Center; and the Naval Training Center.

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 2nd 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.

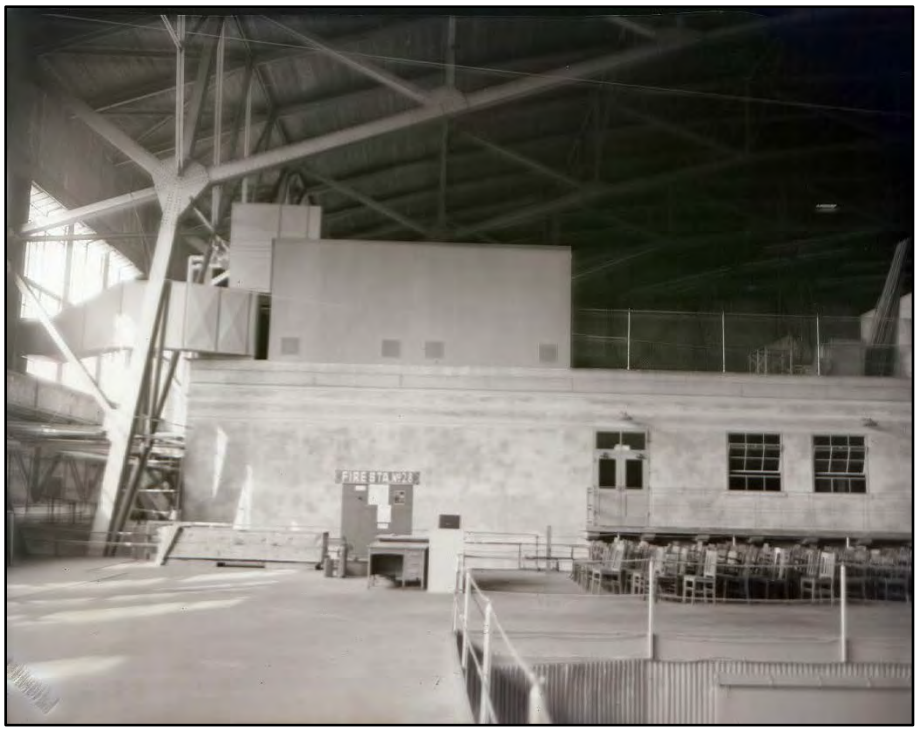


Photo 3 Interior of Hangar 2, 1953, showing radar building

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

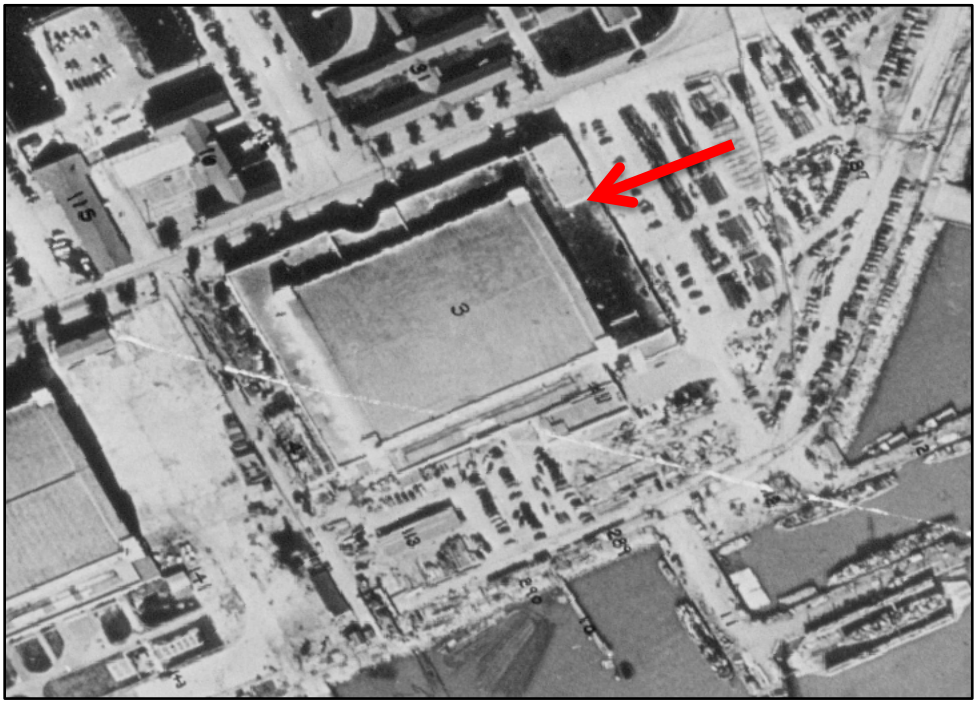


Photo 6 1945 photo showing the presence of the optical shop on the north corner of the Building 3 roof

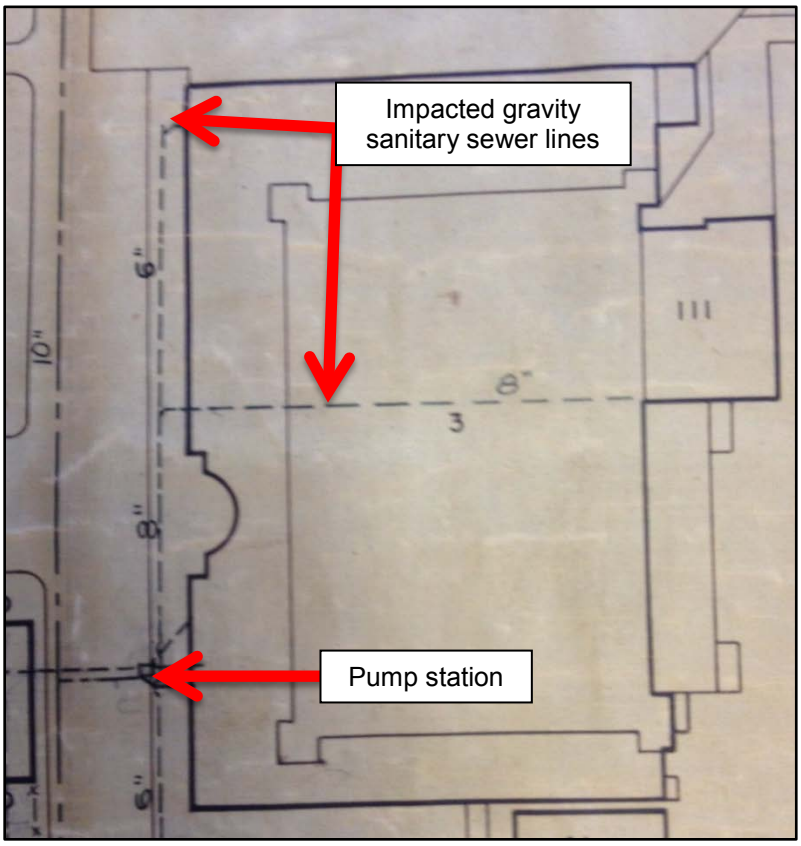


Photo 7 Showing sanitary sewer line in 1946 drawing

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 HRASTM 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.

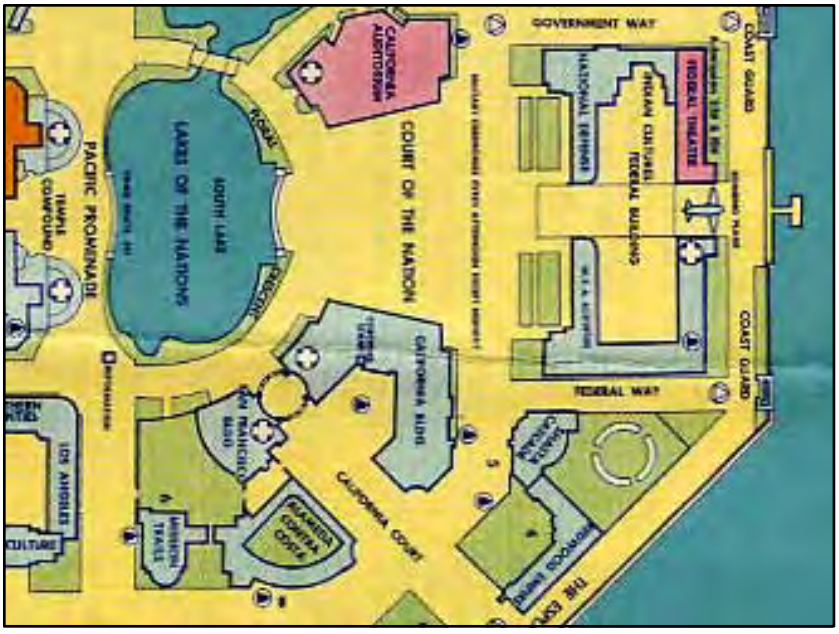


Photo 8 1939 Map of GGIE showing the vicinity of the future hospital area

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 a erial 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. A vailable 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.

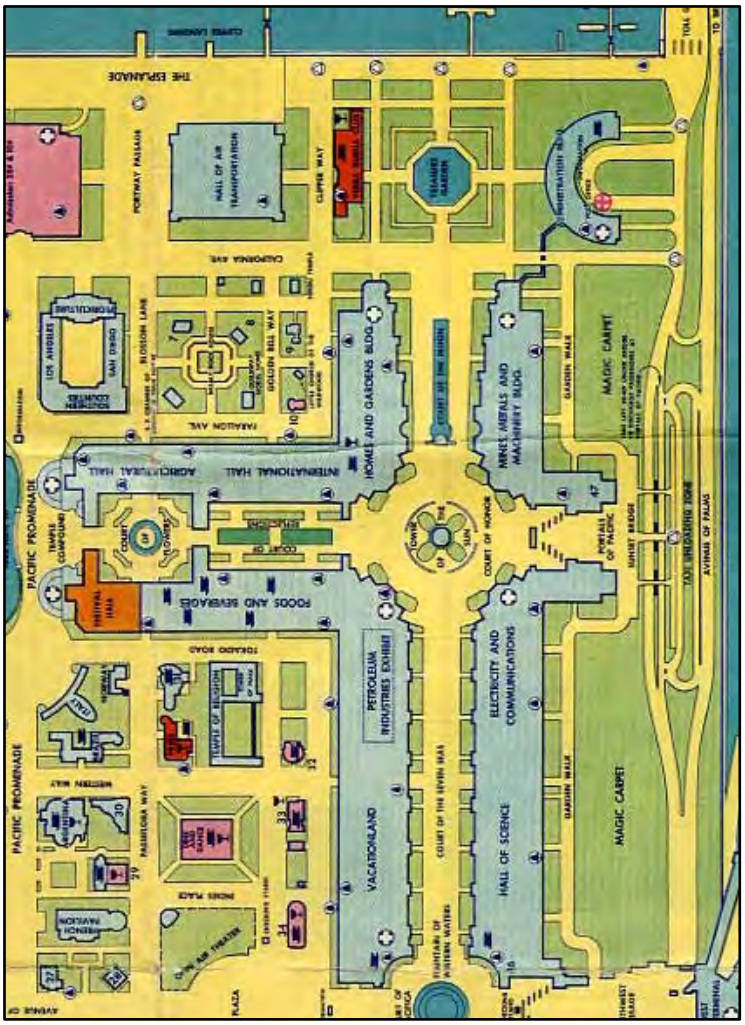


Photo 10 Map showing halls of GGIE

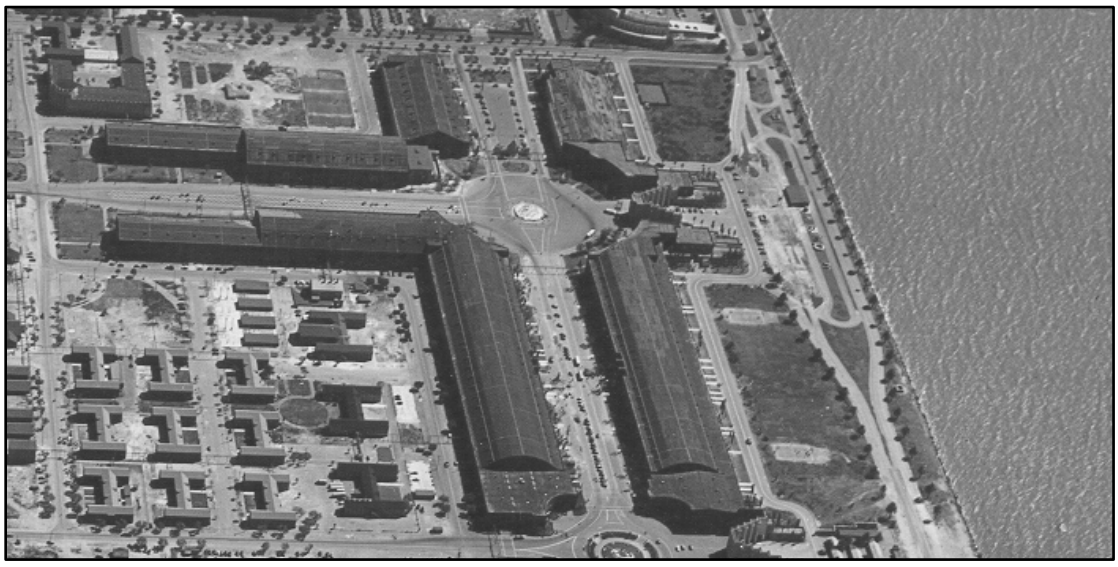


Photo 11 1943 photo of AOI 3

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 HRASTM 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).

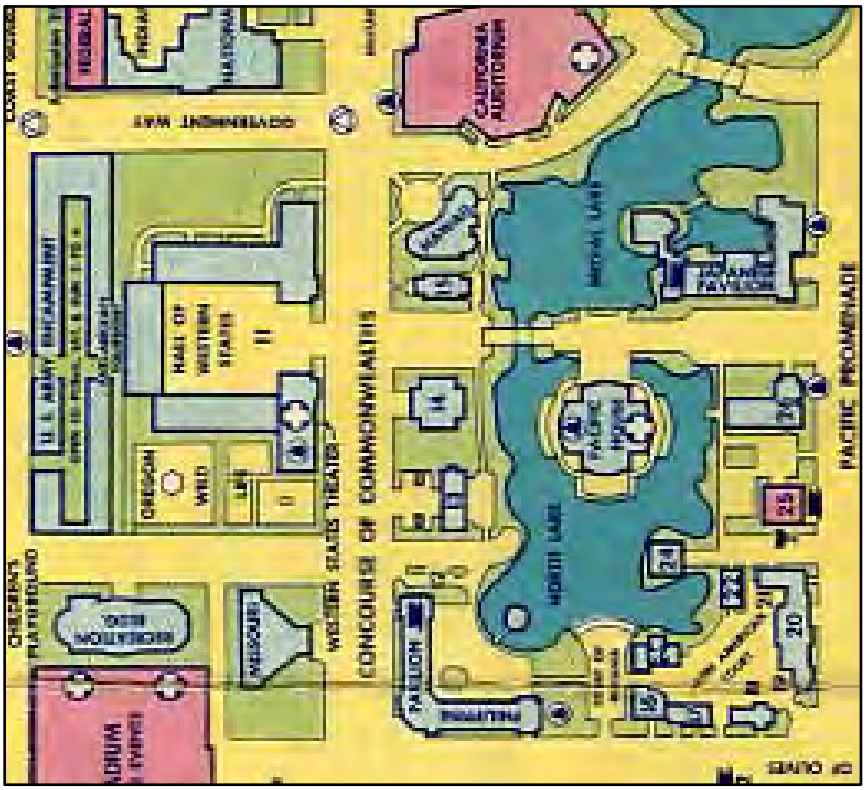


Photo 12 Vicinity of AOI 4 during the GGIE

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.

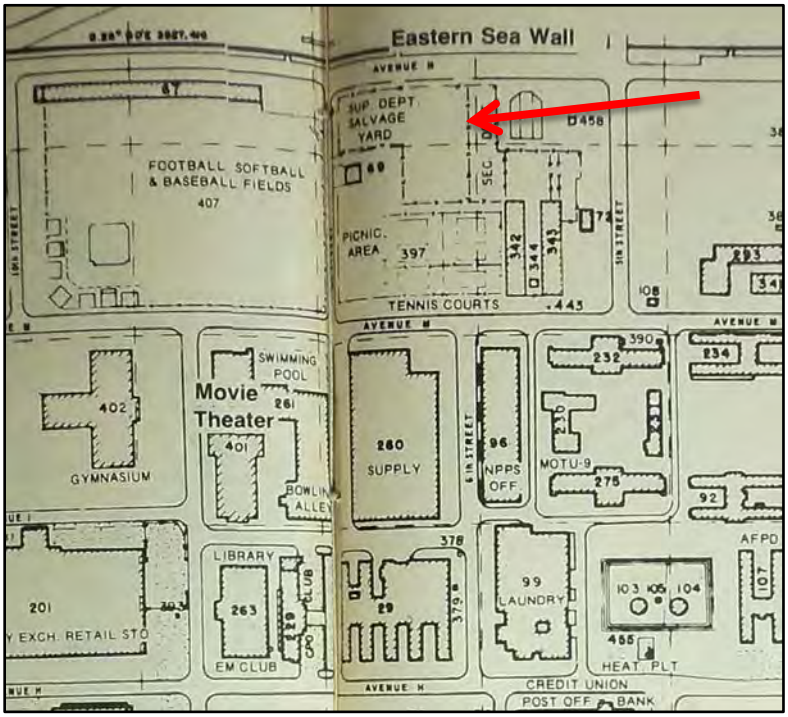


Photo 14 1969 base map showing the Supply Department Salvage Yard

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.

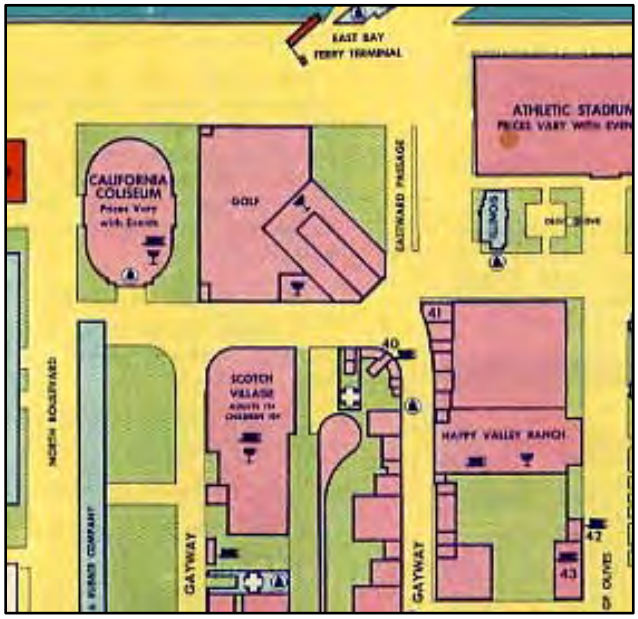


Photo 15 Map of AOI 5 area during the GGIE

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).

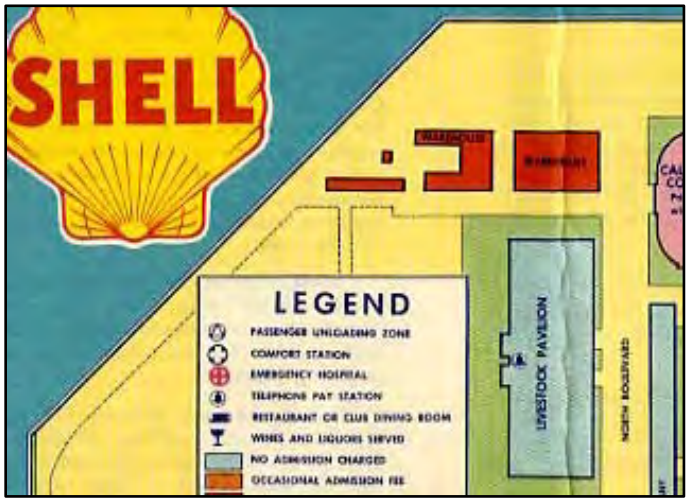


Photo 17 Vicinity of AOI 6 during the GGIE

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

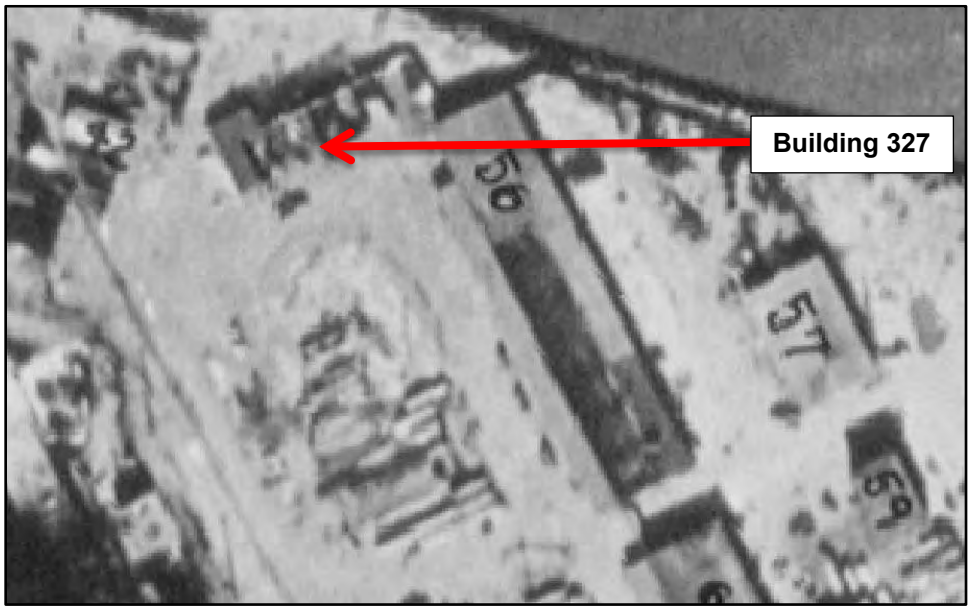


Photo 19 Building 327 and probable salvage yard directly to the south

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 13th 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 12th 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.

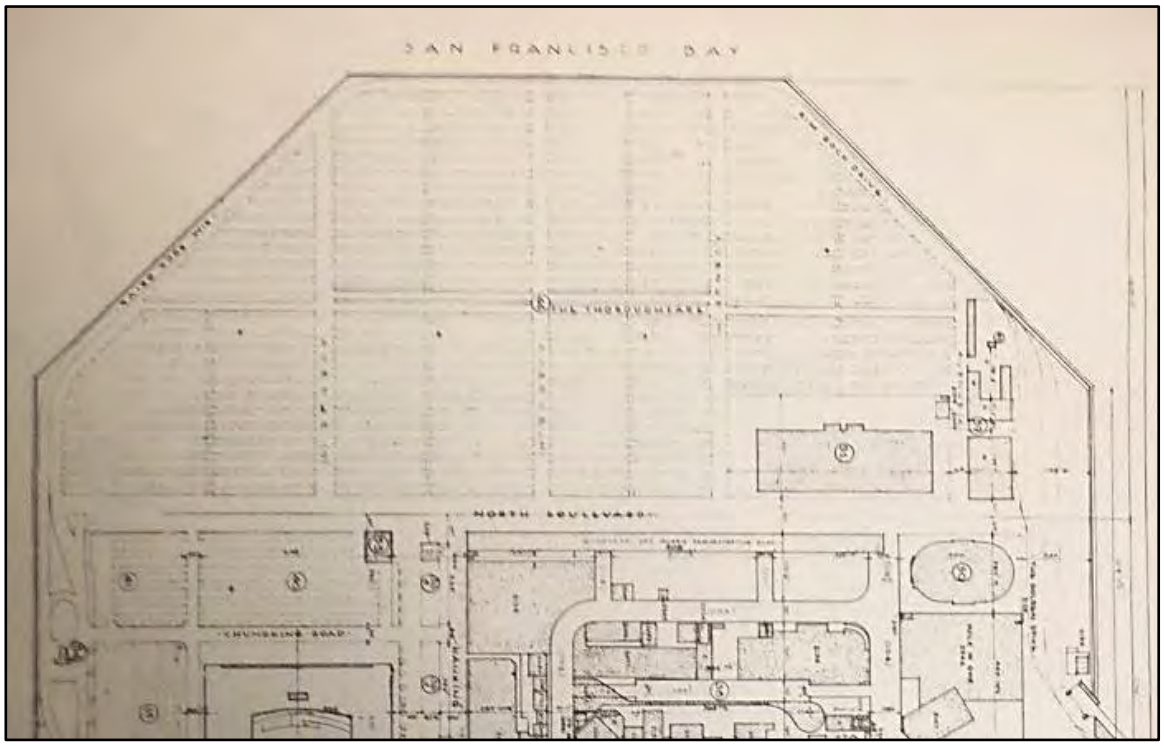


Photo 20 Map of the GGIE showing the parking areas on the north end of TI

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). T he 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.

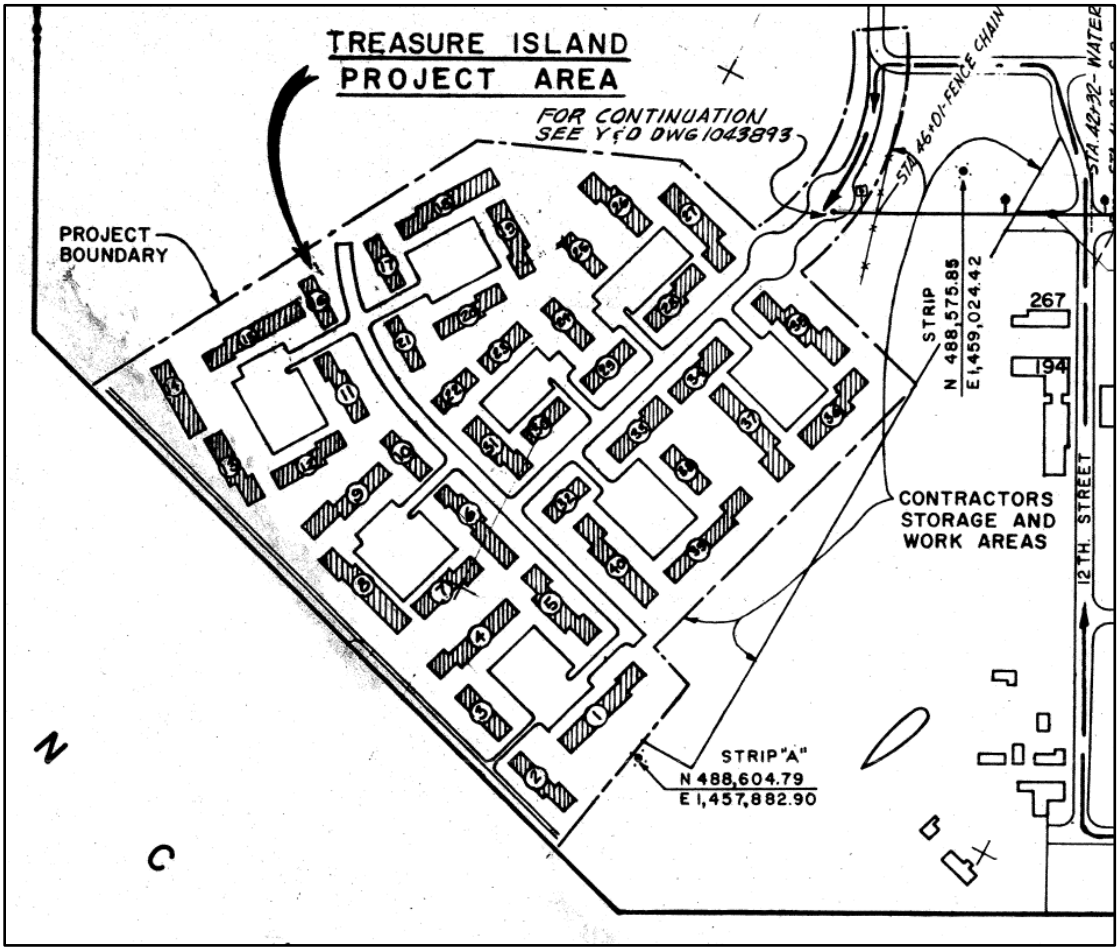


Photo 21 1100 Series housing project boundary and contractors storage and work areas (Navy 1965)

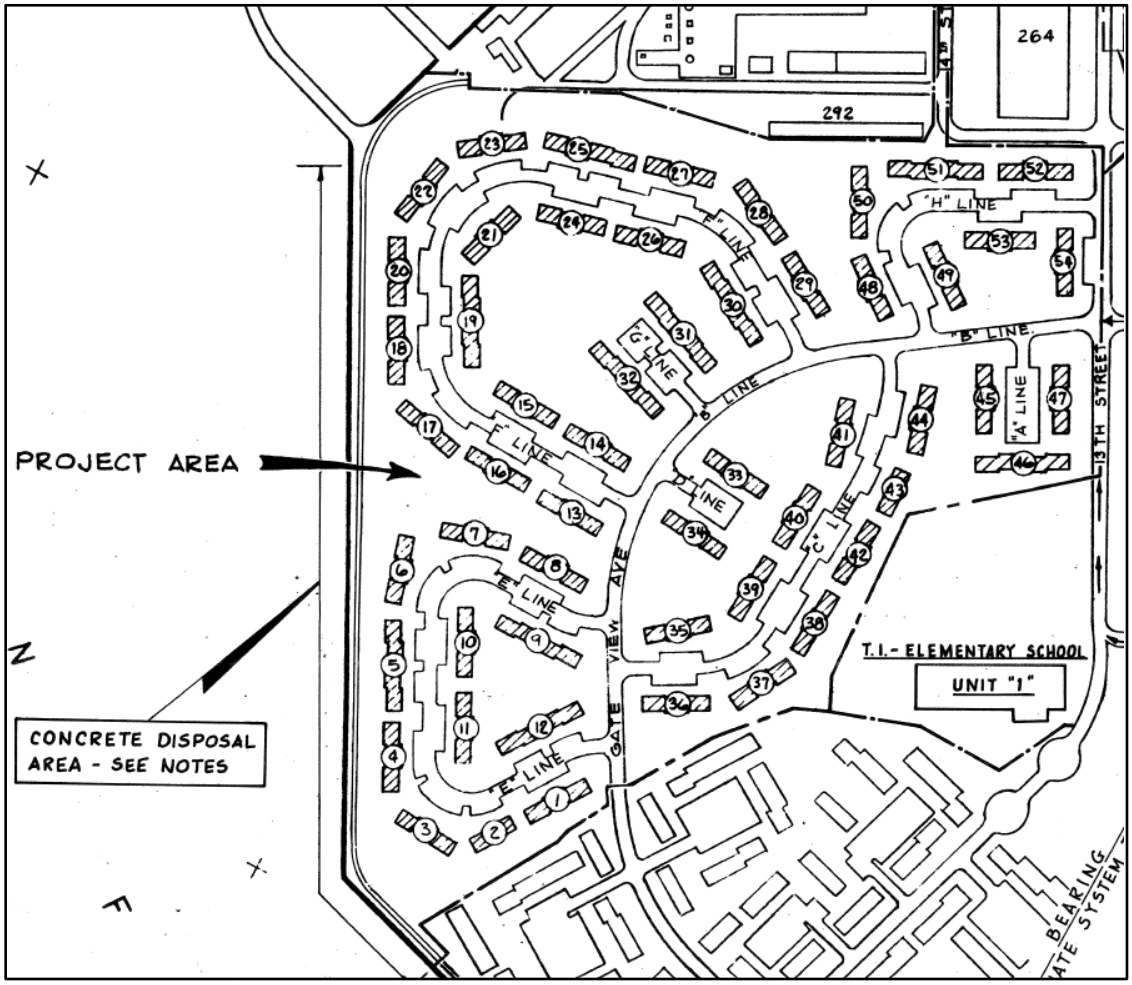


Photo 22 1200 Series housing project boundary (Navy 1968)

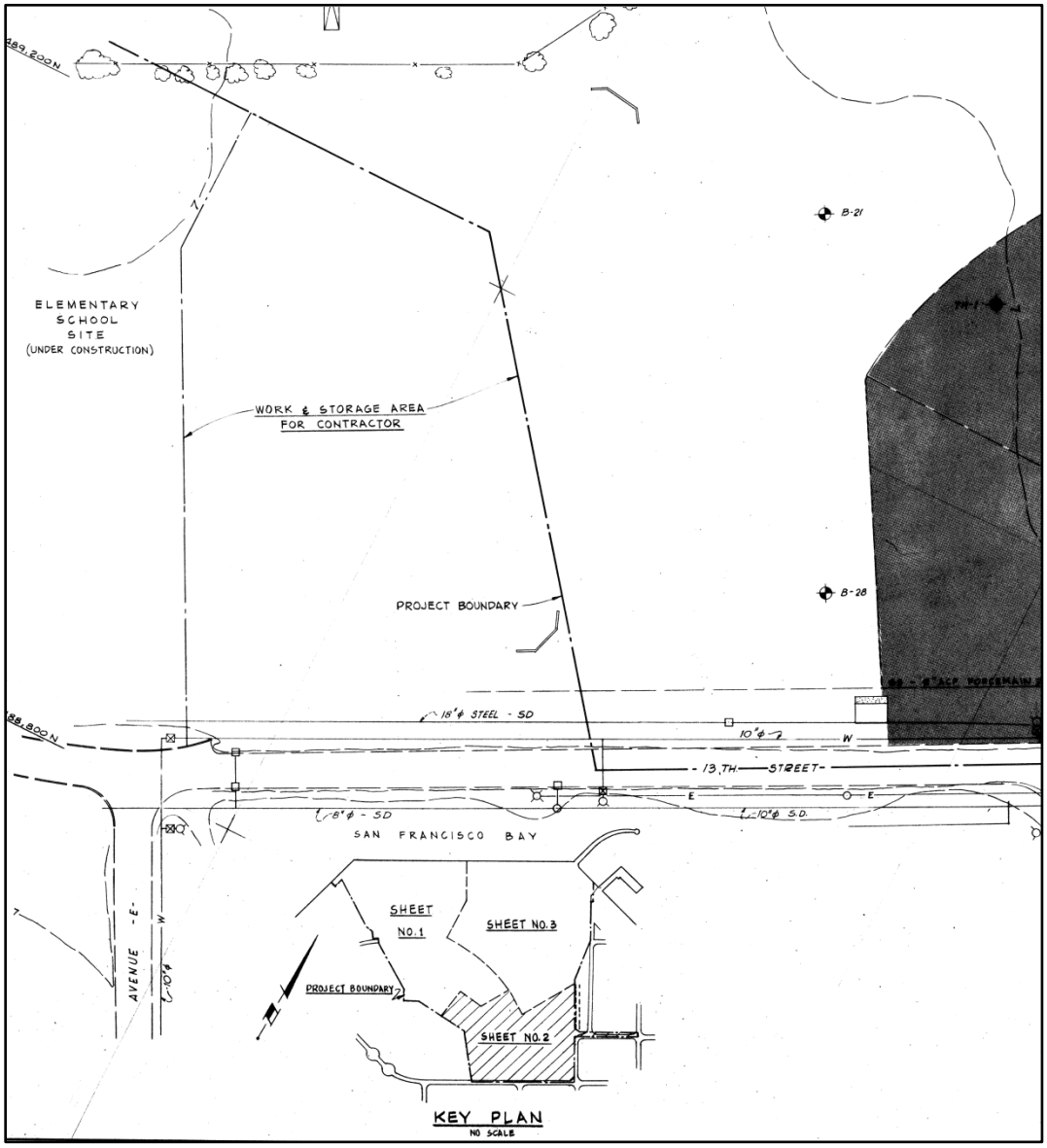


Photo 23 1200 Series housing contractors storage and work areas (Navy 1968)

- **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).

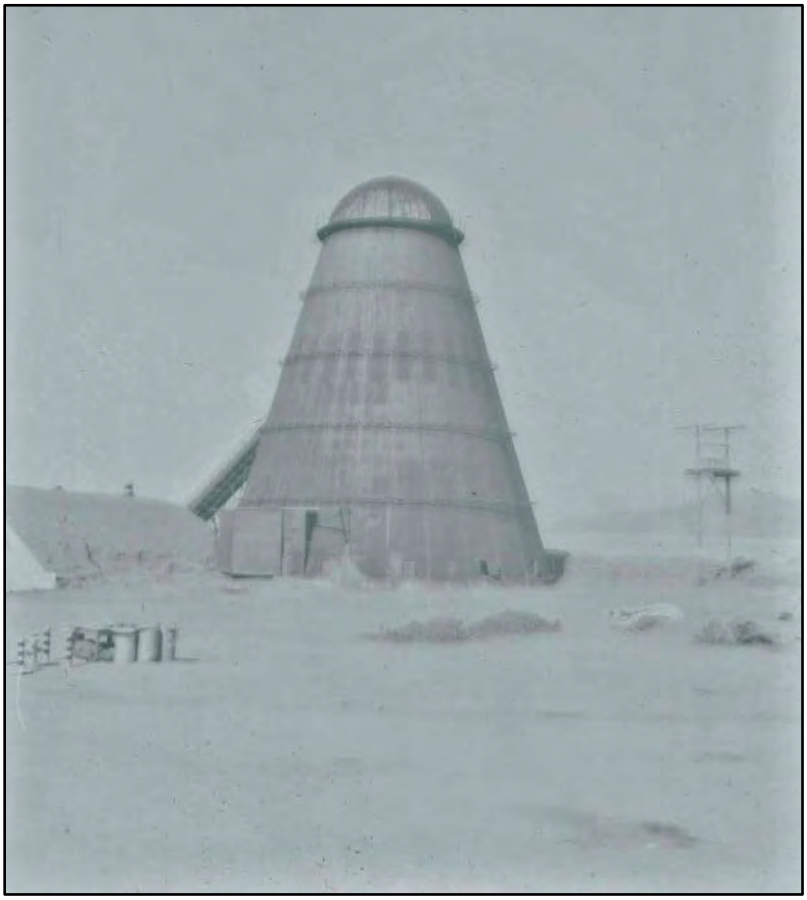


Photo 26 Photograph of incinerator

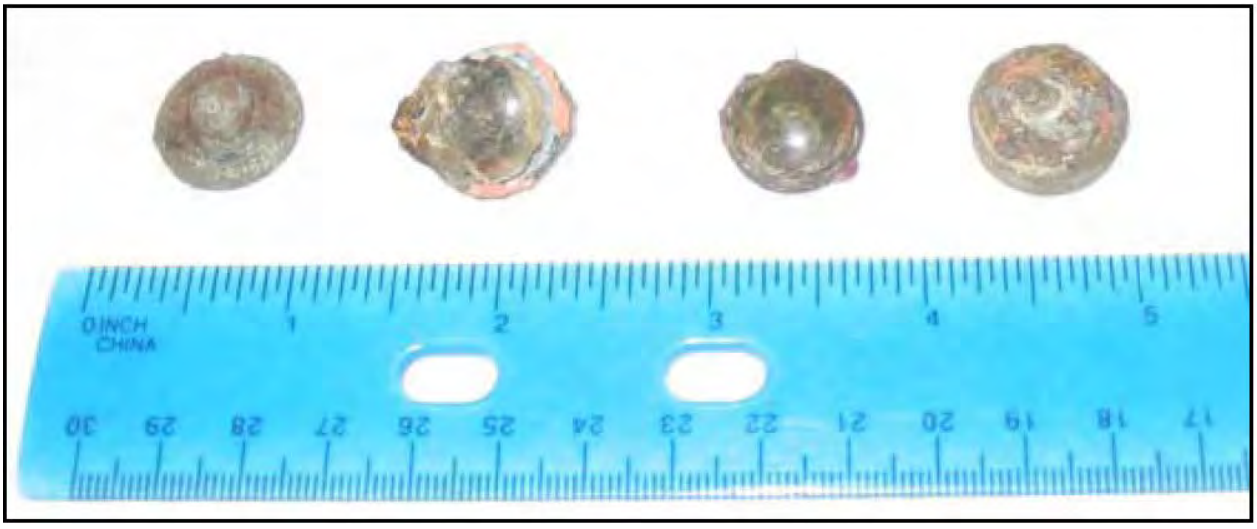


Photo 27 Low-level radiological objects found at SWDAs Bayside and North Point in 2007

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).

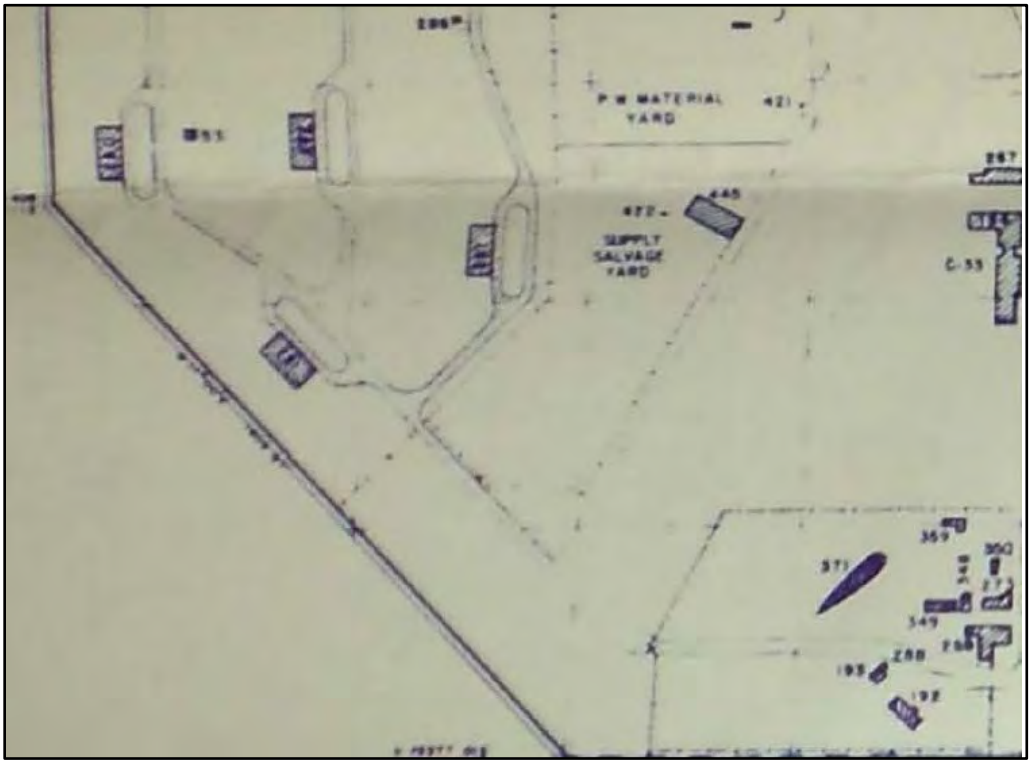


Photo 28 Supply Salvage Yard shown in 1962 base map

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.

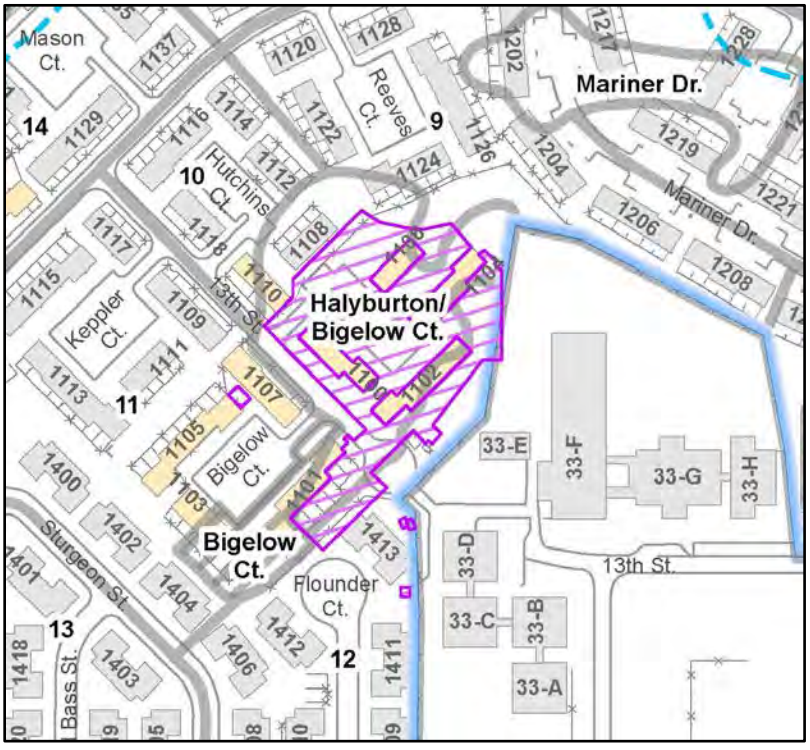


Photo 29 Showing excavated areas at Halyburton and SWDA Bigelow Courts

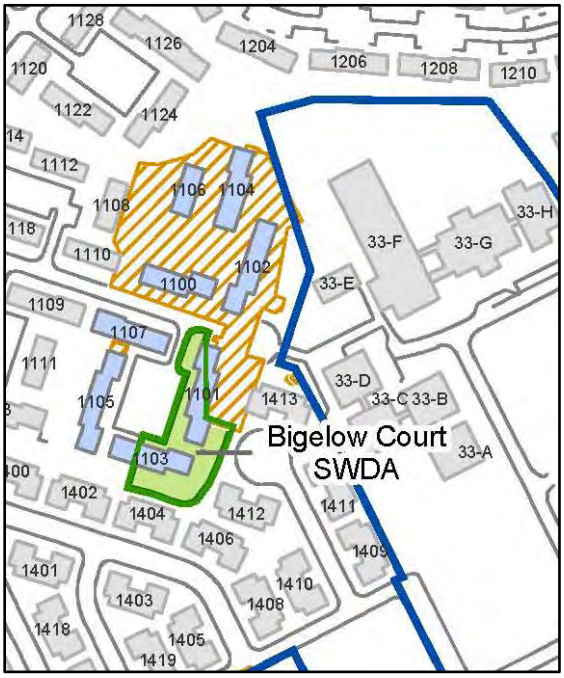


Photo 30 Showing planned excavation area (green) at SWDA Bigelow Court and adjacent to previous Halyburton Court excavation area (gold)

- 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).

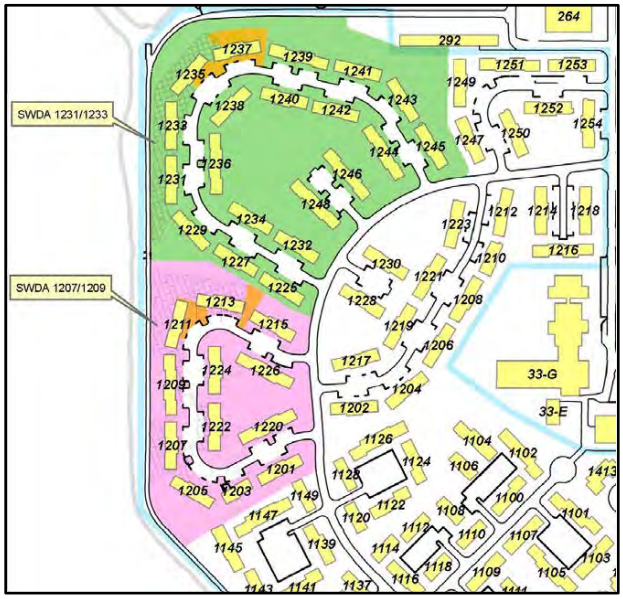


Photo 31 Showing North Point (green) and Bayside (pink) areas subjected to gamma walkover surveys

- 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^2) to 9,325 m^2 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 ± 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.

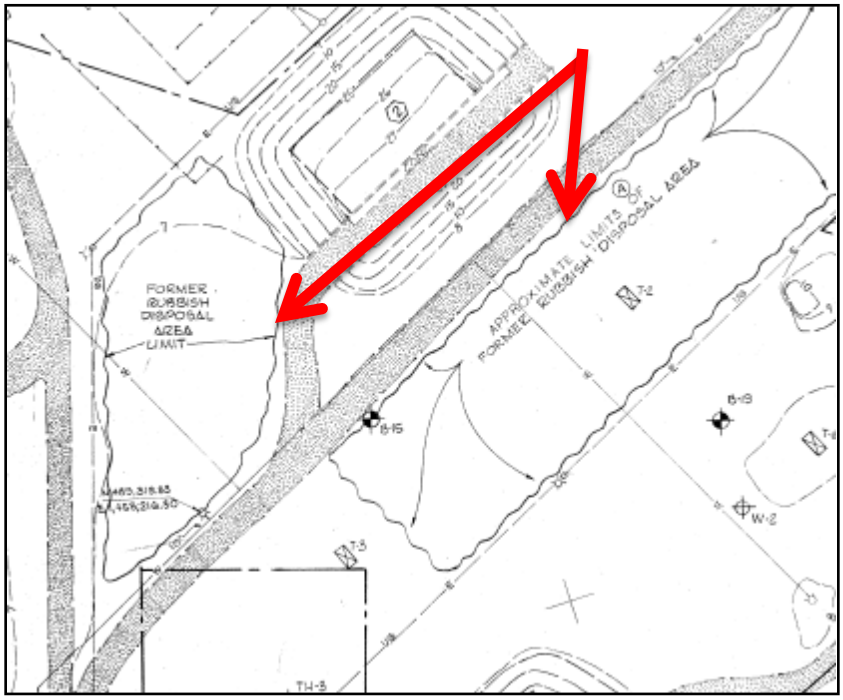


Photo 32 Two rubbish disposal areas
(Note: The lower rubbish disposal area is only partially shown)

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, 9th 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 r adiologically 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. T he 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, a n as-built drawing from 1989 w as discovered indicating that the Navy Public Works Center installed an 8-inch water line down the middle of 11th 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.

