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The Impact of the Federal Water Pollution Control Act on the Discharge of Sanitary Waste from United States Navy Ships

William G. Fidyk
University of Rhode Island

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TABLE OF CONTENTS

INTRODUCTION

During the late 1960's and early 1970's several significant pieces of environmental legislation were enacted. These pieces of legislation were designed to restore, improve, preserve and protect our natural resources. These natural resource programs include soil and water conservation, fish and wildlife management, air and water pollution abatement, protection of endangered species, and preservation of cultural and historic property. The recreation policies for the nation are stated in the National Historical Preservation Act (Public Law 88-29). "(A)ll American people of present and future generations should be assured adequate outdoor recreation resources, and ... all levels of government ... take prompt and coordinated action to the extent practicable without diminishing or affecting their respective powers and functions to conserve, develop and utilize such resources for the benefit and enjoyment of the American people."[1]

The legislation with the most impact on the United States Navy and Naval vessels has been the Federal Water Pollution Control Act.[2] Under this act, the discharge of inadequately treated or untreated sewage from U.S. Navy vessels into the navigable waters of the United States after 1 April 1981 is prohibited unless appropriately exempted. The primary source of concern here is untreated sewage, and the pathogenic bacteria and viruses it may contain. In order to cause disease such pathogens must be ingested - usually in excess of a certain quantity, the number depending on the kind of organism. Ingestion of shellfish taken from sewer contaminated water poses the greatest threat to health. Clams, oysters and mussels are filter feeders, and they concentrate bacterial and viral agents. Since these shellfish are eaten whole, and often uncooked, they have been responsible for epidemics of hepatitis in many parts of the world.[3]

In order to meet the statutory requirements of the Clean Water Act, the United States Navy had to embark on a program to: modify existing vessels with Marine Sanitation Devices (MSD's), and install such devices on new construction ships. This program has been both costly and controversial. This paper will examine the legal requirements for Marine Sanitation Devices, the design criteria of MSD's for Naval vessels, types of systems, operation of the systems and problems associated with MSD's.

LEGAL REQUIREMENT

The National Environmental Policy Act (NEPA) of 1969[4] affirmed the federal government's responsibility to manage man's impact upon the environment. To clarify this responsibility, Executive Orders 11514[5] and 11752[6] were issued. These Executive Orders emphasized the role of the federal government, and its agencies in the national effort to protect and enhance the quality of our environment. These Executive Orders are the legal basis upon which the Navy is required to act.[7] Each Executive Order is discussed below, followed by the requirements levied in the Federal Water Pollution Control Act.

Executive Order 11514 deals with the protection and enhancement of environmental quality. It was passed on May 5, 1970. This Executive Order supports the purpose of the National Environmental Policy Act of 1969. It requires that the federal leadership be aware of existing environmental standards and that their respective agencies shall direct their policies, plans and programs to meet national environmental goals. It also tasks these individuals to "demonstrate to the public an awareness of the environmental implication of their actions."[8]

Executive Order 11752 tends to be a little more specific in dealing with pollution control. Its effective date is December 17, 1973, and it is titled "Prevention, Control and Abatement of Environmental Pollution at Federal Facilities." It requires federal agencies to be aware of their commitment to environmental maintenance and enhancement by upholding seven specific pieces of legislation. They are:

1. Clean Air Act (42 U.S.C. 1857);
2. Federal Water Pollution Control Act (P.L. 92-500);
3. Solid Waste Disposal Act (42 U.S.C. 3251);
4. Noise Control Act of 1972 (42 U.S.C. 4901);
5. Marine Protection, Research and Sanctuaries Act (16 U.S.C. 1431);
6. Federal Environmental Pesticide Control Act (7 U.S.C. 136);
7. National Environmental Policy Act (42 U.S.C. 4321).[9]

The objective of the Federal Water Pollution Control Act (Clean Water Act) is to "restore and maintain the chemical, physical and biological integrity of the nation's waters."[10] In addition, the act (in Section 101) declared that:

(1) It is the national goal that the discharge of pollution into navigable waters be eliminated by 1985.

(2) It is the national goal that wherever attainable, an interim goal of water quality which provides for the protection and propagation of fish, shellfish and wildlife and provides for recreation in and on the water be achieved by July 1, 1983.[11]

To attain the goals established in Section 101, obviously a rather comprehensive program had to be embarked upon. Sewage treatment plants had to be modified to meet EPA effluent standards; industries who discharge waste into the navigable waters had to develop a means whereby they treated or transferred it to sewage treatment facilities for processing. In addition, Naval vessels had to develop a method of processing their own waste.

Section 312 of Public Law 92-500 deals with Marine Sanitation Devices. It requires that all U.S. Flag vessels or boats conform to the standards prescribed in the Clean Water Act. The standard is that the discharge of inadequately treated (to be discussed later) or untreated sewage from vessels into the navigable waters of the United States (within the three mile limit) after 1 April 1981 will be prohibited unless appropriately exempted. The law only prohibits the discharge of soil drains over the side; waste drains may continue to be discharged within the three mile limit. (See Appendix 1 for definitions.) Public Law 92-500 also states that approved systems must be placed into use as soon as installed and accepted, even though the effective date of the requirement is 1 April 1981.[12]

