This document is part of Appendix A, and includes Photo Lab Drains: 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)

Photo Lab Drains: Nature of Discharge

April 1999

NATURE OF DISCHARGE REPORT

Photo Lab Drains

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 photographic laboratory drains 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

Shipboard photographic laboratory wastes result from the processing of color, black-and-white, and X-ray film. The chemicals used aboard vessels for these purposes are the same as those used at shore-based photographic facilities. This discharge is controlled by the Armed Forces by current guidance which requires containerization of all photo processing wastes for shore disposal when within 12 nautical miles (n.m.) of shore.[1]

The photographic wastewater processing system consists of three elements: a film processor, a washwater recycle system, and a fixer recycle and silver recovery subsystem. The film processor effluents include the developer and fixer solutions and the thiosulfate washwater stream. After the film is fixed, it goes through the washwater recycle system, where it is immersed in thiosulfate washwater and then sprayed with freshwater (rinsewater).[2] Black-and-white and X-ray film effluents are then containerized for shore disposal or directly discharged overboard via the ship's collection, holding, and transfer (CHT) system if outside 12 n.m. Fixer solutions must always be containerized for shore disposal within 12 n.m. Beyond 12 n.m. the fixer solution may be discharged overboard, provided the fixer solution is processed through a silver recovery unit, if one is available on-board.[3] A silver recovery unit uses an electrolytic recovery assembly to recover the silver from the recycled fixer solution.[2] The effluent from the recovery unit is then containerized, or discharged overboard if outside 12 n.m.[1] Color film processor effluent (small quantities) may be discharged directly overboard beyond 12 n.m. via the plumbing drain system.[3] In port, or in transit within 12 n.m., the effluent is containerized for shore disposal. In some cases, rinsewater is discharged to the CHT system in port for discharge ashore if local regulations permit.

The amount and frequency of waste generation across vessel classes will vary depending upon the vessels' photo processing capabilities (color and/or black-and-white), equipment, and operational objectives. Color film processing waste is generated from batch quantities of developer, fixer, and intensifier solutions. Black-and-white and X-ray film processing waste is generated from processor effluent, stop bath, detergents, and hardener solutions. Many vessels are now being outfitted with self contained automatic processors or digital processors. Automatic processors do not produce a continuous rinsewater stream. Digital processors do not use chemicals.[4]

2.2 Releases to the Environment

Photographic processing effluents are only discharged outside of 12 n.m. from shore. Black-and-white and X-ray photographic processing effluent is discharged overboard via the CHT system. Color film processor effluent is permitted to be discharged overboard above the waterline via the plumbing drain system.[1] The discharge can consist of stop bath, detergents, hardener, developer, fixer, and rinse solutions.

2.3 Vessels Producing the Discharge

Navy vessels such as aircraft carriers (CV/CVN), amphibious assault ships (LHD/LHA/LPD/LCC), and submarine tenders (AS) have photographic laboratory facilities, including color, black-and-white and X-ray photographic processors. Two Military Sealift Command (MSC) hospital ships (T-AH) have photo processing equipment, but neither is used on a routine basis or within U.S. contiguous or territorial waters. The U. S. Coast Guard (USCG) currently has two WAGB 400 Class icebreakers with photographic and X-ray processing capabilities, but does not discharge wastes overboard within 12 n.m. of shore.[5] The Army and the Air Force are not expected to produce this discharge because their vessels do not have photographic developing capabilities.

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

Naval Ships' Technical Manual (NSTM), Chapter 593, provides uniform guidance in the handling and disposal of photographic processing chemicals. While in port or in transit within 12 n.m., all discharges of X-ray, color and black-and-white photographic processing fixers, and developers are containerized for shore-side disposal. Film rinsewaters are not containerized in port due to their large volumes, but are disposed of in to the CHT system. The CHT system is connected to the pierside collection piping while the vessel is docked. Therefore, overboard discharges of photographic processing effluents do not occur from any vessel within 12 n.m. of shore, and most vessels containerize their waste even beyond this point.

Beyond 12 n.m., all photo processing chemicals, if not containerized, are directed to the CHT system where they are mixed with blackwater and discharged overboard.[3] Wastes that can be directed to the CHT system are black-and-white and X-ray film processing waste from processor effluent, stop bath, detergents, hardener solutions, and silver recovery unit effluent.

3.2 Rate

Discharge flow rate data were not obtained.

