



APPENDIX A
SITE INVESTIGATION NOTES

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(JoAnn West/Jennifer Kleveno)



PART A1.1
MECHANICAL/STRUCTURAL SITE INVESTIGATION NOTES
GENERAL

This appendix contains the Mechanical/Structural Site Investigation Notes recorded by John Rasmussen of Willbros Engineers, Inc. from Sunday, May 1, 1994 through Sunday, May 15, 1994. These notes address fire protection of the Red Hill Complex located on Oahu, Hawaii. The daily field notes are given in Part A1.2 of this appendix.



PART A1.2
MECHANICAL/STRUCTURAL SITE INVESTIGATION NOTES
DAILY FIELD NOTES

A1.2.1 Sunday, 1 May 1994

A1.2.1.1 Traveled from Tulsa to Honolulu.

A1.2.2 Monday, 2 May 1994

A1.2.2.1 Met John and Ken Echtermacht at Nimitz Gate and obtained base passes and reported to PACDIV at 0930. Forehand, Transue, Rasmussen and Fire Safety Consultants, John and Ken Echtermacht, met with Roy Kaneshiro and he called in Bob Riola, Asst. Fire Protection Engineer for PACDIV. Joe Condlin, Fire Protection Engineer at PACDIV, is recovering from a triple bypass operation. Roy did not have any special instructions, but said we would all meet with Jim Gammon of FISC at 0900, Tuesday, 3 May, inasmuch as Jim was not available this date, 2 May. John Rasmussen passed out the report outline and Roy Kaneshiro made extra copies for use in the meeting the following day. Masa Fujioka, Jennifer Kleveno and JoAnn West arrived from MFA and John Rasmussen went over the outline. John Rasmussen also discussed calling on the Fire Chief and the Chief is still Chief Mullen, as mentioned in previous correspondence. Riola and Roy thought this a good idea. George Rio is Supervisor of Inspectors at 471-3916. Roy Kaneshiro suggested MFA contact the PACDIV Environmental Group upstairs in Building 258.

A1.2.2.2 The entire group, without PACDIV personnel, began a familiarization tour of the lower Harbor Tunnel, entering through Critical Infrastructure and Critical Infrastructure and progressing well above the Critical Infrastructure to get FSC, MFA acquainted with the facility.

A1.2.2.3 In the afternoon, the group entered Critical Infrastructure and toured the Red Hill lower tunnel to Critical Infrastructure. The group next toured the upper tunnel Critical Infrastructure then took the Critical Infrastructure to the lower tunnel of Critical Infrastructure. Having seen broadly all the areas included in the scope of the project, the group adjourned for the day.



A1.2.3 Tuesday, 3 May 1994

A1.2.3.1 Arrived at Bldg. 427 for meeting with Jim Gammon and prior to the meeting, met Mr. Mohamad Yousuf, General Engineer, DFSC Headquarters.

A1.2.3.2 Meeting with Jim Gammon began 0900. Attending were:

Roy Kaneshiro	PACDIV
Bob Riola	PACDIV
Jim Gammon	FISC
Charles Transue	WEI
Terry Forehand	WEI
John Rasmussen	WEI
John Echternacht	FSC
Ken Echternacht	FSC
Masa Fujioka	MFA
Jennifer Kleveno	MFA
JoAnn West	MFA

A1.2.3.3 John Rasmussen reviewed what the group did the previous day. Jim went over the background for the Fire Study and Roy passed out the letters from LCDR Martin and Joe Conklin on the initiation of the Study. Jim also discussed the environmental background. Questions were raised on several matters such as a "phantom" fire study that no one can seem to locate. It may be the study for the alarm system which is nearing 100% design. John Echternacht asked if the alarm for the CO₂ system is still operational and it is, but the CO₂ system in the Critical Infrastructure was deactivated several years ago.

A1.2.3.4 John Rasmussen said that Willbros personnel were very interested in identifying the doors to be cored so it was agreed Jim would take the group to the tunnel to mark the Critical Infrastructure. Everyone was interested in going along to hear what Jim had to say and so the group, less PACDIV, began on a tour similar to the Monday tour, starting at the pumphouse. Jim took the group to the under floor area below the electrical room and where the large vent fans operate. Jim also pointed out the end of the French drain which comes into the pumphouse, where it ends in a trough and eventually goes to a sump in the basement portion of the pumphouse. The French drain outlet was 5/8-filled with gravel/sand/dirt.



- A1.2.3.5 The group walked up to the Critical Infrastructure and marked the door and bulkhead to be cored. The group discussed why Critical Infrastructure could not be blocked off. Jim claims it's the only good route to bring in new pipe.
- A1.2.3.6 Continued up the tunnel to a point where the PWC water line has a vertical riser. Jim says this is the beginning of the French drain. Also passed a small vertical sump that floods during the rainy season and Masa said this would be a good place to remove the track and slab as required in the Rail Study. This is at Critical Infrastructure as marked in chalk on the pipe. This stationing is about Critical Infrastructure from the stenciled stationing. French drain begins Critical Infrastructure A number of 2" pipes in ceiling were for gouting at Critical Infrastructure
- A1.2.3.7 Next, the group went to Critical Infrastructure and marked a second door for coring -- not a drop track. It is just on the Critical Infrastructure of the PWC pump station. Critical Infrastructure from this door is the Critical Infrastructure Jim requested to be cored and it was also marked.
- A1.2.3.8 At Critical Infrastructure
Critical Infrastructure Jim pointed out the former pipeline leak in the concrete anchor. John Rasmussen looked at and photographed the thrust block by the sump pit which would be a potential location for a liquid-tight bulkhead and door to control large tank spills. There is also a large anchor downhill from Critical Infrastructure Photographed this potential closure spot also. Looked in the PWC water pump station which was very neat and well maintained. Noted hollow spots in tunnel walls and ceilings of the lower access tunnel which could potentially fail if pressured by a big spill. Adjourned from Critical Infrastructure about 1730.

A1.2.4 Wednesday, 4 May 1994

- A1.2.4.1 Began the day by trying to contact Concrete Coring Company (CCC), but to no avail. Transue and John Rasmussen went to the pass office to verify that the letter authorizing Concrete Coring to obtain passes was on hand. Called Concrete Coring from the pass office and talked with the dispatcher, Bobby, and made arrangements to meet him at the pass office at 1230 and then tour the coring sites.
- A1.2.4.2 Showed Charlie Transue the Upper Tank Farm and Middle Tank Farm. Charlie designed the stairs to Tank 48.



- A1.2.4.3 Jim Gammon was pulling drawings for FSC, MFA and WEI.
- A1.2.4.4 At 1230 Charlie Transue and John Rasmussen met Bobby and Shannon from Concrete Coring. They already had base passes from other projects. Went into [Critical Infrastructure] and then the [Critical Infrastructure] and up to the [Critical Infrastructure]. Looked around for electrical outlets and some were in the area. CCC concluded they did not want to bring their coring equipment through [Critical Infrastructure].
- A1.2.4.5 Next went to [Critical Infrastructure] and checked out the two coring sites at this location about [Critical Infrastructure]. [Critical Infrastructure] Electrical outlets were scarce in this area. There were some outlets, but it was not known if they were operational or their capacity.
- A1.2.4.6 Set up a start time for coring of 0730, 5 May, starting at [Critical Infrastructure].
- A1.2.4.7 Went over drawings to be reproduced that Jim Gammon had pulled from his files. Since the volume was quite large, JoAnn West was asked to take some of the drawings for reproduction, even if some duplicates were needed by us and others.
- A1.2.4.8 Jim suggested an early reproduction so he could highlight the important areas of the drawings.

A1.2.5 Thursday, 5 May 1994

- A1.2.5.1 John Rasmussen and Charlie Transue met Ron of Concrete Coring Company (CCC) at [Critical Infrastructure] at 0730 to start coring of the two bulkheads near the PWC pump station. Train arrived as requested the day before and all the drilling equipment was loaded on a flat car and hauled to the first bulkhead approximately [Critical Infrastructure]. [Critical Infrastructure] CCC began drilling at 0910. This door is not liquid-tight, having no drop track doors. Door is plated on both sides with steel as shown on some of the drawings. The through-the-wall core was very light weight gunite. The angle core yielded a piece of 1/4" plate about 6" in from the surface, then 2" of gunite and then decayed timber for the remainder of the length of tool which was 39" long. Cores for both bulkhead and key ways were fractured with maximum length of any piece being 6". Break up was probably the result of old fractures.
- A1.2.5.2 At the [Critical Infrastructure] [Critical Infrastructure] coring was begun on the ceiling due to 440' cable and piping obstructions on the side walls. This is [Critical Infrastructure]. First portion of core was 14" of gunite and this



was followed by blue rock. The length of tool was 39". The rail flat car was used as a platform. Hole 5 was an 18" core taken from the bulkhead. This core cut a 3/4" rebar about 5" in from the surface. Core was porous. Second core was taken in the afternoon and it was decided to not take the train down to the Critical Infrastructure until the following day after discussing with the gauger and Mike Lau, the Red Hill Supervisor.

- A1.2.5.3 Departed Critical Infrastructure and checked in at Bldg. 427. Jim Gammon had broken out some additional drawings which we reviewed for possible reproduction. Quite a large number of drawings have been selected and went to Hawaii Blueprint near the Airport at 1645, but they had closed at 1630. Drawings will be dropped off for reproduction on 6 May 1994.

A1.2.6 Friday, 6 May 1994

- A1.2.6.1 Charlie Transue, Terry Forehand and John Rasmussen met CCC at Critical Infrastructure at 0730. Called Gauger Station to bring down the locomotive to move CCC's gear down Critical Infrastructure to the Critical Infrastructure in accordance with arrangements made the previous day with Mike Lau. Once the train was under way, WEI took the CCC man to Critical Infrastructure by car and met the train coming down the tunnel. Train arrived at same time as the WEI/CCC group.
- A1.2.6.2 CCC began drilling the angle key way using the 5' high anchor block as a platform. The first portion of the core included 1/2" rebar near the surface and was quite porous. First piece was about 1' long. Upon further coring, a 4" piece of gunite was obtained with heavy rebar encased. The last piece of gunite was about 6" and was followed by a void. The end of the gunite had a wood grain surface indicating it had been shot against timber which now accounted for the void.
- A1.2.6.3 The through-the-bulkhead core was straightforward over the door and yielded cores of 10", 4" and 5".
- A1.2.6.4 CCC began packing the core holes using Tremco's Polyset Patching Compound.
- A1.2.6.5 The train then hauled CCC's gear back to the PWC pump station area. Again, WEI and CCC drove to Critical Infrastructure and met the train.
- A1.2.6.6 While the lower coring operation was underway, Terry Forehand took drawings to Hawaii Blueprint for reproduction.



