

1. Introduction

A detailed assessment of the fuel load and potential for future releases was conducted for the sunken Second World War-era vessel, USS *Chehalis*, Pago Pago Harbor, Tutuila Island, American Samoa. As discussed in detail in the report for previous work phases (Phase I & II, CH2M Hill 2006) the vessel was a gasoline carrier that caught fire and sank approximately 350 feet north of the fuel dock in Pago Pago Inner Harbor on 07 October 1949. Work previous to this Phase III investigation included a review of available archival information relevant to ship's structure and operations (Phase I), a pre-dive survey using a submersible remotely controlled vehicle (ROV) (Phase I), an external "stand off" visual survey by divers (Phase II), and limited sediment and water sampling in the vicinity of the vessel for analysis for petroleum hydrocarbons (Phase II). This report documents the results of Phase III of the *Chehalis* investigations. Phase III was designed and implemented based on findings from previous phases of the work. Phase III follows on the probability raised by the results of Phase I & II that indicate a significant quantity of fuel remains on-board the vessel.

There is now sufficient evidence to indicate a potential future threat from release of fuel from the *Chehalis*. There is evidence that the structural integrity of the vessel is compromised due to advanced and on-going deterioration, that large volumes of fuel have leaked from the vessel during the past ~5 years, and that the vessel contains a large volume of petroleum cargo and ship's fuel.

1.1 Purpose

The results of the USS *Chehalis* Phase III investigation are intended to provide a basis to support a request for remedial efforts from United States authorities, as a response to protect environmental quality and human health and safety in Pago Pago Harbor. Objectives of the USS *Chehalis* Phase III – Cargo Inspection, included:

- To determine if fuel is present in cargo tanks and ship's fuel storage tanks;
- To accurately define to the extent possible the type of fuel, quantity of fuel, and location of fuel on-board, based on direct observations by penetration of cargo and fuel tanks; and,
- To develop recommendations for remediation and/or environmental management efforts.

1.2 Background

Recent data from the Pago Pago Harbor Sediment Toxicity Study (“Sed Tox Study”) conducted by the American Samoa Environmental Protection Agency (AS EPA) included bathymetry, side-scan sonar, sub-bottom profiling, and sediment analyses that characterized features of the Harbor bottom. Bathymetric and side-scan sonar data collected for Sed Tox Study Element 2 (Seabed Characterization and Mapping) verified the location of the sunken vessel USS *Chehalis*, lying in approximately 160 feet of water, some 350 feet north of the fuel dock at the main port facilities of Pago Pago, American Samoa. The location of American Samoa and Pago Pago Harbor, the location of the USS *Chehalis* in the Inner Harbor, and an image of the wreck, are shown in Figures 1-1, 1-2, and 1-3, respectively.

According to best information available to AS EPA, the AOG-48 USS *Chehalis* is a Patapsco class gasoline tanker of 4130 tons displacement, built at Cargill, Savage, Minnesota, and commissioned on 05 December 1944 (Figure 1-4). The *Chehalis* is 311 feet in length, with a beam of 49 feet, and a draft of 14 feet 6 inches. The vessel is lying on her starboard side, bow east, with her port rail at a depth of about 110 feet. Anecdotal references to records indicated that the vessel contained more than 400,000 gallons of petroleum cargo and thousands of rounds of artillery shells on the day the vessel caught fire and sank in October 1949. To dispel uninformed local opinion as to the water quality impacts from the *Chehalis*, AS EPA designed and implemented a three-phase investigative effort that was conducted between November 2005 and February 2007, that was specifically designed to answer three relevant questions: Is there fuel aboard the USS *Chehalis*?; If there is fuel present, what is the volume and type of fuel(s)?; and, What is the location of the fuel on the vessel?

Based on the recent occurrence of environmental impacts from deteriorating hulls of Second World War-era wrecks in the Pacific (e.g., USS *Mississinewa*, Yap State), AS EPA determined there was imperative and exigent need to assess potential environmental impacts from the *Chehalis*. This determination was supported by the 2004 annual report from the Oceania Regional Response Team, and recommendations from the 2001 cursory survey by Pacific Underwater Construction (PUC). It was AS EPA's position that the USS *Chehalis* may pose a present and future environmental problem.

