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Prospects for Improved Marine Pollution Control+

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Abstract

When considering marine pollution control procedures there are three general areas which demand close attention. These are:

- oily bilge water
- refuse
- sewage

All of these applications can be handled using Hamworthy equipment currently avaliable world-wide.

However, the equipment requirements are constantly changing to address the complexity of the waste management issues.

The basic marine pollution regulations are covered by the International Maritime Organizations MARPOL 73/78 convention, with the various annexes and revisions. Of particular importance for equipment suppliers are the Annexes I, Ⅳ and Ⅴ, which define approval procedures for equipment to deal with oily-water, sewage and plastic wastes.

+ This paper was presented to the Marine Safety & Environmental Protection Seminar co-chaired by Prof. Lee Sang-Jib, President of the Society of Maritime Safety and Capt. Brian Tayler, Director of British Marine Equipment Council, Nov. 2, 1995.

Ⅰ. Rising disposal costs

What has become more and more apparent is that specialist shore facilities worldwide will continue to charge large amounts of money to dispose of waste. In addition, there is an increasingly wide variation in waste disposal costs around the world with certain regions starting to charge prohibitive amounts.

For example, a recent Marine Safety Agency (MSA) survey indicated that disposal costs varied by as much as 200 per cent on a regional basis in the UK alone (Northern Island and Western Scotland being the most expensive areas). There is similarly a vast difference in shore disposal costs around the world, with charges being most punitive in North America.

Ⅱ. Waste and sewage treatment

Annex V of the MARPOL convention deals with waste in the form of refuse. In theory the refuse disposal issue appears simple compared with the thornier problems associated with oily water separation.

When dealing with refuse disposal there are two key solutions currently available. The waste can be compacted and taken back to port or it can be incinerated in transit. Compaction leads back to the issue of rising disposal costs. Incineration, however, avoids the issue.

In recent years the quality of fuel oil for shipping has declined and this poorer grade fuel is creating more waste on the form of fuel oil sludge.

Hamworthy's Neptune range of vertical cyclone type incinerators are able to deal with fuel oil sludge, which has become a growing problem, along with plastics and other solid and liquid wastes.

However, the sheer volume of fuel oil sludge is becoming an increasingly important factor in pollution control activities. In certain cases as much as one tonne of sludge can be created per day from burning 20 tonnes of oil a day.

This is a trend which looks likely to worsen in the short term and the spiralling increases in waste volumes from fuel oil sludge for incinerators means that the marine incinerators will need to be operated for longer periods.

Although a complex application, sewage treatment which is covered by MARPOL, Annex Ⅳ, is in many ways the most clear cut. There is a complete solution in the form of Hamworty's well proven Super Trident marine sewage treatment plant range. Hamworthy Super Trident range of plants operate on the extended aeration principle. Accelerated natural biological processes purify the sewage and produce clean, safe effluent, suitable for overboard discharge or ballast tank retention.

Systems in this range can handle any size of vessel, from tugs carrying only five or six people to the largest ocean-going vessels. The Oriana cruise liner is equipped with several Super Trident systems.

Ⅲ. Oil pollution

Of all the pollution control measures covered by the MARPOL convention it seems that dealing with oily bilge water currently poses one of the stiffest technical challenges facing ships engineers. Given that any vessel of more than 400 tonnes must comply to the MARPOL Annex 1 conditions, the implications for worldwide shipping are immense.

Under Annex I of IMO's International Convention for the Prevention of Pollution from ships (MARPOL 73/78), the regulations state

that oily-water separators must have a certificate that shows satisfactory operation under defined laboratory conditions.

However, operational experience and independent surveys, including the reports of the UK's world renowned Warren Springs Laboratory show that a high proportion of certified separators do not operate satisfactorily when in service on board ships.

Ⅳ. The scale of the problem

According to UN experts, during the 1980's the estimated input of petroleum hydrocarbons into oceans worldwide due to marine transportation activities was reduced by about 60 per cent, from 1.47 million tonnes in 1981 to 570 000 tonnes in 1989.

However, this success has put increasing pressure on one source of oil pollution to tighten up its control procedures. The problem centres on bilge and fuel oil discharges, which were 0.3m tonnes worldwide in 1981, but had only reduced by around 15 per cent to 0.253m tonnes in 1989. During this period, as a proportion of the total, these discharges rose from 15 per cent of overall pollution to represent about 50 per cent of the total in less than a decade. The increased significance of bilge and fuel oil as a discharge 'black spots' places in form of pollution under much closer scrutiny by the regulatory authorities.