A1.2.6.7 Patching of the two bulkheads 1,000' in from [Critical Infrastructure] was accomplished in about an hour and CCC checked out at 1330.

A1.2.6.8 Charlie Transue, Terry Forehand and John Rasmussen returned keys to Bldg. 427 and discussed progress with John Echternacht. Also discussed plans to see Fire Chief and Fire Inspector and possibly talk with Joe Condlin, Fire Protection Engineering PACDIV, who is recovering from heart surgery. John Rasmussen also met with Jim Gammon and set up tentative debriefing time of 0800, Wednesday, 11 May. Debriefing to be held in LCDR Higgins' office (if satisfactory to Mr. Kaneshiro).

A1.2.7 Saturday, 7 May 1994

Worked on field notes in the hotel.

A1.2.8 Sunday, 8 May 1994

Non-work day.

A1.2.9 Monday, 9 May 1994

A1.2.9.1 Called Allen Smith at 0630 to report progress to date and plans for remaining days on site.

A1.2.9.2 Called Roy Kaneshiro and discussed progress, current thinking and future plans for the remainder of the site visit and confirmed that the time and location of the debrief was satisfactory to him.

A1.2.9.3 Charlie Transue and John Rasmussen packed the cores taken from the tunnel walls and bulkheads for shipment via UPS.

A1.2.9.4 The test of the drop track door was scheduled for 1330 and it was planned to meet with Gammon at 1230 to go to [Critical Infrastructure]. Enroute up [Critical Infrastructure] the entire crew of J. Gammon, John Echternacht, Terry Forehand, Charlie Transue and John Rasmussen stopped in at the PWC pump house which was open and took photos of this installation. Once in the pump station, the crew hiked up [Critical Infrastructure] [Critical Infrastructure] with a [Critical Infrastructure] which [Critical Infrastructure] and [Critical Infrastructure].



Critical Infrastructure

A1.2.9.5 Tested the first drop track door uphill toward the tanks from the PWC pump station. This was the second door that was cored the past week. The door was secured with a rope which is normal practice, so it does not slam shut when a train is passing. To close the door, the float switch was tripped manually by Terry Forehand. A cable hooked to a counterweight pulls the door closed, but there are considerable gaps at the seal even after the door is dogged down. The flapper valve on the drain does not close as it is supposed to. As Terry Forehand suspected, the relay that releases the door requires power to release the door for closure. If power is knocked out for any reason or the lights are turned off, the door will not close. The chance of the power being out when the area is flooded is quite great. Fortunately, a switch nearby allowed shutting off the relay without shutting out all the lights in the tunnel. Links between the relay and door were broken and wire was used as a repair.

A1.2.9.6 After the door test, the entire crew went through the Critical Infrastructure and checked tank and tunnel vents. Critical Infrastructure and vents Critical Infrastructure Next the group drove past the Critical Infrastructure of the Critical Infrastructure The crew next went to the 500,000 gallon water tank Critical Infrastructure Critical Infrastructure are above the Critical Infrastructure Critical Infrastructure of the Critical Infrastructure are Critical Infrastructure The Critical Infrastructure on the Critical Infrastructure Critical Infrastructure Critical Infrastructure

A1.2.9.7 Returned to Bldg. 427, picked up a few additional drawings for reproduction and headed for Hawaii Blueprint to pick up drawings left by Terry Forehand last Friday.

A1.2.10 Tuesday, 10 May 1994

A1.2.10.1 Reported to Bldg. 427 at 0730 and began sorting drawings with Charlie Transue since extra copies were obtained for MFA and FSC. Also prepared WEI drawings and concrete cores for shipment to Tulsa. Kept drawings unpacked most of the day for Jim's review but he was not available and could not be located.

A1.2.10.2 John Echternacht arrived about 1000 and arrangements were made with FSC/MFA for a pre-briefing of things that would be brought up at the Wednesday a.m. debriefing of PACDIV and FISC. This review was set for 1330 this date.



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- A1.2.10.3 Attempted to call PWC, Karen Renaldi and Tom Kurashima but both were out.
- A1.2.10.4 Visited Hickam AFB Fuels Dept. with John Echternacht after lunch. Their old office has been removed and Saucerman, the Fuel Dept. Supt., had not been replaced since his retirement and Capt. Arevedo is Acting Fuel Supt.
- A1.2.10.5 The 1330 meeting was attended by all WEI personnel, John Echternacht, JoAnn West and Jennifer Kleveno. John Rasmussen said he would start off the meeting acknowledging the good assistance, give general impressions and then ask Charlie Transue, FSC and MFA to follow with comments in their respective fields. John Rasmussen said it is not the purpose of the debriefing to give conclusions but to let people know what we did and give them preliminary impressions. Terry Forehand, FSC and MFA went thru the items they intended to bring up.
- A1.2.10.6 Called Capt. Chitty at DFR PAC and discussed his next assignment as Deputy Commander DFSC. Also discussed Air Force plans for Waikakalaua which may include the removal of tanks and facilities using Air Force Red Horse (Construction Forces) according to Capt. Chitty. He also emphasized prevention in regards to fire protection at Red Hill.
- A1.2.10.7 Took drawings and cores to UPS for shipment to Tulsa.
- A1.2.10.8 At about 1830 Jim Gammon called at the hotel to postpone the 0800 debriefing to 0930. Made necessary calls to John Echternacht of FSC, Jennifer Kleveno of MFA and WEI personnel to inform them of the switch. Jim called again at 2130 to ask about the drawing list so he could check his returned originals.

A1.2.11 Wednesday, 11 May 1994

- A1.2.11.1 Arrived at Bldg. 427 FISC at 0900 for the 0930 debriefing. Called Allen Smith to determine the invoice amount for FSC at the completion of the site investigation and submittal of site investigation field notes. Also determined that original and one copy of notes are needed.
- A1.2.11.2 Meeting began about 0930 and ran to 1130 with attendees being LCDR Higgins, Jim Gammon, Roy Kaneshiro, Bob Riola, Masa Fujioka, Jennifer Kleveno, JoAnn West, Charlie Transue, Terry Forehand and John Rasmussen. Minutes of the meeting were taken and are separate from these notes.



A1.2.11.3 Asked Jim for listing of projects and he said he would mail us the latest list.

A1.2.11.4 After adjournment of the meeting, WEI departed from FISC, picked up luggage at hotel and Terry Forehand took John Rasmussen to the Airport for return to CONUS.

A1.2.12 Thursday, 12 May 1994

A1.2.12.1 Layover in Los Angeles.

A1.2.13 Friday, 13 May 1994

A1.2.13.1 Layover in Los Angeles on leave.

A1.2.14 Saturday, 14 May 1994

A1.2.14.1 Layover in Los Angeles.

A1.2.15 Sunday, 15 May 1994

A1.2.15.1 Returned to Tulsa.



PART A2.1
CIVIL/STRUCTURAL SITE INVESTIGATION NOTES
GENERAL

This appendix contains the Civil/Structural Site Investigation Notes recorded by Charles Transue of Willbros Engineers, Inc. from Sunday, May 1, 1994 through Tuesday, May 10, 1994. These notes address fire protection of the Red Hill Complex located on Oahu, Hawaii. The daily field notes are given in Part A2.2 of this appendix.



PART A2.2
CIVIL/STRUCTURAL SITE INVESTIGATION NOTES
DAILY FIELD NOTES

A2.2.1 Sunday, 1 May 1994

A2.2.1.1 Arrived in Hawaii.

A2.2.2 Monday, 2 May 1994

A2.2.2.1 Obtained base permit, met with Roy Kaneshiro, then toured the lower tunnel late morning.

A2.2.2.2 In the afternoon, toured Critical Infrastructure Went into Critical Infrastructure which is being cleaned.

A2.2.2.3 Made sketches of the pipes that are greater than 6" diameter and inspected the bulkhead doors.

A2.2.2.4 Oahu has been rezoned from 2 to 2B seismic by UBC. NOTE: It is 2A.

A2.2.3 Tuesday, 3 May 1994

A2.2.3.1 At morning meeting discussed plan of the day.

- 1) Determine core hole locations.
- 2) Are the bulkheads keyed into the rock as are the thrust blocks for the pipe at the bulkheads.
- 3) Electrical systems.
- 4) Fire protection systems
- 5) Drainage of tunnel by the French drain. Pump from drain is in the pumphouse.

A2.2.3.2 Toured pumphouse and tunnel with Jim Gammon. Located core holes in bulkhead.

A2.2.4 Wednesday, 4 May 1994

A2.2.4.1 Contacted Concrete Coring Company (CCC) in the morning to set up a site visit for them in the afternoon.

A2.2.4.2 Located power and water sources during tour with CCC.



A2.2.4.3 Reviewed drawings and made a list for printing to complete our portion of the study.

A2.2.5 Thursday, 5 May 1994

A2.2.5.1 Met CCC coring operator at 7:30 at [Critical Infrastructure]. Retrieved the train to haul in CCC's equipment. Started coring at 12" thick door in tunnel part of [Critical Infrastructure]. Cores are fractured in the main wall supporting the door. The wall is cracked adjacent to the setting channel.

A2.2.5.2 [Critical Infrastructure] door is plated each side of W.F., plug welded on upstream side.

A2.2.5.3 Core #3 - straight through the bulkhead, core is very light gunite.

A2.2.5.4 Core #4 - angled at the corner, hit steel plate at 6" in diagonally. Then two inches more of gunite and hit decayed timber for the remainder of the 39" core tube. Core tube was at maximum depth and still nothing. Fractures between pieces of the core are old, maximum core piece is 6" long in core hole 3.

A2.2.5.5 Core 4 maximum length is 4". NOTE: Gunite is fractured just behind the channel the door seals against.

A2.2.5.6 The diagonal core hit 1/4" thick sheet of metal, then a void full of decayed timber.

A2.2.5.7 Cored the 24" thick bulkhead downstream of the tanks, Core 5 and 6.

A2.2.5.8 Cores are porous, cut through 1" diameter rebar. The upper core at the ceiling drilled diagonally indicates that the keyway wall dug out and filled with gunite.

