This document is part of Appendix A, and includes Elevator Pit 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)

Elevator Pit Effluent: Nature of Discharge

April 1999

NATURE OF DISCHARGE REPORT

Elevator Pit 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)~~ei~~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 discharge from elevator pits 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

Most large surface vessels have at least one type of elevator; however, elevator configurations vary between ship classes. On each ship, several different types and sizes of elevators may be used to transport small packages, large cargo items, ordnance, food supplies, and personnel.[1] Elevators can service several decks depending on their purpose. Elevator doors open at each deck for loading and unloading. The elevator operates using either cables, rails, or hydraulic pistons. The elevators that raise and lower aircraft on aircraft carriers cannot produce this discharge because they are open to the sea and do not have elevator pits. Elevators that operate in shafts have a sump in the pit to collect liquids that may enter the elevator and shaft area.[1] If the elevator pit is located above the waterline, the sump is fitted with a drain that directs the waste overboard. This drain is normally higher than the sump floor to prevent clogging from solids. If the elevator pit is located below the waterline, the pit is educted dry using the firemain water supply.

2.2 Releases to the Environment

For elevators with pits, deck runoff and elevator equipment maintenance activities are the major sources of liquid that accumulate in the pit. Deck runoff occurs during heavy rains, rough seas, and deck washdowns. During these events, water from the deck can enter the elevators and elevator shafts when the elevator doors are open, or through worn seals when the doors are closed (non-watertight). When water enters the elevator pit, it can contain materials that were on the deck, including aviation fuel, hydraulic fluid, lubricating oil, residual water, and aqueous film forming foam (AFFF).[2] The runoff may also include lubricant applied to the elevator doors, door tracks, and other moving elevator parts. Residue in the elevator car from the transport of materials may also be washed into the elevator pit. The cleaning solvent used during maintenance cleaning operations as well as liquid wastes generated by the cleaning process drain into the elevator pit sump. This mixture of materials and liquid collects in the sump at the bottom of the elevator pit.

Waste accumulated in the elevator pits is removed by gravity draining, by educting overboard using firemain powered eductors, by using a vacuum or sponges to transfer the waste to the ship's bilge system for treatment as bilgewater, or by containerizing it for shore disposal.[3] Since elevator pit eductors use the firemain water supply, the elevator pit effluent can contain any constituents present in the firemain water. The ratio of elevator pit waste to firemain supply can vary from 1:1 to 3:1, depending on the type of eductor used to evacuate the elevator pit.

2.3 Vessels Producing the Discharge

All of the ships listed in Tables 1, 2, and 3 have the potential to produce an elevator pit discharge. Table 1 lists the MSC ships that have elevators. Tables 2 and 3 list the number and types of major elevator systems on Navy surface combatants and support ships, respectively.[4] U.S. Coast Guard (USCG), Air Force, and Army vessels do not produce this discharge because they do not have elevator pits.

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

This discharge has the potential to occur within and beyond 12 nautical miles (n.m.) from shore. Inspections of elevator pits on Navy ships in port revealed that elevator pits are generally dry and that elevator pit effluent is not expected to be discharged in significant amounts within 12 n.m. because of current practices which educt the waste overboard prior to the ship coming within 12 n.m. of shore.[3] Without these practices, this effluent could be discharged while pierside or underway.

3.2 Rate

The rate of this discharge is subject to frequency and amount of deck runoff (e.g., washdown water and rainfall), as well as the frequency of use of the elevators and the size of the elevator opening. These factors vary greatly between vessel classes. Inspections were performed on nine vessels to investigate the presence of accumulated waste in elevator pits. The inspections revealed that elevator pits in each vessel were often dry when the vessel came into port, because the accumulated waste had either been drained or educted overboard prior to the vessel coming within 50 n.m. of land, containerized for shore disposal, or the waste had been transferred to the bilge for treatment by the oil water separator (OWS) as bilgewater.[3] Based on this information, it is estimated that the discharge flow rates of elevator pit effluent within the 12 n.m. zone are minimal.

