Nō te rere moana Aotearoa
MARITIME NEW ZEALAND

TEL +64 4 473 0111 FAX +64 4 494 1263
Level 11,1 Grey Street, PO Box 25620, Wellington 6140
New Zealand

5 April 2019

[redacted]

Our ref: F27018
By email

Dear [redacted]

Official Information Act request: Report into *MV Aratere* Oil Content Meter Tampering Investigation

I refer to your request on 12 March 2019 for the report regarding the alleged tampering of the oil content meter on ***MV Aratere***.

We have considered your request in accordance with the Official Information Act (the Act).

Please find enclosed the memorandum dated 8 August 2018, prepared by a Maritime NZ Specialist Investigator and a Maritime Officer regarding the investigation.

Maritime NZ has redacted some information from this document for the following reasons:

- to protect the privacy of natural persons (section 9(2)(a) of the Act); and
- to protect information which is subject to an obligation of confidence, where the making available of the information would be likely to prejudice the supply of similar information, or information from the same source, and it is in the public interest that such information should continue to be supplied (section 9(2)(ba)(i) of the Act).

Maritime NZ considers the withholding of this information is not outweighed by other considerations which render it desirable, in the public interest, to make the information available (section 9(1) of the Act refers).

You have the right to seek an investigation and review by the Ombudsman of this decision. Information about how to make a complaint is available at www.ombudsman.parliament.nz or freephone 0800 802 602.

If you wish to discuss this decision, please feel free to email me or contact me on direct dial 04 495 9661 or freephone 0508 225 522.

Yours sincerely

Anna Cochran
Advisor, Ministerial Services

Enclosed: Document covered by your request

Memorandum

MARITIME NEW ZEALAND

TO	Paul Fantham Manager Intelligence & Planning
FROM	[redacted] Specialist Investigator & [redacted] Maritime Officer
DATE	08 August 2018
OUR REF	Aratere OCM

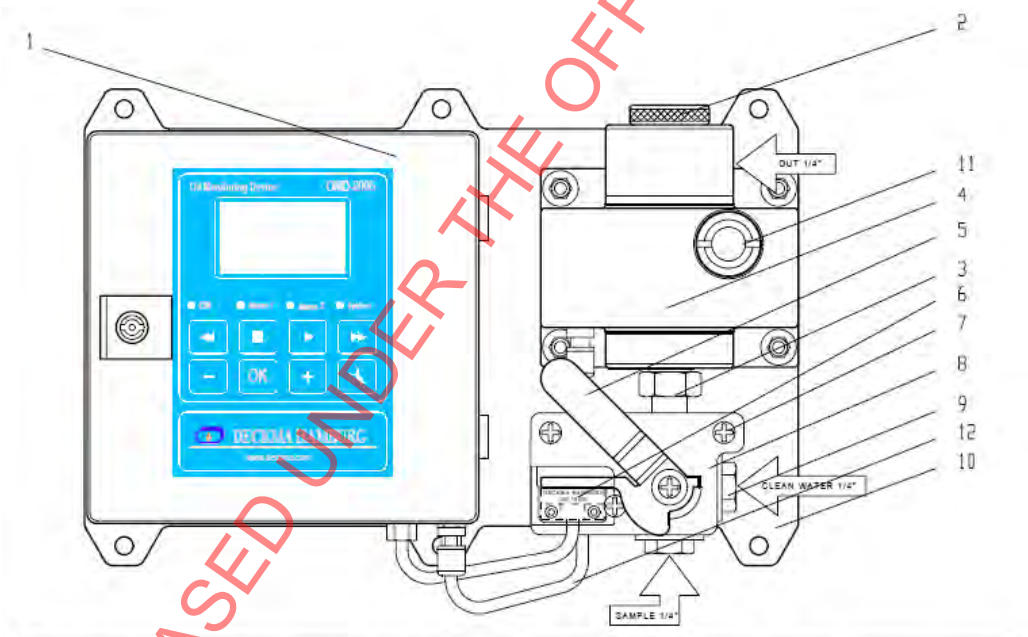
Level 11, 1 Grey Street
PO Box 25620
Wellington 6146
New Zealand

Tel +64 4 473 0111
Fax +64 4 494 1263
www.maritimenz.govt.nz

Introduction

In February 2018 [redacted] Interislander contacted MNZ with suspicions that some of the engineering crew on the Aratere have been manipulating the Deckma OMD-2005 Oil Content Meter (OCM). This would have the result that bilge water with unknown traces of oil could have been discharged into Cook Strait[1]. He was particularly concerned with the week 24-31 January 2018[2].

He said that crew from one watch ([redacted]' shift) had found a copper wire with a flattened end they feel may have been used to 'fool' the OCM into thinking the water passing through had zero parts per million (0 ppm) of oil (by bridging a circuit). He also said they had found some small scratches on the 3/2 way valve (Item 9 in Figure 1 below) inside the handle that may have been made by the copper wire.



1	Computer Unit	5	Handle	9	3/2 Way Valve
2	Head Screw	6	Limit Switch	10	Mounting Plate
3	Fitting	7	Spacer	11	Desiccator
4	Measuring Cell	8	Valve Plate	12	Communication Cable

[1] NB – the amount of oil would be very low (parts per million)

[2] Aratere runs a Wednesday-Wednesday working week.

Figure 1 Deckma OMD-2005 diagram.

This resulted in the OWS piping before the overboard valve being disconnected and seals installed on the overboard valve and the control booth for the OCM. Since then the oily water has been taken off the ship by truck and disposed of ashore, which had been done previously with the sludge. The OCM on Aratere was previously on the Kaitaki.

Allegation

[redacted] believes that some crew members of the Interisland ferry Aratere are deliberately manipulating the OCM. This manipulation could allow water with higher than 15 ppm of oil to be discharged over the side.

He has provided a copy of his report . This is summarised below. [redacted]

[redacted] Report

In his report, [redacted] states that his attention was brought to potential problems with how the OCM has been operated on the Aratere. The information passed to [redacted] was that [redacted] suspected that someone from [redacted]' shift had tampered with the OCM to allow water that potentially had a higher than 15 ppm reading to pass overboard, rather than being automatically re-directed to the sludge tank. This suspicion was formed by [redacted] seeing higher than normal back pressures in the OWS filters and excessive ppm readings when [redacted] When they checked the OCM by reviewing the OCM memory they saw that there were 0 ppm readings during [redacted]' shift) which they felt was impossible.

They also found evidence of dirtier than normal filters and in July 2017 a wire rod with one end flattened that was found on top of the OCM.

It was thought that by inserting the rod into the gap between the valve plate and the handle on the OCM (the sample valve reed switch) while having the 3/2 valve in the fresh water flushing line, it would bridge a circuit and allow the unit to think that it was set to effluent sample, and therefore it would not alarm when the fresh water flushing line was used.

In [redacted] opinion the only reason the OCM could be reading 0 ppm during discharges while operated by [redacted]' shift, and having positive ppm readings while being operated by [redacted] shift would be if the system was being deliberately tampered with (Figure 2 below).