A2.2.6 Friday, 6 May 1994

A2.2.6.1 [Critical Infrastructure] - coring - Met at 7:30 a.m. at [Critical Infrastructure]. Loaded gear on train and went by automobile to [Critical Infrastructure]. Entered, met train at [Critical Infrastructure] bulkhead.

A2.2.6.2 Drilled cores from [Critical Infrastructure]. A 1" diameter bar was contained in the diagonal core. Void after 24" - end cores showed wood grain on it.

A2.2.6.3 Core 2 - Straightforward, 3 pieces with old breaks between core.



A2.2.7 Saturday, 7 May 1994

Non-work day.

A2.2.8 Sunday, 8 May 1994

Non-work day.

A2.2.9 Monday, 9 May 1994

- A2.2.9.1 Met with Jim Gammon at 8:00 a.m. Discussed possibility of imploding an empty tank.
- A2.2.9.2 Mr. Gammon said there was an abandoned leak detection system with telltale pipes. We have drawings of the telltale piping.
- A2.2.9.3 Packed cores in a double box and took them to UPS to ship to A. Smith.
- A2.2.9.4 Jim Gammon reiterated the need of a computer model of the complete tunnel with elevations and stations.
- A2.2.9.5 Picked up prints of tunnel drawings.
- A2.2.9.6 Visited PWC water station. Pump bases are Critical Infrastructure above the floor level.
- A2.2.9.7 There is a Critical Infrastructure on the pump bases block that needs a water-tight seal. It is now covered with a steel checked plate hinged and hasped.
- A2.2.9.8 Explored the air vent shaft and vent tunnel for the pump house which is about above the Critical Infrastructure
- A2.2.9.9 Drove up to the vent area of fuel tanks and water tank Critical Infrastructure
- A2.2.9.10 Tested drop track. Controls only work when lights are on. The clip is broken and the doors are usually tied back with a piece of rope so the door would not release even if the lights are on.
- A2.2.9.11 The seals are the originals. The doors are warped enough that a complete seal is not possible even with the wedges. A light is visible from the opposite side.



A2.2.10 Tuesday, 10 May 1994

A2.2.10.1 Sorted drawings and collated drawings.

A2.2.10.2 Had meeting to discuss debriefing meeting.

A2.2.10.3 Packaged drawings.

A2.2.10.4 Took core samples and drawings to UPS for shipment.



PART A3.1
ELECTRICAL SITE INVESTIGATION NOTES
GENERAL

This appendix contains the Electrical Site Investigation Notes recorded by Terry Forehand of Willbros Engineers, Inc. from Sunday, May 1, 1994 through Wednesday, May 11, 1994. These notes address fire protection of the Red Hill Complex located on Oahu, Hawaii. The daily field notes are given in Part A3.2 of this appendix.



PART A3.2
ELECTRICAL SITE INVESTIGATION NOTES
DAILY FIELD NOTES

A3.2.1 Sunday, 1 May 1994

A3.2.1.1 Arrived in Hawaii.

A3.2.2 Monday, 2 May 1994

A3.2.2.1 Arrived at Pearl Harbor at approximately 7:30 a.m. and received base pass.

A3.2.2.2 Meeting with Roy Kaneshiro at PACDIV. Meeting attendees are as follows:

Roy Kaneshiro	PACDIV
John Echternacht	FSC
Ken Echternacht	FSC
Masa Fujioka	MFA
Jennifer Kleveno	MFA
JoAnn Romano West	MFA
Charlie Transue	WEI
John Rasmussen	WEI
Terry Forehand	WEI
Bob Riola (part-time)	PACDIV

A3.2.2.3 Bob Riola is with the Fire Protection Safety Department. If any questions, Bob Riola will assist FSC when requested.

A3.2.2.4 Bob suggested that during the Fire Protection/Safety Study, we should talk to:

- Chief Mullins Pearl Harbor
 Fire Chief
- Mr. Rio Supervisor of Fire Inspectors
 471-3916

A3.2.2.5 John Rasmussen discussed the report outline and scope of work for each group (Fire/Safety, Environmental and Civil).



A3.2.2.6 Decided today's activities to be a group tour of **Critical Infrastructure** Red Hill lower tank area and upper tank area.

A3.2.2.7 The balance of the day was spent touring lower tunnel and Red Hill.

A3.2.3 Tuesday, 3 May 1994

A3.2.3.1 Meeting at 427 with the following:

Roy Kaneshiro
John Echternacht
Ken Echternacht
Masa Fujioka
Jennifer Kleveno
JoAnn Romano West
Charlie Transue
John Rasmussen
Terry Forehand
Bob Riola
Jim Gammon

A3.2.3.2 There is a current fire alarm system project in Red Hill. PWC is the lead department. Jim Gammon will arrange a meeting with David E. AcFalle.

A3.2.3.3 Jim explained about environmental problem outside of **Critical Infrastructure** In particular, an evaporation pit, which is not used.

A3.2.3.4 Jim Gammon will provide a leak history of the pipelines in Harbor Tunnel.

A3.2.3.5 Jim Gammon talked briefly of the tank cleaning contract and safety during construction.

A3.2.3.6 PWC maintains the fire system in Red Hill.

A3.2.3.7 Jim took the group to Pumphouse 59 for a tour and comments.

A3.2.3.8 The fire system is not connected to the pump motor shutdowns.



A3.2.3.9 The connection between the **Critical Infrastructure** and **Critical Infrastructure** is by a cable which is strapped to the lighting conduit in the tunnel.

A3.2.3.10 Jim stated that the telephone company is uncomfortable about working in the tunnel. They feel the tunnel is a Class I, Division 1 location.

A3.2.3.11 Went to **Critical Infrastructure**

A3.2.4 Wednesday, 4 May 1994

A3.2.4.1 Spent the morning at 427 reviewing drawings, procedures and planning.

A3.2.4.2 1:00-2:30 p.m. - met with David AcFalle about a current fire alarm system design in Red Hill. Meeting attended by:

John Echternacht	FSC
Terry Forehand	WEI
David AcFalle	Fuels
Mohamad Yousuf	DFSC

A3.2.4.3 Fire Alarm System project is funded by OSHA.

A3.2.4.4 There will be heat sensors placed in the ceiling of Red Hill lower tunnel from **Critical Infrastructure** **Critical Infrastructure** Upper tank level at the top of the tanks.

A3.2.4.5 Annunciator panels will be located in the **Critical Infrastructure** **Critical Infrastructure**

A3.2.4.6 The existing fire system in the **Critical Infrastructure** area will be removed.

A3.2.4.7 The system will be interfaced with the **Critical Infrastructure** During an alarm state, **Critical Infrastructure** will go to the **Critical Infrastructure**

A3.2.4.8 Had considerable discussion about the electrical power source for the lower tunnel. It was decided that Terry Forehand would look at the system on his trip to the lower tunnel.

A3.2.4.9 Discussed **Critical Infrastructure** and what it powered in the lower tunnel. It is not known what is fed from PWC water pump area.




A3.2.4.10 David thinks the MOV's on the mainline valves at **Critical Infrastructure** are powered from the PWC water pump area.

A3.2.4.11 David stated that the Harbor Tunnel has been classified a Division 1, Class II area. He suggested we talk to Mike Orlowski (474-3815), Fire Detection Engineer at PWC.

A3.2.4.12 John Echternacht asked if smoke detection was to be incorporated in with the heat detection alarm project. Answer: Smoke detection was not considered. Maintenance personnel have problems with smoke detection equipment due to malfunction and false detection of fire.

A3.2.4.13 The new heat detection project will not be connected to the existing control system.

A3.2.4.14 Mohammed suggested that the fire detection system could be incorporated into the new pollution control system installed in FY 96. Tyronne Hall at DSFC is in charge of the project, 1-703-274-6825.

A3.2.4.15 Reviewed electrical drawings of the lower tunnel and PWC water pump area in **Critical Infrastructure** 

A3.2.4.16 John Echternacht requested copies of DM-22 and NAVFAC MO-230.

A3.2.5 Thursday, 5 May 1994

A3.2.5.1 Looked at the electrical system at PWC water pump area. The water pump area is fed from two sources at 12 KV. One source is preferred, the other is alternate. Feeder breakers from the 12 KV feed the following:

- a. N1 - Pumps located outside of **Critical Infrastructure** by the slop tanks
- b. 750 KVA transformer
12 KV/2.4 KV
- c. 500 KVA Transformer
12 KV/480 V

A3.2.5.2 The 480 V and 208 V incoming power to the lower tunnel is fed from the water pump area to a large junction box by LP-13. LP-13 is located in the **Critical Infrastructure**



A3.2.5.3 From the large junction box, there are four conduits installed during the original construction. The conduits are as follows:

- a. 480 VAC fed from the water pump area
- b. 208 VAC fed from the water pump area
- c. 208 VAC fed from the breaker panel located **Critical Infrastructure** located near **Critical Infrastructure**
- d. 480 VAC fed from the breaker panel located **Critical Infrastructure**

A3.2.5.4 The **Critical Infrastructure** are fed from the large junction box. Could not determine if this feed is connected to the 480 V feed to or from the gauger station. The **Critical Infrastructure**

A3.2.5.5 The 480 V feed to the **Critical Infrastructure** located by **Critical Infrastructure** are from a junction box located by the sump. Could not determine if this feed is connected to the 480V feed to or from the gauger station.

A3.2.5.6 The **Critical Infrastructure** located by **Critical Infrastructure** is feed from the breaker panel between **Critical Infrastructure**. This valve is from the original construction.

A3.2.5.7 The 2400 V feed to the electrical system installed during the **Critical Infrastructure** **Critical Infrastructure** is from the power panel located in the transformer room across from the gauger station. This feed goes through the bulkhead and up the **Critical Infrastructure**.

A3.2.5.8 The feed for the **Critical Infrastructure** is fed from a new breaker installed on its electrical system. The conduit feed is through the old elevator shaft into a breaker panel located in the **Critical Infrastructure** then from this breaker panel to the fan in the **Critical Infrastructure**.

A3.2.5.9 Looked at the top of **Critical Infrastructure**

A3.2.6 Friday, 6 May 1994

A3.2.6.1 Went to **Critical Infrastructure** with John Rasmussen and Charlie Transue to meet with the concrete coring contractor.



A3.2.6.2 Looked at the door solenoid at Critical Infrastructure This solenoid could possibly be 120 V and feed from the receptacle and light feed to the tunnel.

