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Bilge Water Management & Pollution

Bilge Water Management & Pollution

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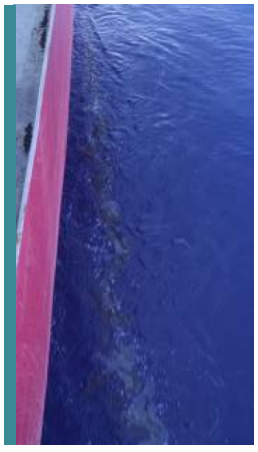
Introduction

Pollution fines for the illegal discharge of oil contaminated bilge water continue to occur, particularly so when violations arise or are uncovered in the United States.



If a vessel is found to be in violation of legislation such as the US Clean Water Act or the US Act to Prevent Pollution from Ships, then fines can total several million US dollars and crew members can find them sentenced to prison terms. Violators may face the equally serious and additional charges of obstruction of justice. Owners may also be subject to a strict compliance programme which can be both costly and extremely time consuming or even banned from trading in certain waters.

Common factors in the high profile prosecutions would appear to be the use of temporary transfer lines, known as 'magic pipes' which effectively by-pass bilge processing equipment, the manipulation of the oil content monitor and the falsification of the ship's Oil Record Book.

This briefing includes observations on the recent prosecutions in the United States, an overview of bilge water processing equipment with the illegal techniques possibly used by ships' crews to discharge oily and dirty bilge water. It concludes with suggestions on the types of practices that could be adopted by a shipowner to prevent these occurrences and to better protect themselves.

Oil Pollution Cases in the USA

A 2014 report issued by the Environmental and Natural Resources Division of the United States Department of Justice stated that in the last ten years vessel oil pollution prosecutions has resulted in a total of over US$200 million being paid in penalties. This is in addition to the accumulated total of 17 years' incarceration of the offenders, who were mostly seafarers.

The information and background on these incidents is disclosed by the United States Department of Justice and is available in the public domain.

The main observations of the reviewed cases are as follows:

- In half of the cases, an Environmental Compliance Plan (ECP) was enforced on the shipowner in addition to financial penalties. Environmental Compliance Plans incur extra costs, administrative burdens and maintenance for ship managers and crew
- In all cases, a charge of falsification of records, which includes the vessel's Oil Record Book, was raised
- In almost half of the cases, the authorities were alerted by a whistle-blowing crew member. The rewards to whistle-blowers can be quite considerable, and very attractive to crew members regardless of their origin. In some of the

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cases reviewed, the crew member received awards approaching US$1 million

- The oily water separator (OWS) was bypassed, by the use of a 'magic pipe', in most of cases
- The oil content monitor (OCM) of the OWS was 'tricked' in a third of cases. This is usually achieved by passing clean water through the sensor
- Approximately half of the cases reportedly resulted in the sentencing of a crew member and in some cases imprisonment
- In a quarter of the cases, the crew were directly ordered to lie to the investigating authorities, resulting in obstruction of justice charges. In some instances the shore based management were found to be complicit

Shipboard Bilge Water Management

There are essentially three aspects to good bilge water management:

- Reducing the amount of bilge water at source
- Maintaining and operating bilge water processing equipment correctly
- Proper documentation and record keeping

Bilge Water

The accumulation of bilge water in the machinery spaces of ships in service is inevitable. However, there is no justification for the illegal discharge of bilge water unless it is for the purpose of securing the safety of a ship or saving life at sea.

Bilge water can be of sea water or fresh water origin and contain contaminants such as fuel oil, lubricating oil, debris/detritus, chemicals and sewage.

The source of bilge water accumulation can include but is not limited to the following:

- Leakage from pipes and connections
- Leakage from valve and pump glands/seals
- Careless performance of maintenance and general poor standards of housekeeping
- Insufficient cleaning and removal of debris and subsequent blockage of save-alls
- Water condensed from air systems (such as air-conditioning equipment, air compressors, compressed air receivers and diesel engine charge/scavenge air cooler drains)
- Using excessive amounts of water and chemicals when washing down & cleaning

Bilge water holding tanks may also collect contaminated water stripped and transferred from the ship's sludge tanks (originating from settling tank drains, purifier sludge tanks, economiser washings and so on) or other designated dirty tanks.