My conclusions from the above analysis were:

- it seems unlikely that the readings of 0ppm obtained in the week of 24 -31 January 2018 truly reflect the PPM levels of the effluent discharged that week.
- Therefore it can only mean that the meter was being tricked by some fashion. This could be bridging of the sensor wires or fooling the reed switch with a foreign metal object.

Figure 2 - extract from [redacted] report

[redacted]

For the investigation, [redacted] had Antelope Engineering (NZ) Ltd (the New Zealand service agents for Deckma) attend the Aratere and run tests. A video of this inspection was shared to our investigators by the crewmembers. Antelope found that two wires serving the sample reed valve switch had been transposed. These wires were inside the OCM cabinet. It was not known by [redacted] what effect this

transposition would have on the operation of the OCM. Later in our investigation it was determined this would not have any effect on the system.

[redacted] mentions the fresh water supply valve and states that its operation would be the same for both shifts equally and therefore its position would not make any difference[3].

During his investigation, [redacted] compared readings from the OCM with Oil Record Book (ORB) readings to illustrate that the zero readings occurred predominantly when [redacted] shift were operating the system.

[redacted]

[redacted] stated that Deckma advised him that the OCM was not malfunctioning and was working properly. Although the video appears to show that water is leaking from the head screw (#2 in Figure 1 above), Deckma apparently told [redacted] that it was pressure tested to 10 psi and was not found to be leaking.

An email dated 20 March 2018 from [redacted] to [redacted] shows an email from Deckma which states "We have no clear evidence of manipulation"

The Oily water separator overboard discharge pipe was removed and inspected and there was no trace of oil inside the pipe.

[redacted]

MNZ Investigation

As part of the investigation we boarded the Aratere and were shown the operation of the OCM[4] by [redacted] shift crew. This crew suggested that the 0 ppm readings [redacted] shift had experienced during discharging was not possible, and that even low levels of reading should have been visible during the discharge. They stepped through the OCM digital readout and went back in time to compare discharges when their shift had been working – which showed fluctuations in ppm with the other shift that showed 0 ppm readings. On the face of it this seemed odd.

[redacted] showed how by inserting a bare copper rod, flattened at one end into the gap between the valve plate and the handle he could 'trick' the OCM into thinking that (Figure 6) the OCM was getting the sample fluid from the discharge pipe when in actuality the fresh water flushing line was activated. If the copper rod was not inserted in this position the alarm would sound and send the OWS discharge back to the sludge tank. If the copper rod was inserted and then the fresh water flushing line was activated no alarm would sound.

A Technical Advisory from the USCG dated 16 September 2006 notes that the Deckma OMD-2005 is very easily fooled. It states: "By placing a magnet near the micro-switch or by using items such as a binder clip, this interlocking function is disabled and the valve may be repositioned to allow clean water to flow continuously to the OCM. OMD-2005 units delivered after January 2005 have been fitted with a cover plate which makes this intervention slightly more difficult. Owners of units that do not have this cover plate are encouraged to obtain one by contacting their equipment's technical representatives."

It appears that if Interislander had bought a new OCM when it installed this OCM it would have had the tamper resistant cover plate installed.

[3] NB – we think this may not be correct, as the shifts had the valve in different positions

[4] This was an abridged demonstration of the OCM, and was not a demonstration of the entire process

A similar piece of wire was found by [redacted] shift in July 2017 and they left a note asking who it belonged to and what did it do (for [redacted] shift). When [redacted] shift came back on-board the tool and note were both gone.

When [redacted] and [redacted] visited the vessel on 20 June 2018 the sealed cabinet was opened (with the approval of [redacted] Interislander Strategy Manager). A similar wire was found with insulation still on part of it. The insulation on the wire would NOT allow the bridging of the reed switch. It was found that the wire fit in the small screws found inside the cabinet. See Figure 3 below. These screws adjust the timing of the system.

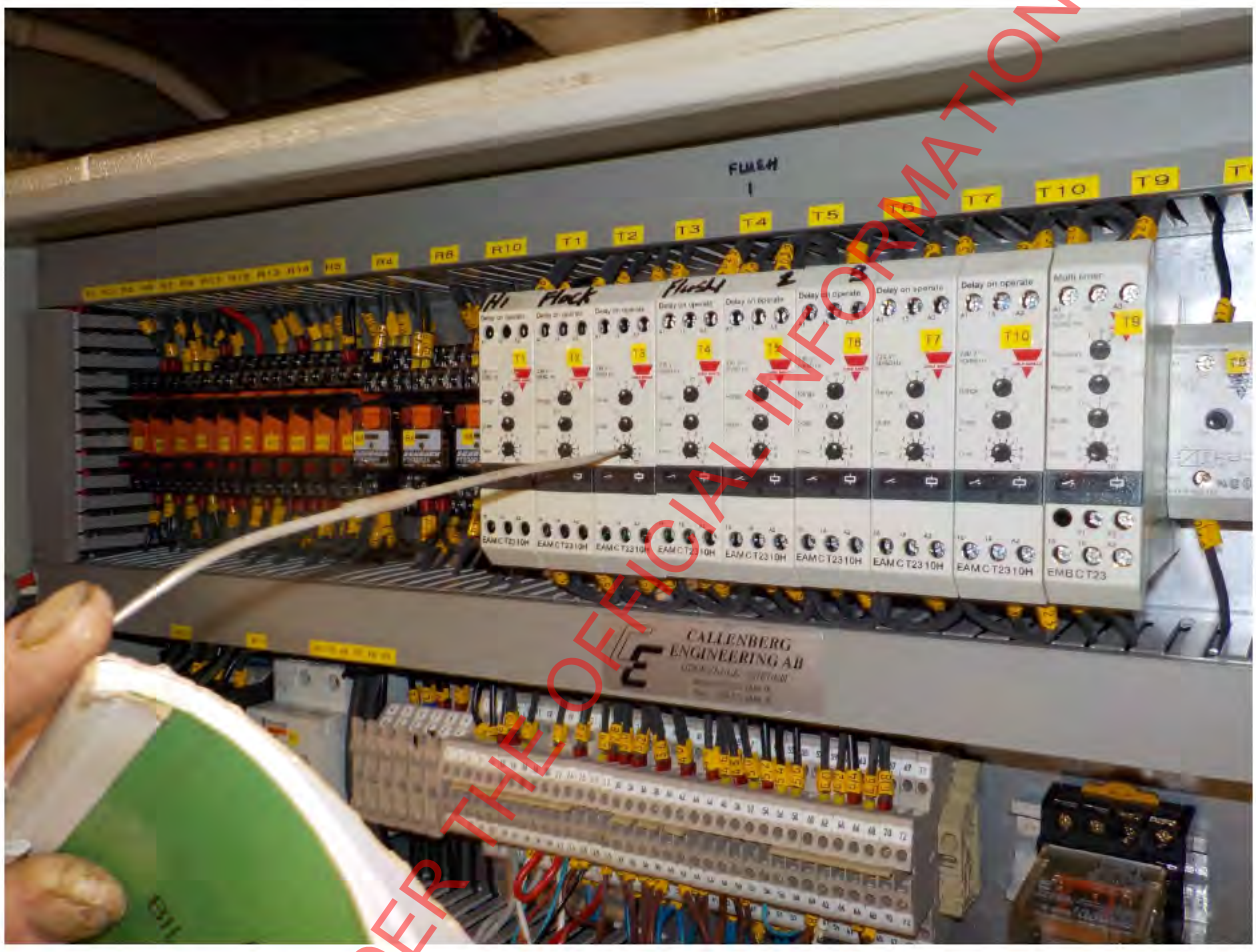


Figure 2. Wire found in the sealed cabinet being used as screw driver for changing times on relays

Also, it was brought to our attention that the OCM sample line had not been installed in accordance with the manufacturer's requirements. In the DECKMA OMD-2005 manual it states the sample point of the oily water separator should be located above the outlet of the monitor to ensure the sample cell is flooded at all times. It was determined the sample point on the Aratere is below the OCM. See Figures 3 and 4.