A3.2.6.3 Took drawings to Honolulu Blueprint.

A3.2.6.4 Looked at door solenoid at Critical Infrastructure Model #GE CR95006100A2A.

A3.2.6.5 Reviewed drawings, discussed plans for next week and did project paper work.

A3.2.7 Saturday, 7 May 1994

Non-working day.

A3.2.8 Sunday, 8 May 1994

Non-working day.

A3.2.9 Monday, 9 May 1994

A3.2.9.1 Meeting with Bob Rio, Fire Chief for Inspection, also attended by John Echternacht and myself.

A3.2.9.2 Red Hill is inspected by an assigned inspector once a month. The inspector makes a visual inspection of the area and fire equipment such as fire extinguishers.

A3.2.9.3 Each area has a building warden who is in charge of sign off on fire extinguishers.

A3.2.9.4 John Echternacht asked and received a form which the fire inspector would use during inspection.

A3.2.9.5 Bob suggested we talk to Leo Larson (PWC, 474-0478) about testing and maintenance of fire alarm system.

A3.2.9.6 Meeting with Chief Gonzales and Chief Mullins (Fire Chiefs at Pearl Harbor). Chief Gonzales is the operational side of the fire department.

A3.2.9.7 Discussed how the fire department would respond to a fire in Red Hill.

A3.2.9.8 They do one drill per year at Red Hill.



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- A3.2.9.9 Chief Mullins indicated that communications would be a problem in Red Hill.
- A3.2.9.10 Fire department depends on the fuels department for equipment within Red Hill. If equipment is not available, then the fire department provides the correct equipment during the fire.
- A3.2.9.11 Fire department will react to the fire and situation.
- A3.2.9.12 Chief Mullins indicated that it would be helpful to have a foam tank at the lower tank area.
- A3.2.9.13 Went to 427 to review drawings and start working on joint recommendations with John Echternacht.
- A3.2.9.14 Fuels department did a simulated test on the door at Critical Infrastructure It seemed to work properly mechanically. The float assembly which energized the solenoid was not in operation.
- A3.2.9.15 The solenoid to operate the door is 120 VAC. The solenoid protective circuit is fed from a switch located near the door.
- A3.2.9.16 The light and receptacle circuits are usually turned off when personnel are not in the tunnel area.
- A3.2.9.17 Look at the Critical Infrastructure above ground.

A3.4.10 Tuesday, 10 May 1994

- A3.4.10.1 Worked on report, especially electrical power.
- A3.4.10.2 Discussed possible recommendations with John Echternacht.
- A3.4.10.3 Called Curtis Naborikaua (474-0387) about electrical feed to pumphouse. Only one feed.
- A3.4.10.4 Meeting with project team on debriefing meeting for 11 May 1994.

A3.4.11 Wednesday, 11 May 1994



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- A3.4.11.1 Debriefing meeting was held at Building 427 with PACDIV, Fuels and study team. Items discussed during the meeting are listed below.
- A3.4.11.2 The bulkheads were discussed and Charlie Transue gave a brief description of what he found during the coring.
- A3.4.11.3 The water/oil-tight door at Critical Infrastructure would not close completely. Discussed possible new type door.
- A3.4.11.4 Fire/Safety items were discussed and listed below.
- a. Housekeeping in the tunnel and lower tank area. Trench for drainage to the sump needs to be cleaned. Fuel leaks in the valve gallery area.
 - b. Lack of preventive maintenance program.
 - c. How the facility is controlled and monitored. ESD system to be added, monitor tank level hourly, tank level alarm on decreasing level with valves closed, and visual monitoring of the area.
 - d. Fire communication system, similar to one installed in high rise buildings.
 - e. Meeting with Chief Mullins.
 - f. Addition of fire fighting systems, including automatic systems.
 - g. The current project on fire detection.
 - h. Addition of life safety items such as air packs, emergency listing, etc.
 - i. Different types of fire suppression in the lower tank area.
 - j. Coordination with fire department.
- A3.4.11.5 Environmental:
- a. Overall leak protection
 - b. Secondary containment of a leak
 - c. Grouping of tanks for secondary containment



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- d. Possible pumping from top of tanks
 - e. Testing of the trench to the sump area

A3.4.11.6 Prepared for return trip to Tulsa.



PART A4.1
FSC SITE INVESTIGATION NOTES
GENERAL

This appendix contains the FSC Site Investigation Notes recorded by John Echternacht and Ken Echternacht of Fire Safety Consultants from Monday, May 2, 1994 through Wednesday, May 11, 1994. These notes address fire protection of the Red Hill Complex located on Oahu, Hawaii. The daily field notes are given in Part A4.2 of this appendix.

REGIONAL STUDY OF
MILITARY BULK POL DISTRIBUTION SYSTEMS
CONTRACT N62742-89-C-0069

SITE INVESTIGATION PLAN FOR
RED HILL COMPLEX
FIRE AND LIFESAFETY RISK ASSESSMENT/ANALYSIS

DAILY SURVEY NOTES
FIRESAFETY CONSULTANTS

John E. Echternacht, P.E.

Monday, May 2, 1994

The field survey team consisted of John Echternacht, President and Kenneth Echternacht, Associate. We met team members from Willbros Butler Engineers, Inc.: John Rasmussen, Charles Transue, and Terry Forehand; meeting at 7:30 A.M. at the Nimitz gate house to obtain passes for the duration of the field investigation.

We then proceeded to a meeting with Roy Kaneshiro, Project Design Engineer (PDE) and Bob Riola, Fire Protection & Safety. There was a brief introduction to the project and discussion about schedules.

It should be noted that Terry Forehand, Electrical Engineer with Willbros Butler Engineers has been assigned to the fire protection group to provide technical input regarding evaluation of electrical systems/equipment as a source of ignition and potential hazards as well as review the existing emergency power sources/lighting.

At approximately 9 A.M. we met with team members from Masa Fujioka & Associates: Masa Fujioka, Jennifer Kleveno, and JoAnn West. After a short initial meeting we spent the rest of the day conducting an introductory tour of the facilities.

The tour was started at Critical Infrastructure we quickly went through the Critical Infrastructure and then toured Critical Infrastructure. After lunch we resumed the tour at the Red Hill facility by

entering at **Critical Infrastructure** We went down and walked through the lower access tunnel to the entrance to the Harbor Tunnel, to the **Critical Infrastructure** and through the upper access tunnel.

The entire first day was one of familiarization; discuss project overview; walk through the facility to get a feel for the hazard areas and overall site operations.

The fuel storage facility at Red Hill consists of **Critical Infrastructure** constructed in subterranean vaults hollowed out of rock. Each vault has the form of a vertical cylinder closed top and bottom by hemispherical domes. The diameter of each tank is **Critical Infrastructure** and the overall height from bottom to top is **Critical Infrastructure** the capacity of each tank is approximately

Critical Infrastructure

The **Critical Infrastructure** at Red Hill are located **Critical Infrastructure**

Critical Infrastructure

Critical Infrastructure

There are **Critical Infrastructure**

The upper tunnel is near the dome area of each tank and the lower tunnel has its floor about **Critical Infrastructure** the tank bottoms. Both the upper and lower tunnel have short spur tunnels which branch to a

Critical Infrastructure

The upper tunnel extends from **Critical Infrastructure** approximately

Critical Infrastructure There is a **Critical Infrastructure**

A bulkhead separates **Critical Infrastructure** **Critical Infrastructure** from the remainder of tanks. This bulkhead has a man door for egress from one area to the other. There are **Critical Infrastructure** which travels

from the upper tunnel level to the lower tunnel level. These **Critical Infrastructure** must be used to get from the lower tunnel on one side of the bulkhead to the lower tunnel on the other side.

The more **Critical Infrastructure** has explosion proof equipment and machinery, and has a vestibule at each tunnel level for the protection of workers while waiting for the elevator in case of fire or other emergency.

Approximately **Critical Infrastructure** down from the upper tunnel level there is a tunnel providing primary access to the area containing **Critical Infrastructure** this tunnel leads to **Critical Infrastructure** The elevator in this section of tanks provides the **Critical Infrastructure** from the **Critical Infrastructure**

At the upper access tunnel level there is **Critical Infrastructure** **Critical Infrastructure**

On top of each tank there is an opening through a steel cover manhole in which there is a smaller hole for tank gauging.

The lower tunnel extends from the tanks approximately **Critical Infrastructure** to the Receiving Pumphouse. There are **Critical Infrastructure** in the lower access tunnel: **Critical Infrastructure** carrying diesel fuel marine; **Critical Infrastructure** carrying JP-5 jet fuel; **Critical Infrastructure** carrying diesel fuel marine.

About **Critical Infrastructure** from the **Critical Infrastructure** which branches from the main tunnel and provides a shorter approach from a portal in the **Critical Infrastructure**. At the junction of the main tunnel and the lower access tunnel, there is a pumping plant operated by Public Works (PWC). This pumping plant, with deep wells in the lava rock, provides a part of the fresh water reserve supply for the Naval Base. At this location there is **Critical Infrastructure**. Within the **Critical Infrastructure** there is a 6 inch water line providing fire protection water to the upper and lower access tunnels. A 500,000 gallon, above ground, concrete water tank provides the water supply.

At the PWC water pump station the lower access tunnel branches in a Y to form the harbor tunnel. The harbor tunnel is approximately **Critical Infrastructure** and terminates at the **Critical Infrastructure**. **Critical Infrastructure** is the **Critical Infrastructure** to the **Critical Infrastructure**. There is a **Critical Infrastructure** entrance to the **Critical Infrastructure** through **Critical Infrastructure** which intersects at **Critical Infrastructure**.

Tuesday, May 3, 1994

Attended meeting at 9:00 A.M. in Building 427 with James Gammon, Superintendent, NSC Fuel Department. Jim started the meeting by providing a background of events/concerns which led to this specific study.

In the early 1960's the area housing tank **Critical Infrastructure** at the Red Hill complex was converted for the storage of AVGAS.

As such all equipment was converted to explosion proof, Class I, Division 1 rating. Also a 22 ton Cardox low pressure carbon dioxide system was installed to provide total flooding fire protection for this area.

However, the tanks were never used for storage of AVGAS and in the 1980's, due to concern for personnel as well as system leaks and inadvertent discharges, the CO2 system was emptied and taken out of service. The only remaining fire protection for the storage tank area consists of portable fire extinguishers and 1/2 inch hydrant (valve outlets) from the installed water line for manual firefighting.