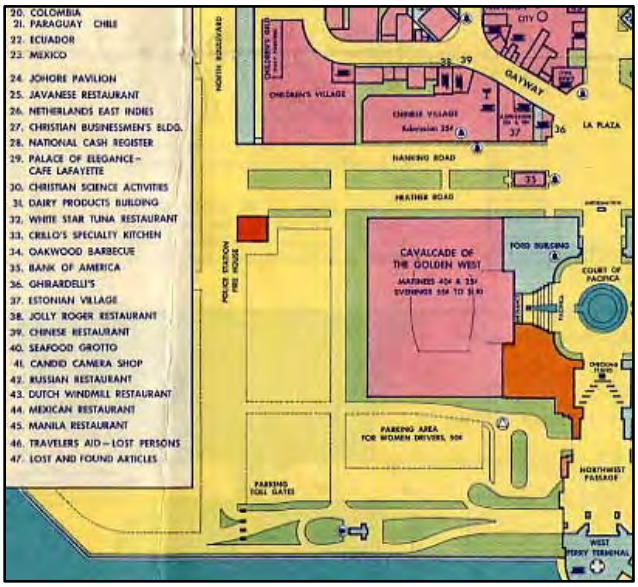


Photo 33 AOI 8 during the GGIE

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.

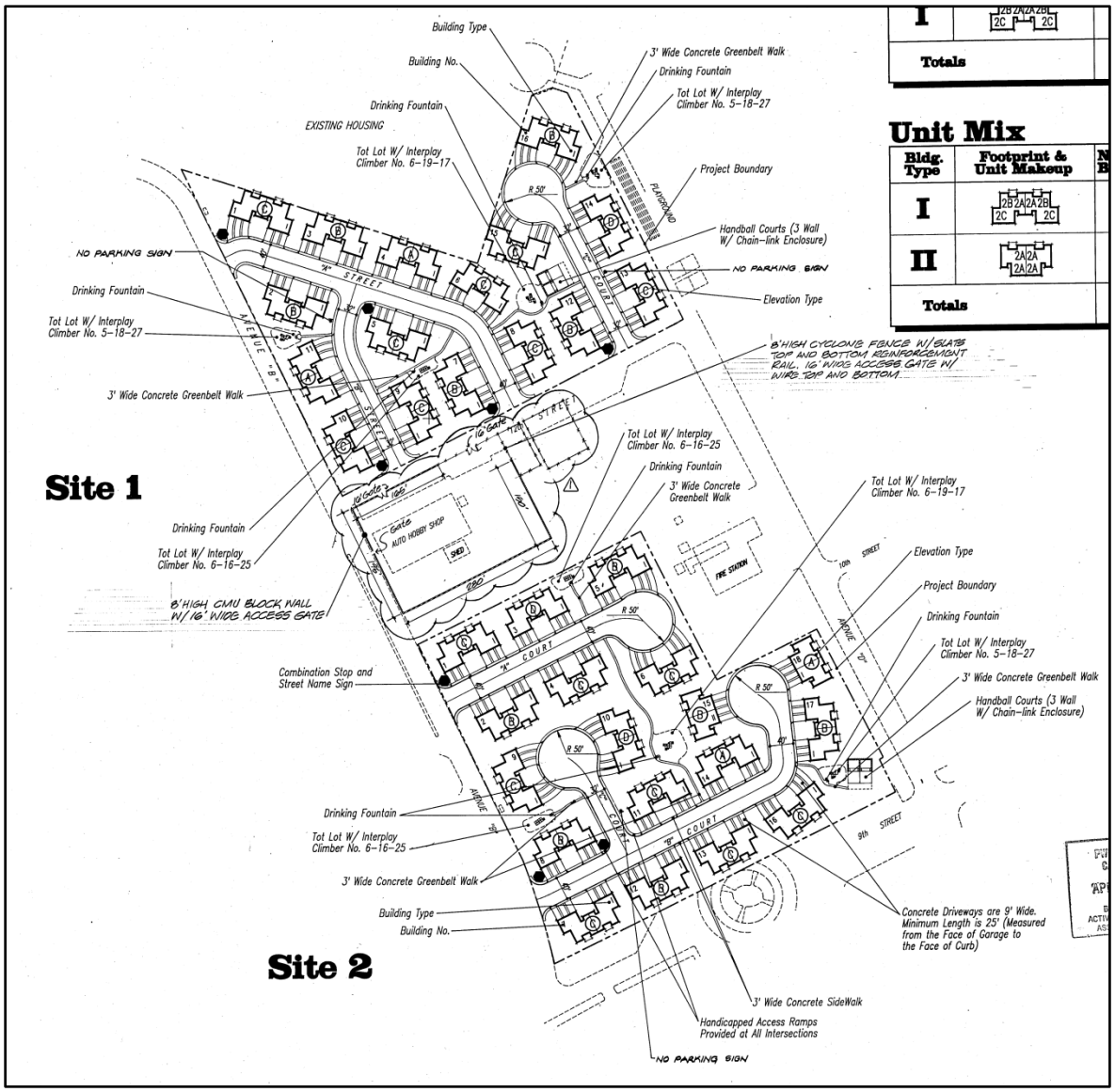


Photo 34 1400 Series project boundaries and fencing/concrete block wall

- 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 HRASTM 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 (µCi) 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 SWDAs 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).

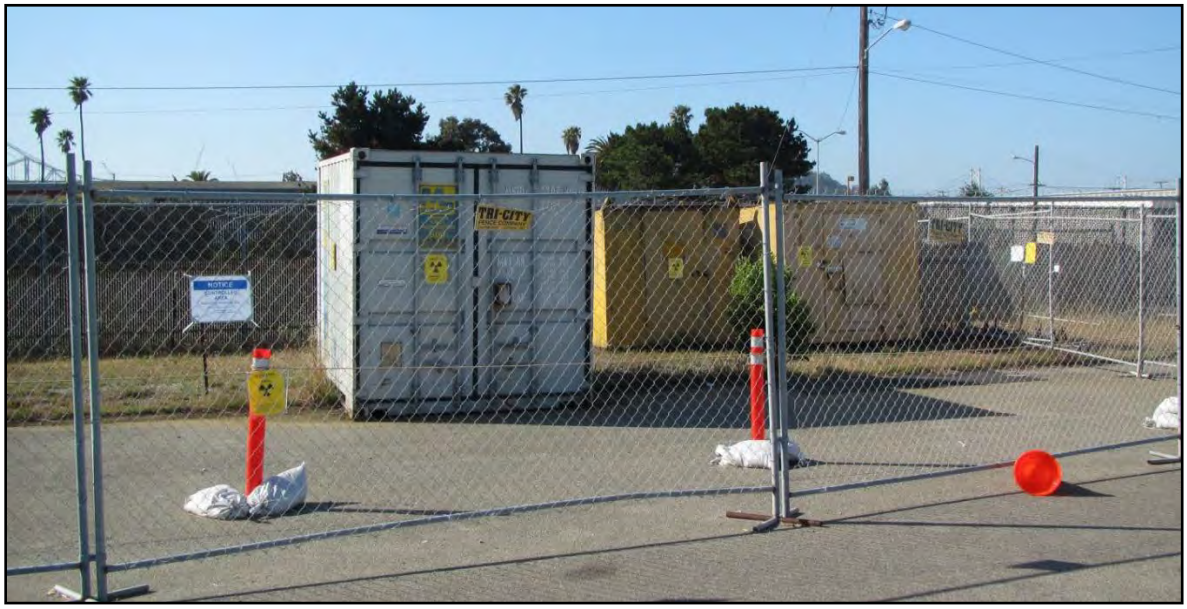


Photo 36 Conex boxes used for storage of LLROs in the Building 570 compound

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). Approximately 790 tons 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).

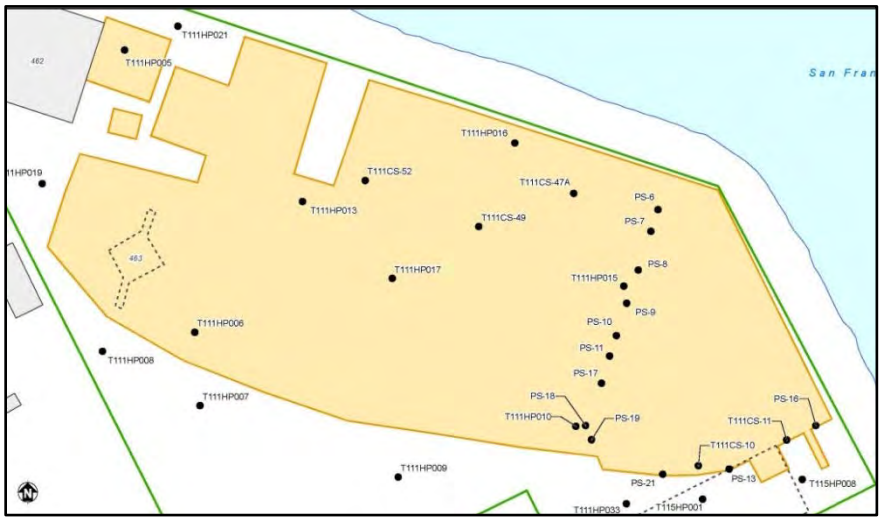


Photo 37 Site 32 excavation footprint (Tan shaded area)

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.

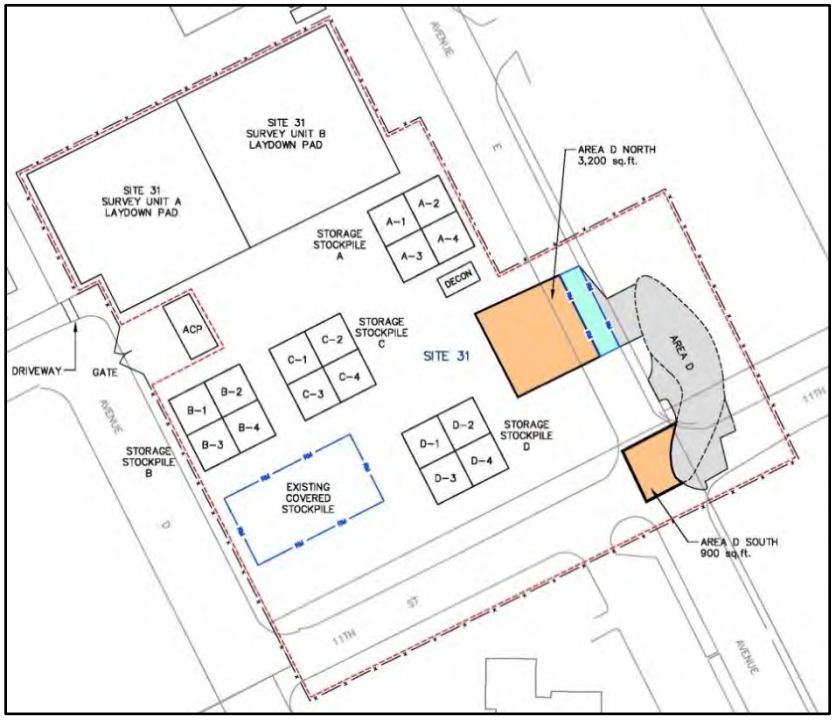


Photo 40 Site 31 Phase II excavation areas (colored portions)

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.

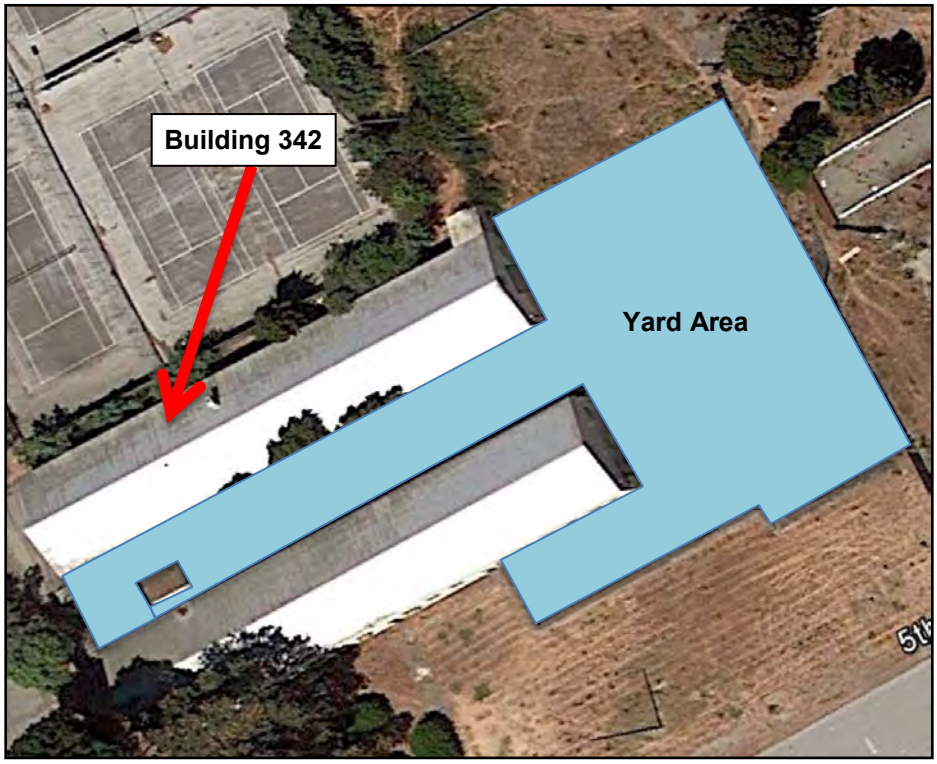


Photo 41 Building 342 and associated yard area

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 ha ve 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 t o 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^2 to 9,325 m^2 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 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.

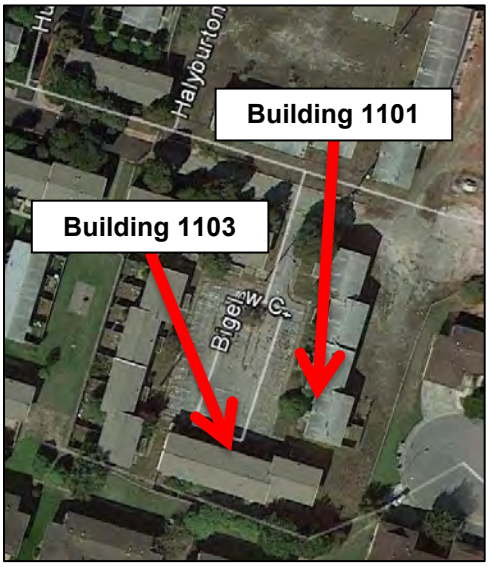


Photo 43 Radiologically impacted area of SWDA Bigelow Court

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 ±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 TI/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. W here 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 HRASTM 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 (4th 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

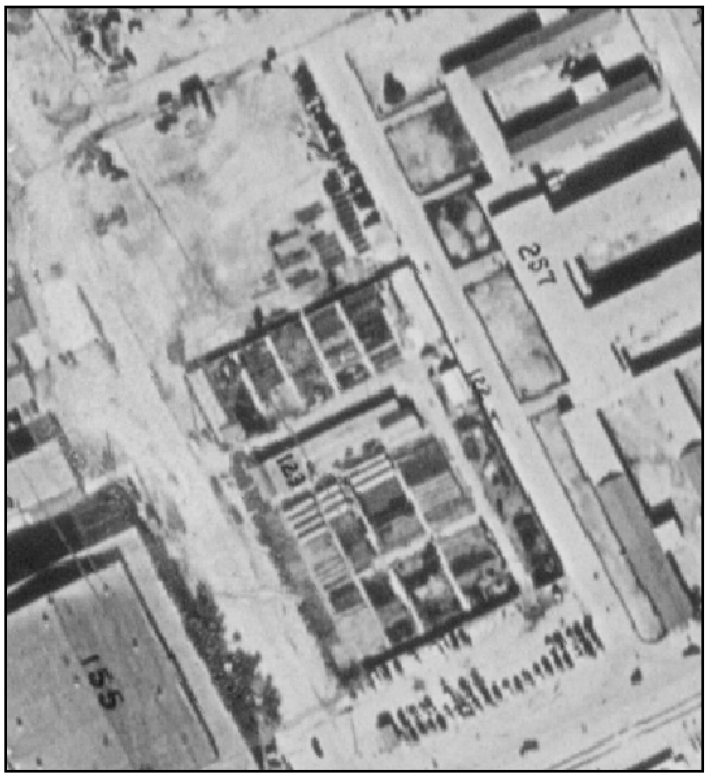


Photo 53 Storage yard area circa 1945

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 11th 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 11th 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 13th 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 11th 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 9th 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

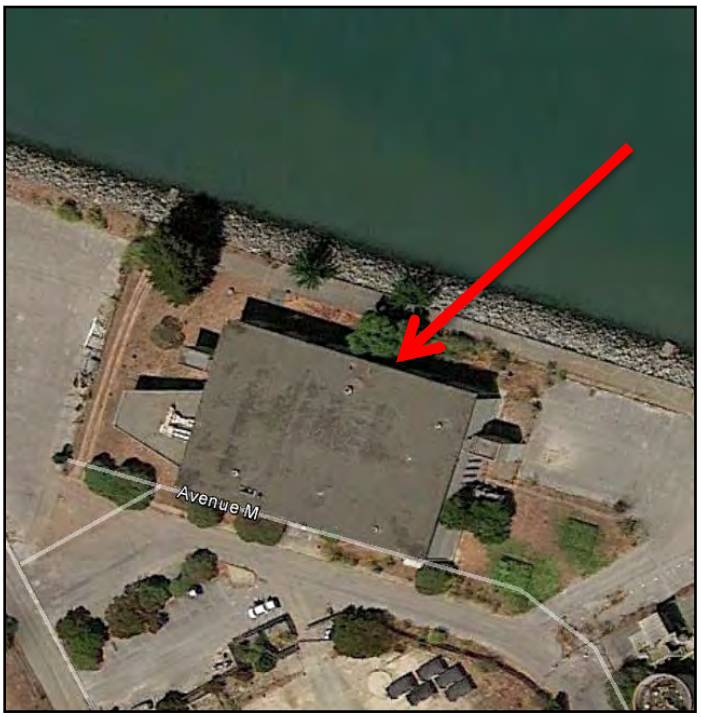


Photo 57 Location of Building 461

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

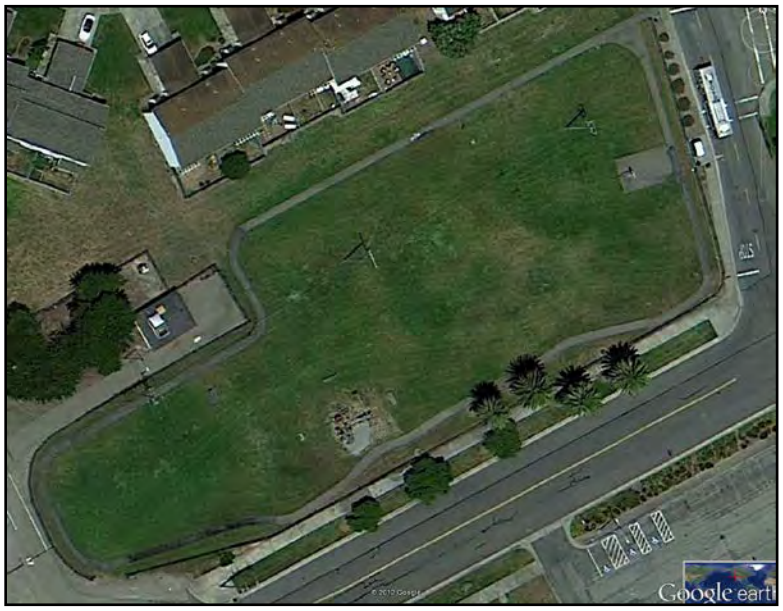


Photo 58 Recreation field located at southern end of housing area

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 9th 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 HRASTM. 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

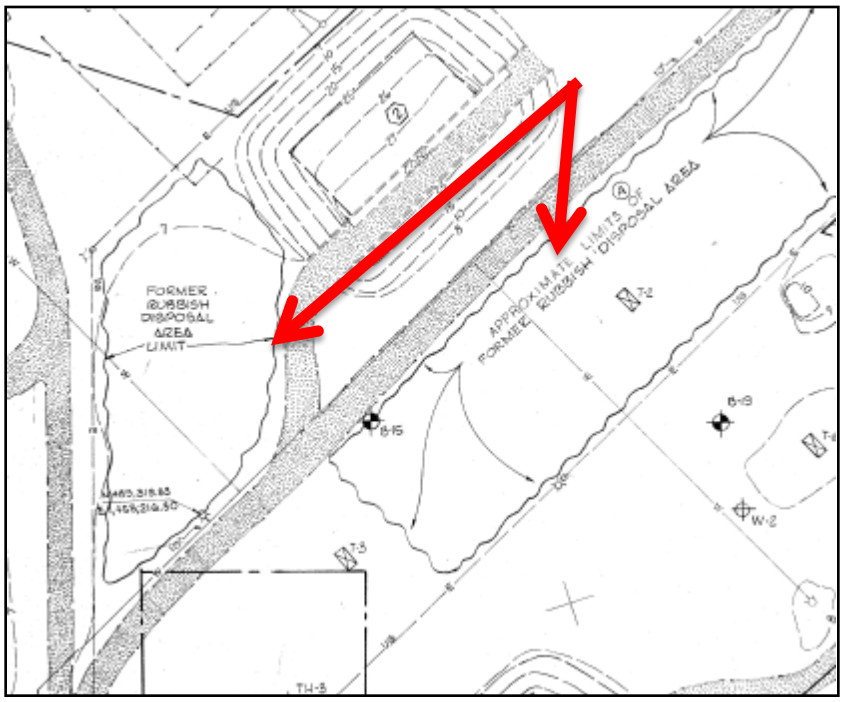


Photo 60 Two rubbish disposal areas

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 ±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. A ll 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 ha ve 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.

7.0 REFERENCES

California Department of Public Health (CDPH). 2011a. "*Site 12 Gamma Survey*." September 28. **TI-HRASTM-26**.

CDPH. 2011b. "*Letter regarding Yerba Buena Island.*" December 23.

CDPH. 2012. "*Letter regarding Treasure Island's 9th Street Playground.*" March 22. **TI-HRASTM-18**.

CDPH. 2013. Letter Report titled "*[Radiological Assessment Unit] RAU Staff Soil Sampling, Treasure Island, Site 12, March 20-21, 2013."* September 23. **TI-HRASTM-42**.

Department of Toxic Substances Control (DTSC) and CDPH. 2009. "*Unrestricted Release of Buildings 343 and 344; Naval Station Treasure Island (NSTI), San Francisco, California.*" January 16. **TI-HRASTM-5**.

Engineering/Remediation Resources Group, Inc. 2013. "*Post-Construction Summary Report for Underground Storage Tank and Aboveground Storage Tank 240 Area*" October.

IT Corporation. 2001. "*Final Work Plan, Site 12 Area Interim Measures Trench Exploration and Installing Interim Cover, Old Bunker Storage Area, Treasure Island, California.*" March 15. **TI-HRASTM-9**.

IT Corporation. 2002. "*Final Post-Construction Summary Report – Site 20 Remedial Excavation Petroleum Excavation Program, Treasure Island, California.*" February 15. **TI-HRASTM-46**.

Lee. 1969. C.H. Lee and M. Praszker Case History 1: "Treasure Island Fill" in, Bay Mud Developments and Related Structural Foundations. In H.B. Goldman, ed., Geological and Engineering Aspects of San Francisco Bay Fill. California Division of Mines and Geology Special Report.

Lowry & Associates. 1971. "*Contract N62474-72-C-0008 for Engineering Services in Connection with Subsurface Investigation for East Bay Turnkey Housing.*" August 30. **TI-HRASTM-13**.

National Defense Research Committee (NDRC). 1946. "*Summary Technical Report of the National Defense Research Committee.*" **TI-HRASTM-54.**

NDRC. Undated. "*National Defense Research Committee- Extract from unknown report.*" **TI-HRASTM-10**.

Department of the Navy (Navy). 1943. "*Field Tests of the Radium Plaque Adaptometer, Medical Research Laboratory, U.S. Naval Submarine Base New London.*" 26 November. **TI-HRASTM-53.**

Navy. 1944a. "*Plan Elevations and Details – Optical Shop.*" September 26. **TI-HRASTM-23**.

Navy. 1944b. "Sanitary Sewer System." Navy Drawing Se44. June 5. **TI-HRASTM-35**.

Navy. 1945a. *MASTHEAD* News Article, July 7. **TI-HRASTM-7**.

Navy. 1945b. *MASTHEAD* News Article, September 22. **TI-HRASTM-20**.

Navy. 1945c. Drawing No. 3-272, "*Optical Shop, Bldg. No. 3. Removal of Partition-Installation New Girder.*" **TI-HRASTM-29**.

Navy. 1946a. "*The Naval History of Treasure Island.*" **TI-HRASTM-2**.

Navy. 1946b. *MASTHEAD* News Article, June 1. **TI-HRASTM-11**.

Navy. 1951a. NAVSHIPS 91447, "*Instruction Book for RADIAC SET AN/PDR-18*" 24 April. **TI-HRASTM-52**.

Navy. 1951b. Drawing No. 3-1026, "*Optical Shop, Bldg. No. 3. Floorplan.*" **TI-HRASTM-30**.

Navy. 1951c. "*United States Navy Medical News Letter.*" 9 February. **TI-HRASTM-19**.

Navy. 1952. Map of U.S. Naval Station, Treasure and Yerba Buena Islands, San Francisco, California, showing condition on July 1, 1951. June. **TI-HRASTM-40**.

Navy. 1959. Property Record Card #2-00397, Incinerator #345. **TI-HRASTM-41**.

Navy. 1965. Drawing No. DPWO-12-B-721087, "*300 Units – Appropriated Fund Quarters, Treasure Island, Existing Site Conditions, Sheet I."* January 25. **TI-HRASTM-33**.

Navy. 1968. NAVFAC Drawing No. 1064605, **"***704 Units Appropriated Fund Quarters."* March 6. **TI-HRASTM-39**.

Navy. 1972. "Atomic Energy Commission License No. 04-04346-02; request for renewal of and amendment to." May 10. **TI-HRASTM-27**.

Navy. 1974. Self Help Drawing. PW-GR-129 (PWC #67656). **TI-HRASTM-36**.

Navy. 1975. Drawing No. 6023085 "*Naval Complex East Bay, San Francisco, CA 04 Family Housing Unites."* January 9. **TI-HRASTM-45**.

Navy. 1976. *MASTHEAD* Historic 1946 Map of Base, November 10. **TI-HRASTM-31**.

Navy. 1988. Drawing No. 6342739 "*200 Family Housing Units at Treasure Island, CA."* November 22. **TI-HRASTM-44**.

Navy. 2009. "Summary of Northpoint Area Surveys and Commodity Removal, Northpoint Drive." Briefing. **TI-HRASTM-24**.

Navy. Undated. "*History of Naval Section Base and Frontier Base.*" Undated. **TI-HRASTM-21**.

McArthur, R.D. and F.L. Miller, 1989. Off-Site Radiation Exposure Review Project Phase II Soils Program, Publication #45064, Water Resources Center, Desert Research Institute, University of Nevada, Las Vegas, Nevada.

McCreary Koretsky Engineers. 1965. "*Soil and Foundation Investigations for Appropriated Fund Quarters at U. S. Naval Station, Treasure Island, San Francisco, California.*" January 11. **TI-HRASTM-32**.

Pacific Northwest National Laboratory. 2013. Software program titled "*Visual Sample Plan: A Tool for Design and Analysis of Environmental Sampling (VSP)*", Version 6.5.

Shaw Environmental, Inc. (Shaw). 2003. "*Final Site Health and Safety Plan Addendum, Site 12 Housing Area, Sitewide Investigation, Treasure Island, San Francisco, California.*" July 28. **TI-HRASTM-25**.

Shaw. 2004. "Final Data Summary Report, Site 12 Housing Area, Sitewide Investigation, Treasure Island, San Francisco, California." September 9. **TI-HRASTM-12**.

Shaw. 2005. "*Technical Memorandum, Treasure Island, Site 12 Radiological Field Screening*." November 2. **TI-HRASTM-22**.

Shaw. 2007a. "*Final Removal Action Work Plan/Remedial Design, Non-Time Critical Removal Action, Installation Restoration Site 12, Three Solid Waste Disposal Areas (SWDAs A&B, 1207/1209, and 1231/1233), Treasure Island, San Francisco, California.*" February 26. **TI-HRASTM-16**.

Shaw. 2011a. "*Field Activity Report Soil Excavation, Parcel T111/Installation Restoration Site 32, and TX-152(1) PCB Remediation, Treasure Island, San Francisco, California.*" July 13. **TI-HRASTM-6**.

Shaw. 2011b. "*Final Treatability Report, In Situ Anaerobic Bioremediation Pilot Study, Site 21, Treasure Island, San Francisco, California.*" March 1. **TI-HRASTM-17**.

Shaw. 2012a. "*Final Revision 1, Final Remedial Action Work Plan, Former South Storage Yard/Site 31, Site 33, and Building 262, Treasure Island, San Francisco, California.*" January 2012. **TI-HRASTM-14**.

Shaw. 2012b. "*Draft Post Construction Summary Report, Installation Restoration Site 12, Solid Waste Disposal Areas 1207/1209 and 1231/1233, Treasure Island, San Francisco, California.*" September. **TI-HRASTM-8**.

Shaw. 2012c. "*Draft Post Construction Summary Report, Installation Restoration Site 33, Treasure Island, San Francisco, California.*" August. **TI-HRASTM-55**.

Shaw. 2013a. "*Draft Post Construction Summary Report, Installation Restoration Site 12, Solid Waste Disposal Area A&B, Treasure Island, San Francisco, California.*" January. **TI-HRASTM-37**.

Shaw. 2013b. "*Final Post Construction Summary Report, Installation Restoration Site 12, Solid Waste Disposal Areas 1207/1209 and 1231/1233, Treasure Island, San Francisco, California.*" July. **TI-HRASTM-50**.

Shaw. 2014. "*Final Radiological Remedial Action Report and Final Status Survey Plan, Building 233 Site, Former Naval Station Treasure Island, San Francisco, California.*" January. **TI-HRSTM-49**.

TestAmerica. 2012. "Analytical Report, Project No. 122412-48.02." March 19. **TI-HRASTM-38**.

Treasure Island-Historical Radiological Assessment (**TI-HRA-57**). 1975. RASO Report of Technical Assistance Visit to TI. April 15.

Tetra Tech EC, Inc. 2008a. "*Final Status Survey Report for Building 343; Naval Station Treasure Island, Treasure Island, California.*" October 31. **TI-HRASTM-3**.

Tetra Tech EC, Inc. 2008b. "*Final Status Survey Report for Building 344; Naval Station Treasure Island, Treasure Island, California.*" October 31. **TI-HRASTM-4**.

Tetra Tech EC, Inc. 2008c. "*Final Scoping Survey Report for Building 233 Drain Lines and Wall Vents."* October 31. **TI-HRASTM-15**.

Tetra Tech EC, Inc. 2014. "Final Radiological Investigation and Source Removal on March 20 and 21, 2013." February. **TI-HRASTM-43**.

TriEco LLC and Tetra Tech Inc. (TriEco-Tt). 2012. "*Final Remedial Investigation Report for Installation Restoration Site 12, Old Bunker Area, Naval Station Treasure Island, Treasure Island, California.*" June. **TI-HRASTM-28**.

University of California Berkeley. 1940. "*Science in the Service of Man, Exhibits in Basic Science, Hall of Science, Golden Gate International Exposition, 1939-1940.* **TI-HRASTM-56**.

Weston Solutions, Inc. 2006. "*Final Treasure Island Naval Station Historical Radiological Assessment, Former Naval Station Treasure Island, California*." February. **TI-HRASTM-1**.

FIGURES

LEGEND

- Freeway
- Highway
- Major Road
- Railroads
- Rivers

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A Joint Venture

Naval Station Treasure Island
Department of the Navy, BRAC PMO West, San Diego, California

FIGURE 1

LOCATION MAP
TREASURE ISLAND
AND THE
SAN FRANCISCO BAY AREA

2012-05-29 C:\GIS\Treasure_Is\TI_AOIs_03-2012\fig-1_TI_SF-CA_Location-Map.mxd TriEco-SD chris.lynch

San Francisco Bay

Former Supply Department Salvage Yard (Lot69)

Bldg 342

Bldg 342 Yard Area

Bldg 343 & Bldg 344

Bldg 342 Sanitary Sewer Line

Bldg 233 Area

Bldg 233

Bldg 233 Storm Line

Pandemonium Site II (NE)

Bldg 570 Site

IR Site 24

IR Site 32

Former Salvage Yard and Current Sewage Treatment Plant

IR Site 6

Waste & Clean Soil Stockpile and Truck Loading & Decon Site

Bldg 461

IR Site 33

Bldg 3 Sanitary Sewer Line

IR Site 21

Former Lake of the Nations

Bldg 3 Site

SWDA North Point

Former Incinerator

SWDA Bayside

Historic Burn Area

IR Site 12

Rubbish Area

SWDA Bigelow Court

SWDA Westside

Pandemonium Site I (NW)

Storage Areas and Sites 30 & 31

Playground and Gyro Compass Repair Shop

AOI 1

AOI 2

AOI 3

AOI 4

AOI 5

AOI 6

AOI 7

AOI 8

Avenue M

Avenue N

Avenue I

Avenue H

Avenue D

Avenue C

Avenue B

Avenue F

Avenue of the Palms

Gateview Ave.

Bayside Dr.

North Point St.

Exposition Dr.

California Ave.

4th St.

5th St.

6th St.

9th St.

11th St.

13th St.

1st St.

3rd St.

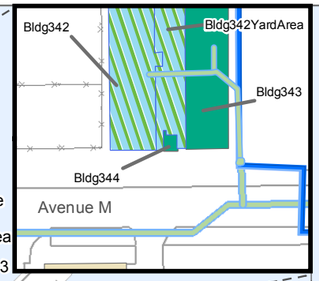
Clipper Cove

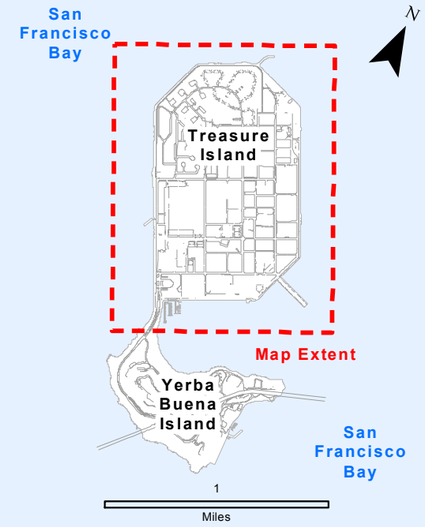
San Francisco Bay

San Francisco Bay

250 0 250 500

Feet





LEGEND

- Newly Identified Radiologically Impacted Site
- Newly Identified Radiologically Impacted Sewer or Storm Line
- 2006 HRA Radiologically Impacted Site Where Recent Surveys Have Not Found Low Level Radiological Contamination. Site Released.
- 2006 HRA Radiologically Impacted Site Where Recent Surveys Have Found Low Level Radiological Contamination or Objects
- Area of Interest
- IR Site
- Radiologically Impacted Soil Site With Non-Radiologically Impacted Building/Structure
- Building
- Former Lake of the Nations
- Fence
- Road

Note: Areas are not radiologically impacted unless specifically identified.

HRA Historical Radiological Assessment
IR Installation Restoration
SWDA Solid Waste Disposal Area

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Naval Station Treasure Island
Department of the Navy, BRAC PMO West, San Diego, California

FIGURE 2

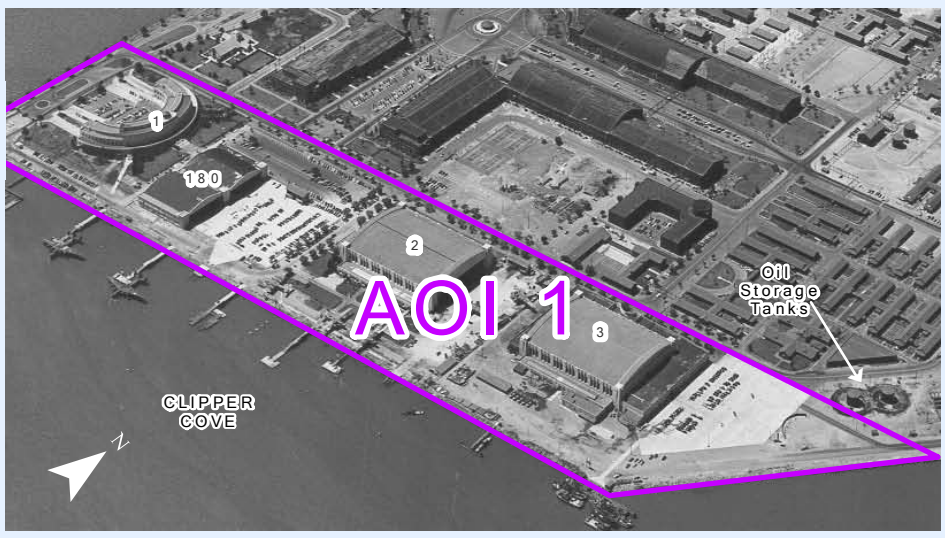
NEWLY IDENTIFIED RADIOLOGICALLY IMPACTED AREAS

2014-06-25 \\DISKSTATION\TriEcoProjects\NAVFAC - AECRU V\BRAC 2\Treasure Island\CTO-0003_Treasure_Island\Treasure_Is_GIS\TI_HRASTM_2012\Fig02\fig-2_TI_Areas_of_Interest_rev-39.mxd TriEco-Tt clynch

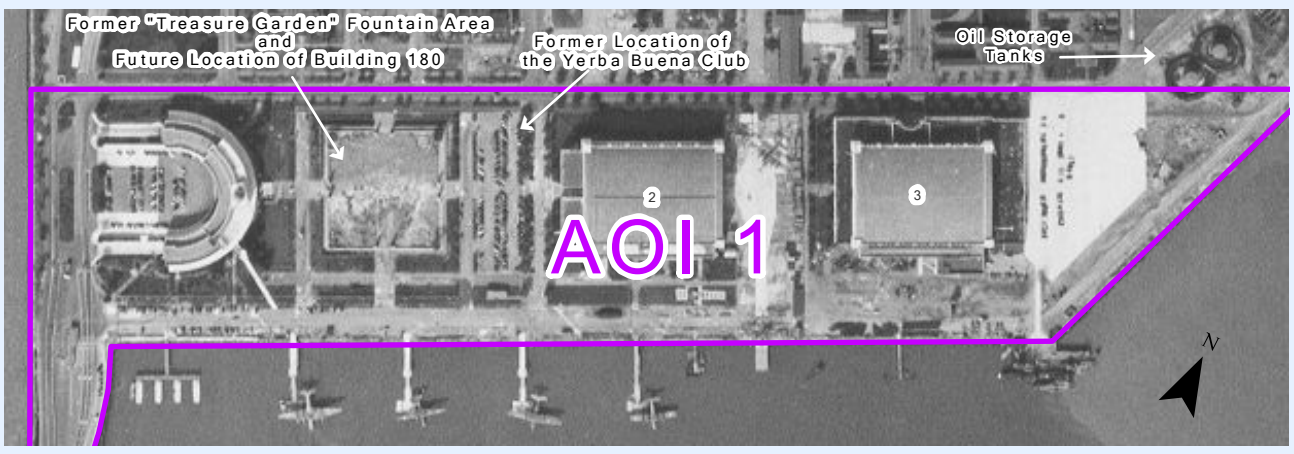
NOTES:
-Treasure Island was leased by Navy on 31 February 1941. The Navy took title to Treasure Island on 17 April 1942.
-Infrastructure was essentially built out and predominately paved since beginning of operations when licensed or unlicensed radioactive materials would have been handled.
-No significant construction occurred during the war period with the exception of piers. Building 180 represents the only significant infrastructure change within this footprint subsequent to the World's Fair. During the World's Fair, the footprint of Building 180 was referred to as the "Treasure Garden" and contained a fountain. In the 4 June 1942 photo (bottom left) the fountain has been demolished and site preparations for Building 180 are underway.
-Building 3 is considered impacted due to the level of repair operations that were conducted during WWII which may have involved the handling of radium containing devices.
-In addition, an optical shop which likely handled radioactive materials was located on the roof of Building 3.
-Oil storage tanks on southeast corner of Treasure Island were removed shortly after the end of the WWII.

Seaplane Lagoon Area of Interest 1
15 August 2000 (not to scale)

Seaplane Lagoon Area of Interest 1
24 March 1947 (not to scale)

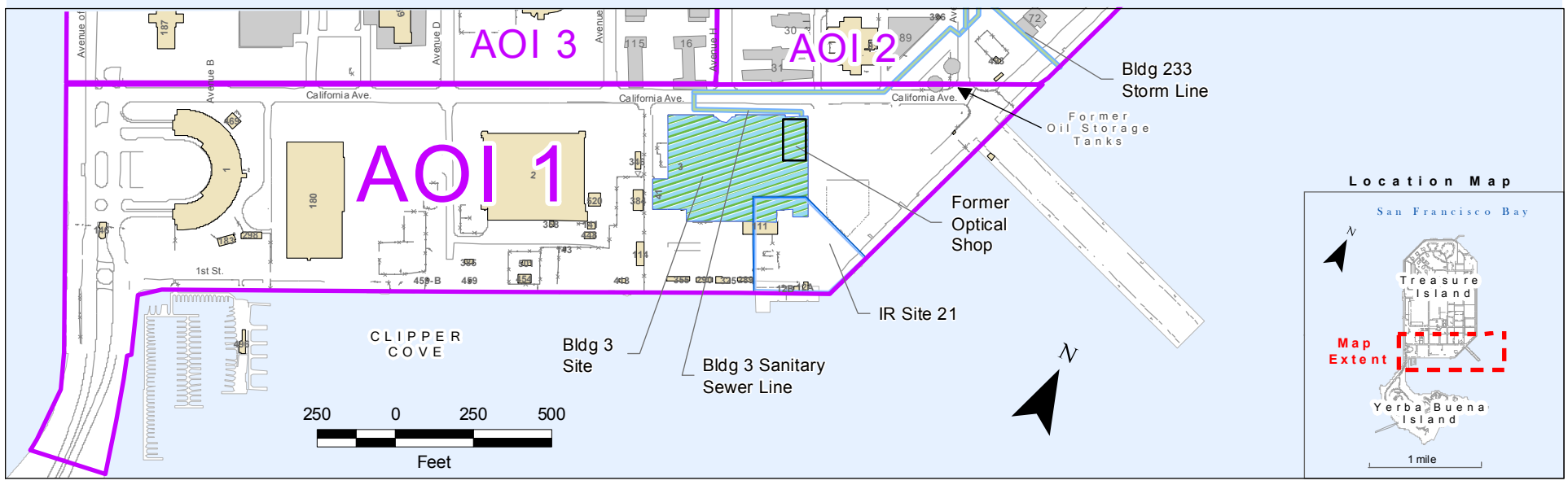


Seaplane Lagoon Area of Interest 1
ca. 1943 (not to scale)



Seaplane Lagoon Area of Interest 1
04 June 1942 (not to scale)

Seaplane Lagoon
Area of Interest 1
20 February1945
(not to scale)



LEGEND

- Area of Interest
- IR Site
- Newly Identified Radiologically Impacted Site
- Newly Identified Radiologically Impacted Sewer or Storm Line
- Existing Building (as of 19 June 2011)
- Demolished Building
- Road
- Fence

Note: Areas are not radiologically impacted unless specifically identified.

IR Installation Restoration

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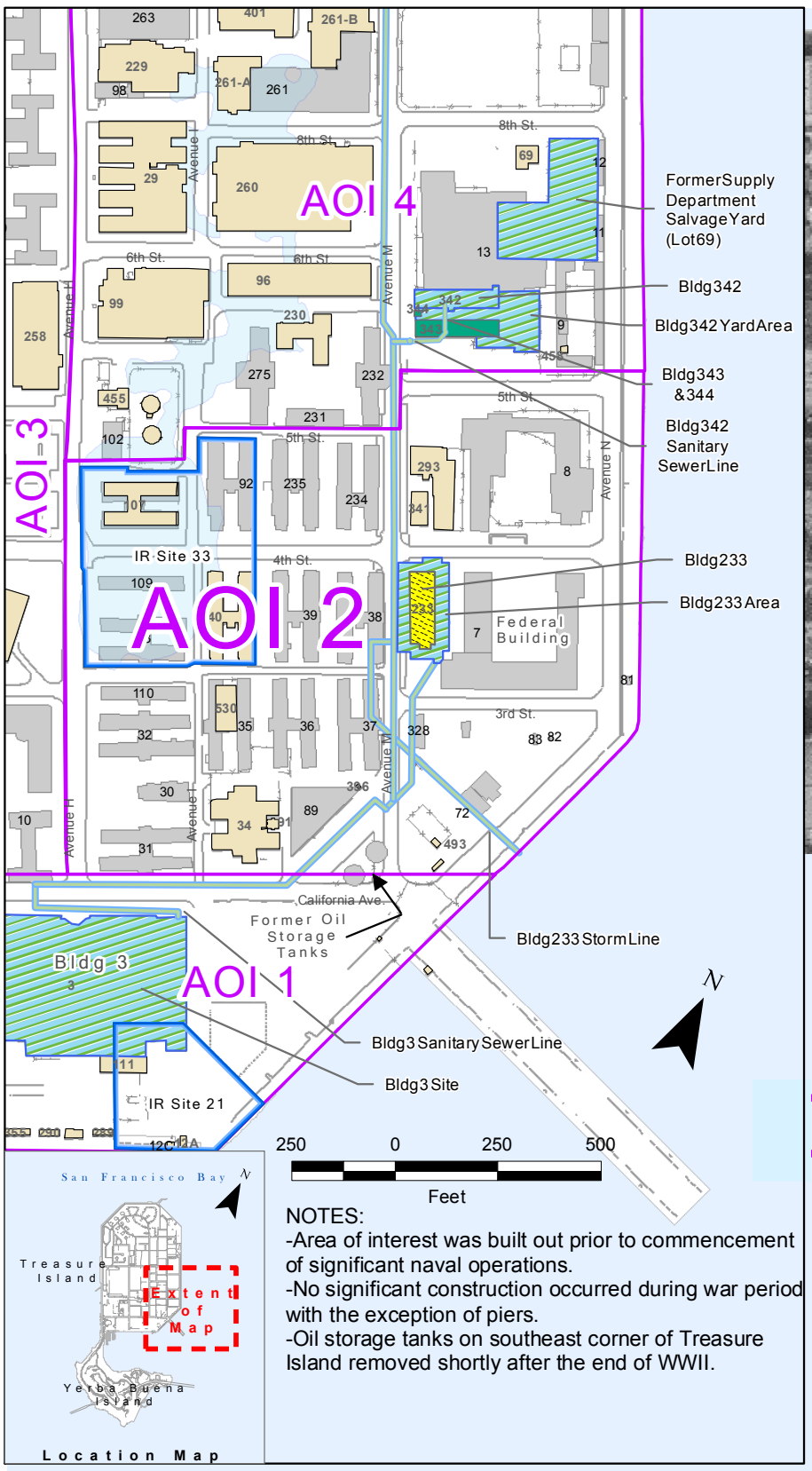
Naval Station Treasure Island
Department of the Navy, BRAC PMO West, San Diego, California

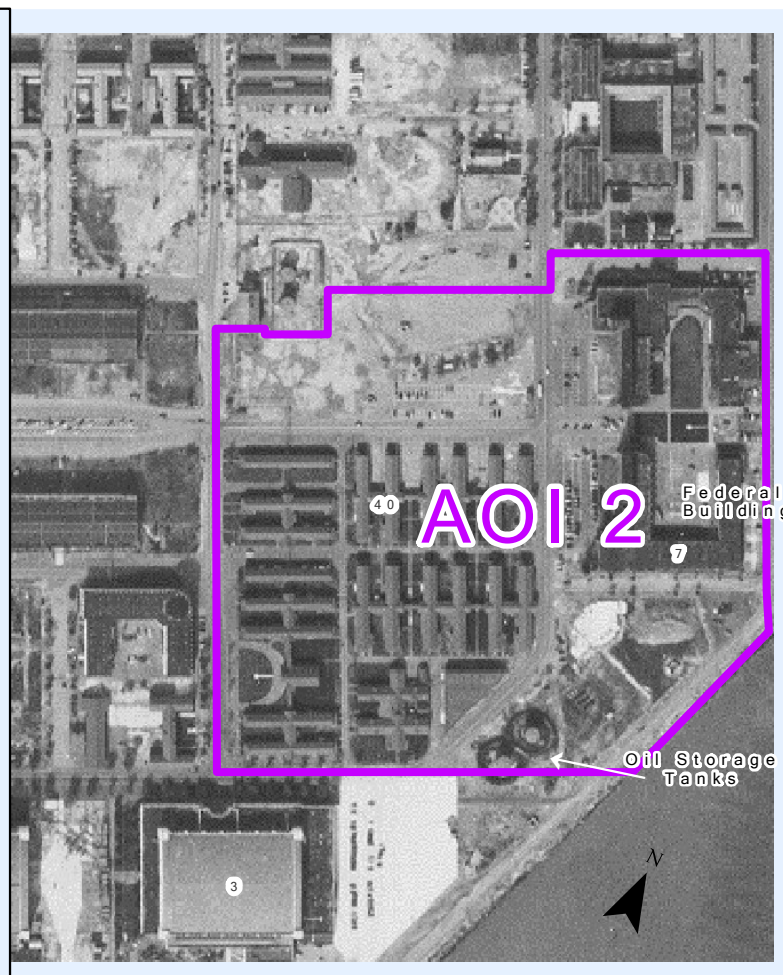
FIGURE 3

SEAPLANE LAGOON AREA OF INTEREST 1

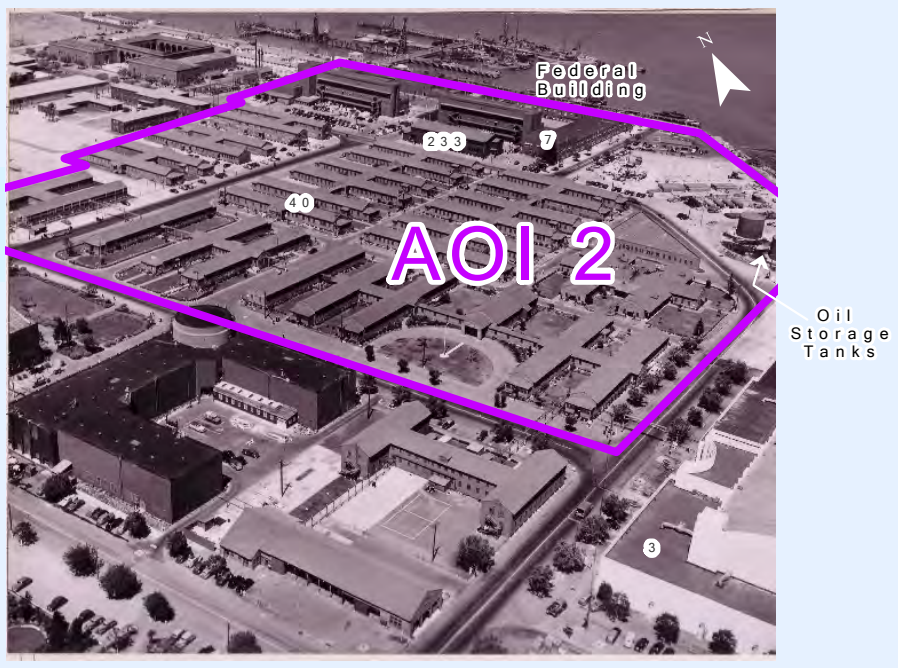
2014-04-09 \\DISKSTATION\TriEcoProjects\NAVFAC - AECRU V\BRAC 2\Treasure Island\CTO-0003_Treasure_Island\Treasure_Is_GIS\TI_HRASTM_2012\Fig03\fig-3_TI_SeaplaneLagoon_AOI-1_rev-17.mxd TriEco-Tt clynch



NOTES:
-Area of interest was built out prior to commencement of significant naval operations.
-No significant construction occurred during war period with the exception of piers.
-Oil storage tanks on southeast corner of Treasure Island removed shortly after the end of WWII.