7.0 PIPING (Refer to Fig. 3)

Connect the OMD-2005 Monitor to the sample point of the oily-water separator outlet and to a source of oil free water employing 10 mm OD copper or stainless steel pipe. The sample point should be located on a vertical section of the separator outflow piping to minimize the effects of any entrained air. The tapping point should be at a level above the outlet of the monitor to ensure the sample cell is flooded at all times.

If connection to a vertical section of the separator outlet piping is impractical, the tapping may be made into the side of the horizontal pipe. Avoid top or bottom entry.

For separator discharge pipes up to 75 mm OD a standard "T"-type junction of the welded or screwed type is satisfactory for the tapping point. For the separator discharge pipes of 80 mm OD and above a sample probe should be employed which protrudes into the discharge piping by approx. 25 % of the ID of the pipe.

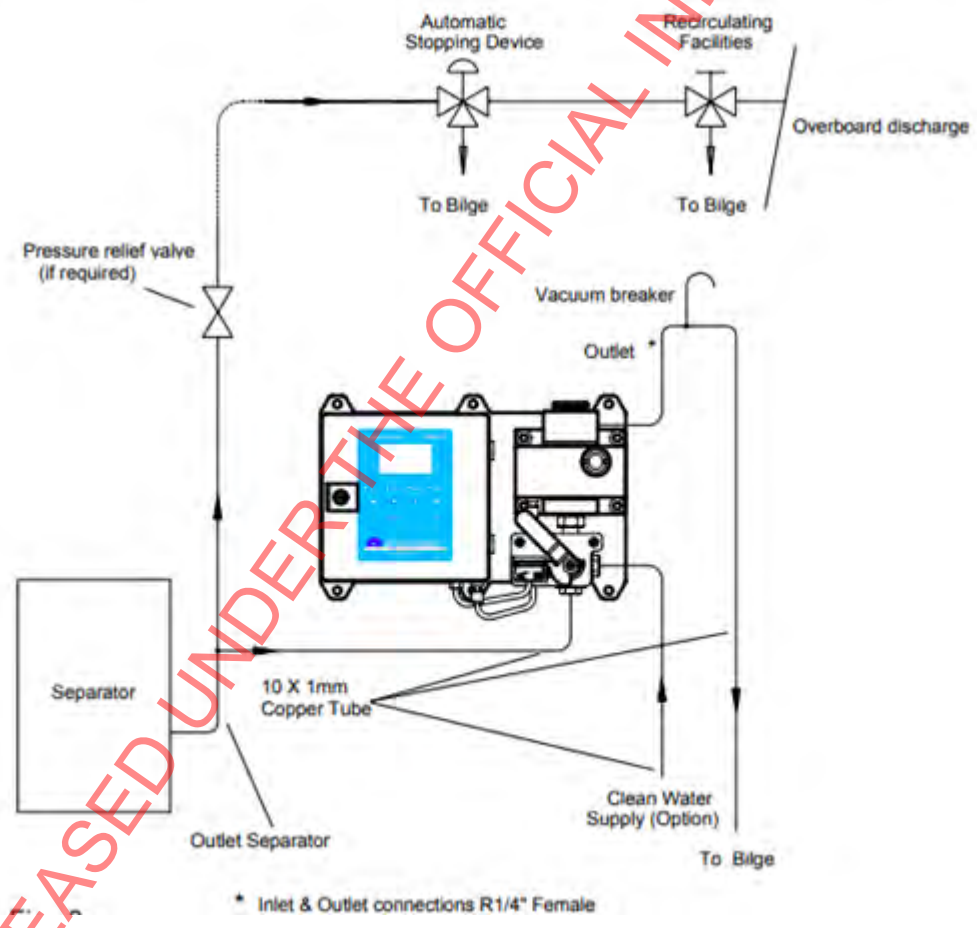


Figure 3. From the DECKMA OMD-2005 manual showing where the sample line should be installed