In July 1983 Bill Garrison, M & M Protection Consultants, conducted a risk analysis for fire protection in the underground pump house, Building 59. As a result of this

study an extensive list of recommendations was developed requiring fixed fire suppression for this facility. In 1987 a project was initiated to implement most of these recommendations by installing a fixed aqueous film forming foam (AFFF) system throughout the pump house, thermal and ultra violet (UV) detection systems for actuation of the foam system, and a Halon 1301 system for protection of the control room, calibration room, cable room, and transformer room.

After the meeting the group toured the pump house and the respective tunnel and storage tank areas. When in the pump house control room it was noted that there is a switch on the **Critical Infrastructure** to manually close the drop track door at **Critical Infrastructure**. Jim Gammon also pointed out that an interface relay box was installed above the central control panel to allow isolation of the fire suppression systems for maintenance/testing purposes.

When touring the tunnels it was noted that motor operated (MOV) block valves for isolating the fuel pipelines are installed at **Critical Infrastructure** intersection **Critical Infrastructure** **Critical Infrastructure** and lower access tunnel), and just below the **Critical Infrastructure**

The volume of fuel which could be trapped in the fuel pipelines between the Receiving Pump House and the first tank at Red Hill is as follows:

Critical Infrastructure

Further, fuel could be trapped in the piping between **Critical Infrastructure** **Critical Infrastructure** as follows:

Critical Infrastructure

There would be a total of **Critical Infrastructure** **Critical Infrastructure** that could contain trapped fuel.

Jim Gammon noted that JP-5 fuel can be used as a substitute for diesel fuel, but that diesel cannot be substituted for JP-5.

When asked about normal occupancy levels in the tunnels, Jim Gammon responded that the tunnels are normally unoccupied; during periods of maintenance there would be 1 - 2 persons; however, tour groups periodically go through the Red Hill complex; e.g., members of the Navy League, POL conferees, and other groups. The tour groups enter **Critical Infrastructure** go through the **Critical Infrastructure** look into **Critical Infrastructure** then exit the facility. The groups don't use the **Critical Infrastructure** or go through the lower access tunnel.

The greatest concern for a fire potential is when work is being performed in the tunnel complex by outside contractors; primarily work that requires cutting and/or welding (hot work), pulling pipe apart, and cleaning of the tanks. A "hot work" permit is required on a daily basis, and an inspection of the area/equipment is also required by a certified gas inspector or marine chemist.

Communications in the tunnel sections is poor; previously used telephone handsets supplied by Hawaiian Bell, but telephone company wanted to charge for each phone jack as if it was a separate appliance. Due to potential hazard in the tunnel (potential for generation of sparks) telephone company wanted all equipment to be Class I, Division 1 rating. This system is not currently utilized.

It should be noted that a Willbros Butler Engineers' study conducted 8/92 classified the Harbor Tunnel as a Class I, Division 2 area from the floor to a 2 foot height above the floor. The balance of the tunnel is considered to be a non classified area. Furthermore, Critical Infrastructure

Critical Infrastructure

Critical Infrastructure is Class I, Division 2 three feet around the valve down to the floor. This classification also remains valid.

The 1992 study also classified the floor trench that runs the length of the lower access tunnel (tank storage area) is Class I, Division 1. The area adjacent to the floor trench is Class I, Division 2 for 18 inches above floor level and 10 feet in all directions.

The Critical Infrastructure is a Class I, Division 1 location due to the sump being below grade. The area 18 inches above grade and 25 feet in all direction is a Class I, Division 2 location. Equipment installed in the sump area is Class I except for the telephone set.

In my personal opinion the classifications as described above are still valid.

The Critical Infrastructure is protected by an AFFF deluge system, as is pumphouse 59. The remainder of the tunnel (harbor tunnel, lower access tunnel, and the upper access tunnel) does not have any form of fixed fire suppression. The only fire protection consists of manual firefighting equipment: portable fire extinguishers and water lines supplying hydrants/valved outlets. There is a skid mounted twin agent unit installed on a rail car and is located at the Critical Infrastructure of tunnel at the PWC water pump station. This unit consists of a 500 lb. Purple K dry chemical tank, a 100 gallon premixed

AFFF tank, nitrogen tanks for agent discharge, and a hose reel with twin agent nozzles. This unit is available for emergency use, but is primarily used for backup fire fighting purposes by outside construction crews; positioned with the work crew as part of the firewatch equipment.

Water supply for the tunnel complex comes from a 500,000 above ground concrete storage tank located adjacent to the Critical Infrastructure for Critical Infrastructure. It provides a 6 inch supply line to the upper and lower access tunnels; the water line in the Harbor Tunnel varies from 6 inch from the pumphouse to the Makalapa Adit, then 20 inch line leading to the 32 inch PWC potable water line.

All fire suppression systems at the Red Hill complex are inspected by the Federal Fire Department and maintained by the PWC.

Wednesday, May 4, 1994

The morning period was spent in Building 427, reviewing engineering drawings, documents, and obtaining additional background regarding the Red Hill facility from Fuel Department personnel.

At 11:00 A.M. we took a brief tour of the foam pump house (bldg. 1721) and the upper tank farm located above Critical Infrastructure. Within the pump house there is Critical Infrastructure. Critical Infrastructure fire pump, Critical Infrastructure jockey pump, Critical Infrastructure pump controllers, and balanced pressure proportioning Arr system for protection of Critical Infrastructure in the Critical Infrastructure. Critical Infrastructure. The foam proportioning system has both an electric driven and diesel foam pump. A Critical Infrastructure concentrate tank, manufactured by Critical Infrastructure is located in a separate building (bldg. 1613).

At 1:00 P.M. Terry Forehand and John Echternacht met with David Acfalle, Project Engineer, to discuss Construction Contract No. N62471-89-C-2416, "Provide Fire Alarm System, Red Hill POL Fuel Storage Facilities". Project design was contracted to Leung & Pang Associates, Honolulu. Mike Orłowski, fire protection engineer, PWC, provided engineering review. The project has been approved, but will not be funded until FY 1995. Design is completed, specifications prepared, but not yet out for bid.

We discussed conceptual design, reviewed the project drawings and specifications, and discussed in general the current study that is in process. New panels will be located at the gauger

station and at **Critical Infrastructure** for fire department response; the signal will be transmitted by radio frequency. The existing thermal detection system installed in the new tank section is not in service. The fire alarm upgrade is to provide notification of an emergency fire condition for personnel in the upper and lower access tunnels at the storage tank location. **Critical Infrastructure**

Critical Infrastructure and will also have a manual override switch. There is no fan shutdown as part of this project. It has been proposed by PWC that consideration be given for the following:

Critical Infrastructure

Toward the end of the meeting Mohamad Yousuf, General Engineer, DFSC Headquarters, joined us for further discussions.

Thursday, May 5, 1994

At 8:30 A.M. I entered **Critical Infrastructure** to begin a tour of the lower access tunnel. The existing thrust block in the main tunnel is located approximately **Critical Infrastructure**. This represents a possible location to install a new bulkhead to provide fire separation and containment of fuel release from the storage tank area.

As I walked through the storage tank area I noted the current classification of fuel stored in each respective tank as follows:

Critical Infrastructure

Note: **Critical Infrastructure** is out of service

In the valve gallery for **Critical Infrastructure** there is a **Critical Infrastructure** transformer; **Critical Infrastructure**. The dimension of the valve gallery is approximately **Critical Infrastructure**.

I continued on to the gauger station, then took the **Critical Infrastructure** up to tour the upper access tunnel, the **Critical Infrastructure** took the **Critical Infrastructure** down to **Critical Infrastructure** inspected the Cardox 22 ton low pressure system (the tank has been emptied and the system taken out of service), went on down to the new section lower access tunnel, inspected self-closing doors between each zone, looked at bulkhead between new and old section, then took the **Critical Infrastructure** back up to the upper tunnel, and then the **Critical Infrastructure** down to the lower access tunnel, and exited the

facility back at Critical Infrastructure

It should be noted that all designated air mask stations the self contained breathing equipment has been removed. Discussion with Jim Gammon indicated that the equipment was ordered to be removed by the Safety Department after the CO2 system was taken out of service.

Friday, May 6, 1994

All day Friday was spent in Building 427 continuing with document review and additional data collection.

One of the document packages reviewed was NAVFAC Specification No. 14-88-2343, "Replace Red Hill Water Line at Red Hill", Sept. 16, 1988. It should be noted that during previous walkdowns of the tunnel complex it was observed that a Cla-Val pressure reducing valve was installed in the new 6 inch water line in the tunnel adjacent to the PWC water pump station; the pressure on the water pump station side was approximately 270 psi and the pressure on the downstream side was 120 psi. It was also noted that the old 6 inch water riser in Critical Infrastructure is still in place, but has been taken out of service by the installation of a Wedgevalve installed in Critical Infrastructure

Critical Infrastructure

Monday, May 9, 1994

Terry Forehand and John Echternacht met at 8:00 A.M. with Chief George Rio, Chief Fire Inspector, Fire Prevention Division, Federal Fire Department. The purpose of the meeting was to discuss fire inspections conducted by the Fire Department for the Red Hill fuel storage facility. The inspections are conducted on a monthly basis and are visual only; they check to assure equipment is in place, available for use, and in working order. The inspectors complete Federal Fire Department Inspection Notice (form PH-NAVSTA-11320/1, Rev. 11-81). This form provides a brief description of fire hazards and actions required to correct stated fire hazards. Inspection reports are turned in to the Fire Warden for the facility (Fuel Department Foreman) for information and completion of more detailed inspection of equipment and/or correction of deficiencies.

Chief Rio indicated that maintenance of fixed fire protection systems (fire suppression and fire alarm) is conducted by PWC. The primary contact is Leo Larson, Supervisor. We tried to reach him to schedule a meeting, but he was not at work today.

Chief Rio then introduced us to Chief James D. Mullins, Fire

Chief, and Chief Larry Gonzalez, Head of Operations. We briefly discussed normal response to a fire alarm from Red Hill; after receipt of a telephone call from the facility (there is no direct Fire Department connection). The fire department would respond with 2 engine companies (2 - 1000 gpm pumpers) and 1 ladder company (1 - ladder truck). They will enter the facility at the specific Critical Infrastructure indicated by Red Hill personnel. Upon arrival at the facility the fire department will take command of the fire emergency. The department has 100 people on duty at all times.

