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SAN BRUNO ARCHIVE

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Title: RADIOLOGICAL DECONTAMINATION WHILE UNDERWAY (11/8/96)

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SAN FRANCISCO NAVAL SHIPYARD  
San Francisco 24, Calif.

MEMORANDUM

~~CONFIDENTIAL~~ JUL 1983 8 November 1946  
JUL 1983 *NOV 1946* 181 AGENCY/NRDL  
*MFA*

To: COMMANDING OFFICERS, Bikini Vessels.

Location SAN BRUNO FRC

Access No. 181-58A 3203 S-636

Subj: Radiological Decontamination while underway under 599(1)

Decontamination 1946

Encl: (A) Decontamination Procedure and Safety Precautions.

1. Enclosure (A) has been prepared at the San Francisco Naval Shipyard for use of vessels at the Yard. These instructions amplify BuShips dispatch 141550 of Oct. and BuShips Speedletters Serial 1381 of 30 Sept. and 1383. When the work is undertaken at sea certain obvious modifications must be made to permit it to be successfully accomplished. Some background information as well as some of the changes are cited to assist the ship to carry out the decontamination process.

2. The material that it is desired to remove from non target vessels was deposited aboard from the sea water in Bikini Lagoon after test BAKER. The places on non target vessels which were exposed are the evaporators, heat exchangers using salt water cooling, the main and auxiliary condensers, the fire and flushing system and the exterior underwater body of the hull. No other locations have been found to date. The preliminary radiological clearance which was given at the operating area gave assurance that no hazard exists as long as the ship's systems are intact. When the safety precautions set forth in the referenced memorandum are carried out, it is known that no possibility of a radiological hazard will occur. The Bureau of Ships and the U.S. Naval Shipyard are continuing experimentation which may prove that some of the current safety precautions are unnecessary or that some of the parts of the ship need not be treated. This is noted here that when and if revised safety precautions are issued it will definitely be understood that a calculated risk is not accepted but that it has been definitely determined that NO risk does in fact exist.

3. The principle modifications that are necessary to apply the procedures to a vessel underway are necessitated by operational considerations. These considerations will vary for each particular plant and installation. Each machinery unit or section of line will be required to be isolated and unused for the period of time the acid solution or the neutralizing solution is soaking. There may be sections of salt water piping or vital coolers which cannot be secured at sea. Because of the great simplification of the whole process by doing the work at sea these exceptions should be critically examined that the ship is assured that it is indeed impossible to treat the excepted unit. The principle upon which

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DATE  
REVIEWED BY  
*LTJr. DNA Vargo*  
TO  
*DOE, OC dated 6/16/87*

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the decontamination process is based is dissolving and loosening scale, rust, and marine growth from the salt water side of machinery units and piping. To do this requires that the decontamination solution be put into the system in the strength outlined and be allowed to stand or circulate for the specified time. The system is then flushed thoroughly to remove all traces of the mixture and loosened particles and then the system is neutralized and again flushed. Each ship may have individual preferences and will have differences in physical set-up which will affect the mechanics of accomplishing the above. Whether the firemain is filled by gravity through the fire hose or is pumped into the system makes no difference as long as the steps above are accomplished in the order given.

4. The steps in obtaining radiological clearance are as follows:
- (a) A careful monitoring with particular emphasis being placed on the parts of the ship outlined for ships force decontamination. Those parts of the ship which show either no readings or only background need not be treated. In monitoring it will probably be found that the parts of the systems which were not used or used only slightly at Bikini are not radioactive. Thus risers to magazine sprinklers, firemain branches which were not used etc., are usually background or less. When tracing out a system the checking should be continued even after all readings disappear to assure that the limits are not exceeded on down the line. Responsible ships officers should accompany the monitors to assist in pointing out the units and lines which may be active. A recorder should also be provided to record data. It is the Commanding Officer's responsibility to assure that all likely spots which may be radioactive are monitored.
  - (b) On the basis of the monitorings a plan should be prepared for the decontamination work. The ship should work out just what sections of the firemain can be isolated, at a time, how it is to be filled, drained; which heat exchangers can be isolated at a time, etc.
  - (c) Decontamination materials should be procured. SAN BRUNO FRC
  - (d) Proceed to sea and perform the work. A monitor is not required for this operation, as was pointed out above there is NO radiological hazard provided all the precautions are carried out.

