This document is part of Appendix A, Chain Locker Effluent: Nature of Discharge for the "Phase I Final Rule and Technical Development Document of Uniform National Discharge Standards (UNDS)," published in April 1999. The reference number is EPA-842-R-99-001.

Phase I Final Rule and Technical Development Document of Uniform National Discharge Standards (UNDS)

Appendix A

Chain Locker Effluent: Nature of Discharge

April 1999

NATURE OF DISCHARGE REPORT

Chain Locker Effluent

1.0 INTRODUCTION

The National Defense Authorization Act of 1996 amended Section 312 of the Federal Water Pollution Control Act (also known as the Clean Water Act (CWA)) to require that the Secretary of Defense and the Administrator of the Environmental Protection Agency (EPA) develop uniform national discharge standards (UNDS) for vessels of the Armed Forces for "...discharges, other than sewage, incidental to normal operation of a vessel of the Armed Forces, ..." [Section 312(n)(1)]. UNDS is being developed in three phases. The first phase (which this report supports), will determine which discharges will be required to be controlled by marine pollution control devices (MPCDs)—either equipment or management practices. The second phase will develop MPCD performance standards. The final phase will determine the design, construction, installation, and use of MPCDs.

A nature of discharge (NOD) report has been prepared for each of the discharges that has been identified as a candidate for regulation under UNDS. The NOD reports were developed based on information obtained from the technical community within the Navy and other branches of the Armed Forces with vessels potentially subject to UNDS, from information available in existing technical reports and documentation, and, when required, from data obtained from discharge samples that were collected under the UNDS program.

The purpose of the NOD report is to describe the discharge in detail, including the system that produces the discharge, the equipment involved, the constituents released to the environment, and the current practice, if any, to prevent or minimize environmental effects. Where existing process information is insufficient to characterize the discharge, the NOD report provides the results of additional sampling or other data gathered on the discharge. Based on the above information, the NOD report describes how the estimated constituent concentrations and mass loading to the environment were determined. Finally, the NOD report assesses the potential for environmental effect. The NOD report contains sections on: Discharge Description, Discharge Characteristics, Nature of Discharge Analysis, Conclusions, and Data Sources and References.

2.0 DISCHARGE DESCRIPTION

This section describes the chain locker effluent and includes information on: the equipment that is used and its operation (Section 2.1), general description of the constituents of the discharge (Section 2.2), and the vessels that produce this discharge (Section 2.3).

2.1 Equipment Description and Operation

Surface vessels of the Armed Forces have one to three anchors, depending on vessel class.[1] Each surface vessel's anchor is attached to at least 810 feet (135 fathoms) of steel chain that is stored below decks in the chain locker when not in use. The chain is constructed in 90-foot (15-fathom) lengths, called "shots," which are connected together by detachable links. A diagram of a typical detachable link is provided in Figure 1. The inside of each detachable link is greased to prevent binding and corrosion, and to permit easy disassembly of the detachable parts. The chain locker is an enclosed compartment used only to store the anchor chain.[2] The bottom of the locker has a grating on which the chain is stowed. Below the grating is a sump. The chain locker sump contains multiple zinc sacrificial anodes to prevent corrosion. The anodes are physically connected (e.g. by bolts or welding) to the steel surface of the chain locker sump. The zinc anode is preferentially corroded or "sacrificed" instead of the chain locker sump's steel surface.

The chain moves through the chain pipe and the hawse pipe as the anchor is raised or lowered. The chain pipe connects the chain locker to the deck and the hawse pipe runs from the deck through the hull of the ship. When recovering the anchor, the anchor and chain are washed off with a fire hose to remove mud, marine organisms, and other debris picked up during anchoring. Seawater from the fire hose is directed either through the hawse pipe or directly over the side onto the chain while recovering the anchor.

The top of the chain pipe has a canvas sleeve to keep water from entering the chain locker through the chain pipe. Under rare circumstances, like heavy weather, rain or green water (seawater that comes over the bow during heavy weather) gets under the chain pipe canvas cover and into the chain locker. A diagram of a typical chain locker is provided in Figure 2.

