Saxton Bill, H. R. 1027, Opposition White Paper

Comments from Ed McKiernan, President, Dometic Sanitation Systems

I was having dinner with my wife, son and two friends in Seattle at a pier-side seafood restaurant offering over two-dozen species of raw oysters, when I finally understood what the Saxton Bill was all about. If the Saxton Bill is passed, either existing shellfishing beds will be greatly reduced in size or boats will lose access to certain waters where shellfish are harvested. There are economic implications for both industries (pleasure boating and shellfishing), and on a much larger scale there are implications for the overall health of our environment.

Briefly, the Saxton Bill encourages boaters to use Type I marine sanitation devices (MSDs), which provide a minimal level of treatment before discharging their waste into the water. Supporters feel this is a better option than utilizing a Type III device, which is basically a holding tank. When a boat reaches a marina with a pumpout station, the sewage is removed from the holding tank, which in most cases is connected to a municipal waste treatment facility. Holding tanks can also be discharged in non-sensitive waters at least three miles offshore.

While well intentioned, H.R. 1027, the Saxton Bill, makes claims that I believe:

- Have not been upheld by scientific peer review.
- The FDA will not allow the use of Type I devices on or near currently unrestricted shellfish beds, given the presumption that contamination and chemical pollution may occur.
- May actually introduce into No Discharge Zones (NDZs) chemicals more harmful to the environment than the waste they purportedly are treating.

- May be unenforceable, since there are no provisions in the Saxton Bill to require any routine inspection of the installed treatment devices that require varying degrees of service and maintenance.

I believe the best solution is not to dump anything into sensitive waters. Education of boaters, marinas and regulators, along with the installation of properly working "pump-outs" from Type III holding tanks offers a proven, long-term method for reducing boat pollution going into rivers, bays and offshore waters.

Toilet Training

Bathrooms are a basic necessity of life. Home values often are measured according to the number of bathrooms. Most of us grow up never really understanding what happens to the waste when we flush a toilet. On airplanes and recreational vehicles equipped with toilets, waste goes into a holding tank and is emptied into a proper "dumping station" which in most cases is connected to a municipal waste treatment center.

On a boat, the U.S. Coast Guard has approved several methods for disposing of sewage (1). The Coast Guard defines a Type I Marine Sanitation Device (MSD) as a device, which treats sewage with disinfectant chemicals and by other means before it is discharged into the water. The treated discharge must meet certain health standards for bacteria content and must not produce any visible floating solids. A Type II MSD is also a treatment device like the Type I, but it must meet a higher level of sewage treatment.

Under the Federal Water Pollution Control Act of 1972 (FWPCA) (2), no raw sewage may be dumped overboard within the three-mile territorial limits of U.S. waters.

Also, no sewage, treated or untreated, may be discharged into certain sensitive waters called No Discharge Zones.

Vessel sewage discharge is regulated under Section 312 of the FWPCA. A State can have all or portions of their waters designated as a no-discharge zone for vessel sewage to:

1. Protect aquatic habitats where pumpout facilities are available.
2. Protect special aquatic habitats or species.
3. Safeguard human health by protecting drinking water intake zones.

According to the EPA web site on regulatory waste sewage, (http://www.epa.gov/owow/oceans/regulatory/vessel_sewage/) "Currently 6 States have all (or nearly all) of their surface waters designated as NDZs. Those States are: Michigan, Missouri, New Hampshire, New Mexico, Rhode Island, and Wisconsin. In addition, 11 other States have segments of their surface waters designated as NDZs. Those States are: California, Florida, Georgia, Massachusetts, Minnesota, New Jersey, Nevada, New York, South Carolina, Texas, and Vermont. In 2002, Maryland completely prohibited sewage discharge from vessels in Herring Bay on the Chesapeake Bay. This year or next, NDZs will be established for other areas within the Chesapeake Bay and its tributaries. Nationwide, approximately 50% of the NDZs are in fresh water and the other 50% are in salt or estuarine waters."

The Case Against H.R. 1027

Saxton Bill supporters make the simplistic argument that Type I technology, specifically as offered by MSD manufacturer Raritan Engineering Co., is equal to and

frequently superior to municipal sewage treatment facilities. In regard to Raritan's devices, Mr. Saxton's claim is based on two studies (3):

1. The original certification testing for the Coast Guard conducted in the 1970's.
2. A 1997 study by the Department of Veterinary and Pathology at the University of Sydney, Australia.

