The Standard

STANDARD SAFETY

SETTING THE STANDARD FOR SERVICE AND SECURITY

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In this *Standard Safety*, we look at the issue of the ISM Code and the introduction of a number of key revisions introduced by IMO that was effective from July 2010. As a club that actively carries out condition surveys and Member Risk Reviews, we acknowledge that these amendments are welcome; how well they are implemented and how effective they will be is an open question and depends very much on how well Flag or Class conduct their audits. We are grateful for Dr Phil Anderson from Consult ISM in giving an overview on the ISM Code changes.

We record in brief the outcome of the condition surveys carried out by the loss prevention department during the past 12 months.

We review also the requirements introduced at the beginning of 2010 relating to low sulphur fuel in ships' operation. Also, as a result of finding that a small but significant number of members do not carry out fuel oil analysis, we highlight the benefits of carrying out rigorous bunker fuel oil analysis. Although it may be considered a hull insurance matter, the operational and safety implications of fuel oil analysis cannot be underestimated. The impact on the safety of the ship is clearly apparent.

We also highlight an issue arising from an unfortunate incident which occurred during routine repairs that required welding in a container ship hold. A container near to where the welding was taking place contained scrap aluminium and, through a chemical reaction, produced hydrogen, which is highly flammable. An explosion occurred, resulting in an accident. Operators of container ships should take note.

We bring to members' attention the issue of tank entry. It is clear from our surveys that the safety issues surrounding enclosed space entry are still not fully understood by a significant number of personnel, particularly on dry cargo/bulk and container ships.

Also, we highlight the fact that during a small but significant number of surveys, we have come across evidence that the senior officers do not know how to operate the fixed CO_2 and other fire extinguishing systems.

INTERNATIONAL SAFETY MANAGEMENT (ISM) CODE

The shipping industry has come a long way since the introduction of the ISM Code initially applied to tankers and passenger ships in July 1998 and other ships in July 2002.

Twelve years after ISM became mandatory, the International Maritime Organization (IMO) has issued the first revision of the Code and its amendments came into force on 1 July 2010. All companies should be aware of these revisions and be taking steps to ensure their compliance. There are some amendments explicitly requiring companies to carry out certain safety management functions. The changes include:

- there is a slight change in the definition of a major non-conformity
- companies must fully asses all identified risks and show how these risks have been identified
- companies must ensure that safety and environmental policies are established to achieve the ISM Code objectives as described in para 1.2 of the Code
- masters must periodically review their Safety Management System (SMS) and report deficiencies to shore-based management
- measures are implemented to prevent accidents from recurring (learning from mistakes)
- ship and shore internal audits are carried out every 12 months
- the company should periodically evaluate the effectiveness of the SMS

Some jurisdictions have already stated that this means a complete review of the SMS ashore and on ship at least once a year.

Nothing in the above should affect a mature and well-operating SMS. However, there is an emphasis on the system now being effective.

The Safety and Loss Department, through its condition surveys and Member Risk Reviews, has recorded that there are aspects of ISM systems that are not being effectively implemented.

We have seen a significant number of:

- internal audits that are ineffective
- master's reviews that are ineffective
- SMSs with no coherent system to ensure that lessons are being learnt from mistakes that have been made, i.e. recording near misses, accidents, analysis of accidents and sending out fleet notices/alerts or equivalent to prevent accidents from recurring
- SMSs that do not have any risk assessments

All of the above are now far more clearly stated as being required. Companies should ensure that their safety management review includes a review of the changes made in the revised ISM Code.

The use of wording such as 'effectiveness' should galvanise members into making sure their systems are effective. The ineffectiveness of SMSs has been in part due to the poor understanding and training given to the ship's staff, and ineffective implementation and auditing by the Flag States and Class. That is a generalisation of course, but why else would the oil and gas industry have implemented the Tanker Management Self Assessment (TMSA).