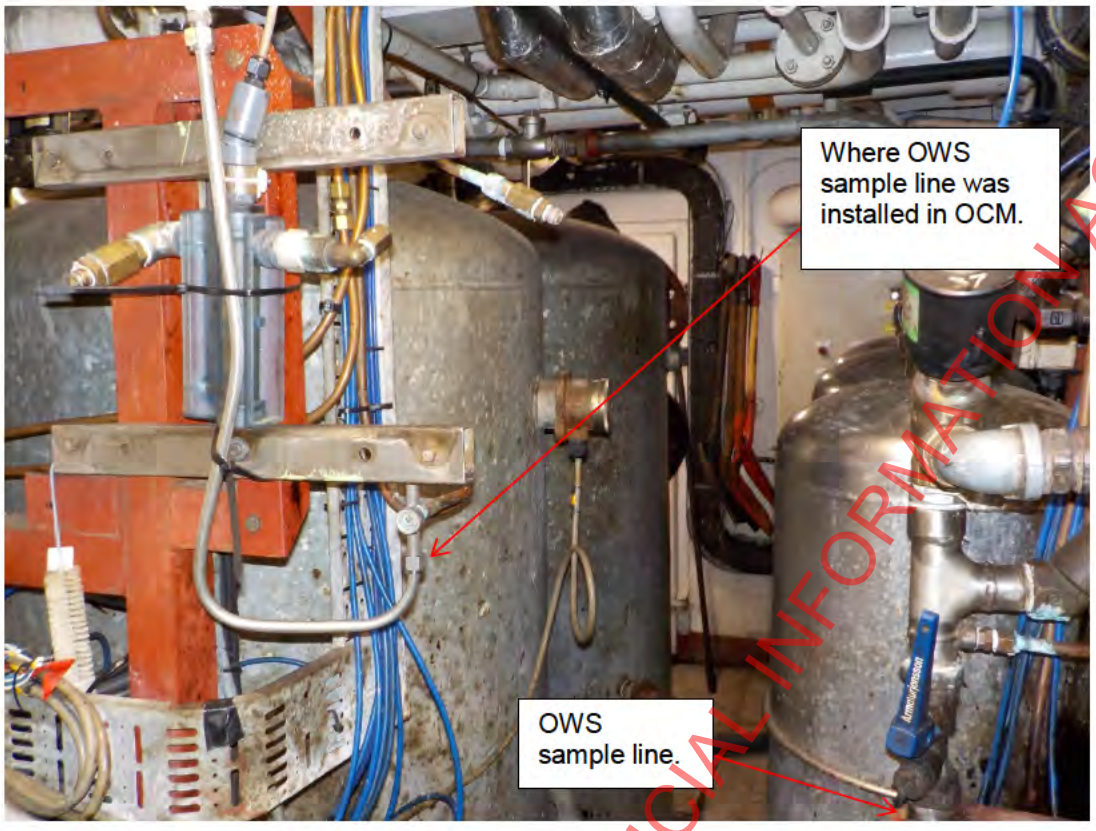
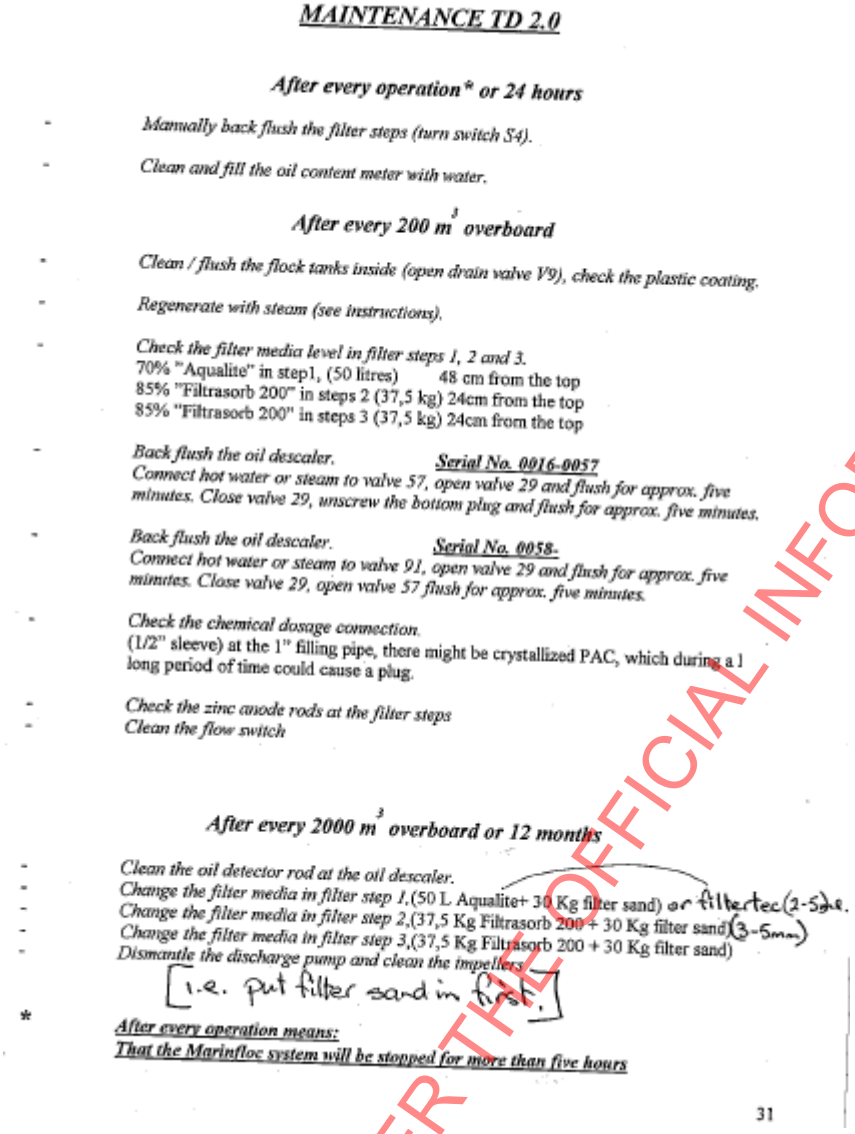


Figure 4. Showing location of where OCM was located and the OWS sample line location.

During the visit it was also determined that the engineers are not following the OWS manufacturers maintenance procedures as listed in the manual (pg 31). The vessel does not have steam so it cannot follow the referenced procedure and other maintenance procedures were not being followed. See figure 5



MAINTENANCE TD 2.0

After every operation* or 24 hours

- Manually back flush the filter steps (turn switch S4).
- Clean and fill the oil content meter with water.

After every 200 m^3 overboard

- Clean / flush the flock tanks inside (open drain valve V9), check the plastic coating.
- Regenerate with steam (see instructions).
- Check the filter media level in filter steps 1, 2 and 3.
  70% "Aqualite" in step1, (50 litres) 48 cm from the top
  85% "Filtrasorb 200" in steps 2 (37,5 kg) 24cm from the top
  85% "Filtrasorb 200" in steps 3 (37,5 kg) 24cm from the top
- Back flush the oil descaler. **Serial No. 0016-0057**
  Connect hot water or steam to valve 57, open valve 29 and flush for approx. five minutes. Close valve 29, unscrew the bottom plug and flush for approx. five minutes.
- Back flush the oil descaler. **Serial No. 0058-**
  Connect hot water or steam to valve 91, open valve 29 and flush for approx. five minutes. Close valve 29, open valve 57 flush for approx. five minutes.
- Check the chemical dosage connection.
  (1/2" sleeve) at the 1" filling pipe, there might be crystallized PAC, which during a l
  long period of time could cause a plug.
- Check the zinc anode rods at the filter steps
- Clean the flow switch

After every 2000 m^3 overboard or 12 months

- Clean the oil detector rod at the oil descaler.
- Change the filter media in filter step 1,(50 L Aqualite+ 30 Kg filter sand) or filtertec (2-5ø.
- Change the filter media in filter step 2,(37,5 Kg Filtrasorb 200 + 30 Kg filter sand) (3-5mm)
- Change the filter media in filter step 3,(37,5 Kg Filtrasorb 200 + 30 Kg filter sand)
- Dismantle the discharge pump and clean the impellers

[i.e. put filter sand in first.]

