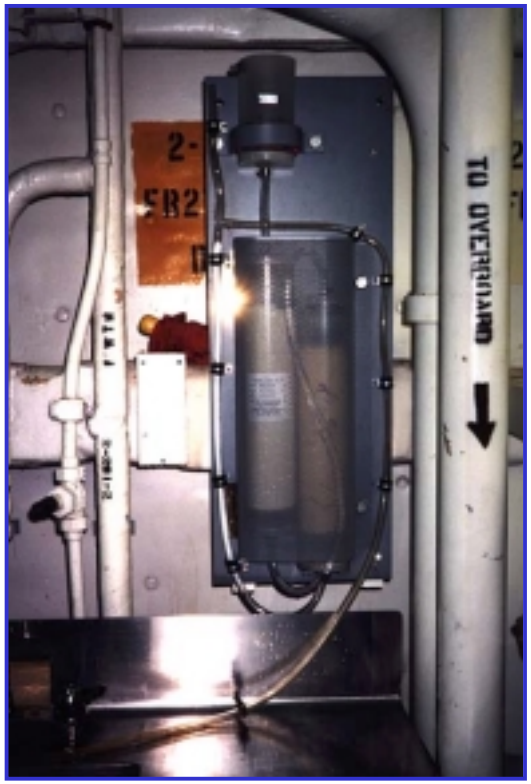
Mercury Ion Exchange Cartridge System



The U.S. Navy developed the Mercury Ion Exchange Cartridge System to process the mercury-contaminated wastewater resulting from boiler feedwater and boiler water chloride testing.

The System is typically installed in the ships' Oil Lab where chloride testing is usually performed. On average, Navy ships may generate as much as 85-gallons of mercury-contaminated wastewater per 6-month deployment. This waste is stored in 5-gallon polyethylene carboys, usually under a counter-top within the Oil Lab until the space available is exceeded.

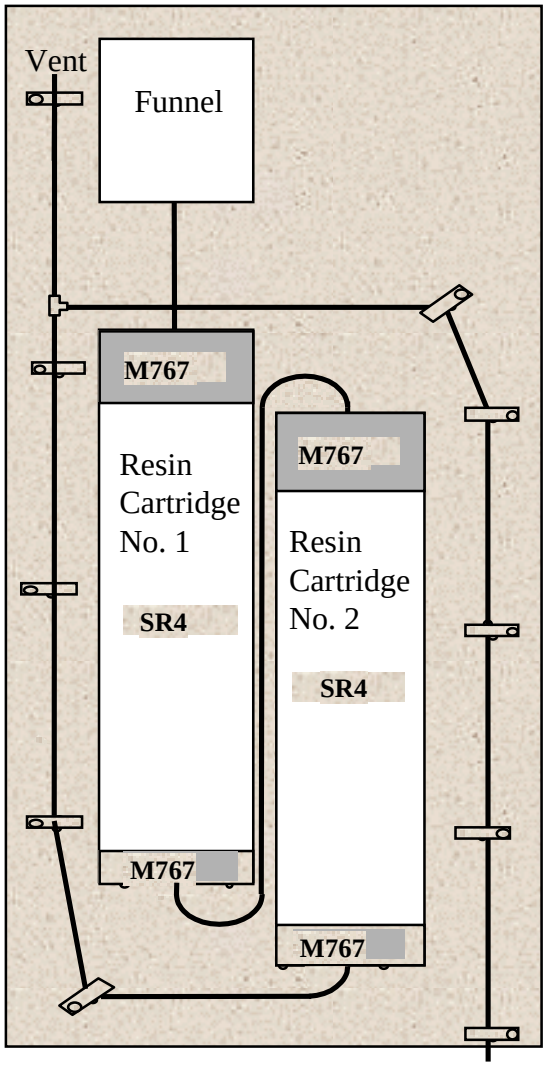
The mercury-contaminated wastewater is generated as part of a chloride test in which drops of mercuric nitrate are added to titrate the water sample. The resulting waste water can now be poured through a gravity-fed funnel into resin beds specifically designed for mercury absorption. As the wastewater passes through the resin bed, mercury is captured. The resulting effluent has been tested to have mercury levels less then 2 ppb (the legal limit for discharge). By capturing the mercury in this way, the waste stream is reduced by more than an order of magnitude.