Engine room cleaning chemicals need to be suitable for use with the bilge processing equipment. Chemical suppliers should provide maintenance plans to assist with this.

A conscientious on board engineering team will look to identify the main sources of ingress and contamination, taking measures to reduce and ideally eliminate both. This may be as simple as the timely repair of leakages and taking more care during cleaning routines.

Reduce the source – reduce the problem.

Bilge Water Treatment

In a typical bilge system, accumulated bilge water is pumped to the ship's bilge holding tank via a bilge pump. The contents of the bilge holding tank can then be pumped through the bilge water processing equipment and if the oil content of the effluent is 15ppm or less (and allowed by the relevant environmental legislation) it can be discharged overboard. If the oil content of the effluent is above 15ppm it will be re-circulated back to the inlet of the processing equipment or to the holding tank. As oil accumulates in the processing equipment, it is led or decanted to the ship's designated sludge tank.

The bilge water processing equipment, such as oil water separators (OWS) and oil content monitors (OCM) must be considered as critical machinery. The improper functioning of such equipment can be grounds for a port State control detention.

Depending on the year of build of the vessel, the fitted equipment will meet one of two specification standards set out by the Marine Environment Protection Committee under Resolution MEPC.60(33) or MEPC.107(49). The main purpose of the latter, adopted in 2011, was to improve the capability of processing equipment in treating emulsified oil.

Oil Water Separators

There are two main types of oil water separator in common use; the static OWS and the centrifugal OWS.

There are several types of static OWS, but the general principles of operation are:

- Gravity separation – the density of oil is generally lighter than water, although some heavy fuel oils are similar, and the oil will separate and 'float' on the water
- Coalescing of oil droplets to form larger oil droplets which improves separation
- The oil/water interface is kept in the upper section of the unit

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and oil is removed automatically as required

- Filter material with a natural affinity to oil can be used to polish the bilge water and remove particles

RWO Static OWS

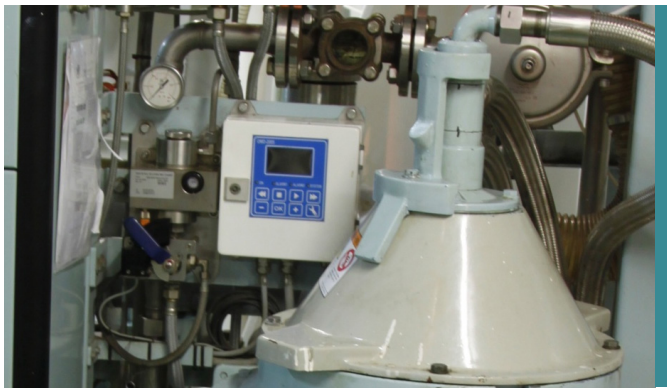
The centrifugal OWS has a different principle of operation:

- Bilge water is centrifuged in a high speed spinning bowl containing a plate stack
- The heavy particles (higher density than water) move to the outer bowl area and can be discharged through regular 'de-sludging' when the spinning bowl momentarily opens
- The oil, which has a lower density than water, moves to the inner bowl area and flows out of the separator to a sludge tank

Westfalia Centrifugal OWS

Oil Content Monitors

The oil content monitor (OCM), which is also known as the oil monitoring device (OMD) or the 15ppm bilge alarm, draws a sample of the oil water separator discharge effluent and measures the oil content in parts per million (ppm). If the measured value is 15ppm or less then it will allow the discharge to be directed overboard. If the oil content is over 15ppm then the effluent will be diverted either back to the OWS inlet or to the bilge holding tank, depending on the system layout.