To our knowledge, neither of these documents, nor any other studies have been published in a scientific journal and subjected to peer review – a common and accepted practice in the field of microbiological sciences. Their particular claims are:

"The independent lab test results required for certification documented coliform reduction in the sewage treatment process to less than 20 per 100 ml in 38 of 40 samples" (highest two readings discounted per standard procedure).

"Results of the lab test resulted in the following comments by the Virologist: this system is effective and will remove 78-98% of viruses from fecal material, as Hepatitis A virus (HAV) is one of the most difficult to destroy by chemical sterilization, a higher rate of removal for other enteric viruses can be expected when using this device."

It appears that those who favor a Type I system are making the assumption that because of reduction of one species of indicator bacteria and one type of virus the toilet-generated wastes receive sufficient treatment to be safely discharged overboard in any coastal waters.

Public health officials don't agree and here's why.

Scientists have known with certainty that oysters from waters with acceptable levels of "indicator organisms" (aka fecal coliform bacteria), can still be loaded with disease-causing viral particles (4). "Indicator organisms" are not a reliable way to assure

the public's health [statistically 1 in 2,000 servings of raw oysters, clams or mussels may result in an illness (5)]. The result has been expanded condemnation of waters where shellfish are harvested, not because of higher levels of bacteria, but because of the presumption that contamination may occur.

Today, 98% of the 16,000 sewage treatment plants operating in the U.S. are at secondary level of treatment or higher (only about 5% were operating at this level in 1972) (6). Discharges are well within safe limits for shellfishing waters. The Food and Drug Administration (FDA) presumes, however, that accidents and failures occurring with the disinfection system, or unpredicted overflows or other mishaps will occur. So, their guidelines require the closure of waters within a proximity close enough to a treatment plant (or a marina) should a problem occur and affect shellfish beds (such closures usually encompass many acres of surface waters)(7). These control measures work for land-based sewage treatment plants, but what about highly mobile boats? Is an onboard Type I so failsafe that the FDA will accept the discharge from boats over shellfish beds?

FDA currently says no, for several reasons: First, there is no reliable evidence proving Type I discharges will always be safe; second, there is no current or cost-effective means to ensure Type I devices will always be working properly; third, the introduction of chemicals in shellfish waters by Type I discharges adds another hazard that must be routinely determined by state authorities at state cost; and, last, safer and ecologically sound alternatives already exist for fresh and marine waters. Consider the following facts. Licensed specialists bear personal liability for the proper operation of sewage treatment facilities throughout the U.S., and this still is not totally sufficient under FDA guidelines. There are no Coast Guard or EPA requirements for failsafe operation of Type

I's to assure that they are always operating within safe parameters. (More on the engineering and maintenance concerns in a moment.)

But wait a minute, boats generally only have a few people on board and their discharge is tiny in quantity compared to a land based municipal plant. Aren't the Feds overreacting to such a small amount of discharge? In 1995, an article appeared in the *Journal of the American Medical Association* (8) that described an outbreak of gastroenteritis caused by oyster consumption. In this article, physicians and public health specialists from the Center for Disease Control (CDC) in Atlanta reported that this outbreak was caused by Norwalk virus and affected 70 of 84 people who ate oysters harvested from waters thought to be safe from land-based sources of contamination. The oysters implicated in this particular outbreak were from Louisiana, and they did not have unacceptable levels of indicator organisms. Similar illness outbreaks attributable to oysters from Florida (Norwalk-like virus) (9) and from Texas (*Shigella* bacteria) (10) have been studied and reported in medical journals. Each of these outbreaks was caused by waste discharged from watercraft.

Keep in mind that viruses can remain viable in seawater for a long time, and disease-causing viruses have been shown to survive as long as 17 months in the marine sediment (11). Moreover, in filter-feeding molluscan shellfish (clams, oysters, mussels, etc.) viruses become concentrated at levels higher than the surrounding water and, though they do not multiply inside shellfish, they do accumulate and are retained in their liver-like digestive gland (12) for weeks. Now, consider that doctors from the CDC surmise the waste from a single infected person would yield enough viral particles in one day to contaminate an oyster bed one kilometer long and 100 meters wide (an area over ten

football fields) (13). In light of all these facts, people have the right to expect that legislators and regulators will ensure the safety afforded by Type I devices before giving the kind of approval sought in H.R. 1027.

Introduction of Harmful Chemicals?

H.R. 1027 claims no harmful chemicals are discharged with the Type I system since none are added to the waste being processed. Sales brochures from Raritan state, "Generates its own natural disinfectant from salt water" and "Coated electrodes use salt water to kill bacteria and viruses without adding harmful chemicals to the sea" (14).

A brief understanding of the chemical process involved in treating sewage at a municipal plant and through the onboard Type I system will help to illustrate why this claim may be misleading or at a minimum confusing.