Any fluid that accumulates in the chain locker sump is removed by either a drainage eductor for discharge directly overboard or by draining the chain locker effluent into the bilge. As the fluid in the chain locker sump is being drained for overboard discharge, the locker is sprayed with firemain water to flush out sediment, mud, or silt. An eductor is a pumping device that uses a high velocity jet of seawater from the firemain system to create a suction to remove the accumulated liquids and solids. The seawater supply from the firemain system is referred to as motive water for the eductor. OPNAVINST 5090.1B, Section 19-10 requires chain lockers of Navy vessels to be washed down outside of 12 n.m. to prevent the transfer of non-indigenous species and to flush out any sediment, mud, or silt.[2] Chain locker effluent which is drained into the bilge becomes bilgewater and is covered by the Surface Vessel Bilgewater/OWS Discharge NOD report.

2.2 Releases to the Environment

Chain locker effluent has the potential to contain living plants and animals, including microorganisms and pathogens, that are native to the location where the water was brought aboard during anchor retrieval. Chain locker effluent can also contain paint, rust, grease, and zinc. The chain locker and eductor operations are performed using water from the firemain. Therefore, the chain locker effluent can contain any constituents present in firemain water (see Firemain NOD report).

2.3 Vessels Producing the Discharge

Chain locker discharges occur in surface ships equipped with a wet firemain, including vessels belonging to the Navy, U.S. Coast Guard, Military Sealift Command, Army, and Air Force.[3] Submarine chain lockers are always submerged, open to the sea, and do not collect effluent to produce this discharge.

3.0 DISCHARGE CHARACTERISTICS

This section contains qualitative and quantitative information that characterizes the discharge. Section 3.1 describes where the discharge occurs with respect to harbors and near-shore areas, Section 3.2 describes the rate of the discharge, Section 3.3 lists the constituents in the discharge, and Section 3.4 gives the concentrations of the constituents in the discharge.

3.1 Locality

The Navy has an instruction for chain locker effluent discharge.[2] This instruction states that following anchor retrieval, chain lockers shall be washed down outside 12 miles from land to flush out any sediment, mud, and silt. This guideline also helps prevent the transfer of unwanted pathogens and marine organisms present in chain locker effluent.

3.2 Discharge Rate

Rated capacities of the eductors used to pump out chain locker sumps range between 50 and 150 gallons per minute. The chain locker effluent is mixed directly with the motive water from the firemain system before going overboard. The eductor uses 1/2 to 1 gallon of motive water for every gallon of effluent. Therefore, the total discharge ranges between 75 and 300 gallons per minute, of which 25 to 150 gallons per minute is motive water. The amount of effluent discharged yearly cannot be measured because the discharge is infrequent and little effluent is discharged.

3.3 Constituents

The small amount of water that is washed into the chain locker drains through the bottom grating and into the sump where it contacts paint chips, rust, grease, and sacrificial zinc anodes. This water has the potential to contain marine organisms.

The chain locker is painted using epoxy polyamide, epoxy, and zinc primer.[1,4,5,6]

The detachable links and other anchor chain components are periodically lubricated with Termalene #2, a water-resistant grease (Commercial Item Description (CID) A-A-50433). Termalene #2 is a compound that includes mineral oil, an aluminum complex, a calcium-based rust inhibitor, an antioxidant, and dye.[7] The grease was tested for resistance to washout.[8,9] This test measures the water washout characteristics of lubricating greases under elevated temperatures and mechanical operating conditions. Termalene #2 experienced "nil" washout when tested.[9] Because the grease is not exposed outside the link and due to the wash-resistant nature of the grease, it is unlikely grease would be released to the environment.

The zinc anodes in the chain locker can be in contact with seawater for extended periods of time. Zinc can leach continuously into the chain locker sump. The water that collects in the chain locker is a combination of seawater and water from the firemain. Also, firemain water is used as motive water when chain locker effluent is discharged. Therefore, the water could contain the constituents present in the firemain water. A more complete discussion of these constituents is found in the Firemain Systems NOD report.

The chain locker effluent might contain the priority pollutants bis(2-ethylhexyl) phthalate, copper, iron, nickel, and zinc. This effluent does not contain any bioaccumulators.