As mentioned above, all vessels must comply with the Clean Water Act, unless they are appropriately exempted. Section 312(d) clearly states that the Secretary of Defense has the power to exempt any Department of Defense (DoD) vessels. "Regulations promulgated (under the Clean Water Act) apply to vessels owned and operated by the United States, unless the Secretary of Defense finds that compliance would not be in the interest of national security."[13] The Secretary of Defense has taken the authority of Section 312(d) and has issued a Directive concerning exemptions. He states: "It has been determined that, at certain times and under certain circumstances, compliance with the foregoing provisions of this Directive for certain vessels would unduly and unreasonably detract from their military characteristics, effectiveness and safety to such an extent as to be not in the interest of national security. Consequently, all DoD vessels <u>shall comply</u> with the provisions of this Directive except during the times and under the circumstances set forth below:

a. Vessels, while underway and transiting the navigable waters of the United States to the extent that such vessels are incapable of retaining total ship-generated sewage on board for later discharge on the high seas or to pierside sewage collection facilities are exempt. Discharges into the navigable waters of the United States shall be accomplished as far from land as possible.

b. All DoD vessels that are conducting or participating in military operations and exercises (including training and readiness exercises and operations) within the navigable waters of the United States are exempt when retention of total ship-generated sewage onboard such vessels would either interfere with their operational effectiveness or pose a hazard to the health, welfare and well-being of crew members or other participants aboard.

c. All DoD vessels, while anchored or moored within navigable waters away from the pier, where barge support is not feasible because of foul weather, poor visibility, unsafe environmental conditions, or inadequate barge capacity, and where onboard retention of total ship-generated sewage would either interfere with the operational effectiveness of the vessel or be a hazard ... are exempt.

d. Existing DoD vessels that are scheduled to be decommissioned, inactivated, sold or otherwise disposed of by the end of FY 1981 are exempt until they are so disposed."[14]

In addition to the Secretary of Defense, as can be expected, the President may exempt any effluent source of any federal department or agency. Regardless of the circumstances, exemptions are limited to one year periods, subject to renewal. The President must inform Congress each January of all exemptions granted during the preceding year, together with the reasons for such authorizations.[15]

As one can see, the reasons for and the authority to grant exemptions are fairly restrictive. The reason for this is clear. Congress, when it enacted the Clean Water Act, wanted the water quality improved. In order to do this, it had to restrict the number of departments and agencies who had exemption power, so the federal government could implement the provisions of the law and set an example for the private sector. In addition, Executive Order 11752 clearly stated the executive branch's commitment to environmental enhancement. So, on one hand the Department of Defense had Congress, via Public Law 92-500, telling it to conform to the new clean water standards, and the executive branch, via E.O. 11752, reinforcing this order. The only alternative for the United States Navy, at this point was to implement a program for installation of Marine Sanitation Devices aboard its vessels.

DESIGN CRITERIA

Once the legal requirement was established under Public Law 92-500, then a standard of performance had to be published. The federal agency responsible for establishing the standards was the Environmental Protection Agency (EPA). These standards were published in 36 F.R. 8639 of 12 May 1971. They required a level of treatment equivalent to "secondary treatment standards for municipal sewage plants, i.e., 240 M.P.N./100 ml, coliform bacteria maximum; B.O.D. 100 mg/1000 ml maximum; and suspended solids not to exceed 150 mg/1000 ml."[16] In following the letter of the law, the United States Navy would have to design, buy and install a Marine Sanitation Device that would be equivalent to a secondary treatment system found in municipal sewage treatment plants.

Once the standard was published, the EPA held public hearings and requested written comments on its regulations. What was revealed during those hearings was that reliable flow-through Marine Sanitation Devices were not available, nor were they anticipated to be available for installation before the effective date of the standard. Upon realizing the magnitude of the problem, the EPA modified its requirements. The agency through 37 F.R. 12391 of 23 June 1972, stated that vessels may install holding systems instead of treatment systems. This would be allowed as long as the contents of the holding system were capable of being transferred to a shore based facility for treatment. This alleviated the requirement for sewage treatment facilities aboard Naval vessels.[17]

At this particular time, the public law gave the Navy the option of either installing a zero-discharge system, i.e., a sewage treatment facility, or a no-discharge system, i.e., a system that holds sewage and transfers it to a facility on the pier for treatment. The advantage of the zero-discharge system is that a vessel treats its own waste and then discharges over the side an environmentally acceptable effluent. The vessel does not have to rely upon sewage treatment facilities on the pier. It can enter any port in the United States and not have to worry about transferring its waste. This type of system is an excellent choice for a ship still in its design stage. Prior to construction, space can be allocated for installation of a sewage treatment system. These systems are fairly complex and require a large amount of space. Again, this space can be allocated at the drawing board stage. For ships already in commission, this type of system is almost out of the question. These ships were built with each space having a dedicated purpose. It would be impossible to install such a system aboard a ship already constructed without a detrimental effect on its combat mission.

In addition to the space allocation problems associated with zero-discharge systems, one would also have to worry about any changes in discharge standards. If they did in fact become more stringent, then the systems installed could possibly become obsolete. These three factors, i.e., space consideration, lack of development of a zero-discharge system and changing effluent standards were the major forces in the decision by the Navy to put no-discharge systems on ships in commission. "The Chief of Naval Operations, on 3 January 1972, declared the Navy policy to install 'no-discharge' Collection, Holding and Transfer (CHT) systems in its major ships, in order to make the Navy insensitive to any changes regarding effluents and discharge of effluents later imposed by federal, state and local jurisdictions."[18] On ships still in their design stages, it was decided that a zero-discharge system should be installed.