3.3 Constituents

Table 1 lists the chemical constituents identified in the most commonly used developing solutions and fixers, and in rinse waters on vessels of the Armed Forces. Silver is the only priority pollutant in this discharge. There are no known bioaccumulators identified in this discharge.

3.4 Concentrations

The range of photographic processing chemical concentrations was not obtained.

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

Constituent mass loadings were not calculated since the discharge does not occur inside 12 n.m. Furthermore, discharge concentrations and flow rates are unknown.

4.2 Environmental Concentrations

Concentrations released to the environment were not calculated since the discharge does not occur inside 12 n.m. and the discharge concentrations are unknown.

4.3 Potential for Introducing Non-Indigenous Species

Potable water is used in photographic laboratories; therefore, there is no possibility for the introduction, transport, or release of non-indigenous species.

5.0 CONCLUSIONS

Existing data are insufficient to determine whether drainage from shipboard photographic labs has the potential (or has a low potential) of causing an adverse environmental effect.

6.0 DATA SOURCES AND REFERENCES

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

Specific References

1. Naval Ships' Technical Manual (NSTM) Chapter 593 Appendix D, pp D-9 and D-10, Disposal Guidelines For Shipboard Hazardous Waste. September 1, 1991.

2. Laboratory Evaluation of a Photographic Wastewater Processing System, prepared by David W. Taylor Naval Ship Research and Development Center, Bethesda, MD. August, 1982.

3. UNDS Equipment Expert Meeting Minutes. Photo Laboratory Discharges - April 2, 1997.

4. Personal Communication Between John Julian, NAVSEA 03L13, and Sr. Chief Freeland, Naval Imaging Command, on Self Contained Automatic Processors and Digital Processors for use in Photographic Laboratory. September 23, 1997.

5. Personal Communication Between LT. Joyce Aivalotis, U.S. Coast Guard and Dan Mosher of Malcolm Pirnie, Inc., on USCG Photographic Processing Procedures. April 28, 1997.

6. Personal Communication Between Albert Browne, NAVSEA 03L13, and Mr. Joseph MacDonald, NAVSEADET (PERA-CV), on Kodak Processor Chemistry Listings for Kreonite/Kodak RA-4, Black-and-White Imagemaker, and Kodak C-41 Color Imagemaker Processors. July 25, 1996.

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. Chemical Constituents Identified in the Most Commonly Used Photographic Developing Solutions and Fixers, and in Rinse Waters on Vessels of the Armed Forces[6]

1,3 - propylenediaminetetraacetic acid	Diethanolamine - sulfur dioxide	potassium hydroxide
2- aminoethanol	Diethanolamine - sulfur dioxide complex	potassium sulfite
4 - (N-ethyl- N-2-methanesulfonylaminoethyl) - 2 - methylphenylenediamine sesquisulfate monohydrate	diethylene glycol	propylene glycol
4 - (N-ethyl-N-2-hydroxyethl)-2-methylphenylenediamine sulfate	Formaldehyde	silver*
4 - (N-ethyl- N-2-methanesulfonylaminoethyl) - 2 - methylphenylenediomine sulfate	glacial acetic acid	sodium acetate
acetic acid	Hydroquinone	sodium bisulfite
aluminum sulfate	Hydroxylamine sulfate	sodium citrate
Ammonia	Isothiazolones	sodium metabisulfite
ammonium (ethylenodinitrilo) tetraacete) ferrate	lithium sulfate	sodium sulfite
ammonium acetate	methyl alcohol	sodium sulfosuccinate
ammonium bromide	N,N-diethylhydroxylamine	stilbene brightner
ammonium citrate	nitric acid	sulfuric acid
ammonium ferric ethylenediaminetetra acetic acid	Organosilicone fluid	tetra sodium ethylene diamine tetraacetrate
ammonium ferric propylenediaminetetraacetic acid	penitetic acid	triethanolamine
ammonium sulfite	potassium bicarbonate	
ammonium thiosulfate	potassium carbonate	
boric acid	potassium chloride	

* Priority Pollutant

Table 2. Data Sources

	Data Sources			
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 (NA)				
3.3 Constituents	X			X
3.4 Concentrations (NA)				
4.1 Mass Loadings (NA)				
4.2 Environmental Concentrations (NA)				
4.3 Potential for Introducing Non-Indigenous Species				X

Note: NA = not applicable