Oil Content Monitor

There are several types of monitoring devices which work on one of the following principles of operation:

- Light on photo-cell through passing the sample (obscuration or light absorption)
- Infra-red or optical light scatter through the sample
- Combination of the light scatter and absorption
- Fluorescence detection

The most commonly used oil content monitor is the light scatter type, as this is seen to be the most cost effective solution. Its performance may be limited however, as contaminants other than oil in the sample water can give a false reading. Contaminants that can give false high readings are sewage, soot, particles and cleaning chemicals and the presence of such can prevent the legal discharge overboard. Conversely, it may be possible that clean oils could pass through the monitor without activating the alarm.

A good example of this can be described as follows: If the monitor is filled with milk it will read a high ppm and will go into alarm and prevent discharge overboard, but if filled with a clean hydrocarbon oil product, it will read a low ppm and not go into alarm and therefore allow discharge.

For vessels equipped with OWS filtering equipment complying with MEPC 107(49), officers and crew members must be thoroughly familiar with the operation and maintenance of the equipment, which includes the ability to retrieve historical data

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from the OCM in accordance with manufacturer's instructions and as indicated in MEPC 107 (49) and as paraphrased as follows:

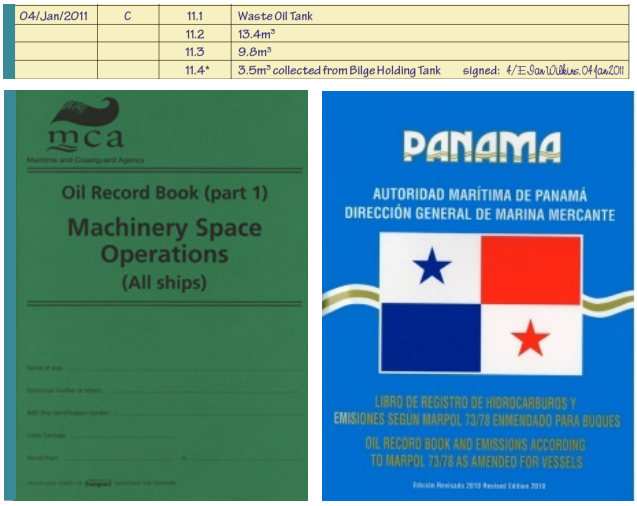
The 15 ppm Bilge Alarm should record date, time and alarm status, and operating status of the 15 ppm Bilge Separator. The recording device should also store data for at least eighteen months and should be able to display or print a protocol for official inspections as required. In the event the 15 ppm Bilge Alarm is replaced, means should be provided to ensure the data recorded remains available on board for 18 months.

It should be stressed that any modifications to the bilge system or equipment must be approved by the vessel's classification society and/or the authority issuing the vessel's IOPP certificate before any work is carried out.

It is not unknown for sea-going engineers to have reservations regarding the level of effectiveness of some types of oil water separators and oil content monitors, in particular those manufactured before MEPC 107(49) came into effect. Both static and centrifugal OWS machines can require the cleaning of internal elements and components to be undertaken at very regular intervals to ensure effective operation. This can lead to a significantly labour intensive operation.

Oil Record Book

The Oil Record Book Part 1 - 'Machinery Space Operations (All Ships)' is required for every ship of over 400 tons gross tonnage (other than oil tankers) and every oil tanker over the 150 tons gross tonnage if subject to the requirements of MARPOL Annex I or its enactment through national or domestic law. In addition to recording the bunkering of fuel and lubricating oils, the Oil Record Book (ORB) is used to record machinery space operations involving the transfer, discharge or disposal of bilge water and sludge (waste oil).



Oil Record Books (United Kingdom & Panama)

IMO Circular MEPC.1/Circ.736/Rev.2 Guidance for the Recording of Operations in the Oil Record Book Part I was issued in October 2011, and gives strict guidance on how the book should be completed.

There is ever increasing scrutiny of the ship's Oil Record Book. The failure to correctly maintain the ORB can lead to a port State control detention and possibly criminal proceedings. As referred to in the earlier section *'Oil Pollution Cases in the USA'*, falsification of the ORB appears regularly as a charge and stands as a serious offence. In effect by falsifying the ORB you are lying to a federal official which constitutes a crime in itself.