The logic of the choice of a no-discharge system aboard ships in commission is somewhat questionable. From a legal standpoint, changing the effluent standards should have no effect on systems already in use. The law (PL 92-500) holds that "after the effective date of the initial standards and regulations ... no state or political subdivision thereof shall adopt or enforce any statute or regulation of such state; ... with respect to the design, manufacture or installation or use of any Marine Sanitation Device ... subject to the provision of this section."[19] In addition, the principle of federal supremacy embodied in the Constitution allows federal facilities to be exempted from local standards. The question of a reliable zero-discharge system and space considerations go hand in hand. It is my opinion that had we put our technical experts to work, we could have developed a sound system that would be compact and meet the required standards. The choice of a no-discharge system has one major disadvantage, i.e., facilities are required on the pier to receive the sewage that is being collected aboard the ship. As I will document later, this has turned out to be a major problem with the Collection, Holding and Transfer system (CHT).

Once the decision was made that the Collection, Holding and Transfer system would be installed on the majority of Naval vessels, one key decision had to be made. How big should the holding system be? The capacity of the system would have to be a function of (1) the size of the space available for the holding tank; (2) the number of crew members; and (3) the transit time, i.e., the amount of time it would take a ship to transit from the beginning of the territorial waters to its pierside berth.[20]

The ultimate goal was to have a tank capable of handling twelve hours worth of soil drain discharge (those drains which carry human waste). This calculation was derived from a Booz-Allen Research report (Appendix 2) which shows that the average transit time in all Navy ports to be less than five hours during both normal transits and transits with dense traffic and poor weather conditions. Another factor that had to be considered when determining the capacity of the tank would have to be the size of the crew. It is estimated that the average discharge from water closets and urinals is thirty gallons per man per day. Consequently, the holding capacity of the CHT tank should be 15 gallons per man.[21] Now that the theoretical size of the tank had been determined, spaces had to be allocated to house the tank. This turned out to be a most difficult task. In almost all cases, the required space did not exist. In this light, the Navy decided to back off on its original twelve hour goal and base the holding capacity on the size of the space best suited/available to house such a tank. As one can see from Appendix 3, the average holding capacity is about three hours, much less than the desired twelve. This can be attributed to the fact that Naval vessels are designed to cost limitations. Each space has a dedicated purpose, and in the initial design of these vessels, CHT was not a consideration. Consequently, space was not allocated for the system.

Public Law 92-500 states that it is illegal to dump soil drains in the territorial sea of the United States. Waste drains are not mentioned. When designing the ship alteration for CHT, the Navy decided that it was in their best interest to include waste drains in the CHT system. The logic of this decision was two-fold: (1) since virtually all the soil drain piping had to be removed and new piping installed, it would be easy to include, with little added expense, the waste drain piping; and (2) should the Clean Water Act later be amended to include waste drains, Naval vessels would not have to go through another expensive ship alteration. The logic was sound.

The cost of the CHT installation in 1972 was estimated to average $294,000 per vessel. In addition, pier modification to accept sewage was estimated to cost $106,000 per pier. The total Navy cost for CHT in 1972 was estimated to be one-half billion dollars.[22] As we will see later, those figures were greatly exceeded.

MSD OPERATIONS

There are four basic MSD systems utilized by the Navy today. They are CHT, JERED, Pall Trinity and GATX systems. I will discuss in detail the CHT system, since it is installed on approximately 80% of the Navy's ships. The other systems, I will only touch on briefly.

The CHT system (see diagram, Appendix 4) is comprised of three elements. They are the collective element, which consists of the soil and waste drains, the holding element, which is comprised of the tank and the transfer element, which includes the sewage pumps and overboard and discharge piping.[23]

The system is extremely flexible and can be operated in three modes:

(a) In port: In this particular mode, both the soil and the waste drains are collected in the CHT tank.

(b) In transit: Due to the limited holding capacity of the tank, only the soil drains are diverted to the CHT tank. The waste drains are diverted, via gravity flow, over the side.

(c) At sea: Once the ship passes outside the restricted waters (the 3 mile limit), both the soil and waste drains are diverted over the side, i.e., the CHT system is secured.[24]

Installation of the collection element was the most expensive to accomplish. New sewage piers had to be run from each and every soil and waste drain to the CHT tank. In order for this to be accomplished, an extensive modification to the ship's plumbing system had to be designed. This alteration had to be done during a ship's overhaul, since it involved removing the existing plumbing system and installing a new one. This particular facit of the operation took about six to nine months to accomplish because of its complexity.

The CHT piping was designed so that the soil and waste drains joined, just prior to entry into the holding tank. This was done so that the contents of both drains could pass through the comminutor. The function of the comminutor is to act as a garbage grinder, i.e., take the solids and pulverize them. Once this is accomplished, both the solids and liquids pass into the holding tank.[25]

The holding element is comprised of the holding tank, fluid level sensors inside the tank and an air supply. The tank size, controlled by the space available and the size of the crew, will normally be in excess of 2000 gallons. The tanks vary from 4000 gallons on a destroyer to 20,000 gallons on an aircraft carrier.[26] Inside the tank there are four level sensors. Their function is to monitor the fluid level in the tank and pump it down automatically when the volume reaches a certain level. These level sensors will be discussed in more detail when I go through a sequence of events for automatic operation. Also inside the tank is an air source. This air source is low pressure air, 3-5 psi, and its function is in two-fold: first, it is to prevent the contents of the tank from becoming anaerobic; and also to keep the solids in suspension. If this were not supplied, the contents would become anaerobic and produce several toxic gases: methane, carbon dioxide and hydrogen sulfide. Consequently, the forced air reduces the existence of these gases. Also, this low pressure air helps to keep the solids in suspension. If the air were not present, the solids would tend to settle to the bottom. Eventually, they would harden and clog the pick-ups for the sewage pumps.[27]