Economic viability for the Territory of American Samoa relies almost exclusively on the Port of Pago Pago. The Harbor also plays an important role in fisheries and recreational activities for surrounding villages. It is therefore important to understand the potential threats to port operations, to environmental health, and to human safety, posed by the presence of the USS *Chehalis*.

The work described in this Phase III report and previous phases is limited to technical aspects of the vessel and its cargo. Ownership of the USS *Chehalis* and the identification of a responsible party are unknown to AS EPA at this time, and the determination of such was not a part of this investigation or any other investigation by AS EPA.

Completion of this cargo inspection is one component of a comprehensive environmental monitoring and remediation effort for Pago Pago Harbor undertaken by AS EPA. The work was carried out by AS EPA under the Consolidated Environmental Management Program for American Samoa, as supported by US EPA Pacific Islands Office, Region IX, San Francisco.

Locus Map Pago Pago Harbor, American Samoa

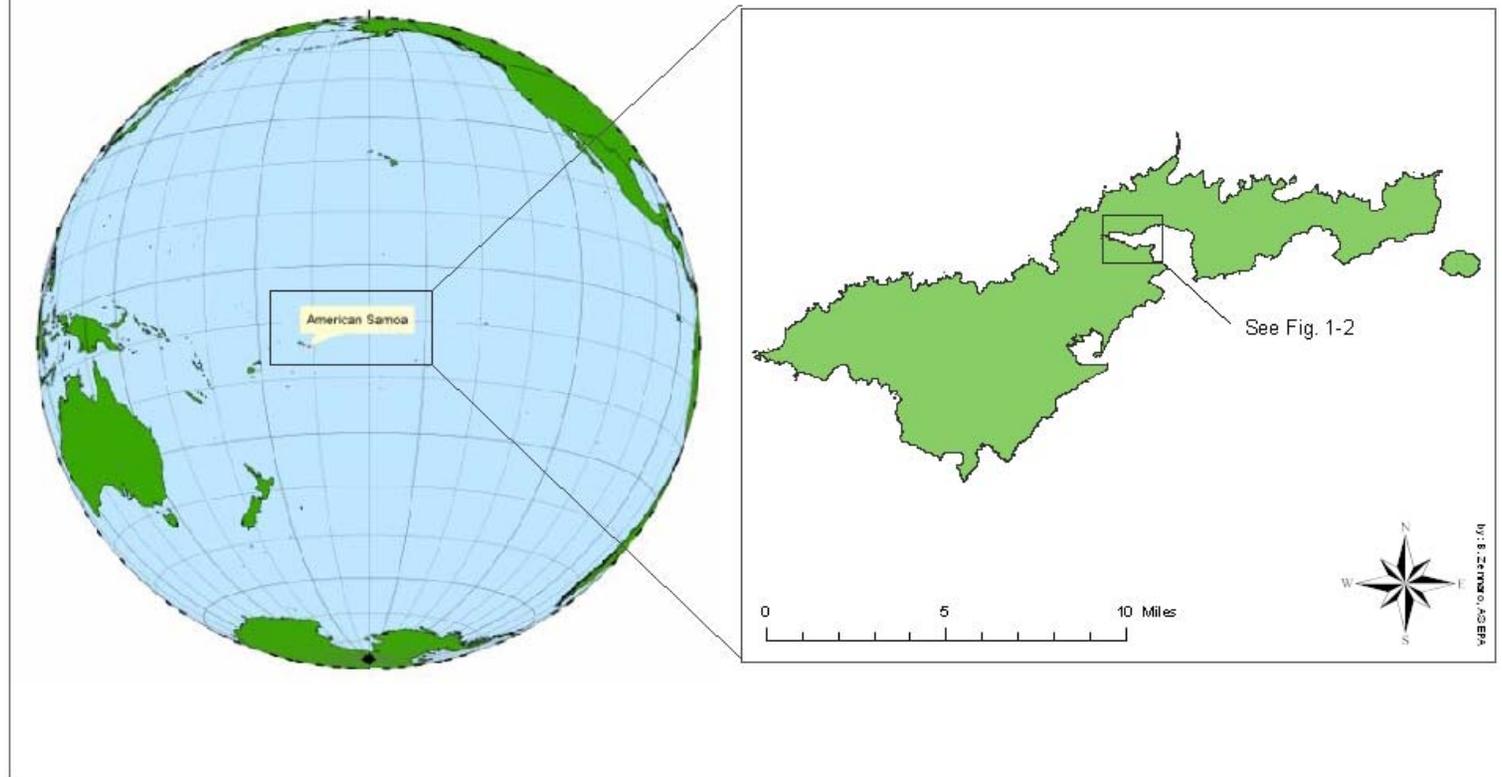


Figure 1-1. Location of Pago Pago Harbor, American Samoa

USS Chehalis Pago Pago, Inner Harbor

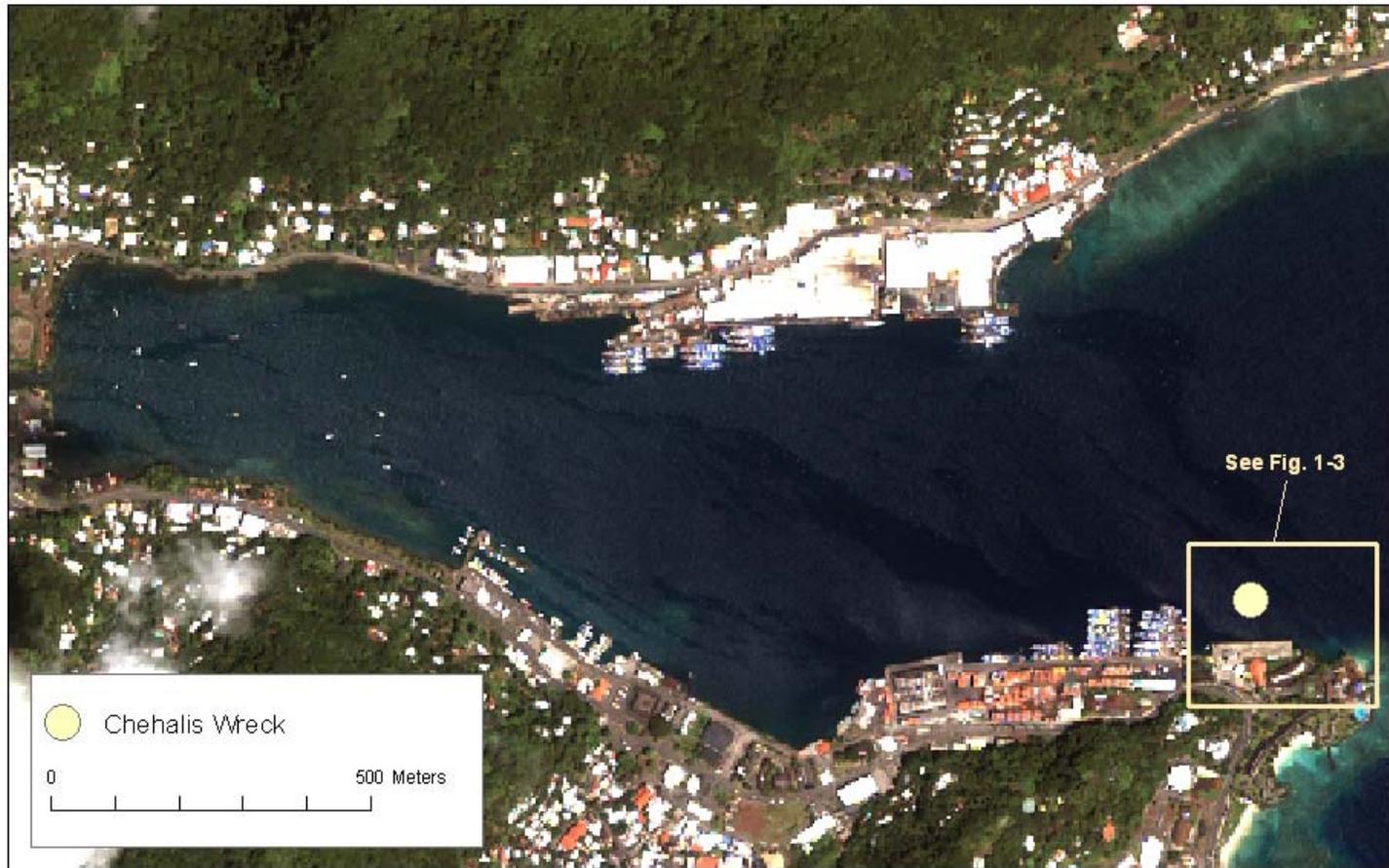


