

## Stern Tube Seals and Underwater Bearing Lubrication Discharge Summary

### Description of Discharge

**How is this discharge generated?** This discharge is the seawater pumped through stern tube seals and underwater bearings to lubricate and cool them during normal operation.

Propeller shafts are supported by stern tube bearings at the point where the shaft exits the hull (for surface ships and submarines), and by strut bearings outboard of the ship (for surface ships only). A stern tube seal is used to prevent seawater from entering the vessel where the shaft penetrates the hull. The stern tube seals and bearings are cooled and lubricated by forcing seawater from the firemain or auxiliary cooling water system through the seals and over the bearings. On submarines, potable water (freshwater) may be supplied from pierside connections for stern tube seal lubrication during extended periods in port.

Strut bearings are not provided with forced cooling or lubrication. Instead, strut bearings use the surrounding seawater flow for lubrication and cooling when the vessel is underway. Submarines do not have strut bearings and instead use a self-aligning bearing aft of the stern tube that supports the weight of the propeller and shafting outboard of the vessel.

**Which vessels generate this discharge?** Almost all classes of surface vessels and submarines have stern tube seals and bearings that require lubrication.

**How often and where is this discharge generated?** These discharges are continuous.

### Analysis

**Nature of Discharge:** The discharge can contain synthetic (Buna-N) rubber used in the construction of the bearings. Metals such as copper and nickel, the materials of construction of the stern tube, can also be present in the discharge. When freshwater is used for lubricating submarine seals, the freshwater may contain residual chlorine. Based on estimates of chlorine concentrations in potable water, fleetwide approximately 0.8 lbs/year of chlorine exit through the stern tube seals and bearings.

The following table summarizes the concentrations and resulting mass loadings for those constituents that exceed Federal or State water quality criteria.

Constituent	Concentration ( $\mu\text{g/L}$ )	Annual Mass Loading (lbs)
Total Residual Chlorine	NA*	0.84
Total Copper	5.8	180
Total Nickel	1.5	45

NA\* = Not available.

Total annual mass loadings for the metal constituents of seawater lubrication were calculated based on materials of construction in the stern tube, corrosion rates for those materials, and the surface area of the material exposed to seawater for a DDG 51 Class ship. While the copper concentrations can exceed chronic Federal criteria and State chronic water quality criteria, the rate at which the water is discharged through a vessel's stern tube seal and bearings is relatively small -- 20 gal/min each shaft, 2 shafts per ship -- resulting in a low pollutant mass loading exiting through the seals and bearings. Further, these discharges are distributed throughout the U.S. at Armed Forces' ports, and each individual port receives only a fraction of the total fleetwide mass loading.

**Stern Tube Seals and Underwater Bearing Lubrication  
Discharge Summary (continued)**

**Discussion and Discharge Determination**

**Discussion:** Given the low rate of the discharge and the low mass loadings, this discharge has a low potential for causing adverse environmental impacts. Therefore, EPA and DOD determined it is not reasonable and practicable to require the use of a MPCD to mitigate adverse impacts on the marine environment for this discharge.

**Determination:** A marine pollution control device is not required.