The transfer system is composed of two sewage pumps, and a series of pipes which transfer the contents to either the pier or overboard. There are two pick up tubes in the tank. One is for each sewage pump. When the pumps are activated, the pick up tubes will draw suction on the liquid. The sewage pumps then transfer the liquid as dictated by the valve line up, i.e., to the pier or over the side. If the contents are going to the pier, then the effluent is transferred to a riser on the main deck of the vessel. Connected to the riser is a hose, which in turn is connected to a riser on the pier. The contents are then transferred from the pier to a sewage treatment facility for processing.[28]

In port (diverting both soil and waste drains to the system), the system can be operated in either the manual or automatic mode. In automatic, the level sensors are activated via a motor controller. The first level sensor indicates a 10% level in the tank. A 10% level is maintained so that the pick ups for the sewage pumps will always have a positive suction. When the fluid, which is being dumped into the tank, reaches 30% of the tank volume, a second level sensor is activated. This sensor sends a signal to the motor controller, which in turn activates a sewage pump. The pump pumps the fluid level in the tank down to 10% and automatically shuts off, thus, the automatic mode. Should the 30% level sensor fail, or the sewage pump fail, the level of the tank would continue to rise. When it reaches 60%, a third level sensor is activated. It tells the motor controller that the first pump failed and, in turn, the motor controller activates the second sewage pump. If both pumps fail, and when the contents reach 85%, a fourth sensor is activated. This sensor is associated with an alarm which is sounded about the ship. Ships force personnel should then divert both the soil and waste drains overboard and correct the problem.[29]

The manual mode is utilized so that positive control can be maintained over the system. Examples of when this mode of operation would be used are: when the level sensors are inoperative, prior to disconnecting the sewage hose from the pier, and in transit. While in transit, we are diverting the soil drains to the stowage tank and dumping our waste drains overboard. If we are transiting to port, the system stays in manual until we reach our berth and a sewage hose is hooked up for the pier riser. If we are transiting from the pier to the open ocean, the system stays in manual until we reach the three mile limit. At this point, the soil drains are diverted over the side, and the contents of the tank are pumped out. Salt water is run through the system to get the tank as clean as possible. Once this is accomplished, then the system is secured.[30] For trouble shooting the system, we would again utilize the manual mode. We would divert both soil and waste drains overboard, pump the contents of the tank down and flush salt water through the system. This, of course, is done to reduce the health hazard for those who have to repair the system.

GATX is a small (25 man) system, particularly suitable for small craft and patrol craft such as minesweepers, tug boats and yard patrol craft. The system operates on the principle of volume reduction of sewage. It minimizes the sewage generated by using controlled volume flushing, i.e., each urinal produces 1 pint of water, each water closet 3 pints of water. The solids and liquids are then sent to a macerator. The macerator reduces the waste materials to small particles and sends them to an evaporator tank. The evaporator tank is steam heated 230°F, which permits vaporization and venting of the majority of the liquid to the atmosphere. When the reduced sludge has accumulated to the prescribed level, the contents are pumped to a shore facility or into the open ocean.[31] This is a commercial system and can also be found on numerous fishing boats, ferries and other vessels.

The JERED is the MSD which is currently being utilized aboard DD-963 class destroyers. This system also employs a reduced volume flush. The solids and liquids pass through a macerator which in turn transfers the contents to a collection tank. It then passes to an incinerator where the sewage is heated to approximately 2000°F. This reduces the sewage to an ash. The ash is removed from the incinerator via a vacuum cleaner type of machine and put into the trash. The ash is an environmentally acceptable by-product.[32] The major advantage of this system is that it does not rely on facilities ashore to treat its waste. There are some disadvantages to JERED. The incinerator utilizes ship's fuel oil as its heat source, which in turn reduces the ship's cruising distance. In addition, the JERED system is only capable of receiving soil drains. Waste drains are always sent overboard. Should PL 92-500 be expanded to include waste drains, a major ship's alteration would be required for this class of ship.

The Pall Trinity System can be found only aboard the amphibious ship, LHA. It also employs a macerator to grind the sewage. The macerator dumps the solids into a holding tank where bacteria are allowed to break down and reduce the volume of the sewage. As the sewage is used up, solid dumps of bacteria called FLOC settle to the bottom of the tank. The combination of FLOC and sewage in the tank is called mixed liquid. The mixed liquid is treated with disinfectant (chlorine), which is injected into the system. The mixed liquid is then dumped over the side as environmentally clean water. The advantage of this system is that it is a complete sewage treatment system. The system accepts both soil and waste drains, treats the sewage, and discharges an environmentally acceptable by-product. The disadvantage of the system is that it requires a large amount of space to house the treatment system. Consequently, it is best suited for larger ships, such as aircraft carriers and the LHA.[33]