The Standard Club is in the enviable position of having the experience of surveying ships and also seeing the SMSs of owners. From what we see, the majority of SMSs are in a good shape, but there are still a significant number that have gaps, in particular when considering the effectiveness of the system.

The club surveyors are aware of the differences in SMS requirements seen on different ships and trades; however, we are striving to see that the best practices are passed on and that the ISM system onboard is effective. The number of claims of all varieties is a continual testament to the fact that ISM systems are not being implemented as effectively as they should be.

Companies should review their ISM SMS to see whether their audits and master's reviews are effective. This should be a priority set by the chief executive – failure to do so could lead to a major casualty or result in a major ISM non-conformance.

"From what we see, the majority of SMSs are in a good shape, but there are still a significant number that have gaps, in particular when considering the effectiveness of the system."

RISK ASSESSMENT AND THE NEW AMENDMENTS TO THE ISM CODE

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1. INTRODUCTION

In my opinion, the ISM Code always did represent an example of a risk-based approach to managing safety – it just never said so! It was implied but left to interpretation by each ship operator.

At the 85th session of the IMO Maritime Safety Committee (MSC), an agreement was reached to promulgate a number of amendments to the ISM Code – including an important clarification with regard to the relevance of risk assessment to the Code. Resolution MSC.273(85) introduced these amendments on 1 July 2010.

In this article, I will endeavour to explain what I think the amendment with regard to risk assessment will actually mean in practice and what steps, if any, a ship operator will need to take in order to ensure its SMS remains compliant with the requirements of the Code.

2. WHAT CHANGES WILL TAKE PLACE?

The core objectives of the ISM Code are set out in Section 1.2 of the Code. This is a very important part of the Code and contains not only the basic philosophy behind the Code but also the goals that must be aimed for, if not achieved, through the SMS.

Within the safety management objectives of the Code, there has always been an implied reference to risk assessment. The IMO has traditionally shied away from making the assessment of risk an actual requirement. In the original version of Section 1.2.2.2 of the Code, the requirement of the company with regard to the safety management objectives included the need to:

- establish safeguards against all identified risks

The use of the word 'risk' here was, in my opinion, incorrect – the word that should have been used was 'hazard'. It has always been a mystery to me why this irregularity was never rectified before now.

It was never entirely clear what exactly was intended by this extremely wide-ranging requirement. It resembled the second part of a classic four-part risk management formula:

- identification of the hazards
- assessment of the risks associated with those hazards
- application of controls to reduce the risks that are deemed intolerable
- monitoring of the effectiveness of the controls

After more than a decade since the phase one implementation deadline, the IMO decided to make an important amendment to Section 1.2.2.2. From 1 July 2010, IMO Resolution MSC.273(85) will introduce a number of amendments to the ISM Code, including a major change to Section 1.2.2.2. The revised Section 1.2.2.2 will now require the safety management objectives of the company to:

- assess all risks to its ships, personnel and the environment, and establish appropriate safeguards

Whilst this amendment still falls short of the full four-part Risk Management formula, it does come very close. My interpretation of this requirement is that a ship operator will now have to carry out a risk assessment on its operational activities and produce an SMS that is based upon the findings of that risk assessment. More so, the company will have to produce objective evidence to demonstrate that it has indeed carried out the risk assessment.

3. WHY ARE THE CHANGES BEING MADE?

The new amendments will considerably strengthen the foundations of the ISM Code by establishing a more coherent basis for the Standard Operating Procedures of a company. It will provide an opportunity to encourage companies to adopt more informed and more responsible approaches to operational risk assessment.

4. WHAT DOES A COMPANY NEED TO DO?

For many companies, the additional requirement should not pose a major problem – particularly where the company has developed its own SMS as was originally intended by the ISM Code. A company that bought a ready-made 'off-the-shelf' SMS from a so-called ISM consultant may encounter more of a problem.