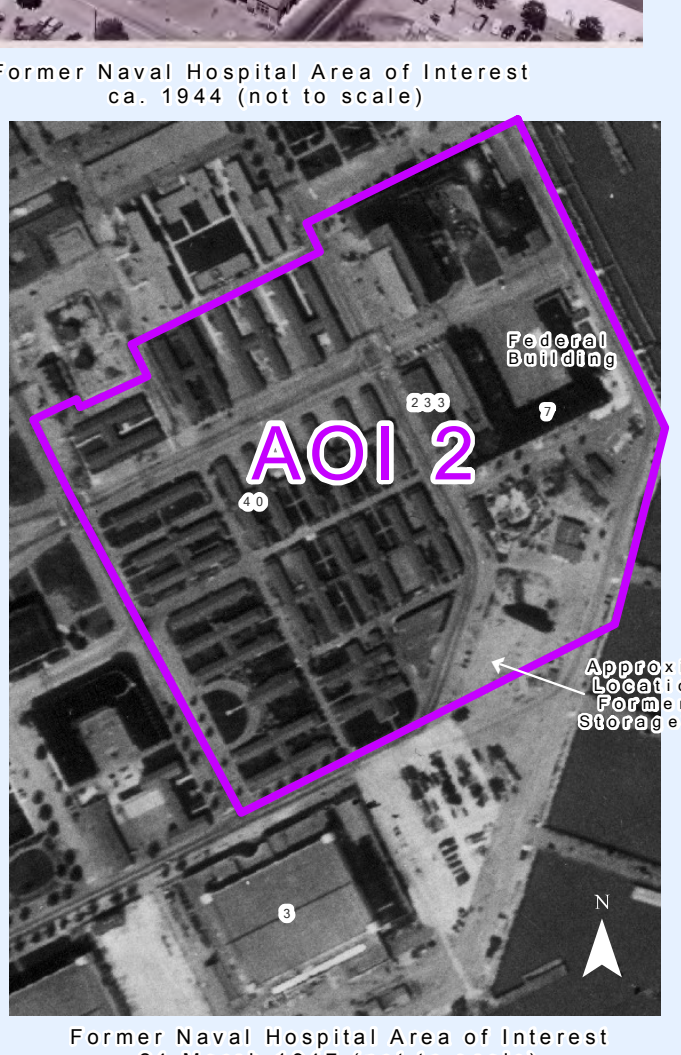


Former Naval Hospital and Surrounding Area of Interest 04 June 1942 (not to scale)



Former Naval Hospital Area of Interest ca. 1944 (not to scale)

Former Naval Hospital Area of Interest 15 August 2000 (not to scale)



Former Naval Hospital Area of Interest 24 March 1947 (not to scale)

LEGEND

- Area of Interest
- Newly Identified Radiologically Impacted Site
- Newly Identified Radiologically Impacted Sewer or Storm Lines
- 2006 HRA Radiologically Impacted Site Where Recent Surveys Have Not Found Low Level Radiological Contamination. Site Released.
- 2006 HRA Radiologically Impacted Site Where Recent Surveys Have Found Low Level Radiological Contamination or Objects
- IR Site
- Road
- Fence
- Existing Building (as of 19 June 2011)
- Demolished Building
- Former Lake of the Nations

Note: Areas are not radiologically impacted unless specifically identified.

HRA Historical Radiological Assessment
IR Installation Restoration

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Naval Station Treasure Island
Department of the Navy, BRAC PMO West, San Diego, California

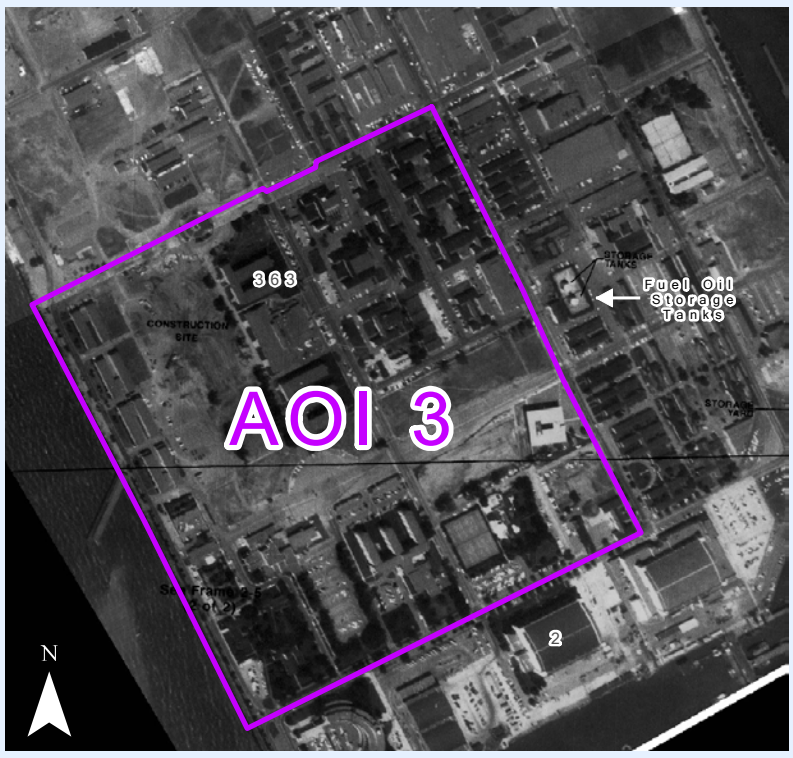
FIGURE 4

FORMER NAVAL HOSPITAL AREA OF INTEREST 2

NOTES:
Area of Interest 3 has no radiologically impacted areas:
1) No evidence of radiological work has been found in this area;
2) Buildings in the area primarily served as barracks and support facilities and there is no evidence of industrial activities in this area;
3) There is no evidence of industrial lay down areas having been present in this area from review of available documents.

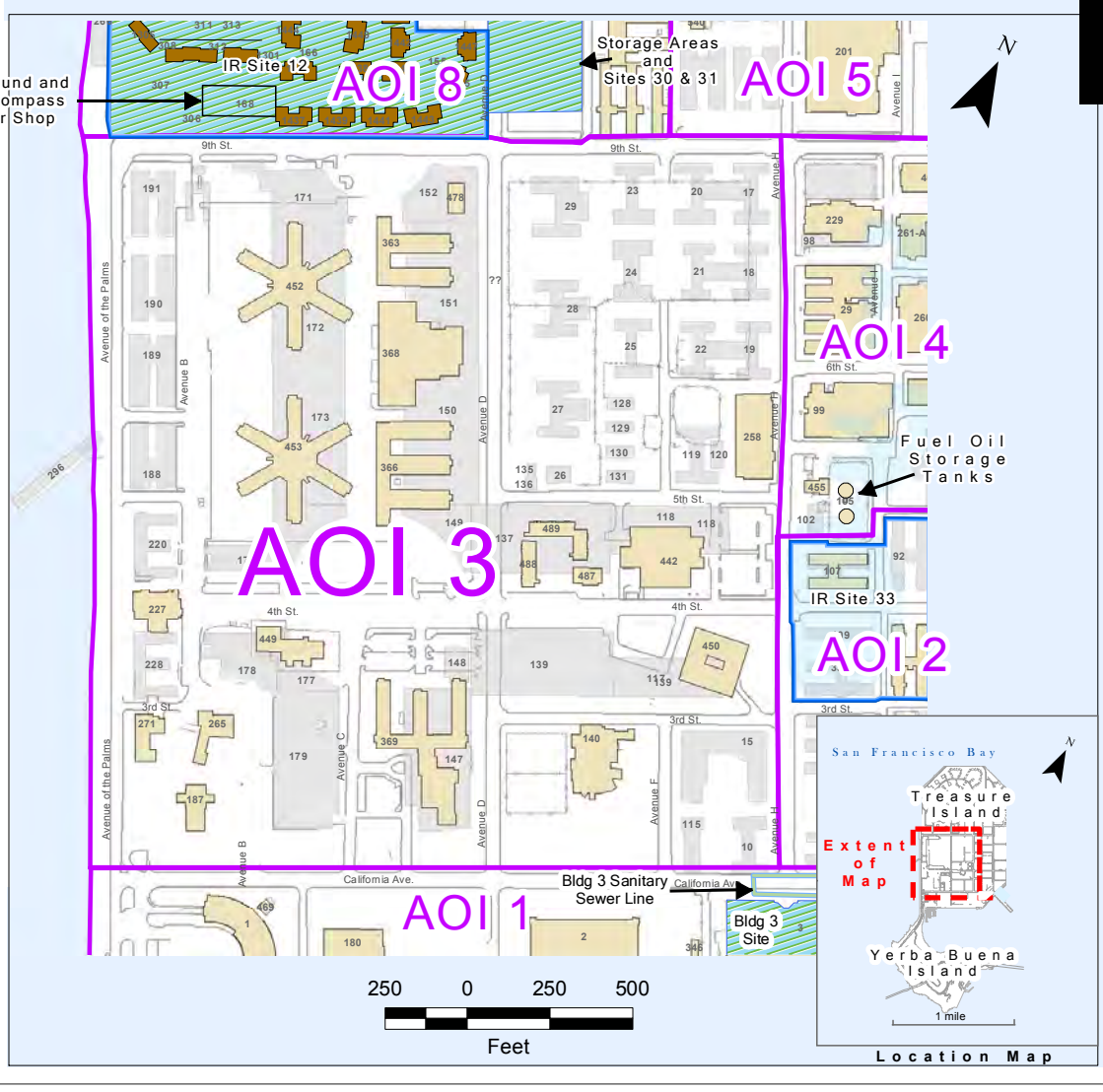
Island Core Area of Interest
15 August 2000 (not to scale)

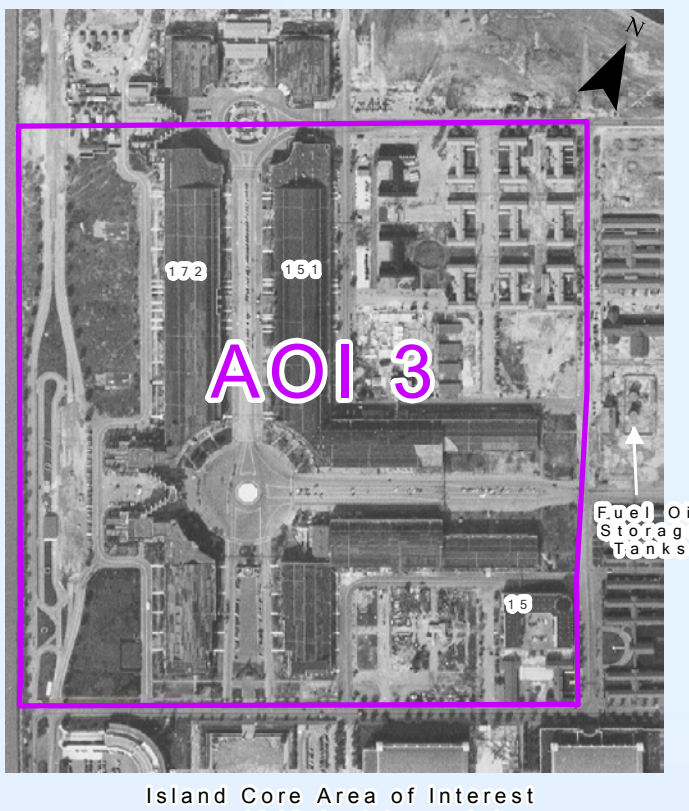
Island Core Area of Interest
19 May1969 (not to scale)



Island Core Area of Interest
18 April 1968 (not to scale)

Island Core Area of Interest
24 March 1947 (not to scale)





Island Core Area of Interest
ca. 1942 (not to scale)

LEGEND

- Area of Interest
- IR Site
- Newly Identified Radiologically Impacted Site
- Radiologically Impacted Soil Site With Non-Radiologically Impacted Building/Structure
- Newly Identified Radiologically Impacted Sewer or Storm Lines
- Former Lake of the Nations
- Existing Building (as of 19 June 2011)
- Demolished Building
- Fence
- Road

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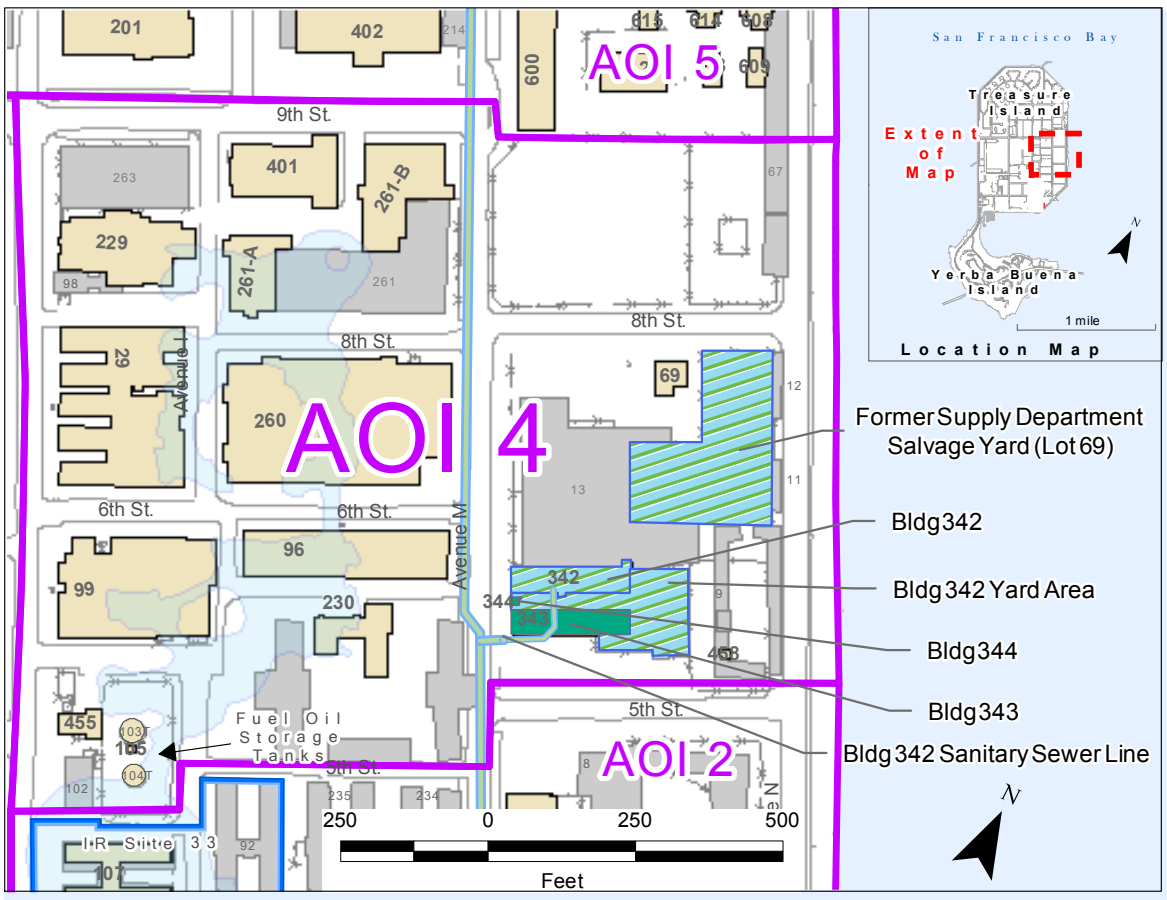
Note: Areas are not radiologically impacted unless specifically identified.

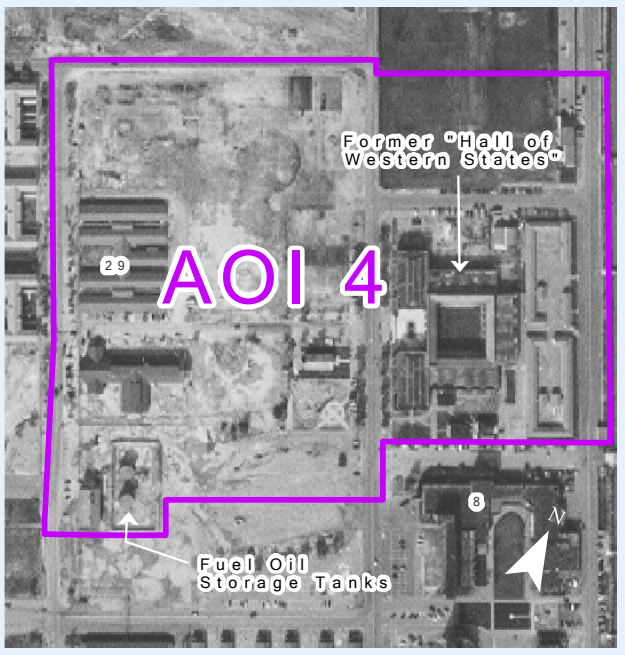
IR Installation Restoration

Naval Station Treasure Island
Department of the Navy, BRAC PMO West, San Diego, California

FIGURE 5

ISLAND CORE AREA OF INTEREST 3



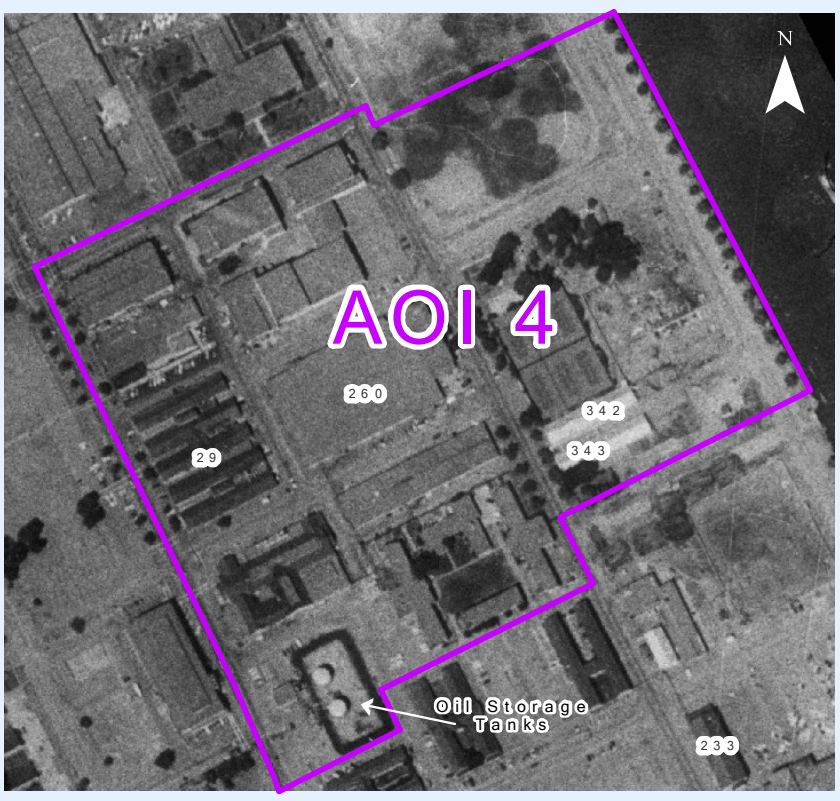


Southwestern Area of Interest
04 June 1942 (not to scale)

Southwestern Area of Interest
24 March 1947 (not to scale)

Southwestern Area of Interest
1 March 1958 (not to scale)

Southwestern Area of Interest
15 August 2000 (not to scale)



Southwestern Area of Interest
09 April 1975 (not to scale)

LEGEND

- Area of Interest
- IR Site
- Newly Identified Radiologically Impacted Site
- Newly Identified Radiologically Impacted Sewer or Storm Line
- Former Lake of the Nations
- 2006 HRA Radiologically Impacted Site Where Recent Surveys Have Not Found Low Level Radiological Contamination. Site Released.
- Existing Building (as of 19 June 2011)
- Demolished Building
- Fence
- Road

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Note:
Areas are not radiologically impacted unless specifically identified.

HRA Historical Radiological Assessment
IR Installation Restoration

Naval Station Treasure Island
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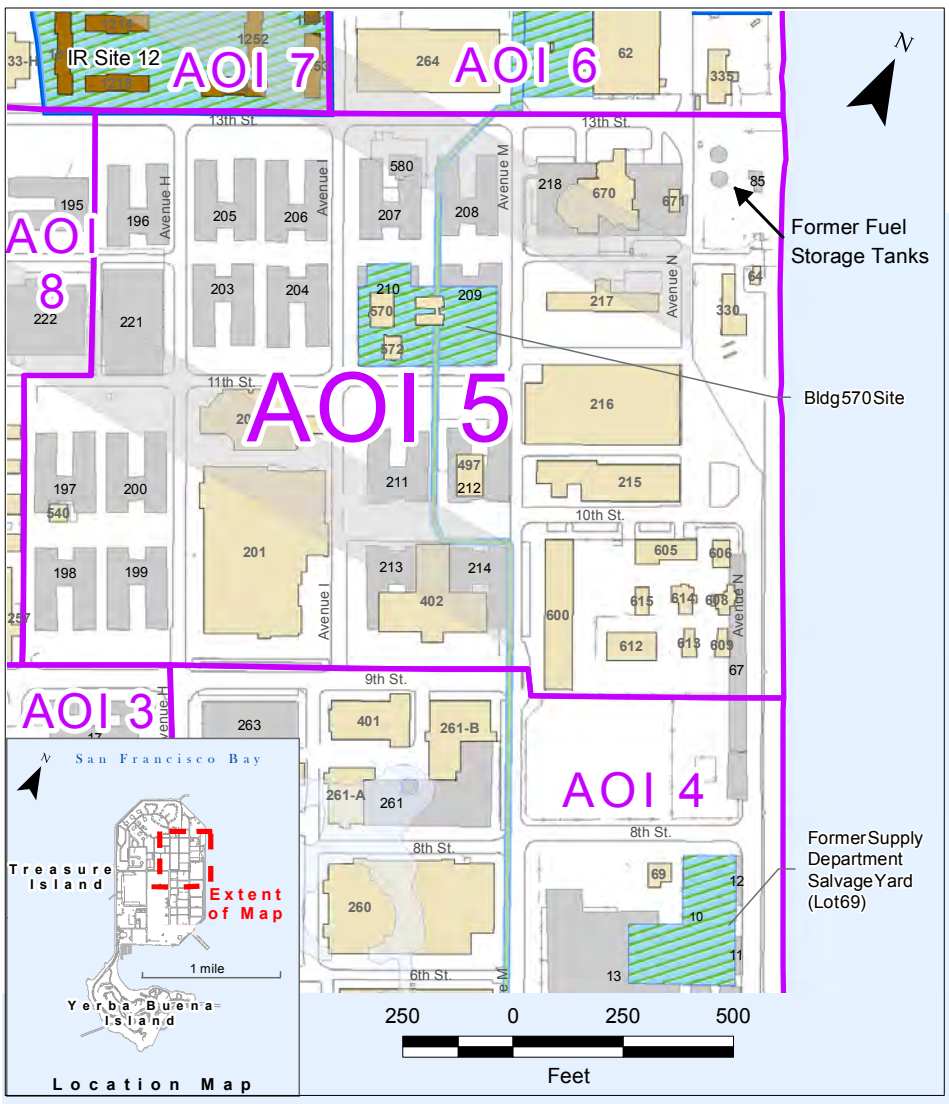
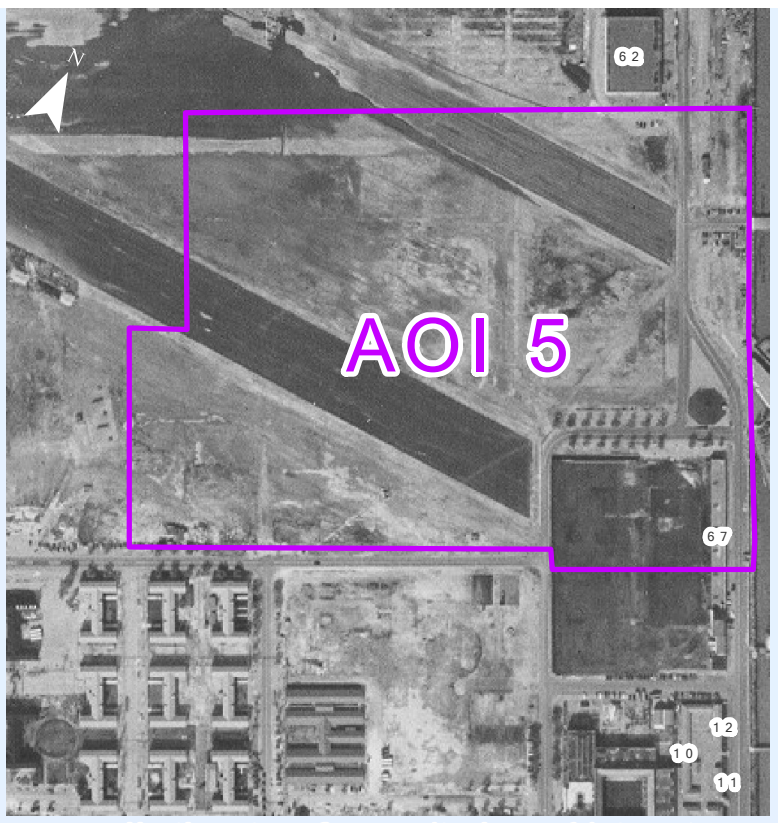
FIGURE 6

SOUTHWESTERN AREA OF INTEREST 4

2014-06-24 \\DISKSTATION\TriEcoProjects\NAVFAC - AECRU V\BRAC 2\Treasure Island\CTO-0003_Treasure_Island\Treasure_Is_GIS\TI_HRASTM_2012\Fig06\fig-6_TI_RecArea_AOI-4_rev-17.mxd TriEco-Tt clynch



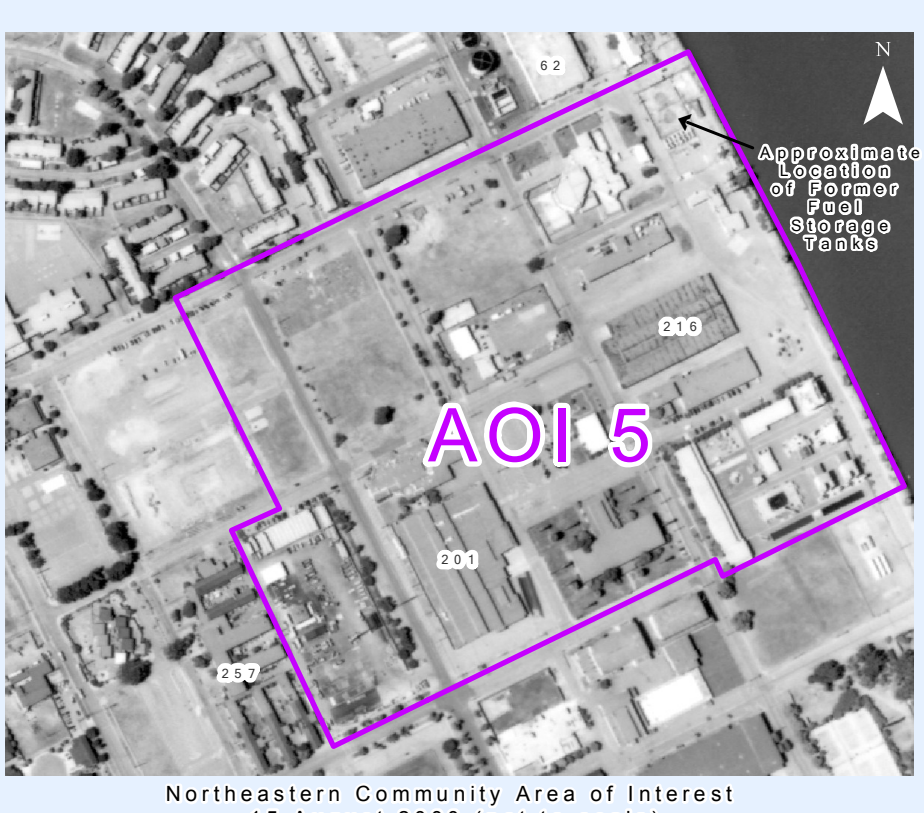
NOTES:
-Area of Interest largely undeveloped prior to commencement of significant naval operations with the exception of runway construction (later abandoned) and the piers.
-The parcel was entirely built out during war period leaving little likelihood or opportunity for disposal operations to occur.



Northeastern Community Area of Interest
04 June 1942 (not to scale)

Northeastern Community Area of Interest
01 March 1958 (not to scale)

Northeastern Community Area of Interest
24 March 1947 (not to scale)



Northeastern Community Area of Interest
15 August 2000 (not to scale)

Northeastern Community Area of Interest
04 September 1975 (not to scale)

LEGEND

- Area of Interest
- IR Site
- Newly Identified Radiologically Impacted Site
- Newly Identified Radiologically Impacted Sewer or Storm Line
- Radiologically Impacted Soil Site With Non-Radiologically Impacted Building/Structure
- Existing Building (as of 19 June 2011)
- Demolished Building
- Former Lake of the Nations
- Former Runway
- Road
- Fence

Note: Areas are not radiologically impacted unless specifically identified.

IR Installation Restoration

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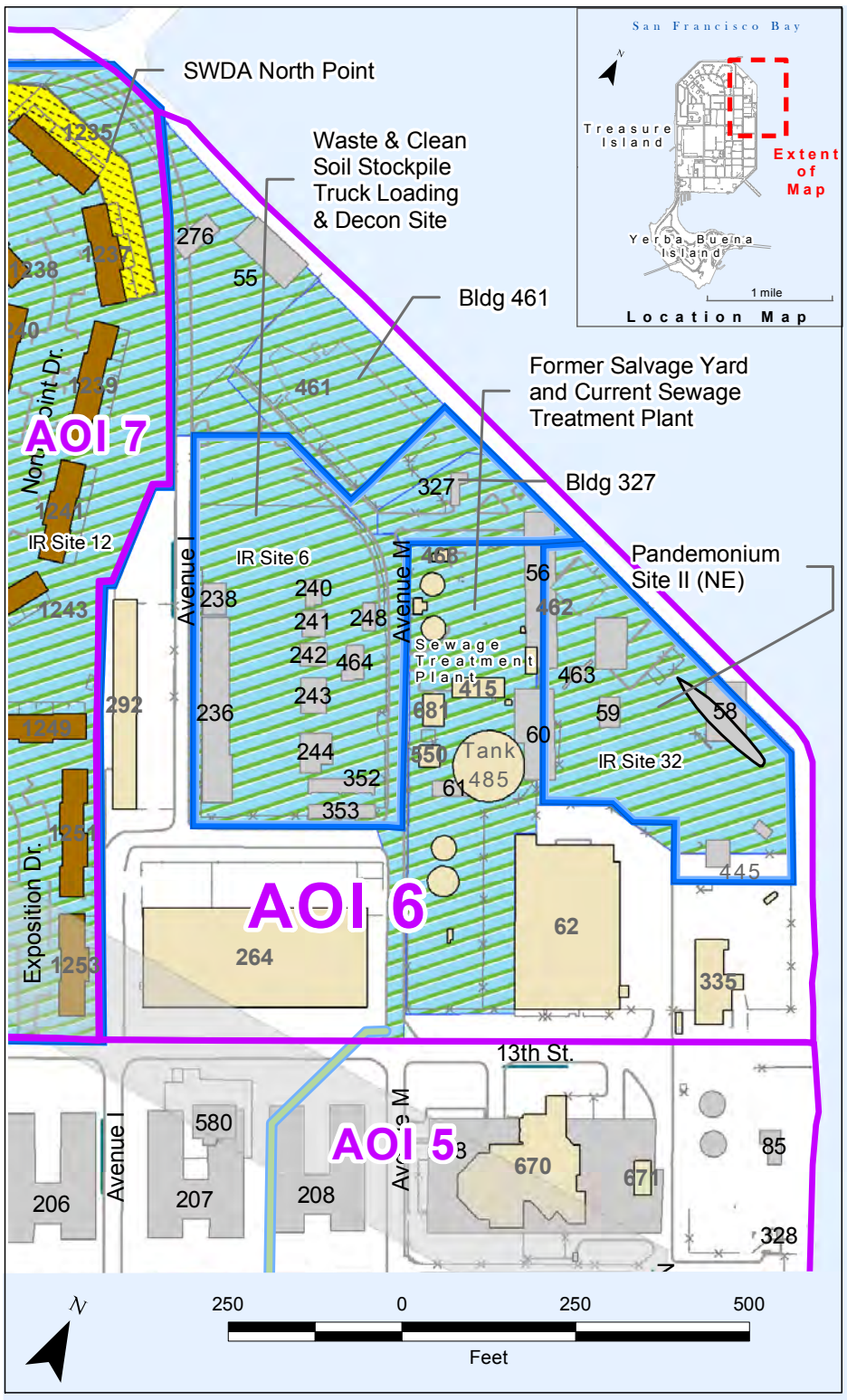
Department of the Navy, BRAC PMO West, San Diego, California

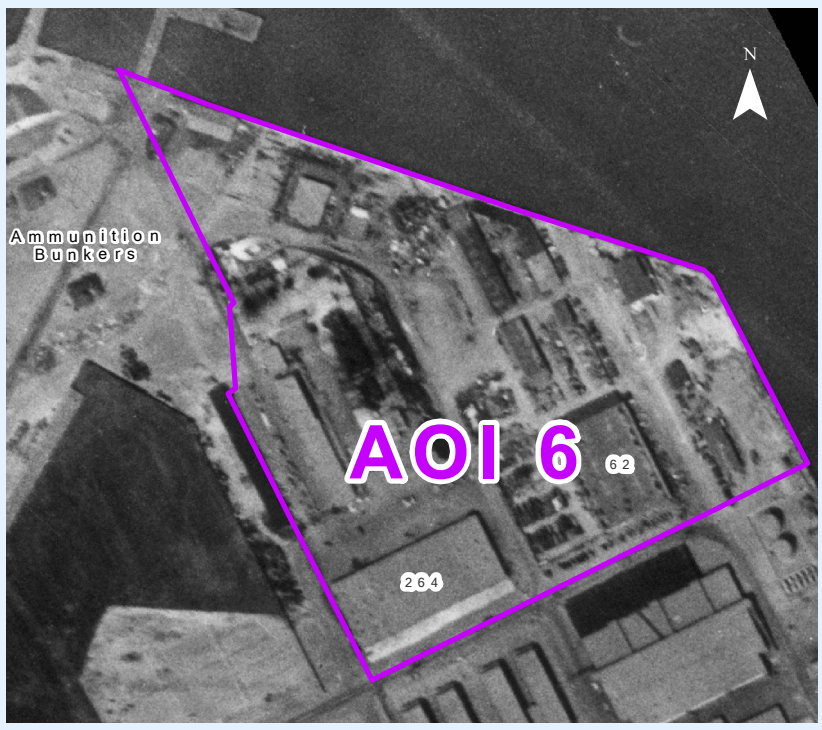
FIGURE 7

NORTHEASTERN COMMUNITY AREA OF INTEREST 5

2014-06-26 \\DISKSTATION\TriEcoProjects\NAVFAC - AECRU V\BRAC 2\Treasure Island\CTO-0003_Treasure_Island\Treasure_Is_GIS\TI_HRASTM_2012\Fig07\fig-7_TI_Dispensary_AOI-5_rev-13.mxd TriEco-Tt clynch



Sewage Treatment Area of Interest
04 June 1942 (not to scale)



Sewage Treatment Area of Interest
24 March 1947 (not to scale)

Sewage Treatment Area of Interest
15 August 2000 (not to scale)

Sewage Treatment Area of Interest
30 December 1969 (not to scale)

NOTES:
-There is evidence of lay down areas being utilized during the war in the area that is now the sewage treatment plant, suggesting this activity was associated with the Supply Department or a salvage yard. The waste treatment facility was constructed in the early 1960s.
-In 1970, the Navy's damage control school, which included radioactive decontamination training, was relocated to the northern portion of the site. Facilities included Buildings 461 and 462 and the USS Pandemonium Site II (NE), a full scale mockup training ship. The relocation was completed in September 1970. The use of these facilities ended by 20 February 1994.

LEGEND

- Area of Interest
- IR Site
- Newly Identified Radiologically Impacted Site
- Newly Identified Radiologically Impacted Sewer or Storm Line
- 2006 HRA Radiologically Impacted Site Where Recent Surveys Have Found Low Level Radiological Contamination or Objects
- Radiologically Impacted Soil Site With Non-Radiologically Impacted Building/Structure
- Existing Building (as of 19 June 2011)
- Demolished Building
- Former Runway
- Road
- Fence

Note: Areas are not radiologically impacted unless specifically identified.

HRA Historical Radiological Assessment
IR Installation Restoration
SWDA Solid Waste Disposal Area

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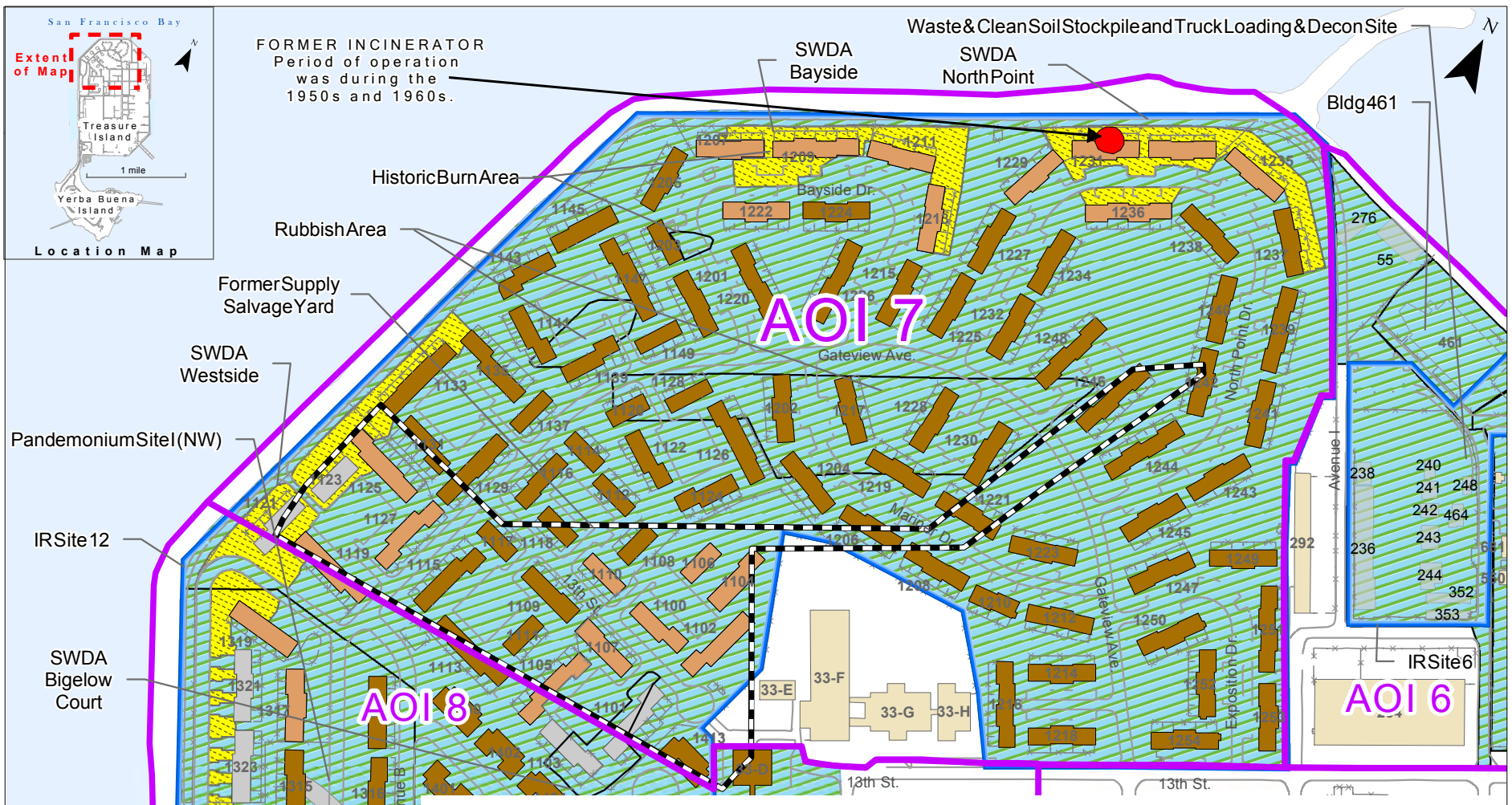
Naval Station Treasure Island
Department of the Navy, BRAC PMO West, San Diego, California

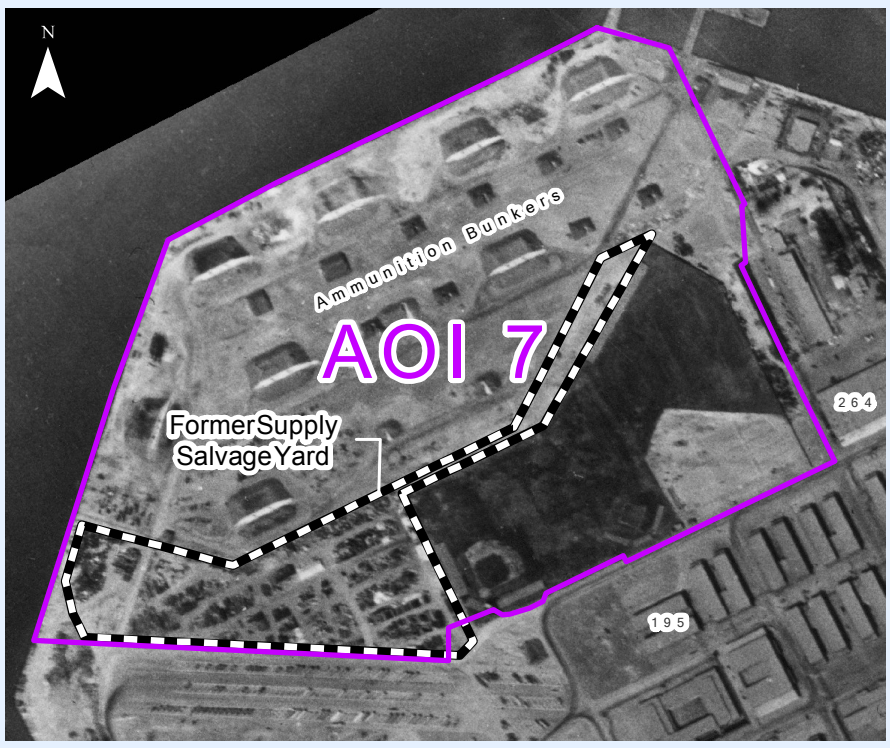
FIGURE 8

SEWAGE TREATMENT AREA OF INTEREST 6

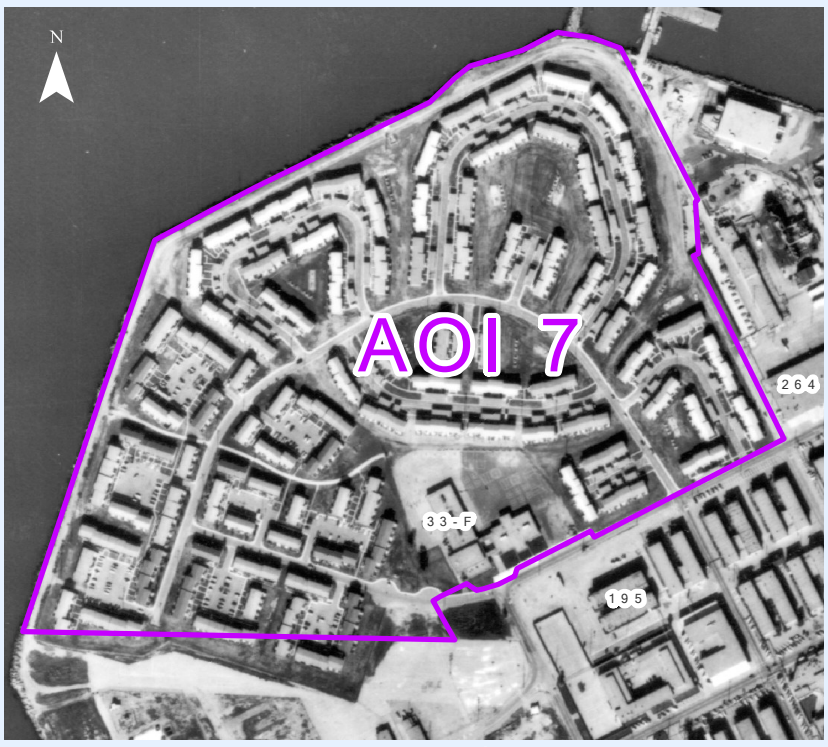


NOTES:
-The Area of Interest remained a likely spot for disposal of debris throughout WWII and into the 1960s.
-Housing was constructed in the area beginning in the mid-1960s.
-A salvage yard was operated in the southwestern portion of the site beginning sometime during WWII and into the 1960s.

Housing Area of Interest
04 June 1942 (not to scale)



Housing Area of Interest
24 March 1947 (not to scale)



Housing Area of Interest
30 December 1969 (not to scale)

Housing Area of Interest
10 April 1968 (not to scale)

LEGEND

- Area of Interest
- IR Site
- Newly Identified Radiologically Impacted Site
- 2006 HRA Radiologically Impacted Site Where Recent Surveys Have Found Low Level Radiological Contamination or Objects
- Radiologically Impacted Soil Site With Non-Radiologically Impacted Building/Structure
- Former Storage/Salvage Yard†

Buildings

- Occupied
- Unoccupied
- Demolished
- Road
- Fence

Notes:
Areas are not radiologically impacted unless specifically identified.
† Former Supply Salvage Yard from US Naval Station Treasure Island San Francisco, California General Development Map, 1962.