3.3 Constituents

The constituents of elevator pit effluent are affected by the amount and type of materials on deck, the agents used during cleaning and maintenance of the elevators, and to some degree the material transported in the elevators. At any given time elevator pit effluent may contain the following constituents:

- grease;
- lubricating oil;

- solvent;
- soot;
- dirt;
- paint chips;

Additional constituents that may be carried into the elevator pit by deck runoff can include fuel, AFFF, glycol, and sodium metasilicate. Material safety data sheet (MSDS) information on these materials indicate that the constituents can include polymers, heavy hydrocarbons, paraffinic distillates, silicone compounds, various organic acids, hydroxyl compounds, naphtha compounds, various oils, and some metals such as lead and zinc.

When eductors are used to remove the waste accumulated in elevator pits, the effluent is a combination of the pit waste and the firemain water that is used for eduction. It is not possible to determine the percentages of each of these sources, because they would vary from ship to ship depending upon a number of factors. Furthermore, effluent sampling would not help to determine these percentages, as it would be impossible to isolate and analyze the three sources of the discharge. The Firemain Systems NOD report contains a more complete discussion of those constituents found in firemain water. The only constituents present in the firemain water that were found to exceed water quality criteria were copper, iron, and nickel.

Of the constituents listed above, the expected priority pollutants in this discharge are bis(2-ethylhexyl) phthalate, silver, chromium, copper, iron, nickel, lead, zinc, and phenols. Deck runoff is the source of these pollutants, with the exception of bis(2-ethylhexyl) phthalate, copper, iron, and nickel, which are also present in firemain water. Additional information concerning these pollutants can be found in the Deck Runoff NOD report.

No bioaccumulators are anticipated in this discharge.

3.4 Concentrations

Constituent concentrations of deck runoff resulting from precipitation will vary with a number of factors. The following factors affecting deck runoff constituent concentrations are dependent on time since the last rainfall or deck washdown:

- intensity and duration of rainfall;
- type, intensity, and duration of weather (high sea state and green water);
- season (which will affect glycol loading from deicing fluids);
- ship's adherence to good housekeeping practices; and
- ship's operations.

The periodicity of cleaning and lubrication of the mechanical components in the elevator pit will also affect constituent concentrations. For example, if the guide rollers, bearings, etc., located in the bottom of the elevator shaft are cleaned and greased more often, the concentrations of solvent and grease in the effluent could increase.

The Firemain Systems NOD report contains a more detailed analysis of firemain water constituent concentrations. As shown in Table 4, the firemain water constituents that exceeded the most stringent water quality criteria were total nitrogen, bis(2-ethylhexyl) phthalate, copper, iron, and nickel, where the total measured effluent log-normal mean concentrations were 500 micrograms per liter (µg/L), 22 µg/L, 62.4 µg/L, 370 µg/L, and 15.2 µg/L, respectively.[5]

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. A discussion of mass loadings is presented in Section 4.1. In Section 4.2, the concentrations of discharge are discussed, and in Section 4.3, the potential for the transfer of non-indigenous species is evaluated.

4.1 Mass Loading

Mass loadings cannot be calculated because the quantity of constituents released from elevator pits cannot be estimated, and because the concentration of these constituents will vary as discussed in Section 3.4. Inspections of elevator pits on Navy ships in port revealed that elevator pits are generally dry and that elevator pit effluent is not expected to be discharged in significant amounts within 12 n.m. because of current practices which educt the waste overboard prior to the ship coming within 12 n.m. of shore.[3]

4.2 Environmental Concentrations

Concentrations of grease, oil, cleaning solvent, and other pollutants that might be present in elevator pit effluent have not been estimated. The concentrations of total nitrogen, bis(2-ethylhexyl) phthalate, copper, iron, and nickel in the firemain water used for eduction have been found to exceed water quality criteria.