The veracity and reliability of the ORB can be assessed by checking for continuity in recorded bilge and sludge tank levels and comparing the relevant tank level changes against the times the OWS was in use. For example, an entry stating a declared amount of bilge water was discharged through the OWS during a certain period of time and is later found to be greater than the designed throughput of the equipment may alert a reviewer that something is amiss.

All changes in tank quantities should be accounted for and consideration made to processes where levels fall such as the boiling off or the steaming of sludge tanks through heating.

Engine room alarm records may also be checked for bilge high level alarms and the ORB then reviewed for a correlating entry related to the pumping operation.

Another check that can be made by a reviewing party is to cross reference the present tank levels as recorded in the ORB with the actual levels at time of inspection.

Scrutiny of the ORB may result in unusual trends being identified, such as a sudden and marked reduction in bilge pumping entries. It may be that the bilge water ingress was arrested by a conscientious crew, but it may also signify something more sinister.

Illegal Practices

Faced with the difficulties and frustrations in relation to bilge water management, it is regrettable that on some occasions the ship's crew attempt various methods of 'cheating' the system. The following highlights some of the known illegal practices attempted on board:

1. **'Tricking' the Oil Content Monitor by shutting off the sample supply and leaving on the flushing water.**

The monitor is fooled into thinking the oil content of the effluent is 15ppm or less and allows discharge overboard regardless of the actual oil content.

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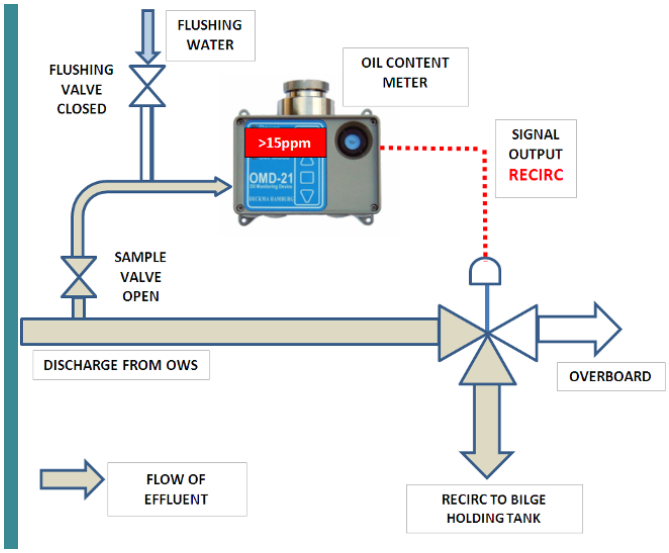
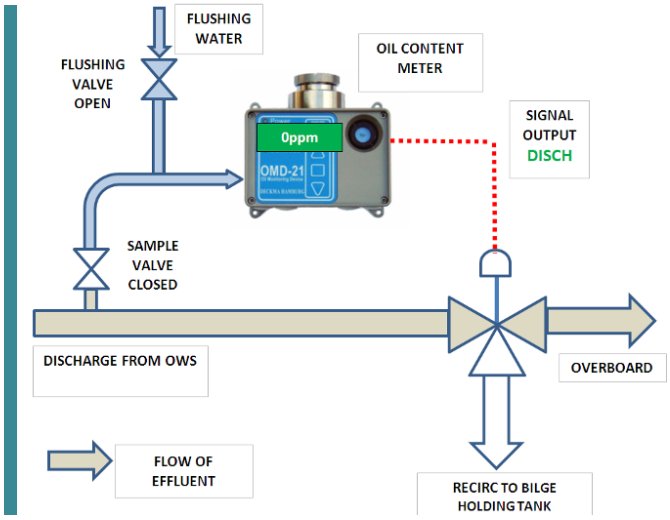
The flushing water should only be used for cleaning the oil content monitor or for checking the 'zero' calibration of the unit. When the OWS is in operation, a representative sample of the actual effluent must be fed through the monitor.