HRA Historical Radiological Assessment
IR Installation Restoration
SWDA Solid Waste Disposal Area

Naval Station Treasure Island
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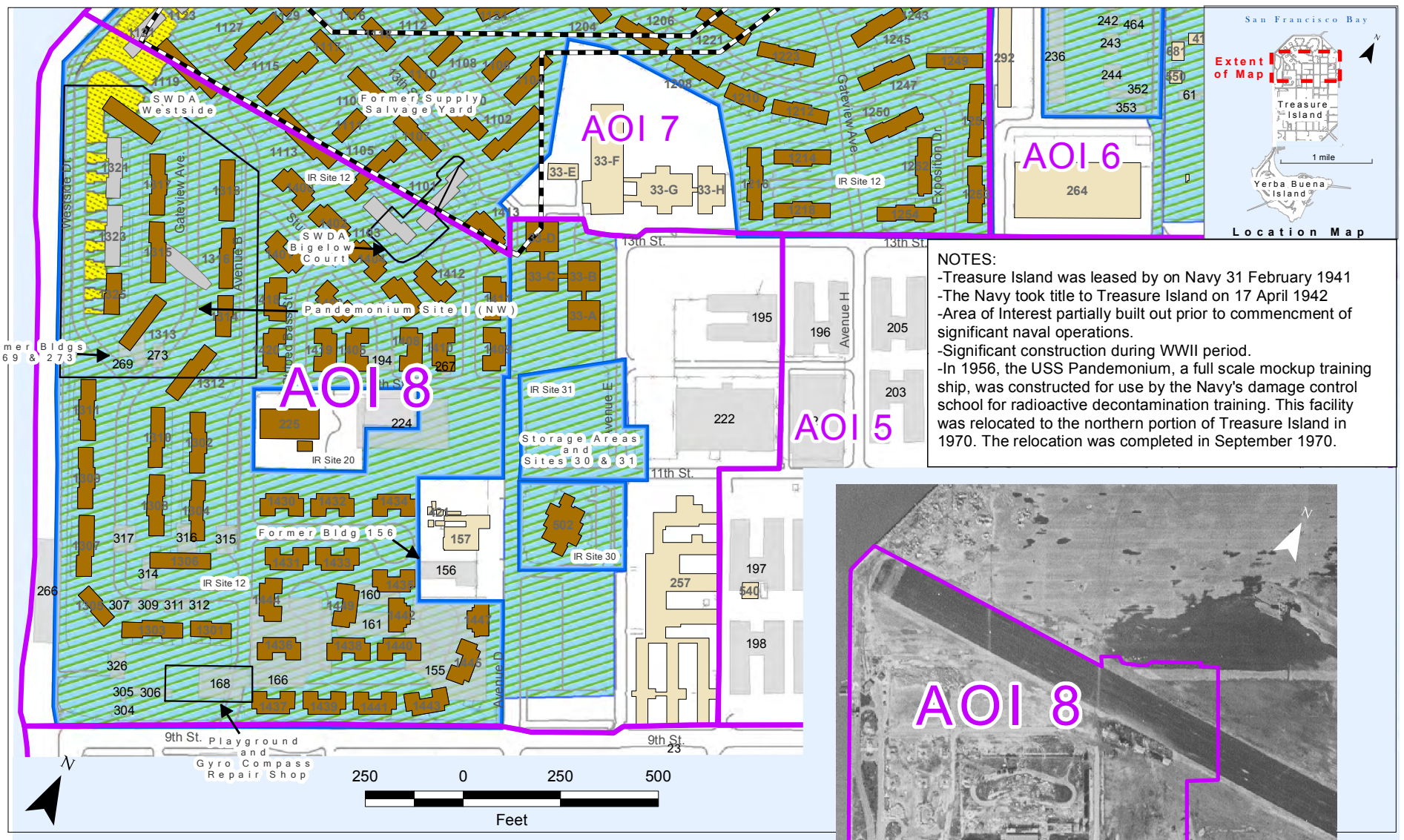
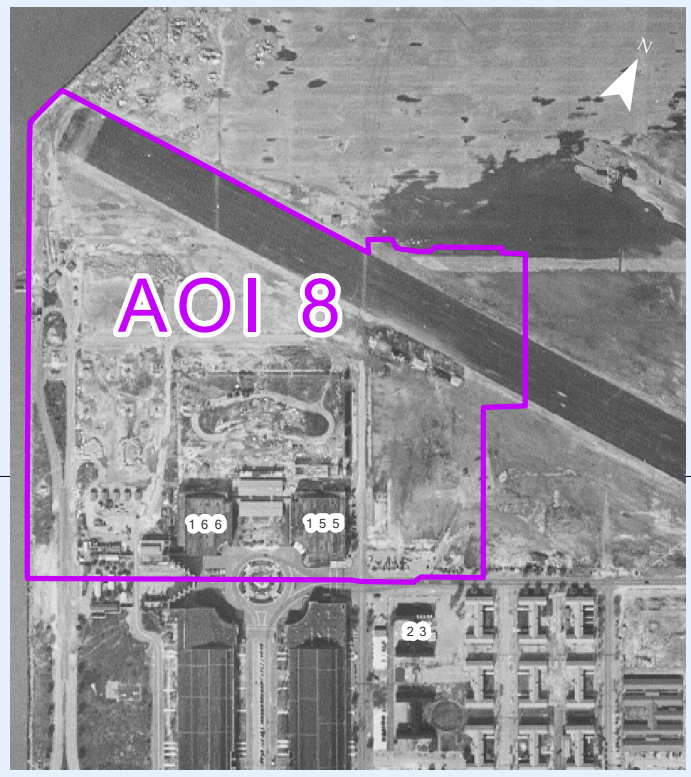
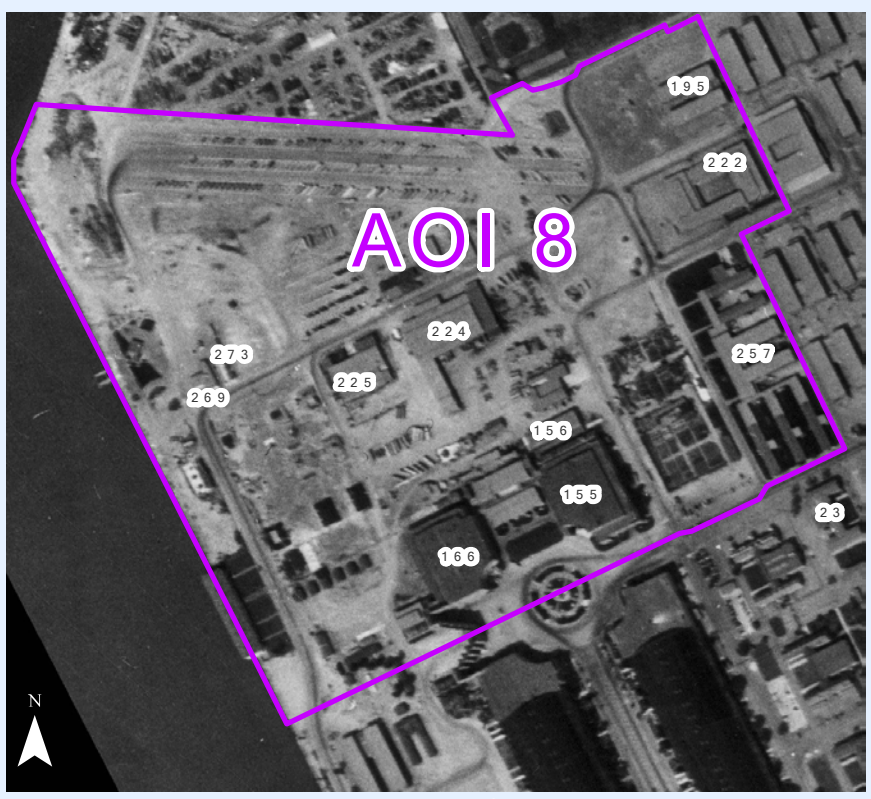
FIGURE 9
HOUSING AREA OF INTEREST 7



NOTES:
-Treasure Island was leased by on Navy 31 February 1941
-The Navy took title to Treasure Island on 17 April 1942
-Area of Interest partially built out prior to commencment of significant naval operations.
-Significant construction during WWII period.
-In 1956, the USS Pandemonium, a full scale mockup training ship, was constructed for use by the Navy's damage control school for radioactive decontamination training. This facility was relocated to the northern portion of Treasure Island in 1970. The relocation was completed in September 1970.



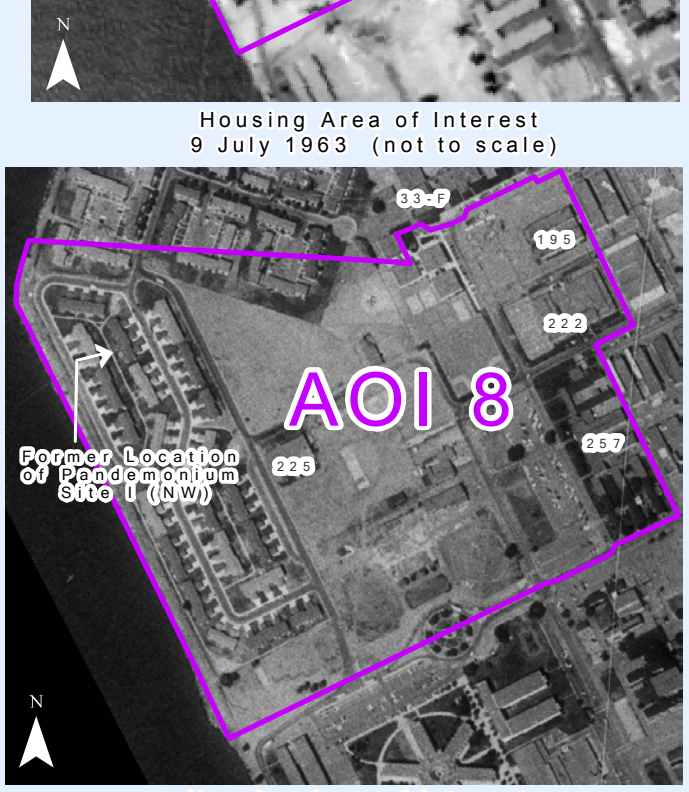
Housing Area of Interest
04 June 1942 (not to scale)



Housing Area of Interest
24 March 1947 (not to scale)

Housing Area of Interest
9 July 1963 (not to scale)

Housing Area of Interest
15 August 2000 (not to scale)



Housing Area of Interest
4 September 1975 (not to scale)

LEGEND

- Area of Interest
- IR Site
- Newly Identified Radiologically Impacted Site
- 2006 HRA Radiologically Impacted Site Where Recent Surveys Have Found Low Level Radiological Contamination or Objects
- Radiologically Impacted Soil Site With Non-Radiologically Impacted Building/Structure
- Former Storage/Salvage Yard†
- Road
- Fence
- Existing Building (as of 19 June 2011)
- Demolished Building

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Notes:
Areas are not radiologically impacted unless specifically identified.
† Former Supply Salvage Yard from US Naval Station Treasure Island San Francisco, California General Development Map, 1962.

HRA Historical Radiological Assessment
IR Installation Restoration
SWDA Solid Waste Disposal Area

Naval Station Treasure Island
Department of the Navy, BRAC PMO West, San Diego, California

FIGURE 10
HOUSING
AREA OF INTEREST 8

Note: 1. The surface exposure readings were measured at the ground surface.
2. Three SWDAs have been renamed as follows: SWDA Westside (previously A&B), SWDA Bayside (previously 1207/1209), SWDA North Point (previously 1231/1233).

cm Centimeter
IR Installation Restoration
millirem/hr Milliroentgens equivalent man per hour
SWDA Solid waste disposal area

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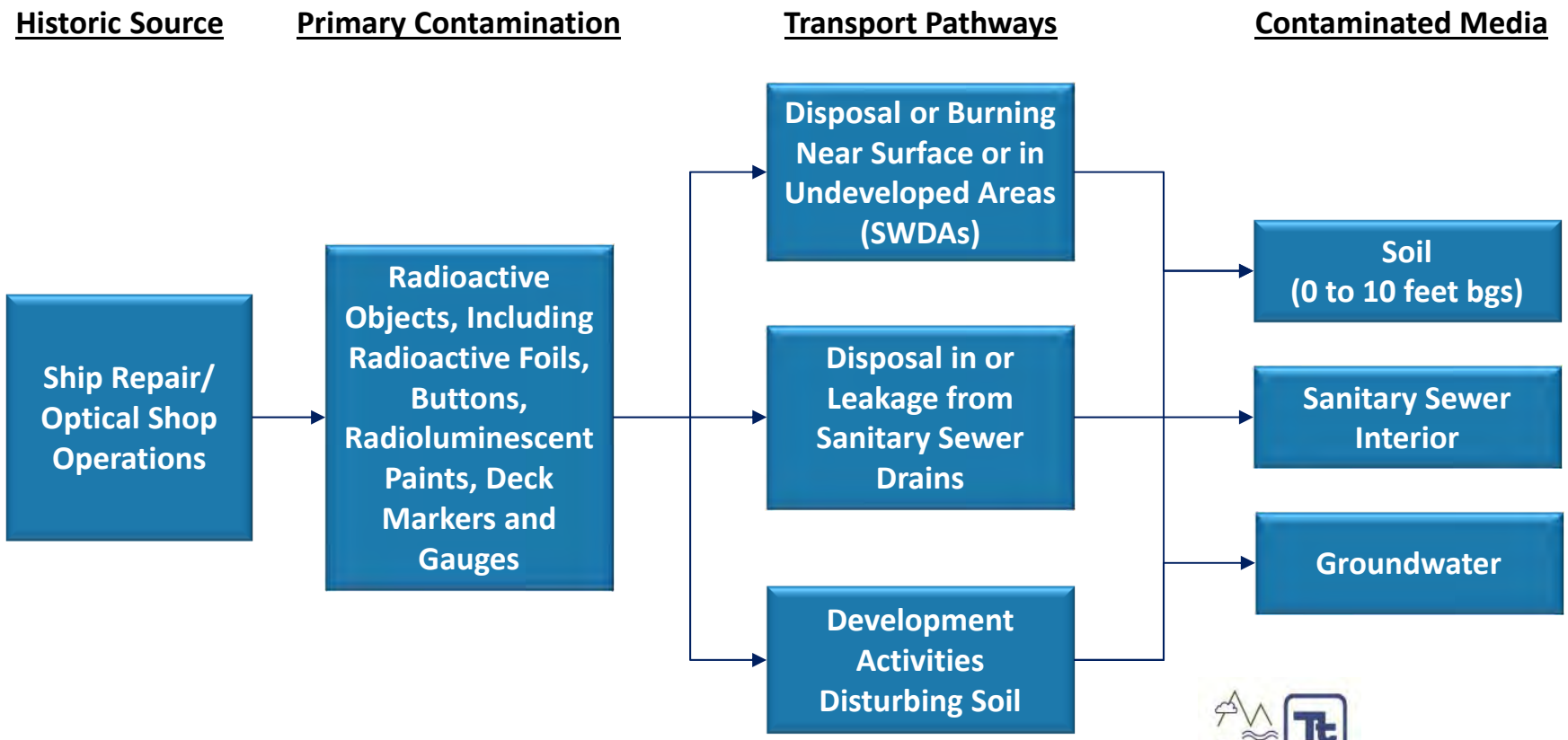
FIGURE 11

SITE 12
LOW LEVEL RADIOLOGICAL OBJECTS



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Notes:

bgs Below ground surface
SWDA Solid waste disposal area

Key Assumptions:

1. Ship repair activities were limited to WWII (the Frontier Base) and for a short period afterward (the "Small Craft Facility").
2. Disposal/burial areas would not be found within active or developed areas of the base.

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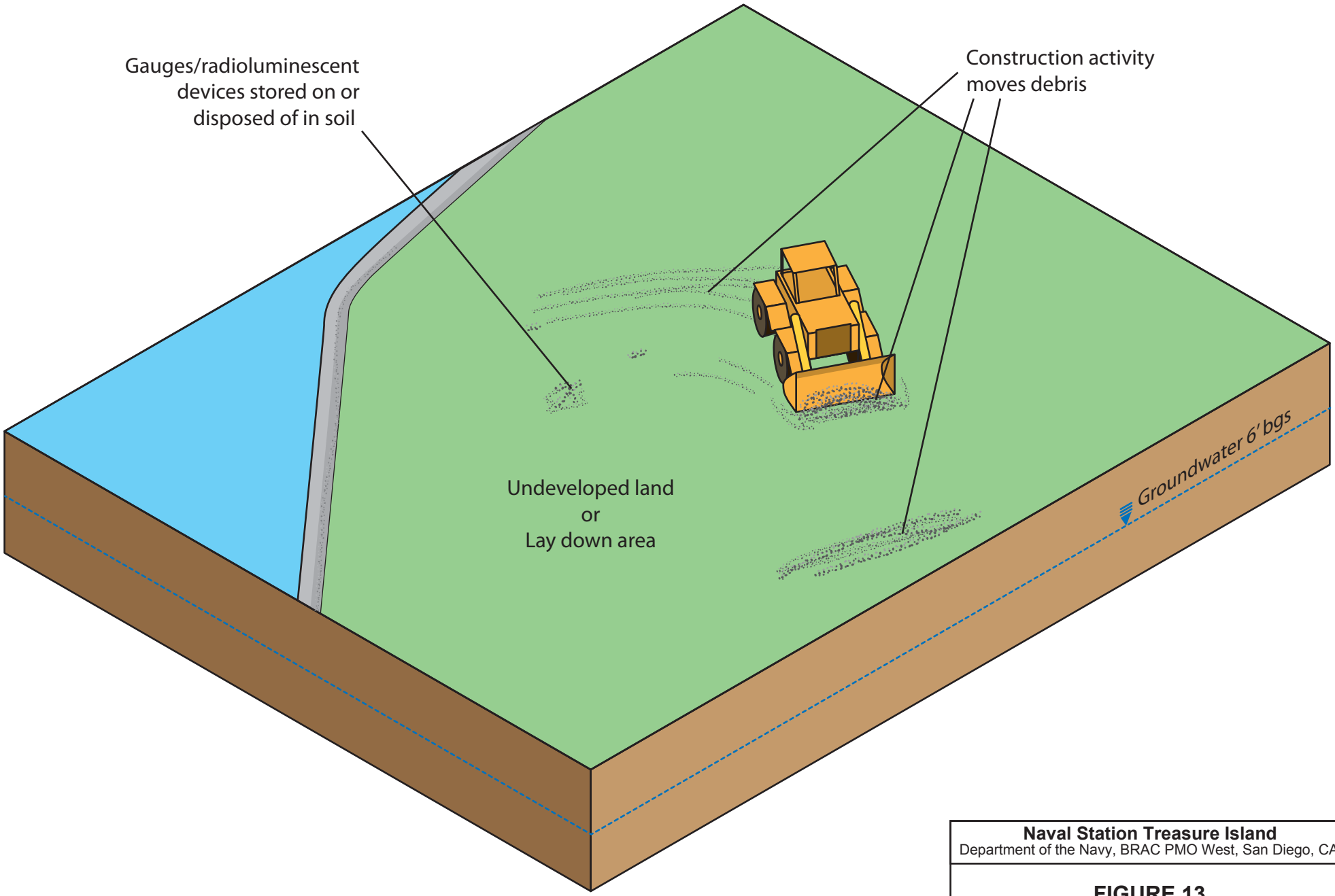
FIGURE 12

REPAIR/SOLID WASTE DISPOSAL OPERATIONS – CONCEPTUAL SITE MODEL

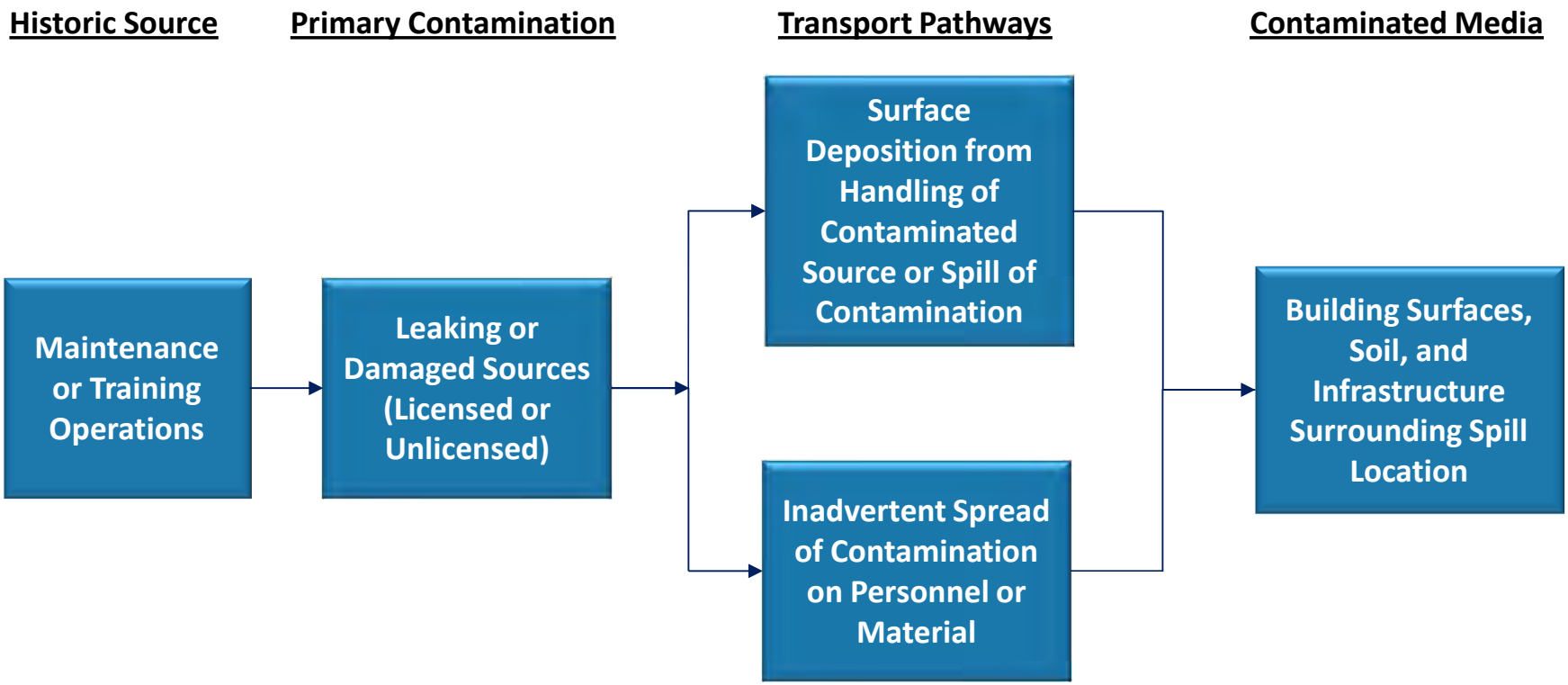


Note:
bgs Below ground surface

Naval Station Treasure Island
Department of the Navy, BRAC PMO West, San Diego, CA

FIGURE 13

REPAIR/SOLID WASTE DISPOSAL OPERATIONS - CONCEPTUAL SITE MODEL



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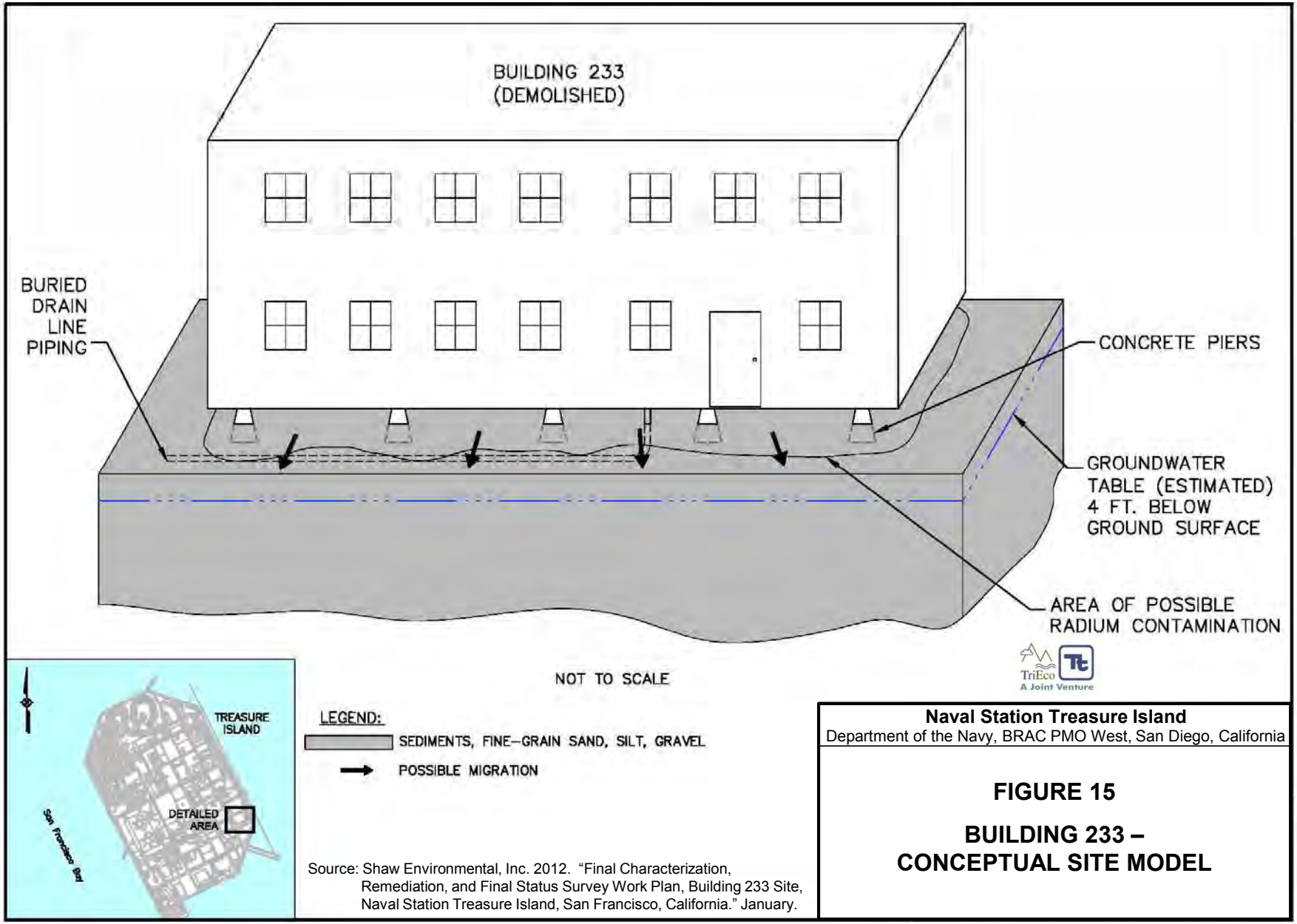
Department of the Navy, BRAC PMO West, San Diego, California

Key Assumption:

1. Known actual or potential spills are confined to Building 233 and former USS *Pandemonium* locations.

FIGURE 14

INCIDENTAL RELEASES FROM TRAINING OPERATIONS – CONCEPTUAL SITE MODEL

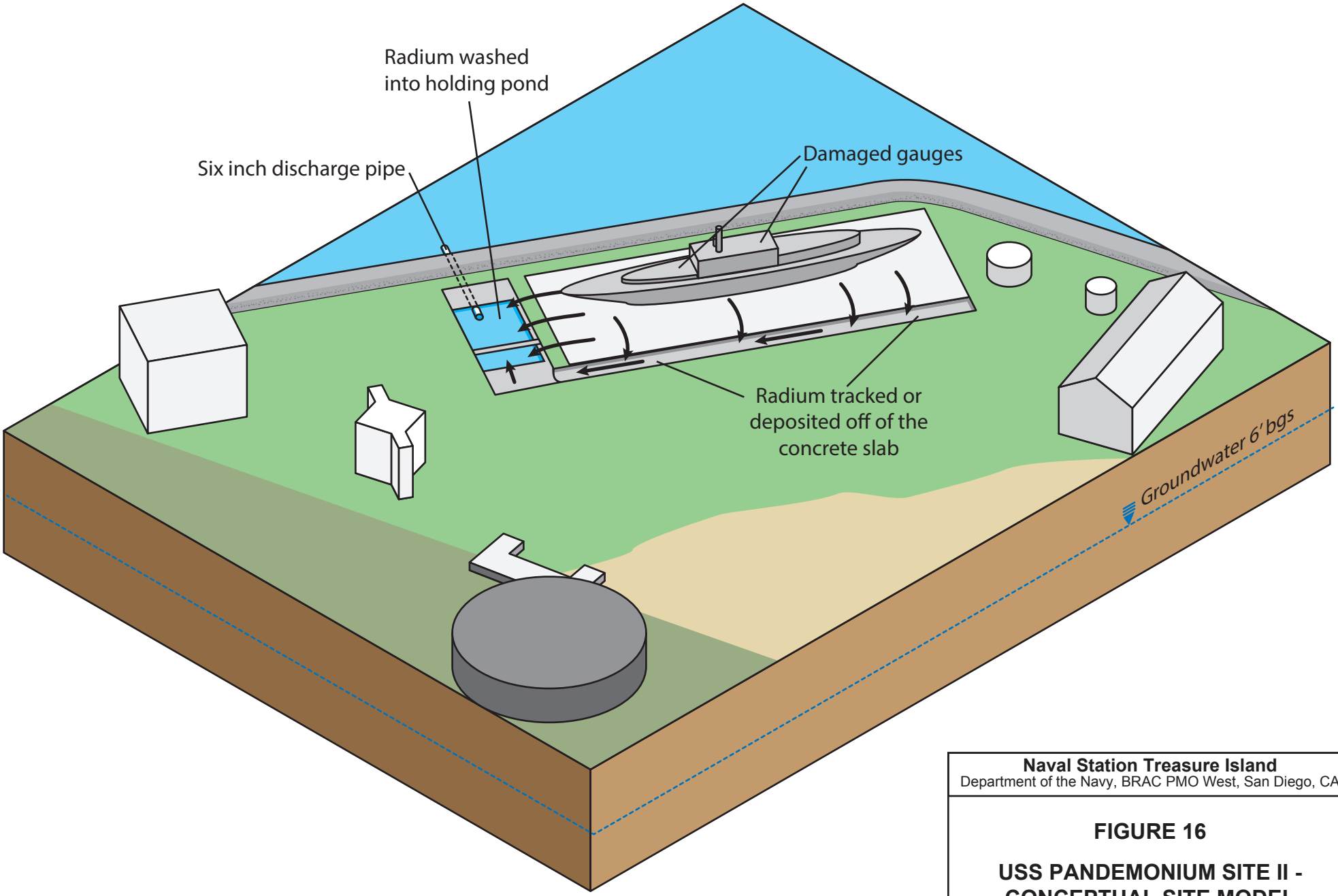


Source: Shaw Environmental, Inc. 2012. "Final Characterization, Remediation, and Final Status Survey Work Plan, Building 233 Site, Naval Station Treasure Island, San Francisco, California." January.

Naval Station Treasure Island
Department of the Navy, BRAC PMO West, San Diego, California

FIGURE 15

BUILDING 233 – CONCEPTUAL SITE MODEL

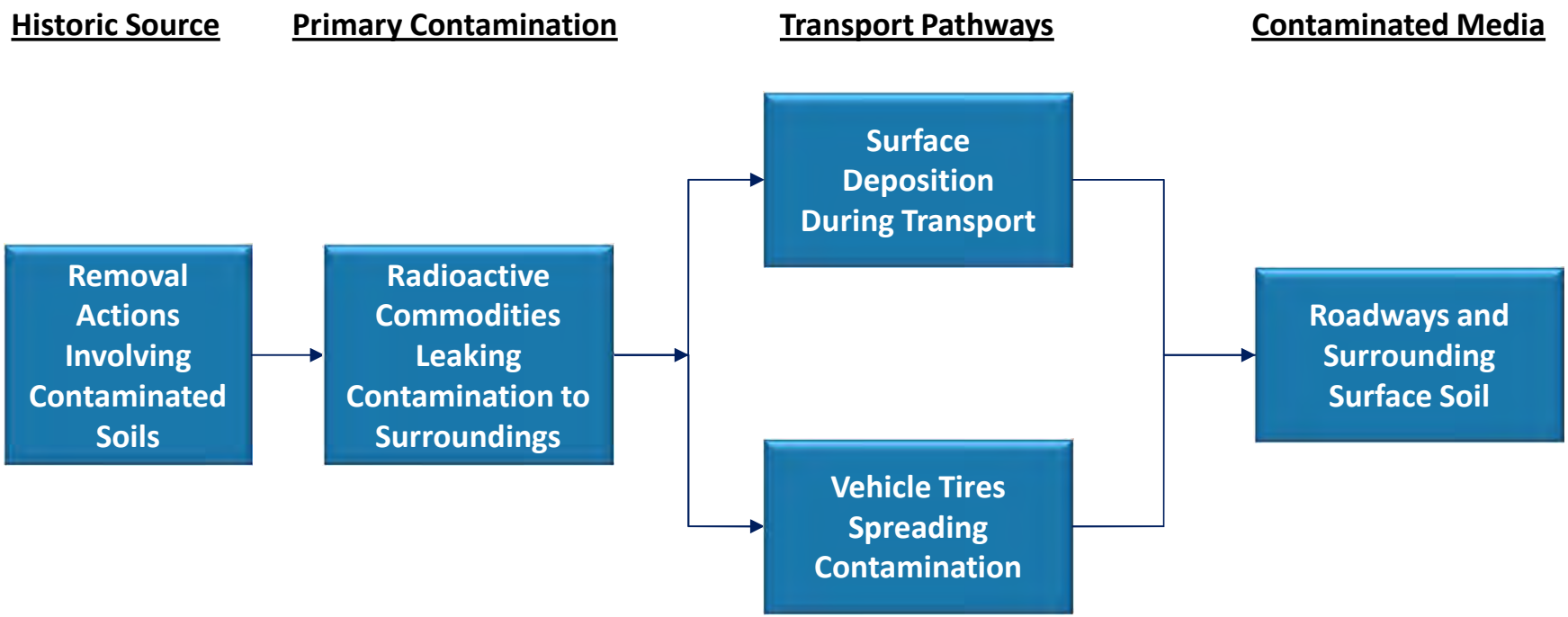


Note:
bgs Below ground surface

Naval Station Treasure Island
Department of the Navy, BRAC PMO West, San Diego, CA

FIGURE 16

USS PANDEMONIUM SITE II - CONCEPTUAL SITE MODEL



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Note:

SWDA Soild waste disposal area

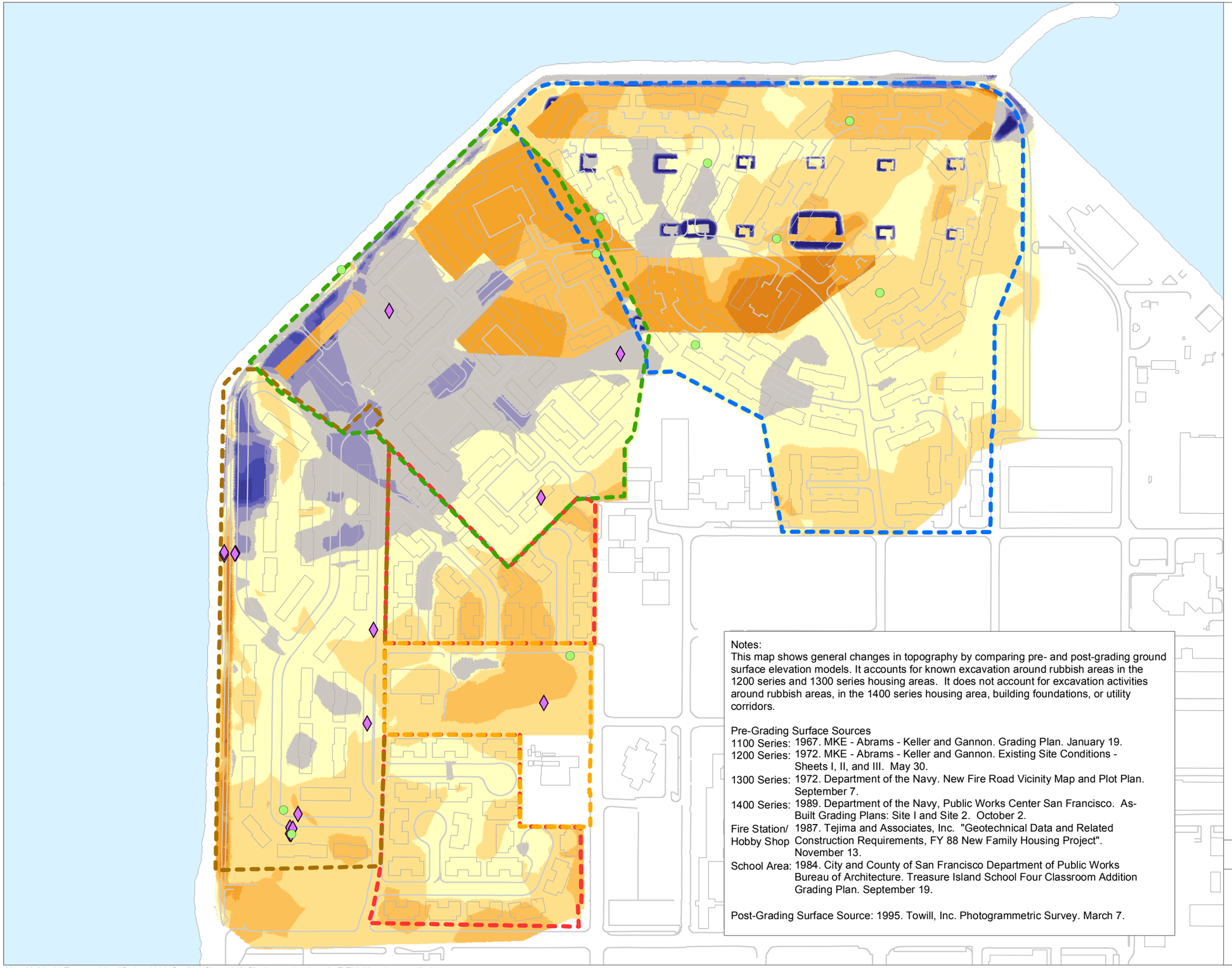
Key Assumptions:

1. Controls on transport of contaminated soil from Site 6, Site 12 SWDAs, and Site 32 were not adequate to contain contamination.
2. Impacted areas would be confined to primary truck routes.

Naval Station Treasure Island
Department of the Navy, BRAC PMO West, San Diego, California

FIGURE 17

SPILLS/CONTAMINATION RESULTING FROM HANDLING OF CONTAMINATED SOILS FROM SITE 12 SWDAs – CONCEPTUAL SITE MODEL



Note:
* Information on excavation and compaction beneath buildings is incomplete. Where available it suggests that between 2 and 2.5 feet of compacted soil was required beneath footings.

150 0 150 300
Feet

Notes:
This map shows general changes in topography by comparing pre- and post-grading ground surface elevation models. It accounts for known excavation around rubbish areas in the 1200 series and 1300 series housing areas. It does not account for excavation activities around rubbish areas, in the 1400 series housing area, building foundations, or utility corridors.

Pre-Grading Surface Sources
1100 Series: 1967. MKE - Abrams - Keller and Gannon. Grading Plan. January 19.
1200 Series: 1972. MKE - Abrams - Keller and Gannon. Existing Site Conditions - Sheets I, II, and III. May 30.
1300 Series: 1972. Department of the Navy. New Fire Road Vicinity Map and Plot Plan. September 7.
1400 Series: 1989. Department of the Navy, Public Works Center San Francisco. As-Built Grading Plans: Site I and Site 2. October 2.
Fire Station/ Hobby Shop: 1987. Tejima and Associates, Inc. "Geotechnical Data and Related Construction Requirements, FY 88 New Family Housing Project". November 13.
School Area: 1984. City and County of San Francisco Department of Public Works Bureau of Architecture. Treasure Island School Four Classroom Addition Grading Plan. September 19.

Post-Grading Surface Source: 1995. Towill, Inc. Photogrammetric Survey. March 7.

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Department of the Navy, BRAC PMO West, San Diego, California

FIGURE 18

GRADING ELEVATION CHANGE COMPARED TO EXCAVATED PRE-GRADING SURFACE

2014-06-25 V:\Treasure Island\Projects\031_Grading_Change\18_fill_above_min_alt.mxd TtEMI-AL simon.cardinale

TABLE

TABLE 1 – LOW-LEVEL RADIOLOGICAL OBJECTS RECOVERED FROM SITE 12
Historical Radiological Assessment Supplemental Technical Memorandum, NAVSTA TI, California

No.	LLRO ID Number	Date Recovered	Highest 30 cm (mR/h) [1]	LLRO Description	Estimated Ra-226 (mCi) RadiumThumb Rule [2]	LLRO Recovered By and Date Recovered
1	TI-01	2007-08	0.028	jar	0.0031	New World Technology 3/7/2007 to 4/27/2008
2	TI-02	2007-08	0.022	jar	0.0024	New World Technology 3/7/2007 to 4/27/2008
3	TI-03	2007-08	0.044	jar	0.0049	New World Technology 3/7/2007 to 4/27/2008
4	TI-04	2007-08	0.032	jar	0.0035	New World Technology 3/7/2007 to 4/27/2008
5	TI-05	2007-08	12	jar	1.3271	New World Technology 3/7/2007 to 4/27/2008
6	TI-06	2007-08	10	foil	1.1060	New World Technology 3/7/2007 to 4/27/2008
7	TI-07	2007-08	9	foil	0.9954	New World Technology 3/7/2007 to 4/27/2008
8	TI-08	2007-08	10	foil	1.1060	New World Technology 3/7/2007 to 4/27/2008
9	TI-09	2007-08	8	foil	0.8848	New World Technology 3/7/2007 to 4/27/2008
10	TI-10	2007-08	6	foil	0.6636	New World Technology 3/7/2007 to 4/27/2008
11	TI-11	2007-08	6	foil	0.6636	New World Technology 3/7/2007 to 4/27/2008
12	TI-12	2007-08	6	foil	0.6636	New World Technology 3/7/2007 to 4/27/2008
13	TI-13	2007-08	8	foil	0.8848	New World Technology 3/7/2007 to 11/24/2008
14	TI-14	2007-08	5	foil	0.5530	New World Technology 3/7/2007 to 11/24/2008
15	TI-15	2007-08	9	foil	0.9954	New World Technology 3/7/2007 to 11/24/2008

TABLE 1 – LOW-LEVEL RADIOLOGICAL OBJECTS RECOVERED FROM SITE 12
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No.	LLRO ID Number	Date Recovered	Highest 30 cm (mR/h) [1]	LLRO Description	Estimated Ra-226 (mCi) RadiumThumb Rule [2]	LLRO Recovered By and Date Recovered
16	TI-16	2007-08	8	foil	0.8848	New World Technology 3/7/2007 to 11/24/2008
17	TI-17	2007-08	6	foil	0.6636	New World Technology 3/7/2007 to 4/27/2008
18	TI-18	2007-08	8	foil	0.8848	New World Technology 3/7/2007 to 11/24/2008
19	TI-19	2007-08	6	foil	0.6636	New World Technology 3/7/2007 to 11/24/2008
20	TI-20	2007-08	6	foil	0.6636	New World Technology 3/7/2007 to 11/24/2008
21	TI-21	2007-08	8	foil	0.8848	New World Technology 3/7/2007 to 11/24/2008
22	TI-22	2007-08	10	foil	1.1060	New World Technology 3/7/2007 to 11/24/2008
23	TI-23	2007-08	4	foil	0.4424	New World Technology 3/7/2007 to 11/24/2008
24	TI-24	2007-08	4	foil	0.4424	New World Technology 3/7/2007 to 4/27/2008
25	TI-25	2007-08	12	foil	1.3271	New World Technology 3/7/2007 to 11/24/2008
26	TI-26	2007-08	10	foil	1.1060	New World Technology 3/7/2007 to 11/24/2008
27	TI-27	2007-08	8	foil	0.8848	New World Technology 3/7/2007 to 11/24/2008
28	TI-28	2007-08	0.02	button	0.0022	New World Technology 3/7/2007 to 11/24/2008
29	TI-29	2007-08	0.006	foil	0.0007	New World Technology 3/7/2007 to 4/27/2008
30	TI-30	2007-08	0.02	foil	0.0022	New World Technology 3/7/2007 to 11/24/2008

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No.	LLRO ID Number	Date Recovered	Highest 30 cm (mR/h) [1]	LLRO Description	Estimated Ra-226 (mCi) RadiumThumb Rule [2]	LLRO Recovered By and Date Recovered
31	TI-31	2007-08	0.044	button	0.0049	New World Technology 3/7/2007 to 11/24/2008
32	TI-32	2007-08	0.04	button	0.0044	New World Technology 3/7/2007 to 11/24/2008
33	TI-33	2007-08	0.006	button	0.0007	New World Technology 3/7/2007 to 11/24/2008
34	TI-34	2007-08	0.022	button	0.0024	New World Technology 3/7/2007 to 11/24/2008
35	TI-35	2007-08	0.022	button	0.0024	New World Technology 3/7/2007 to 11/24/2008
36	TI-36	2007-08	0.02	button	0.0022	New World Technology 3/7/2007 to 4/27/2008
37	TI-37	2007-08	0.032	button	0.0035	New World Technology 3/7/2007 to 11/24/2008
38	TI-38	2007-08	0.03	button	0.0033	New World Technology 3/7/2007 to 11/24/2008
39	TI-39	2007-08	0.032	button	0.0035	New World Technology 3/7/2007 to 11/24/2008
40	TI-40	2007-08	0.02	clear button cover	0.0022	New World Technology 3/7/2007 to 11/24/2008
41	TI-41	2007-08	0.04	soil	0.0044	New World Technology 3/7/2007 to 4/27/2008
42	TI-43	2007-08	0.026	rusted metal	0.0029	New World Technology 3/7/2007 to 11/24/2008
43	TI-44	2007-08	0.015	metal strap with button	0.0017	New World Technology 3/7/2007 to 11/24/2008
44	TI-45	2007-08	0.03	soil	0.0033	New World Technology 3/7/2007 to 11/24/2008
45	TI-46	2007-08	0.024	piece of old deck marker?	0.0027	New World Technology 3/7/2007 to 11/24/2008

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No.	LLRO ID Number	Date Recovered	Highest 30 cm (mR/h) [1]	LLRO Description	Estimated Ra-226 (mCi) RadiumThumb Rule [2]	LLRO Recovered By and Date Recovered
46	TI-47	2007-08	0.02	soil	0.0022	New World Technology 3/7/2007 to 11/24/2008
47	TI-48	2007-08	0.015	soil	0.0017	New World Technology 3/7/2007 to 11/24/2008
48	TI-49	2007-08	0.015	soil	0.0017	New World Technology 3/7/2007 to 4/27/2008
49	TI-50	2007-08	0.04	soil	0.0044	New World Technology 3/7/2007 to 11/24/2008
50	TI-51	2007-08	0.015	soil	0.0017	New World Technology 3/7/2007 to 11/24/2008
51	TI-52	2007-08	0.024	soil	0.0027	New World Technology 3/7/2007 to 11/24/2008
52	TI-53	2007-08	0.08	soil	0.0088	New World Technology 3/7/2007 to 11/24/2008
53	TI-54	2007-08	0.022	soil	0.0024	New World Technology 3/7/2007 to 4/27/2008
54	TI-55	2007-08	0.015	soil	0.0017	New World Technology 3/7/2007 to 11/24/2008
55	TI-56	2007-08	9	foil	0.9954	New World Technology 3/7/2007 to 11/24/2008
56	TI-57	2007-08	10	foil	1.1060	New World Technology 3/7/2007 to 11/24/2008
57	TI-58	2007-08	10	foil	1.1060	New World Technology 3/7/2007 to 11/24/2008
58	TI-59	2007-08	10	foil	1.1060	New World Technology 3/7/2007 to 11/24/2008
59	TI-60	2007-08	8	foil	0.8848	New World Technology 3/7/2007 to 11/24/2008
60	TI-61	2007-08	6	foil	0.6636	New World Technology 3/7/2007 to 4/27/2008

TABLE 1 – LOW-LEVEL RADIOLOGICAL OBJECTS RECOVERED FROM SITE 12
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No.	LLRO ID Number	Date Recovered	Highest 30 cm (mR/h) [1]	LLRO Description	Estimated Ra-226 (mCi) RadiumThumb Rule [2]	LLRO Recovered By and Date Recovered
61	TI-62	2007-08	8	two 0.5 cm chunks of corrosion?	0.8848	New World Technology 3/7/2007 to 11/24/2008
62	TI-63	2007-08	10	foil	1.1060	New World Technology 3/7/2007 to 11/24/2008
63	TI-64	2007-08	6	foil	0.6636	New World Technology 3/7/2007 to 11/24/2008
64	TI-65	2007-08	8	foil	0.8848	New World Technology 3/7/2007 to 11/24/2008
65	TI-66	2007-08	0.24	foil	0.0265	New World Technology 3/7/2007 to 4/27/2008
66	TI-67	2007-08	10	foil	1.1060	New World Technology 3/7/2007 to 11/24/2008
67	TI-68	2007-08	6	foil	0.6636	New World Technology 3/7/2007 to 11/24/2008
68	TI-69	2007-08	10	foil	1.1060	New World Technology 3/7/2007 to 11/24/2008
69	TI-70	2007-08	8	foil	0.8848	New World Technology 3/7/2007 to 11/24/2008
70	TI-71	2007-08	8	foil	0.8848	New World Technology 3/7/2007 to 11/24/2008
71	TI-72	2007-08	12	foil	1.3271	New World Technology 3/7/2007 to 11/24/2008
72	TI-73	2007-08	8	foil	0.8848	New World Technology 3/7/2007 to 4/27/2008
73	TI-74	2007-08	1.6	foil	0.1770	New World Technology 3/7/2007 to 11/24/2008
74	100	2007-08	58	foil	6.4145	New World Technology 3/7/2007 to 11/24/2008
75	101	2007-08	10	foil	1.1060	New World Technology 3/7/2007 to 11/24/2008

TABLE 1 – LOW-LEVEL RADIOLOGICAL OBJECTS RECOVERED FROM SITE 12
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No.	LLRO ID Number	Date Recovered	Highest 30 cm (mR/h) [1]	LLRO Description	Estimated Ra-226 (mCi) RadiumThumb Rule [2]	LLRO Recovered By and Date Recovered
76	102	2007-08	5	foil	0.5530	New World Technology 3/7/2007 to 11/24/2008
77	103	2007-08	0.012	soil	0.0013	New World Technology 3/7/2007 to 4/27/2008
78	104	2007-08	0.008	soil	0.0009	New World Technology 3/7/2007 to 11/24/2008
79	105	2007-08	0.006	soil	0.0007	New World Technology 3/7/2007 to 11/24/2008
80	106	2007-08	0.03	button	0.0033	New World Technology 3/7/2007 to 11/24/2008
81	107	2007-08	0.022	button	0.0024	New World Technology 3/7/2007 to 11/24/2008
82	108	2007-08	0.015	button	0.0017	New World Technology 3/7/2007 to 11/24/2008
83	109	2007-08	0.034	button	0.0038	New World Technology 3/7/2007 to 11/24/2008
84	110	2007-08	0.024	button	0.0027	New World Technology 3/7/2007 to 4/27/2008
85	111	2007-08	0.012	soil	0.0013	New World Technology 3/7/2007 to 11/24/2008
86	112	2007-08	0.04	button	0.0044	New World Technology 3/7/2007 to 11/24/2008
87	113	2007-08	0.006	soil	0.0007	New World Technology 3/7/2007 to 11/24/2008
88	114	2007-08	0.23	button	0.0254	New World Technology 3/7/2007 to 11/24/2008
89	115	2007-08	0.02	button	0.0022	New World Technology 3/7/2007 to 4/27/2008
90	401	04/28/08	6	foil	0.6636	New World Technology 3/7/2007 to 11/24/2008