PROBLEMS ASSOCIATED WITH MSD'S

"The presence of marine sanitation devices and the associated equipment and facilities aboard ship increase the risk of exposure to untreated waste water, which in turn increases the potential for the occurrence of enteric diseases associated with human waste."[34] This commonly occurs when personnel are exposed to accidental sewage spills. These spills can normally be attributed to an inadequate slope in the piping, which causes the sewage to back up into the associated toilet. When installing any gravity flow type piping, a proper slope must be achieved, so that the effluent can freely reach its discharge point. When ships are constructed, it is easy to insure that this slope is achieved. One must remember that the CHT system was an afterthought, i.e., installed after the ship has been constructed. In running the CHT pipes about the ship, this proper slope was not always achieved; consequently, sewage back-ups are common aboard CHT equipped ships.[35]

The U.S. Navy has directed its Commanding Officers to handle sewage spills as they would a biological warfare type of problem. The area around the spill must be isolated, the clean up crew must wear special clothing, and a special disinfectant must be used to clean the decks. After the area is cleaned, the special clothing is sent to the laundry, and the crew washes down thoroughly with soap and water.[36] If the sewage were not immediately cleaned up, then the possibility exists that bacteria could spread about the ship. The threat of hepatitis aboard Navy ships from this source is real.

Another problem with the CHT system is that most non-Navy ports do not have the capability to receive sewage from Navy ships. A recent survey shows that, out of the thirty-two frequently visited Navy ports, twelve have some type of pier sewer installation, while twenty ports have no pier sewer facilities.[37]

In looking at the twenty ports that have no facilities available, the Navy has one of three options available: (1) Cancel all visits to the port; (2) hire some sort of a reception facility at that port (this would probably be at a great expense); or (3) divert the soil drains to the tank until it is filled, and then dump the soil drains into the bay. Option three, of course, could only be done with an exemption granted by the Secretary of Defense.[38] Will the Secretary of Defense grant twenty exemptions? The answer has yet to be promulgated. It is my feeling that a blanket exemption will not be granted. Each port will be handled on a case by case basis, and the exemption will be a function of local political and environmental atmosphere of the state. In those states where the environment is a hot issue, option two will be chosen. "(R)outine procedures and practices, although technically legal, may impact the environment and become subjected to external scrutiny and criticism .... Actions which do not significantly affect the environment, may at times be construed by the public as harmful."[39] I don't ever expect to see option one exercised. The Navy needs to visit these ports to maintain its image and remind the general public of the necessity of sea power. In addition, most of the cities/ports look forward to having a periodic visit. It adds to their image and, of course, generates revenues for the local economy.

The initial estimates for installation of MSD's, pier modifications and new sewage barges were five hundred million dollars. This figure was grossly underestimated. This can be attributed to several factors: (1) In programming the total costs, the financial managers anticipated an inflation rate of five percent. Obviously, this was well below the actual rate. (2) In many ports, the Navy's sewage treatment facilities were not capable of handling the added waste. Consequently, commercial sewage plants had to be modified to accept the additional refuge. (3) During the early stages of the CHT program, technical problems were encountered with different pieces of equipment, i.e., failure to operate properly, etc. These problems were eventually solved but they caused delays, and delays mean more money. (4) There were inaccurate initial cost estimates. It is now estimated that the final cost will be in the neighborhood of 1.25 billion dollars.[40]

Section 312(G)(4) of the Clean Water Act deals with the enforcement aspect of MSD's. Basically, it charges the Secretary of the Treasury with the responsibility to enforce the standards. The Secretary of the Treasury, in turn, has placed this responsibility on the Coast Guard. I have discussed this issue with the Captain of the Port of Providence, and he states that Coast Guard officials will not routinely stop vessels to check for MSD's. They will, however, look at MSD's when conducting various other ship checks. If a system is found deficient, then the owners of the vessel could be subject to a fine of $5000.[41] The Navy intends to police its own ships. Firm guidelines have been sent to Commanding Officers, stating that once the systems are installed, they are to be utilized.

CONCLUSION

The Clean Water Act levied a number of significant requirements on the United States Navy. It required that several major alterations be made to its ships, piers and sewage treatment plants. These alterations have been expensive, with the final cost exceeding one billion dollars. In addition to the monetary outlay, one must also consider other negative impacts caused by MSD's. Internal sewage spills caused by clogged pipes are not only a health hazard, but also have a negative impact on morale. Crew members must live with and clean up such spills, obviously not a pleasant task.

It is my opinion that the requirement for MSD's has been worthwhile. The Navy has reduced considerably its discharge of sewage and other waste in the internal waters of the U.S.. This, in turn, has helped to improve the aesthetic value and quality of the water within this area. This improvement outweighs the initial cost of the MSD's and the other negative factors associated with them.

The Navy should be proud of its MSD program and its dedication to environmental quality. In addition to its statutory obligations, the Navy has committed itself to improving water quality by insisting that its ships discharge nothing into the territorial waters of the United States. It has met and exceeded the challenges of the Clean Water Act.

TERMINOLOGY[42]

Influent - The sewage that enters the CHT tank or MSD.

Effluent - The sewage or sludge which is discharged from the CHT or MSD.

Sludge - Solid matter produced by sewage treatment.

Anearobic - Living without the presence of oxygen.

Aerobic - Living only in the presence of oxygen.

Aeration - To supply or impregnate with air.

Comminutor - A motor driven grinder used to pulp or liquify sewage solids.

MSD - Marine Sanitation Device. An installation on ships designed to collect and/or treat sewage.

CHT - Collection, Holding and Transfer system for sewage and waste water.