3.4 Concentrations

The concentrations of constituents present in the chain locker cannot be easily measured. Chain lockers are kept dry on most vessels to reduce maintenance. Zinc anodes are present in the bottom of the chain locker. Because the chain locker is often dry, it is unlikely that these anodes significantly affect the concentration of zinc in the effluent. The average measured concentrations of firemain water constituents that exceed the Federal and/or most stringent water quality criteria are presented in Table 1.[10] Firemain is used as the motive water for drainage eductors.

4.0 NATURE OF DISCHARGE ANALYSIS

Based on the discharge characteristics presented in Section 3.0, the nature of the discharge and its potential impact on the environment can be evaluated. Mass loadings are discussed in Section 4.1 and the concentrations of discharge constituents after release to the environment are discussed in Section 4.2. In Section 4.3, the potential for the transfer of non-indigenous species is discussed.

4.1 Mass Loadings

Mass loadings were not calculated because constituent concentrations were not estimated. Chain locker effluent is not anticipated to result in significant loads within 12 n.m. because of the infrequency of discharge and because of the management practices in place which pump this discharge overboard when the vessel is beyond 12 n.m. of shore. Chain locker effluent is discharged infrequently because only small volumes of water accumulate in the chain locker sump over time. This determination was made after inspections of chain lockers aboard several ships.[10,11]

4.2 Environmental Concentrations

Chain locker effluent is expected to contain zinc, rust, paint, grease, and any constituents from the firemain water. Because of the intermittent nature of this discharge, acute toxicities are the primary concern. There is no concentration data available for chain locker effluent. Table 1 shows the concentration of constituents of firemain water that total nitrogen, bis(2-ethylhexyl) phthalate, copper, iron, and nickel, exceed the Federal and/or the most stringent state acute water quality criteria.

4.3 Potential for Introduction of Non-Indigenous Species

Inspections of chain lockers aboard several ships revealed that only small amounts of water actually accumulate within the chain locker. Therefore, there is little potential for introducing non-indigenous species into the chain locker. The process of washing down the anchor as it is taken aboard and discharging the effluent beyond 12 n.m. further reduces the possibility of transferring species via the chain locker.[2]

5.0 CONCLUSIONS

The small volume of chain locker effluent results in small mass loadings and provides little opportunity for the transfer of non-indigenous species. The discharge volume is expected to be small even if the discharge was not controlled. Therefore, this discharge has a low potential for causing adverse environmental effects.

6.0 DATA SOURCES AND REFERENCES

To characterize this discharge, information from various sources was obtained. Table 2 shows the source of the data used to develop this NOD report.

Specific References

1. UNDS Equipment Expert Meeting Minutes - Anchor Chain Washdown and Chain Locker Effluent. July 30, 1996.

2. OPNAVINST 5090.1B, Environmental and Natural Resources Program Manual, November 1 1994.

3. UNDS Round 2 Equipment Expert Meeting Minutes. March 11, 1997.

4. Military Specification MIL-P-24441, Epoxy polyamide. July 1991.

5. Performance Specification MIL-PRF-23236, Epoxy. April 1990.

6. Naval Ships' Technical Manual (NSTM). Chapter 631, Paragraph 8.23.2.1. Preservation of Ships in Service. December 1996.

7. Bel Ray Company, Inc., Material Safety Data Sheet for Termalene #2. 1996.

8. The American Society for Testing and Materials (ASTM) test method D-1264. June 1996.

9. Bel Ray Company, Inc., Product Data Sheet for Termalene #2. 1993.

10. UNDS Phase 1 Sampling Data Report. Volumes 1-13, October 1997.

11. Navy Fleet Technical Support Center Pacific (FTSCPAC) Inspection Report Regarding Elevator Pit and Anchor Chain Locker Inspection Findings on Six Navy Ships, March 3, 1997.

General References

USEPA. Toxics Criteria for Those States Not Complying with Clean Water Act Section 303(c)(2)(B). 40 CFR Part 131.36.

USEPA. Interim Final Rule. Water Quality Standards; Establishment of Numeric Criteria for Priority Toxic Pollutants; States' Compliance – Revision of Metals Criteria. 60 FR 22230. May 4, 1995.

USEPA. Water Quality Standards; Establishment of Numeric Criteria for Priority Toxic Pollutants. 57 FR 60848. December 22, 1992.

USEPA. Water Quality Standards; Establishment of Numeric Criteria for Priority Toxic Pollutants for the State of California, Proposed Rule under 40 CFR Part 131, Federal Register, Vol. 62, Number 150. August 5, 1997.

