LOW TECHNOLOGY (BURN BARREL) DISPOSAL OF SHIPBOARD-GENERATED (MARPOL V) WASTES

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ABSTRACT

To help ensure more widespread compliance with marine disposal laws, alternatives are needed that are applicable to a variety of wastes, but are less costly than using marine incinerators. Burn barrels are low technology burners for disposing of MARPOL wastes at sea. They are not considered state-of-the-art combustion devices, but they are a practical, technically feasible alternative. They comply with existing environmental and marine regulations and are currently in use. Design and operational guidelines for optimizing safety and combustion in burn barrels were developed.

INTRODUCTION AND REGULATORY FRAMEWORK

Traditionally, shipboard waste has been dumped at sea without regard for the impact of the waste on marine life or navigation. Marine debris is recognized as a growing problem, threatening marine life, beaches, and vessel safety worldwide. Public Law 100-220, The Marine Plastic Research and Control Act (effective 30 December 1988) domestically implements MARPOL Annex V. It restricts at-sea discharge of garbage to certain zones and bans all at-sea disposal of plastics. In addition, it requires ports to have available suitable waste reception facilities.

Shoreside disposal of certain wastes is resticted by U.S. Department of Agriculture (USDA) regulations for controlling plant and animal diseases and pests. Wastes contaminated by food from foreign ports (except Canada) must be enclosed in leakproof containers and brought ashore under USDA supervision. These wastes must then be disposed of via incineration, steam sterilization, or grinding into a sewer. Thus, existing regulations make disposal of shipboard wastes more difficult both at sea and ashore.

In R. S. Shomura and M. L. Godfrey (editors), Proceedings of the Second International Conference on Marine Debris, 2-7 April 1989, Honolulu, Hawaii. U.S. Dep. Commer., NOAA Tech. Memo. NMFS, NOAA-TM-NMFS-SWFSC-154. 1990.

ALTERNATIVES FOR DISPOSAL OF SHIPBOARD WASTES

Under MARPOL and USDA regulations, vessel operators are faced with the following disposal alternatives, each of which has drawbacks:

- Incineration. True marine incinerators, those with combustion air fans, are expensive, moderately complicated, and occupy valuable deck space.

- Grinding. This process is generally suitable only for food wastes and cannot be used to dispose of plastics at sea.

- Compaction. Requires wastes to be stored, using valuable space. It creates possible odor problems and a potential for morale and aesthetics problems as the crew must work in close proximity to stored garbage.

- Onshore disposal (per local solid waste or USDA regulations). Drawbacks are similar to compaction, but uncompacted garbage requires even more space aboard ship.

- Biodegradable plastics. This may apply to some packaging materials; biodegradable rope and nets are not yet available; degradation products may be toxic or otherwise harmful to marine life.

- Burn barrels (low-technology burners). These may produce excessive harmful emissions or pose safety and fire hazards.

BURN BARRELS--ONE POSSIBLE SOLUTION

No single technology or disposal method can solve the marine debris problem by itself. A variety of technologies are necessary to accommodate the range of wastes produced, vessel and crew sizes, trip durations, and missions. To help ensure more widespread compliance with marine disposal laws, alternatives are needed that are applicable to a variety of wastes, but are less costly than using marine incinerators.

It has been reported that a variety of vessels are currently utilizing low-technology burn barrels to dispose of their wastes at sea. Burn barrels are simple (typically, a 208.2-L (55-gal) drum with some holes cut in the sides), "low tech," and similar to those barrels commonly used to burn household trash during the 1950's. The Marine Entanglement Program, National Marine Fisheries Service, NOAA, retained SCS Engineers to evaluate the technical feasibility, safety, and potential environmental impacts of using burn barrels to dispose of shipboard wastes.

It should be stressed that the burn barrel technique is not being advocated. However, under present regulatory authority, such technology is permissible and actively being utilized. Thus, the goal of the investigation was to provide guidelines for burn barrels that would enable legal

disposal of shipboard wastes while protecting the environment, shipboard personnel, and the vessel itself.