If the flushing water remains flowing through the monitor whilst the OWS is in operation, there is no measurement or control of the actual effluent.



Oil Content too high – no discharge allowed



Flushing water on - Illegal discharge

For oil content monitors that comply with MEPC 107(49), the alarm should activate whenever clean water is used for cleaning or zeroing purposes.

2. 'Tricking' the Oil Content Monitor by shutting off the sample when the monitor is reading <15ppm. Therefore no sample flows through the monitor but reading stays below 15ppm.

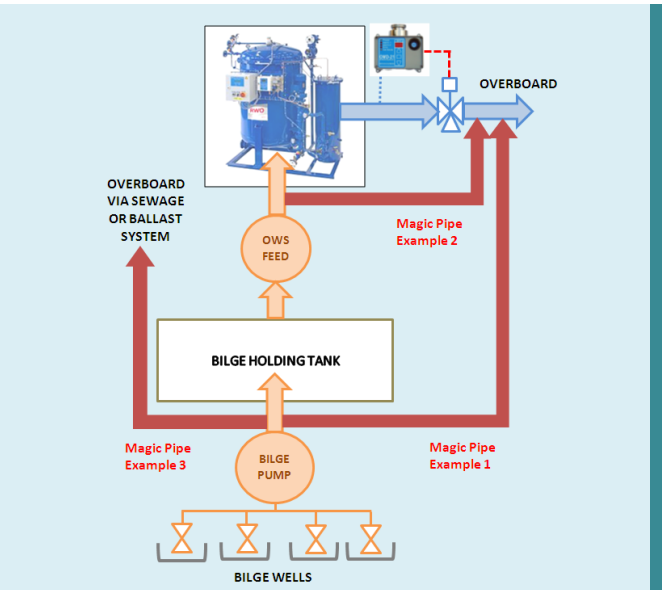
Again, the monitor is fooled into thinking the oil content of the effluent is 15ppm or less and allows discharge overboard regardless of the actual oil content.

Consequently there is no measurement or control of the actual effluent.

3. Modifying the system to bypass the OWS – "Magic Pipe"

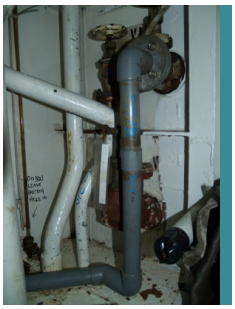
Magic pipes are generally only detected during inspections. However, these can be very difficult to identify as the bypass line can be positioned well away from the OWS and out of sight under the engine room floor-plates.

Magic pipes are often temporary, sometimes flexible and can be easily removed. If the magic pipe has been removed before an inspection, then an inspector or surveyor may notice and be alerted by disturbed paint coatings on flanges. Or conversely, if a fresh coat of paint is noticed on a flange this may be seen as an attempt to hide the evidence. Blanked flanges and T-pieces on the discharge pipes may also lead authorities to investigate deeper.



Examples of 'magic pipes'

The magic pipe may be a direct means of discharging the bilge holding tank (or even sludge tank) by bypassing the OWS. Or there may be a direct discharge overboard from the bilge wells using the bilge pump(s). The more creative offenders may tap into other discharge systems such as the ballast pumps or sewage/grey water lines.



A magic pipe – in this case a temporary plastic pipe

Bilge Water Management & Pollution (cont.)

4. Pumping bilges directly overboard with the bilge pump

This is the most direct method of illegal discharge and is possible as the bilge pump will usually have the capability to discharge overboard directly which should only be utilised in the event of an emergency.

It is difficult to physically restrict this practice as padlocking overboard valves may affect the emergency preparedness of the bilge pump.