TABLE 1 – LOW-LEVEL RADIOLOGICAL OBJECTS RECOVERED FROM SITE 12
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No.	LLRO ID Number	Date Recovered	Highest 30 cm (mR/h) [1]	LLRO Description	Estimated Ra-226 (mCi) RadiumThumb Rule [2]	LLRO Recovered By and Date Recovered
91	402	04/29/08	5	foil	0.5530	New World Technology 3/7/2007 to 11/24/2008
92	403	04/29/08	10	foil	1.1060	New World Technology 3/7/2007 to 11/24/2008
93	404	04/30/08	12	foil	1.3271	New World Technology 3/7/2007 to 11/24/2008
94	405	04/30/08	2	possible foil fragments	0.2212	New World Technology 3/7/2007 to 11/24/2008
95	501	05/01/08	15	foil	1.6589	New World Technology 3/7/2007 to 11/24/2008
96	502	05/21/08	0.04	button	0.0044	New World Technology 3/7/2007 to 4/27/2008
97	503	05/22/08	0.008	switch	0.0009	New World Technology 3/7/2007 to 11/24/2008
98	504	05/29/08	0.035	button	0.0039	New World Technology 3/7/2007 to 11/24/2008
99	601	06/02/08	0.025	button	0.0028	New World Technology 3/7/2007 to 11/24/2008
100	602	06/16/08	2	appear to be foil fragments	0.2212	New World Technology 3/7/2007 to 11/24/2008
101	603	06/19/08	0.04	button	0.0044	New World Technology 3/7/2007 to 4/27/2008
102	604	06/26/08	0.04	foil	0.0044	New World Technology 3/7/2007 to 11/24/2008
103	701	07/03/08	0.04	button	0.0044	New World Technology 3/7/2007 to 11/24/2008
104	702	07/24/08	0.008	electronic component	0.0009	New World Technology 3/7/2007 to 11/24/2008
105	703	07/24/08	0.008	metallic piece	0.0009	New World Technology 3/7/2007 to 11/24/2008

TABLE 1 – LOW-LEVEL RADIOLOGICAL OBJECTS RECOVERED FROM SITE 12
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No.	LLRO ID Number	Date Recovered	Highest 30 cm (mR/h) [1]	LLRO Description	Estimated Ra-226 (mCi) RadiumThumb Rule [2]	LLRO Recovered By and Date Recovered
106	704	07/24/08	0.025	button like	0.0028	New World Technology 3/7/2007 to 11/24/2008
107	705	07/24/08	0.02	metallic piece	0.0022	New World Technology 3/7/2007 to 11/24/2008
108	706	07/30/08	0.008	switch	0.0009	New World Technology 3/7/2007 to 4/27/2008
109	707	07/30/08	0.008	metal piece	0.0009	New World Technology 3/7/2007 to 11/24/2008
110	801	08/04/08	0.008	metal piece	0.0009	New World Technology 3/7/2007 to 11/24/2008
111	802	08/12/08	10	foil	1.1060	New World Technology 3/7/2007 to 11/24/2008
112	803	08/19/08	0.01	metal fragments	0.0011	New World Technology 3/7/2007 to 11/24/2008
113	804	08/19/08	10	foil fragments	1.1060	New World Technology 3/7/2007 to 4/27/2008
114	805	08/20/08	0.4	metal fragments	0.0442	New World Technology 3/7/2007 to 11/24/2008
115	806	08/20/08	0.01	metal fragments	0.0011	New World Technology 3/7/2007 to 11/24/2008
116	807	08/26/08	0.008	metal fragments	0.0009	New World Technology 3/7/2007 to 11/24/2008
117	808	08/27/08	0.02	metal fragments	0.0022	New World Technology 3/7/2007 to 11/24/2008
118	809	08/28/08	0.008	metal fragments	0.0009	New World Technology 3/7/2007 to 11/24/2008
119	810	08/28/08	0.008	metal fragments	0.0009	New World Technology 3/7/2007 to 11/24/2008
120	901	09/02/08	0.02	metal fragments	0.0022	New World Technology 3/7/2007 to 4/27/2008

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No.	LLRO ID Number	Date Recovered	Highest 30 cm (mR/h) [1]	LLRO Description	Estimated Ra-226 (mCi) RadiumThumb Rule [2]	LLRO Recovered By and Date Recovered
121	902	09/23/08	0.01	metal fragments	0.0011	New World Technology 3/7/2007 to 11/24/2008
122	903	09/23/08	0.01	switch	0.0011	New World Technology 3/7/2007 to 11/24/2008
123	904	09/23/08	0.01	metal fragments	0.0011	New World Technology 3/7/2007 to 11/24/2008
124	905	09/23/08	0.04	metal fragments	0.0044	New World Technology 3/7/2007 to 11/24/2008
125	906	09/23/08	0.01	metal fragments	0.0011	New World Technology 3/7/2007 to 4/27/2008
126	907	09/23/08	0.01	metal fragments	0.0011	New World Technology 3/7/2007 to 11/24/2008
127	908	09/23/08	0.01	metal fragments	0.0011	New World Technology 3/7/2007 to 11/24/2008
128	909	09/23/08	0.01	metal fragments	0.0011	New World Technology 3/7/2007 to 11/24/2008
129	910	09/23/08	0.01	metal fragments	0.0011	New World Technology 3/7/2007 to 11/24/2008
130	911	09/23/08	0.01	metal fragments	0.0011	New World Technology 3/7/2007 to 11/24/2008
131	912	09/23/08	0.01	metal fragments	0.0011	New World Technology 3/7/2007 to 11/24/2008
132	913	09/23/08	4	foil	0.4424	New World Technology 3/7/2007 to 4/27/2008
133	914	09/24/08	0.01	metal fragments	0.0011	New World Technology 3/7/2007 to 11/24/2008
134	915	09/24/08	0.014	metal fragments	0.0015	New World Technology 3/7/2007 to 11/24/2008
135	916	09/24/08	0.012	metal fragments	0.0013	New World Technology 3/7/2007 to 11/24/2008

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No.	LLRO ID Number	Date Recovered	Highest 30 cm (mR/h) [1]	LLRO Description	Estimated Ra-226 (mCi) RadiumThumb Rule [2]	LLRO Recovered By and Date Recovered
136	917	09/24/08	0.01	metal fragments	0.0011	New World Technology 3/7/2007 to 11/24/2008
137	918	09/24/08	0.01	metal fragments	0.0011	New World Technology 3/7/2007 to 4/27/2008
138	919	09/24/08	0.01	metal fragments	0.0011	New World Technology 3/7/2007 to 11/24/2008
139	920	09/25/08	0.01	metal fragments	0.0011	New World Technology 3/7/2007 to 11/24/2008
140	921	09/25/08	0.04	metal fragments	0.0044	New World Technology 3/7/2007 to 11/24/2008
141	922	09/25/08	0.014	metal fragments	0.0015	New World Technology 3/7/2007 to 11/24/2008
142	923	09/25/08	0.01	metal fragments	0.0011	New World Technology 3/7/2007 to 11/24/2008
143	924	09/25/08	0.01	metal fragments	0.0011	New World Technology 3/7/2007 to 11/24/2008
144	925	09/25/08	0.01	metal fragments	0.0011	New World Technology 3/7/2007 to 4/27/2008
145	926	09/25/08	0.01	metal fragments	0.0011	New World Technology 3/7/2007 to 11/24/2008
146	927	09/25/08	0.01	metal fragments	0.0011	New World Technology 3/7/2007 to 11/24/2008
147	928	09/25/08	0.01	metal fragments	0.0011	New World Technology 3/7/2007 to 11/24/2008
148	929	09/25/08	0.01	metal fragments	0.0011	New World Technology 3/7/2007 to 11/24/2008
149	930	09/25/08	0.01	metal fragments	0.0011	New World Technology 3/7/2007 to 4/27/2008
150	931	09/25/08	0.01	metal fragments	0.0011	New World Technology 3/7/2007 to 11/24/2008

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No.	LLRO ID Number	Date Recovered	Highest 30 cm (mR/h) [1]	LLRO Description	Estimated Ra-226 (mCi) RadiumThumb Rule [2]	LLRO Recovered By and Date Recovered
151	932	09/25/08	0.01	metal fragments	0.0011	New World Technology 3/7/2007 to 11/24/2008
152	933	09/25/08	0.02	metal fragments	0.0022	New World Technology 3/7/2007 to 11/24/2008
153	934	09/25/08	0.01	metal fragments	0.0011	New World Technology 3/7/2007 to 11/24/2008
154	935	09/25/08	0.018	metal fragments	0.0020	New World Technology 3/7/2007 to 11/24/2008
155	936	09/25/08	0.01	metal fragments	0.0011	New World Technology 3/7/2007 to 11/24/2008
156	937	09/25/08	0.01	metal fragments	0.0011	New World Technology 3/7/2007 to 4/27/2008
157	938	09/25/08	0.03	metal fragments	0.0033	New World Technology 3/7/2007 to 11/24/2008
158	939	09/29/08	20	foil	2.2119	New World Technology 3/7/2007 to 11/24/2008
159	940	09/29/08	0.01	metal fragments	0.0011	New World Technology 3/7/2007 to 11/24/2008
160	941	09/29/08	0.01	metal fragments	0.0011	New World Technology 3/7/2007 to 11/24/2008
161	942	09/29/08	0.008	metal fragments	0.0009	New World Technology 3/7/2007 to 4/27/2008
162	943	09/29/08	0.01	metal fragments	0.0011	New World Technology 3/7/2007 to 11/24/2008
163	944	09/29/08	0.008	metal fragments	0.0009	New World Technology 3/7/2007 to 11/24/2008
164	945	09/29/08	0.01	metal fragments	0.0011	New World Technology 3/7/2007 to 11/24/2008
165	946	09/29/08	0.01	metal fragments	0.0011	New World Technology 3/7/2007 to 11/24/2008

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No.	LLRO ID Number	Date Recovered	Highest 30 cm (mR/h) [1]	LLRO Description	Estimated Ra-226 (mCi) RadiumThumb Rule [2]	LLRO Recovered By and Date Recovered
166	947	09/29/08	0.008	metal fragments	0.0009	New World Technology 3/7/2007 to 11/24/2008
167	948	09/29/08	0.01	metal fragments	0.0011	New World Technology 3/7/2007 to 11/24/2008
168	949	09/29/08	0.01	metal fragments	0.0011	New World Technology 3/7/2007 to 4/27/2008
169	950	09/29/08	0.01	metal fragments	0.0011	New World Technology 3/7/2007 to 11/24/2008
170	951	09/29/08	0.008	metal fragments	0.0009	New World Technology 3/7/2007 to 11/24/2008
171	952	09/30/08	0.012	metal fragments	0.0013	New World Technology 3/7/2007 to 11/24/2008
172	953	09/30/08	0.01	metal fragments	0.0011	New World Technology 3/7/2007 to 11/24/2008
173	954	09/30/08	0.01	metal fragments	0.0011	New World Technology 3/7/2007 to 4/27/2008
174	955	09/30/08	0.22	metal fragments	0.0243	New World Technology 3/7/2007 to 11/24/2008
175	956	09/30/08	0.012	metal fragments	0.0013	New World Technology 3/7/2007 to 11/24/2008
176	957	09/30/08	0.01	metal fragments	0.0011	New World Technology 3/7/2007 to 11/24/2008
177	958	09/30/08	0.01	metal fragments	0.0011	New World Technology 3/7/2007 to 11/24/2008
178	959	09/30/08	0.014	metal fragments	0.0015	New World Technology 3/7/2007 to 11/24/2008
179	960	09/30/08	0.02	metal fragments	0.0022	New World Technology 3/7/2007 to 11/24/2008
180	961	09/30/08	0.008	metal fragments	0.0009	New World Technology 3/7/2007 to 4/27/2008

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No.	LLRO ID Number	Date Recovered	Highest 30 cm (mR/h) [1]	LLRO Description	Estimated Ra-226 (mCi) RadiumThumb Rule [2]	LLRO Recovered By and Date Recovered
181	962	09/30/08	0.008	metal fragments	0.0009	New World Technology 3/7/2007 to 11/24/2008
182	963	09/30/08	0.014	metal fragments	0.0015	New World Technology 3/7/2007 to 11/24/2008
183	964	09/30/08	0.008	metal fragments	0.0009	New World Technology 3/7/2007 to 11/24/2008
184	965	09/30/08	0.01	metal fragments	0.0011	New World Technology 3/7/2007 to 11/24/2008
185	966	09/30/08	0.008	metal fragments	0.0009	New World Technology 3/7/2007 to 4/27/2008
186	967	09/30/08	0.008	metal fragments	0.0009	New World Technology 3/7/2007 to 11/24/2008
187	968	09/30/08	0.008	metal fragments	0.0009	New World Technology 3/7/2007 to 11/24/2008
188	969	09/30/08	0.012	metal fragments	0.0013	New World Technology 3/7/2007 to 11/24/2008
189	970	09/30/08	0.008	metal fragments	0.0009	New World Technology 3/7/2007 to 11/24/2008
190	971	09/30/08	0.008	metal fragments	0.0009	New World Technology 3/7/2007 to 11/24/2008
191	972	09/30/08	0.008	metal fragments	0.0009	New World Technology 3/7/2007 to 11/24/2008
192	973	09/30/08	0.008	metal fragments	0.0009	New World Technology 3/7/2007 to 4/27/2008
193	974	09/30/08	0.01	metal fragments	0.0011	New World Technology 3/7/2007 to 11/24/2008
194	975	09/30/08	0.012	metal fragments	0.0013	New World Technology 3/7/2007 to 11/24/2008
195	976	09/30/08	0.018	metal fragments	0.0020	New World Technology 3/7/2007 to 11/24/2008

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No.	LLRO ID Number	Date Recovered	Highest 30 cm (mR/h) [1]	LLRO Description	Estimated Ra-226 (mCi) RadiumThumb Rule [2]	LLRO Recovered By and Date Recovered
196	977	09/30/08	0.008	metal fragments	0.0009	New World Technology 3/7/2007 to 11/24/2008
197	978	09/30/08	0.01	metal fragments	0.0011	New World Technology 3/7/2007 to 4/27/2008
198	979	09/30/08	0.01	metal fragments	0.0011	New World Technology 3/7/2007 to 11/24/2008
199	980	09/30/08	0.008	metal fragments	0.0009	New World Technology 3/7/2007 to 11/24/2008
200	981	09/30/08	0.01	metal fragments	0.0011	New World Technology 3/7/2007 to 11/24/2008
201	982	09/30/08	0.008	metal fragments	0.0009	New World Technology 3/7/2007 to 11/24/2008
202	983	09/30/08	0.014	metal fragments	0.0015	New World Technology 3/7/2007 to 11/24/2008
203	984	09/30/08	0.01	metal fragments	0.0011	New World Technology 3/7/2007 to 11/24/2008
204	1001	10/01/08	0.01	metal fragments	0.0011	New World Technology 3/7/2007 to 11/24/2008
205	1002	10/01/08	0.08	metal fragments	0.0088	New World Technology 3/7/2007 to 11/24/2008
206	1003	10/01/08	0.03	metal fragments	0.0033	New World Technology 3/7/2007 to 11/24/2008
207	1004	10/01/08	0.05	metal fragments	0.0055	New World Technology 3/7/2007 to 11/24/2008
208	1005	10/01/08	0.01	metal fragments	0.0011	New World Technology 3/7/2007 to 11/24/2008
209	1006	10/01/08	0.008	metal fragments	0.0009	New World Technology 3/7/2007 to 11/24/2008
210	1007	10/01/08	0.05	metal fragments	0.0055	New World Technology 3/7/2007 to 11/24/2008

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No.	LLRO ID Number	Date Recovered	Highest 30 cm (mR/h) [1]	LLRO Description	Estimated Ra-226 (mCi) RadiumThumb Rule [2]	LLRO Recovered By and Date Recovered
211	1008	10/01/08	0.01	metal fragments	0.0011	New World Technology 3/7/2007 to 11/24/2008
212	1009	10/01/08	0.01	metal fragments	0.0011	New World Technology 3/7/2007 to 11/24/2008
213	1010	10/01/08	0.08	metal fragments	0.0088	New World Technology 3/7/2007 to 11/24/2008
214	1011	10/01/08	0.008	metal fragments	0.0009	New World Technology 3/7/2007 to 11/24/2008
215	1012	10/01/08	0.01	metal fragments	0.0011	New World Technology 3/7/2007 to 11/24/2008
216	1013	10/01/08	0.008	metal fragments	0.0009	New World Technology 3/7/2007 to 11/24/2008
217	1014	10/02/08	0.01	metal fragments	0.0011	New World Technology 3/7/2007 to 11/24/2008
218	1015	10/02/08	0.008	metal fragments	0.0009	New World Technology 3/7/2007 to 11/24/2008
219	1016	10/02/08	0.008	metal fragments	0.0009	New World Technology 3/7/2007 to 11/24/2008
220	1017	10/02/08	0.008	metal fragments	0.0009	New World Technology 3/7/2007 to 11/24/2008
221	1018	10/02/08	0.008	metal fragments	0.0009	New World Technology 3/7/2007 to 11/24/2008
222	1019	10/02/08	0.008	metal fragments	0.0009	New World Technology 3/7/2007 to 11/24/2008
223	1020	10/02/08	0.01	metal fragments	0.0011	New World Technology 3/7/2007 to 11/24/2008
224	1021	10/02/08	0.008	metal fragments	0.0009	New World Technology 3/7/2007 to 11/24/2008
225	1022	10/02/08	0.01	metal fragments	0.0011	New World Technology 3/7/2007 to 11/24/2008

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No.	LLRO ID Number	Date Recovered	Highest 30 cm (mR/h) [1]	LLRO Description	Estimated Ra-226 (mCi) RadiumThumb Rule [2]	LLRO Recovered By and Date Recovered
226	1023	10/02/08	0.008	metal fragments	0.0009	New World Technology 3/7/2007 to 11/24/2008
227	1024	10/02/08	0.01	metal fragments	0.0011	New World Technology 3/7/2007 to 11/24/2008
228	1025	10/02/08	0.008	metal fragments	0.0009	New World Technology 3/7/2007 to 11/24/2008
229	1026	10/06/08	0.01	metal fragments	0.0011	New World Technology 3/7/2007 to 11/24/2008
230	1027	10/06/08	0.008	metal fragments	0.0009	New World Technology 3/7/2007 to 11/24/2008
231	1028	10/06/08	0.008	metal fragments	0.0009	New World Technology 3/7/2007 to 11/24/2008
232	1029	10/06/08	0.008	metal fragments	0.0009	New World Technology 3/7/2007 to 11/24/2008
233	1030	10/07/08	0.008	metal fragments	0.0009	New World Technology 3/7/2007 to 11/24/2008
234	1031	10/07/08	0.01	metal fragments	0.0011	New World Technology 3/7/2007 to 11/24/2008
235	1032	10/07/08	0.008	metal fragments	0.0009	New World Technology 3/7/2007 to 11/24/2008
236	1033	10/07/08	2	foil	0.2212	New World Technology 3/7/2007 to 11/24/2008
237	1034	10/07/08	0.01	metal fragments	0.0011	New World Technology 3/7/2007 to 11/24/2008
238	1035	10/07/08	0.008	metal fragments	0.0009	New World Technology 3/7/2007 to 11/24/2008
239	1036	10/08/08	0.012	metal fragments	0.0013	New World Technology 3/7/2007 to 11/24/2008
240	1037	10/08/08	0.02	metal fragments	0.0022	New World Technology 3/7/2007 to 11/24/2008

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No.	LLRO ID Number	Date Recovered	Highest 30 cm (mR/h) [1]	LLRO Description	Estimated Ra-226 (mCi) RadiumThumb Rule [2]	LLRO Recovered By and Date Recovered
241	1038	10/08/08	0.01	metal fragments	0.0011	New World Technology 3/7/2007 to 11/24/2008
242	1039	10/08/08	0.012	metal fragments	0.0013	New World Technology 3/7/2007 to 11/24/2008
243	1040	10/08/08	0.012	metal fragments	0.0013	New World Technology 3/7/2007 to 11/24/2008
244	1041	10/09/08	0.01	metal fragments	0.0011	New World Technology 3/7/2007 to 11/24/2008
245	1042	10/09/08	0.01	metal fragments	0.0011	New World Technology 3/7/2007 to 11/24/2008
246	1043	10/13/08	0.008	metal fragments	0.0009	New World Technology 3/7/2007 to 11/24/2008
247	1044	10/13/08	0.01	metal fragments	0.0011	New World Technology 3/7/2007 to 11/24/2008
248	1045	10/13/08	0.008	metal fragments	0.0009	New World Technology 3/7/2007 to 11/24/2008
249	1046	10/13/08	0.025	metal fragments	0.0028	New World Technology 3/7/2007 to 11/24/2008
250	1047	10/13/08	0.01	metal fragments	0.0011	New World Technology 3/7/2007 to 11/24/2008
251	1048	10/13/08	0.008	metal fragments	0.0009	New World Technology 3/7/2007 to 11/24/2008
252	1049	10/13/08	0.008	metal fragments	0.0009	New World Technology 3/7/2007 to 11/24/2008
253	1050	10/13/08	0.04	metal fragments	0.0044	New World Technology 3/7/2007 to 11/24/2008
254	1051	10/13/08	0.01	metal fragments	0.0011	New World Technology 3/7/2007 to 11/24/2008
255	1052	10/14/08	0.008	metal fragments	0.0009	New World Technology 3/7/2007 to 11/24/2008

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No.	LLRO ID Number	Date Recovered	Highest 30 cm (mR/h) [1]	LLRO Description	Estimated Ra-226 (mCi) RadiumThumb Rule [2]	LLRO Recovered By and Date Recovered
256	1053	10/14/08	0.012	metal fragments	0.0013	New World Technology 3/7/2007 to 11/24/2008
257	1054	10/14/08	0.008	metal fragments	0.0009	New World Technology 3/7/2007 to 11/24/2008
258	1055	10/14/08	0.008	metal fragments	0.0009	New World Technology 3/7/2007 to 11/24/2008
259	1056	10/14/08	0.008	metal fragments	0.0009	New World Technology 3/7/2007 to 11/24/2008
260	1057	10/14/08	0.015	4" dia x 4" long cylindrical gauge	0.0017	New World Technology 3/7/2007 to 11/24/2008
261	1058	10/14/08	0.01	metal fragments	0.0011	New World Technology 3/7/2007 to 11/24/2008
262	1059	10/14/08	0.008	metal fragments	0.0009	New World Technology 3/7/2007 to 11/24/2008
263	1060	10/14/08	0.008	metal fragments	0.0009	New World Technology 3/7/2007 to 11/24/2008
264	1061	10/14/08	0.01	metal fragments	0.0011	New World Technology 3/7/2007 to 11/24/2008
265	1062	10/14/08	0.008	metal fragments	0.0009	New World Technology 3/7/2007 to 11/24/2008
266	1063	10/14/08	0.008	metal fragments	0.0009	New World Technology 3/7/2007 to 11/24/2008
267	1064	10/15/08	0.01	metal fragments	0.0011	New World Technology 3/7/2007 to 11/24/2008
268	1065	10/15/08	0.01	metal fragments	0.0011	New World Technology 3/7/2007 to 11/24/2008
269	1066	10/15/08	1.5	foil	0.1659	New World Technology 3/7/2007 to 11/24/2008
270	1067	10/15/08	0.012	metal fragments	0.0013	New World Technology 3/7/2007 to 11/24/2008

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No.	LLRO ID Number	Date Recovered	Highest 30 cm (mR/h) [1]	LLRO Description	Estimated Ra-226 (mCi) RadiumThumb Rule [2]	LLRO Recovered By and Date Recovered
271	1068	10/15/08	0.01	metal fragments	0.0011	New World Technology 3/7/2007 to 11/24/2008
272	1069	10/15/08	0.5	metal fragments	0.0553	New World Technology 3/7/2007 to 11/24/2008
273	1070	10/15/08	0.02	foil fragment	0.0022	New World Technology 3/7/2007 to 11/24/2008
274	1071	10/16/08	0.006	metal fragments	0.0007	New World Technology 3/7/2007 to 11/24/2008
275	1072	10/16/08	0.008	metal fragments	0.0009	New World Technology 3/7/2007 to 11/24/2008
276	1073	10/16/08	0.005	metal fragments	0.0006	New World Technology 3/7/2007 to 11/24/2008
277	1074	10/16/08	0.012	metal fragments	0.0013	New World Technology 3/7/2007 to 11/24/2008
278	1075	10/16/08	0.004	metal fragments	0.0004	New World Technology 3/7/2007 to 11/24/2008
279	1076	10/16/08	0.005	metal fragments	0.0006	New World Technology 3/7/2007 to 11/24/2008
280	1077	10/16/08	0.01	metal fragments	0.0011	New World Technology 3/7/2007 to 11/24/2008
281	1078	10/16/08	0.1	metal disc	0.0111	New World Technology 3/7/2007 to 11/24/2008
282	1079	10/20/08	0.01	metal fragments	0.0011	New World Technology 3/7/2007 to 11/24/2008
283	1080	10/20/08	0.008	metal fragments	0.0009	New World Technology 3/7/2007 to 11/24/2008
284	1081	10/20/08	0.005	metal fragments	0.0006	New World Technology 3/7/2007 to 11/24/2008
285	1082	10/20/08	0.008	metal fragments	0.0009	New World Technology 3/7/2007 to 11/24/2008

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No.	LLRO ID Number	Date Recovered	Highest 30 cm (mR/h) [1]	LLRO Description	Estimated Ra-226 (mCi) RadiumThumb Rule [2]	LLRO Recovered By and Date Recovered
286	1083	10/20/08	0.008	metal fragments	0.0009	New World Technology 3/7/2007 to 11/24/2008
287	1084	10/20/08	0.005	metal fragments	0.0006	New World Technology 3/7/2007 to 11/24/2008
288	1085	10/20/08	0.008	metal fragments	0.0009	New World Technology 3/7/2007 to 11/24/2008
289	1086	10/20/08	0.008	metal fragments	0.0009	New World Technology 3/7/2007 to 11/24/2008
290	1087	10/21/08	0.007	metal fragments	0.0008	New World Technology 3/7/2007 to 11/24/2008
291	1088	10/21/08	0.012	metal fragments	0.0013	New World Technology 3/7/2007 to 11/24/2008
292	1089	10/21/08	0.007	metal fragments	0.0008	New World Technology 3/7/2007 to 11/24/2008
293	1090	10/21/08	0.008	metal fragments	0.0009	New World Technology 3/7/2007 to 11/24/2008
294	1091	10/23/08	0.008	metal fragments	0.0009	New World Technology 3/7/2007 to 11/24/2008
295	1092	10/23/08	0.008	metal fragments	0.0009	New World Technology 3/7/2007 to 11/24/2008
296	1093	10/23/08	0.008	metal fragments	0.0009	New World Technology 3/7/2007 to 11/24/2008
297	1094	10/23/08	0.008	metal fragments	0.0009	New World Technology 3/7/2007 to 11/24/2008
298	1095	10/23/08	0.008	metal fragments	0.0009	New World Technology 3/7/2007 to 11/24/2008
299	1096	10/23/08	0.008	metal fragments	0.0009	New World Technology 3/7/2007 to 11/24/2008
300	1097	10/23/08	0.008	metal fragments	0.0009	New World Technology 3/7/2007 to 11/24/2008

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301	1098	10/27/08	0.008	metal fragments	0.0009	New World Technology 3/7/2007 to 11/24/2008
302	1099	10/27/08	0.007	metal fragments	0.0008	New World Technology 3/7/2007 to 11/24/2008
303	10100	10/27/08	0.01	metal fragments	0.0011	New World Technology 3/7/2007 to 11/24/2008
304	10101	10/27/08	0.006	metal fragments	0.0007	New World Technology 3/7/2007 to 11/24/2008
305	10102	10/27/08	0.006	metal fragments	0.0007	New World Technology 3/7/2007 to 11/24/2008
306	10103	10/27/08	0.007	metal fragments	0.0008	New World Technology 3/7/2007 to 11/24/2008
307	10104	10/27/08	0.015	metal fragments	0.0017	New World Technology 3/7/2007 to 11/24/2008
308	10105	10/27/08	0.006	metal fragments	0.0007	New World Technology 3/7/2007 to 11/24/2008
309	10106	10/28/08	0.006	metal fragments	0.0007	New World Technology 3/7/2007 to 11/24/2008
310	10107	10/28/08	0.006	metal fragments	0.0007	New World Technology 3/7/2007 to 11/24/2008
311	10108	10/28/08	0.006	metal fragments	0.0007	New World Technology 3/7/2007 to 11/24/2008
312	10109	10/28/08	0.004	metal fragments	0.0004	New World Technology 3/7/2007 to 11/24/2008
313	10110	10/28/08	0.008	metal fragments	0.0009	New World Technology 3/7/2007 to 11/24/2008
314	10111	10/28/08	0.005	metal fragments	0.0006	New World Technology 3/7/2007 to 11/24/2008
315	10112	10/28/08	0.006	metal fragments	0.0007	New World Technology 3/7/2007 to 11/24/2008

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No.	LLRO ID Number	Date Recovered	Highest 30 cm (mR/h) [1]	LLRO Description	Estimated Ra-226 (mCi) RadiumThumb Rule [2]	LLRO Recovered By and Date Recovered
316	10113	10/28/08	0.005	metal fragments	0.0006	New World Technology 3/7/2007 to 11/24/2008
317	10114	10/28/08	0.005	metal fragments	0.0006	New World Technology 3/7/2007 to 11/24/2008
318	10115	10/28/08	0.008	metal fragments	0.0009	New World Technology 3/7/2007 to 11/24/2008
319	10116	10/28/08	0.005	metal fragments	0.0006	New World Technology 3/7/2007 to 11/24/2008
320	10117	10/28/08	0.008	metal fragments	0.0009	New World Technology 3/7/2007 to 11/24/2008
321	10118	10/28/08	0.007	metal fragments	0.0008	New World Technology 3/7/2007 to 11/24/2008
322	10119	10/28/08	0.01	metal fragments	0.0011	New World Technology 3/7/2007 to 11/24/2008
323	10120	10/29/08	2.8	Soil/Debris Fragments	0.3097	New World Technology 3/7/2007 to 11/24/2008
324	10121	10/29/08	0.014	Metal Fragments	0.0015	New World Technology 3/7/2007 to 11/24/2008
325	10122	10/29/08	0.014	Metal Fragments	0.0015	New World Technology 3/7/2007 to 11/24/2008
326	10123	10/29/08	0.03	Metal Fragments	0.0033	New World Technology 3/7/2007 to 11/24/2008
327	10124	10/29/08	2	Foil	0.2212	New World Technology 3/7/2007 to 11/24/2008
328	10125	10/29/08	0.05	Button	0.0055	New World Technology 3/7/2007 to 11/24/2008
329	10126	10/29/08	2	Foil	0.2212	New World Technology 3/7/2007 to 11/24/2008
330	10127	10/30/08	0.07	Metal Fragments	0.0077	New World Technology 3/7/2007 to 11/24/2008

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No.	LLRO ID Number	Date Recovered	Highest 30 cm (mR/h) [1]	LLRO Description	Estimated Ra-226 (mCi) RadiumThumb Rule [2]	LLRO Recovered By and Date Recovered
331	10128	10/30/08	1.5	Foil	0.1659	New World Technology 3/7/2007 to 11/24/2008
332	10128	10/30/08	0.012	Metal Fragments	0.0013	New World Technology 3/7/2007 to 11/24/2008
333	10130	10/30/08	1	Foil Fragments	0.1106	New World Technology 3/7/2007 to 11/24/2008
334	10131	10/30/08	0.008	Metal Fragments	0.0009	New World Technology 3/7/2007 to 11/24/2008
335	10132	10/30/08	0.05	Soil	0.0055	New World Technology 3/7/2007 to 11/24/2008
336	10133	10/30/08	0.04	Soil	0.0044	New World Technology 3/7/2007 to 11/24/2008
337	10134	10/30/08	0.035	Metal Fragments	0.0039	New World Technology 3/7/2007 to 11/24/2008
338	10135	10/30/08	0.012	Metal Fragments	0.0013	New World Technology 3/7/2007 to 11/24/2008
339	1101	11/04/08	2	Foil	0.2212	New World Technology 3/7/2007 to 11/24/2008
340	1102	11/04/08	0.017	Metal Fragments	0.0019	New World Technology 3/7/2007 to 11/24/2008
341	1103	11/04/08	0.01	Metal Fragments	0.0011	New World Technology 3/7/2007 to 11/24/2008
342	1104	11/04/08	0.012	Metal Fragments	0.0013	New World Technology 3/7/2007 to 11/24/2008
343	1105	11/04/08	0.007	Metal Fragments	0.0008	New World Technology 3/7/2007 to 11/24/2008
344	1106	11/04/08	0.006	Metal Fragments	0.0007	New World Technology 3/7/2007 to 11/24/2008
345	1107	11/04/08	0.01	Metal Fragments	0.0011	New World Technology 3/7/2007 to 11/24/2008

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No.	LLRO ID Number	Date Recovered	Highest 30 cm (mR/h) [1]	LLRO Description	Estimated Ra-226 (mCi) RadiumThumb Rule [2]	LLRO Recovered By and Date Recovered
346	1108	11/04/08	0.005	Metal Fragments	0.0006	New World Technology 3/7/2007 to 11/24/2008
347	1109	11/04/08	0.007	Metal Fragments	0.0008	New World Technology 3/7/2007 to 11/24/2008
348	1110	11/04/08	0.008	Metal Fragments	0.0009	New World Technology 3/7/2007 to 11/24/2008
349	1111	11/04/08	0.006	Metal Fragments	0.0007	New World Technology 3/7/2007 to 11/24/2008
350	1112	11/04/08	0.006	Metal Fragments	0.0007	New World Technology 3/7/2007 to 11/24/2008
351	1113	11/04/08	0.008	Metal Fragments	0.0009	New World Technology 3/7/2007 to 11/24/2008
352	1114	11/04/08	0.006	Metal Fragments	0.0007	New World Technology 3/7/2007 to 11/24/2008
353	1115	11/04/08	0.02	Metal Fragments	0.0022	New World Technology 3/7/2007 to 11/24/2008
354	1116	11/04/08	0.04	Metal Fragments	0.0044	New World Technology 3/7/2007 to 11/24/2008
355	1117	11/04/08	0.007	Metal Fragments	0.0008	New World Technology 3/7/2007 to 11/24/2008
356	1118	11/04/08	0.03	Metal Fragments	0.0033	New World Technology 3/7/2007 to 11/24/2008
357	1119	11/04/08	0.005	Metal Fragments	0.0006	New World Technology 3/7/2007 to 11/24/2008
358	1120	11/04/08	4	Foil	0.4424	New World Technology 3/7/2007 to 11/24/2008
359	1121	11/04/08	0.007	Metal Fragments	0.0008	New World Technology 3/7/2007 to 11/24/2008
360	1122	11/04/08	0.007	Metal Fragments	0.0008	New World Technology 3/7/2007 to 11/24/2008

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No.	LLRO ID Number	Date Recovered	Highest 30 cm (mR/h) [1]	LLRO Description	Estimated Ra-226 (mCi) RadiumThumb Rule [2]	LLRO Recovered By and Date Recovered
361	1123	11/04/08	0.006	Metal Fragments	0.0007	New World Technology 3/7/2007 to 11/24/2008
362	1124	11/04/08	0.006	Metal Fragments	0.0007	New World Technology 3/7/2007 to 11/24/2008
363	1125	11/04/08	0.01	Metal Fragments	0.0011	New World Technology 3/7/2007 to 11/24/2008
364	1126	11/05/08	1.5	Foil	0.1659	New World Technology 3/7/2007 to 11/24/2008
365	1127	11/05/08	0.05	Metal Fragments	0.0055	New World Technology 3/7/2007 to 11/24/2008
366	1128	11/05/08	1.5	Foil	0.1659	New World Technology 3/7/2007 to 11/24/2008
367	1129	11/05/08	0.012	Metal Fragments	0.0013	New World Technology 3/7/2007 to 11/24/2008
368	1130	11/05/08	0.008	Metal Fragments	0.0009	New World Technology 3/7/2007 to 11/24/2008
369	1131	11/05/08	0.015	Metal Fragments	0.0017	New World Technology 3/7/2007 to 11/24/2008
370	1132	11/06/08	0.005	Metal Fragments	0.0006	New World Technology 3/7/2007 to 11/24/2008
371	1133	11/06/08	0.005	Metal Fragments	0.0006	New World Technology 3/7/2007 to 11/24/2008
372	1134	11/06/08	0.01	Metal Fragments	0.0011	New World Technology 3/7/2007 to 11/24/2008
373	1135	11/06/08	0.007	Metal Fragments	0.0008	New World Technology 3/7/2007 to 11/24/2008
374	1136	11/06/08	0.005	Metal Fragments	0.0006	New World Technology 3/7/2007 to 11/24/2008
375	1137	11/06/08	0.5	Foil Fragment	0.0553	New World Technology 3/7/2007 to 11/24/2008

TABLE 1 – LOW-LEVEL RADIOLOGICAL OBJECTS RECOVERED FROM SITE 12
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No.	LLRO ID Number	Date Recovered	Highest 30 cm (mR/h) [1]	LLRO Description	Estimated Ra-226 (mCi) RadiumThumb Rule [2]	LLRO Recovered By and Date Recovered
376	1138	11/06/08	0.005	Metal Fragments	0.0006	New World Technology 3/7/2007 to 11/24/2008
377	1139	11/06/08	0.014	Metal Fragments	0.0015	New World Technology 3/7/2007 to 11/24/2008
378	1140	11/06/08	0.005	Metal Fragments	0.0006	New World Technology 3/7/2007 to 11/24/2008
379	1141	11/06/08	0.008	Metal Fragments	0.0009	New World Technology 3/7/2007 to 11/24/2008
380	1142	11/06/08	0.02	Button	0.0022	New World Technology 3/7/2007 to 11/24/2008
381	1143	11/06/08	0.02	Metal Fragments	0.0022	New World Technology 3/7/2007 to 11/24/2008
382	1144	11/06/08	0.007	Metal Fragments	0.0008	New World Technology 3/7/2007 to 11/24/2008
383	1145	11/06/08	0.005	Metal Fragments	0.0006	New World Technology 3/7/2007 to 11/24/2008
384	1146	11/10/08	2	Foil	0.2212	New World Technology 3/7/2007 to 11/24/2008
385	1147	11/10/08	1.5	Foil	0.1659	New World Technology 3/7/2007 to 11/24/2008
386	1148	11/10/08	0.025	Metal Fragments	0.0028	New World Technology 3/7/2007 to 11/24/2008
387	1149	11/10/08	0.008	Soil	0.0009	New World Technology 3/7/2007 to 11/24/2008
388	1150	11/10/08	0.02	Metal Fragments	0.0022	New World Technology 3/7/2007 to 11/24/2008
389	1151	11/10/08	0.008	Soil	0.0009	New World Technology 3/7/2007 to 11/24/2008
390	1152	11/10/08	0.008	Metal Fragments	0.0009	New World Technology 3/7/2007 to 11/24/2008

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No.	LLRO ID Number	Date Recovered	Highest 30 cm (mR/h) [1]	LLRO Description	Estimated Ra-226 (mCi) RadiumThumb Rule [2]	LLRO Recovered By and Date Recovered
391	1153	11/10/08	0.025	Metal Fragments	0.0028	New World Technology 3/7/2007 to 11/24/2008
392	1154	11/10/08	2	Foil Fragments / Soil	0.2212	New World Technology 3/7/2007 to 11/24/2008
393	1155	11/10/08	0.02	Metal Fragments	0.0022	New World Technology 3/7/2007 to 11/24/2008
394	1156	11/10/08	0.006	Metal Fragments	0.0007	New World Technology 3/7/2007 to 11/24/2008
395	1157	11/10/08	0.008	Metal Fragments	0.0009	New World Technology 3/7/2007 to 11/24/2008
396	1158	11/10/08	0.02	Metal Fragments	0.0022	New World Technology 3/7/2007 to 11/24/2008
397	1159	11/10/08	2	Foil	0.2212	New World Technology 3/7/2007 to 11/24/2008
398	1160	11/10/08	0.006	Metal Fragments	0.0007	New World Technology 3/7/2007 to 11/24/2008
399	1161	11/10/08	0.015	Metal Fragments	0.0017	New World Technology 3/7/2007 to 11/24/2008
400	1162	11/11/08	0.008	Metal Fragments	0.0009	New World Technology 3/7/2007 to 11/24/2008
401	1163	11/12/08	0.01	Metal Fragments	0.0011	New World Technology 3/7/2007 to 11/24/2008
402	1164	11/13/08	0.02	Metal Fragments	0.0022	New World Technology 3/7/2007 to 11/24/2008
403	1165	11/17/08	0.005	metal object 4" dia x 6"	0.0006	New World Technology 3/7/2007 to 11/24/2008
404	1166	11/17/08	0.012	soil with metal fragments	0.0013	New World Technology 3/7/2007 to 11/24/2008
405	1167	11/17/08	0.007	small metal fragment	0.0008	New World Technology 3/7/2007 to 11/24/2008

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No.	LLRO ID Number	Date Recovered	Highest 30 cm (mR/h) [1]	LLRO Description	Estimated Ra-226 (mCi) RadiumThumb Rule [2]	LLRO Recovered By and Date Recovered
406	1168	11/17/08	0.01	small metal object	0.0011	New World Technology 3/7/2007 to 11/24/2008
407	1169	11/17/08	0.004	metal fragment	0.0004	New World Technology 3/7/2007 to 11/24/2008
408	1170	11/17/08	0.005	metal object 1 ft x 1" dia	0.0006	New World Technology 3/7/2007 to 11/24/2008
409	1171	11/17/08	0.01	metal fragment	0.0011	New World Technology 3/7/2007 to 11/24/2008
410	1172	11/17/08	0.012	metal fragment	0.0013	New World Technology 3/7/2007 to 11/24/2008
411	1173	11/17/08	0.008	rusted metal object 9" dia	0.0009	New World Technology 3/7/2007 to 11/24/2008
412	1174	11/17/08	0.01	metal fragment	0.0011	New World Technology 3/7/2007 to 11/24/2008
413	1175	11/17/08	0.005	metal fragment	0.0006	New World Technology 3/7/2007 to 11/24/2008
414	1176	11/17/08	0.012	metal fragment	0.0013	New World Technology 3/7/2007 to 11/24/2008
415	1177	11/17/08	0.015	soil with metal fragments	0.0017	New World Technology 3/7/2007 to 11/24/2008
416	1178	11/18/08	0.015	metal fragments	0.0017	New World Technology 3/7/2007 to 11/24/2008
417	1179	11/18/08	0.008	metal fragments	0.0009	New World Technology 3/7/2007 to 11/24/2008
418	1180	11/18/08	0.008	metal fragments	0.0009	New World Technology 3/7/2007 to 11/24/2008
419	1181	11/18/08	0.025	foil	0.0028	New World Technology 3/7/2007 to 11/24/2008
420	1182	11/18/08	0.01	metal fragments	0.0011	New World Technology 3/7/2007 to 11/24/2008

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No.	LLRO ID Number	Date Recovered	Highest 30 cm (mR/h) [1]	LLRO Description	Estimated Ra-226 (mCi) RadiumThumb Rule [2]	LLRO Recovered By and Date Recovered
421	1183	11/18/08	0.008	metal fragments	0.0009	New World Technology 3/7/2007 to 11/24/2008
422	1184	11/18/08	0.03	button	0.0033	New World Technology 3/7/2007 to 11/24/2008
423	1185	11/18/08	0.025	metal fragments	0.0028	New World Technology 3/7/2007 to 11/24/2008
424	1186	11/18/08	0.03	button	0.0033	New World Technology 3/7/2007 to 11/24/2008
425	1187	11/18/08	0.008	metal fragments	0.0009	New World Technology 3/7/2007 to 11/24/2008
426	1188	11/18/08	0.01	metal fragments	0.0011	New World Technology 3/7/2007 to 11/24/2008
427	1189	11/18/08	0.02	metal fragments	0.0022	New World Technology 3/7/2007 to 11/24/2008
428	1190	11/18/08	0.025	button	0.0028	New World Technology 3/7/2007 to 11/24/2008
429	1191	11/18/08	0.006	metal fragments	0.0007	New World Technology 3/7/2007 to 11/24/2008
430	1192	11/18/08	0.015	metal fragments	0.0017	New World Technology 3/7/2007 to 11/24/2008
431	1193	11/18/08	0.015	metal fragments	0.0017	New World Technology 3/7/2007 to 11/24/2008
432	1194	11/18/08	0.01	brick (concrete)	0.0011	New World Technology 3/7/2007 to 11/24/2008
433	1195	11/18/08	0.02	metal fragments	0.0022	New World Technology 3/7/2007 to 11/24/2008
434	1196	11/18/08	0.01	metal fragments	0.0011	New World Technology 3/7/2007 to 11/24/2008
435	1197	11/20/08	1.5	Foil	0.1659	New World Technology 3/7/2007 to 11/24/2008

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No.	LLRO ID Number	Date Recovered	Highest 30 cm (mR/h) [1]	LLRO Description	Estimated Ra-226 (mCi) RadiumThumb Rule [2]	LLRO Recovered By and Date Recovered
436	1198	11/20/08	0.025	Glass	0.0028	New World Technology 3/7/2007 to 11/24/2008
437	1199	11/24/08	0.01	Metal Fragments	0.0011	New World Technology 3/7/2007 to 11/24/2008
438	11100	11/24/08	0.015	Soil/Metal Fragments	0.0017	New World Technology 3/7/2007 to 11/24/2008
439	09-0001	01/15/09	0.01	Metal Fragments	0.0011	Shaw 07/02/09 to Present
440	070209-1	07/02/09	0.02	Metal Fragment	0.0022	
441	070209-2	07/02/09	0.013	Sandy soil (1 tsp)	0.0014	Shaw 07/02/09 to Present
442	070609-3	07/06/09	0.01	Metal flakes & soil	0.0011	Shaw 07/02/09 to Present
443	070709-4	07/07/09	0.032	4-in dia by 8-in long rusted metal cylinder	0.0035	Shaw 07/02/09 to Present
444	070709-5	07/07/09	0.013	3-in by 2-in flat rusty metal	0.0014	Shaw 07/02/09 to Present
445	070709-6	07/07/09	0.009	1.5-in round by 3/8-in thick metallic device	0.0010	Shaw 07/02/09 to Present
446	070709-7	07/07/09	0.02	metal fragment 0.75-in by 0.5-in by 0.125-in	0.0022	Shaw 07/02/09 to Present
447	070809-8	07/08/09	0.015	3 metal fragments mixed w/soil	0.0017	Shaw 07/02/09 to Present
448	070809-9	07/08/09	0.016	Soil and Rust flakes ~ 2 tsp	0.0018	Shaw 07/02/09 to Present
449	070909-10	07/09/09	0.011	Soil ~ 2 tbsp	0.0012	Shaw 07/02/09 to Present
450	071409-11	07/14/09	0.013	3.5-in round metal	0.0014	Shaw 07/02/09 to Present
451	071409-12	07/14/09	0.014	~1 cup soil	0.0015	Shaw 07/02/09 to Present

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No.	LLRO ID Number	Date Recovered	Highest 30 cm (mR/h) [1]	LLRO Description	Estimated Ra-226 (mCi) RadiumThumb Rule [2]	LLRO Recovered By and Date Recovered
452	071409-13	07/14/09	0.013	~1/4 cup soil w/metal flakes	0.0014	Shaw 07/02/09 to Present
453	071409-14	07/14/09	0.022	Metal 3/4-in long by 1/2-in thick by 1/2-in wide	0.0024	Shaw 07/02/09 to Present
454	071409-15	07/14/09	0.018	Oval metal fragment 1/2-in long by 3/8-in wide	0.0020	Shaw 07/02/09 to Present
455	071409-16	07/14/09	0.014	1/8 cup of soil	0.0015	Shaw 07/02/09 to Present
456	071409-17	07/14/09	0.016	Metal fragment 3/4-in long by 1/4-in wide	0.0018	Shaw 07/02/09 to Present
457	071409-18	07/14/09	0.016	1.5 cups soil with metal fragments	0.0018	Shaw 07/02/09 to Present
458	071509-19	07/15/09	0.015	Wire 3-in long by 1/4-in diameter	0.0017	Shaw 07/02/09 to Present
459	071509-20	07/15/09	0.016	Gauge 5-in diameter by 5-in long with wires extending from the back	0.0018	Shaw 07/02/09 to Present
460	072009-21	07/20/09	0.016	wire 2.5-in long by 0.25-in in diameter	0.0018	Shaw 07/02/09 to Present
461	072009-22	07/20/09	0.015	2-in rounded piece of metal 1/4–in wide	0.0017	Shaw 07/02/09 to Present
462	072009-23	07/20/09	0.012	1.5-in diameter, 3/8-in thick piece of metal	0.0013	Shaw 07/02/09 to Present

