Boiler Blowdown
Discharge Summary

Description of Discharge

How is this discharge generated? This discharge is the water and steam discharged during the blowdown of a boiler or steam generator, or when a safety valve is tested. Boilers are used to produce steam for propulsion and a variety of auxiliary and hotel services. Water supplied to the boiler system (feedwater) is treated with chemicals to inhibit corrosion and the formation of scale in the boiler and boiler system piping. Periodically, water must be removed from the boiler to control the buildup of particulates, sludge, and treatment chemical concentrations. The term "blowdown" refers to the minimum discharge of boiler water required to prevent the buildup of these materials in the boiler to levels that would adversely affect boiler operation and maintenance. There are four types of boiler blowdown procedures employed on Armed Forces' vessels: 1) surface blowdowns for removing materials dissolved in the boiler water and for controlling boiler water chemistry; 2) scum blowdowns for removing surface scum; 3) bottom blowdowns for removing sludge that settles at the bottom of boilers; and 4) continuous blowdowns for removing dissolved metal chelates and other suspended matter. The type of blowdown used is a function of the boiler water chemistry and thus varies among vessel classes. With the exception of continuous blowdowns, boiler blowdowns are discharged below the vessel waterline. Continuous blowdowns are discharged inside the vessel and are directed to the bilge. These are addressed as part of the surface vessel bilgewater/OWS discharge. Another discharge occurs during periodic testing of steam generator safety valves on nuclear-powered vessels. The safety valve discharge is a short-duration release of steam below the vessel waterline.

Which vessels generate this discharge? Approximately 360 surface vessels and submarines discharge boiler blowdowns directly to receiving waters.

How often and where is this discharge generated? These blowdowns occur both within and beyond 12 n.m. from shore. Nuclear-powered ships perform steam generator safety valve testing only in port once every five years.

Analysis

Nature of Discharge: Boiler blowdown is discharged intermittently in small volumes (approximately 300 gallons per discharge), at high velocities (over 400 feet per second), and at elevated temperatures (over 325 degrees Fahrenheit). Boiler water treatment chemicals used by Armed Forces' vessels include ethylenediamine-tetraacetic acid (EDTA), hydrazine, sodium hydroxide, and disodium phosphate. Sampling data for boiler blowdowns indicate the presence of nitrogen (in the form of ammonia, nitrates and nitrites, and total Kjeldahl nitrogen), phosphorus, hydrazine, iron, bis(2-ethylhexyl)phthalate, copper, lead, nickel, and zinc. Boiler blowdown discharges from conventionally-powered boilers can exceed acute Federal criteria or State acute water quality criteria for copper, iron, lead, nickel, zinc, bis(2-ethylhexyl)phthalate, nitrogen (in the form of ammonia, nitrates and nitrites, and total Kjeldahl nitrogen) and phosphorus. Blowdown discharges from nuclear-powered steam generators exceed acute Federal criteria and State acute water quality criteria for copper, and the most stringent State acute water quality criteria for lead and nickel. For nitrogen (in the form of ammonia, nitrates and nitrites, and total Kjeldahl nitrogen) and phosphorus concentrations, the most stringent State water quality criteria are expected to be exceeded. However, the turbulent mixing resulting from the high velocity discharge, and the relatively small volume of the boiler blowdown causes pollutant concentrations to rapidly dissipate to background levels or below acute Federal criteria and State acute water quality criteria within a short distance from the point of discharge. Based on thermal modeling of the discharge plume, boiler blowdowns are not expected to exceed State standards for thermal effects. Thermal effects from safety valve testing are substantially less than those from blowdowns, thus safety valve testing also will not exceed State standards for thermal effects. Annual fleetwide pollutant discharges from boiler blowdowns within 12 n.m. are estimated at 3,036 pounds per year of phosphorus, approximately 2,300 pounds of nitrogen, approximately 11 pounds of copper, approximately 2 pounds of lead, approximately 11 pounds of nickel, and approximately 12 pounds of zinc. The fleetwide discharge of all pollutants from safety valve testing is less than 5 pounds per year.

Boiler Blowdown
Discharge Summary (continued)

Analysis (continued)

The following table summarizes the concentrations of constituents and resulting mass loadings for those constituents from all boiler blowdown and safety valve testing activities that can exceed acute Federal criteria and/or State water quality criteria.

Constituent	Fleetwide Concentration Range (ug/L)	Fleetwide Annual Mass Loading (lbs)
Copper		
Dissolved	14.8 - 207	
Total	40.6 - 3390	11.44
Iron		
Dissolved	44.8 - 626	
Total	344 - 24800	37.5
Nickel		
Dissolved	12.3 - 1860	
Total	12.6 - 1835	10.6
Zinc		
Dissolved	8.02 - 594	
Total	58.5 - 7850	12.48
Lead		
Dissolved	2.12 - 22.8	
Total	7.35 - 463	1.58
Ammonia as Nitrogen	30-1800	6.9
Nitrate/Nitrite	230-115000	2234
Total Nitrogen[A]	640-125000	2747
Total Phosphorus	50-100,000	3036

[A] *Total nitrogen is the sum of nitrate/nitrite and total Kjeldahl nitrogen.*

Discussion and Discharge Determination

Discussion: While the pollutant concentrations in the boiler blowdown discharges exceed acute Federal criteria and State acute water quality criteria, they are discharged intermittently and in small volumes. 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. Based on the information in the administrative record to the rule regarding the low mass of pollutants discharged during boiler blowdowns and safety valve discharges, and the manner in which the discharges take place, there is a low potential for causing adverse environmental impacts. Therefore, EPA and DOD have concluded that 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.