* **After every operation means:**
That the Marinfloc system will be stopped for more than five hours

31

Figure 5. Marinfloc maintenance procedures as per manufacturer

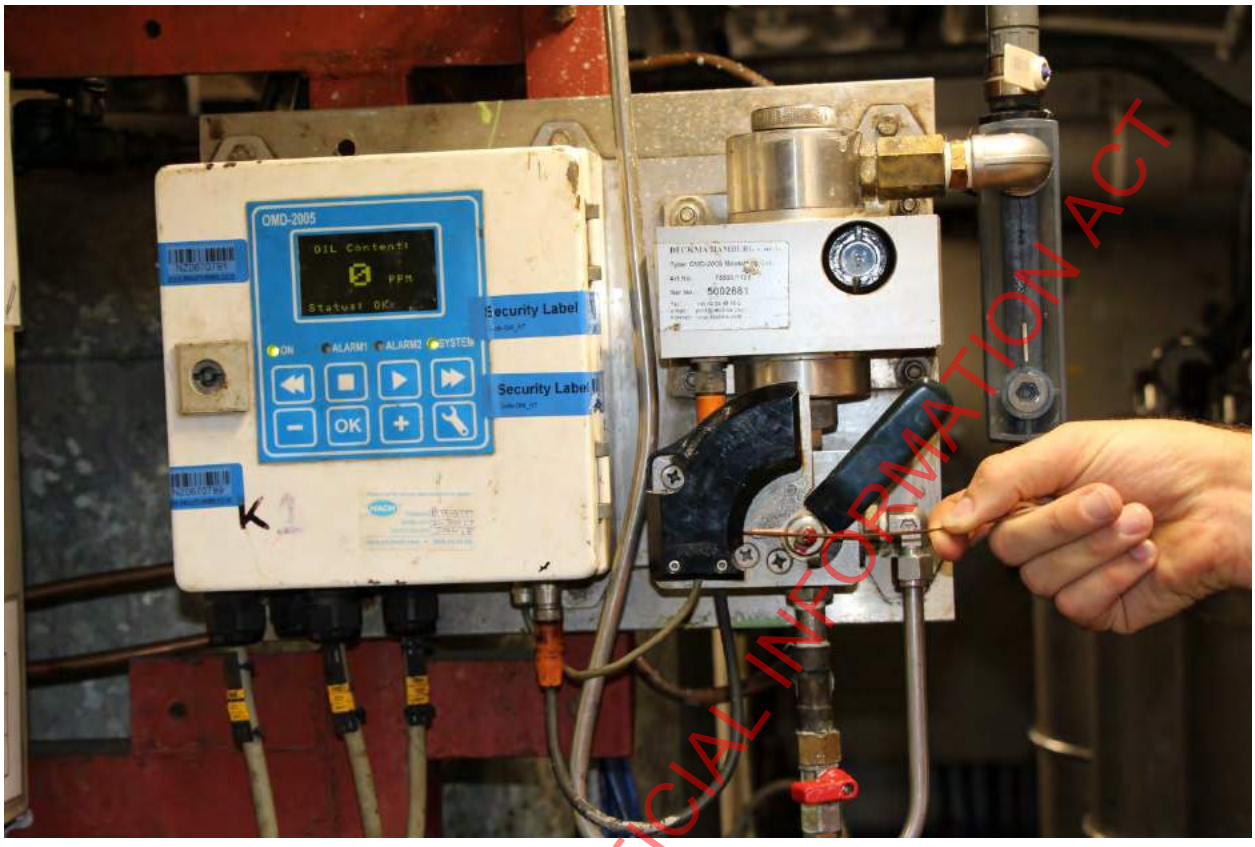


Figure 6

Showing how the bare copper wire "tricked" the system into thinking the OWS sample line is supplying the liquid to the sensor when the fresh water sampling line is actually supplying the fluid to the unit.

We met with [redacted] on several occasions to discuss what was possibly happening and why. He facilitated the visit and provided contact details for three crew members – [redacted]

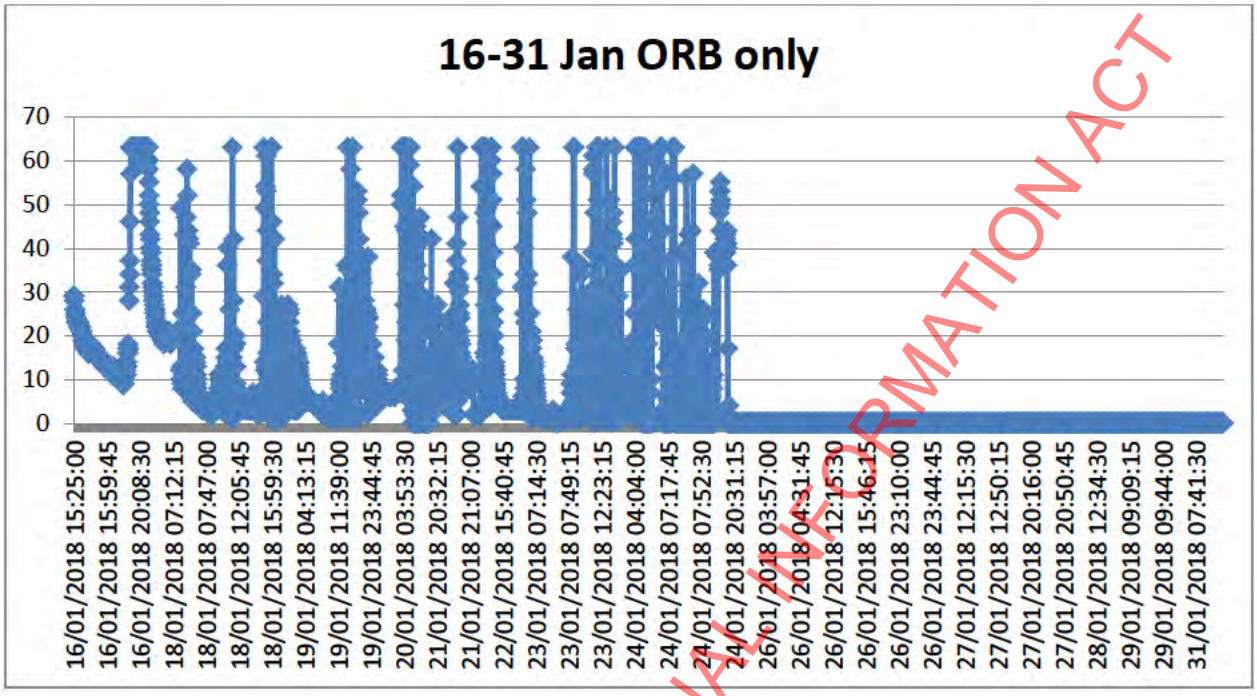
Results of the Deckma analysis of the unit and SD card (conducted in Hamburg, Germany) was obtained and analysed. This was compared to the oil record book to see who was discharging from the ship when the unit was reading 0 ppm. The results showed that there was a variety of readings that ranged from 0-63 ppm. The amount of 63 ppm readings was very high and suggested that when the readings were high over most of the operation it suggested the actual amount of fluid sent overboard was questionable since when it exceeded 15 ppm the fluid was sent back to the tank. There were also a lot of 0 ppm readings in the months identified as being under suspicion. The data was difficult to analyse and was converted into an excel document. This was then compared to entries in the ORB and charts made.

Several people were identified from this analysis. The people who operated the OCM with a high number of 0 ppm readings were identified as [redacted] shift). These people also all had fluctuating entries.

Those with predominantly fluctuating ppm readings included [redacted] shift).

However, there were several occasions when [redacted] shift crew also had 0 ppm readings during apparent discharges.

Both shifts had fluctuations, and both had 0 ppm readings, but [redacted]' shift had more 0 ppm readings than [redacted] shift.



[redacted] was asked to provide contact details for all those personnel.