Soil Drains - Drains and their associated piping systems that carry human waste.

Waste Drains - Drains and their associated piping systems that carry food waste.

Macerator - A device that softens or separates sewage as a result of being wetted.

Zero Discharge - Refers to a MSD system that is not discharging waste over the side.

Restricted Zone - The navigable waters of the United States CO - 3 miles from shore).

No-Discharge - Refers to a system that can either hold sewage or discharge it over the side.

Flow through System - Device which produces an overboard effluent with a fecal coliform count of not more than 1,000 per 1,000 ml and no visable floating solids.

APPENDIX 1

TERMINOLOGY
(CONT'D)

GATX - Commercial holding system for sewage found on small craft.

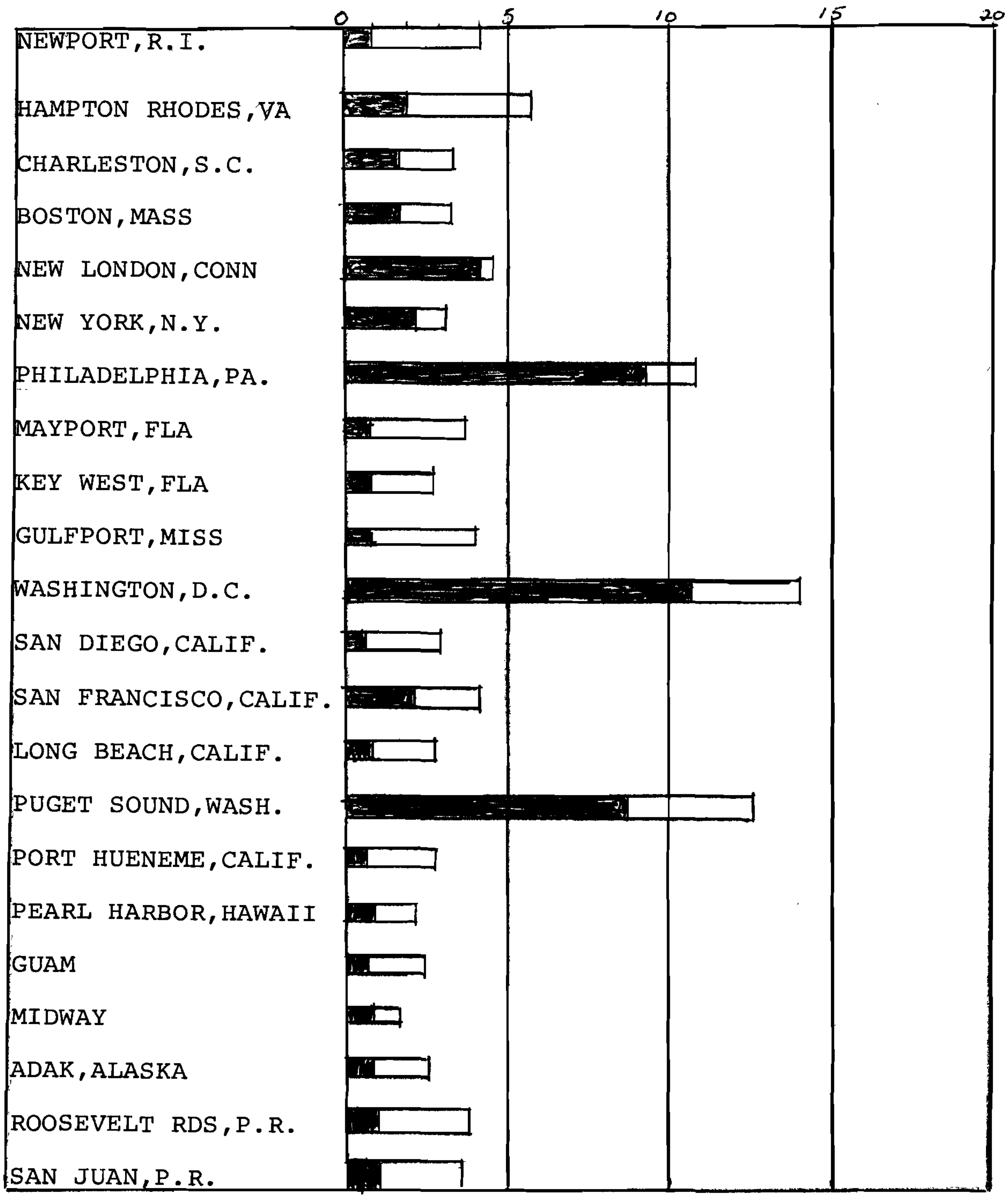
JERED - System found of 963 class destroyers which collects and processes sewage into non-volatile gases and a sterile ash residue.

Poll Trinity - Manufacturer's name for a sewage treatment system found on LHA type ships.

APPENDIX 1

TRANSIT TIME IN HOURS[43]

Solid portion of each bar indicates normal transit times. Total bar indicates transit time under worst conditions, i.e., delays for pilots, traffic, tugs, weather, etc.