The fire department recognizes that the storage tank areas and upper and lower access tunnels have no fixed protection; therefore they will respond with hose packs, self-contained breathing apparatus, and foam supply. Each truck carries 4 breathing sets plus 3 - 30 minute air bottles and the ladder truck carries additional required emergency equipment (i.e., extra air bottles, Jaws of Life, etc.). The department has a foam truck with 1000 gallons of 3% AFFF (they converted from 6% to 3% AFFF concentrate several years ago). In addition the department has approximately 6,000 gallons of 3% AFFF concentrate in a warehouse.

Chief Mullins indicated that the department conducts an annual simulated fire drill at Red Hill to exercise their personnel on various fire scenarios. The Chief indicated that he would like to see Red Hill fitted with dedicated self-contained breathing units located at the major Adits for use by arriving emergency personnel.

At 9:00 A.M. we met with Mike Orlowski, Fire Protection Engineer, PWC, and Glenn Sunakoda, Electrical Engineer, PWC. The purpose of the meeting was to obtain additional background regarding the fire alarm upgrade project for the tank storage area. This project has been approved, but not yet funded. Therefore, if recommendations from the current study require changes to the initial design, such changes can most likely be incorporated.

We also discussed electrical classification for the Harbor Tunnel and portion of the lower access tunnel below the storage tank area; Mike indicated that he felt the tunnel area should be unclassified (agreeing with the professional opinion of both Terry Forehand and John Echternacht).

At 1:00 P.M. we entered Critical Infrastructure to witness a test of the drop track door in the lower access tunnel. On the way to the door test we briefly inspected the PWC water pump station. Those in attendance during the afternoon inspection were: J. Gammon, J. Rasmussen, C. Transue, T. Forehand, and John Echternacht. The inoperative float valve was manually actuated (initiated fan shutdown) and the door was manually released. The drop

track operated successfully and the door closed. However, a slight gap was noted at the upper left hand side of the door due to slight warpage of the door. In this condition the door is not considered to be liquid tight. The drop track was reset and the fan restarted after the test.

The group then briefly inspected the **Critical Infrastructure** **Critical Infrastructure** and the above ground 500,000 gallon water storage tank.

Tuesday, May 10, 1994

The morning period was spent reviewing field notes to assure that all required documents had been collected and to begin preparing summary notes for final debriefing meeting to be held Wednesday morning.

At 1:00 P.M. I conducted a final walkdown of the tunnel complex. I entered at **Critical Infrastructure** briefly inspected the PWC water pump station, and walked through the lower access tunnel to the storage tank area.

I returned to Building 427 and spent the remainder of the afternoon making telephone calls. I contacted Jim Claffey, Concrete Core Drilling Company, telephone 545-4222, and Kevin at National Concrete Sawing Company, telephone 839-7406, to request budget quotations for drilling a 36 inch diameter opening in the 4 foot thick bulkhead at the lower access tunnel between the old and new sections of tank storage. Both companies indicated that they would send quotes by Fax to my office in Houston.

I also spoke briefly to Richard Leung, Leung & Pang Associates, telephone 522-1866, regarding the Fire Alarm Upgrade project. I contacted Kevin Kelly, Operations Manager, Hawaii Instrumentation & Controls, telephone 531-3595, regarding their background work in Navy projects; Kevin referred me to their fire protection manager, Donald Horseley, who was not available at the time. This company represents and installs Cerberus/Pyrotronics and Notifier fire alarm equipment.

My final call was to Bob Riola, PACDIV fire protection and safety, to see if we could set up a conference call with Joe Condlin. Joe is still out on health leave and would not be available for discussions until his return on June 6.

Wednesday, May 11, 1994

The entire project team assembled in LCDR Higgins' office at

9:30 A.M. for our final debriefing meeting. The summary of my presentation is as follows:

Fire Protection/Lifesafety

Housekeeping Lower access tunnel, trench; contains considerable accumulation of fuel residue and needs to be thoroughly cleaned. Floor around outlet valves in tank valve gallery shows periodic fuel spill/leakage and needs to be cleaned.

Preventive Maintenance Numerous devices, e.g., drop track doors, door releases, float valve mechanism have not been properly maintained and were found to be inoperable. This area needs improved attention. In addition it is recommended that more frequent monitoring of tank levels be conducted; i.e., on an hourly basis rather than once per shift. Also Operations personnel should conduct periodic walk throughs of the tank storage area to receive early notification of a problem area.

Fire protection system maintenance is conducted by PWC on a monthly and semi annual basis. This covers fire suppression and fire alarm equipment systems. However, during interviews with PWC personnel, it appears that special hazard systems such as the UV flame detection system has never been properly serviced. Also the AFFF concentrate should be sampled on an annual basis and there was no evidence that this is being done. Consideration should be given to bring in an outside contractor on an annual basis with expertise in these specific areas.

Fire Dept. Fire department personnel are familiar with the facility. They conduct an annual simulated fire drill. However, I did not see evidence during my interview process of prepared Pre-Fire Plans indicating response to different fire/emergency scenarios. This needs to be put into place. Also communications in the Red Hill complex are of major concern. At present there is only limited capability. The fire inspectors conduct monthly visual inspections of the fire equipment to assure that it is in place and appears to be functioning. They prepare a written report of

their observations and any deficiencies which is turned over to the Fire Warden (Fuel Dept. Superintendent) to provide a more detailed follow on inspection and correct any deficiencies.

Manual
Firefighting

The Fuel Department is relying too much on outside support from the fire department. In a fire emergency the Federal Fire Department must respond with all needed firefighting equipment; fire hose packs, foam concentrate, self contained breathing equipment, etc. The only equipment on-site are portable fire extinguishers. Red Hill requires the installation of fire hose stations, 150 lb. Purple K wheeled fire extinguishers, and dedicated self contained breathing apparatus for their own personnel.

Egress

There is only one method of egress from the lower tank level in the new tank section; **Critical Infrastructure** It is strongly recommended that a secondary method of egress be provided by installing a mandoor in the lower bulkhead separating the 2 sections.

As noted above, self contained breathing equipment should be provided to allow personnel in the complex breathable air during the evacuation period. Dedicated units should be provided in the gauger station. **Critical Infrastructure**

Critical Infrastructure and at **Critical Infrastructure**

Critical Infrastructure

Emergency
Lighting

There is a major concern regarding the electrical power feeds to the tunnel complex. A secondary power supply is needed and the following equipment should be connected to an emergency generator: emergency lighting, exit lights, fire alarm panels, elevators. There is also a need for illuminated exits lights to be installed throughout strategic areas of the tunnel complex.

Fire
Separation

There is a major concern about the adequacy of the existing drop track doors; specifically, their structural integrity, if they are water tight, and the fact that they are not fail safe in their closure. The solenoid for automatic release is normally de-energized and must receive power to operate. Upon power failure the doors will not close. Also it was discovered that the release circuit is

connected to the lighting circuit. Therefore, when the tunnel lights are turned off there is no power to the solenoid.

It is also recommended that additional separation be provided in the lower access tunnel; at the area below

Critical Infrastructure

Critical Infrastructure

The **Critical Infrastructure** are supported on unprotected steel racks; consideration should be given to the application of sprayed on or painted fireproofing material.

Fire Suppression

There is no fixed fire suppression systems in the tank storage area. The highest hazard is to be found in the lower access tunnel at the valve gallery areas. It is recommended that a fixed suppression system be installed (zoned AFFF deluge system) at the lower tank storage area. This system will be automatically actuated by thermal detection (presently part of the Fire Alarm Upgrade project). Detection design will be required to be modified to accommodate needed system actuation.

Ventilation

The ventilation system will need further review to assure adequate ventilation for the lower tank storage area if additional separation is provided.

Summary

Overall the Fire Protection Program appears to be very fragmented. There is currently multiple areas of responsibility as noted:

Inspection	-	Federal Fire Department Fuel Department, Fire Warden
Maintenance	-	PWC
Engineering	-	PACDIV PWC Fuel Department
Firefighting	-	Fuel Department Federal Fire Department

The Fuel Department (FISC) needs to assume a stronger more centralized role in overall responsibility for the Fire Protection Program.

ATTACHMENT A

DOCUMENTS/DRAWINGS REVIEWED

1. "Calculations for Conversion of POL Storage Facilities", prepared by Earl and Wright Consulting Engineers, April 1, 1960.
2. "Operation and Maintenance Manual, Fire Protection Systems, Upper Tank farm and U.G. Fuel Pumphouse, Bldg. 59", Volumes I through VI, by W.A. Hirai & Associates, October 1990.
3. Fuel Department Instruction 11320.1F, "Fuel Department Master Fire Bill", Code 700, Amend 3.
4. Cardox Division of Chemetron Corp., drawings FD-43721 through FD-43724, "Low Pressure Carbon Dioxide System for POL Storage Facility", Job No. 12359, 1/20/61.
5. NAVFAC Specification No. 14-88-2343, "Replace Red Hill Water Line at Red Hill", Sept. 16, 1988.
6. NAVFAC Specification No. 14-89-24-16, "Provide Fire Alarm System, Red Hill POL Fuel Storage Facilities", August 25, 1993.
7. Drawings related to NAVFAC Specification No. 14-89-24-16, drawing nos. 7479814 through 7479820.
8. "Manual for Operation and Maintenance of Aviation Fuel Systems", Volumes 1 - 3, prepared by Earl and Wright, August 1962.
9. Project description and sketches (Sheets 1 - 9) for project no. EC1-84, "Install Emergency Generator, Red Hill", dated 18 Nov. 92.
10. Drawings for AFFF system for protection of Critical Infrastructure drawing numbers SK-8753, SK-8754, and SK-8755, prepared by Goss Fire Protection, Forest, Mississippi.

REGIONAL STUDY OF
MILITARY BULK POL DISTRIBUTION SYSTEMS
CONTRACT N62742-89-C-0069

SITE INVESTIGATION PLAN FOR
RED HILL COMPLEX
FIRE AND LIFESAFETY RISK ASSESSMENT/ANALYSIS

DAILY SURVEY NOTES
FIRESAFETY CONSULTANTS

Kenneth L. Echternacht, Ph.D., P.E.

Monday, May 2, 1994

The field survey team consisted of John Echternacht, President and Kenneth Echternacht, Associate. We met team members from Willbros Butler Engineers, Inc.: John Rasmussen, Charles Transue, and Terry Forehand; meeting at 7:30 A.M. at the Nimitz gate house to obtain passes for the duration of the field investigation.