4.3 Potential for Introducing Non-Indigenous Species

The major sources of elevator pit effluent, deck runoff and maintenance activities, do not have a significant potential to introduce non-indigenous species; therefore, this discharge does not have a significant potential for transporting non-indigenous species.

5.0 CONCLUSION

Uncontrolled, elevator pit effluent could possibly have the potential to cause an adverse environmental effect because oil could be discharged in amounts and concentrations high enough to cause an oil sheen, especially when the vessel is pierside. There are currently no formalized management practices in place regulating this discharge. However, surveys and inspections of nine Navy ships indicated that the current practice is to containerize the waste for shore disposal, to transfer the waste to the ship's bilges for processing by the OWS, or to refrain from discharging the waste overboard.[3]

6.0 DATA SOURCES AND REFERENCES

To characterize this discharge, information from various sources was obtained, reviewed, and analyzed. Table 5 indicates the data source of the information presented in each section of this NOD report.

Specific References

1. UNDS Equipment Expert Meeting Minutes - Elevator Pit Effluents. October 1, 1996.

2. Round 2 Equipment Expert Meeting Minutes - Elevator Pit Effluent. April 3, 1997.

3. 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.

4. Naval Surface Warfare Center, Carderock Division, Philadelphia Site (NSWCCD-SSES) Report Regarding Number and Type of Elevators on Various Navy Vessels, Paul Hermann, October 17, 1997.

5. UNDS Phase I Sampling Data Report, Volumes 1-13, October 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).

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. March 23, 1995.

Table 1. Type of Elevators and Conveyors on MSC Ships

Vessel	Passenger Elevators	Cargo Elevator	Stores Lift (British)
Mars AFS 1		(1) 16,000 lb CARGO (2) 4,000 lb (HYD) HELO	
Niagara Falls AFS 3		(1) 16,000 lb CARGO (2) 10,000 lb HELO (2) 12,000 lb CARGO	
Concord AFS 5		(1) 16,000 lb CARGO (2) 10,000 lb HELO (2) 12,000 lb CARGO	
San Diego AFS 6		(1) 16,000 lb CARGO (2) 10,000 HELO	
San Jose AFS 7		(1) 16,000 lb CARGO (2) 10,000 lb HELO (2) 12,000 CARGO (3) 4,000 lb CARGO	
T-AFS 8 Class 3 Vessels		8 per vessel	1 per vessel
T-AH 19 Class 2 Vessels	10 per vessel		
T-AO 187 Class 10 Vessels	1 per vessel		
LKA-113 Class 2 Vessels		6 per vessel	
T-AE 28 Class 4 Vessels		6 per vessel	
T-AE 32 Class 4 Vessels		6 per vessel[1]	

1. Number 6 elevator divides into two elevators.

Table 2. Number and Type of Major Elevator Systems (Navy Surface Combatants)

Ship Class	Number of Vessels	Number of Elevators Per Vessel	Type of Elevator
CG 47	27	2	Ammunition
DD 963/ DDG 993	35	2	Ammunition
FFG 7	48	1	Pallet
CVN 65	1	14	Weapons
CVN 68	7	9 (CVN 72 - 74) 10 (CVN 68, 70, 71) 11 (CVN 69)	Weapons
CV 67	1	9	Weapons
CV 63	2	11 (CV 63) 12 (CV 64)	Weapons

Table 3. Number and Type of Major Elevator Systems (Navy Auxiliary and Amphibious ships)