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No.	LLRO ID Number	Date Recovered	Highest 30 cm (mR/h) [1]	LLRO Description	Estimated Ra-226 (mCi) RadiumThumb Rule [2]	LLRO Recovered By and Date Recovered
463	072009-24	07/20/09	0.012	A gauge 4-in in diameter by 3-in deep	0.0013	Shaw 07/02/09 to Present
464	072109-25	07/21/09	0.014	piece of metal 1.75-in long by 3/4-in wide	0.0015	Shaw 07/02/09 to Present
465	072109-26	07/21/09	0.024	3/4-in diameter by 1/2-in thick button	0.0027	Shaw 07/02/09 to Present
466	072109-27	07/21/09	0.013	3-in diameter by 3-in deep gauge	0.0014	Shaw 07/02/09 to Present
467	072109-28	07/21/09	0.034	piece of metal 5-in long by 3.5-in wide by 3-in deep	0.0038	Shaw 07/02/09 to Present
468	072209-29	07/22/09	0.017	4-in round by 1.5-in deep metal object	0.0019	Shaw 07/02/09 to Present
469	080309-30	08/03/09	0.016	3.5" x 2.5" x 1.5" Metal object fused with rock	0.0018	Shaw 07/02/09 to Present
470	080309-31	08/03/09	0.012	5" x 4" x 1" Metal Object	0.0013	Shaw 07/02/09 to Present
471	080309-32	08/03/09	0.012	.75" x .5" x .25" Metal Object	0.0013	Shaw 07/02/09 to Present
472	080309-33	08/03/09	0.012	3" x 1.5" x 1" Metal object	0.0013	Shaw 07/02/09 to Present
473	080309-34	08/03/09	0.013	1.5" x 1" x .5" Metal	0.0014	Shaw 07/02/09 to Present
474	080509-35	08/05/09	0.012	Fused mixture of glass, rock, and soil 6" x 4" x 2"	0.0013	Shaw 07/02/09 to Present

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475	081109-36	08/11/09	0.014	Fused metal rock and glass 6" round x 3" thick	0.0015	Shaw 07/02/09 to Present
476	081109-37	08/11/09	0.019	Infused rock, metal and glass 9" long x 6" wide x 5" thick	0.0021	Shaw 07/02/09 to Present
477	081209-38	08/12/09	0.019	4 Metal fragments .75" x .25" and up to 4" x 2" x 1.5"	0.0021	Shaw 07/02/09 to Present
478	081809-39	08/18/09	1	Hexagon shaped object ~.75"	0.1106	Shaw 07/02/09 to Present
479	081809-39A	08/18/09	0.014	7" x 3.5" x 2" object	0.0015	Shaw 07/02/09 to Present
480	082009-40	08/20/09	0.036	Round metal object 1.5" round and .5" thick	0.0040	Shaw 07/02/09 to Present
481	082409-41	08/24/09	0.015	Round metal object 1.5" x 1" x .5"	0.0017	Shaw 07/02/09 to Present
482	082409-42	08/24/09	0.04	Round metal object .75" round and .5" thick	0.0044	Shaw 07/02/09 to Present
483	083109-43	08/31/09	0.017	2" x .5" pocket watch	0.0019	Shaw 07/02/09 to Present
484	083109-44	08/31/09	2	Dime size piece of black metal hexagon shaped	0.2212	Shaw 07/02/09 to Present
485	083109-45	08/31/09	0.024	An infused rock metal and wire 1.5" x 1.25" x .5"	0.0027	Shaw 07/02/09 to Present
486	083109-46	08/31/09	0.06	Round metal object 2" x .5" round	0.0066	Shaw 07/02/09 to Present

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487	090209-47	09/02/09	0.036	Metal button 1.5" x .25"	0.0040	Shaw 07/02/09 to Present
488	090209-48	09/02/09	0.032	Metal object 3" long x 2" wide x 1.5" thick	0.0035	Shaw 07/02/09 to Present
489	091509-49	09/15/09	0.018	Metal object 3" x 2" x 1.5"	0.0020	Shaw 07/02/09 to Present
490	092309-50	09/23/09	0.016	Metal object 1/2" across and 1/8" in depth	0.0018	Shaw 07/02/09 to Present
491	092909-51	09/29/09	0.018	Metal object 3/4" round and 3/8" deep	0.0020	Shaw 07/02/09 to Present
492	093009-52	09/30/09	1.4	Metal object 1/2" diameter and 1/8" deep	0.1548	Shaw 07/02/09 to Present
493	093009-53	09/30/09	0.014	Metal object 1/2" x 1/4" round	0.0015	Shaw 07/02/09 to Present
494	093009-54	09/30/09	0.022	Metal object 4" x 2.5" x 1"	0.0024	Shaw 07/02/09 to Present
495	100109-55	10/01/09	0.044	10" long tool (micrometer)	0.0049	Shaw 07/02/09 to Present
496	102209-56	10/22/09	0.014	Metal object 1" x 1/2" x 1/8"	0.0015	Shaw 07/02/09 to Present
497	102209-57	10/22/09	0.03	Metal object 3 1/2" x 1/2"	0.0033	Shaw 07/02/09 to Present
498	102609-58	10/26/09	0.024	Round metal object 3/4" by 1/4"	0.0027	Shaw 07/02/09 to Present
499	102609-59	10/26/09	0.017	Triangular metal object 1/2" x 1/4"	0.0019	Shaw 07/02/09 to Present
500	102609-60	10/26/09	0.014	Metal object 1/2" x 1/2" x 1/8"	0.0015	Shaw 07/02/09 to Present
501	110409-61	11/04/09	0.014	Wrist watch (no band) 3/4" x 1/4"	0.0015	Shaw 07/02/09 to Present

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502	110409-62	11/04/09	0.02	Metal object 2 1/2" x 1"	0.0022	Shaw 07/02/09 to Present
503	110409-63	11/04/09	0.024	Metal object 3/8" x 3/8" x 1/8"	0.0027	Shaw 07/02/09 to Present
504	110409-64	11/04/09	0.016	Metal object 4" x 1 1/2"	0.0018	Shaw 07/02/09 to Present
505	110909-65	11/09/09	0.013	Fused wire and rock 2" x 3/4" x 1/2"	0.0014	Shaw 07/02/09 to Present
506	111009-66	11/10/09	0.013	Metal object 1/2" x 1/2" x 1/4"	0.0014	Shaw 07/02/09 to Present
507	111009-67	11/10/09	0.015	Wire 3" long by 1 1/4"	0.0017	Shaw 07/02/09 to Present
508	111209-68	11/12/09	0.034	Metal object 3/4" x 1/2" x 1/4"	0.0038	Shaw 07/02/09 to Present
509	111709-69	11/17/09	0.015	Metal object 1 3/4" x 1/2"	0.0017	Shaw 07/02/09 to Present
510	112309-70	11/23/09	0.015	Fused metal and wire 4" x 2"	0.0017	Shaw 07/02/09 to Present
511	113009-71	11/30/09	0.013	Metal object 2" x 1" x 1"	0.0014	Shaw 07/02/09 to Present
512	113009-72	11/30/09	0.013	Compass 3/4" x 1/4"	0.0014	Shaw 07/02/09 to Present
513	120909-73	12/09/09	0.02	Metal object 3/4" x 1/2" x 1/2"	0.0022	Shaw 07/02/09 to Present
514	120909-74	12/09/09	0.02	Wire 3/4" x 1/4"	0.0022	Shaw 07/02/09 to Present
515	011310-75	01/13/10	0.036	Metal object 6" x 4"	0.0040	Shaw 07/02/09 to Present
516	011310-76	01/13/10	0.032	Metal object 2" x 1/2"	0.0035	Shaw 07/02/09 to Present
517	020210-77	02/02/10	0.034	Metal object 1 1/2" x 1/4"	0.0038	Shaw 07/02/09 to Present
518	020910-78	02/09/10	0.016	Metal object 1" x 1/2"	0.0018	Shaw 07/02/09 to Present
519	021010-79	02/10/10	0.015	Metal object 3" x 2 1/2" x 1/2"	0.0017	Shaw 07/02/09 to Present

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520	021010-80	02/10/10	0.018	Metal object 1" x 3/4" x 1/2"	0.0020	Shaw 07/02/09 to Present
521	021010-81	02/10/10	0.018	Metal object 1" x 3/4" x 1/2"	0.0020	Shaw 07/02/09 to Present
522	021110-82	02/11/10	0.022	Metal object 1" x 1/2"	0.0024	Shaw 07/02/09 to Present
523	021110-83	02/11/10	0.07	Metal object 2" x 1/2"	0.0077	Shaw 07/02/09 to Present
524	021510-84	02/15/10	0.06	Metal object (possible Radiolumine scent Personnel Marker) 2" x 1/4"	0.0066	Shaw 07/02/09 to Present
525	021510-85	02/15/10	0.013	Metal object (slag) 4' x 3" x 3"	0.0014	Shaw 07/02/09 to Present
526	021510-86	02/15/10	0.018	Metal object 3/4" x 1/4"	0.0020	Shaw 07/02/09 to Present
527	021810-87	02/18/10	0.019	Metal object 1/4" round	0.0021	Shaw 07/02/09 to Present
528	021810-88	02/18/10	0.014	Metal object 1/2" x 1/4" x 1/4"	0.0015	Shaw 07/02/09 to Present
529	021810-89	02/18/10	0.015	Metal object 1/2" x 1/4" x 1/4"	0.0017	Shaw 07/02/09 to Present
530	021810-90	02/18/10	0.02	Metal object 1/8" round	0.0022	Shaw 07/02/09 to Present
531	022210-91	02/22/10	0.012	Metal object 1" x 3/4" x 1/2"	0.0013	Shaw 07/02/09 to Present
532	022210-92	02/22/10	0.02	Metal object 8" x 6" x 5"	0.0022	Shaw 07/02/09 to Present
533	022210-93	02/22/10	0.017	Metal object 1/2" x 1/4" x 1/4"	0.0019	Shaw 07/02/09 to Present
534	022210-94	02/22/10	0.016	Metal object 1/2" x 1/2" x 1/4"	0.0018	Shaw 07/02/09 to Present
535	022310-95	02/23/10	0.013	Metal object 1/2" x 1/4"	0.0014	Shaw 07/02/09 to Present

TABLE 1 – LOW-LEVEL RADIOLOGICAL OBJECTS RECOVERED FROM SITE 12
Historical Radiological Assessment Supplemental Technical Memorandum, NAVSTA TI, California

No.	LLRO ID Number	Date Recovered	Highest 30 cm (mR/h) [1]	LLRO Description	Estimated Ra-226 (mCi) RadiumThumb Rule [2]	LLRO Recovered By and Date Recovered
536	030410-96	03/04/10	0.015	Metal object 1/2" round with 2" wire	0.0017	Shaw 07/02/09 to Present
537	030910-97	03/09/10	0.017	Metal object 1 1/2" x 1" x 1/4"	0.0019	Shaw 07/02/09 to Present
538	030910-98	03/09/10	0.034	Metal object 2" x 2" x 1/16"	0.0038	Shaw 07/02/09 to Present
539	030910-99	03/09/10	0.016	Metal object 1/2" x 1/4" x 1/8"	0.0018	Shaw 07/02/09 to Present
540	031010-100	03/10/10	0.06	Flat metal object 1/2" round	0.0066	Shaw 07/02/09 to Present
541	031010-101	03/10/10	0.018	Metal object 1" x 1/4" x 1/4"	0.0020	Shaw 07/02/09 to Present
542	032410-102	03/24/10	0.013	Metal object 1/4" x 1/4"	0.0014	Shaw 07/02/09 to Present
543	040710-103	04/07/10	0.03	Metal object 1/2" x 1/4"	0.0033	Shaw 07/02/09 to Present
544	050810-104	05/08/10	0.018	Metal object rusted oblong 1/8 " x 1/2"	0.0020	Shaw 07/02/09 to Present
545	051910-105	05/19/10	0.02	Metal object round 1/4" think by 1/2" diameter	0.0022	Shaw 07/02/09 to Present
546	052010-106	05/20/10	0.02	Metal object 4"x4" by 1/4" thick with a 2"x1.5 " diameter object attached in center	0.0022	Shaw 07/02/09 to Present
547	052010-107	05/20/10	0.015	Metal object cylindrical 1"x3/8" diameter	0.0017	Shaw 07/02/09 to Present
548	052010-108	05/20/10	0.8	Metal object 1/4"x1/2"	0.0885	Shaw 07/02/09 to Present

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Historical Radiological Assessment Supplemental Technical Memorandum, NAVSTA TI, California

No.	LLRO ID Number	Date Recovered	Highest 30 cm (mR/h) [1]	LLRO Description	Estimated Ra-226 (mCi) RadiumThumb Rule [2]	LLRO Recovered By and Date Recovered
549	052010-109	05/20/10	0.034	Metal object flat round 1/8" diameter x 1/2"	0.0038	Shaw 07/02/09 to Present
550	052610-110	05/26/10	0.015	Metal object oblong 1/2" x 1/4" x 1/4" thick	0.0017	Shaw 07/02/09 to Present
551	052610-111	05/26/10	0.02	Metal object oblong 1" x 1/2" x 1/4" thick	0.0022	Shaw 07/02/09 to Present
552	052610-112	05/26/10	0.013	Metal object square 1" x 1" x 1/2" thick	0.0014	Shaw 07/02/09 to Present
553	052610-113	05/26/10	0.013	Metal object round 1/2" diameter 1/8" thick	0.0014	Shaw 07/02/09 to Present
554	052610-114	05/26/10	0.015	Metal object oblong 1/2" x 1/4" x 1/8" thick	0.0017	Shaw 07/02/09 to Present
555	070110-115	07/01/10	0.013	Watch round 3" x 1/2"	0.0014	Shaw 07/02/09 to Present
556	070610-116	07/06/10	0.012	Metal object 1" x 1/4"	0.0013	Shaw 07/02/09 to Present
557	070610-117	07/06/10	0.013	Metal object 1" x 1/8"	0.0014	Shaw 07/02/09 to Present
558	070810-118	7/8/2010	0.015	Metal object 1/8" by 1/2" by 1/2"	0.0017	Shaw 07/02/09 to Present
559	070810-119	07/08/10	0.02	Metal round object 1/4" x 1/2" thick	0.0022	Shaw 07/02/09 to Present
560	071310-120	07/13/10	0.016	3" Needle from gauge	0.0018	Shaw 07/02/09 to Present
561	071310-121	07/13/10	0.015	1" long wire in insulation	0.0017	Shaw 07/02/09 to Present
562	071410-122	07/14/10	0.034	Personnel marker 1 1/2" diameter	0.0038	Shaw 07/02/09 to Present

TABLE 1 – LOW-LEVEL RADIOLOGICAL OBJECTS RECOVERED FROM SITE 12
Historical Radiological Assessment Supplemental Technical Memorandum, NAVSTA TI, California

No.	LLRO ID Number	Date Recovered	Highest 30 cm (mR/h) [1]	LLRO Description	Estimated Ra-226 (mCi) RadiumThumb Rule [2]	LLRO Recovered By and Date Recovered
563	071510-123	07/15/10	0.014	Metal Object 1" x 1/2"	0.0015	Shaw 07/02/09 to Present
564	071910-124	07/19/10	0.013	Piece of Metal 1/8" x 1/4"	0.0014	Shaw 07/02/09 to Present
565	072010-125	07/20/10	0.014	Metal fragment 1/2" x 1/2"	0.0015	Shaw 07/02/09 to Present
566	072110-126	07/21/10	0.014	Metal Foil 1" x 3"	0.0015	Shaw 07/02/09 to Present
567	072210-127	07/22/10	0.02	1" diameter round metal object 1/4" thick	0.0022	Shaw 07/02/09 to Present
568	072610-128	07/26/10	0.017	Metal 1/2" x 3"	0.0019	Shaw 07/02/09 to Present
569	072710-129	07/27/10	0.016	Stone & Metal 1/2" x 1/2"	0.0018	Shaw 07/02/09 to Present
570	072710-130	07/27/10	0.014	Metal object 1/4" x 1/8"	0.0015	Shaw 07/02/09 to Present
571	072710-131	07/27/10	0.017	Metal object 1/2" x 1/4"	0.0019	Shaw 07/02/09 to Present
572	072710-132	07/27/10	0.015	Metallic Fragment 1/32" x 1/64"	0.0017	Shaw 07/02/09 to Present
573	072710-133	07/27/10	0.014	1" x 1/2 thick triangle hard clay metallic	0.0015	Shaw 07/02/09 to Present
574	072710-134	07/27/10	0.024	1/2" x 3/4" triangular hard clay metallic	0.0027	Shaw 07/02/09 to Present
575	072710-135	07/27/10	0.026	Tiny metal fragment 1/8" x 1/8"	0.0029	Shaw 07/02/09 to Present
576	072710-136	07/27/10	0.016	1/4" x 1/8" x 1/8" oval metal object	0.0018	Shaw 07/02/09 to Present
577	072710-137	07/27/10	0.03	1" x 1" x 1/2" triangular hard clay metallic	0.0033	Shaw 07/02/09 to Present

TABLE 1 – LOW-LEVEL RADIOLOGICAL OBJECTS RECOVERED FROM SITE 12
Historical Radiological Assessment Supplemental Technical Memorandum, NAVSTA TI, California

No.	LLRO ID Number	Date Recovered	Highest 30 cm (mR/h) [1]	LLRO Description	Estimated Ra-226 (mCi) RadiumThumb Rule [2]	LLRO Recovered By and Date Recovered
578	032013-138	03/20/13	1.6	flat octagonal metallic object	0.1770	Tetra Tech EC 03/20/13 to 06/03/13
579	032113-139	03/21/13	0.014	flat octagonal metallic object	0.0015	Tetra Tech EC 03/20/13 to 06/03/13
580	032013-140	05/30/13	0.014	soil	0.0015	Tetra Tech EC 03/20/13 to 06/03/13
581	032113-141	05/30/13	0.014	soil	0.0015	Tetra Tech EC 03/20/13 to 06/03/13
582	032013-142	05/30/13	0.024	soil	0.0027	Tetra Tech EC 03/20/13 to 06/03/13
583	032113-143	05/31/13	0.036	soil	0.0040	Tetra Tech EC 03/20/13 to 06/03/13
584	032013-144	05/31/13	0.015	soil	0.0017	Tetra Tech EC 03/20/13 to 06/03/13
585	032113-145	05/31/13	0.018	soil	0.0020	Tetra Tech EC 03/20/13 to 06/03/13
586	032013-146	06/03/13	0.04	foil fragment	0.0044	Tetra Tech EC 03/20/13 to 06/03/13
587	032113-147	03/21/13	0.022	UNK device	0.0024	Tetra Tech EC 03/20/13 to 06/03/13
588	012814-148	01/28/14	0.012	box of samples	0.0013	Tetra Tech EC 03/20/13 to 06/03/13
589	012814-149	01/28/14	0.4	box of samples	0.0442	Tetra Tech EC 03/20/13 to 06/03/13
590	012814-150	01/28/14	0.22	bucket of Samples	0.0243	Tetra Tech EC 03/20/13 to 06/03/13
591	012814-151	01/28/14	0.36	bag of soil from drum	0.0398	Tetra Tech EC 03/20/13 to 06/03/13
592	020514-152	02/05/14	1.2	metal object .75" hexagon	0.1327	CB&I 02/04/14 to 2/17/14
593	021114-153	02/11/14	0.018	Rock	0.0020	CB&I 02/04/14 to 2/17/14
594	021114-154	02/11/14	0.01	Metal fragment	0.0011	CB&I 02/04/14 to 2/17/14
595	021714-155	02/17/14	0.02	Gauge	0.0022	CB&I 02/04/14 to 2/17/14
596	021914-156	02/19/14	0.008	Toggle switch	0.0009	CB&I 02/19/14
597	022114-157	02/21/14	0.12	TtEC misc material	0.0133	CB&I 02/21/14

TABLE 1 – LOW-LEVEL RADIOLOGICAL OBJECTS RECOVERED FROM SITE 12
Historical Radiological Assessment Supplemental Technical Memorandum, NAVSTA TI, California

No.	LLRO ID Number	Date Recovered	Highest 30 cm (mR/h) [1]	LLRO Description	Estimated Ra-226 (mCi) RadiumThumb Rule [2]	LLRO Recovered By and Date Recovered
598	020214-158	02/20/14	0.008	metal objects	0.0009	CB&I 02/20/14
599	022414-159	02/24/14	0.01	metal debris	0.0011	CB&I 02/24/14
600	022414-160	02/24/14	0.16	knob/ Button	0.0177	CB&I 02/24/14
601	032514-161	03/25/14	0.11	2 " dial	0.0122	CB&I 03/25/14
602	Gilbane 1	10/29/13	0.028	debris < 3 cm diameter	0.0031	Gilbane 10/29/13
603	Gilbane 2	10/29/13	0.015	fragments in soil	0.0017	Gilbane 10/29/13
604	Gilbane 3	11/12/13	0.028	metal object	0.0031	Gilbane 11/12/13
605	Gilbane 4	12/02/13	0.02	metal object	0.0022	Gilbane 12/02/13
606	Gilbane 5	12/02/13	0.006	metal object	0.0007	Gilbane 12/02/13
607	Gilbane 6	12/02/13	0.03	metal object	0.0033	Gilbane 12/02/13
608	Gilbane 7	12/05/13	0.03	metal object	0.0033	Gilbane 12/05/13
609	Gilbane 8	12/09/13	0.025	metal object	0.0028	Gilbane 12/09/13
610	Gilbane 9	01/29/14	0.012	glass dial	0.0013	Gilbane 01/29/14

Note:

1. Reading shown as measured in mR/h or calculated using highest contact reading (µR/h) × 0.001.
2. Radium Thumb Rule, RSO Magazine, Volume 10, No 4, 2005 = mR/h × 929/8400.

µR/h	Microroentgen per hour
cm	Centimeter
ID	Identification
mCi	Millicurie
mR/h	Milliroentgen per hour
NA	Not available; not calculated
No.	Number
Ra-226	Radium-226
tbsp	Tablespoon
tsp	Teaspoon

APPENDIX A
GENERAL HEALTH PHYSICS INFORMATION

APPENDIX A: GENERAL HEALTH PHYSICS INFORMATION

A1.0 GENERAL

Radiation is energy in the form of electromagnetic waves or subatomic particles. It is emitted from the nucleus or electron cloud of atoms or from devices generating electromagnetic waves and particles such as X-ray machines, neutron generators, and cyclotrons. Radiation is either *ionizing* or *non-ionizing*.

Radiation that has insufficient energy to remove electrons from atoms is non-ionizing radiation. Examples of non-ionizing radiation include most visible light, infrared light, microwaves, and radio waves. Radiation that has sufficient energy to remove electrons from atoms is ionizing radiation. All radiological investigations at Naval Station Treasure Island have focused on ionizing radiation, which includes alpha, beta, and gamma radiation.

A2.0 ALPHA RADIATION

Alpha particles are charged particles containing two protons and two neutrons. Alpha particles are emitted from the nuclei of certain heavy atoms, such as uranium, when they decay. Because of its size and heavy electrical charge, +2, an alpha particle can travel only a few centimeters in air. It can be stopped or shielded by a sheet of paper. Alpha particles cannot penetrate the outer layer of skin but can cause localized damage inside the body if ingested or inhaled.

A3.0 BETA RADIATION

Beta particles are particles with the mass of an electron and a -1 electrical charge; essentially they are high-velocity electrons. Radioactive isotopes of many different elements emit beta particles. Even though moderate energy beta particles can travel as far as 10 feet through air, they easily can be stopped by a 1/3-inch-thick sheet of plastic or a 1/8-inch-thick sheet of aluminum. They are a hazard to the body's skin and the eyes because beta particles can penetrate the outer layer of skin and affect living tissue.

A4.0 GAMMA RADIATION

Gamma radiation is electromagnetic radiation with no mass or charge. Gamma rays are emitted from the nucleus of an atom during radioactive decay. Gamma radiation can penetrate most materials because it has no mass or charge. In air, higher-energy gamma radiation can travel several hundred feet. Gamma radiation can penetrate the skin and interact with the dense structures of the body. Dense materials such as lead or concrete are needed for shielding against gamma radiation.

A5.0 X-RAYS

X-rays are also electromagnetic radiation with no mass or charge. The difference between gamma radiation and X-radiation is the nature of their origin. Gamma radiation originates in the nucleus, while X-rays originate in the electron region of the atom. The penetrating properties are the same; therefore, safety concerns and shielding mechanisms are similar. X-rays are typically produced by machines, and thus are not a hazard if the machine is turned off.

A6.0 SCIENTIFIC NOTATION

Radiation measurement units are normally reported in scientific notation. Scientific notation is also known as exponential or power-of-ten notation. It is a concise method of expressing numbers from very small to very large. Basically, scientific notation is the expression of a number raised to a power of ten. For example, 3,456 can be expressed as 3.456×10^3. Scientific notation is often used in this technical memorandum when radiation units are reported.

Here is a listing of common numbers expressed in scientific notation:

$10^6 = 1{,}000{,}000$
$10^5 = 100{,}000$
$10^4 = 10{,}000$
$10^3 = 1000$
$10^2 = 100$
$10^1 = 10$
$10^0 = 1$

$10^{-1} = 0.1$ (1/10)
$10^{-2} = 0.01$ (1/100)
$10^{-3} = 0.001$ (1/1000
$10^{-4} = 0.0001$ (1/10,000)
$10^{-5} = 0.00001$ (1/100,000)
$10^{-6} = 0.000001$ (1/1,000,000)

A7.0 RADIATION UNITS

Radiation measurements are stated in units of curies, roentgens, rads, and rems. These units are defined as:

A7.1 CURIE (CI)

The curie measures radioactivity: one curie is that quantity of a radioactive material that will have 37,000,000,000 (3.7×10^{10}) transformations in 1 second. Often, radioactivity is expressed in smaller units like thousandths (10^{-3}, millicurie or mCi), millionths (10^{-6}, microcurie or μCi), billionths (10^{-9}, nanocurie or nCi) or trillionths (10^{-12}, picocurie or pCi) of a curie.

A7.2 ROENTGEN (R)

The roentgen is a unit used to measure exposure. It describes an amount of gamma and X-rays, and only in air. The roentgen is a measure of the ionization of the molecules in a mass of air: one roentgen is equal to depositing in dry air enough energy to cause an electrical charge of 2.58×10^4 coulombs per kilogram (kg; 1 kg = 2.2 pounds). The main advantage of this unit is

that it is easy to measure directly, but it is limited because it is only for deposition in air, and only for gamma and X-rays.

A7.3 RAD (RADIATION ABSORBED DOSE)

The rad is a unit used to measure absorbed dose. This measure relates to the amount of energy actually absorbed in some material. It is used for any type of radiation and any material. One rad is defined as the absorption of 100 ergons (ergs) per gram of material. The unit "rad" can be used for any type of radiation, but it does not describe the biological effects of different radiations.

A7.4 REM (FROM ROENTGEN EQUIVALENT MAN)

The rem is a unit used to derive a quantity called equivalent dose. This measure relates the absorbed dose in biological tissue to the biological effect. Not all radiation has the same biological effect, even for the same amount of absorbed dose. Equivalent dose is often expressed in terms of thousandths of a rem, or millirem (mrem). To determine equivalent dose in rem, absorbed dose (rad) is multiplied by a quality factor (Q) that is unique to the type of incident radiation and the material in which the energy is deposited.

APPENDIX B
INTERVIEWS

APPENDIX B: INTERVIEWS

B1.0 GENERAL

Archival research conducted during preparation of the Naval Station Treasure Island (NAVSTA TI) Historical Radiological Assessment Technical Memorandum (HRASTM) included locating and making contact with people who had specific knowledge of radiological and related operations at NAVSTA TI.

To make contact with these people, archival documents were reviewed for the names of individuals who may have such knowledge, and commercial web search engines were utilized to try to locate those individuals. Interviews with those individuals who were located and consented to provide information have been included as references to this HRASTM. In addition, informal interviews were conducted by e-mail or phone with a number of other individuals, and the substance of all of the interviews conducted follows:

B2.0 INTERVIEWS

Brian DeGraffenried

Dennis Kelly of Tetra Tech spoke with Mr. DeGraffenried by telephone on the afternoon of August 6, 2013. Mr. DeGraffenried was an enlisted sailor and designated as the Chief Photographer in the Naval History of Treasure Island published in 1946 (TI-HRASTM-2). He was on temporary assignment at the TACDEN PHOTO LAB, located on the second floor of Ships Service Building #1, from May 24, 1945, to May 10, 1946. His rate was Photographers Mate 2nd Class and he was the Petty Officer in Charge of the photo laboratory most of that time. His responsibility was photographing assignments for various purposes.

Mr. DeGraffenried did not recall seeing any rubbish or solid waste burial or burning taking place on TI. He did recall photographing the north end of TI (at the time an ammunition storage area), but had no recollection of pits or disposal areas.

Mr. DeGraffenried did not recall any berthing of Operation Crossroads Ships at NAVSTA TI and believes that if they would have been berthed, it would have been after he left (Note: this information is consistent with his time of service and the time frame for the conduct of Operation Crossroads).

Mr. DeGraffenried was asked if he ever observed or photographed the optical shop on Building 3. Mr. DeGraffenried was not aware of the presence of the optical shop and stated he had never seen it.

Mr. DeGraffenried was questioned to see if he had any recall of radioactive materials being used or stored on NAVSTA TI. Mr. Kelly explained that these materials would include the use of radioluminescent paints on dials or in deck markers. Mr. DeGraffenried explained that he was

unaware of any radioactive material use on NAVSTA TI and further explained that he was not aware of the term radioactive until later after he left NAVSTA TI. He did note that he was aware of X-ray machines being used for medical purposes on NAVSTA TI.

In response to who he worked with that may recall more information, he indicated that a potential contact would be Commander Henry McDowell, Commanding Officer of the Radar Training Facility on Treasure Island, who was living at 19 Madison Ave, Summit, NJ, when he last heard from him on March 27, 1947 (Note: that Tetra Tech attempted to locate Commander McDowell and was unable to find him) (TI-HRASTM-47).

Chuck Taylor

Mr. Kelly of Tetra Tech spoke with Mr. Taylor by telephone on the afternoon of November 21, 2013. Mr. Taylor was an enlisted sailor and served at NAVSTA TI from about 1965 to 1970. During this time, he was first assigned as an electronics "A" school (A school was basic or introductory school) instructor and later worked in the Radiation Detection, Indication, and Computation (RADIAC) repair facility in Buildings 342 and 343, and the vault in Building 344. He was also responsible for maintenance of the licensed sources and licenses used for calibrating instruments in the *Pandemonium* training. During that time, he did periodic leak checks on the sources. He recalled that when the *Pandemonium* was moved from the west side of the island to the east side, he first removed all of the sealed sources from the ship and temporarily stored them in the vault in Building 344. His recollection was that the sources were cesium-137. When he temporarily stored them in the Building 344 vault, he built a matrix with 2- by 12-lumber in the vault and filled it with soil surrounding 60-millimeter (mm) shell casings into which he placed the sealed sources.

Mr. Taylor did not recall seeing any rubbish or solid waste burial or burning taking place on TI, nor did he have any information regarding operation of the incinerator, which was operated during the 1950s at the north end of the island or in particular, what happened to the ash from the incinerator. Mr. Taylor did not recall ever hearing any information regarding the berthing of Operation Crossroads Ships.

Mr. Kelly described the octagonal radium foils that have been found in the Solid Waste Disposal Areas (SWDA) on NAVSTA TI. Mr. Taylor was familiar with the foils as he had recently dug up some of those that have been found during his current work on Navy projects at NAVSTA TI; however, he has no recollection of the foils being used in association with any operations on NAVSTA TI. Mr. Kelly asked if perhaps they had been used in association with *Pandemonium* training operations, and Mr. Taylor indicated that he had never seen any foils like those found used anywhere during his tenure on NAVSTA TI. Mr. Taylor was asked if he ever observed the optical shop on Building 3. Mr. Taylor was not aware of the presence of the optical shop and stated he had never seen it.

Mr. Taylor was asked if he ever worked in Building 233, and he indicated that he had not worked there until the recent decontamination efforts in the last few years as a Navy contractor. Mr. Taylor was asked if he recalled any radiation areas or materials ever being present in the supply

department at NAVSTA TI. He responded that he had no recollection of any such radiation areas or materials in the supply department. Mr. Taylor was questioned to see if he recalled radioactive materials used or stored on NAVSTA TI or any radiological spills anywhere on NAVSTA TI. Mr. Taylor explained that he was unaware of any radioactive material use on NAVSTA TI other than as described above. In response to who he worked with who may recall more information, he indicated that he could not recall the names of any individuals who might have additional information or individuals who worked in the Public Works Department (TI-HRASTM-48).

David Nishimura

Mr. Kelly of Tetra Tech spoke with Mr. Nishimura on several occasions by telephone in late 2013. Mr. Nishimura was the Project Civil Engineer for the Actus Sundt Joint Venture, the contractor that built the 1400 series housing on NAVSTA TI. Mr. Nishimura indicated that his primary focus on that project had been the design of the sewer systems, and he noted that he had spent limited time on site during construction. Although no formal interview was conducted, Mr. Nishimura provided the following information:

Mr. Nishimura was asked if he was aware of any evidence (geotechnical or field observations) that rubbish disposal took place on the site prior to the construction of this housing project. Mr. Nishimura responded that the actual construction phase of the project was under the direction of the project managers, project architect, and construction managers, and that he was not very involved, so his knowledge is limited. With that qualification, he did state that he was not aware of any specific rubbish disposal areas within the project boundaries. He recalled that the base was constructed of fill material and not native soil. Mr. Nishimura also stated that he was not aware of any evidence that grading and construction associated with the adjacent housing to the north and west moved soil onto the project site. Tetra Tech attempted to locate the soils engineer for the project, but found that he was deceased.

Mr. Nishimura did not specifically recall if the "Project Boundaries" shown in the as-built drawings had meaning with respect to the extent of site intrusive activities associated with grading (TI-HRASTM-44). Mr. Nishimura stated that typically all work on the turnkey military family housing projects were to be confined to the project boundaries provided by the Military. Mr. Nishimura could not recall whether or not the project boundaries were fenced during construction.

Mr. Nishimura provided the names of several individuals involved in the 1400 series housing construction, including the owner of Town and Country Inc., the project architect, and that of the construction superintendent; however, none of the individuals could be located by Tetra Tech as they were since deceased.

Breton Hanville

Mr. Kelly of Tetra Tech spoke with Mr. Hanville on June 14, 2013. Mr. Hanville was employed by the Naval Facilities Engineering Command, Engineering Field Activity West, at the time of construction of the 1400 series housing in 1987, and his proper title relative to the housing would have been "Project Leader." He fulfilled that role for the design and construction of housing projects up and down the West Coast and Alaska. He has no recollection of any specific issues related to soils engineering or grading at the 1400 series site. He believes that the proper person to contact would be the Resident Officer in Charge of Construction (ROICC) for site-specific information. T etra Tech attempted to contact the ROICC personnel who would have been involved in the construction of the 1400 series housing, but was unable to locate them.

APPENDIX C
RESPONSES TO AGENCY COMMENTS ON THE DRAFT HISTORICAL RADIOLOGICAL ASSESSMENT SUPPLEMENTAL TECHNICAL MEMORANDUM

RESPONSES TO AGENCY COMMENTS ON THE DRAFT HISTORICAL RADIOLOGICAL ASSESSMENT – SUPPLEMENTAL TECHNICAL MEMORANDUM NAVAL STATION TREASURE ISLAND, SAN FRANCISCO, CALIFORNIA

NOTE REGARDING THE FOLLOWING RESPONSES TO COMMENTS:

This document presents the Department of the Navy's (Navy) responses to comments that were previously submitted to the regulatory agencies for review on January 18, 2013. These responses were provided to the "Draft Historical Radiological Assessment – Supplemental Technical Memorandum (HRASTM), Naval Station Treasure Island (NAVSTA TI), San Francisco, California, dated August 6, 2012."

Following submission of these responses, a corresponding revision to the HRASTM, and several meetings with the regulatory agencies, the Navy initiated additional research to address several questions associated with the radiological history of NAVSTA TI. The Navy revised the HRASTM to include the findings of the additional research and to conform to discussions and agreements made following the submission of the following RTCs. As a result of those revisions, some of the responses that follow may no longer reflect the additional findings or changes made to the text of this "*Final Historical Radiological Assessment – Supplemental Technical Memorandum (HRASTM),"* however, these responses were included to maintain the integrity of the administrative record.

RESPONSES TO AGENCY COMMENTS ON THE DRAFT HISTORICAL RADIOLOGICAL ASSESSMENT – SUPPLEMENTAL TECHNICAL MEMORANDUM NAVAL STATION TREASURE ISLAND, SAN FRANCISCO, CALIFORNIA

This document presents the Department of the Navy's (Navy) responses to comments from staff at the California Department of Toxic Substances Control (DTSC); the California Department of Public Health's (CDPH) Environmental Management Branch (EMB); the San Francisco Public Utilities Commission (SF PUC); AMEC Environmental & Infrastructure (AMEC), on behalf of the Treasure Island Development Authority (TIDA); NGTS, Inc. (NGTS) on behalf of TIDA and AMEC; Terraphase Engineering Inc. (Terraphase) on behalf of the Treasure Island Community Development, LLC (TICD); Dade Moeller on behalf of Arc Ecology; EPA; and the San Francisco Bay Regional Water Quality Control Board (Water Board) on the "Draft Historical Radiological Assessment – Supplemental Technical Memorandum (HRASTM), Naval Station Treasure Island (NAVSTA TI), San Francisco, California, dated August 6, 2012." The comments addressed below were received from the DTSC on October 5, 2012; CDPH EMB on October 4, 2012; SF PUC on October 2, 2012; TIDA (NGTS and AMEC) on October 3 and 5, 2012; TICD (Terraphase Engineering) on October 5, 2012; Arc Ecology (Dade Moeller) on October 5, 2012; EPA on October 10, 2012; and the Water Board on October 12, 2012.

Additional comments were received from CDPH EMB on December 11, 2012 in response to the Navy's initial responses to comments received from the above regulatory agencies in October 2012. Please note that the Navy's initial responses to October 2012 comments were thus revised to conform with the responses to December 2012 comments where appropriate.

RESPONSES TO DTSC COMMENTS (REMEDIOS SUNGA)

GENERAL COMMENTS

1. Comment: **<u>Information and Data since 2006 HRA</u>. The HRASTM should discuss and provide all information and data that have been generated and gathered to date from the radiological activities at TI since 2006. The 2006 HRA indicated that radiological contamination in the Solid Waste Disposal Areas (SWDAs) was unlikely. However, the 2007 removal actions in the SWDAs found radiological contamination and several commodities. This new information should be incorporated in the HRASTM.**

Response: The text will be updated to include a listing of commodities that have been found to-date as requested. All remedial actions with radiological analysis were considered in the HRASTM when making determinations of property classification as impacted or not impacted. As information becomes available from ongoing radiological investigation prior to finalization of the HRASTM, the HRASTM text will be updated to summarize any new information resulting from these ongoing investigations. This work includes investigations at Sites 12, 31, 33, and Building 233.

2. Comment: **<u>Final HRASTM</u>. The HRASTM should be finalized with changes in the text, figures, and tables, as needed, in response to all comments, and not just attaching the Responses to Comments to the draft as an appendix.**

Response: Navy concurs.

SPECIFIC COMMENTS

3. Comment: **<u>Section 2.2.7-AOI7: Northern Housing Area of Interest, Pages 18-24</u>. The soil removal action in 2007 at SWDAs 1207/1209 and 1231/1233 should be discussed in this section. The sampling data and a list of all commodities found at these SWDAs should also be included for reference. The discovery of radiological commodities during the 2007 removal action warranted the 2009 surveys at the Northpoint and Bayside housing areas. If wipe samples were collected during this surveys from residential buildings, the results of this sampling should also be incorporated in the HRASTM. The HRASTM should include all radiological findings from any buildings, soil/wipe samples, scans, and commodities found to date not previously provided in the 2006 HRA.**

Response: The work done within solid waste disposal areas (SWDAs) 1207/1209 and 1231/1233 is discussed in general in Sections 4.3.6 and 4.3.7. Regarding the request for additional detail, please see the response to DTSC General Comment #1.

4. Comment: **<u>Section 2.2.8-AOI8: Southern Housing Area, Pages 24 and 25</u>. The 2007 soil removal action at SWDAs A&B should be discussed in this section. The sampling data and a list of all radiological commodities found at these SWDAs should also be included for reference. The removal action findings prompted the California Department of Public Health (CDPH) to survey the areas surrounding the Radiological Controlled Area at SWDAs A&B.**

Response: The work done within SWDAs A&B is discussed in general in Section 4.3.8. Regarding the request for additional detail, please see the response to DTSC General Comment #1.

5. Comment: **<u>Section 4.1-Radiologically Impacted Sites, Pages 28-33</u>. The Bigelow Court SWDA should be included in the list of radiologically impacted sites. The reason for this is because it was classified as a SWDA in earlier investigations at Site 12 and as discussed on page 22 of the HRASTM.**

Response: Comment noted the Navy will designate this area as an impacted. Details on the basis for this recommendation will be addressed in Section 6.0. Contamination potential for subsurface will be listed as unlikely and a scoping survey will be recommended.

6. Comment: **<u>Section 4.1.7-Former Storage Areas 30 and 31, Page 32</u>.**

6.1 <u>First Paragraph</u>. The last sentence states that no radiological or other Installation Restoration Program (IRP) related work has been done at Site 30 or the areas north and south of the IR sites, since the 2006 HRA. Please clarify the meaning of "work" in this sentence since IR related work or activities have been completed at Site 30, i.e., Proposed Plan and Record of Decision.

Response: The last sentence of the first paragraph has been revised to eliminate the use of the word "work" as follows: "No radiological or other intrusive activities related to the Installation Restoration (IR) Program has been done at Site 30 or the areas north and south of the IR sites since the 2006 HRA."

6.2 <u>Second Paragraph</u>. The second to the last sentence states that laboratory testing confirmed the presence of non-naturally occurring Ra-226, possibly from a deteriorated metal gauge. Please clarify whether a deteriorated metal gauge or any commodity was found in the area of elevated radiological readings.

Response: Elevated radiological readings were discovered during the Phase I activities, but no commodities were observed. Laboratory analysis of soil confirmed the presence of radium (Ra)-226 at levels suggesting non-naturally occurring radionuclides (10 to 11 picocuries per gram [pCi/g]). While unconfirmed, it is possible that this elevated concentration was from a deteriorated man-made item.

7. Comment: **<u>Section 4.2-Radiologically Non-Impacted Sites, Pages 33 and 34</u>. The radiological screenings at Site 33 was performed in early 2012 and the results of this survey should be discussed in the HRASTM. Site 33 is classified as not impacted based on the screening results as presented in the Radiological Characterization Report that is currently under review.**

Response: Comment noted. The text of the last sentence of the second paragraph of Section 2.2.2 has been revised to read: "At the time of publication, the majority of remedial action fieldwork at the Waterline Replacement Area, Site 33 (Figure 4), has been completed including radiological surveys/samples. Although not yet documented in a final report, the preliminary data would support the conclusion that soil and asphalt

samples from the five separate excavation areas, Site 33 are free of non-naturally occurring Ra-226, cesium (Cs)-137, and strontium (Sr)-90 contamination."

8. Comment: **<u>Section 6.1.2.7-Former Storage Area and Sites 30 and 31, Pages 55-56. Site 31, Page 56</u>. The elevated radiological readings during the July 2010 soil excavation and the removal of soil with no commodities found in April 2011 should be discussed in this section. The HRASTM needs to incorporate all available data.**

Response: Section 6.1.2.7 has been updated to address the current radiological status of Site 31 by revising the language under the header "Previous Radiological Investigations" to read as follows: "The northern and southern portions of the storage area – None; Site 30 – None; Site 31 – non-time-critical removal action (NTCRA). During the Phase I removal action, elevated radioactivity suggesting the presence of non-naturally occurring Ra-226 was discovered in the sidewall of the excavation. Laboratory testing confirmed the presence of Ra-226 in concentrations exceeding the cleanup goal (Shaw 2012b). The contaminated soil was removed and no commodities were found in association with the elevated background." All work will be documented in a site-specific remedial action completion report (RACR) and final status survey (FSS) report.

9. Comment: **<u>Figure 2-Newly Identified Radiologically Impacted Areas</u>.**

9.1 <u>Radiologically Impacted Sites</u>. SWDAs A&B, 1207/1209 and 1231/1233 are shown in this figure but not identified in the Legend as radiologically impacted sites. In addition, Bigelow Court SWDA is not shown and Building 233 is not identified as impacted. Please clearly present both the new areas identified as impacted in this HRASTM as well as those identified in the 2006 HRA in different colors. The figure should denote all radiologically impacted areas identified in the 2006 HRA and the newly identified areas. The newly impacted areas should also include Bigelow Court SWDA and the paved compound at the rear of Buildings 342, 343 and 344 (see Comments #6 and 11). The figure title should also be updated accordingly.

Response: Figure 2 and all other appropriate figures (Figures 4, 6, 8, 9 and 10) have been revised to indicate those areas previously identified as impacted in the 2006 Historical Radiological Assessment (HRA), as requested. In addition, the figure title has been updated and explanatory text has been added to the end of the Section 2.3 to further discuss and introduce the results of the HRA.

In addition, as requested, The Bigelow Court SWDA and the paved compound at the rear of Buildings 342, 343 and 344 have been added as radiologically impacted sites to the HRASTM.

9.2 <u>Radiologically Impacted Site Boundaries</u>. The current SWDA boundaries exclude the buildings where sidewall samples taken beneath the buildings showed radiological contamination. The boundaries should be adjusted to conservatively include the buildings. Building 233 impacted boundaries should also be adjusted as discussed at the BCT meetings based on the detection of radiological contamination along sewer lines. The Building 233 boundary includes surrounding areas beyond the building footprint.

Response: The 2006 HRA boundaries for the SWDAs and Building 233 have been expanded in the HRASTM as recommended. See the revised boundaries in Figures 2, 4, 8, 9 and 10.

The text of the HRA has been modified as follows:

1. Add the following bullet to the end of the Executive Summary:

   - *This HRASTM expands the site boundaries for each of the Site 12 SWDAs to account for investigatory results obtained subsequent to the HRA.*

2. Revise the last sentence of paragraph 5 in Section 2.2.7 to read:

   "*Although further investigation will be performed throughout Site 12, the potential for the presence of radioactive materials in AOI 7 outside of the SWDAs is minimized because:…*"

3. Revise the last sentence of the first paragraph in Section 2.2.8 to read:

   "*The findings of this HRASTM for Area of Interest (AOI) 8 differ from the HRA in that this HRASTM expands the footprint of the existing SWDAs by 50 feet around the perimeter based on new information from investigations subsequent to the final HRA.*"

4. Insert the following new Sections 4.1.1 and 4.1.2 and renumber the follow-on sections:

   "4.1.1 Radiologically Impacted Sites Identified in the HRA

   This section addresses work that was done 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 1231/1233, 1207/1209, and A&B.

4.1.1.1 Building 233

Building 233 was the former 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 U.S. Naval Radiological Defense Laboratory decontaminated and cleaned up the building. Although the floor was decontaminated at the time, the Navy is currently performing remedial activities and surveys to ensure the 1950 cleanup meets current standards. At the time of publication, 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 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. In addition, a scoping survey of the building completed in September 2007 identified contamination under paint in interior areas and areas of elevated readings outside the building (Shaw 2012d). The demolition of the building was completed in January 2011 and at the time of this HRASTM, the Navy is conducting the characterization, remediation, and FSS for the building footprint, the sanitary/storm sewer system 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 comprised the RADIAC school from the 1950s to the 1970s. The closeout survey conducted by the Navy in a storeroom of Building 343 detected two alpha wipe survey points that were above release limits. Although these survey points were decontaminated, the HRA found that these 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.

MARSSIM Final Status Surveys 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 survey results for both buildings had 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 SWDA 1231/1233, 1207/1209 (Bayside/North Point)

A NTCRA began in March 2007 at SWDAs 1231/1233, and 1207/1209 (Bayside/North Point) (Shaw 2007b). During the NTCRA, approximately 20 radiological commodities were discovered as well as incidental soil contamination. Additional remediation of SWDAs 1231/1233 and 1207/1209 will take place in order to support free release of the area.

4.1.1.4 SWDA A&B

A NTCRA began in March 2007 at SWDAs A&B (Shaw 2007b). During the NTCRA, several hundred radiological items ranging in Ra-226 content from 0.4 to 6,400 microcuries (μCi) were found. Additional remediation is necessary for SWDA A&B in order to support free release of the area.

4.1.2 Radiologically Impacted Sites Identified in this HRASTM

This section addresses work done at sites not designated as radiologically impacted at the time of the HRA, but subsequently designated as radiologically impacted in this HRASTM. These sites include Building 3, the entire sanitary sewer line from Buildings 3 and 233, the storm drain line from Building 233, the former incinerator in Site 12 and the downwind area potentially affected by aerial deposition, Building 570, both former USS Pandemonium Sites I and II, a probable former salvage yard site, a waste & clean soil stockpile/loading and decontamination site, the Bigelow Court SWDA, the asphalted area outside and east of Building 342, Building 168 (a former gyro compass repair building), and a former storage area (Sites 30 and 31)."

5. Add the following to the end of Section 6.1.1.3:

"*Intrusive investigation of SWDAs A&B, 1207/1209, and 1231/1233 has shown that radioactive debris extends beyond the footprints identified in the HRA for these SWDAs. Figures 2, 9, and 10 of this HRASTM show the expanded footprints for these impacted areas.*"

10. Comment: **<u>Appendix A-References, HRASTM-27 Lic 04-0436002 Amend</u>. This reference document states "The Radiac Instrument Maintenance Branch of Nuclear, Biological and Chemical Defense School is located near the corner of 5th Street and Avenue M on the Northeast side of Treasure Island (Fig. 1). It consists of numbered Buildings 343, 344**

and a portion of 342 and a paved compound of approximately 4,800 square feet which is enclosed by a 7' chain link fence (Figs. 2, 3, 4, and 5)… The paved compound to the rear of the buildings (Fig. 5) is used to conduct outdoor monitoring exercises using sealed sources. Whenever sources are exposed in the compound a red warning light on the inside wall of Lab #3 is activated by staff personnel and personnel are restricted from that area." Based on these statements, the paved compound should be identified in the HRASTM as potentially impacted. Please also verify whether there is documentation indicating a release of sealed sources in any of these locations. This new impacted location should be shown in Figure 2.