Figure 1-2. Location of the USS *Chehalis* in Pago Pago Inner Harbor

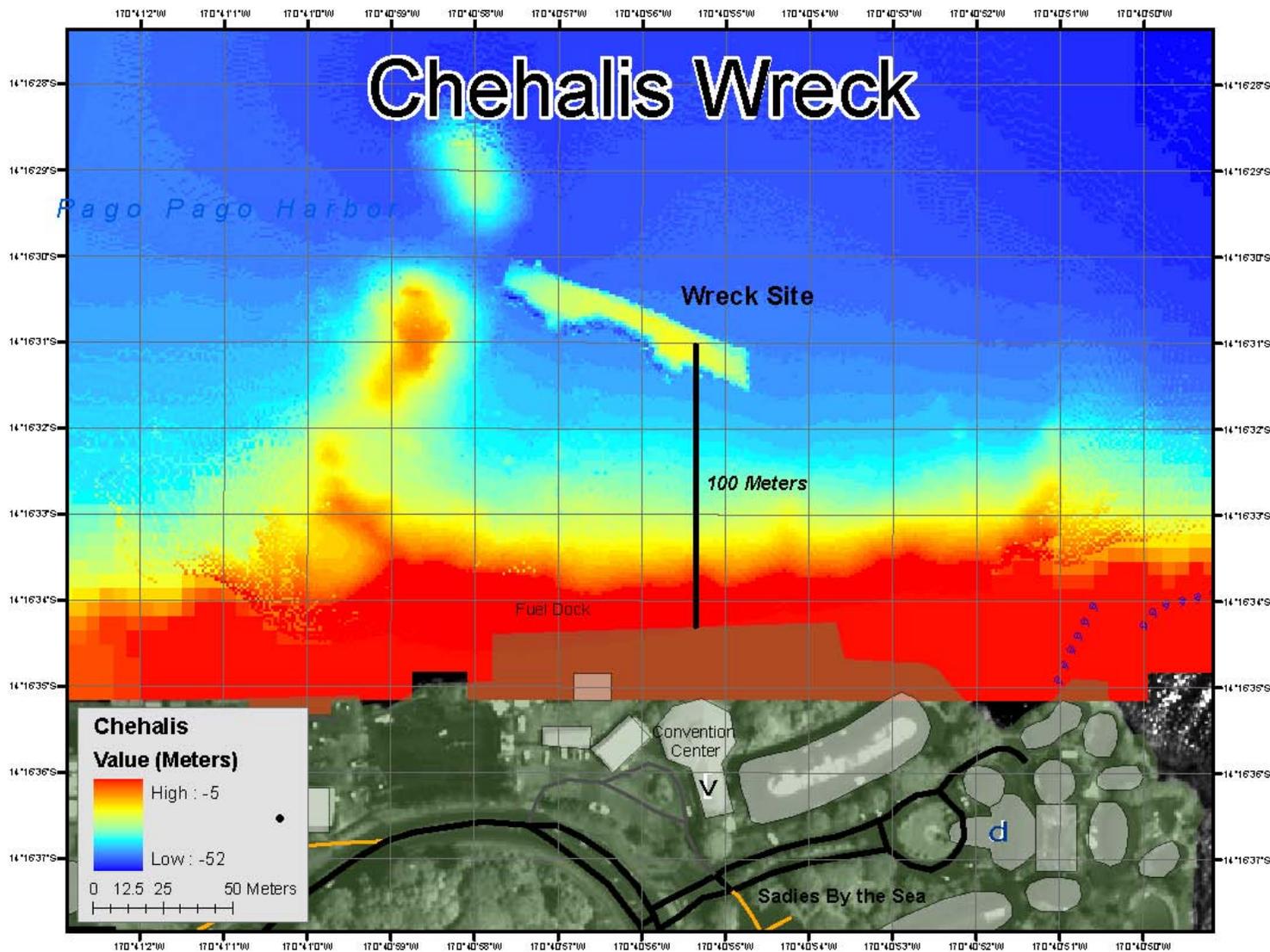


Figure 1-3. Image of the wreck of the USS *Chehalis* in Pago Pago Inner Harbor

Photo # NH 83319 USS Chehalis (AOG-48), circa 1944



Figure 1-4. Photograph of the USS *Chehalis* (circa 1944)

1.3 Approach

The USS *Chehalis* Phase III – Cargo Inspection was based on four major project elements:

- A direct inspection of ship's cargo and fuel tanks, through penetration dives and/or drilling through ship's hull.
- Sampling fuel(s) and identification of fuel(s) type.
- Calculation of volume of each type of fuel.
- Accurate determination of location of fuel.