We then proceeded to a meeting with Roy Kaneshiro, Project Design Engineer (PDE) and Bob Riola, Fire Protection & Safety. There was a brief introduction to the project and discussion about schedules.

At approximately 9 A.M. we met with team members from Masa Fujioka & Associates: Masa Fujioka, Jennifer Kleveno, and JoAnn West. After a short initial meeting we spent the rest of the day conducting an introductory tour of the facilities.

The tour was started at Critical Infrastructure we quickly went through the receiving pump house, and then toured the Harbor Tunnel. After lunch we resumed the tour at the Red Hill facility by entering at Critical Infrastructure. We went down and walked through the lower access tunnel to the entrance to the Harbor Tunnel, to the Critical Infrastructure and through the upper access tunnel.

Tuesday, May 3, 1994

Attended meeting at 9:00 A.M. in Building 427 with James Gammon, Superintendent, NSC Fuel Department.

Following the meeting, the group made a second inspection tour of the underground facility under the direction of James Gammon. The group entered the facility at the lower pump house. The facility was examined for in place fire protection and existing electrical. Following the pump house inspection, the group walked the Harbor Tunnel to

Critical Infrastructure At that location the integrity of the fuel tight door was examined. The tour then proceeded up tunnel to approximately Critical Infrastructure The inspection team exited Critical Infrastructure

The next section inspected was the Lower Access Tunnel. The group entered the facility at Critical Infrastructure then proceeded to the lower level of the Red Hill facility. Inspections included the fuel tight door at the junction of the Critical Infrastructure access tunnel and at the junction of the Harbor Tunnel and Lower Access Tunnel. At the Red Hill facility, the new area-- Critical Infrastructure Critical Infrastructure were inspected at the lower level. At the upper level, the interior of Critical Infrastructure was inspected.

Following the sight inspection the group returned to Building 427. As Built and construction drawings for the facility were examined and those needed by various team members were flagged for reproducing.

Wednesday, May 4, 1994

At 1:00 P.M. Terry Forehand and John Echternacht met with David Acfalle, Project Engineer, to discuss Construction Contract No. N62471-89-C-2416, "Provide Fire Alarm System, Red Hill POL Fuel Storage Facilities". We discussed conceptual design, reviewed the project drawings and specifications, and discussed in general the current study that is in process. Toward the end of the meeting Mohamad Yousuf, General Engineer, DFSC Headquarters, joined us for further discussions.

The afternoon was spent finishing the selection of drawings. The drawings selected for documenting the hydraulics subsection of the fire protection section included: 294005 Critical Infrastructure, 293986 Critical Infrastructure 294161 Underground Fuel Storage dated 5/25/42, 293905 General Plan and Profile of Pipe Line Tunnel dated 4/7/41.

Thursday, May 5, 1994

At approximately 8:00 a.m. we assembled at Critical Infrastructure Kenneth Echternacht proceeded Critical Infrastructure
Critical Infrastructure The section of tunnel was inspected from hydraulic flow considerations. I.e., tunnel wall conditions were inspected so as to afford closer parameterization of side wall friction coefficients to be used for the numerical model of the failure estimate.

During the afternoon, inspection of facility drawings was continued and the final selection made. No additional drawings other than the list given above were needed for the hydraulics subsection part of the study.

Friday, May 6, 1994

The initial numerical analysis was run to examine the following:

1. Potential flow velocity and volume resulting from a worst case tank failure--open channel flow following spill. The model was run for a fully wetted tunnel and included estimates of flow velocity and Q.
2. Potential worst case scenario: uncontrolled spill through a ruptured pipe. Case study examined--Critical Infrastructure rupture from lower elevation pipe connection. The case of a free discharge through an open orifice at the bottom elevation of the tank. The following were modelled: stream velocity and Q through the open orifice, head loss due to turbulence at the opening, and time to empty tank.



PART A5.1
MFA SITE INVESTIGATION NOTES
GENERAL

This appendix contains the MFA Site Investigation Notes recorded by Masa Fujioka of Masa Fujioka and Associates, Inc. from Monday, May 2, 1994 through Friday, May 13, 1994. These notes address fire protection of the Red Hill Complex located on Oahu, Hawaii. The daily field notes are given in Part A5.2 of this appendix.

PART A5.2

ENVIRONMENTAL DAILY FIELD NOTES

A 5.2.1

Monday, May 2, 1994

A 5.2.1.1 Kick off Meeting at 8:00 a.m. with Willbros Butler Engineers (WB), Fire Safety Consultants (FSC), and Masa Fujioka & Associate (MFA), USN representative Roy Kaneshiro made introductions but did not attend the meeting. WB presented review of site background, schedules, and scope of work. We review MFA responsibilities in respect to the environmental aspects of the study.

A 5.2.1.2 At 9:20 we adjourn to begin our site reconnaissance of the Red Hill tunnel starting at Pearl Harbor. In front of is a large metal grate covering a concrete lined pit containing several pipes. This is the sump area where the drains located in the floor of the tunnel discharge. There is a slight product odor coming from the pit and a slight flow of air.

A 5.2.1.3 The entrance consists of a large metal gate in the side of a tuff outcrop. John Rassmussen unlocks the gate and we enter a large tunnel with clean concrete floor and walls. Continuing into tunnel and passing through a heavy door, we enter the Pearl Harbor control room. The control room has 9"x9" vinyl tile floor (possible asbestos tile), a large map of the tunnel on one wall, fire safety alarms and equipment, control panels, work station, and various other unknown equipment. A large window in the control room looks out into the pump room. Access to the pump room is located through a door in the control room. The pump room is a large noisy room (pumps) with a metal grate floor in the center and a concrete floor on two adjacent sides. Fire safety equipment is noted on the ceiling. Pipes run under the grate floor and up into the main room. Most pipes are labeled either diesel or JP-5. At one end of the room is a metal stairway giving access to the lower part of the room and to the Harbor Tunnel (which is the proper nomenclature for the lower portion of the Red Hill Tunnel). The floor is stained black below the stairs, and a shallow trench appears to run the length of the bottom concrete floor. There is standing water in the trench and the bottom is stained black. The second door to the Harbor Tunnel is a drop track door and the railway to Red Hill begins here. There is standing water in the drop track area. Over the door are red pipes with metal sleeves (fire protection). The fire protection piping goes through the concrete over

the door which does not appear sealed around the piping. Also the piping has mudded joints (possible asbestos); however, the piping appears new.

A5.2.1.4 Inside the tunnel are Critical Infrastructure running along the south wall; Critical Infrastructure labeled DFM, Critical Infrastructure labeled JP-5, and Critical Infrastructure labeled DFM. On the north wall is a single 4" pipe which contains water. Above the water line are 220 volt outlets every hundred feet or so. There is moderate product odor in the tunnel and the concrete floor is fairly clean with the railway running down the center of the floor. There is a shallow trough between the rails. The walls and ceiling are gunite and there are ceiling mounted lights approximately every 50 feet with electrical cable running along the center of the ceiling.

A5.2.1.5 We reach a fork in the tunnel, here begins a 32" water line which replaces the 4" water line noted at the lower end of the Harbor Tunnel. One fork of the tunnel leads to the Critical Infrastructure the other fork continues to Red Hill. The 32" water line appears to come down from Critical Infrastructure The Critical Infrastructure is sealed. Also near the fork are manual valves on the pipelines and another drop track door. We walk a few hundred feet further before turning around and exiting at Critical Infrastructure

A5.2.1.6 After lunch we drive to Red Hill and meet WB and the on-duty Red Hill operator at Critical Infrastructure As in Critical Infrastructure Also the gunite surrounding the tunnel walls and ceiling appears to have been applied directly on the surrounding rock, whereas in the Harbor Tunnel the gunite appeared to have been applied to forms. We enter the Upper Access Tunnel which runs along the top of the Critical Infrastructure Critical Infrastructure We Critical Infrastructure to the bottom of tanks and to the Lower Access Tunnel. Critical Infrastructure are separated from the others by a 6' layer of concrete because those tanks used to contain AVGAS. Currently Critical Infrastructure contain diesel and the rest contain JP-5, except Critical Infrastructure We walk down the Lower Access Tunnel toward Pearl Harbor. We reach a triangle-shaped intersection where the Lower Access Tunnel, Harbor Tunnel, and Critical Infrastructure A drop track door is located before Critical Infrastructure at the connection to the Lower Access Tunnel. The groundwater pumping station and ventilation shaft are also located Critical Infrastructure The door into the pumping station is in the Critical Infrastructure between Critical Infrastructure and the drop track door at the Lower Access Tunnel. No access to pumping station at this time. We walk back toward the tanks and into the control room located at the base of the tanks. The on-duty operator escorts us back Critical Infrastructure and to the Upper Access Tunnel. We follow the operator to

Critical Infrastructure We enter Critical Infrastructure
Critical Infrastructure The
tank is domed at the top and bottom. The walls, ceiling, and floor appear to be steel. The tank is clean
and incredibly huge. We exit the tank and Critical Infrastructure to the bottom of the tanks to
look at the bottoms of Critical Infrastructure We leave Critical Infrastructure walk out Critical Infrastructure and return to
our office.

A5.2.2 Tuesday, May 3, 1993

A5.2.2.1 Masa Fujioka, Jennifer Kleveno, and JoAnn West (MFA) attend a meeting with John Rassmussen, Terry Forehand, Charley Transue (WB); Jim Gammon, Roy Kaneshiro, and Bob Riola (PacDiv); and John and Kenneth Echternacht (FSC) to discuss project. Jim Gammon gives an informative historical narrative of the Red Hill tunnel and tanks. Some of the highlights follow:

- a) State Department of Transportation (DOT) drilled holes into the tunnel during construction of the H1 freeway and was supposed to grout after; however, Navy has been unable to verify if work was completed by DOT.
- b) There is approximately one mile of steel ribs in the tunnel that were installed in the 1950s or 1960s. Workers noticed cracks in the walls and ceilings and the ribs were used for support. A local geologist (C. Wentworth) conducted an investigation concerning the cracks and Jim will find a copy of the report for us. It is a possible location for liquid to escape from the tunnel where the ribs were installed.
- c) During construction of tunnel, some areas were over-blasted; thus, when rebar was installed it didn't fit so wood was used for brace and fill. Wire mesh was placed over wood and then gunited. In some cases the wood was removed, in other areas it was left in place and has since rotted.
- d) Drop track doors are supposed to stop flow of product; however, they have never been properly tested. Also, operators in tunnel often prop open doors and this would prohibit automatic closing of the doors in an emergency.