Response: The text of the HRASTM has been modified to address this outdoor area as radiologically impacted. T he last paragraph has been rewritten as follows to improve the clarity of the HRASTM:

> "*This HRASTM identifies Building 342 and surrounding area (Figure 6) as impacted based on new information indicating the possibility that prior use of the building may have included use as a radiological counting room. The presence of a counting room suggests the possibility that samples 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 DTSC concurred with the unrestricted release of Buildings 343 and 344 on January 16, 2009 (DTSC 2009). Based on the completion of 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 also indicates that the paved area to the rear of the buildings was used to conduct outdoor monitoring exercises using sealed sources. This area has also been designated as impacted to allow for the possibility of outside spills or leaks*."

OTHER COMMENT

11. Comment: Additional comments from CDPH are provided in the enclosed memorandum. Many of these comments pertain directly to the HRASTM, and the Navy should consider them the State's comments. Several of the comments or parts of the comments are related to future work or are not germane to the HRASTM. The Navy should address these comments in future documents. The comments that do not apply directly to the HRASTM and which the Navy should address in future documents are:

- **Comment 3 - third and fourth sentences**
- **Comment 21 - second and third sentences**
- **Comments 7 and 14**
- **Comments 4, 5, 6, 8, 11, 12, 16, 18 and 23 should be addressed in the revised HRASTM if information is available. If not, they should be addressed in a future document**

Response: Comment noted. The Navy has addressed all CDPH comments, including those referenced above. The Navy recognizes that additional site history/information developed after the HRASTM is published may be presented in future documents.

RESPONSES TO CDPH EMB COMMENTS (LARRY MORGAN)

GENERAL COMMENTS

1. Comment: EMB recommends identification and listing of radionuclides of concern for all radiological impacted sites and buildings. The Department of Navy (DON) needs to identify the use of radionuclides, and where and how disposed. Please establish if there were any known radionuclide sealed sources or radiological contamination prior to DON's ownership of Treasure Island (TI), and whether your records indicate the fate and transport of such items.

Response: The HRASTM (as well as the 2006 HRA) identifies radionuclides of concern for all radiological impacted sites and buildings. Please see Section 6.1.2 and subheadings "Potential Radionuclides of Concern" for all newly impacted sites. Regarding previously identified radiologically impacted sites in the HRA, the radionuclides of concern were identified in the HRA in Section 8.3 under the subheading "Radionuclides of Concern."

With respect to identifying the use of radionuclides, and where and how disposal occurred, the research, references and conceptual site models developed in both the 2006 HRA and the HRASTM aim to answer these questions. As noted in the HRASTM, the Navy has reviewed documents from the Golden Gate International Exposition (GGIE) and has found no evidence to date of use or presence of radioactive materials during the period prior to Navy ownership of Treasure Island. While this does not preclude presence of radioluminescent materials on common items such as watches or on instruments associated with the Pan American (Pan Am) Clippers, no evidence has been found of disposal of these items. The following text has been added to the end of the 3rd paragraph in Section 2.2:

"The Navy has reviewed documents from the GGIE and has found no evidence to date of the use or presence of radioactive materials during the period prior to Navy ownership of Treasure Island. While this does not preclude the presence of radioluminescent materials in

association with common items such as watches or on instruments associated with the Pan Am Clippers, no evidence has been found of disposal of these items at TI."

2. Comment: The Historical Radiological Assessment Supplemental Technical Memorandum (HRA-STM) needs to adequately address EMB current concerns regarding the higher level activity Ra-226 items found on Treasure Island (TI) in the form of radium foils and buttons, commonly referred to as commodities.

EMB stated in a Memorandum of May 17, 2012, "Understanding the presence, use and location of disposal for all these items (foils and buttons) needs to be the primary focus of the Technical Memorandum (TM) to the Historical Radiological Assessment (HRA)." The updated Conceptual Site Model, 5.2.1.1 states, "Based on the research conducted to date, the source of the radioactive foils and buttons is unclear..." Please further elaborate their use, location, and disposal. Please detail how many cubic feet of Low Level Radioactive Waste (LLRW) have been shipped from TI and its point of origin. Please detail how many radioactive waste shipments whose contents were greater than LLRW have been made from TI, their nature and point of origin.

Response: The Navy concurs that in the absence of information for a site, a better understanding of function and use of different commodities may lead to a better of understanding of which areas warrant designation as radiologically impacted. However, the weight of evidence suggests that the radium foils resulted from Navy operations and that they were probably used in association with training activities. This basis is concluded because the foils are found buried in the SWDAs. Burial in the SWDAs would have been done by the Navy in the late 1940s or early 1950s based on when the SWDA debris pits were in use. The fact that the burial would have occurred after the WWII period indicates that it is unlikely that the foils would have been from the period of the GGIE. Furthermore, the curie content of the foils seems to vary, which indicates the foils were probably used for naval training activities. The absence of additional specific knowledge does not preclude the Navy from designating impacted areas and conducting appropriate response actions based on the availability of other lines of evidence. In fact, the SWDAs had been identified without any knowledge of what type, if any, commodities were present, even though all but one of the commodities have been found within those SWDAs to-date. I addition, the Navy has performed extensive records research as part of the HRASTM in an attempt to understand as many specifics as possible regarding the types of commodities that have been found. To the extent information is available on the types of commodities that have been found to-date, this information is provided in Section 5.2.1.1 of the HRASTM. The Navy continues to

research all types of radioluminescent devices and Ra-226 sources used by the Navy. Areas of interest on TI include the TI calibration laboratory, classrooms, and USS *Pandemonium* locations due to the use of radioactive sources and devices.

No High Level Radioactive Waste (HLRW) has been shipped from NAVSTA TI. Appropriate changes have been made in response to the CDPH EMB request to summarize information related Low Level Radioactive Waste (LLRW) shipped from TI including available details on such shipments.

3. **Comment:** **DON previously excavated approximately 580 trenches presumably for characterization purposes, and collected over 1,500 soil samples; of which four soil samples were analyzed for radionuclides. EMB has not seen characterization plan(s) that included analysis of a large fraction or all of the 1,500 samples. If the previously collected samples are unavailable for analysis now, the locations where samples were collected and chemicals, debris, staining or odors were found need to be incorporated into upcoming characterization plans. Since CDPH's stated conceptual model is that these sites are potentially impacted by radionuclides, these characterization plans need to be developed soon.**

   Response: The soil samples that were collected in 2003 have been subsequently disposed of and are not available for additional analysis. All previous investigative data will be considered in the process of developing upcoming characterization plans and CDPH will be provided an opportunity to comment on these plans.

4. **Comment:** **Based on a preliminary review, EMB has found DON did not provide radiological information about the extent of contamination for all radiologically impacted buildings or sites from the following:**

   - **Industrial waste lines,**
   - **Outfalls to the San Francisco Bay,**
   - **Characterization of surface below asphalt,**
   - **Removal of surface anomalies,**
   - **Excavation of sewer drainage system,**
   - **Plume footprint from incinerator, and**
   - **Solid waste disposal areas for the entire island.**

   Response: Regarding the extent of contamination at radiologically impacted buildings or the listed sites, the following Navy input is provided:

   - Industrial waste lines: There are no industrial waste lines on TI.

- Outfalls to the San Francisco Bay: Outfalls to San Francisco Bay have not been designated as impacted; however, the outfalls will be designated impacted if ongoing investigations warrant such designation.
- Characterization of surface below asphalt: Characterization of soil surfaces below the asphalt cover will occur in impacted areas.
- Removal of surface anomalies: One near-surface anomaly was found and disposed of, and that anomaly is discussed in Section 2.2.7. If additional anomalies are found they will be investigated appropriately.
- Excavation of sewer drainage system: The Navy presumes this comment refers to the sewer lines undergoing remediation in association with Building 233. That work is ongoing and will be reported as additional data becomes available.
- Plume footprint from incinerator will be investigated.
- All known SWDAs for the entire island are being investigated: The Navy presumes this comment refers to the radiologically impacted SWDAs in Site 12 (Bigelow Court, 1231/1233, 1207/1209, and A&B). That work is ongoing and will be reported separately from this HRASTM.

5. **Comment:** **For future reference, please provide EMB with a summary table of Site 12, Solid Waste Disposal Area (SWDA) sites. The table should include the following information: all buildings, potentially impacted buildings and building sites. At a minimum, display the following information; Area of Interest (AOI), surface area m^2, total number of soil samples collected, elevated Radionuclide of Concern (ROC), total soil remediated, and backfill soil data and analysis for all buildings, building sites and sites.**

It is important for EMB to understand past and current soil movement by DON and their contractors. EMB's conceptual model views the presence of debris, odors or soil discoloration, as an indicator of potential presence of radionuclides. EMB welcomes future review of a revised and complete conceptual site model.

The revision to the HRA document does not list the sites at TI where debris, odors or soil discoloration has been observed. Please list these sites in a summary table and provide a corresponding legend. This table would guide further scoping and characterization work that EMB has indicated will be needed at TI.

Response: The summary of all radiological work performed to-date in the SWDA sites is documented in two separate reports: SWDA Bayside/North Point Post Construction Summary Report (PCSR) and the SWDA A&B PCSR.

These reports summarize all the details and information referenced in the above comment.

Historic soil movement activities within Site 12 and other impacted sites (Sites 32, 31 30, 6 a nd Building 233) includes material related to investigation-derived waste (IDW), remediation, and construction activities. The only other intrusive CERCLA excavation involves the current remedial action at Site 33 for which preliminary results suggest there is no man-made Ra-226 contamination. Soil movement associated with remediation activities are summarized in their respective project reports. For Site 12, this work would have included: PCB investigation at Halyburton and Bigelow Courts; the four historic removal actions conducted within Site 12 (Site 12 R I, Section 1.3.13); and, the ongoing removal actions at SWDAs A&B and Bayside/North Point. Petroleum corrective actions within Site 6 a nd the Toxic Substances Control Act (TSCA) action within Site 32 are also documented in their respective reports. All projects were performed per work plans that included control procedures to properly contain contaminated soil and debris. Work associated with the Building 233 remediation and SWDAs A&B and Bayside/North Point includes radiological characterization of soil. Characterized LLRW is put into sealed bins at the radiologically controlled area and disposed of in out-of-state facilities. Comprehensive records are not available to document soil movements associated with historic construction activities.

Two primary lines of evidence have been used to develop areas that are impacted and subject to further investigation. (1) Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) sites with other non-radiological known soil contamination, and suspect contamination based on hi storical site models. All CERCLA sites with soil contamination are subject to ongoing or future investigation. These CERCLA sites were identified over the years following various investigations, taking into account factors including visual characteristics as well as subsurface soil analysis. (2) In addition, several areas will be investigated because of the conceptual potential for radiological contamination based on hi storical site models (e.g., Building 3, Lot 69, etc.).

6. Comment: In reference to soil movement on TI, EMB recommends including information gained from public interviews of current and past contract workers who worked or remediated during site operation or after site closure.

Response: Although no interviews were or will be conducted as part of the preparation of the HRASTM, the Navy has taken a number of actions to address the potential that soil movement from the Site 12 SWDAs to the soil stockpile areas may have resulted in the spread of contamination. These actions include performing surface scans of the route taken by the transport vehicle, designating the soils stockpile area for the IDW as radiologically impacted, and the commitment to conduct site-wide gamma walkover surveys of Site 12. The information appears in the last paragraph of Sections 2.2.6 and 5.2.3.3.

7. Comment: There are no Applicable or Relevant and Appropriate Requirements (ARARS) in the HRA-STM that describe radiological ARARS. Please provide radiological ARARS information in a prescribed section. See Title 17 of California Code of Regulations Section 30256, which EMB uses to determine Radiological Unrestricted Release Recommendation (RURR) for buildings and sites.

Response: Applicable or Relevant and Appropriate Requirements (ARARs) are not included in HRAs, but are evaluated per site as part of the CERCLA process.

8. Comment: Provide an assessment for the likelihood of contamination migration from surface to subsurface, sediment, soil types, ground water, airborne, and drainage systems for all impacted sites.

Response: Contaminated media and potential migration pathways are addressed in this HRASTM, as well as in the 2006 HRA. Please see "Contaminated media" and "potential migration pathways" in the HRA (Section 8.3) and the HRASTM (Section 6.1.1). Please note that consistent with DTSC's Other Comment #11, additional detail regarding investigation of impacted sites will be appropriately included in future work plans prepared pursuant to CERCLA.

9. Comment: During past discussions at Base Closure Team (BCT) meetings and Technical meetings, DON staff mentioned possible disposal of radionuclides used at Treasure Island (TI). Please provide documentation and resolution about a DON contracted report (NBy-61078) submitted in 1965, and other reports if they exist, that provide further information about "...radioactive and poisonous wastes had been buried west of the abandoned landing strip in a future construction area."

Response: The referenced report is the only known reference regarding deliberate disposal of radiological wastes at Treasure Island other than the short half-life bromine (Br)-82 isotopes that were used during training operations on the USS *Pandemonium,* which are discussed in detail in the HRA. The statement has been confirmed with the discovery of contamination at

SWDA A&B, the referenced disposal area at the end of an early runway. Other known debris disposal activities within Site 12 are supported by other lines of evidence but do not specifically indicate purposeful disposal of radiological wastes. The last paragraph of Section 2.2.8 of the HRASTM has been modified to discuss this cited report by replacing the second sentence with the following four sentences:

> "*After the 2006 HRA, radiological commodities were found in each of the SWDAs confirming the report of radiological disposal activities at Treasure Island. The referenced report is a geotechnical report that contains 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 discovered that specifically suggest the disposition of radiological waste at Treasure Island. .*"

In addition, this report has been added to the HRASTM list of references as follows:

> *McCreary Koretsky Engineers. 1965. "Soil and Foundation Investigations for Appropriated Fund Quarters at U. S. Naval Station, Treasure Island, San Francisco, California." January 11.* ***TI-HRASTM-33.***

10. Comment: Area of Interest (AOI) boundaries should follow streets or natural landmarks. AOI boundaries currently cut through buildings making identification difficult.

Response: All AOI boundaries do follow existing streets or natural landmarks except for the boundary between AOI 7 and AOI 8. The boundary between AOI 7 and AOI 8 was established to align with the northern edge of the former runway. The runway is an important landmark that appears in aerial photographs of TI through the early 1960s, and it facilitates efforts to locate some historic site features important to this analysis, specifically a former salvage yard discussed in Section 2.2.7 and a radioactive material disposal area discussed in Section 2.2.8. As such, the existing AOI boundaries will be retained as presented in the draft HRASTM.

11. Comment: There is no general discussion about release of radiological contaminants from the outfalls to the San Francisco Bay. Please explain potential storm drain and sanitary sewer contamination.

Response: Drainage systems and the potential for impacted sites to affect them have been discussed in this HRASTM. S ee the sub-category "Drainage Systems" under the "Potential Migration Pathways" category in HRA Section 8.3 and in HRASTM Section 6.1.1. The final HRASTM has been modified to designate the entire sanitary sewer line from Buildings 3 and 233 (the potential sources of contamination) to the outfall as contaminated. Storm sewer evaluation within impacted sites will be considered during development of radiological survey work plans.

12. Comment: HRA-STM needs to address the potential contamination migration via sanitary sewer and storm drains. For example, Building 233 sanitary sewer system extends beyond the boundaries of Building Site 233 and its terminus is as yet unknown.

Response: The HRASTM addresses drainage systems as discussed in CDPH EMB General Comment #11 above.

SPECIFIC COMMENTS

13. Comment: <u>Page ES-1, Executive Summary, paragraph four</u>, bulleted radiological impacted areas should have included the following:

- **Site 33 Sailboard pad and drain lines,**
- **Ash Incinerator, and**
- **Roads, storm drains and ditches adjacent to roads and wash down areas used in soil transport**

Response: All radiologically impacted areas will be included in the Executive Summary.

- Site 33 has not been designated as impacted as the weight of the evidence does not support such as designation (see DTSC Comment #7 for additional discussion regarding Site 33).
- The sailboard pad has been designated impacted in the HRASTM as suggested.
- Drain lines are considered in each impacted area as discussed in Section 6 of the HRASTM.
- The former incinerator has been designated impacted as well as the prevailing downwind areas on TI.
- The roads, storm drains, ditches and transfer areas in AOI 6 have all been impacted. AOI 6 is the area most likely to be impacted by contamination resulting from transportation of soil.

14. Comment: **<u>Page 9, Section 2.2.2, AOI 2: Former Hospital Area, second paragraph</u> "The Waterline Replacement Area, Site 33, (Figure 4) is currently undergoing additional investigation ... the work will be published in a Remedial Action Completion Report after the work is done". A final status survey report of Site 33 should also be provided.**

Response: The waterline replacement area, Site 33, is not designated as an impacted site. Characterization surveys have been completed for this site and did not identify any Ra-226, Cs-137, or Sr-90 contamination above the investigation levels. As this is not an impacted site, the Navy is considering regulatory comment.

15. Comment: **<u>Page 11, Section 2.2.2, AOI 2: Former Hospital Area, paragraph three</u>, states "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". What is DON's rationale for this statement? What are the soil subsurface conditions? Does DON still maintain that it stored the more than 200 drums of radiological waste originating from Building 233 (Final Treasure Island Naval Station Historical Radiological Assessment, Former Naval Station Treasure Island, San Francisco, California. February 2006, page 6-21, Section 6.6.1, paragraph two, sentence five) prior to being loaded aboard USS *Independence*? Please review to see if this statement still reflects DON assessment.**

Response: The Navy began leasing property on TI in 1941 and began constructing new buildings on the site. By early 1942, the Lake of the Nations had been filled in and construction of the hospital buildings was nearing completion. Disposal of debris in the AOI during that period was unlikely because the site had been developed when the Navy began leasing the property. The only area within AOI 2 where a small amount of debris was observed in the subsurface is at Site 33 and this area was filled in almost immediately following the transition to Navy ownership.

Based on a review of documents included in the HRA and new research conducted as part of the HRASTM, no new information has been found to conflict with the statement that the drums were stored until they were loaded onto the USS *Independence* for storage pending disposal. It is most likely that the drums used for decontamination of Building 233 were stored at the work site and near Building 233 until they were filled, and then they would have been shipped off site to Hunters Point Shipyard where radiological storage areas already existed that could accommodate the drums. The radiologically impacted area surrounding Building 233 has been expanded to include the outdoor paved area, which was the most likely temporary storage area for the drums during the decontamination of Building 233.

16. Comment: **<u>Page 16, Section 2.2.6, AOI6: Sewage Treatment Area, paragraph three</u>, states "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". It further noted soil was removed to a depth of two to twelve feet; please include the fate and transport of removed soil. The USS *Pandemonium* itself was dismantled and shipped from site. Please include a radiological assessment of the vessel at time of disassembly as well as fate and transport of remains.**

The infrastructure to wash or remove radiological contamination at both sites needs further clarification. Radiological decontamination by washing or some other means indicates that the affected pipes, containers, ditches etc. are considered contaminated. Please expand the discussion about areas or buildings that are potentially contaminated during radiological training.

Response: Approximately 790 tons 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. Although no radiological screening of the material was conducted on-site, it is appropriate to note that hazardous waste that is shipped to landfills for disposal may include screening on arrival for radiological materials using radiological portal monitors. There is no record of any waste generated at TI being rejected at a landfill. Concrete and asphalt was broken up and recycled. No liquid waste (waste water) was generated during field activities; soil excavated from below the water table was dried before being transported offsite (Shaw 2011).

As noted in Section 4.1.3 of the HRASTM, "The USS *Pandemonium* was removed from the training site and sold for scrap metal prior to the HRA." The final destination of the scrap metal from the former USS *Pandemonium* is unknown. The Navy would simulate various radiation levels at various locations on the mockup by moving sealed Cs-137 sources within the ship and the students would use monitoring instruments to locate "radioactivity" during training exercises. In addition, decontamination training exercises were conducted that involved dispersing water containing a radioactive isotope with a half-life of approximately 10 days (such as Br-82) on the surface of the mock ship and the students would decontaminate the ship. The concrete holding tanks would collect the effluent water that ran off of the concrete pad until the radioactivity had decreased to safe levels, and then the water would be drained to the San Francisco Bay. The wash-down activities ceased in 1972, but training continued using sealed sources of Cs-137 at the mock ship until 1992.

The ship was stored on land, atop a 9-inch thick concrete pad occupying much of the site. While most of the training was conducted using sealed sources within shielded wells on the mockup ship, decontamination exercises were also conducted by washing down the surface of the ship with water that had radioactive isotopes with short half-lives (10 days). The wash-down water would have presumably drained to the concrete pad and then into the concrete holding tanks via piping or grading of the concrete surface. On a 1973 sanitary sewer system map, a 6-inch pipe is shown leading to the San Francisco Bay from the concrete holding tanks (see HRA reference TI-HRA-82). A figure included in the 2011 Final Site 32 field activity report (Shaw 2011) shows several utilities near the concrete pad, including a steam line, separate storm and sanitary sewer pipelines, a fresh water pipeline (hydrant), and two steel pipelines (2- and 3-inch diameters) of unknown use. During the removal action, the 3-inch steel pipe was discovered originating from the concrete sump and running parallel to the rip rap; the piping was removed and discarded and the openings were plugged (Shaw 2011). Following the removal action, the only remaining site features that could be potentially contaminated were soils deeper than 2 feet below ground surface (bgs) (soils were excavated down to 2 feet bgs in the entire removal action footprint, though some areas were excavated up to 12 feet), the two concrete holding tanks, interior areas within Building 462, and any remaining piping associated with the tanks. All other site features that may have been contaminated during training exercises have been removed. The Navy is planning a gamma walkover survey and sampling of soil and sediment at the former USS *Pandemonium* Site II (NE) area.

17. Comment: **<u>Page 18, Section 2.2.6, AOI 6: Sewage Treatment Area, paragraph one, sentence four</u>, please clarify the period of use, and potential trips per day for the "...end loader bucket..." used to transport potential radiologically contaminated soil from Site 12 to Site 6.**

Response: The field work plan for the NTCRA activities at the Site 12 SWDAs described appropriate procedures for storing and transporting soil that was excavated during the removal action. Section 4.6.4.5 of the NTCRA Work Plan (Shaw 2007b) states that "During excavation activities, waste soil will be either directly loaded on to local haul trucks for transportation to a waste soil/debris staging area or directly loaded into end-dumps for offsite transportation and disposal. Prior to leaving the exclusion zone, local haul trucks and/or end-dumps will be decontaminated and tarped."

Although the work plan called for tarped transport of soil from Site 12 to Site 6, transport of untarped soil within end loader buckets possibly occurred for a limited period of time. Since the use of this transport method clearly was not an approved method of transport, the Navy has committed to conducting a gamma walkover survey of the roadways between Sites 12 and 6 to ensure absence of radioactive contamination

along the roadsides that could have resulted from such transport practices. It is noted that a survey conducted by the contractor at the time did not disclose any evidence of a release of radioactive material associated with this transport method.

18. Comment: **<u>Page 18, Section 2.2.7, AOI 7: Northern Housing Area of Interest, first paragraph</u> states that a radiological survey performed in North Point and Bayside Areas in 2009 provide the data and insert those data and results in the HRA-STM, perhaps as an appendix. Gamma walkover surveys will not address the subsurface contamination or the debris underneath the building and soil beneath telephone poles.**

Response: The work is not complete, data collected to-date for the ongoing NTCRA has also been presented in the draft post construction summary report (Shaw 2012c).

19. Comment: **<u>Page 20, Section 2.2.7, AOI 7: Northern Housing Area of Interest, photograph 19</u>, this is a picture of the former incinerator, provide an assessment of the conceptual site model for the ash from the incinerator that includes standard meteorological data and wind-flow information. The seasonal plume areas need to be identified, especially adjacent to the incinerator. Please identify how the ash from the incinerator was transported and deposited on the island. Please provide maps or diagrams of ash distribution. Please detail the extent of burn pits to which the ash might have been transported, including the methodology on how those pits were bounded.**

The conceptual model should include historical background, nature and extent of the contaminant release, environmental media impacted, fate and transport of radionuclides of concern in the environment, potential receptors, exposure pathways and risk assessment In this description please include the high activity foils, the buildings and debris locations, the adjacent incinerator's plume impact on this site, demographics of ash and burn debris, radiological fall out, wind flow diagrams, sanitary sewer and industrial waste lines, the crawl space below the building and the area surrounding the building.

Response: Please note that the incinerator is located within SWDA 1231/1233 and is considered an impacted area. In addition, areas located downwind of the incinerator based on pr evailing winds have been impacted in this HRASTM to account for the possibility of radiological materials having been incinerated. All available information regarding the designation of the former incinerator as an impacted area, including prevailing wind analysis, will be provided in the final HRASTM.

20. Comment: **<u>Page 30, Section 4.1.3, USS *Pandemonium* Site II (NE), paragraph two</u>, states, "…the contractor did periodic radiological scans on the hands and feet of personnel and on rubber tires of heavy equipment demobilizing from the site ... No elevated radiation was detected." Health and Safety scans for remediation staff do not qualify as a characterization scan for any site. Please eliminate this statement from the HRA-STM text.**

Response: The Navy concurs that the information does not preclude the need for future work plans detailing appropriate scoping, characterization, and an FSS for the site. The statement regarding health and safety screening has been eliminated as request.

21. Comment: **<u>Page 36, Section 4.3.4, Building 233, first paragraph</u>, the text fails to mention discovery of additional radiologically impacted terra cotta pipe.**

The Final Status Survey (FSS) must demonstrate a preponderance of evidence that there are no other impacted lines associated with Building 233. The remediation of a newly discovered impacted pipe, encountered while remediating a known impacted pipe, does not meet this standard.

Response: Comment noted. As discussed in the second paragraph of the referenced section, the characterization, remediation, and FSS for the Building 233 footprint, the sanitary and storm sewer system associated with the building and the surrounding area are ongoing. The summary of the response actions will appear in future documents.

22. Comment: **<u>Page 39, Section 5.2.1.4, Human Receptors and Exposure Pathways</u>, please include Building 233, Site 6, Site 32, as bulleted items.**

Response: A bullet for Building 233 will be added to Section 5.2.2.4, which is under the conceptual site model (CSM) for incidental releases in association with training/operations.

Information regarding Site 6 is included as the Waste and Clean Soil Stockpile/Loading and Decontamination Site in Section 5.2.3.4, which is under the CSM for spills/contamination resulting from handling of contaminated soils from Site 12 SWDAs.

Information regarding Site 32 is included as USS *Pandemonium* Site II (NE) in Section 5.2.2.4, which is under the CSM for incidental release in association with training operations.

23. Comment: **<u>Page 43, Section 6.1.1.1, Building 233, paragraph one</u> states "This HRASTM did not identify any changes from the previous findings of the HRA for this building and sanitary sewer system other than the plan to conduct an FSS for the Building footprint, the sanitary sewer system associated with the building and surrounding areas." This statement fails to identify the Building 233 parking lot and additional sanitary sewer pipes adjacent to Building 233 as items to be covered in a FSS. What additional sites or building drainage systems are impacted by the contaminated pipelines?**

Response: The impacted area associated with Building 233 now includes the Class 1 Survey area, which includes the building footprint and surrounding areas that will be subject to a FSS. Utilities and associated catch basins outside of this area will be investigated as a separate area. Building 233 field work performed to-date showing this Class 1 survey area will be documented in a PCSR (Shaw in-production)

RESPONSES TO ADDITIONAL CDPH EMB COMMENTS (DATED DECEMBER 11, 2012) ON THE NAVY'S RESPONSES TO COMMENTS

GENERAL COMMENTS

1. Comment: **EMB requests that the *Draft Historical Radiological Assessment - Supplemental Technical Memorandum (DHRA-STM)* and/or a modified version of the HRA (2006) include a complete listing and investigational information, and times and locations of shipment of all commodities or fragments of commodities or items found to date on Treasure Island. These items have been referred to in documents such as the Site 12 Trench Report of 2004 and *Draft Post Construction Summary Report Installation Restoration Site 12 Solid Waste Disposal Areas 1207/1209 and 1231/1233, September 2012.* Other than Site 12 and Building Site 233, where else have remediation activities or other activities located radionuclides?**

Response: The text will be updated to include a listing of commodities as requested. As indicated in the draft responses to comments provided to CDPH EMB, the HRASTM text will be updated as information becomes available from ongoing investigations to summarize any new information resulting from ongoing investigations. Other than Site 12 and Building 233, radionuclides have only been detected at Site 31, which was discussed in the text of the draft HRASTM.

2. Comment: **Please provide a history of past soil movement during remediation activities, non-remediation activities, and storage of soil for future use or disposal on or off the TI. Include a parallel accounting of all radiological activities on Yerba Buena Island and Treasure Island.**

Response: Navy will consider past soil movement from radiologically impacted areas in future work plans for surveys of radiologically impacted sites. Yerba Buena Island (YBI) is not addressed in the HRASTM because no radiologically impacted sites have been identified on YBI (Weston 2006). CDPH EMB concurred in a December 23, 2011 memorandum that no further involvement by CDPH is required for YBI because of the lack of radionuclide impacts to YBI and the fact that control procedures were in place to properly contain radiologically contaminated soil and debris transported via trucks over YBI (CDPH EMB 2011).

3. **Comment: Provide EMB with a copy of all available surface and subsurface drawings, maps, and blueprints that identify current and past locations and routes of sewer and storm lines, drains, manholes, catchments, and outfalls.**

Response: The requested documents will be provided separately to CDPH EMB as requested.

4. **Comment: Specify all locations of potentially contaminated surfaces or routes that have been contaminated with radionuclides and insert those findings in the HRA.**

Response: All potential radiologically contaminated areas and routes have been identified in the HRASTM as radiologically impacted areas and the findings for these areas are discussed in the HRASTM. Truck routes outside of Sites 12 and 6 are not classified as radiologically impacted because known transport of contaminated materials over roadways in these other areas was conducted utilizing control procedures designed to properly contain contaminated soil and debris being transported by trucks.

5. **Comment: The current conceptual site model, pages 37 to 42 of the HRA-STM needs to be revised based on the November 29, 2012 Coordination Meeting that outlined recent DON accommodation of additional sites on TI that are now considered impacted with radionuclides.**

Response: The CSMs will be adjusted to account for discussion during a November 29, 2012 meeting between the Navy, DTSC, and CDPH EMB. Specifically, the CSMs will be revised to include the potential for radiological impacts from air emissions from the former incinerator, the former gyro compass shop, and the potential for releases into or from sewers (both sanitary and storm).

SPECIFIC COMMENTS RELATED TO NAVY'S RESPONSES TO DTSC COMMENTS

6. **Comment: <u>DTSC Comment 8, Page 3 of 20 in responses</u>: The work plan for Site 31 indicates that a FSSR will be done for Site 31. The response to this comment indicates that work will be documented in a site specific Remedial Action Completion Report (RACR). The Navy has**

committed to providing a FSSR in their work plan. Is the response saying that the FSSR will be submitted as part of the RACR? Based on a December 7, 2012 Coordination Meeting, the DON indicated that a FSSR will be supplied either through a RACR or a stand-alone FSSR.

Response: It is the Navy's intent to publish the FSS for Site 31 as a stand-alone document that is independent of the Site 31 RACR.

7. Comment: **<u>DTSC Comment 9.2, Item 2 and 4 on Page 5 of 20 in responses</u>: The responses indicate that this HRA-STM expands the footprint perimeters of the existing SWDA's by 50 feet. The HRA-STM needs to explain the basis for this adjustment, and identify information leading to selection of a 50-foot value for the expansion of the footprint for the SWDAs.**

Response: The HRASTM will include an explanation of the basis for this adjustment and identify information that was used to select the 50-foot value.

8. Comment: **<u>DTSC Comment 9.2, Item 3 on Page 5 of 20 in responses</u>: The revised last sentence of paragraph 5 in Section 2.2.7, which was revised to read in part, "...potential for the presence for radioactive materials in AOI-7 outside of the SWDAs is minimized because..." Please state the DON's basis for this conclusion.**

Response: The basis for the Navy's conclusion is stated in the six bullets that are presented in the draft HRASTM at the end of Section 2.2.7. These bullets remain valid evidence for mitigating the potential for radioactive materials outside of the SWDAs.

9. Comment: **<u>DTSC Comment 9.2, Item 5, Section 4.1.1, Radiologically Impacted Sites Identified on the HRA, on Page 5 of 20 in the responses</u>: An examination of the Draft Remedial Investigation Report for Installation Restoration Site 12, Old Bunker Area, Naval Station Treasure Island, San Francisco, June 2011, Figure 1-3, Historical Site Features, photograph dated 1968 shows a section labeled, "Historical Burn Area", which is congruent with Soil Area of Interest 1201/1203/1220. Historically, burn pits have been associated with elevated Ra^{226} levels; and EMB's conceptual site model for TI indicates the soil for Area of Interest 1201/1203/1220 should be considered potentially impacted. Please include a description of the burn areas and an explanation about the conceptual site model.**

Response: Section 2.2.7, which already discusses the burn pits, will be expanded to provide additional information including their locations. In addition, the CSM for Solid Waste Disposal Operations will be modified to include the burn pits. The Navy will consider impacting the portion of Site 12 RI Area of Interest 1201/1203/1220 associated with the "Historical Burn Area."

10. Comment: **<u>DTSC Comment 9.2, Item 5, Section 4.1.1.1, Building 233, on Page 6 of 20 in the responses</u>: Reference labeled as Shaw 2012d needs to be added to the references in the HRA-STM.**

Response: The reference list will be updated in the final HRASTM. The referenced document is the forthcoming Building 233 FSS.

11. Comment: **<u>DTSC Comment 9.2, Item 5, Section 4.1.1.5, SWDA A&B, Page 7 of 20 in the responses</u>: The response states that "… low level radiological items containing Ra-226 were found in all of the SWDAs." The term "low level radiological items" is misleading to many people, and that terms needs to be replaced with a specific range of the activities of items found. While the items found are not high level radioactive waste as defined by the Nuclear Regulatory Commission (NRC), the levels found in these areas are elevated.**

Response: The term "low level" has been eliminated and the second sentence of Section 4.1.1.3 has been revised as follows: "*During the NTCRA, radiological items ranging in Ra-226 content from 0.4 to 6,400 µCi were found in all of the SWDAs."*

12. Comment: **<u>DTSC Comment 9.2, Item Section 4.1.2, Radiologically Impacted Sites Identified in this HRA-STM as described on Page 7 of 20 in the responses</u>: It appears that the HRA-STM needs to address sanitary sewer and storm drainages from, or passing in the vicinity of, potentially impacted areas; potentially impacted buildings and any related structures. These sanitary sewer and storm drainage systems should be designated as potentially impacted in the HRA-STM including their outfalls.**

Response: The final HRASTM has been modified to designate the entire sanitary sewer line from Buildings 3 and 233 (the potential source of contamination) to the outfall as contaminated. Please note that drainage systems and the potential for radiologically impacted sites to affect those systems have been discussed in the draft HRASTM for all impacted sites. See the sub-category "Drainage Systems" under the "Potential Migration Pathways" category in Section 8.3 of the 2006 final HRA and in Section 6.1.1 of the draft HRASTM. Sections of the Building 233 sewer systems have been found to be contaminated with Ra-226. The sewer lines associated with Building 233 remain under investigation and the extent of the contamination has not been fully determined. Characterization of the sanitary system associated with the Building 3 optical repair shop will also occur as a separate project. Storm sewer evaluation within impacted sites will be considered during development of radiological survey work plans.

13. Comment: **Please include areas now classified as potentially impacted due to their location relative to collection and disposal of ash directly from the incinerator, and due to the incinerator's discharge plume of smoke and ash potentially contaminated with radionuclides.**

Response: The former incinerator was located within SWDA 1231/1233, which is considered an impacted area. The CSMs and potentially impacted areas will be adjusted to include the potential for radiological impacts from air emissions from the former incinerator, as well as potential impacts associated with ash disposal. (Note that no records have been located that provides any details on ash disposal from the former incinerator). All available information regarding the incinerator will be provided in the final HRASTM.

14. Comment: **<u>DTSC Comment 10, on Page 8 of 20 in the responses</u>: This indicates that text of the HRA-STM has been modified to address Building 342 and the area between Buildings 342, 343, and 344. However, the response fails to indicate that the HRA-STM has been modified to address the Building 343 and 344 sanitary sewer line.**

Response: Buildings 342 and 343 are serviced by sanitary sewer lines. No sanitary sewer line services Building 344. The sanitary sewer line servicing Building 342 will be designated as impacted in the final HRASTM. A FSS was conducted for Building 343 in 2008; no contamination was found and the building was provided unrestricted release by the DTSC per a memorandum from CDPH to DTSC.

SPECIFIC COMMENTS RELATED TO NAVY'S RESPONSES TO CDPH GENERAL COMMENTS

15. Comment: **<u>CDPH Comment 2, page10 of 20 in the responses</u>: This response appears to indicate that the Navy has no idea where the larger level Ra-226 sources came from or where these sources could be found on Treasure Island.**

Response: The prior CDPH comment focused, in part, on the potential use of radiological items on Treasure Island prior to the Navy's ownership. The Navy's response was intended to convey that the Navy has searched for and found no records of the use of radiological items prior to Navy ownership. While this does not preclude the presence of radioluminescent materials on common items such as watches or on instruments associated with the Pan Am Clippers, or the GGIE, no specific evidence has been found regarding the use or disposal of these items at TI.

The Navy does not, as indicated in the comment, know what the larger level Ra-226 sources (radium foils) were used for, or where they were used; however, the extent of the disposal locations (SWDAs) are known with a high degree of certainty and the areas containing those disposal locations has been designated as radiologically impacted. The Navy will

continue to investigate the use of the foils after the publication of the HRASTM.

16. Comment: **<u>CDPH Comment #1</u> indicates that there is no record indicating that the sources found on Treasure Island came from the Golden Gate International Exposition. Some of the sources found so far exceed levels of Ra-226 known to have been used in instruments, or as deck or bridge markers. Based on the responses to CDPH Comments 1 and 2, it appears the DON has no current information regarding the activities that could have utilized these sources and why the highest level Ra-226 sources were disposed on Treasure Island or existing location of contamination. Therefore, the basis for designation of areas impacted by these sources is knowledge of where they have been found to date. So the current conceptual model for the largest Ra-226 sources found is that their location of use and use is unknown, consequently, it is unknown where they could be disposed. Based on available information, all but one of these sources has been found within the SWDAs. Other than where they have been found to date, there is no basis to prematurely eliminate other locations on Treasure Island.**

Response: Comment noted. The HRASTM conservatively impacts the locations where both licensed and unlicensed activities could have taken place, regardless of any actual documentation specifically indicating so. In the absence of specific documentation, conceptual site models have been developed to support impacting a site.

17. Comment: **The numerous sources that came from the Building 1321 "hot spot" have apparently not been characterized and that characterization information might provide additional information useful for the site conceptual model. Please provide an estimate of the date when that information would be available.**

Response: No specific information regarding commodities found at the Building 1321 "hotspot" is available. The soil associated with the "hotspot" under the steel plate (a subarea of SWDA A) that was excavated in June 2011 was placed commingled (soil and any commodities present) into B-25 boxes. The material will be disposed of in upcoming field work activities during 2013.

18 Comment: **<u>CDPH Comment 3, on page 11 of 20, in responses</u>: The soil samples collected in 2003 from the trenching work have been disposed. As noted previously, CDPH considers any areas with debris or discoloration to be potentially impacted. The previous trenching activity in Site 12 recorded areas with observed debris or discoloration. Therefore, those areas should be identified as potentially impacted in the HRA-STM.**

Response: Although the Navy does not agree with the statement that any areas with debris or discoloration as discussed in the trenching work should be considered impacted for that reason alone, the Navy will conduct further radiological surveys within IR Site 12.

19. Comment: **<u>CDPH Comment 4, on page 11 of 20:</u>**

Bullet 2: This indicates outfalls have not been designated as impacted if ongoing investigations warrant such designation. Given that the sanitary sewer lines and storm drains from Building 233 have both been identified as impacted, an investigation of outfalls is warranted. Please include outfalls as potentially impacted.

Bullet 5: Please amend this bullet to include storm drains.

Bullet 6: The incinerator plume footprint should be shown in the HRA-STM as potentially impacted.

Response: Bullet 2: The entire upland section of the sanitary sewer lines from Building 3 (the most upstream potential contamination source) to the waterfront has been identified as impacted. As indicated in the prior response, outfalls to San Francisco Bay have not been designated as impacted; however, the outfalls will be designated impacted if ongoing investigations of sewer lines yield data that warrant such designation.

Bullet 5: As noted in the original CDPH EMB Comment #4 and its reference to "excavation of sewage drainage system," it is presumed that this additional CDPH EMB comment requests that the draft HRASTM be modified to include current radiological information for the ongoing investigation of storm drain lines at Building 233. Thus, the text of the final HRASTM will be updated to summarize the investigation and remedial actions completed at Building 233 to-date.

Bullet 6: Areas on TI within the incinerator plume footprint and the Building 461 area that is downwind of the former incinerator will be shown as radiologically impacted.

20a. Comment: **<u>CDPH Comment 5, on page 12 of 20 in responses</u>: This statement is misleading. While Site 12 was subject to extensive subsurface soil characterization as reported in Shaw 2004, the characterization was for Chemicals of Concern. Only a few samples were analyzed for radionuclides. Please amend the response to indicate the number of radiological samples taken and the utility of those samples.**

Response: The Navy agrees that the primary purpose of the Site 12 trenching investigation was for subsurface characterization and to identify areas of debris disposal, staining, and for chemicals of concern that did not include radioisotopes (except for three soil samples that were analyzed for radioisotopes at a laboratory). The trenching investigation consisted of

587 trenches approximately 2 feet wide by 5 feet long and excavated to 4 feet bgs. Removed soils and the trench walls were logged and scanned with sodium iodide detectors for gamma radiation. A total of 2,244 radiation readings were recorded and of these, only three exceeded the health and safety action levels. While this work was not conducted to the standards recommended by MARSSIM, it does provide valuable information about the potential for debris disposal within Site 12 and the relative lack of higher reading commodities within the trenched areas.

20b. Comment: **<u>CDPH Comment 5, on page 12 of 20 in responses</u>: Please list in table form the sites where debris, odor or soil discoloration was observed and add them as potentially impacted.**

Response: As indicated in the Navy's response to additional CDPH EMB Comment #20a above, detailed results and a tabular presentation of the trench log observations were previously published (Shaw 2004) and is included as a reference in Appendix A of the HRASTM.

20c. Comment: **<u>CDPH Comment 5, on page 12 of 20 in responses</u>: Figure 2 does not appear to identify those SWDA's that have been identified as radiologically impacted in the legend, nor does it show the 50-foot step-out from the existing SWDA footprint perimeters.**

Response: The 50-foot step-out boundary from the existing SWDA boundaries will be included on the figures.

21. Comment: **<u>CDPH Comment 11, on page 14 of 20 in responses</u>: This indicates that the Building 233 sewer line contamination is not expected to extend beyond the gravity portion of the sewer systems. Please explain the basis for this statement.**

Response: The HRASTM will be revised to show the entire downstream portion of the sanitary sewer line from Building 233 as radiologically impacted; therefore, the statement subject to this comment will be removed.

SPECIFIC COMMENTS RELATED TO NAVY'S RESPONSES TO CDPH SPECIFIC COMMENTS

22. Comment: **<u>CDPH Comment 15, on page 16 of 20 responses</u>: Please refine the time period and potential locations of temporary storage areas for the 200 drums of radiological waste originating from Building 233. The DON states that all drums were eventually loaded on the USS Independence for disposal.**

Response: There is no record of the temporary storage area(s) for the waste drums associated with the Building 233 spill cleanup. It is presumed that for practical reasons these drums were stored near Building 233 prior to being shipped to the USS *Independence* at Hunters Point Shipyard. The Navy

notes that, according to the HRA, the shipment of the drums to the USS *Independence* was for storage and not for disposal.

23. Comment: **<u>CDPH Comment 16, on page 16 of 20 in responses</u>: Will additional information about waste disposal from USS Pandemonium Site 2 be included in the HRA-STM? If this site is now considered potentially impacted, what actions are needed for the waste previously shipped to Altamont and Buttonwillow?**

Response: The additional information provided in the Navy's response to original CDPH EMB Comment #16 will be summarized in the final HRASTM. While the USS *Pandemonium* Site II has now been designated as radiologically impacted, the Navy notes this is a conservative designation and no evidence of actual contamination at the site exists. No action is planned regarding previous waste shipments unless results of the future investigation indicate that actual contamination existed on the site.

23b. Comment: **Note that based on the original HRA, the description of uses of Cs-137 need to be further developed so it is clear that only Cs-137 sealed sources were used, if that is indeed the case.**

Response: It is presumed that this comment refers to the USS *Pandemonium* Site II (NE). It is not the case that only Cs-137 sealed sources were used at USS *Pandemonium* Site II, as detailed in both the HRA and the HRASTM. Bagged radioluminescent gauges were used as check sources as discussed in Section 2.2.6 of the draft HRASTM. The knowledge that these types of items were used during training exercises contributed to the Navy's decision to consider the site radiologically impacted.

RESPONSES TO SF PUC COMMENTS (GEORGE BIBBINS)

GENERAL COMMENTS

1. Comment: **Document is for TI only; what is YBI status?**

Response: The CDPH EMB has concurred that areas of YBI subject to future transfer are not contaminated. (CDPH EMB 2011). Therefore, this HRASTM does not evaluate YBI. The last sentence in Section 2.1 has been replaced with the following sentence to clarify the status of YBI: "CDPH has concurred that areas on YBI subject to future property transfers are not contaminated and are therefore have not been evaluated in the HRASTM."

SPECIFIC COMMENTS

1. Comment: **<u>Figure 2</u>: Newly Identified Radiologically Impacted Areas (Map)**

- **Building 233 not colored green although sounds "previously impacted" (Section 2.2.2 and 4.3.4); maybe because already demolished, however some activities are ongoing.**

- **Site 12 SWDAs not shown as "impacted", although radiation remediation and monitoring is ongoing (Section 2.2.7 and 4.3.6).**
- **Radiological item found in AOI 7, but outside of SWDA (Sections 2.2.7, 5.2.1.3 and 4, 6.1.1.3, Figures 11 and 12). Future scans planned; precaution/warning needed for SFPUC subsurface work. Not noted on map or document; "impacted" designation appears applicable.**

Response: Areas previously identified as radiologically impacted (i.e. Building 233 and the SWDAs) were added to the figures in this HRASTM as further discussed in response to DTSC Specific Comment #9.1.

Site 12 will be subject to area specific scoping surveys as well as further general investigation to determine potential for radiological contamination outside of discrete areas. Due to the current status of Site 12 as a site still under evaluation as well as the presence of other impacted sites on TI, radiological controls are required for any intrusive work in these areas. Figure 2 will note that all areas not formally designated as impacted are considered non-impacted.

2. Comment: **<u>Sections 6.1.2.4 and 6.1.2.5</u>: What is basis for listing contamination potential as unlikely; is potential there because areas may have buried salvage materials (6.1.2.4) or site 12 SWDA soil (6.1.2.5).**

Response: The assessments provided in these sections are qualitative judgments prepared in conformance with Sections 7.3 and 7.4 of the HRA. For clarity, Section 6.1 of the HRASTM has been expanded to include a new sentence that reads: "The findings and recommendations presented in this section have been developed in conformance with Sections 7.3 and 7.4 of the HRA, which provides background and guidance on assessing media, migration pathways and recommendations (Weston 2006)."

The former Salvage Yard has been designated with a contamination potential of "unlikely" in Section 6.1.2.4 because of absence of direct evidence that radiological items or other debris was buried, and because extensive excavation would have occurred in association with construction of the sewage treatment plant.

The Waste and Clean Soil Stockpile/Loading and Decontamination Site has been designated with a contamination potential of "unlikely" in Section 6.1.2.5 because (1) the source of contamination would have been IDW from recent removal activities, (2) no direct evidence indicates that radiological items or other debris was buried in the subsurface, and (3) all work has been conducted with procedures in place and with awareness that radiological materials were being handled.

RESPONSES TO TIDA (AMEC) COMMENTS (SCOTT WARNER)

GENERAL COMMENTS

1. **Comment:** **We believe that the introduction to the document (starting in Section 1.0) should be strengthened to better indicate the rationale for commencing with the research that lead to the HRASTM. We also request that the introduction be strengthened to better indicate how the conclusions reached by the HRASTM integrate with those reached by the 2006 HRA. Please clarify what parts of the 2006 HRA are now obsolete, and which parts are specifically supplemented by the HRASTM. Please provide an overall "roadmap" showing the integration of the information, if appropriate.**

   Response: The text of Section 1.1 has been replaced with the following text to address this comment:

   > *"The HRASTM format and content are designed to augment the original HRA with new information obtained through additional research and the review and consideration of new data that became available through site investigations since the HRA was finalized. The new information was also used to update CSMs for radiologically impacted areas and to update the list of areas designated as impacted. The updated CSMs, historical research, and a review of activities that occurred at TI since the original HRA was published are presented in this HRASTM. Figure 2 presents all of the areas which are considered radiologically impacted and non-impacted on TI based on the results of the 2006 HRA and this HRASTM. Details regarding specific CERCLA investigations or remedial efforts after issuance of this HRASTM will be documented in project specific reports or additional technical memoranda."*

2. **Comment:** **We also request that the definition of "impacted" and "non-impacted" sites be provided in the opening paragraph of the document. Please consider both the technical and non-technical reader in providing this definition.**

   Response: The following new paragraph has been added to the end of the Executive Summary and as a new second paragraph in Section 1.1.