Ship Class	Hull	Number of Elevators	Type of Elevator
Underway Replenishment Ships	AE 27	6	Cargo/Weapons
	AE 28	6	Cargo/Weapons
	AE 29	6	Cargo/Weapons
	AE 32	7	Cargo/Weapons
	AE 33	7	Cargo/Weapons
	AE 34	7	Cargo/Weapons
	AE 35	7	Cargo/Weapons
	AOE 1	9	Cargo/Weapons
	AOE 2	9	Cargo/Weapons
	AOE 3	9	Cargo/Weapons
	AOE 4	9	Cargo/Weapons
	AOE 6	6	Cargo/Weapons
		1	Cargo
	AOE 7	6	Cargo/Weapons
		1	Cargo
	AOE 8	7	Cargo/Weapons
	AO 177	1	Weapons
	AO 178	1	Weapons
	AO 179	1	Weapons
	AO 180	1	Weapons
	AO 186	1	Weapons
Material Support Ships	AS 36	8	Cargo
		2	Component
		2	Weapons
	AS 39	8	Cargo
		2	Component
		1	Weapons
	AS 41	8	Cargo
		2	Component
		1	Weapons
Amphibious Warfare Ships	LCC 19	1	Vehicle
	LCC 20	1	Vehicle
	LHA 1	5	Cargo/Weapons
		1	Medevac
	LHA 2	5	Cargo/Weapons
		1	Medevac
	LHA 3	5	Cargo/Weapons
		1	Medevac
	LHA 4	5	Cargo/Weapons
		1	Medevac
	LHA 5	5	Cargo/Weapons
		1	Medevac
	LHD 1	6	Cargo/Weapons
		1	Medevac
	LHD 2	6	Cargo/Weapons
		1	Medevac

Ship Class	**Hull**	**Number of Elevators**	**Type of Elevator**
Amphibious Warfare Ships (continued)	LHD 3	6	Cargo/Weapons
		1	Medevac
	LHD 4	6	Cargo/Weapons
		1	Medevac
	LHD 5	6	Cargo/Weapons
		1	Medevac
	LPD 1	Decommissioned	
	LPD 2	Decommissioned	
	LPD 4	1	Cargo/Weapons
	LPD 5	1	Cargo/Weapons
	LPD 6	1	Cargo/Weapons
	LPD 7	1	Cargo/Weapons
	LPD 8	1	Cargo/Weapons
	LPD 9	1	Cargo/Weapons
	LPD 10	1	Cargo/Weapons
	MCS 12	1	Cargo/Weapons
	LPD 13	1	Cargo/Weapons
	LPD 14	1	Cargo/Weapons
	LPD 15	1	Cargo/Weapons
	LPH 3	2	Weapons
	LPH 11	2	Weapons
	LPH 12	2	Weapons
	LSD 41	1	Cargo
		1	Weapons
	LSD 42	1	Cargo
		1	Weapons
	LSD 43	1	Cargo
		1	Weapons
	LSD 44	1	Cargo
		1	Weapons
	LSD 45	1	Cargo
		1	Weapons
	LSD 46	1	Cargo
		1	Weapons
	LSD 47	1	Cargo
		1	Weapons
	LSD 48	1	Cargo
		1	Weapons
	LSD 49	2	Cargo
		1	Ammunition
		3	Lift Platform
	LSD 50	2	Cargo
		1	Ammunition
		3	Lift Platform
	LSD 51	2	Cargo
		1	Ammunition
		3	Lift Platform
Other Auxiliary Ships	AGF 3	1	Cargo/Weapons/Stores
	AGF 11	1	Cargo/Weapons

Table 4. Mean Concentrations of Constituents 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					
Total	15.2	BDL	52.1	74.6	8.3 (FL, GA)

Notes:
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.

CT = Connecticut
FL = Florida
GA = Georgia
MS = Mississippi
WA = Washington

Table 5. 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			X
2.3 Vessels Producing the Discharge	UNDS Database			X
3.1 Locality	X			X
3.2 Rate	X			
3.3 Constituents	MSDS			X
3.4 Concentrations			unknown	
4.1 Mass Loadings			unknown	
4.2 Environmental Concentrations			unknown	
4.3 Potential for Introducing Non-Indigenous Species				X