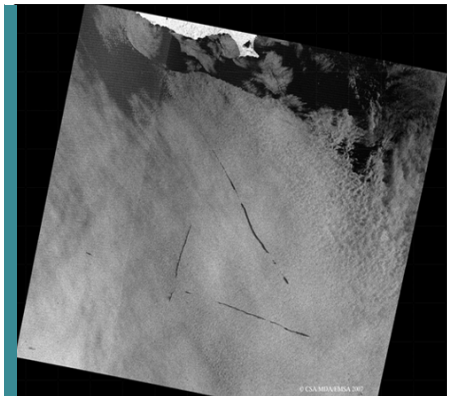
Methods of Detection

In addition to the aforementioned, other methods of detection can be employed by inspecting authorities.

An attending inspector/surveyor may notice the crew's unfamiliarity of the OWS operation during testing. This may lead them to suspect that the crew have not been operating the equipment correctly, if at all.

An inspector may request the removal of the pipe between 3-way valve and the overboard valve to allow an internal inspection. There should be no traces of oil residue in this section and the presence of such will lead them to conclude that oil has passed illegally through the pipe.

Spotter aircraft and satellite monitoring may be utilised, such as HELCOM in the Baltic Sea and CleanSeaNet in the European Union.



EU CleanSeaNet sample satellite image of oil spills

Whilst in port or at anchorage, authorities may send divers down to look at the OWS discharge from the sea-side. Again there should be no traces of oil.

Culture of Compliance

There are a number of reasons why a crew member may decide to illegally discharge bilge water. The crew may be restricted in opportunities to legally discharge due to the trading route of the vessel, or experience difficulties with the operation of the processing equipment, inadequate capacity and ultimately due to an absence of a culture of compliance.

The review of recent prosecutions in the United States found that in most cases the ship's senior officers were criminally liable, and there was no suggestion that shore management was complicit.

However, there have been reported cases where it was proven that illegal discharges had been carried out with the knowledge and in some cases the direct instruction from shore management. In these cases the outcome of the cases was particularly burdensome, with both high fines and compliance regimes in place.

It may be that some illegal discharges occur due to the perceived pressure on crew and superintendents to meet budget targets. The charges involved in discharging contaminated bilge water and sludge vary worldwide but in some locations they can be prohibitively expensive.

Quite often the shore reception charges for receiving bilge water is much greater than sludge/waste oil as the receivers can treat the sludge and sell it on elsewhere or add it to bunkers – bilge water is far less valuable.

It is important therefore that company policy in respect of discharges is absolutely clear and well communicated to both seagoing and shore staff. This should assist in avoiding rogue decisions taken by employees in contravention of company policy.

Whistle-blowing

Crew members are often rewarded by port States and in particular those within the United States. The United States Act to Prevent Pollution from Ships (33 USC 1908(a)) advises:

"A person who knowingly violates the MARPOL Protocol, this chapter, or the regulations issued thereunder commits a class D felony. In the discretion of the Court, an amount equal to not more than ½ of such fine may be paid to the person giving information leading to conviction."

There may have previously been an assumption that a whistle-blowing crew member was a disgruntled employee or someone genuinely troubled by illegal on board practices. However, there is now concern that the significant sums of money available to whistle-blowers is resulting in the wrong kind of behaviour. Rather than notifying the company and/or the ship's Flag State of any wrongdoings, there are concerns that crew members will look to wait until the vessel is in US waters in the hope of receiving an award.

INTERTANKO have developed guidelines to help companies implement whistle-blowing policies which allows crew members to report to their management without fear of reprisal and maintain anonymity. It may be that such a system may help discredit a financially motivated whistleblower if they looked to bypass such a confidential reporting facility.

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A responsible and open culture may deter would-be whistleblowers if they think an allegation would be easy to disprove.

Loss Prevention

There are a number of preventative measures that can be taken to prevent illegal discharges of bilge water. Such measures, examples of which will be detailed below, clearly vary in cost and practicality in terms of implementation as well as the time involved in installation and commissioning and may not be appropriate in all cases.

For the purpose of this briefing, the preventative measures can be categorised as 'hardware', 'documentation' and 'management'.

Hardware

Bilge water processing equipment should be regarded as high priority and the maintenance and spare part supply is treated as such. The vessels Planned Maintenance Systems (PMS) should include the OWS and associated equipment so that maintenance is not only carried out as planned, but also properly documented for retrieval of historical data as necessary.