As with previous investigations, coordination was established with the American Samoa Historic Preservation Office (AS HPO), the American Samoa Government (ASG) Port Administration (Port), and U.S. Coast Guard (USCG) Marine Safety Detachment, American Samoa, for operations at the fuel dock and near the vessel. Notification under Section 106 as required by the National Historic Preservation Act of 1966 (as amended) was submitted by US EPA Pacific Islands Office, Region IX, San Francisco.

2. Diver Survey

For Phase III, a comprehensive survey by divers was conducted by Associated Underwater Services (AUS), Spokane, Washington, USA, during January and February 2007. The objectives, methods, and results are summarized below. A full report prepared by AUS, including audio and video recordings, are provided in Appendices A, B and C.

2.1 Objectives

Objectives for the diver survey included:

- Obtain video images and still images of selected critical locations or surfaces, as directed by AS EPA.
- Identify openings and potential openings for cargo tanks, in particular hatches and vent ports, as potential access points to tanks' interiors, and provide location details for each.
- Enter cargo tanks if access available.
- Identify location of ship's fuel storage tanks in hull areas below ship's waterline.
- Drill ship's fuel tanks at multiple elevations (relative to water surface) to determine fuel levels in tanks.
- Identify the elevation (feet below water surface) of fuel levels in tanks, adjusted to mean sea level, and relative to ship's port rail.
- Collect samples from all cargo tanks and ship's fuel tanks where fuel was found.

2.2 Methods

A five-man commercial diving crew utilizing underwater audio and video mounted to divers' helmets conducted the Phase III inspection of the USS *Chehalis* performed by AUS. The surface support vessel (diving platform) consisted of a twin-engine 38ft mono-hull motor vessel with surface-supplied air diving equipment mounted on the bow and main decks. The surface support vessel was maintained on station above the wreck by mooring lines secured to the wreck's port side. AUS conducted repetitive decompression dives to the USS *Chehalis* using in-water decompression techniques. A dual-lock decompression chamber was stationed on the vessel, and was pressurized and ready for immediate use in the event of a decompression emergency. All diving operations, including mobilization and demobilization, were conducted in accordance with commercial diving operations standards for safety and AUS Safe Diving Practices.

AUS divers made direct penetration dives into each of the ten cargo tanks (tanks B-1 through B-10), and made a series of exploratory drill holes in the hull below the vessel's waterline. Holes were drilled at various elevations to determine if fuel remained at any level within inaccessible ship's fuel tanks (forward tanks A-303, A-304, A-305, and aft tanks C-905).

Sampling of fuel was by direct grab samples by divers when access was available. Direct grab samples were taken with clean 8-oz. glass jars with Teflon[®] lined lids. At depth, divers inverted an open flooded jar, applied air to the jar opening to displace seawater, then raised the inverted air-filled jar into the fuel mass. In the fuel mass the jar was turned upright and capped, which trapped the fuel sample in the jar (see Photo 3, Appendix A).

For sampling through drill holes when direct diver access to tank contents was not available, sampling was performed with a fabricated suction apparatus made of a hand-squeeze primer bulb and a length of ½" I.D. rubber hose. Using the same inverted air-filled jar technique as described above, the diver flexed the primer bulb until a representative sample of tank contents filled the jar. The jar remained inverted until capped. To ensure that a representative sample of tank contents was collected, the bulb-hose apparatus was calibrated for the number of strokes required to effect greater than one complete volume change within the length of hose and the bulb (see Photo 5, Appendix A).