Design Guidelines

Because actual construction and testing of a burn barrel were beyond the scope of this project, guidelines for the design, construction, and operation of burn barrels were developed (Fig. 1). A primary consideration was to optimize combustion, that is, to make the barrel act like an incinerator as far as practical in a unit with no moving parts. Types of wastes to be burned, environmental regulations, operator safety, and fire prevention were also evaluated. The burn barrel should be large enough to burn the expected volume of waste in a reasonable time, but without occupying too much deck space.

As shown in the schematic, a complete burn barrel installation should have the following features:

- Combustion chamber (208.2-L (55-gal), 16-gauge steel, Department of Transportation standard 17C drum) located inside an 321.7 L (85-gal) steel overpack drum.
- Combustion air inlets for underfire and overfire air.
- Air gap to cool combustion chamber and preheat combustion air.
- Spark arrester, grate, ash scoop or pan, rain cap.
- Suitable anchoring and insulation.
- Adequate clearances from all combustible surfaces.
- Location: aft and downwind.
- Nearby fire hose or extinguisher and first-aid kit.

Operational Guidelines

Operational guidelines for burn barrels are largely a matter of common sense. Primary concerns are good combustion and fire safety.

- Burn during calm sea conditions, avoiding rainy weather.
- Build the fire with loosely stacked paper and wood kindling, not with flammable liquids. Add plastics in small amounts to ensure burning rather than melting.
- Avoid potential explosives such as liquid-filled bottles and aerosal cans.