What is important to understand is that the IMO has not prescribed any particular method of risk assessment that must be used across the industry. There are many models available – although most would be based on a risk management formula similar to that set out in Chapter 2 of this article. My advice is to always follow the 'KISS' (keep it simple sailor) principle and do not allow yourself to be baffled by science – there are some very complicated risk management models out there!

Most companies, whether they realised it at the time or not, would have carried out the sort of risk assessment that is now expected – when preparing their safety management manuals. What they probably did not do was actually approach it in a systematic way or write down what they were doing.

RISK ASSESSMENT AND THE NEW AMENDMENTS TO THE ISM CODE CONT.

To explain what will be required, it may be useful to use an example. Section 7 of the Code requires the company to establish procedures, plans and instructions for key shipboard operations. One such key shipboard operation that would be common to all ships would be navigational aspects and bridge management. There are a number of hazards that could be identified, e.g. other ships, weather conditions, navigational obstructions, etc. Having identified the hazards, it will then be necessary to assess the potential consequences. A common approach to this exercise is to create a 'risk matrix' – from which a 'risk factor' can be calculated. Depending upon the level of risk factor, controls can be introduced to reduce the risk to 'as low as reasonably practicable' (ALARP). As far as navigation and bridge management are concerned, this probably starts by ensuring that properly qualified and experienced people are appointed in the first place; that appropriate training is provided in, for example, Bridge Team Management or Crew Resource Management techniques; that the requirements of the relevant sections of the STCW Convention and Code are met; that berth-to-berth passage plans are produced; and that checklists are produced for pre-arrival and pre-departure checks for bridge equipment, steering gear, propulsion equipment, etc. By way of example, such a risk assessment could resemble Diagram 1 shown opposite (although it is important to realise that Diagram 1 is only for illustration purposes and does not attempt to set out a full risk assessment).

5. WHEN DOES A COMPANY NEED TO DO IT?

The simple answer is now; the amendments came into effect on 1 July 2010. A company can expect the External Auditor from the Flag State Administration, or a Recognised Organisation acting on its behalf, to look for evidence that such risk assessments have been carried out.

6. WHAT ARE THE IMPLICATIONS AND CONSEQUENCES?

Properly developed and implemented, a systematic approach to risk assessment can provide a company with a very valuable tool to help it manage safety as well as manage the company itself.

An External Auditor, on behalf of the Flag State Administration/ Recognised Organisation, establishes that a company has not developed documented procedures for risk assessment and the company could not provide evidence to show that it had, at least, begun the process of assessing all the risks associated with its operations and activities, then it is very likely that a major non-conformity would be raised.