2.3 Summary of Findings

The USS *Chehalis* is located in approximately 156 ft of water, 350-400 feet directly north of the government-owned fuel pier in Pago Pago Harbor (operated by BP Southwest Petroleum, Ltd.). The visibility around the wreck during the Phase III survey operations ranged from 5-30ft. Water temperature was consistently ~86 °F, with no discernible variation during Phase III operations. The bottom in the vicinity of the wreck consists mainly of sandy mud. The majority of the hull, deck, and superstructure are intact but are covered with a heavy layer of silt and rusty scale (see Phase I & II report). Marine life observed around the wreck consisted of small tropical reef fish and some large scallop-like clams that were attached to the hull. Larger predatory fish such as grouper, mahi mahi or sharks were not observed.

Aviation gasoline (115/145) and motor gasoline fuel was found in cargo tanks B-2, B-3, B-6, B-8, B-9 and B-10 (see Figure 2-1). Diesel fuel was found in ship's aft fuel tank C-905 (see Figure 2-2). Direct visual inspection, application of flame-test, and laboratory analytical results, confirm fuel types (Figures 2-3 and 2-4, and Appendix D).

AUS could not determine the status of the vessel's lube oil tanks (tanks A-2 and A-3) because of their location below the aft end of the forecastle.

There is evidence of hull damage (probably from explosions) on the forward starboard side of the cargo deck (tanks B-1 and B-3).

Direct observations by American Samoa EPA personnel during the period of Phase III operations, and intermittently throughout the 2007 calendar year, substantiate anonymous reports of leakage; aviation gasoline has been routinely observed on the water surface above the vessel.