An interview was conducted with Interisland [redacted] stated that he had never manipulated the OCM and he did not have any reason to. If the system alarms higher than 15 ppm the water returns to the tanks and the process repeats itself until it is below the desired level. He said that does not add to [redacted] and there was no pressure from above to get the discharges done.

[redacted] stated that he operated the system with the manual water supply valve (Figure 7 below) turned on and it appears [redacted]' shift did not do this. If the OCM had a leak at the 3/2 valve this would mean that the [redacted] shift would unintentionally be diluting the OCM sample which could make the reading be zero. However, [redacted] showed the wiring diagram for the OWS system. If this is still how the system is wired, once the bilge pump for the OWS is started the fresh water solenoid is closed (this is a small valve right before the OCM (not the valve pictured below in Figure 7). Therefore, even with the manual fresh water valve open it would require changing the wiring or the failure of the solenoid AND a leak on the 3/2 valve inside the OCM.

Figure 7 The fresh water supply valve which feeds the fresh water flushing system on the OCM.

According to [redacted], [redacted] asked Interislander to have a third party electrician come on board and determine if the wiring diagram in the OWS manual is the same as what is currently installed in the system. [redacted] Interislander has not done such an audit.

[redacted] was spoken to via phone. He said he initially thought the 3/2 way valve was broken as it was allowing water to push in when under pressure. He was surprised when Deckma said they tested it and it seemed to be functioning correctly. He said he did not think the crew of Aratere had deliberately manipulated the OCM, but rather it was a fault with the unit. [redacted] asked if I had been shown the emails from Deckma [redacted] and I said that I had not.

These emails were requested from [redacted] (not provided).

[redacted] was spoken to via phone. [redacted]

He said he does not know why anyone would deliberately manipulate the OCM as there was nothing to gain from doing that. [redacted] comments that there is no pressure from Interislander to discharge at sea and if they needed to tank the water off by truck that was fine to do. He said the system is generally very good and he only experienced problems with it when the company changed to non-approved cleaning chemicals that didn't work as well with decanting the oil. Once they reverted to approved chemicals the system functioned well and he regularly had 0-1 ppm readings for entire discharges. He said as the water was sent back through, when it came back to the OCM it was often 0 ppm. He said he was the one who usually operated the OWS when he was on the vessel. [redacted]

[redacted] was interviewed.

[redacted] supported most of the points made by the other two engineers. He repeated that there was no pressure to do the wrong thing. If a tanker truck was needed for bilge water there was never any push back from the company. He did state that if the OCM 15 ppm alarm sounded the fluid from the OWS would be sent automatically to the sludge tank. It would not automatically reset the valves if the OCM reading dropped below 15 ppm. He stated that he would always have the fresh water valve opened when he operated the OWS. He stated that when [redacted] was on board he was the one who usually operated the OWS. [redacted]

He stated that the Advent system (computer system in the Engine Control Room – ECR) is always recording the tank levels every 5 seconds in the engine room including the bilge and sludge tanks. It was determined the sounding of these two tanks is not that accurate. There is no actual sounding pipe in the Sludge and Oily Bilge tank. There is an electronic sensing unit. Only the Clean bilge tank has a sounding pipe. They would like to recalibrate the two tanks using a water tanker but it has not been done.

From the interview it appeared that before the DECKMA OMD-2005 was installed the OWS was more automated. If the OCM went above 15 ppm it would send it back to the tank. Once the OCM went below 15 ppm it would automatically send the discharge overboard. It is not entirely clear, but it appears that when the new OCM was installed once the OCM exceeded 15 ppm it would send it to the tank and continue doing this until a crewmember stopped the system. We were later told this was not the case. The new OCM did not change how the OWS operated.

Also, [redacted] stated he would stand by the tundish[6] with his hand on the button to operate the sludge pump. This was used to transfer water from the sludge tank to the bilge tank. Once oil was detected in the tundish the button would be released and the pump would stop. There were comments made by [redacted] that some engineers were getting headaches from the fumes at the tundish. A blower was installed above the tundish to alleviate this. Before the modification of the system an engineer would sit in a chair and make sure no oil entered the bilge tank. The new arrangement required engineers to stand and look down at the tundish while holding the button. This could go on for long as an hour. He said he had no problem doing it but he heard some people would install a device to keep the button

[5] [redacted]

[6] A tundish is a large open funnel

pressed. This is very important since this operation minimises the oil going from the sludge tank to the bilge tank.

[redacted] interviewed as part of this investigation. He stated that:

- The water supply valve may have contributed to the 0 ppm readings
- The 3/2 valve was leaking
- The Deckma OMD-2005 OCM had been incorrectly installed
- The OCM installed on Aratere had been on the Kaitaki and there were rumours of it being faulty while on there, and possibly being manipulated
- [redacted]
- He quoted a Deckma email that said: "We have no clear evidence of manipulation", and "the gasket from the valve was mounted in a slightly wrong way. This could cause a leaking valve"[7].
- Having the water supply line charged (by opening the valve) could cause the leaking 3/2 valve to allow water to dilute the sample and therefore affect the ppm reading by lowering it
- The system works very well when operated correctly, and can operate at 0 ppm as demonstrated on YouTube videos.

Evidence

The Deckma OMD-2005 OCM appears to be very easy to trick (on systems without a solenoid to prevent this). Inserting a thin wire with a flattened end into the gap next to the 3/2 way valve handle is one way, and there is anecdotal evidence to suggest that magnets will also trick the system. However, the fresh water solenoid on this system appears to prevent this from having any effect. The solenoid remained from a previous OCM/OWS arrangement, and in this particular setup prevents tampering of this nature.

There appears to be no apparent benefit to tampering with the OCM. If the system alarms and sends the water back through to the sludge tank to go through the process again there is no added burden on the engineer. If there is a build-up then the excess is taken off by truck. [redacted] were all asked if Interislander place any pressure on the engineers to prevent the need for trucks taking the oily water away and they all said there was not.

The only realistic motive to trick the system that was identified is the process of moving water from the sludge tank to the bilge tank. It is demanding on both time and effort as the engineer is required to stand with his finger holding the button down the whole time while looking down into a tundish to check on the colour of water passing through. The average discharge takes around 50 minutes to complete and the button is just about shoulder height. There would be some benefit for an engineer who didn't want to do all of that to simply allow the water to go straight back to the sludge tank and not have to do the discharge at all. If they did not keep an eye on this transfer it would send oily water to the bilge tank. This could make the filters clog up and eventually make the OCM alarm more frequently. If the filters were getting clogged or the OCM kept alarming it is possible an engineer might be motivated to trick the system. . One way to trick the system would be to use the fresh water flushing line instead of the sample line to the OCM. This would then result in 0 ppm readings. This is all circumstantial

[7] [redacted]

If sludge water was not sent to the bilge water tank there would be very little need to do this process in the first place. Many systems on ships use heating to evaporate the water out of the sludge tank. This could then be sent ashore via the tanker truck which has been done for some time. To keep the process more simple, the sludge water would not be sent to the bilge tank and it would be evaporated with the residual pumped to a tanker as has been done in the past (but after a lot of the water has been removed by draining to the bilge tank).