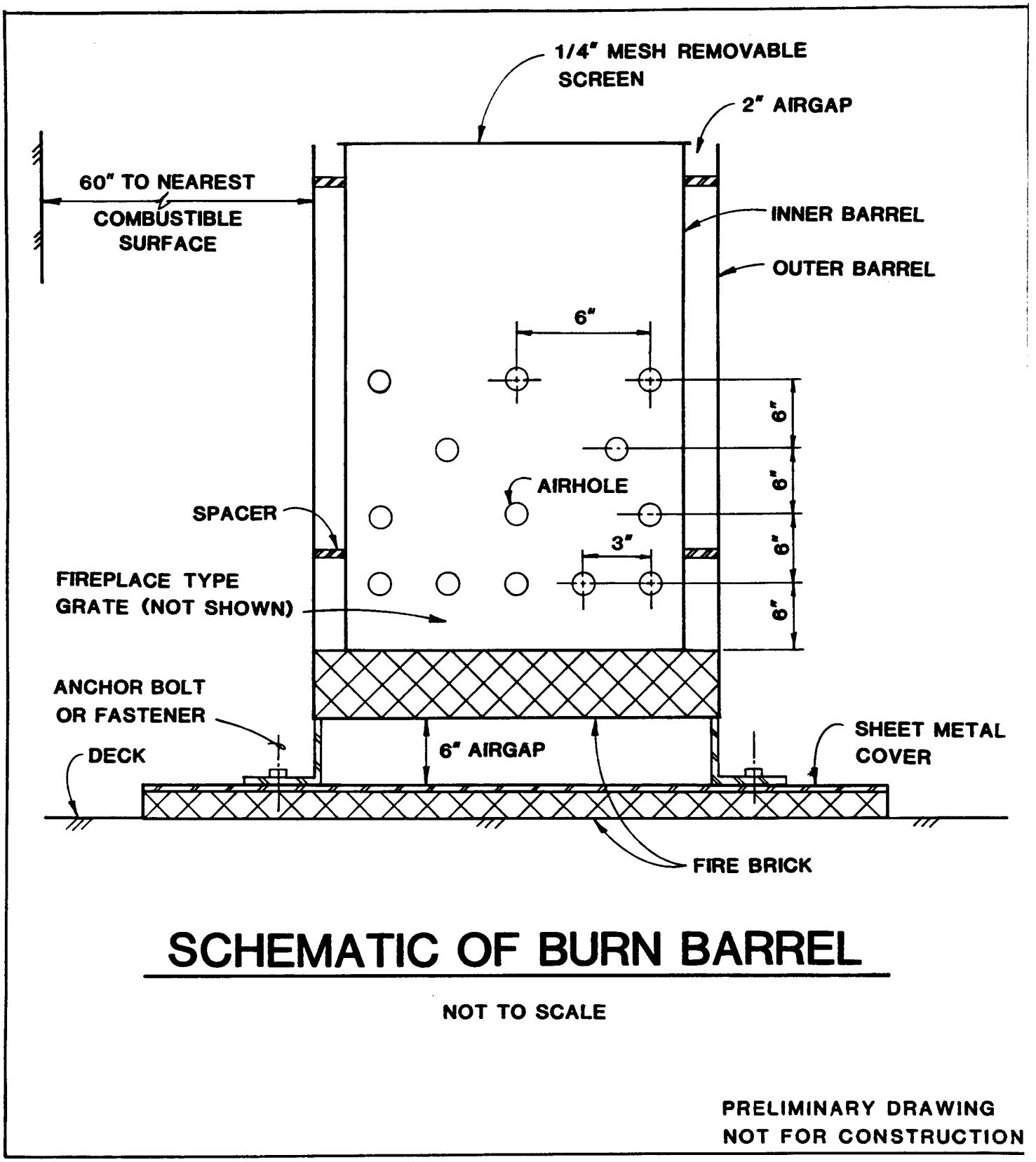

Figure 1.--Schematic of a burn barrel.

- Agitate the wastes with a metal poker for more complete combustion.
- Don't cook food over the fire.
- Wear safety goggles or glasses while operating the burn barrel.
- Avoid inhaling burn barrel smoke and fumes, which might contain hydrochloric acid from burning plastics.

ENVIRONMENTAL CONSIDERATIONS

Ash Disposal

The ash resulting from proper burn barrel operations should consist of only sand, dirt, metal, and glass (all of which do not burn); small amounts of unburned carbon (similar to charcoal); and small globules of melted plastic. The latter are still considered to be plastic and cannot be legally disposed of at sea. Since separating the plastic is inconvenient, the entire supply of ash should be stored in a metal container and disposed of properly ashore.

Air Emissions

The U.S. Environmental Protection Agency currently has no air pollution regulations that apply to burn barrels, and has no plans to promulgate any. State and local air pollution district regulations vary widely, and some of these may affect the use of burn barrels in certain coastal jurisdictions.

Actual air emissions from a burn barrel were not tested, but major components are expected to be water vapor, carbon dioxide, particulates (smoke), carbon monoxide, small amounts of hydrogen chloride (from chlorinated plastics and salt air), and various products of incomplete combusions.

The combustion conditions in burn barrels are more similar to open burning than to an incinerator. Furthermore, they lack air pollution control equipment to clean emissions. On the other hand, due to the small quantities of wastes per burn barrel, airborne emissions are expected to be modest. Air quality impacts from burn barrels operated on the open ocean are not anticipated to be significant. However, emissions testing of burn barrels is warranted.

COST CONSIDERATIONS

A burn barrel is expected to cost approximately $500, while steam sterilization of wastes to meet USDA regulations is estimated to cost about 30¢/lb. Assuming a 5-day trip with a 30-person crew generating 1.64 kg (4.4 lb) per person per day, it would cost about $200 to dispose of their wastes via steam sterilization. If a burn barrel were used instead, it would pay

for itself in only 2.5 trips. Alternatively, a marine incinerator would cost upwards of $20,000.

CONCLUSION

While they are not considered to be state-of-the-art combustion devices, burn barrels are a practical and technically feasible alternative. When properly used, they appear to comply with existing environmental and marine regulations. It is believed that they can provide a safe, convenient, and low-cost alternative to either onshore disposal or incineration of shipboard-generated wastes.