Figure 2-1: Fuel remaining in cargo tanks B-1 thru B-10

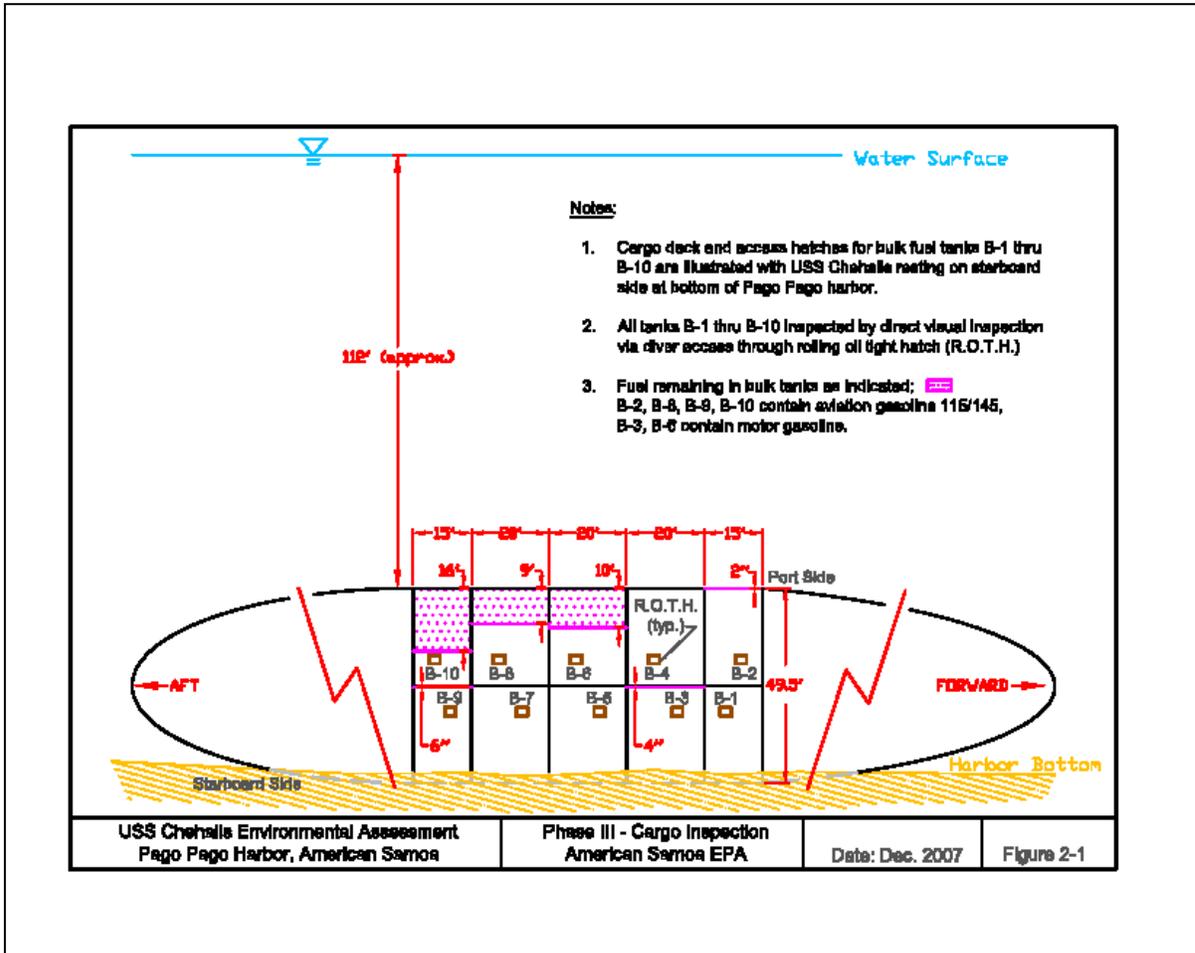


Figure 2-2. Fuel remaining in ship's aft fuel tank C-905

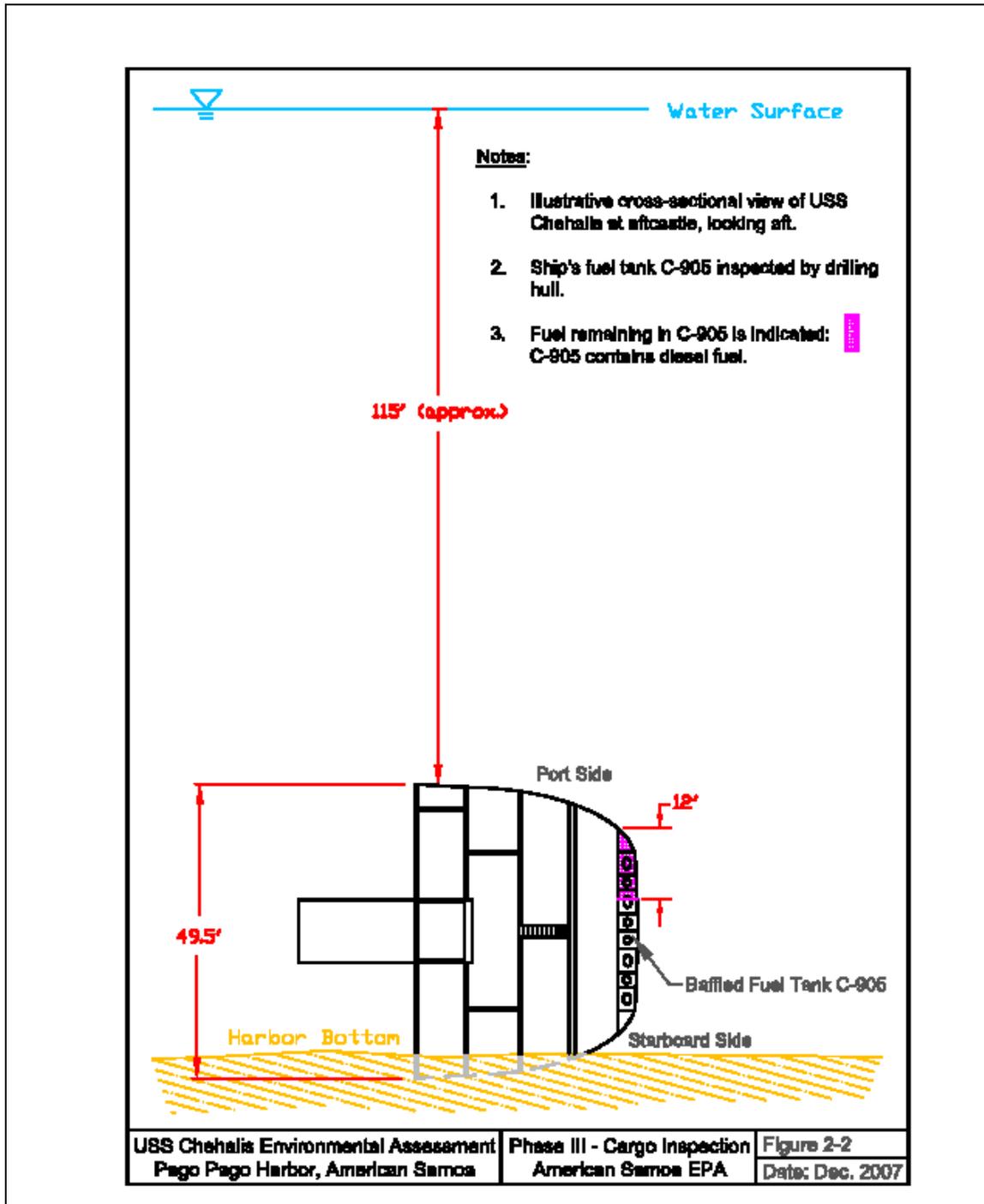




Figure 2-3. Fuel samples



Figure 2-4. Flame test on Avgas 115/145 fuel sample

3. Overall Assessment

Based on information from the diver survey and results of laboratory analyses, an assessment of the remaining fuel load and recommendations for remedial actions are presented below.

3.1 Evaluation of Vessel Access Points

As indicated in the Phase I & II report, the USS *Chehalis* appears remarkably well preserved. Although damaged in very specific locations by explosions generated by fuel (rather than ordnance), the vessel does not appear to be broken and the hull shows no tears or holes. Fuel tanks not involved in the explosions are largely intact and capable of holding fuel that had not been off-loaded prior to the fire. All cargo tanks (B tanks) were accessible for direct diver entry via rolling oil tight hatches (R.O.T.H.). Ship's forward fuel tanks (A tanks), lube oil tanks, and aft fuel tanks (C tanks) were not accessible for direct diver entry.

3.2 Evaluation of Fuel Load

It was confirmed that a significant quantity of the fuel on board the USS *Chehalis* at the time it sank remains in the intact cargo tanks and the ship's aft fuel tanks. A review of historical records indicates that the cargo was composed mostly of aviation and motor gasoline, although an inventory of the entire cargo was not available. Fuel tanks for the ship's propulsion system appear to be intact and contain a significant quantity of diesel fuel.

Calculation of fuel volume was based on elevations measured by divers using a pneumofathometer, and tanks' structural dimensions based on ship's drawings (see Phase I & II report). Laboratory analyses indicate fuel types (see Appendix D). There are approximately 70,000 gallons of aviation gasoline ("avgas" 115/145), remaining in the cargo tanks ("B" tanks) as indicated by a high concentration of gasoline range organics. There are approximately 40,000 gallons of motor gasoline ("mogas") remaining in the cargo tanks ("B" tanks) as indicated by a high concentration of gasoline