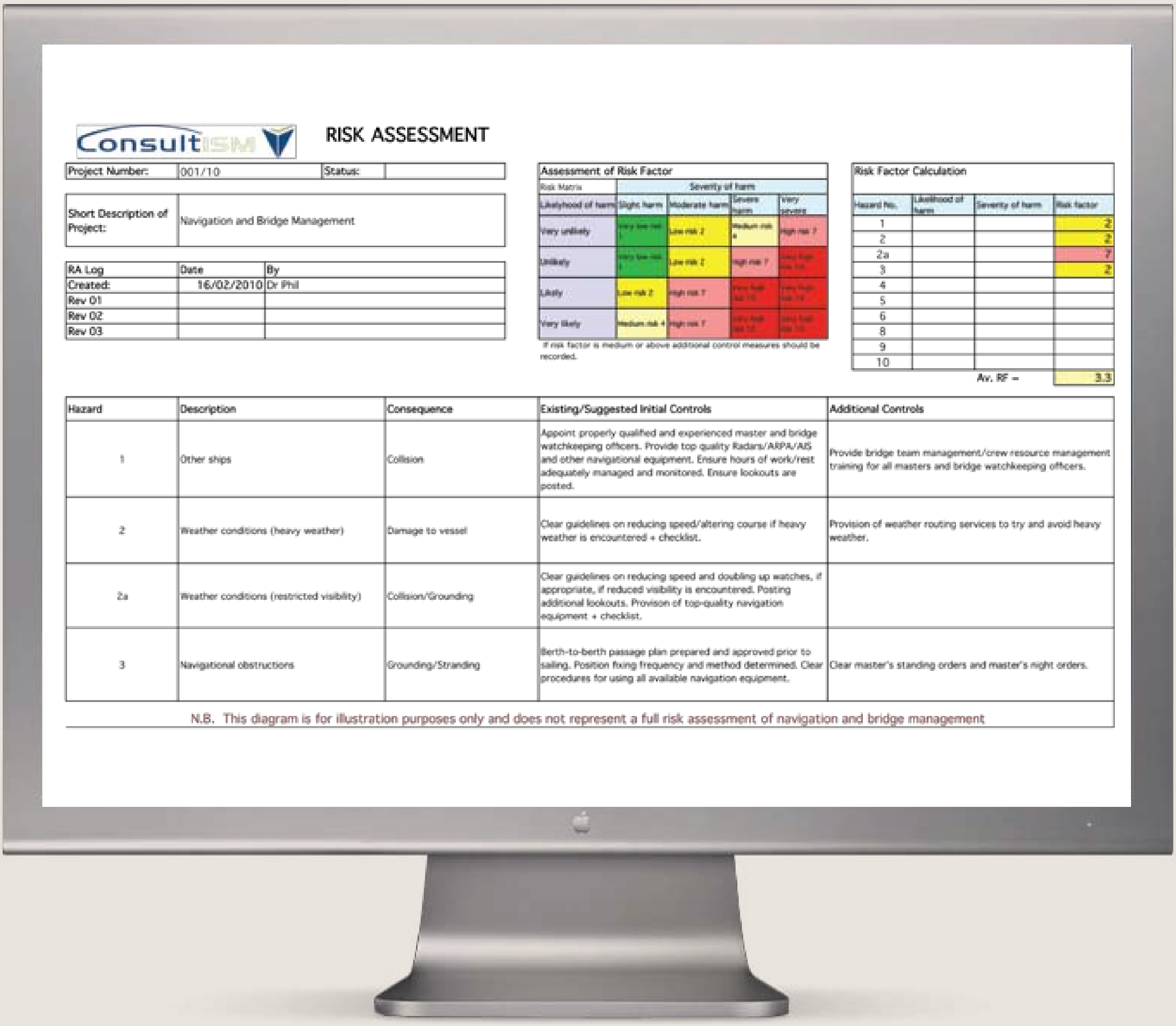
7. CONCLUSION

Remember, the company has been given the freedom to decide how it satisfies the requirement of the new Section 1.2.2.2. of the Code. However, whatever approach is adopted, the company should ensure that it can demonstrate that it has:

- systematically examined its operation
- identified where things may go wrong
- developed and implemented adequate controls

The company will need to document its procedures for assessing its risks and maintain records of the risk assessments carried out.

Risk assessment really can be a most valuable tool. This new requirement will provide ship operators with an opportunity to carry out a thorough review of their SMS and consider whether it really is still 'fit for purpose'.