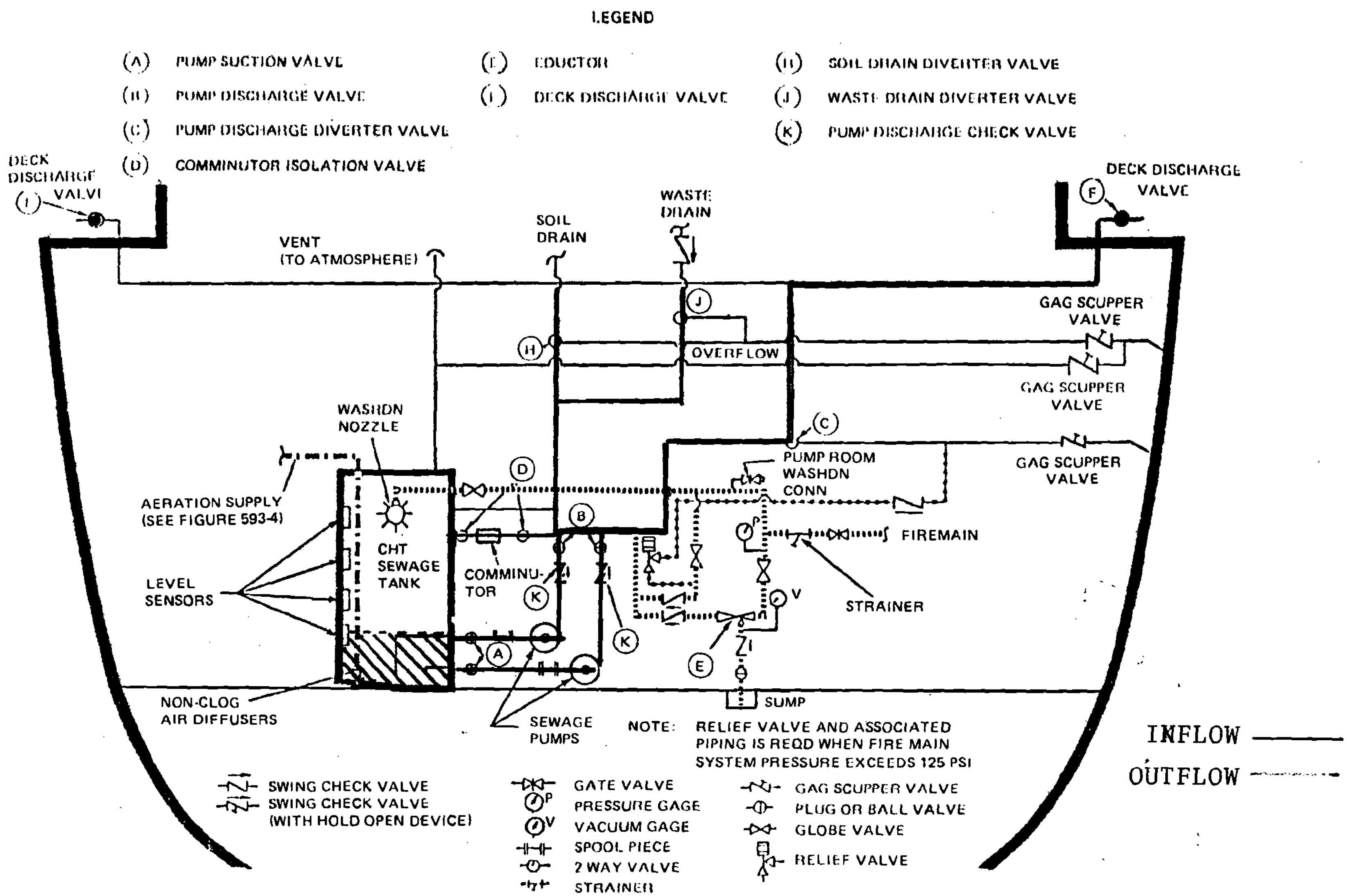
APPENDIX 2

SHIPS/CLASSES HAVING LESS THAN 12 HOURS CHT CAPACITY[44]

Ship Class	Holding Time (hrs)1	Ship Class	Holding Time (hrs)1
DD 710	6	CG 16	3
DD 825	6	CG 26	3
DD 931	4.4	CGN 35	3
DD 933	3	CG 3/6	3
DD 948	3	CG 10	3
FF 1098	3	CGN 9	3
FF 1037	3	AH 17	6
FF 1040	3	ARS 6	8
FF 1052	3.2	ARS 38	10
FFG 1	3	AS 11	6
DDG 2/31	3	AS 31/33	5
DDG 35/37	3	ARS 7	10
LST 1179	4	LPH 1	5
LSD 28/35	4	LPD 1/4	3

1. Holding times calculated on basis of 1.25gal/man/hr

APPENDIX 3


LEGEND
(A) PUMP SUCTION VALVE
(B) PUMP DISCHARGE VALVE
(C) PUMP DISCHARGE DIVERTER VALVE
(D) COMMINUTOR ISOLATION VALVE
(E) EDUCTOR
(F) DECK DISCHARGE VALVE
(H) SOIL DRAIN DIVERTER VALVE
(J) WASTE DRAIN DIVERTER VALVE
(K) PUMP DISCHARGE CHECK VALVE
DECK DISCHARGE VALVE
DECK DISCHARGE VALVE
VENT (TO ATMOSPHERE)
SOIL DRAIN
WASTE DRAIN
GAG SCUPPER VALVE
OVERFLOW
GAG SCUPPER VALVE
GAG SCUPPER VALVE
WASHDN NOZZLE
PUMP ROOM WASHDN CONN
AERATION SUPPLY (SEE FIGURE 593-4)
FIREMAIN
CHT SEWAGE TANK
LEVEL SENSORS
COMMINU-TOR
STRAINER
SUMP
NON-CLOG AIR DIFFUSERS
SEWAGE PUMPS
NOTE: RELIEF VALVE AND ASSOCIATED PIPING IS REQD WHEN FIRE MAIN SYSTEM PRESSURE EXCEEDS 125 PSI
INFLOW
OUTFLOW
SWING CHECK VALVE
SWING CHECK VALVE (WITH HOLD OPEN DEVICE)
GATE VALVE
PRESSURE GAGE
VACUUM GAGE
SPOOL PIECE
2 WAY VALVE
STRAINER
GAG SCUPPER VALVE
PLUG OR BALL VALVE
GLOBE VALVE
RELIEF VALVE

FOOTNOTES

[1]National Historic Preservation Act, 16 U.S.C. 470, et seq, P.L. 88-29; enacted May 28, 1963.