- e) Navy has plans to clean nine of the tanks soon. After cleaning takes place, the tanks can be inspected.
- f) Sometimes Navy takes tour groups (such as Navy League) into tunnel and Critical Infrastructure
- g) There are holes in the walls and floor of the tunnel.
- h) Water comes out of the french drain onto railway in some tunnel areas during heavy rains.
- i) The french drain does not extend the entire length of the tunnel; it starts somewhere beneath Radford High School.
- j) There were side drains from the tunnel that discharged into Halawa Stream. They were supposedly plugged up.
- k) Critical Infrastructure sits on top of the tunnel and a vent is nearby.
- l) There is a large overhead thrust block near Critical Infrastructure that may be a good place to add another door.
- m) All hot work in tunnel must have a hot work permit from Fire Dept. and tested as gas-free by Certified Marine Chemist.
- n) Jim suggests we contact Harry Hui for ongoing environmental information gathered by other consultants. Jim's main concerns involve fire and a release of fuel in the tunnel, specifically if the tunnel is to fill with product. We should consider the impact of a catastrophic release of fuel.

A 5.2.2.2 We adjourn the meeting and begin our site reconnaissance of the Red Hill tunnel. This time we are guided by Jim Gammon and we will again start at Pearl Harbor Critical Infrastructure. The bulk of the notes taken during the second site visit are information provided by Mr. Gammon during field observations.

A5.2.2.3 The grate covering a concrete lined pit in front of [Critical Infrastructure] is the outflow for the french drain located in the bottom of the tunnel. The liquid is pumped by a sump and transferred to an oil/water separator. The water is discharged to the sanitary sewer and any oil is transferred to an aboveground storage tank and eventually burned. An emergency generator is located at the entrance to [Critical Infrastructure]. At the **Critical Infrastructure** carrying product out of (or into) Red Hill are located **Critical Infrastructure**. We continue to the Pearl Harbor Pump House.

A5.2.2.4 The Pearl Harbor Pump House consists of control room, pump room, transformer room and other facilities. In the control room the following concerns are discussed with the control room foreman Mike Lau.

a) Fire Protection: The control room and the transformer room have halon fire protection installed and the adjacent pump room has ultra violet protectors and heat activated sprinklers. There is no prevention for a pressure fire which could be caused by fuel leaking from a flange.

b) Limited Communication: There are only three phones located throughout the tunnel system.

c) Response Time: It could take **Critical Infrastructure** from the control room once a problem is encountered. The valves are normally closed at the valve. There are **Critical Infrastructure** **Critical Infrastructure**

d) Pipeline Capacity: Between Red Hill and Pump House the total capacity of the pipelines are

Critical Infrastructure

e) Tank Containment: If a tank ruptured the lower tunnel could fill with fuel which would probably escape out of **Critical Infrastructure** because there are no oil tight doors at these adits.

f) **Critical Infrastructure**
Also this door is not spill proof but is of heavy construction and is always locked. **Critical Infrastructure**
built for construction purposes and could still be used to bring in new pipe.

A 5.2.2.5 After lunch we resume our field trip at the Pump House. At the end of the pump room is the entrance to the Harbor Tunnel. Here, beneath the metal stairway, the french drain daylight. There was an automatic valve on the pipe above the drain; however, the valve is missing thus allowing a tunnel spill to flow freely into the pump room. The french drain measures 8" wide and 12" deep.

A 5.2.2.6 Not noted in the first visit are distance markers stenciled on the piping such as **Critical Infrastructure** denoting feet. Also every fifth thrust block is numbered. There are holes in the floor of the tunnel and at the base of the wall. The holes in the floor were apparently made on purpose, but the holes at the base of the wall appear corroded probably by water. Near thrust block **Critical Infrastructure** just past the first curve, Jim points out a low point in the tunnel floor. The french drain is probably clogged because water comes up from the floor and pools here.

A 5.2.2.7 Near thrust block **Critical Infrastructure** is a rough cement patch on the wall marking the location of a side drain leading off the french drain. The side drain discharged into Halawa Stream and was reportedly closed.

A 5.2.2.8 Near distance **Critical Infrastructure** pipes are sticking out of the walls and ceiling. These are the grout pipes installed during construction of H1 Freeway. It is not known if the pipes were properly sealed.

A 5.2.2.9 **Critical Infrastructure** Also nearby begins the floor drains. The pipe wrap is loose on **Critical Infrastructure** at thrust block **Critical Infrastructure** it will be a good place to collect a sample for asbestos analysis if necessary.

A 5.2.2.10 At thrust block **Critical Infrastructure** we turn and head back toward the pump house.

A 5.2.2.11 We leave Pearl Harbor and meet at **Critical Infrastructure** on Red Hill. **Critical Infrastructure** **Critical Infrastructure** which open to a metal stairway leading down to an iron gate and into the adit tunnel. There are three pipelines on one wall and another on the opposite wall. The pipelines are stenciled as "fresh water", and "water to Red Hill tanks". The third pipe is not labeled, nor is the pipe on the opposite wall. The tunnel dips slightly before rising up to meet the Lower Access Tunnel. A sump is located at the low point. A heavy drop track door separates the adit tunnel from the Lower Access Tunnel; however, pipelines running through the wall around the door do not appear

sealed. Before the door to the Lower Access Tunnel, is the Navy PWC groundwater pumping station.

A 5.2.2.12 Beyond the water tight door is the triangle-shaped intersection of the **Critical Infrastructure**
Critical Infrastructure The groundwater pumping station and ventilation shaft are located downgradient of the junction. Willbros will collect a core at the nearby drop track door.

A 5.2.2.13 We walk upgradient toward the tanks. Just below **Critical Infrastructure** is a sump and a thrust box. There is a trench approximately 15" wide and slightly deeper leading from each tank to the sump. The trench contains a 4-6" diameter pipe and there is heavy black product at the bottom of the trench. The pipe in the trench drains the water from the tanks to the sump. There is a strong product odor in this area. We continue toward the tanks to the next overhead thrust box before turning around and returning to **Critical Infrastructure**

A5.2.3 Wednesday, May 4, 1994

A 5.2.3.1 Meet with WB, FSC, and Jim Gammon at Pearl Harbor Bldg. 427. Jim pulls all blueprints and plans we may need to proceed with the study. We review plans for several hours and select those most helpful.

A 5.2.3.2 During lunch break JoAnn West (MFA) meets with Harry Hui, Navy Environmental Engineer to discuss previous and ongoing environmental studies conducted at Red Hill. MFA is allowed to borrow several reports including the SPCC and Natural Resource Management Plan. Asbestos surveys were conducted throughout many areas in Pearl Harbor including the **Critical Infrastructure**
Critical Infrastructure Limited asbestos surveys were also conducted in the pump room office at **Critical Infrastructure** the Red Hill tunnel portal, pipe wrap and electrical conduit in the Lower Access Tunnel, and a portion of the Upper Access Tunnel. Results indicated no suspect asbestos at **Critical Infrastructure** no asbestos in areas sampled in the Upper Access Tunnel, and no asbestos in the cardboard pipe or electrical conduit in the Lower Access Tunnel. Piping in the Pump House was sampled and determined to be non asbestos; however, the vinyl tile floor in the control room and packing around the hot water heater for the shower both tested positive for asbestos.

A 5.2.4

Tuesday, May 10, 1994

A 5.2.4.1 MFA attends a debriefing meeting with WB, FSC, and USN. The following subjects were discussed:

- a) The drop track doors are not effective or water tight.
- b) A tank monitoring system should be installed.
- c) The communication system within the tunnel should be upgraded.
- d) The fire alarms and fire protection systems should be upgraded.
- e) The possibility of installing a new thrust block just east of the sump area should be considered.
- f) Ultrasounding the pipes should be considered to check their integrity.
- g) Various safety equipment and fire equipment should be kept or installed in the tunnel.
- h) Housekeeping practices in the tunnel need to be improved.
- i) The open trench leading to the sump area is probably a fire hazard.
- j) If a catastrophic release could be prevented from flowing down the tunnel it would probably flow out. **Critical Infrastructure** If it flowed down the tunnel, it will end up in the drinking water beneath the tunnel.
- k) Precautions must be taken to protect the drinking water beneath the site.
- l) The environmental aspect involving coring in the tunnel will be conducted during the rail study.

A5.2.5

Tuesday, May 17, 1994

A5.2.5.1 MFA meets with Critical Infrastructure to visit the water pumping station in the Red Hill tunnel. We enter through Critical Infrastructure and walk into the pumping station. The station is a large tunnel shaped room with a high, white, concrete ceiling. Control panels and high voltage equipment are at the front of the room. Stored near the door in neat stacks are small containers (50 lbs.) of sodium fluoride. The containers are labeled. Four water pumps are located toward the rear of the room up five or six stairs. The pumps are not running. There is a man hole with a glass window adjacent to the pumps. PWC opens the manhole and although there are no lights in the shaft we can see down to the water table. Critical Infrastructure

A5.2.5.2 We climb up a metal ladder near the ventilator shaft and enter a dark stairway. Approximately Critical Infrastructure concrete stairs lead to Critical Infrastructure PWC opens the door and we are in the

Critical Infrastructure The water pipe is approximately Critical Infrastructure diameter. The tunnel is gunited which appears to have been applied directly on the surrounding rock. The tunnel daylight is not far to the west and as we approach the tunnel gate four wild pigs outside of the gate run away. The Navy chlorine plant is located outside the gate. There is a good rock outcrop showing the geology around the tunnel which at a glance looks like a massive, highly fractured a'a lava flow. The water supply pipeline goes underground directly outside of the gate. We return to the Critical Infrastructure and back to the Critical Infrastructure. The Critical Infrastructure goes quite a distance toward the Critical Infrastructure but there are no lights in this tunnel. PWC says the tunnel extends into

Critical Infrastructure We walk back down the stairs and the ladder into the pumping station.

A5.2.5.3 The Navy water lines hook up to the BWS lines so water could be pumped out or into each others lines. We leave through Critical Infrastructure. Outside of Critical Infrastructure is a storm drain that probably discharges into Halawa Stream which is located down a steep incline. Also located outside of Critical Infrastructure is a former waste oil pit, above ground storage tanks, and an emergency generator for PWC. We leave the site.