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- (e) All materials removed or flushed from the systems is to be dumped directly overboard at sea. Any container used for sludge, scale or marine growth to remove it from the ship should be hosed out but need not be discarded.
  - (f) Upon return request remonitoring. After remonitoring it may be found that the removal of radioactivity has been incomplete; some readings may actually increase. If the areas are few or local ones the parts should be disassembled, scale, marine growth, and sediment removed and the affected parts scrubbed with acid. Short sections of pipe may be blanked-off and acid circulated through them for several hours, drained, flushed and neutralized. When extensive areas of systems or large units are still above the tolerance levels a second complete treatment of that system or unit may be advisable.
  - (g) Monitors may be secured from the District Medical Officer.

5. It may be necessary to perform certain parts of the cleaning at a yard or while alongside a dock. The drydocking, obviously, must be done at a yard. Tests are underway which may eliminate all drydocking except scraping the waterline while at anchor as was done by many ships while actually in Bikini Lagoon. Availability at a repair facility will be granted in the normal fashion when Navy Yard facilities are required to complete the work for full radiological clearance.

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6. Particular attention is invited to the necessity of following the exact steps set forth in the referenced memorandum. By the use of these, damage to ships material and personnel will not occur. It is particularly important that the acid solution not exceed the strength specified at any time in the system. The acid should not remain in the system materially longer than specified or damage to piping and machinery units may result. Flushing out should be thorough to eliminate all pockets where the solutions may collect. Valves often leak and may be opened by uninformed individuals aboard ship. So, it is suggested that closed valves be tied shut and tagged as insurance against unwitting opening. It is pointed out that leaks or weeps may develop as a result of the removal of scale and marine growth. Continuous checking and patrol will probably be necessary to assure that the operation will be successful and no casualties occur. It is pointed out that this is a practical operation and stop watch accuracy is not required but rather a practical common sense appreciation of what is being done. Should acid mixture be spilled in the ship by casualty the following procedure is recommended:

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- (a) Neutralize at once. Liberal use of the soda ash is recommended. Any pharmacist's mate can determine when the acid is spent.
- (b) Thoroughly wash the area with which the acid has come in contact, flushing with copious quantities of water is advisable if spilled in bilges or on deck. If the mixture has been in a system for any length of time the locations where it was spilled should be monitored carefully upon return of the vessel to port.
8. A complete report is requested to be forwarded from each vessel to the Bureau of Ships with copies to the Bureau of Medicine and Surgery and Commander Western Sea Frontier. The report should include the following:
- (a) Duration of stay in Bikini and in general the conditions of operating.
- (b) Copies of all monitors reports.
- (c) Summary of treatments accomplished on all radioactive parts of the vessel, including the final decontamination.
- (d) It is particularly desired that any suggestions relative to the conduct of the cleaning operations be included.

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E. J. Hoffman  
BuShips Representative  
San Francisco.

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Subj: Instructions to Ships on Decontamination Procedures to be Followed  
in Freeing Ship of Radioactive Material

The instructions herein are detailed to give the ship information necessary to completely rid the ship free of radioactive material. Shipyard assistance may be necessary in some instances. The procedures are amplifications of BuShips Serials 1381 and 1383 of 24 & 26 September, and BuShips dispatch 141550 October.

(a) Evaporators:

- (1) Evaporators should be given one or more thermal shock treatments in order to break loose as much scale as possible.
- (2) The thermal shocked loose scale shall be removed from the evaporator shells using the following safety precautions:
  - a. Any remaining water in the shells should be collected and dumped overboard (in the harbor is permissible).
  - b. Canvas should be laid down on the deck and a collecting pan used to hold all of the scale removed.
  - c. Personnel should wear rubber gloves.
  - d. Scale shall be kept wet and segregated for further disposal by dumping at sea in such a container that it will sink. If the ship is in the Shipyard at the time of the process, the Yard will receive the containers of evaporator scale from the ship and will provide for its disposal.
  - e. Any loose scale dropping on the deck shall be swept up and the area washed down with fresh water. Any equipment used for cleaning up should be turned over to the Shipyard for disposal by dumping at sea.

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- (3) After removal of loose scale the evaporator plant must be set up to provide for acid circulation:
  - a. The acid solution instead of just covering the tube nest should be carried up in the shell far enough to cover all scale deposits. Shells must be vented as near the top as possible in order to accomplish complete filling of the shell.
  - b. Positive prevention of the acid solutions getting into the fresh water sides shall be made by blanking off or removal of necessary lines.
  - c. As much of the salt water system as possible should be used for circulating the acid solution through the shells, piping, and heat exchangers. Ships pumps shall be used when possible.
  - d. The acid mixing tank should be placed in a position where good ventilation can be obtained to remove gases evolving from the operation.
  - e. A line shall be run from the acid mixing tank to the pump to take suction of the acid. A line or lines shall be run from the brine discharge lines or other appropriate drain lines back into the acid mixing tank. This circulation system should be tested before acid is added.