The evidence that the OCM was deliberately manipulated is circumstantial and very difficult to prove.

It is very difficult to see when the OCM was operating and the system discharging. Even then, matching 0 ppm readings with a discharge does not prove that the system was being tricked, or if the flocculation was doing what it was supposed to and dropping the oil content right down (possibly in conjunction with fresh water leaking into the system therefore diluting the sample passing through the OCM).

The only information that can be gathered is by using the oil record book to compare discharges and who conducted them to readings from the OCM that read 0 ppm when a variation of readings of 0-15 ppm could be expected. All that shows is that some people operated the system and the OCM read 0 ppm, while others operated it and it read differently. That does not mean that it was manipulated, and it is unlikely MNZ could prove it was manipulated on the balance of probabilities let alone beyond reasonable doubt. It is quite possible that correct engineering practices and proper decanting of water from the system would cause the system to operate well with nothing above 0 ppm.

When [redacted] (Antelope – NZ service agent for Deckma) looked at the system on board he is heard on the video to say 'that valve's buggered'. His thoughts at the time were that water was pushing up past the valve, which it should not have done (Figure 8).

Figure 8

[redacted] the wiring diagram for the OWS system shows that if the supply pump for the OWS is turned on the fresh water solenoid to the OCM will automatically close, stopping fresh water

supply to the OC. Therefore, even if the manual valve is open and the OCm 3/2 valve was leaking trhe automated solenoid valve would be closed not allowing fresh water to go to the OCM Deckma pressure tested the system (to 10psi) in Germany and have stated that the valve is operating correctly[8]. However, on the video (which does not have the bilge pump running, and therefore the fresh water solenoid valve is open and supplying water to the OCM) water can clearly be seen to be pushing up over the top of the head screw (when removed) in Figure 3[9]. [redacted] that meniscus[10] should not form in this situation unless the valve was leaking. This would potentially result in a diluted reading. In theory this could take it from the expected 0-15 ppm and reduce it to 0 while the water is entering in that manner. As mentioned before if one crew made sure water was not going to the OCM via the manual valve then it would not be diluted and the readings would probably be higher. If the other crew opened the fresh water valve and it the OCM fresh water 3 way valve was leaking it might explain why these readings are closer to zero. However, the closed fresh water solenoid would make this situation impossible.

[redacted] he does not believe anyone deliberately manipulated the OCM.

There are no witnesses to any manipulation and there is not any hard evidence.

The scratches inside the 3/2 way valve handle could have been made by the movement of the handle or something else. The demonstration of inserting a rod into the gap done by [redacted] shift crew could also be the source of the scratches (or at least that argument could be made). [redacted] states that if it had been old damage it would be grimy like the rest of the engine room. That is possible, but it was also in a covered place where grime would not necessarily reach so that is not definitive. It may have been there since it was on Kaitaki. There is no way of knowing.

Conclusions

The OCM shows some interesting and suspicious patterns in ppm when comparing the two shifts. [redacted] detailed report allows him to draw conclusions that the only reason for the differences between shifts was that someone on [redacted] shift was deliberately 'tricking' the OCM in some manner.

Our investigation has shown that there are potential reasons other than deliberate tricking that can explain the differences between shifts.

To determine if there was deliberate tricking we need to rule out any other possible reasons. Several key points raise doubt to that hypothesis. The following points are *likely*:

1. The OCM had been incorrectly installed.
2. The 3/2 valve certainly showed signs that it was leaking, and Deckma apparently confirmed that a gasket inside this had not been fitted correctly. If Deckma then fitted the gasket correctly and tested the valve it follows that it would work as it should. Deckma would be interested to see if their unit was faulty, and keen to demonstrate that it was not. This information (the incorrectly fitted gasket) was omitted from [redacted] report, and it was omitted from his communications to MNZ.
3. The water supply valve was operated in the open position by some persons on [redacted] shift and supposedly in the closed position by most persons on [redacted] shift.
4. That in conjunction with a possibly leaking valve, meant the charged line could push fresh water past the sensors therefore diluting the sample and giving a lower reading. However, if the wiring is still the same as the OWS manual the fresh water solenoid would still not allow the water to pass into the OCM. Without having a third party electrical review it is not clear if there is an issue or not.

[8] [redacted] MNZ have not seen that information from Deckma

[9] Deckma have stated that this was incorrectly fitted

[10] The term used by [redacted] disputes this term, as the water was running up and out, so therefore ***not*** a meniscus.

5. The suspicious looking rod could have actually been used to turn the timing screws inside the cabinet to alter timings as needed.

6. The fresh water solenoid fitted for use for the previous OCM (but which remained in this system set-up) prevented the tricking of the system as described if the wiring on the vessel corresponds with the wiring diagram from the OWS manual according to [redacted]

This investigation suggests there are three potential scenarios which explain the differences in the OCM ppm readings from 24 – 31 January 2018. They are:

1. Deliberate tampering of the OCM (by bridging the circuit inside the 3/2 valve reed switch)

- If so, it is not possible to prove this to any evidential standard. There appears little or no motive. Both Deckma and Antelope have stated they see no evidence of deliberate manipulation in this case. While it is possible that this has occurred, it cannot be proven and would not stand up to legal scrutiny. The evidence to support this hypothesis is circumstantial and not convincing. This is considered to be the least likely scenario.

2. Better oil separation procedures before the oil reaches the OWS discharge

- If so, the two shifts should work together to improve practices overall. This is possible but could work in conjunction with point number 3.

3. The fresh water flushing line is leaking inside the OCM and one shift had fresh water charged to this device and the other shift did not AND the fresh water solenoid was not working properly. Additionally the OCM had been incorrectly mounted.

- If so, it is recommended that the valve be closed during operations. Before a new OCM is installed this should be tested to ensure there are no leaks. This is the most likely scenario on the face of it, but probably in conjunction with point 2. The OCM should also be mounted according to manufacturer's specifications.

Recommendation

Due to the lack of evidence we recommend no further compliance action be taken in this matter. For this reason there is nothing to place against the compliance operating model and no charges to consider.

We do recommend a circular be sent out to all NZ operators with OWS on-board, alerting them to the poor practice of combining bilge and sludge water. Also, it is recommended a Concentrated Inspection Campaign occur with Maritime Officers to visit vessels with OWS on-board and review their practices, condition of equipment, ensure the equipment is properly listed on the IOPP and installed properly. This would include comparing operations from the Oil Record Book to the OCM memory (if installed).

If Interislander decides to start using their OWS on their fleet of vessels it is recommended either MNZ or a third party auditor determine if the systems have been installed and maintained properly before they begin operation. This audit should also determine if there has been OWS/OCM specific training for the system and a test of the system. A third party electrical audit of the system should also be conducted on this system.

The bilge and sludge tanks on the Aratere should have correct sounding calculations so the soundings are correct.

