Steam Condensate
Discharge Summary

Description of Discharge

How is this discharge generated? This discharge is the condensed steam discharged from a vessel in port, where the steam originates from shore-based port facilities. Navy and MSC surface ships often use steam from shore facilities during extended port visits to operate auxiliary systems such as laundry facilities, heating systems, and other shipboard systems. In the process of providing heat to ship systems, the steam cools and condenses. This condensate collects in drain collection tanks and is periodically discharged by pumping it overboard. The steam condensate is discharged above the vessel waterline and a portion of the condensate can vaporize as it contacts ambient air.

This discharge is generated only in port because vessels only discharge the condensed steam if it was generated by a shore facility. Ships producing their own steam will recycle their condensate back to the boiler. Vessels take on shore steam when their own boilers are shut down, and thus they have no means for reusing the condensate. There are no systems in place that would allow vessels to return steam condensate to shore for reuse.

Which vessels generate this discharge? Approximately 180 Navy and MSC vessels discharge steam condensate. Coast Guard vessels do not generate this discharge because they operate their auxiliary boilers to produce their own steam even while in port. Army and Air Force vessels do not have steam systems and therefore do not discharge steam condensate.

How often and where is this discharge generated? Depending on the steam needs of individual vessels, the discharge can be intermittent or continuous whenever shore steam is supplied.

Analysis

Nature of Discharge: The constituents of steam condensate include metals from onshore steam piping, ship piping, and heat exchangers, and may have some residual water treatment chemicals. Constituents found in the discharge include nitrogen (in the form of ammonia, nitrates and nitrites, and total Kjeldahl nitrogen), phosphorus, bis(2-ethylhexyl)phthalate, benzidine, copper, and nickel. Sampling of steam condensate from four vessels found copper concentrations that exceed both chronic Federal criteria and State chronic water quality criteria. Nickel concentrations exceeded the most stringent State chronic water quality criteria, but not the chronic Federal criteria. Benzidine, bis(2-ethylhexyl)phthalate, nitrogen (in the form of ammonia, nitrates and nitrites, and total Kjeldahl nitrogen), and phosphorus concentrations exceeded the most stringent State water quality criteria. Using upper-bound estimates of the volume of steam condensate discharged, the fleetwide mass loadings for nitrogen, copper and nickel were calculated to be 3057 lbs/year, 49 lbs/year and 28 lbs/year, respectively. The mass discharged from any individual vessel while in a given port would be a fraction of that total. The upper-bound estimate for the fleetwide discharge volume is 300 million gallons per year.

Analysis (continued)

The following table lists the concentrations of these constituents and resulting fleetwide annual mass loadings:

Constituent	Concentration (µg/L)	Annual Mass Loading (lbs)
Copper		
Dissolved	BDL - 49.0	33
Total	BDL - 91.0	49
Nickel		
Dissolved	BDL - 22.0	25
Total	BDL - 34.7	28
Ammonia as Nitrogen	120-370	444
Nitrate/Nitrite	300-810	1085
Total Nitrogen[A]	1240	3057
Total Phosphorus	BDL - 270	222
Benzidine	BDL - 73.5	81
Bis(2-ethylhexyl)phthalate	BDL - 112	48

BDL= Below Detection Limits

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

The potential for steam condensate to cause thermal environmental effects was evaluated by modeling the thermal plume generated by the discharge and then comparing the model results to State thermal discharge water quality criteria. Results of the modeling indicate that only the largest generator of steam condensate (an aircraft carrier) may exceed state thermal mixing zone criteria, and then, only in the State of Washington. The models predict that the thermal plume from an aircraft carrier moored at the pier in Bremerton, Washington would extend a distance of 80 m from the discharge port along the vessel hull, not extending past the end of the hull. The plume would also extend outward no more than a distance of 30 m from the vessel hull at any point along the hull. Results of the modeling indicate that the aircraft carrier may exceed Washington criteria in an area that only covers 5% of the width, 2% of the length, and 0.07% of the total surface area of Sinclair Inlet.

Discussion and Discharge Determination

Discussion: The EPA and DoD do not consider that the plume results in a significant environmental impact. Such a localized plume would have a low potential for interfering with the passage of aquatic organisms in the water body and would have a limited impact on the organisms that reside in the upper water layer (sea surface boundary layer). In addition, because the discharge is freshwater (no salinity) and warmer than the receiving water, the plume floats in the surficial layer of the water body and has no impact on bottom-dwelling organisms.

The low mass loadings in the discharge and the thermal effects modeling results indicate that steam condensate has a low potential for causing adverse environmental impacts. Therefore, EPA and DoD determined that it is not reasonable and practicable to require a MPCD to mitigate adverse impacts on the marine environment for this discharge.

Determination: A marine pollution control device is not required.