   > *"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. The designation as radiologically impacted does not confirm that radioactive contamination is present; 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.*

3. **Comment:** **It appears that key drivers to the reasoning for preparing the HRASTM do not appear until late in the document. For example, Section 5.2 refers to preparing Conceptual Site Models (CSM) as a major advantage of this HRASTM. We believe this to be important and this objective should be presented early in the introduction to the document. Another important item that should be presented much earlier is the information in Section 2.3 on the summary of the 2006 HRA (which currently appears on Page 26 of the HRASTM).**

   Response: See new text inserted in accordance with response to TIDA (AMEC) General Comment #1

4. **Comment:** **While a full listing of references is provided in the accompanying Compact Disc (CD) of information, could a table be provided that better indicates what documents in the Reference CD was used to support the various bullets of information provided on Pages 1 and 2 of Section 1.2.**

   Response: Citations to the references that support the findings have been added to Section 1.2. Please note that not all findings are supported by such references. Some findings are based on maps or figures included in the text or the results of ongoing activities as described in the text.

5. **Comment:** **Please define, or consider, replacing the word "significant" within the document, unless this term is being used for specific quantification of a value (such as "statistically significant"). For example, what does "significant" ship repair refer to (in Section 1.2, Page 2) compared to what "insignificant" ship repair activities might refer to.**

   Response: In general, the term "significant" has either been replaced with the word "major" or the term has been deleted. The word "significant" has been retained at a few locations where appropriate.

6. **Comment:** **The final section of the HRASTM (6.2) indicates that all areas subject to the prior HRA and this HRASTM are suitable for transfer with respect to impacts on human health and the environment. However, the HRASTM indicates substantial differences from the HRA, and questions remain regarding the potential for discrete sources or localized contamination, unknown piping, former facilities that could have been impacted where deconstruction material may have found its way to other parts of TI. We suggest that this section provide an area by area summary table to better evaluate the potential issues, including uncertainties that will affect the transferability of areas on the island.**

Response: As stated in the existing text, 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 they have not been designated as radiologically impacted in either of these documents. The designations—developed based on a very conservative evaluation of TI—include areas where the hypothetical discrete source would most likely be present. Although the significant contamination is typically sought during any environmental investigation, the HRASTM conservatively has considered even where de minimus concentrations of radionuclides would most likely be present. This includes select lengths of sewer systems.

The text of Section 6.2 has been revised to add a new second paragraph as follows in response to this comment: "No further action is necessary to address the potential for radiological contamination at areas within TI that are subject to this HRASTM, and are not designated radiologically impacted as shown in Figure 2. In areas that are not impacted, no evidence has been found to warrant further investigation of those areas." Similar language has also been added to the front of the document, at the end of the Executive Summary.

RESPONSES TO TIDA (NGTS) COMMENTS (BOB BURNS)

GENERAL COMMENTS

1. **Comment:** **Please clarify how the STM is to be reconciled/integrated with the original HRA or how the two documents are going to be applied to provide consistent guidance for performing radiological investigations on TI. Be as explicit as possible regarding parts of the HRA that may be obsolete, and those parts/conclusions where the STM is more of a compliment or supplement to the HRA.**

   Response: Although the HRASTM is intended to supplement the 2006 HRA, the HRASTM was developed so that it is a stand-alone document that can be referenced for an accurate radiological status of sites at the time of publication. Although the primary purpose of the HRASTM was to evaluate areas not impacted in the 2006 document, the HRASTM does provide extra detail regarding sites discussed in the prior HRA. Section 6.0 of the HRASTM does discuss the conclusions of the original HRA that have been modified as a result of new information and research during development of the HRASTM. Section 6.0 also presents conclusions regarding new sites identified as impacted in this HRASTM.

2. **Comment:** **The definition of radiologically impacted and the other information provided in Section 2.3 should be moved to or otherwise restated in the introductory sections of the STM. The conclusion that no imminent threat or substantial risk to human or environmental health**

was identified should receive particular emphasis. We request that the definitions of "impacted" and "non-impacted" be introduced at the very start of the document and repeated in practical locations thereafter.

Response: See response to TIDA (AMEC) General Comments #1 and #2.

3. **Comment: As discussed under Section 3.2 and elsewhere, there is a potential for anomalous or otherwise unknown discrete sources or associated, localized contamination to be discovered at TI in areas outside the currently known SWDAs. This should be addressed in the Executive Summary, the Conceptual Site Model (Section 5), and the Findings and Recommendations (Section 6).**

Response: The following language has been added to the end of the second paragraph of Section 1.1 in response to this comment:

> "*Additional radiological investigation will be conducted within Site 12, in addition to specific impacted areas (i.e. SWDAs) within Site 12."*

See the response to TIDA (AMEC) General Comment #6 for changes made to Section 6.2.

SPECIFIC COMMENTS

1. **Comment: <u>Section 1.1</u>: Please acknowledge and summarize some of the concerns with the original HRA expressed by CDPH in April 2011. Presently no information is provided as to what prompted the STM to be developed.**

Response: As requested, additional text has been added to summarize CDPH concerns that led to the development of the HRASTM. The second and third sentences have been rewritten as follows in response to this comment: "The format and content are designed to be responsive to concerns expressed by the CDPH and to augment the original HRA with new information obtained through additional research and the review and consideration of new data that became available through site investigations since the HRA was finalized. The new information was used to update CSMs for radiologically impacted areas as was requested by the CDPH and to update the list of areas designated as impacted."

2. **Comment: <u>Section 1.3</u>: Is there a word missing in the first sentence of this section?**

Response: The first sentence has been revised to insert the word "presented" in the following sentence: "A detailed review of the facility background was done using the information acquired through the file research and is *presented* in Section 2.0."

3. **Comment:** **<u>Page 10</u>: Photos 6 and 7 appear to have inconsistent orientation. Please correct or clarify if so.**

Response: Photo 7 has been rotated 90 degrees counterclockwise to provide consistent orientation as requested.

4. **Comment:** **<u>Section 2.2.2, first paragraph at the top of page 11</u>: Elaborate on the findings from the radiological investigations at the Building 233 site with respect to the discovery of undocumented piping and the fact the (known) sewer line and the surrounding soil were found to be contaminated. Undocumented utility lines or inaccurate location information should be considered in work planning.**

Response: At time of publication, remediation is essentially complete within the Class 1 survey area at Building 233. This field work will be documented in a PCSR (Shaw in production). Additional field work will be performed in 2013 to conduct the FSS to support free release of the Building 233 Class 1 area. The Navy concurs that undocumented utility lines or inaccurate location information should be considered in work planning. Characterization of all sewer lines within the Building 233 footprint is part of the ongoing fieldwork for that site, which is essentially complete. Evaluation of sewer lines outside of the Class 1 survey area for the Building 233 footprint will be addressed in subsequent investigations.

5. **Comment:** **<u>Section 2.2.6, bottom of page 16</u>: What was the fate of the soil removed from Site 32 to remediate chemical contamination? Are additional actions warranted for that material now that that area has been deemed radiologically impacted?**

Response: Please see the response to CDPH EMB Specific Comment #16.

6. **Comment:** **<u>Section 2.2.6 re: the further investigations related to the elevated gross gamma measurements discussed on page 18</u>: How will the findings from these additional investigations be incorporated in the HRA/STM once they are completed?**

Response: The sites identified as radiologically impacted in the 2006 HRA, as well as in this HRASTM, are considered to be the entire set of radiologically impacted sites on NAVSTA TI. Findings from future investigation/site characterization will be documented in follow-on documents such as completion reports, and survey reports or additional technical memoranda

7. **Comment:** **<u>Section 2.2.7</u>: While the results from the gamma walkover surveys performed outside the SWDAs in Site 12 are a good indication there is no widespread radiological contamination, caution should be applied in how those results are interpreted with respect to discrete**

commodities given that one has already been found. It may be an overreach to say the potential for radioactive material outside the SWDAs is minimized.

Response: Comment noted. In order to supplement the CSMs and characterization performed to-date that have identified the discrete impacted areas within Site 12, further radiological surveys will be performed within Site 12 in addition to surveys of specifically identified impacted areas.

8. Comment: <u>Section 2.2.7, page 22, second bullet</u>: What was the fate of the soil excavated from the Halyburton and Bigelow Court areas in Site 12?

Response: All soil excavated as part of the removal action was disposed of off-site at appropriate landfills per the State reviewed (Cal/EPA) work plan.

9. Comment: <u>Section 2.2.7, page 24, first bullet</u>: Elaborate on the source of the elevated dose rate readings that prompted expansion of the RCA.

Response: The CDPH reported Ra-226 as the source of the elevated radiation readings (CDPH RHB 2011). Further information regarding the source of the elevated readings that prompted expansion of the radiologically controlled area (RCA) has yet to be determined. The sources of elevated readings will be addressed as part of the Phase II NTCRA work at the SWDA A&B. The Navy presumes that the sources of the elevated readings will be additional commodities or contamination similar to that already found within SWDA A&B or related to asphaltic debris. Such commodities have included deck markers, buttons, metal debris, and foils.

10. Comment: <u>Section 4.0</u>: What is meant by work done "outside" the impacted and non-impacted areas? Shouldn't all areas be one or the other?

Response: All areas are designated as either impacted or non- impacted. Figure 2 shows the classification of property on Treasure Island. A "radiologically impacted site" has, or had at one time, the potential for radioactive contamination above natural background or fallout levels based on historical information. Conversely, a site designated as "non-impacted" has hosted radiological operations but currently poses no reasonable possibility for the presence of radioactive contamination.

11. Comment: <u>Section 4.1</u>: Augment the title to make it clear only the newly-identified radiologically impacted sites are addressed.

Response: Subsequent to the publication of the draft HRASTM pursuant to the response to DTSC Specific Comment #9.2, this section has been rewritten. The section now addresses all radiologically impacted sites and the initial text reads as follows: "This section addresses work done at sites designated as radiologically impacted. This includes sites designated as

radiologically impacted at the time of the HRA, and sites that have been designated as radiologically impacted as part of the HRASTM evaluation efforts."

12. Comment: **<u>Section 4.2 et seq.</u>: The STM cites the fact that no "intrusive IRP work" has been done at a number of sites since the original HRA as a basis for deeming those areas as non-impacted rather than a re-evaluation of those areas vis-à-vis the new information and additional degree of conservatism applied in the STM. This results in an inconsistency with respect to the former pier areas, for instance, where the finding that significant ship repair activities took place on TI would call into question the non-impacted designation given these areas in the HRA. It is recognized those pier areas are long gone, but the associated shoreline areas could still be considered radiologically impacted. There could also be questions about the fate of the materials from the pier demolition actions. The STM should be clear that the non-impacted designations given in Section 4.2 et seq. are based on the original HRA and do not represent a reevaluation of those areas.**

Response: The non-impacted areas were reevaluated as part of the HRASTM and no new evidence has been found to suggest that the shoreline areas should be considered radiologically impacted. Please note that, contrary to the citation in the comment, this section neither implies nor states that "the fact that no 'intrusive IRP work' has been done at a number of sites since the original HRA as a basis for deeming those areas as non-impacted…"

13. Comment: **<u>Section 4.3.2</u>: Recommend including a statement about any public health risk (or lack thereof) associated with the Site 12 recreational area.**

Response: The CDPH has separately requested that the Navy designate the Site 12 recreation area as radiologically impacted (CDPH 2012a). As a result of the recommendation and further evaluation of historical data and references, a portion of the recreation area will be classified as impacted. The subject text in Section 4.3.2 was deleted and moved to Section 4.1, which discusses impacted sites. Section 4.1.10 now reads as follows: "In July 2011, the CDPH RHB performed surveys (CDPH RHB 2011b) of the 9th Street recreational area on NAVSTA TI (see Figure 10). Based on the elevated readings that were noted during the survey, the CDPH RHB recommended the recreational area be designated as radiologically impacted. On March 22, 2012, the CDPH modified their recommendations for this area to provide the conclusion that they did not believe that that there is an external radiation exposure hazard from the recreational area elevated readings and to include characterization to identify the isotopes present and additional actions if found necessary (CDPH 2012a). The CDPH recommended the recreational area not be used as a basis for site

wide background radiation levels due to elevated radiation readings (CDPH 2012a). Subsequent investigation by the Navy included additional soil sampling and the results are suggestive of background naturally occurring isotopes. Based on recent analysis of existing characterization data, additional samples and analysis is required to definitively state whether the detected isotopes are naturally occurring. This sampling is anticipated in conjunction with future survey work plans that will be required because a portion of the area has been designated as impacted in conformance with the CDPH RHB recommendation."

Changes have also been made to the Executive Summary and Sections 2.2.8 and 6.1.2.10 to designate the recreation field as a radiologically impacted site.

14. Comment: **Section 4.3.4: Same comment as for Section 2.2.2 with respect to the additional utility lines discovered at the Building 233 site.**

Response: Please see response to TIDA (NGTS) Specific Comment #4.

15. Comment: **Section 5.0: None of the CSMs appear to address anomalous discrete commodities such as those identified in Site 31 and elsewhere. Given this was one of the drivers for creating the STM in the first place the CSMs ought to address the potential for such sources/types of contaminants.**

Response: Please see response to TIDA (NGTS) General Comment #3.

16. Comment: **Section 5.0: The CSMs focus on specific buildings and areas rather than types of activities. As with any historical site assessment, the STM/HRA should serve as a general guidance document for all radiological investigations at TI.**

Response: The CSMs included in this HRASTM were developed to more fully recognize and conform to the known releases on TI. For instance, the CSM for Repair/Solid Waste Disposal Operations addresses the possibility of disposal of radioactive commodities and contamination resulting from repair/recycling activities in general, but also takes into account some site-specific information such as known disturbances by grading activities during construction of housing within the SWDAs in Site 12. Previous known activities causing contamination such as training or documented disposal have been re-affirmed by the HRASTM. Several new sites however, e.g. lot 69, have been added to the list of impacted sites due to the addition of repair/recycling efforts as potentially impacting sites. Additionally, the HRASTM takes into account all radiological investigations at TI, i.e. those at Site 12, 31, 33 and Building 233.

17. Comment: **<u>Section 5.2.1 and Figure 11</u>: It does not seem appropriate to limit disposal (inadvertent or otherwise) of commodities to known salvage yards. Also, suggest revising the transport pathway to read "near-surface disposal."**

Response: Figure 11 was revised to read "Near Surface Disposal" as suggested.

18. Comment: **<u>Section 5.2.1 and Figure 11</u>: Except for the mention of "sanitary sewers" in Section 5.2.1.2, the CSM does not appear to address known or unknown plumbing or drainage systems in or downstream of the area of concern, or potential contamination migration from such systems (either directly or from leakage).**

Response: The CSM in Figure 11 was revised to include disposal in and leakage from sanitary sewer systems as suggested. Figures 11, 12, 13, and 15 have also been modified to show the contaminant migration pathway from surface soil into storm drains.

19. Comment: **<u>Section 5.2.1</u>: With respect to Building 3 and other facilities where similar work was performed, was there reasonable potential for ship repair activities to have involved any surface-contaminated materials or internally-contaminated components such as those that could have originated from vessels involving in nuclear weapons testing operations in the Pacific Proving Grounds? Presently the CSM does not address potential airborne or liquid contamination pathways from routine repair/refurbishment operations (cutting, grinding, shot blasting, cleaning, rinsing, etc.). We recognize that significant time has elapsed (relative to fission and activation product half-lives) since weapons testing activities in the Pacific ceased, but longer-lived fission products could still remain, in addition to potential actinides. We view this as unlikely, but it is a question that could be raised.**

Response: There is no evidence of repair work at NAVSTA TI on contaminated ships subjected to nuclear weapons testing. The HRA provides a detailed discussion of ships subjected to nuclear weapons testing during OPERATION CROSSROADS and their history at NAVSTA TI. As discussed in the HRA, four ships were brought to NAVSTA TI for berthing following decontamination at other locations. The ships were berthed at NAVSTA TI while awaiting final radiological clearance for redeployment to the fleet. The HRA notes that all four ships subsequently received final clearances, and the HRA concludes that "there is no likelihood of contamination due to berthing of OPERATION CROSSROADS ships." Research for this HRASTM found no additional information that would alter the conclusion of the 2006 HRA.

20. Comment: **<u>Sections 5.2.1.4, 5.2.2.4, and 5.2.3.4</u>: Consider augmenting the categories of potentially-exposed individuals (workers, residents, etc.) with types of activities that could result in them becoming exposed.**

Response: The following text will be added to the end of Sections 5.2.1.4, 5.2.2.4, and 5.2.3.4: " Human receptors may be exposed to radiological contamination in three basic ways: ingestion of, dermal contact with, and inhalation of media (soil, water, air) that is impacted by radioactive contamination."

21. Comment: **<u>Section 5.2.3</u>: The CSM does not address stormwater runoff, wind dispersal, etc. as contamination transport mechanisms for the contaminated soil removed from Site 12. Has this material always been containerized? Also, there is no mention of wash water or other potential contamination transport mechanisms associated with rinsing or cleaning of vehicles used to transport contaminated soil.**

Response: Soil removed from Site 12 has historically been placed into containers for ultimate transport to various disposal facilities. Methods for containerizing soil including direct loading at the site, transport via end loader, and direct loading to sealed container have been employed at Site 12. Due to the concerns about transporting contaminated soil within Site 12, CDPH performed their survey of the roadways. Furthermore, the Navy will conduct additional evaluation of the roadways and open areas to address the potential for surface contamination. Although all material has not always been containerized, all environmental soil remediation efforts have been conducted following work plan procedures to control contaminated soil. This would include decontamination of equipment and vehicles, as well as proper control and disposition of decontamination media. Additionally, sewers will be evaluated as necessary within Site 12. See response to TIDA (NGTS) Specific Comment #18 for additional background.

22. Comment: **<u>Section 6.1.1.1</u>: Same comment as for Sections 2.2.2 and 4.3.4 with respect to the additional utility lines discovered at the Building 233 site.**

Response: Please see response to TIDA (NGTS) Specific Comment #4.

23. Comment: **<u>Section 6.1.1.1</u>, second sentence at the top of page 43 reading "… at least some of the building piping is radiologically impacted." Suggest changing "impacted" to contaminated.**

Response: Section 6.1.1.1 was revised as recommended in the comment.

24. Comment: **<u>Section 6.1.2.1</u>: If such areas still exist, consider expanding the scope of the scoping survey for Building 3 to include areas where dusts or liquids could have accumulated during ship repair activities (e.g., behind wall panels, in/on overhead structures or fixtures, in air handling components, blower motor interiors, intake/exhaust points, floor drains, etc.). Ensure that the characterization methods used would be sensitive to legacy fission products or actinides in addition to Ra-226 or Th-232.**

Response: The "Structures" category under "Contaminated Media" is designated as "Low" to account for the need to consider the building structure itself as potentially contaminated. Designs of future surveys required because of designation of Building 3 as impacted will be considered at the time those survey work plans are prepared. The surveys will also consider CDPH's scans conducted in September 2012 (CDPH RHB 2012b, 2012c), which did not identify any radiation above background levels. Regarding legacy fission products or actinides, these have not been added to the "Potential Radionuclides of Concern." See response to TIDA (NGTS) Specific Comment #19 for additional background.

25. Comment: **<u>Section 6.1.2.1</u>: If there's a high potential for contaminated plumbing/piping associated with the optical shop or other activities, it seems inconsistent to then say there's no potential for contaminated subsurface soil or sediment.**

Response: The "Contaminated Media" sub-section of Section 6.1.2.1 has been revised to re-designate the contamination potential for subsurface soil from "None" to "Low" and the contamination potential for sediment from "None" to "High (sediment within the sanitary sewer piping)."

RESPONSES TO TICD (TERRAPHASE) COMMENTS (BILL CARSON AND WENDY BELLAH)

GENERAL COMMENT

1. Comment: **The document is meant to be a living document, however two known radiological issues are not discussed in the document and it seems pertinent to discuss them in this draft rather than releasing another draft almost immediately upon finalization of this version. The specific issues are:**

- **Radiological detections found beneath the sewer lines for Building 233.**
- **Potential impacts to utilities for Building 3.**

Response: Details regarding the additional characterization of utilities outside of the Building 233 footprint will be discussed in the final HRASTM. The potential for impacts on utilities at Building 3 is considered to be

associated with the sanitary sewer system. The existing text captures that potential by identifying the contamination and indicating a high probability that drainage systems could provide migration pathways. The results of the Navy's future characterization of Building 3 and associated sanitary sewer will be summarized in a corresponding report, i.e., FSS.

SPECIFIC COMMENT

1. **Comment:** **Section 1.2, Bulleted list at top of Page 2: Should the SWDA NTCRA and Building 233 activities be added to this list? If not, why were these activities/results not reviewed?**

   Response: The SWDA NTCRA and Building 233 activities were reviewed along with all other field activities at TI. The referenced list was intended to serve as a general indication of records that were reviewed, not as a detailed list of such. The last bullet has been rewritten to be more descriptive as follows: "Field activity logs, work plans and other materials associated with intrusive environmental remediation work."

2. **Comment:** **Section 1.2, First bullet at the bottom of Page 2: Please change the sentence in the middle of the text to read: "While it is unclear precisely when these ship repair activities ceased, they were significantly reduced immediately following WWII."**

   Response: The word "war" has been changed to read "WWII" as suggested.

3. **Comment:** **Section 2.2.1, Fourth paragraph: How do we know there are not other utility lines for Building 3?**

   Response: The referenced paragraph discusses the former optical repair shop, which is the specific area of interest regarding presence of drain lines. Only one sanitary sewer line is shown on plans for areas leading to the former optical repair shop, and this same line appears on utility drawings. Physical evidence within Building 3 confirms presence of the drain lines that would have served the optical shop. Based on numerous historical plans, there is one main gravity sanitary sewer line that has historically serviced Building 3 and it will be investigated as part of the Building 3 radiological scoping survey.

4. **Comment:** **Section 2.2.2, Last paragraph: This section discusses B233. Should the utility lines for B233 also be discussed in this section?**

   Response: The utility line is discussed in this section to the extent that this section notes the impacted status of Building 233 area and sewer lines.

5. **Comment:** **<u>Section 2.2.6, Last paragraph</u>: This section discusses AOI 6. However, the end of this paragraph discusses the further investigation activities that are required in Site 12 which is in AOI 7. It may help a reader if this discussion is moved to the next section where activities in AOI 7 are discussed.**

   Response: The relevant text has been moved to Section 2.2.7 as suggested.

6. **Comment:** **<u>Section 2.2.7, Page 22, Second bullet</u>: Please clarify if the excavations conducted in the former storage yard were backfilled to grade or if they were left at an elevation below grade.**

   Response: According to the post-construction report (IT 2002a), the excavations were not backfilled to grade. The bullet in Section 2.2.7 will be revised to add the following sentence as the third to last sentence: "The excavation was not backfilled completely to the final grade because additional removal is necessary in the area near Building 1100."

7. **Comment:** **<u>Section 2.2.7, Photo 23</u>: Additional explanation for the shading shown on the photograph is needed. What areas are considered radiologically impacted and what are not?**

   Response: The text and photo have been updated to identify the Bigelow Court SWDA areas in Photo 23 as radiologically impacted.

8. **Comment:** **<u>Section 6.2</u>: This section states that the FOST areas are suitable for transfer, except for those areas identified in the HRA and the HRASTM as radiologically impacted. However, this HRASTM does not discuss the impacts to the B233 utilities and the potential impacts to the Building 3 utilities. Please clarify how these areas are/will be delineated and the appropriateness of the transfer of these areas under the FOST.**

   Response: Figure 2 has been revised to show the previously impacted Building 233 and the impacted sewer and storm lines. The current Figure 2 shows the impacted sanitary sewer line associated with Building 3. The sanitary sewer lines for both sites are shown as impacted along with downstream portions of the sewer lines.

RESPONSES TO ARC ECOLOGY (DADE MOELLER) COMMENTS (STEPHEN BUMP)

GENERAL RECOMMENDATION

1. **Comment:** **One of the drivers for the updated HRA was the intrusive investigation that has happened since the original HRA was written in 2006. As additional intrusive investigation is undertaken, radiological**

screening should be conducted on removed material to ensure that additional undiscovered impacted areas are not present.

Response: The Navy will conduct radiological screening during intrusive investigation of all radiologically impacted sites until completion of a FSS at those sites. All work will proceed in accordance with plans accepted by the state, and will be documented in site-specific reports. In general, areas not designated as radiologically impacted do not warrant further investigation or screening; however, the Navy has agreed to conduct additional radiological surveys of Site 12.

GENERAL COMMENT

1. Comment: There is very little information presented regarding selection of reference areas for the final status surveys. These areas need to be selected carefully due to the history of Treasure Island. For example, when Building 343 was surveyed, Building 342 was used the reference area. Building 342 is now listed as impacted which could call into question the results of the final status survey of Building 343. Reference areas for outdoor areas need to be of similar soil types and must be on Treasure Island. It should be noted if any imported fill material has been placed in the reference area (an example being when the Lake of the Nations was backfilled following the exposition). Such areas should not be used as they will not be representative of the soil present on the remainder of Treasure Island. Care must be taken that the reference area is sufficiently distant from other outdoor impacted areas as to minimize the potential for cross contamination. Reference Areas for buildings should be buildings of similar construction and buildings constructed during the same time frame as the building of interest.

Response: The process of selecting reference areas for any radiological investigation will be included as part of the related work plans. Summary of site selection and characterization is included in subsequent summary reports. The comment regarding use of Building 342 as a reference area is noted. Should future surveys detect contamination in Building 342, the survey results for Building 343 will be evaluated relative to the new data. However, this is an unlikely scenario because no anomalous or unexpected readings were noted during the reference area measurements in Building 342.

SPECIFIC COMMENTS

1. Comment: <u>Section 6.1.1.2, Building 343</u>: Building 342 was used as the reference area for the Final Status Survey (FSS) of Building 343. As part of that FSS it was assumed the Building 342 had no radiological history. The

HRASTM has now reclassified Building 342 as impacted. The FSS for Building 343 should be re-evaluated in light of this reclassification.

Response: See response to ARC Ecology General Comment #1.

3. **Comment:** **<u>Gamma Walkover Surveys</u>: The purpose of Gamma Walkover Surveys needs to be clearly defined. Once the purpose is defined, the sensitivity and limitations also need to be defined. For example, as they are currently being performed, they are adequate to detect hot spot anomalies that are near the surface as noted in several references in the HRASTM. They are not adequate to detect soil contamination that may be near, but above natural background levels. In addition, if the instrumentation used is calibrated to Cesium-137, as is common, the instrument's response to Radium-226 is approximately a factor of two lower which needs to be accounted for in the calculations (see Table 6-7 of MARSSIM, a higher MDC means a lower response). Calibrating the field instrumentation to Ra-226 would eliminate some of this uncertainty. It would not eliminate the inability of a walkover survey to detect soil contamination. In areas where soil contamination is suspected, a sampling protocol should be established that can clearly define whether there is in fact contamination present above natural background levels. As noted earlier, selection of a reference area with which to compare these samples is a key aspect of this sampling protocol.**

Response: The purpose of the gamma walkover survey is to further investigate the surface areas within Site 12 including roadways, in response to a 2011 CDPH scan of Site 12 roadways. The level of detail discussed in the comment, including reference areas, will be addressed in the preparation of the survey work plan. Although there were elevated readings within the Site 12 roadways, it is expected that this is due to naturally occurring isotopes within the roadway aggregate. Roadway shoulders as well as open spaces between houses not previously scanned by the Navy will also be scanned as a conservative effort to ensure lack of human health risk from unknown shallow subsurface radiological contamination.

3. **Comment:** **<u>Impacted Area Surveys</u>: At least two of the impacted areas, USS Pandemonium Site NW and the former Salvage Yard, have had significant construction added on top of the impacted area. Additional supporting documentation is needed to justify only scoping surveys and Gamma Walkover Surveys of these areas given their operational history. This is also supported by the addition of Building 570 and its laydown area where contaminated soil samples from the Solid Waste Disposal Areas on Site 12 were stored and analyzed. The proximity of these SWDAs to the USS Pandemonium Site NE should be evaluated for impact.**

Response: The respective first sentences of the "Recommended Actions" in Sections 6.1.2.3 and 6.1.2.6 ha ve been revised to read as follows: "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." To address the comment regarding proximity to the SWDAs, the "Former Uses" subsection in Section 6.1.2.6 has been revised to add the following new last sentence: "In addition, this site is located adjacent to and contiguous with SWDA A&B discussed in Section 6.1.1.3."

SUMMARY

1. Comment: The HRASTM follows the MARSSIM HRA process and appears to be a thorough and conservative update to the original HRA. The conclusions reached and the recommended actions for each of the impacted areas are reasonable, except as noted, based on the radiological history and the operations conducted in the facilities. The isotopes of interest are reasonable based on the operations of the Treasure Island Shipyard. The HRASTM is a good first step in the MARSSIM process and identifies those areas needing additional radiological investigation. It does not draw any conclusions about their impact on the environment or the public, only that there is a potential impact that needs to be investigated.

Response: Comment noted.

RESPONSE TO EPA COMMENT (DAVID STENSBY)

GENERAL COMMENT

1. Comment: EPA has reviewed the Subject Document. EPA agrees with the State that the document should include and discuss all the additional information California DTSC and DPH have requested. EPA fully concurs with the California DTSC and DPH comments. We do not have any additional comments or questions on the "Draft Historical Radiological Assessment Supplemental Technical Memorandum".

Response: Comment noted. Please see responses to DTSC and CDPH EMB comments.

RESPONSES TO WATER BOARD COMMENTS (MYRIAM ZECH)

SPECIFIC COMMENTS

1. Comment: Please add a glossary to the beginning of the document. Words like "impacted" or "contaminated" are defined in the 2006 HRA, but not

in the HRASTM. Interested parties reviewing the HRASTM may not necessarily consult the 2006 HRA.

Response: A glossary has been added as requested.

2. Comment: The Executive Summary could benefit from a small section explaining the difference between alpha and beta particles, and why we're interested in Radium-226, Thorium-232 and Cesium-137.

Response: The fourth paragraph of the Executive Summary has be rewritten as follows to comply with the suggested changes: "As a result of the research performed and discussed elsewhere in this HRASTM, activities involving the use of the radioisotopes Ra-226, Cs-137, and thorium (Th)-232 resulted in the designation of new radiologically impacted areas. Ra-226 is associated with use in radioluminescent paints, Cs-137 with use in sealed sources, and Th-232 in optical coatings and glass. Discussion regarding nuclear health physics, including alpha and beta particles, will be reserved for discussion in other forums and not in the HRASTM because of the complex and expansive nature of the topic.

3. Comment: Please add a final paragraph to the Executive Summary, describing what work remains to be done to ensure that all sites are radiologically safe.

Response: A new paragraph has been added to the end of the Executive Summary as follows: "Sites that have been 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 (Weston 2006)."

4. Comment: Please include a table indicating:

a) radiation levels found in the soil, in pCi/g;
b) release criteria;
c) background concentrations.

Response: This type of information is site-specific and will be documented in corresponding work plans, after-action summary reports, and the final status .

5. Comment: Please include a table or a chart indicating dates by which investigations or reports are to be completed, including:

a) the scoping surveys that remain to be done;
b) the report explaining the elevated readings at the 9th Street recreational area;
c) the work currently being done on Building 233.

Response: Closeouts of radiologically impacted sites (including those sites identified in the draft HRASTM), as well as anticipated deliverables and time frames, have been integrated into the NAVSTA TI Site Management Plan. Living schedules for further characterization and remediation will be developed with the BCT. A separate technical memorandum will be developed to focus on the 9th street recreational area. The text has updated to summarize the current status of the Building 233 and associated sewer investigations.

6. Comment: Please indicate how elevated count rates (in cpm) relate to pCi/g (p. 26, second paragraph).

Response: The elevated count rates in units of counts per minute (cpm) are the results of radiological gamma scanning with a sodium iodide detector, whereas the Ra-226 concentrations expressed in pCi/g are the results of radiological analyses of soil samples. The relationship between the count rate acquired during gamma scanning and the Ra-226 concentration derived from the analytical results is qualitative. Areas of elevated count rate are used to bias soil sample locations.

7. Comment: The 2006 HRA says that "The Cs-137 sealed sources were leak tested and were demonstrated to be intact." However, on p. 26, the HRASTM designates the USS *Pandemonium* Site I (NW) area as a "radiologically impacted area based on a more conservative interpretation of existing information [about Cs-137] in the HRA." Can you please explain what the more conservative interpretation is, and explain which sites are affected?

Response: The ninth sentence of the fifth paragraph of Section 2.2.8 has been replaced with the following to be consistent with Section 4 of the HRASTM and to clarify the basis for the changed designation: "This HRASTM designates the USS *Pandemonium* Site I (NW) area as a radiologically impacted area based on a more conservative estimate that the documented use of unlicensed instrument check sources could have resulted in a spread of contamination."

8. Comment: Since materials stored at the former storage yard before the construction of housing are not known (p.22), please include Halyburton Court and Bigelow Court on the "impacted" list on p. 44.

Response: Bigelow Court has been designated as impacted (See response to DTSC Specific Comments #9 for Bigelow Court discussion). Halyburton Court has not been impacted as there is no evidence that the area was used as a solid waste disposal area.

9. Comment: On p. 61, please explain more clearly that the purpose of a FOST is to document that the property is environmentally suitable for transfer. Please add a note to say that Buildings 343 and 344 were released for closure because, although impacted, 2007 surveys have shown that they are not contaminated.

Response: Section 6.2 of the HRASTM was revised to read as follows:

"The purpose of a Finding of Suitability to Transfer 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 preventing 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, restriction or covenants are required for the FOST areas.

No further action is necessary to address the potential for radiological contamination at areas within TI that were subject to the HRA or this HRASTM, and are (1) not designated as radiologically impacted, or (2) designated as non-impacted. The conservative evaluation of TI as a whole serves to identify areas not only where significant contamination could be, but even where there are anomalous discrete sources of localized contamination from unlicensed activities. In areas that are not impacted, the probability of contamination posing an unacceptable human health risk is minimal and no evidence has been found to warrant further investigation of the areas."

10. Comment: Typo on p. 37, second paragraph: "impacted areas based <u>on</u> the detection of Ra-226."

Response: The text was revised as suggested.

RESPONSE TO REGULATORY AGENCY COMMENTS ON THE INTERNAL FINAL HISTORICAL RADIOLOGICAL ASSESSMENT-SUPPLEMENTAL TECHNICAL MEMORANDUM AND RESPONSES TO AGENCY COMMENTS ON THE DRAFT HISTORICAL RADIOLOGICAL ASSESSMENT-SUPPLEMENTAL TECHNICAL MEMORANDUM, NAVAL STATION TREASURE ISLAND, SAN FRANCISCO, CALIFORNIA

This document presents the responses to comments from staff from the Department of Toxic Substances Control (DTSC) on the redline version of the "Internal Final Historical Radiological Assessment – Supplemental Technical Memorandum [HRASTM], Naval Station Treasure Island, San Francisco, California," and the Responses to Agency Comments on t he Draft HRASTM, dated February 14, 2013. The comments addressed below were received from DTSC on March 4, 2013.

RESPONSES TO DTSC COMMENTS

GENERAL COMMENTS

1. Comment: New impacted areas/Utility lines and area south of Building 233. The area surrounded by the utility lines south of Building 233 and the utility lines beyond the impacted boundaries of Buildings 3, 233 and 342 as highlighted on Figure 2 is not listed in the bullet list in the Executive Summary. These lines are labeled as Bldg 3 Sanitary Sewer Line, Bldg 233 Storm Line, and Bldg 342 Sanitary Sewer Line on Figure 2. This area and utility lines should be collectively classified as one new impacted area separate from the buildings.

Response: Please see response to Specific Comment #1.

2. Comment: Boundaries of new impacted areas. Please verify the boundaries of the new impacted areas for the larger rubbish area and the yard behind Building 342. The boundaries shown in Figure 2 and the AOI specific figures are inconsistent with the photos.

Response: The boundaries have been revised for consistency.

3. Comment: No Further Action (NFA) on non-impacted areas. The NFA statements in the Executive Summary and FOST section are confusing. It sounds like that NFA is recommended for the whole of TI which is the subject of the HRASTM. Please revise these statements.

Response: These sections have been revised as a result of the comment.

SPECIFIC COMMENTS

1. **Comment:** **<u>Executive Summary, Page ES-2, 8th Bullet</u>. Please add the sewer and storm lines in the bullet list of new impacted areas. Figure 2 shows utility lines from Buildings 3, 233 and 342 to the storm outfall and the WWTP. These lines outside of the buildings and the area surrounding the lines south of Building 233 should be collectively classified as an impacted area separate from the buildings.**

   Response: Potential migration pathways are evaluated in Section 6.1 for radiologically impacted areas. This includes the storm and sanitary utility lines servicing Buildings 3, 233 a nd 342 and the portions shown on t he Figures 2 through 9.

2. **Comment:** **<u>Executive Summary, Page ES-3, 1st Paragraph</u>. Should this definition of an impacted site be moved before the list of newly identified impacted areas?**

   Response: The text defining an impacted site has been moved as suggested.

3. **Comment:** **<u>Executive Summary, Page ES-3, Last Paragraph</u>. The statement is confusing. The whole of TI is the subject of the HRASTM. Please revise this statement.**

   Response: The statement has been revised to read as follows: "*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.*"

4. **Comment:** **<u>Section 1.1, Purpose, Page 1, 2nd Paragraph</u>. Please delete. This is a duplicate of a paragraph in the Executive Summary.**

   Response: The Executive Summary is intended to be stand alone and may contain duplicate text of the document if specific wording and descriptions are desired.

5. **Comment:** **<u>Section 2.2.2, AO1 2: Former Hospital Area, Page 12, Top Paragraph,</u>. Please add the sentence "Therefore, IR Site 33 was classified as not impacted in this HRASTM."**

   Response: The text was revised as suggested.

6. **Comment:** **<u>Section 2.2.2, AO1 2: Former Hospital Area, Page 13, Top Paragraph</u>. Item #12 of the Action Items from the 11/29/2103 conference call requires including the cleanup document for Building 233 in Appendix A. Has this been included in Appendix A?**

Response: The following reference has been added to Appendix A as requested.

Shaw. 2014. "*Final Radiological Remedial Action Report and Final Status Survey Plan, Building 233 Site, Former Naval Station Treasure Island, San Francisco, California*." January. TI-HRASTM-49.

7. Comment: Section 2.2.2, AO1 2: Former Hospital Area, Page 13, Top Paragraph. Insert "be": "A report will "be" issued…

Response: The text was revised as suggested.

8. Comment: Section 2.2.4, AO1 4: Southwestern Community Area, Page 16, 2nd Paragraph. Please insert "and CDPH": (DTSC "and CDPH" 2009)

Response: The referenced letter for DTSC 2009 included the CDPH letter as an attachment, thus no change was made to the citation. Rather, the sixth sentence of the last paragraph of Section 2.2.4 was revised to the following: " The California Environmental Protection Agency's 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)."

9. Comment: Section 2.2.5, AO1 5: Northeastern Community Area, Page 18, 1st Paragraph. Missing word. Insert "of": "…mobilization "of" two gamma..."

Response: This comment is no longer relevant due to other text revisions.

10. Comment: Section 2.2.6, AO1 6: Sewage Treatment Area, Page 18. Please discuss the four identified impacted areas in AOI 6 in bullet form for clarity.

Response: The section has been modified as requested.

11. Comment: Section 2.2.6, AO1 6: Sewage Treatment Area, Page 18, First Paragraph. Please name the two Pandemonium sites consistently in the text and figures. Figure 2 shows "NE" and no "II".

Response: Figure 2 and text has been modified accordingly.

12. Comment: Section 2.2.6, AO1 6: Sewage Treatment Area, Page 19, 3rd Paragraph. *"Radiological sampling was not part of this action, although radiological portals were not set off at target landfills."* Please clarify this statement.

Response: The subject sentence and section has been rewritten to read as follows: "*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.*"

13. Comment: **<u>Section 2.2.6, AO1 6: Sewage Treatment Area, Page 21, 1st Paragraph</u>. *"Additionally, bins filled in Site 12 had to be emptied at Site 6 and resurveyed. Elevated readings outside of the bins had prevented their transport over public roads."* Please clarify these statements. How were the bins transported from Site 12 to Site 6. What roads were used?**

Response: The sentence was revised for clarity to read as follows: "*Additionally, bins containing radioactively contaminated soil that were filled in Site 12 were emptied at Site 6 and resurveyed (Shaw 2013a, 2013b).*" Truck routes are shown in the work plans for the solid waste disposal areas (SWDAs); but no changes to the text has been made because all of Site 12 has been radiologically impacted thus making the specific roads used for transport of the bins little importance.

14. Comment: **<u>Section 2.2.7, AO1 7: Northern Housing Area of Interest, Page 24, 1st Paragraph</u>. Please delete this statement *"Although further investigation will be done throughout Site 12"* or clarify based on the 2/25/2103 conference call.**

Response: The statement has been clarified to read as follows: "*Although further investigation will be done throughout Site 12, various lines of evidence exist to suggest the movement of low-level radiological objects (LLROs) outside of SWDAs by grading was limited within Area of Interest 7 as follows…*"

15. Comment: **<u>Section 2.2.7, AO1 7: Northern Housing Area of Interest, Page 28, 1st Paragraph</u>. Please explain the how the boundary of the larger rubbish area was determined. This boundary is not consistent with the approximate limits of the rubbish disposal area in Photo 24 below.**

Response: The following has been added to the caption of the photo: *"(Note: The lower rubbish disposal area is only partially shown)*" T he rubbish disposal areas are based on the report by McCreary, Koretsky Engineers 1965.

16. Comment: **<u>Section 2.2.7, AO1 7: Northern Housing Area of Interest, Page 28, Last Paragraph</u>. Please revise this new paragraph based on the team's 2/25/2013 conference call.**

Response: The last paragraph has been deleted due to the decision to radiologically impact all of Site 12.

17. Comment: **<u>Section 2.2.8, AO1 8: Southern Housing Area, Page 29, 1st Paragraph, 4th Sentence</u>. Please clarify that although a larger portion of Bigelow Court is within AOI 8, Bigelow Court was classified as impacted under AOI 7.**

Response: The first paragraph of Section 2.2.8 was revised to include the following text as the fourth sentence: "*In addition, this HRASTM provides additional detail regarding AOI 8 including an approximately 175,000-square-foot former storage yard overlapping Bigelow Court (portions of Bigelow Court are also located in AOI 7).*"

Section 2.2.7 was also revised to read, in part: "*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 Bigelow Court (TriEco-Tt 2012) (portions of Bigelow Court are also found in AOI 8).*"

18. Comment: **<u>Section 2.2.8, AO1 8: Southern Housing Area, Page 29, 1st Paragraph, 4th Sentence</u>. Please label the Pandemonium Site I (NW) on Figure 9, and make the name consistent on Figure 2.**

Response: Figures 2 and 9 have been revised as requested.

19. Comment: **<u>Section 2.2.8, AO1 8: Southern Housing Area, Page 29, 1st Paragraph, 4th Sentence</u>. Please discuss this "new information" suggesting that a 50-foot buffer is appropriate to extend the SWDA impacted areas.**

Response: The language regarding the "new information" and the 50 foot buffer has been removed and the entire footprint of Site 12 has now been designated as radiologically impacted.

20. Comment: **<u>Section 2.2.8, AO1 8: Southern Housing Area, Page 31, 2nd Paragraph, 2nd Sentence</u>. Please identify the specific SWDAs where commodities were found since Bigelow Court was also identified as a SWDA in the Site 12 RI report.**

Response: The second sentence of the 7th paragraph was revised to read as follows: "*After the 2006 HRA, LLROs were found in each of the SWDAs, with the exception of the Bigelow Court debris disposal area, confirming the report of radiological disposal at TI.*"

21. Comment: **<u>Section 4.1.1.3, SWDAs 1231/1233 and 1207/1209 (Bayside/North Point), and Section 4.1.1.4, SWDA A&B), Page 35</u>. Please clarify that all commodities have been removed from the SWDAs to the storage area at TI, and not all commodities have been removed from TI based on the Dec 2012 RAB meeting presentation. The remaining commodities that are still stored at TI should be discussed.**

Response: The following new 5th sentence has been added to Section 4.1.1.3: "*LLROs are retained on TI until sufficient quantities have been collected and shipment logistics have been arranged.*"

22. Comment: **<u>Section 4.1.2, Radiologically Impacted Sites Identified in this HRASTM, Page 36</u>. Please include the utility lines from Buildings 3, 233 and 342 to the storm outfall and the WWTP in the list of impacted sites as shown on Figure 2.**

Response: Please see response to Specific Comment 1.

23. Comment: **<u>Section 4.1.2.8, Building 342, Photo 30: Site 31 Excavation Areas, Page 41</u>. This yard area limit is not consistent with the area in Figures 2 and 6. Please reconcile the impacted yard area.**

Response: Figures 2 and 6 of have been revised to match the yard area as shown in the photo.

24. Comment: **<u>Section 4.3, Other Significant Radiologically-Related Work, Page 46</u>. Please discuss the following work in this section: (1) Navy radiological surveys and soil sampling as part of the background concentration determination; and (2) CDPH RHB surveys in 2012 requested by the City.**

Response: Additional text has been added to Section 4.3 to address requested surveys.

25. Comment: **<u>Section 4.3.1, Site 12 Trenching, Page 47</u>. This is inconsistent with the introductory sentence under Section 4.3 that states this section presents other significant radiological surveys done AFTER the final HRA.**

Response: The first two sentences of Section 4.3.2 have been revised to clarify the timing of the trenching work: "*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.*"

26. Comment: **<u>Section 6.1.1.1, Building 233, 2nd Paragraph, Last Sentence, Page 55</u>. Please clearly identify the sewer systems downstream of Building 233. Figure 2 shows lines from Buildings 3, 233 and 342 to the outfall and the WWTP downstream and upstream of Building 233. These lines outside of the buildings should be classified as an impacted area separate from the buildings.**

Response: Please see response to Specific Comment #1.

27. Comment: **<u>Section 6.1.1.3, Site 12, Site Description, Last Sentence, Page 56</u>. Please clarify that the commodities were found only at the four SWDAs A, B, 1207/1209, and 1231/1233, and not throughout Site 12.**

Response: Based on findings subsequent to this comment, the suggested clarification was not made.

28. Comment: **<u>Section 6.1.1.3, Site 12, Recommended Actions, Last Sentence, Page 57</u>. Please revise this statement per the team's 2/25/2013 conference call.**

Response: Based on decisions subsequent to this comment, the entire Site 12 area has been designated as radiologically impacted. T he "Recommended Actions" subsection in Section 6.1.1.3 has been revised accordingly.

29. Comment: **<u>Section 6.1.2, Radiologically Impacted Sites Identified in this HRASTM, Page 57</u>. These utility lines outside of the buildings and the area surrounding the lines south of Building 233 should be collectively classified as an impacted area separate from the buildings.**

Response: Please see response to Specific Comment #1

30. Comment: **<u>Section 6.1.2,7, Former Storage Area and Sites 30 and 31, Site 31, Last Sentence, Page 69</u>. Please revised this statement since completion report and FSS report for Site 31 has not been submitted to the regulatory agencies for review.**

Response: The following text has been added to the end of the Site 31 discussion: "*At the time of this HRASTM, the Navy has finished the soil remediation at Site 31 and the site has been restored and radiologically downposted. The remedial action completion report is being prepared.*"

31. Comment: **<u>Section 6.1.2,7, Former Storage Area and Sites 30 and 31, Previous Radiological Investigations, Page 70</u>. Please clarify that the contamination was found within Site 31 and only small volume of soil is impacted.**

Response: The second sentence has been revised to read as follows: "*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.*"

32. Comment: <u>Section 6.2, Findings of Suitability to Transfer (FOST) Areas, Last Paragraph, Page 82</u>. Please rewrite for clarity.

Response: The last paragraph of Section 6.2 has been rewritten to read as follows: "*No further action is necessary to address the potential for radiological contamination at areas in 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.*"

33. Comment: <u>Figure 2</u>. Please label the utility lines outside of the buildings and the area surrounded by the lines collectively as one impacted area.

Response: See response to Specific Comment #1

34. Comment: <u>Figure 2</u>. Please show Site 24 boundary.

Response: Figure 2 has been updated to show the Site 24 boundary as requested.

35. Comment: <u>Figure 4</u>. The area surrounded the utility lines is shaded as impacted in Figure 2.

Response: Figures 2 and 4 have been updated to show the same impacts for utility lines.

36. Comment: <u>Figure 8</u>. Please make label consistent with the text as "Pandemonium Site II (NE)."

Response: The label has been changed as requested.

37. Comment: <u>Figure 8</u>. Please show and label Building 327. This building is shown and labeled in the first draft HRASTM.

Response: Building 327 has been shown and labeled as requested.

38. Comment: <u>Figure 9</u>. Please identify buildings that are not occupied in a different color and noted in the legend.

Response: Unoccupied buildings in Figure 9 and 10 have been noted in a different color as requested.

39. Comment: **<u>Figure 10</u>. Please label the SWDA, Pandemonium Site I (NW) and the playground that were classified as impacted.**

Response: The polygons that define these areas have been added to the figure and labeled accordingly as requested.

APPENDIX D
HISTORICAL RADIOLOGICAL ASSESSMENT SUPPLEMENTAL TECHNICAL MEMORANDUM REFERENCES

(Provided on DVD)