range organics. There are approximately 5,000 gallons of diesel fuel remaining in the ship's aft fuel tanks ("C" tanks) as indicated by a high concentration of diesel range organics. No fuel was found in the ship's forward fuel tanks ("A" tanks), although it was evident that the tanks contained fuel in the past, as indicated by trace concentrations of diesel range organics.

It was not determined if fuel or other petroleum product was present in ship's forward lube oil tanks (A-2, A-3). The location of these tanks made access extremely hazardous to divers. Lube oil tanks are much smaller in volume compared to cargo or ship's fuel tanks, and it was indeterminable if these tanks share a common surface with the ship's hull, as do cargo and fuel tanks.

3.3 Evaluation of Leakage

Direct observations by divers during the January and February 2007 period showed clearly that the vessel was leaking aviation gasoline, although the quantity leaked appeared small at that time.

Direct observation of cargo tanks B-4, B-5, and B-7, show that the walls of the tanks are completely free of marine growth, and are coated with a thin layer of unidentified black substance that is easily dislodged by abrasion. This indicates that fuel was present in these tanks at a recent date, and further indicates that fuel has recently leaked from the tanks into the harbor environment.

Based on the elevation of the line that delimits the extent of marine growth in these tanks, it is estimated that up to 100,000 gallons of fuel have leaked from the *Chehalis* in recent past years.

3.4 Recommendations

Although the hull and cargo tanks remain largely intact, corrosion is evident and ongoing, and it is certain that the estimated 115,000 gallons of fuel remaining on board will be released to the surrounding waters at some time in the near future. The continued uncertainty regarding the potential for a catastrophic release is considered unacceptable, and AS EPA, in consultation with US EPA Pacific Islands Office, Region IX, San Francisco, recommends immediate notification of the United States Coast Guard, and other appropriate authorities, with subsequent action taken, to eliminate the potential for release of fuel to the Harbor environment.