[redacted]
Specialist Investigator

[redacted]
Maritime Officer

Appendix 1

The current OCM on board the Aratere is a Deckma OMD-2005, which was installed in January 2017. It operates and is certified in accordance with Resolution MEPC.107(49). Prior to this the separating and filtering equipment as well as the OCM was approved in accordance with Resolution MEPC.60(33)

The International Oil Pollution Prevention Certificate (IOPP) has not been updated to reflect this change.

On an IOPP Certificate it lists many important pieces of information in the Form A or B. One of these is which standard the Oil Content Meter has been certified to and which standard the Oily Water Separator has been certified to. It also lists sludge and bilge tanks and certifies they comply with MARPOL. All transfers to and from these tanks must be entered in the Oil Record Book (ORB). Over the course of this investigation it was determined one of the sludge tanks on the vessel was not listed on the IOPP.

The IOPP which was issued on 08.09.2014 (based on a survey on 29.09.2013) and has had annual surveys (last one dated 04.09.2017). On the FORM A it states that both the OCM and OWS are certified to MEPC 60(33) and NOT MEPC 107(49) (only the OCM is now MEPC 107).

An **oily water separator** (**OWS**) (marine) is a piece of equipment specific to the shipping or marine industry. It is used to separate oil and water mixtures into their separate components. They are found on board ships where they are used to separate oil from oily waste water such as bilge water before the waste water is discharged into the environment. These discharges of waste water must comply with the requirements laid out in MARPOL 73/78 Annex I/14.

Bilge water is a near-unavoidable product of shipboard operations. Oil leaks from running machinery such as diesel generators, air compressors, and the main propulsion engine. Modern OWSs have alarms and automatic closure devices which are activated when the oil storage content of the waste water exceeds a certain limit, which is 15 ppm (with some variation related to smaller vessels). The device which scans the discharge before it goes overboard is called the Oil Content Meter (OCM). If the discharge exceeds 15 ppm it will usually (depending on the GT of the vessel) either shut off a pump (allowed under the old MEPC) or activate a three way valve and send it back to the sludge tank (required under MEPC 107(49)).

The bilge area is the lowest area on a ship. The bilge water that collects here include drain water or leftover water from the boilers, water collecting tanks, drinking water and other places where water cannot overflow. However, bilge water doesn't just include water drainage. Another system that drains into the Bilge system comes from the propulsion area of the ship. Here fuels, lubricants, hydraulic fluid, antifreeze, solvents, and cleaning chemicals drain into the engine room bilges in small quantities. The OWS is intended to remove a large proportion of these contaminants before discharge to the environment (overboard to the sea).

Sludge

Before fuel is sent into a vessel's engine it usually goes through a purifier. Most purifiers spin at high rates of speed which causes the impurities to fall out of the fuel. The standard calculation for large vessels which use Heavy Fuel Oil (HFO) is 1% of fuel consumed becomes sludge. The Aratere uses about 42 to 48 m3 (or 42,000 to 48,000 l) of fuel a day. Therefore using this calculation it generates about 420-480 l of sludge a day. The engineers said the vessel can generate up to 1000 l of sludge a day. The purifiers discharge directly to the sludge tank, which on this vessel is called the Sludge tank or T24L.

It is standard practice to keep the sludge and bilge separate. Sludge has numerous impurities such as grit, oil and water in it. Bilge water should be mostly water with usually few other contaminants. Therefore, it does not make sense to contaminate the bilge water with sludge.

OCM

The OCM continuously monitors how much oil is in the water that is pumped out the discharge line of the OWS system. The OCM will not allow the oil concentration of the exiting water to be above the

MARPOL standard of 15 ppm. This standard was first adopted in 1977 with Resolution A.393(X) which was published by the International Maritime Organisation (IMO). These standards were updated again by Resolution MEPC.60(33) with the most current resolution being MEPC 107(49). The oil content meter will sound an alarm if it is still above that standard (which is 15 ppm), then the system will ensure discharge does not go out to the ocean. The OCM uses light beams to determine how oily the water in the system is. The system will then gauge the oil concentration based on a light intensity meter. MEPC 107 approved **oil content meters** have a data logging system that can store oil concentration measurements and operations (such as fresh water flushing and closing the overboard valve) for more than 18 months.

If the OCM determines that there is far too much of a type of oil, the OCM may be fouled and needs to be flushed out. Running clean water through the OCM sensor cell is one way it can be cleaned. Also scrubbing the sensor area with a bottle brush is another effective method. The new MEPC 107(49) standards have set out stringent actions that require the OCM to be tamper proof and also the OCM needs to have an alarm that sounds whenever the OCM is being flushed with water. When the alarm goes off, the OCM it will ensure the discharge does not go over the side of the vessel.

An OCM is a small part of what is called the oil discharge monitoring and control system. The first part is the oil content meter. The second is a flow meter which measures the flow rate of the water at the discharge pipe. Third, is a computing unit which calculates how much oil has actually been discharged along with the day and time of the discharge.[5] And lastly is the overboard valve control system which is essentially just a valve that can stop the discharge from flowing out at the appropriate time.[5]

The OCM continuously monitors how much oil is in the water that is pumped out the discharge line of the OWS system. The OCM will not allow the oil concentration of the exiting water to be above the MARPOL standard of 15 ppm.

MEPC 60 had less stringent requirements and were allowed to be installed from 30 April 1994 to 31 December 2004. These systems could have the fresh water flushing line turned on to the OCM and it would still allow the system to operate. This was the easiest way to trick the system. This system also did NOT require in port test arrangements. When the 15 ppm threshold was exceeded either the bilge pump would stop or a three way valve would be activated to send the discharge back to the sludge tank. This old standard only was tested to a limited amount of materials. It also did NOT have a recording device.

MEPC 107 is more stringent and designed to reduce the ways in which the system can be tricked. All systems installed after 01 January 2005 must comply with this standard. This includes requiring the OCM to be sealed, having a recording device which stores the data for 18 months and requiring a three way valve and a way to test the system when the vessel is in port. Also, if fresh water is sent to the OCM it is required to alarm and send the discharge back to the sludge tank. This new standard is tested to a wider range of materials which can be found in a bilge system.
It also requires:
"Training 1.1.5 Ship staff training should include familiarization in the operation and maintenance of the equipment. Maintenance 1.1.6 The routine maintenance of the 15 ppm Bilge Separator and the 15 ppm Bilge Alarm system should be clearly defined by the manufacturer in the associated Operating and Maintenance Manuals. All routine and repair maintenance to be recorded."

DESIGN OF OWS
The vast majority of these many equipment models, manufacturers, and types start with some sort of gravity separation of bilge water. Simply letting oil and water sit is called decanting, and this does not always meet the 15 ppm criterion, which is why each manufacturer has added additional features to the equipment to ensure that this criterion can be met. The separation that takes place inside the OWS allows oil that floats to the top to be automatically skimmed off to a sludge tank or dirty oil holding tank.
There are many types of OWS on the market. The Aratere has a Marinfloc TD 2.0 and it is rated for 2.5 m3 per hour. According to the engineers this was installed around 2001. This system uses a flocculent to encourage the oil and water to separate before it is sent to the filters. This chemical encourages the oil to clump together forming a larger amount of oil.