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(4) Circulation of acid through the evaporator system shall be accomplished using the following instructions and safety precautions:

- a. The acid solution shall be mixed by adding two parts 18° Baume commercial muriatic acid with 15 parts fresh water. To this must be added inhibitor. (Rodane - Navy Spec. 51-I-2a) in the proportion of 1 part inhibitor to 100 parts commercial acid added.
- b. The acid should be poured into the water.
- c. Personnel handling acid shall use rubber gloves, splash-proof goggles and an acid fume respirator.
- d. Soda ash (boiler compound) shall be on hand to cover over and neutralize any acid solution spilling out.
- e. Sodium bicarbonate solution shall be on hand for personnel to wash off any acid solution getting on their bodies.
- f. When the acid solution enters the shells foaming will occur and may come out the vents. Buckets should be placed by each vent line to catch all overflow.
- g. Normally salt water piping and valves on evaporator plants are not in the best of condition. When scale is removed it may uncover holes in piping, non-tight packing on valve stems or leaky pipe joints. A continuous check of the system is to be made while acid solution is being circulated, in order to stop all leaks and neutralize acid solution as quickly as possible.
- h. The acid shall be continuously circulated until all scale has been dissolved. This may be detected visually or may be determined when the normality of the acid levels off. BuShips Serial 138, specifies two hours.

(5) Upon completion of circulation the acid must be drained completely from all lines and units.

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- a. If the ship is in the Shipyard at the time of cleaning, the acid should be drained into containers and subsequently pumped into a large collecting tank which the Yard will provide.
- b. If the ship is at sea, the acid solution is then to be pumped overboard through the brine discharge line at least ten miles at sea or past the one hundred fathoms' curve.

(6) The system shall then be flushed out with a boiler compound solution in order to neutralize any residual acidity.

(7) The system shall then be flushed out with fresh water, and this water pumped overboard.

(8) Distilled fresh water shall be made and dumped overboard for twenty-four hours.

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ENCLOSURE (A)

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**(9) Miscellaneous instructions**

- a. Any personnel getting seals or acid solution on their clothing or body shall immediately wash the body thoroughly in the affected area and change clothes.
- b. A monitor should be present upon first opening the evaporator shells.
- c. **DO NOT** heat the acid solution.
- d. The above procedure applies to all evaporators except Badger types having double A and triple A types heat exchangers.

**(b) LUBRICATING OIL COOLERS AND OTHER HEAT TRANSFER APPARATUS (EXCEPT CONDENSERS) USING SALT WATER FOR COOLING**

- (1) Heat transfer apparatus separately supplied with cooling water. If monitor's readings indicate that decontamination is necessary, one acid treatment on the salt water side shall be given in the same manner and using the same safety precautions as provided above for evaporators. However, the acid shall be half of the proportion specified for evaporators.
- (2) Heat exchanger units which receive their cooling water from the Firemain. These units, if monitor readings indicate that decontamination is necessary, shall be included in the decontamination procedure set up for the fire and flushing system.

**(c) DRYDOCKING**

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The following procedure applies on the first docking only after leaving Bikini Lagoon. This procedure shall apply to the underwater body, anchors and anchor chain. Composition propellers will not be sand-blasted after being scraped down.

**(1) Removal of marine growth.**

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- a. As the drydock is pumped down, the sides of the ship shall be scraped with long-handled scrapers to remove as much of the marine growth as possible. Personnel doing this work shall wear protective clothing consisting of gloves, boots, coveralls and eyeglasses.
- b. The sides of the ship and the drydock floor shall be kept wet until this scraping is completed.
- c. All growth scraped from the side of the ship shall be collected and placed in a container to be disposed of by the Shipyard by dumping at sea.
- d. Upon completion of scrapping down and cleaning up the scrappings, men shall change clothes and take showers.

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**(2) Sandblasting.**

- a. Sandblasting of the underwater body can be performed by using a regular wet sandblasting procedure insuring wet conditions.
- b. The drydock floor and the sand shall be kept wet until the sand is removed.
- c. The sandblasters shall use standard equipment with a positive pressure supply of breathing air taken from the up-wind side of the sandblasting.
- d. No personnel in the drydock and on the topside of the ship are to be in the down-wind side of the sandblasting where the dust cloud is carried, unless protected as in c.
- e. Ventilation intakes, doors, ports, etc., on the ships where the wind might carry the sand dust are to be closed.
- f. Upon completion of sandblasting, wash down the topside, sides and bottom of the ship and sides of graving dock in order to wash all sand down into the bottom of the drydock.
- g. Sand shall be collected in containers such as 50 gallon drums, and a top layer of cement poured. These drums will be collected for disposal at sea. Personnel handling sand should wear rubber boots. The boots should be washed off upon completion of the work.
- h. The drydock bottom shall then be given a vigorous washdown.
- i. After undocking, capblocks shall be monitored and if necessary shall be disposed of by sinking at sea.
- j. The final washing down of the drydock shall be pumped into the harbor.
- k. After the complete sandblasting job is finished, work can be carried on under normal operations.

