



Acid Waste Treatment Technology (AWTT)

Background

Acid chemical cleaning improves the coefficient of performance for heat exchangers and condensers. This process generates liquid hazardous waste that has a pH of 0.5 or less and contains heavy metals (copper, nickel, zinc, lead).

Navy shipyards generate significant quantities of liquid hazardous waste flushing seawater heat exchanger piping on submarines and surface vessels in order to remove marine growth and scale.

Through a joint effort between NAVSEA, NAVFAC Engineering and Expeditionary Warfare Center, and licensing partner ZYIC, LLC, the Navy patented the Acid Waste Treatment Technology (AWTT). The AWTT system is designed to integrate with existing pier side flushing equipment and enables the acid flushing solution to be reused multiple times before treating the effluent to meet discharge limits.

Technology

The AWTT system incorporates filtration with an automated three-stage pH conditioning and processes of flotation, flocculation and sedimentation.

By adjusting the pH of the waste flushing solution in steps, nearly all of the dissolved heavy metals precipitate and settle out. To accelerate settling, flocculants are added to destabilize suspended solids. Flocculation is accomplished as follows:

- (1) flocculation and air-sparged flotation with cationic polymer at pH of 3,
- (2) flocculation and sedimentation with cationic polymer at pH of 6, and
- (3) flocculation and sedimentation with cationic/anionic polymers at pH of 8.5.

The AWTT system is capable of handling 15 gallons per minute (gpm) continuously to reduce total heavy metal concentration from over 3,000 milligrams per liter (mg/l) to the level of concentration that is below most daily discharge limits.

Technology Benefits

- Significantly reduces the volume of liquid hazardous waste generated from shipboard heat exchanger/condenser cleaning operations
- Enables acid chemical cleaning process water to be recycled multiple times
- Reduces total heavy metal concentrations to below most local daily discharge limits
- Patented technology

Costs

- Capital Equipment Cost - \$250K
- Operator Training - \$50K
- Site Support - \$20K
- Permitting typically not required when integrated with existing pipe flushing equipment
- Short payback period (less than one year)

Availability

The AWTT system design specifications for pre-production construction will be available through a water treatment industrial manufacturer.

Sponsored by:

Navy Environmental Sustainability Development to
Integration (NESDI) Program
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Stage 1, pH 3 Floatable Floccs



Stage 2, pH 6 Quick Settling Floccs



Stage 3, pH 8.5 Quick Settling Floccs

Point of Contact

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