Connecticut. Department of Environmental Protection. Water Quality Standards. Surface Water Quality Standards Effective April 8, 1997.

Florida. Department of Environmental Protection. Surface Water Quality Standards, Chapter 62-302. Effective December 26, 1996.

Georgia Final Regulations. Chapter 391-3-6, Water Quality Control, as provided by The Bureau of National Affairs, Inc., 1996.

Hawaii. Hawaiian Water Quality Standards. Section 11, Chapter 54 of the State Code.

Mississippi. Water Quality Criteria for Intrastate, Interstate and Coastal Waters. Mississippi Department of Environmental Quality, Office of Pollution Control. Adopted November 16, 1995.

New Jersey Final Regulations. Surface Water Quality Standards, Section 7:9B-1, as provided by The Bureau of National Affairs, Inc., 1996.

Texas. Texas Surface Water Quality Standards, Sections 307.2 - 307.10. Texas Natural Resource Conservation Commission. Effective July 13, 1995.

Virginia. Water Quality Standards. Chapter 260, Virginia Administrative Code (VAC) , 9 VAC 25-260.

Washington. Water Quality Standards for Surface Waters of the State of Washington.   Chapter 173-201A, Washington Administrative Code (WAC).

Van der Leeden, et al. The Water Encyclopedia, 2nd Ed. Lewis Publishers: Chelsea, Michigan, 1990.

Committee Print Number 95-30 of the Committee on Public Works and Transportation of the House of Representatives, Table 1.

The Water Quality Guidance for the Great Lakes System, Table 6A. Volume 60 Federal Register, p. 15366. 23 March 1995.