ConsultISM
RISK ASSESSMENT
Project Number: 001/10
Status:
Short Description of Project: Navigation and Bridge Management
RA Log
Date
By
Created: 16/02/2010 Dr Phil
Rev 01
Rev 02
Rev 03
Assessment of Risk Factor
Risk Matrix
Severity of harm
Likelyhood of harm
Slight harm
Moderate harm
Severe harm
Very severe
Very unlikely
Unlikely
Likely
Very likely
Risk Factor Calculation
Hazard No.
Likelihood of harm
Severity of harm
Risk factor
1
2
2a
3
4
5
6
8
9
10
Av. RF =
3.3
Hazard
Description
Consequence
Existing/Suggested Initial Controls
Additional Controls
1
Other ships
Collision
Appoint properly qualified and experienced master and bridge watchkeeping officers. Provide top quality Radars/ARPA/AIS and other navigational equipment. Ensure hours of work/rest adequately managed and monitored. Ensure lookouts are posted.
Provide bridge team management/crew resource management training for all masters and bridge watchkeeping officers.
2
Weather conditions (heavy weather)
Damage to vessel
Clear guidelines on reducing speed/altering course if heavy weather is encountered + checklist.
Provision of weather routing services to try and avoid heavy weather.
2a
Weather conditions (restricted visibility)
Collision/Grounding
Clear guidelines on reducing speed and doubling up watches, if appropriate, if reduced visibility is encountered. Posting additional lookouts. Provison of top-quality navigation equipment + checklist.
3
Navigational obstructions
Grounding/Stranding
Berth-to-berth passage plan prepared and approved prior to sailing. Position fixing frequency and method determined. Clear procedures for using all available navigation equipment.
Clear master's standing orders and master's night orders.
N.B. This diagram is for illustration purposes only and does not represent a full risk assessment of navigation and bridge management

LOW SULPHUR FUEL OIL FOR SHIP'S OPERATION

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The regulations introduced concerning low sulphur fuel oil are testing the shipping industry's ability to adapt their existing machinery and fuel management.

This article outlines the present situation with respect to the use of low sulphur fuel in ship's operation. Although the IMO regulations relating to the use of low sulphur fuel have been in the pipeline for some time, the recent EU requirement introduced on 1 January 2010 to use low sulphur fuels when in port has come as a bit of a surprise to many owners. The recent EU directive outlined below is already catching some shipowners out, particularly at some ports where these regulations appear to be enforced to the letter.

The technical issues are general in nature, and the engine and boiler manufacturers, fuel-analysing companies and Class should be approached for a more in-depth assessment on the impact of low sulphur fuel oils. Use of the incorrect fuel oil can lead to catastrophic damage to machinery and substantial claims, and can endanger the ship and those aboard.

CURRENT LEGISLATION

The current IMO sulphur emission limits (Marpol Annex VI regulation 14) are as follows:

- a global limit on sulphur emissions of 4.5% by mass (m/m)
- when within a sulphur emission control area (SECA) a limit of 1.0% m/m
- California's limit on sulphur limit emission is for marine diesel oil (MDO) and imposes 0.5% m/m limit

New EU legislation that came into effect on 1 January 2010 pertains to the EU Sulphur Directive 2005/33/EC, which defines limits on the sulphur content of marine fuels.

From 1 January 2010, under the directive, the maximum allowable sulphur content of fuel oil used by ships 'at berth' in European Union ports, other than those in the outermost regions, is 0.10% m/m.

This covers all grades of fuel oil and all types of combustion machinery, including main and auxiliary engines, main and auxiliary boilers, inert gas generators and incinerators.

"The use of the incorrect fuel oil can lead to catastrophic damage to machinery and substantial claims, and can endanger the ship and those aboard."

TABLE 1 – FUELS BEING USED

Ship Type	Area	Sulphur%	When implemented	Note
All	Baltic SECA	1.5	11/08/2006	
All	North Sea & English Channel SECA	1.5	11/08/2006	
All	All emission controlled areas (ECAs)	1.0	01/07/2010	
All	All EU ports	0.10	01/01/2010	1,2,3
Passenger ships	All EU	1.5	11/08/2006	4,3
Inland waterway vessels	All EU inland waterways	0.10	01/01/2010	

NOTES
1. Except for ships due to be at berth for less than two hours
2. Derogation for 16 Greek ships operating within Greece until 1 January, 2012
3. Not applicable in the outermost regions of the Community (French overseas departments, Azores, Madeira, Canary Islands)
4. Operators of cruise ships making regular cruises are advised to check with the relevant authorities whether their operation is affected by the definition in the directive: "Passenger vessels on regular services to or from any Community. Alternatively emission abatement technology may be approved. Warships are subject to a special clause."