One of the basic principles of processing municipal wastes is that solids must be reduced to a very low level (30 mg/liter or less, about the equivalent of slightly cloudy water) in order to achieve an effective amount of disinfection (15). This principle is the reason most sewage treatment plants send wastewater slowly through huge settling tanks or ponds, using gravity to settle out much of the solid material. During several steps in the treatment process, solids are either floated to the surface or settled to the bottom. After the solids have been reduced to a minimum, the waste is subjected to chlorination in order to kill many of the remaining microbes. If solids are not removed, chlorination only coats the particles of waste passing through, and the disinfection step is ineffective. The following is from an EPA document on chlorination of combined sewer outfalls: "Because suspended solids can inhibit the disinfecting agent from reacting with the

bacteria, disinfection is usually used in conjunction with an additional technology that specifically reduces the suspended solids in solution" (16).

In Type I devices, solids are not removed from the waste stream. They are only reduced in size (but not in weight) so that they pass through a test sieve with a standard pore size of $1/16^{th}$ of an inch, about the size of a pinhead (17). Literally hundreds of thousands of organisms, even millions, can and are encapsulated into one of these $1/16^{th}$ inch particles, and only the organisms on the surface of particles are effectively killed by the chlorine. Type I devices can not deliver a consistent, controlled disinfection routinely as can a municipal sewage treatment plant because they always contain solid particles.

Type I Basics

Presently two manufacturers offer Type I MSDs, Raritan Engineering and Gross Mechanical (Groco). Groco offers one model, the Thermopure 2 that utilizes heat to eliminate bacteria (18). Raritan offers two models, the Lectra/San LST/MC and the Purasan (19), both depend on chlorine to kill microorganisms. The Lectra/San is a microprocessor-controlled unit that creates chlorine by the electrolytic breakdown of saltwater (20). The Purasan uses calcium hypochlorite tablets that yield chlorine when submerged in water (21). The Lectra/San consumes huge amounts of DC current (50 amps at 12 volts for 2 minutes). The Purasan needs just 10 amps at 12 volts for 2 minutes, and it is intended mainly for boats that either can not meet the power requirements of the Lectra/San model or that travel on freshwater only.

Both the Lectra/San and the Purasan start at the push of a button. The treatment cycle is two minutes. There are three lights to indicate that the treatment is ok, that the

system needs service or adjustment, or that the system is shut down due to insufficient current crossing the plates in the treatment tank.

The Lectra/San will shut down its two-minute treatment cycle if the salt content of the incoming flush water is too low. However, sewage treatment experts tell us that a minimum contact time of at least 30 minutes is necessary to assure that sewage receives the proper level of disinfection (22). The Lectra/San unit operates on a one flush in, one flush out principle. If the people on board are using it at a rate faster than one flush every fifteen minutes or so (as might happen if one of the passengers was ill, or passengers are waking up at the same time in the morning), the discharged waste is likely not getting sufficient treatment. There is no positive control of the amount of time sewage in the Lectra/San unit is in contact with the chlorine generated by the system. And, there are other factors that need to be considered in order to assure proper levels of disinfection, like the pH, water temperature, and concentration of organic wastes (23). Likewise, none of these are controlled in the Lectra/San device.

How does a Lectra/San unit restart once it shuts down due to insufficient chlorine being generated? According to the troubleshooting portion of the operator's manual (24), one throws more salt into the bowl and hits the "reset" button, which then overrides the interruption of the process. The system shuts down again, and then the operators press the reset again, and so on until the salt content reaches operating levels again. Remembering that the Lectra/San device operates on a one in, one out principle, the likelihood that at least one or two under-treated flushes will be discharged is pretty certain.

Another key difference between a Type I device, like the Lectra/San, and a wastewater treatment plant is the discharge of chlorine that is highly toxic to marine life.

Many municipal wastewater treatment plants actually dechlorinate before discharging their effluents into receiving waters, by treating with sulfur-based chemicals that neutralize the residual chlorine. One authoritative text on the subject states, "Dechlorination can virtually eliminate toxic effects resulting from wastewater chlorination" (25). There exist no such environment friendly dechlorination steps in Type I devices on the market today.

Claims about chlorination may be misleading, or at a minimum confusing.