The Mercury Ion Exchange Cartridge System is easy to use and maintain, and is designed to meet rugged shipboard operating conditions.

Mercury Ion Exchange Cartridge Systems are being procured for U.S. Navy ships via the Pollution Prevention Afloat Program beginning in FY 99. Fleetwide implementation of the System has begun and will continue through FY 05.

The Mercury Ion Exchange Cartridge System Consists of:

- An inlet funnel and tubing to pour wastewater into resin-bed.
- Two 17” by 3.25” diameter columns filled with a cation exchange resin with a pronounced selectivity for mercury.
- The resin is a macroporous polystyrene copolymer with an exchange capacity of 3.9 milli-equivalents/liter.
- The cartridges are connected in series with tygon tubing and polypropylene connectors. Each column is rated to absorb mercury from 300 liters of wastewater.
- A dual-column configuration provides an adequate safety factor to ensure mercury is not present in concentrations greater then 2.0 ppb in processed effluent.
- The outlet tubing is routed to the graywater system via a sink in the Oil Lab.



System Characteristics

Weight: 20 lbs (9.09 kg)

Footprint: Width: 11.5”
Depth: 3.5”
Height: 32”

The Mercury Ion Exchange Cartridge is Easy to Operate

- Slowly pour chloride analysis wastewater generated during the performance of Feedwater Chloride Testing as called out in Navy Ships Technical Manual S9086-GX-STM-020/CH-220 V2 Section 26.21 into the reservoir cup.
    - The liquid will pass through the cartridges and drain into a sink, any mercury (Hg) present will be adsorbed by the resin in the cartridge and the resultant effluent, containing less than 2.0 ppb Hg, will be discharged to the sink (as authorized by NAVSEA 05L1).
- Record the amount of liquid processed through the mercury ion exchange cartridge system in the logbook.
- When cartridges are expended, cap both ends of the expended cartridges using the caps removed from the new cartridges. Turn the expended cartridges into the hazardous material coordinator for proper disposal.
- Dispose of cartridges in accordance with OPNAVINST 5090.1B, Environmental and Natural Resources Program Manual, Appendix L, *Disposal of Shipboard Hazardous Material*. This waste is listed as “boiler wastewater” in the column titled *Shipboard Hazardous Material Type*, and further defined as “feedwater and mercuric sample demineralizer resins” under the column titled *Examples of Generation Sources*. The authorized disposal method listed for used or excess ion exchange cartridges is “containerize for shore disposal as used hazardous material”.

Personnel and Training Requirements

- The only manpower requirement is the pouring of the effluent into the funnel cup after completing the titration and replacing the cartridges after expended.
- The Mercury Ion Exchange Cartridge is considered typical HM&E equipment for maintenance purposes.
- A VHS video, technical manual, and MIP have been developed to educated operator and maintenance personnel.
- Mercury Ion Exchange Cartridge operators are required to wear personal protective equipment required under NAVSEA Technical Manual S9086-GX-STM-020/CH-220 V2 Section 26.21, dealing with mercury contaminated wastes

ILS Support

- A Technical Manual to operate, maintain, troubleshoot, and repair the System is provided.

  NAVSEA TM S9593-CS-CAT-010
- Detailed step-by-step scheduled planned maintenance procedures are provided.
- Repair parts are readily available.
- Logistics support has been provided.
  - APL 469990293
  - NSN 0000-LL-CYA-6047

Key System Features

- The Mercury Ion Exchange Cartridge System processes mercury-contaminated waste generated from boiler feedwater and boiler water chloride testing.
- Mercury-contaminated waste storage and disposal are reduced by an order of magnitude.
- The Mercury Ion Exchange Cartridge System is easy to use and rugged.
- All components of the Mercury Ion Exchange Cartridge System are modular.
- One Sailor can easily and safely operates the Mercury Ion Exchange Cartridge System.

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