If there are ongoing or historic problems with on board treatment, then a review of the bilge system may be beneficial. Modifications to the system, in full consultation with class and Flag State of course, may assist the processing of bilge water.

For example, if the only bilge holding tank is a shallow double bottom, there is very little gravity separation effect. The installation of tall pre-separation tank could provide valuable and effective pre-treatment. The choice of either a static or centrifugal OWS may be a factor. In some cases it may be prudent to install both, especially when a centrifugal separator can be used to re-circulate and clean up the contents of the bilge holding tank during times when discharge overboard is not permitted.

An option that may be considered is the fitting of a tamper-proof sampling and monitoring unit. This could simply be a case of fitting padlocks and/or security seals to the OWS effluent sample and clean water flushing line valves or the fitting of a lockable cage to prevent uncontrolled access to these valves. The breaking and replacement of seals can then be recorded accordingly. Newer units may only allow flush water to enter through a timed electrical solenoid valve but be aware that this may have a manual bypass valve.

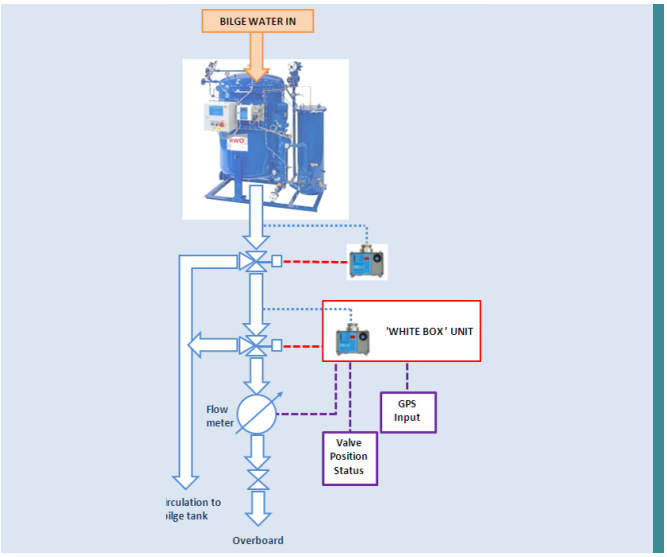
The OWS sample lines can be further modified by fitting flow switches. These will prevent any overboard discharge if no or insufficient sample flow is detected.

The installation of flow meters on OWS overboard discharges will allow the easy monitoring and recording of discharge quantities.

A further adaptation is to install a 'white box' type unit. This is also tamper-proof but has the added benefits of GPS position, flow meter and valve position recording.

The "White Box"

The White Box may be used as a secondary monitoring unit and retrofitted to existing systems.



OWS System with White Box

The fitting of surveillance cameras at bilge processing equipment locations has also been adopted by some operators.

Bilge Water Management & Pollution (cont.)

There are a number of preventative measures that can be considered to stop the illegal use of temporary or 'magic' pipes to bypass the processing equipment. These include welded beads on the pipe flanges or the flanges drilled and security seals fitted through them accordingly.

Security seals on flanges

The removal of suspicious T-piece connections or blanked flanges in bilge system should deter any suspicions from inspecting authorities. This is particularly pertinent when looking at OWS discharge pipe-work. If portable hoses with mating connections compatible with discharge line connections are found on board this could further arouse suspicions.

Documentation

Proper and accurate record keeping is essential. It must be remembered that the Oil Record Book and maintenance records will be scrutinised in the event of a pollution incident or an allegation.

It is very easy to fall foul when it comes to the Oil Record Book, and port State authorities may interpret genuine mistakes as something more sinister.

Therefore, the importance of this document cannot be understated and care must be taken not only when making entries but also when being checked by the ship's master and chief engineer, and perhaps further scrutinised by the superintendent.

The master should be aware of the consequences of failing to verify the reliability of the entries before countersigning the Oil Record Book. If deemed necessary, the master and crew should be provided with suitable training to ensure that they are able to maintain the book effectively.