Raritan's products brochure claims, "Generates its own natural disinfectant from salt water" and "Coated electrodes use salt water to kill bacteria and viruses without adding harmful chemicals to the sea". The form of chlorine that is released by their process is not a "natural" or a non-harmful chemical. True, seawater has an abundance of naturally occurring chlorine ions. The Lectra/San device uses the electrolytic breakdown of salt and water, where: $2NaCl + 2H_2O \rightarrow Cl_2 + 2NaOH + H_2$ (26). The free chlorine (Cl_2) released in their process is man-made, not widely naturally occurring, and it is quite toxic to many aquatic species. One authoritative text on the effect of chlorine on aquatic life concludes, "Chlorine residual levels may need to be as low as 0.002 mg/L to preclude adverse effects" (27). If the discharge level for the Type I device is greater than 10.0 mg/L, that is 5,000 times greater than the "no adverse effects" level.

Another apparent contradiction exists between Raritan's most recent promotional brochure and the Material Safety Data Sheet (MSDS) for its Purasan model. The Purasan model does not make chlorine from salt water, but instead uses calcium hypochlorite tablets similar to swimming pool chlorine tablets. This brochure claims that the Purasan unit, "Neutralizes waste, making it sanitary and safe for boaters and marine life", yet the

MSDS (28) for the Purasan tablets states, "This product is toxic to fish. Do not discharge into lakes, streams, ponds or public waters unless in accordance with an NPDES permit." The manufacturer should get its story straight.

According to one study reported in the *Journal of Applied and Environmental Microbiology*, it takes a chlorine concentration of 10 or 20 mg/liter and an exposure time of 30 minutes to inactivate Hepatitis A virus completely (29). If a Type I device produces a concentration of chlorine that assures sufficient killing of viruses, then the resulting discharge is going to require as much as 20,000 gallons of water to dilute each flush to ensure that effluent is not harmful to the environment. By this calculation, in one day four people on a boat could generate enough chlorine to require dilution by as much as 400,000 gallons of water. Obviously, this is simply not feasible. Thus, either MSD treatment systems must dechlorinate effectively before discharging wastewater, must discharge harmful chemicals into the marine environment, or must altogether forego effective treatment to inactivate pathogenic viruses.

No Provisions to Require Routine Inspection or Maintenance

Independent marine contractors who service Type I systems note that in the warm waters of South Florida, the calcium carbonate build-up on the Lectra/San electrode plates is accelerated, thereby gradually reducing the effectiveness of the unit (30). Instead of the twice a season maintenance as suggested by the manufacturer, boat owners may not realize that a cleaning with muriatic acid is required every three months. This can lead to disuse due to the inconvenience of the 45-minute to two-hour ritual required to acid treat the electrolytic mechanism.

Law Enforcement Inspection

The Saxton Bill makes no provisions for any type of periodic inspection to assure the Type I devices are in good operating condition. Boaters would likely oppose such a measure, assuming there were resources to provide such an inspection. Given the stretched resources of the Coast Guard and other marine law enforcement involved in Operation Iraqi Freedom and Homeland Security, funding is likely out of the question. Holding tanks, on the other hand, can be easily checked. In Avalon Harbor (CA), every visiting boat receives a biodegradable dye tablet. Any sign of that dye in the water and the offending boat is ejected from the harbor and the owner fined.

Doing the Right Thing

I have the pleasure of being a grandfather twice over. Those of you who share this privilege in life know that you will do just about anything for your grandchildren, and we know we can change our behavior. For me, I am committed to the relationship between what the world will be like and my grandchildren. There are a million reasons why we should change our behavior about dumping sewage into our lakes and oceans.

Type I devices are unlikely to ever be an acceptable alternative to no discharge zones for sensitive waters. They just will not be effective or ecologically sound. The alternative, holding tanks, dumps nothing directly into the aquatic environment when properly used and continues to be the best-known method for managing toilet waste in NDZs.

Installation of more pumpout facilities, a concerted effort to educate boat manufacturers and retail dealers, and boaters about clean water has already made a difference on the Great Lakes, and in places like Block Island (RI), Nantucket (MA) and

Avalon Harbor at Catalina Island (CA). No Discharge Zones and using pumpouts are not even issues to boaters in these locations.

Passage of the Saxton Bill will only weaken our clean water laws and create economic challenges to two major industries. Boating is good clean fun. Let's do the right thing; let's keep it that way.

Ed McKiernan is President of Dometic Sanitation Systems. Dometic is a major supplier to the worldwide marine industry of sanitation systems utilizing holding tank system based on vacuum toilet technology. Mr. McKiernan has been active in the marine industry for over 30 years and is currently a member of the National Marine Manufacturers Association, Accessory Manufacturers Division. These remarks represent the views and opinions solely of Mr. McKiernan and not Dometic Corporation nor the National Marine Manufacturers Association nor any other entity.

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End Notes:

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