**(d) SALT WATER LINES**

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- (1) The following steps will be followed in cleaning the fire, flushing, cooling, and associated drainage systems in one operation:

- a. The complete fire, flushing, cooling and associated drainage system will be carefully monitored. When a section shows no reading and can be isolated, it will be excluded from the cleaning process.
- b. A large mixing tank is to be placed on deck in such a position that piping or hose may be run to the suction side of a fire and bilge pump. The suction of this pump can be so arranged with valves so that suction can be obtained on special solution from the mixing tank, on salt water, and on air, alternately. A recirculating hose will be connected to a fire plug at each end of the ship and run back to discharge into the mixing tank.

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- c. If the ship is in drydock, overboard discharges from contaminated drains shall be plugged with a wooden plug containing a capped pipe outlet, and containers provided to catch the outflow from these pipes.
- d. The combined system shall be drained at available drain connections on pumps in engineering spaces and at whatever low drain connections are provided in the ship's pipe system. It will be necessary, in draining, to open outlets of the system so as to allow air to enter and effect complete drainage. Decontaminating chemicals will be mixed in the mixing tank and pumped into the system by fire and flushing pump. Outlets of the system are to be opened until flow of decontaminating solution is observed. As each line is filled, the associated outlet is closed. This procedure is to be followed until all parts of the system are filled at which time all outlets are closed. Continuous circulation will be maintained by running the fire and bilge pump with the two re-circulating hoses discharging into the mixing tank. This will be continued during the length of time determined necessary for decontamination of the system.
- e. When the decontamination flushing is finished, the associated drains which were found in need of decontaminating will be filled from the nearest discharge of the decontaminated system, allowed to stand a specified number of hours, and then drained by removing the cap on the pipe outlet of the overboard discharge, collecting the solution in containers.
- f. At the end of the decontamination process the parts of the system not already drained into contaminated drains shall be drained in the same manner as before, but all solution must be collected in containers for transfer to a large collecting tank which the Shipyard will provide.
- g. Flush system thoroughly at least one hour. Each outlet will be used to flush the system.
- h. The succeeding step consists of mixing a neutralizing solution of soda ash (boiler compound) in the mixing tank and filling the system completely as before. This should be allowed to stand 30 minutes.
- i. The final step consists of filling the system with salt water and flushing each outlet for half an hour.
- (2) If it is necessary to provide head facilities aboard the ship, a temporary hose connection from an isolated or dock-side salt water main shall be led to the specified head to maintain a jury-rig flushing system.

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(e) All overboard discharge chests, lines, and valves not decontaminated by any of the above procedures shall be decontaminated as follows: (The ship is assumed to be in drydock).

(1) The line shall be filled with decontaminating chemicals in accordance with the following:

a. Blanks with capped pipe connections will be provided at all sea chests.

b. The line shall be filled internally with a cleaning solution that has been specified, and allowed to stand the required number of hours.

(2) To drain, remove caps from the pipe connections at the sea chest blanks and collect the solution in containers for disposal by the Yard.

(3) Flush with neutralizer and finally with water.

(f) Ships' Boats:

(1) Wood hull.

Scrub the entire hull thoroughly with a strong mixture of lye and boiler compound, using long-handled scrubbers, and removing as much paint as practicable. Personnel should wear gloves while performing this operation. Repaint the body with four coats of paint. Rudder should be included in this cleaning. Propeller shall be scraped.

(2) Steel Hull Boats:

Steel hull boats shall be decontaminated by wet sandblasting the bottom to bare metal. The propellers are to be scraped by hand. Repaint in accordance with current painting instructions.

(3) If any radioactivity has been reported in engines or coolers, an acid mixture shall be used to clean the system as specified in paragraph (b). Exhaust pipe, fenders and canvas, if active, shall be renewed and the removed material delivered to the Yard for disposal at sea.

(g) Condensers

Renew all zincs. Old zincs to be delivered to the Shipyard for disposal at sea.

The condensers which show readings above tolerance should be opened and all sediment and loose scale removed. They should then be given a thorough mechanical cleaning keeping the tubes and heads wet while working. The materials removed should be prepared for sinking at sea.

ENCLOSURE (A).