Entries in the Oil Record Book must be made with strict adherence to MEPC.1/Circ.736/Rev.2. However, problems may arise when each watch-keeping engineer has a slightly different way of making entries – the codes may very well be correct but the style and layout of entered data may differ. This in principle is acceptable, but it makes following the entries and subsequent auditing difficult. This results in a greater susceptibility to making mistakes, and in turn makes it more difficult for auditors to identify errors.

A consistent method of making entries by all persons would help address this problem. A fleet wide standing instruction on the layout and style of oil record book entries would assist both entry makers and reviewers.

Another method of ensuring entries remain correct is by the utilising of a spreadsheet running alongside the Oil Record Book. This does increase the administrative workload of crew but a properly designed program which maintains a running total of tank levels along with every transfer will help ensure there are no discrepancies.

Management

When considering extra preventative measures, efforts should be made to ensure that they are not too onerous on the ship's crew. A well intentioned but over-cautious ship manager may look to go considerably over and above the statutory requirements when formulating or amending the environmental aspects of a ship's safety management system but may unintentionally increase the risk of pollution. For example the imposing of more stringent restrictions on discharge than is mandatory may restrict the crew too far in their ability to process the bilge water and adversely alter their behaviour.

Another important aspect is the relationship between ship and shore staff. A culture of compliance must be developed and maintained. For an owner to protect themselves against allegations there should be a culture whereupon ship's staff must not feel pressured into carrying out illicit acts for whatever reason.

The ship's crew must believe that shore management is 'on their side' and all communications are unambiguous. For example if the ship's chief engineer informed a superintendent of a bilge water problem, a reply of 'just deal with it' might lead to inappropriate and possibly illegal actions.

The last few years has seen the advent of the whistle-blower and their motives may in some cases be financially driven due to the high level of rewards on offer. A culture should exist whereupon a concerned crew member can advise a senior member of shore management directly of any concerns without fear of retribution, or the knowledge of his fellow crew members. Such a system may also help discredit a financially motivated whistle-blower if they looked to bypass a confidential reporting facility.

Bilge Water Management & Pollution (cont.)

INTERTANKO's guidelines on whistle-blowing policies should be consulted for further information.

Ship's crews must be proactive at reducing bilge water generation at source. This could be as simple as fixing leaks, or ensuring purifiers are operating correctly. Reduce the source – reduce the problem.

Ensure ship's crew are fully trained, confident and competent in the operation of bilge processing equipment and the retrieving of data from oil content monitors.

Training should also be provided in how to manage Port State Control (PSC) inspections. The crew should be able to identify when an inspection moves from being routine to 'expanded', thereby increasing the potential for problems.

Know how to manage PSC inspections

The crew must be instructed to give honest answers when speaking with the PSC inspectors. In the US, it is very important that the crew not invoke their right to silence during routine inspections as these could be interpreted as them having something to hide. The crew need to be able to sense when a routine inspection has become a criminal investigation. When they have positively confirmed that a criminal investigation is underway, then is the time to consider a right to silence.

Superintendents have an important role to play in preventing illegal discharges. Superintendents should be vigilant and learn to recognise any irregularities, such as noticing a change in requests from a vessel to discharge waste to shore reception facilities. The generation of waste on board a ship is inevitable, the fuel and lubricating oil purification equipment alone will generate several tons of waste per month, and if this has disappeared and is not accounted for, it may require further investigation.

There should also be consideration made to the ensuring of an adequate allocation of budget for bilge water and waste oil processing maintenance and discharges to shore reception facilities. Financial pressures should not lead to illegal discharges.

Good prior planning can help alleviate the financial burden of discharging waste to shore reception facilities. Some ports have an arrangement whereupon a limited amount of waste can be discharged at minimal cost or even free. Identify these ports and take advantage of these arrangements.

The easiest way to help prevent illegal discharges is to simply take away the need to do so.

Reduce the source – reduce the problem.

Disclaimer

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