Ⅴ. Seeking progress

Changes to the IMO test requirements, introduced in 1993 as resolution MEPC 60(33), have addressed the failure of separators as a result of bilge water containing oil above 0.94 specific gravity. But other reasons for poor performance exist, and the changes introduced so far seem unlikely to resolve more than a minority of the in-service problems currently faced by ships engineers worldwide.

In the latest changes to the IMO test requirements, other reasons for failure, such as the use of dispersants and cleaners which produce fixed emulsions when mixed with oil and water, were considered. However, failure to agree standard conditions for testing has prevented this from being included in the test requirements. To improve the situation, guideance has been issued by IMO on the use of cleaning agents which form only limited life emulsion.

Despite the use of separators certified for high specific gravity oil, and rigorous enforcement of cleaning agent disciplines, it is likely that problems will be experienced in obtaining satisfactory in-service operation.

Ⅵ. Testing times

Approval test programmes that are more representative of in-service could be laid down and it is possible to produce separators that can successfully meet these more arduous requirements. However, these new generation separators are likely to be ten times the cost of current separators.

The marine industry worldwide is disinclined to purchase these higher specification separators, as long as existing units meet legal requirements. There are, however, signs that operators who are aware of the full cost of an inefficient separator system, including maintenance and shore discharge of excess oily bilge water, are willing to assess alternatives.

Unfortunately, they remain a small minority at present, and sustained improvement will only

be achieved through changes in the certification requirements.

Ⅶ. New generation systems

Hamworthy Marine offers an IMO approved Oily water separator with a working system costing typically about £8000. New generation systems, which make use of state-of-the-art membrane technology, are already available but cost about £100,000.

Hamworthy is able to produce a less expensive product but it will still be about ten times more costly than conventional Oily-water separators. The latter generally use either assisted gravity technology, coalescing elements, or a combination of both principles.

Gravity separators are based on the differing specific gravity of oil and water. Oil globules pass through the separator pack, and make contact and coalesce with the system's oleophilic plates until the globules are large enough to rise through the pack. Coalescer elements perform a similar function: passage through the coalescing medium causes larger globules to form and separate. Unfortunately, these conventional systems simply cannot handle the fixed fine emulsions found in many bilges.

Research on other solutions is underway, but they are still in their infancy. One possibility, for example, is genetically engineered bacteria (bioremediation). However, indications are that such a separator is likely to be very large, with only about 10 per cent reduction in the oil content per pass through the system. It is unlikely that a bioremediation unit could match the current operational practice, where ship's engineers expect to push a button and see clean water being immediately discharged.

There is no doubt that a separator approved under the current MARPOL regulations provides a low cost solution, however, the oil waste influent must conform with the test conditions laid out in the procedures. The major doubt is whether the reality of ship operation allows these laboratory conditions to be achieved in service.

Ⅷ. Complex problems

Changes in the approval procedures for oily water separators recognise the increased use of high SG fuel oil, but other known problems have.

The reason for the relative lack of progress in this sector is the complexity of the problem caused by the mixing of different oils, waters and cleaning agents to create complex emulsions, of very variable nature, finely dispersed and of a fixed form.

The current IMO guidelines for the approval specification call for only bilge water containing less than 15ppm of oil to be discharged. Matching actual measurements at sea with the test input recommended by MARPOL, however, is proving easier said than done. The result at present, is a long way from being achievable on the repeatable basis required for effective pollution control compliance.

Currently, is difficult to predict what shipowners seem reluctant to specify the separator systems called for by MARPOL's Annex I.

Realistically there are only four major scenarios which will see any meaningful improvement in the situation:

1) IMO revises its Annex I guidelines to make them achievable using conventional oily water separator systems.

2) Shipowners and ship's engineers recognise

that IMO regulations can only be met by using new generation(more expensive) systems.

3) A technology breakthrough is achieved by the oily water separator suppliers, creating products which meet IMO guidelines for a more affordable price.

4) Punitive disposal costs force shipowners to opt for the new generation oily water separators, as a less expensive option tn the long term.

Irrespective of the outcome of the regulatory decision making, Hamworthy Marine will continue its overall product policy of offering customers equipment which conforms to regulations, at a price they can afford, and which are easy to install yet minimal maintenance.