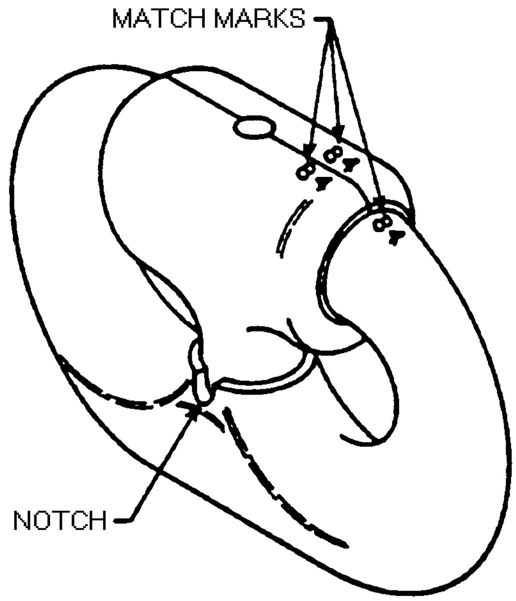

Figure 1. Schematic Diagram of a Typical Detachable Chain Link

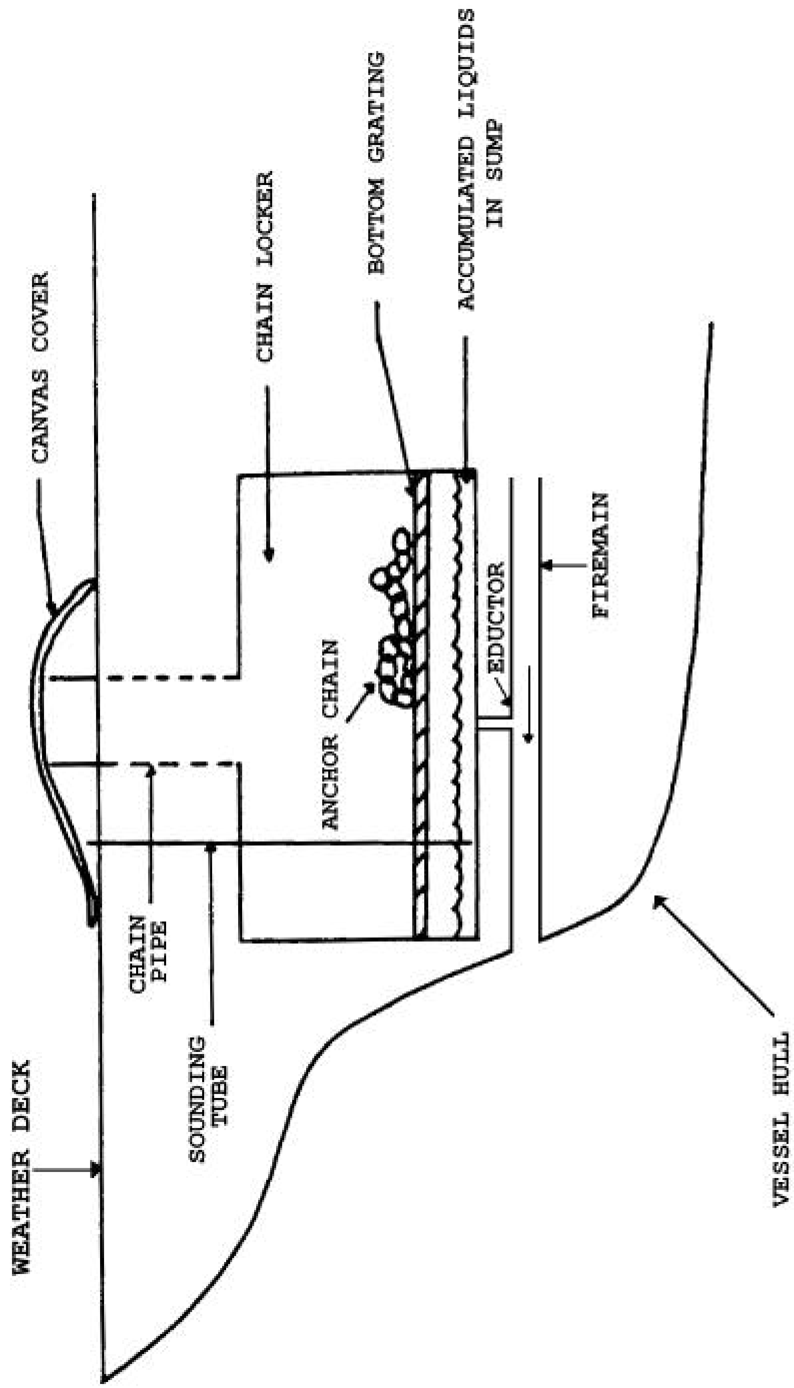

Figure 2. Schematic Diagram of a Typical Chain Locker

Table 1. Concentrations of Constituents of Wet Firemain Discharge that Exceed Water Quality Criteria

Constituents	Log-normal Mean Effluent	Minimum Concentration Effluent	Maximum Concentration Effluent	Federal Acute WQC	Most Stringent State Acute WQC
Classicals (μg/L)					
Total Nitrogen	500			None	200 (HI)[A]
Organics (μg/L)					
Bis(2-ethylhexyl) phthalate	22	BDL	428	None	5.92 (GA)
Metals (μg/L)					
Copper					
Dissolved	24.9	BDL	150	2.4	2.4 (CT, MS)
Total	62.4	34.2	143	2.9	2.5 (WA)
Iron					
Total	370	95.4	911	None	300 (FL)
Nickel					
Dissolved	13.8	BDL	38.9	74	74 (CA, CT)
Total	15.2	BDL	52.1	74.6	8.3 (FL, GA)

Refer to federal criteria promulgated by EPA in its National Toxics Rule, 40 CFR 131.36 (57 FR 60848; Dec. 22, 1992 and 60 FR 22230; May 4, 1995)
A - Nutrient criteria are not specified as acute or chronic values.

CA = California
CT = Connecticut
FL = Florida
GA = Georgia
HI = Hawaii
MS = Mississippi
WA = Washington

Table 2. Data Sources

	Data Source			
NOD Section	**Reported**	**Sampling**	**Estimated**	**Equipment Expert**
2.1 Equipment Description and Operation				X
2.2 Releases to the Environment				X
2.3 Vessels Producing the Discharge	UNDS Database			X
3.1 Locality				X
3.2 Rate			X	
3.3 Constituents	PMS Cards (a)			X
3.4 Concentrations			unknown	
4.1 Mass Loadings			unknown	
4.2 Environmental Concentrations			unknown	
4.3 Potential for Introducing Non-Indigenous Species				X

(a) PMS - Navy planned maintenance system