[2]Federal Water Pollution Control Act, 42 U.S.C. 1251, et seq, P.L. 92-500; enacted October 18, 1972.

[3]Alig, C. S., "The Dispersion and Detectability of Sanitary Waste-Water Discharges from Navy Ships," American Society of Mechanical Engineers, February 1975, p. 237.

[4]National Environmental Policy Act, 42 U.S.C. 4321, et seq, P.L. 91-190; enacted January 1, 1970.

[5]Executive Order 11514, Protection and Enhancement of Environmental Quality, 35 FR 4247, May 5, 1970.

[6]Executive Order 11752, Prevention, Control and Abatement of Environmental Pollution at Federal Facilities, 38 FR 34793, December 17, 1973.

[7]Navy Environmental Protection Program Summary, p. 5, para. 2.1.

[8]Ibid.

[9]Executive Order 11752, Prevention, Control and Abatement of Environmental Pollution at Federal Facilities, 38 FR 34793, December 17, 1973, Section 1.

[10]Federal Water Pollution Control Act, Public Law 92-500, Section 101(A).

[11]Ibid., Section 101(A)(2) and (3).

[12]Ibid., Section 312(B)(1).

[13]Ibid.

[14]Department of Defense Directive 6250.4 of October 23, 1979, pp. 3-4.

[15]Federal Water Pollution Control Act, Public Law 92-500, Section 312(D).

[16]EPA Effluent Guides and Standards For Marine Sanitation Devices, 36 FR 8639, May 12, 1971.

[17]Office of the Chief of Naval Operations, "Candidate Environmental Impact Statement" of June 1975, p. 3.

[18] Ibid.

[19] Federal Water Pollution Control Act, Public Law 92-500, Section 312(F)(1).

[20] Constant, A. E., "Marine Pollution Control: Part III - Ship Design Requirements; the Design Approach," Naval Engineers Journal, October 1975, p. 48.

[21] Ibid.

[22] Office of the Chief of Naval Operations, "Candidate Environmental Impact Statement" of June 1975, p. 6.

[23] Bureau of Naval Medicine, Manual of Preventative Medicine, September 1978, Chapter 7, p. 7-18.

[24] Constant, A. E., "Marine Pollution Control: Part III - Ship Design Requirements; the Design Approach," Naval Engineers Journal, October 1975, p. 48.

[25] Naval Ships Technical Manual, Chapter 593, June 1, 1980, p. 16.

[26] Ibid.

[27] Ibid., p. 18.

[28] Bureau of Naval Medicine, Manual of Preventative Medicine, September 1978, Chapter 7, p. 7-19.

[29] Constant, A. E., "Marine Pollution Control: Part III - Ship Design Requirements; the Design Approach," Naval Engineers Journal, October 1975, pp. 49-50.

[30] Bureau of Naval Medicine, Manual of Preventative Medicine, September 1978, p. 7-20.

[31] Commander, Naval Ships Systems Command, Evaporative Toilet System, February 1, 1978, p. 2-1.

[32] Commander, Naval Ships Systems Command, "JERED Vacu-Burn Shipboard Sewage Disposal System," March 3, 1979, Annex A, p. 2

[33] Alig, C. S., "Sewage Treatment Plants Aboard LHA-Type Ships," Ship Materials Engineering Department Research and Development Report, January 1979, p. 31.

[34] Bureau of Naval Medicine, Manual of Preventative Medicine, September 1978, Chapter 7, p. 7-28.

[35]Geyer, A., "Prevention of Scale Buildup in Collection, Holding and Transfer System Piping Aboard Ship," Naval Sea Systems Command Journal, June 1972, p. 2.

[36]Bureau of Naval Medicine, Manual of Preventative Medicine, September 1978, Chapter 7, p. 7-29.

[37]Chief of Naval Operations Message of 20 March 1981, "Shipboard Sewage Discharge Prohibition in Non-Navy Ports."

[38]Ibid.

[39]Chief of Naval Operations Instruction 6240.3E of July 5, 1977. "Environmental Protection Manual," p. 1-11.

[40]Phone Conversation with Mr. Larry Koss, Naval Sea Systems Command, CHT Project Manager, of 15 March 1981.

[41]Federal Water Pollution Control Act, Public Law 92-500, Section 312(J).

[42]Bureau of Naval Medicine, Manual of Preventative Medicine, September 1978, Chapter 7, p. 7-2.

[43]Office of the Chief of Naval Operations, "Candidate Environmental Impact Statement," of June 1975, p. 10.

[44]Ibid., p. 8.

[45]Naval Ships Technical Manual, Chapter 593, June 1, 1980, p. 16.

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