TABLE 2 – REGULATION SUMMARY

Ship Type	Area	Sulphur%	When implemented	Act
All	Baltic SECA	1.5	19/05/2006	Marpol
All	Baltic SECA	1.5	11/08/2006	EU
Passenger ships	All EU	1.5	11/08/2006	EU
All	North Sea & English Channel SECA	1.5	11/08/2007	EU
All	North Sea & English Channel SECA	1.5	22/11/2007	Marpol
All	Californian waters & 24 NM of the Californian baseline	1.5 GO[1] 0.5 MDO[2]	01/07/2009	CARB[3]
All	All EU ports	0.10	01/01/2010	EU[4]
Inland waterway vessels	All EU inland waterways	0.10	01/01/2010	EU
All	Californian waters & 24 NM of the Californian baseline	0.10	01/01/2010	CARB
All	All emission controlled areas (ECAs)	1.0	01/07/2010	Marpol
16 Greek ferries	Greek ports	0.10	01/01/2012	EU

FIGURE 1 – EMISSIONS LEGISLATIVE OVERVIEW

2005

14 April
EU Parliament passes Sulphur Directive 199/32/EC

19 May
Global sulphur limit 4.5%
Sulphur content on BDN

22 July
Publication of Sulphur Directive 2005/33/EC

2006

19 May
Baltic Sea SECA 1.5%

11 August
EU Member States laws enacted:
– 1.5 in Baltic SECA
– 1.5% for all passenger ships sailing between EU ports
– Use of abatement technology as an alternative to 1.5% fuel

2007

11 August
North Sea SECA 1.5%

November
Baltic Sea 1.5%

2008

6-10 October
MEPC 58 meets for adoption of proposed draft amendments to Annex VI

2009

California 01 July
0.5% sulphur limit on MDO

2010

January 2010
0.1% sulphur limit on all marine fuel used on ships at berth in EU ports

1 July
All SECAs reduced to 1.0%

2011

2012

California 01 July
0.1% sulphur limit on MDO

1 January
Global cap to be reduced to 3.5%

2015

01 January
All SECAs reduced to 0.1%

2020

1 January
Global cap to be reduced to 0.5%

LOW SULPHUR FUEL OIL FOR SHIP'S OPERATION CONT.

HOW DOES THIS AFFECT SHIPS?

These low sulphur fuel oil requirements apply to all ships irrespective of Flag (EU or non-EU), ship type, and date of construction or tonnage.

At present, it has been stated that there will be no dispensations granted to ships other than those visiting the outermost EU regions. The outermost regions are the French overseas departments, the Azores, Madeira and the Canary Islands. In each of these cases, the local air quality standards must be maintained. Members should note that local regulations may strictly follow the most stringent legislation.

The use of residual fuel in slow speed main engines will still be allowed as these are not run continuously in port and the regulations do allow for the ship to enter and leave the berth using low sulphur residual fuel. Time is allowed for manoeuvring alongside and start-up prior to leaving the berth. The legislation is applicable to machinery using fuel oil that will only be running when the ship is berthed.

A limit of 0.10% m/m sulphur content means that the use of residual fuel oil (HFO) during time at the berth is not possible unless the use of exhaust gas scrubbers or selective catalytic reduction is employed and monitored by the use of emissions monitoring equipment. This is commonly referred to as the use of abatement technology. Members are therefore faced with the use of gas oil only when at EU berths unless they have abatement technology fitted to the equipment in use at that time. All members are familiar with the current Marpol Annex VI regulations with respect to Sulphur Emission Controlled Areas (SECA). Members may already have low sulphur fuel for the use in main and auxiliary engines. However, the continuous use of gas oil in diesel generators, boilers and incinerators designed for running on HFO, may pose some operational problems.

TECHNICAL ISSUES

There are a number of technical issues that members should be aware of with respect to the use of low sulphur fuel:

LOW VISCOSITY

It is required to determine what the viscosity limitations are for the machinery in which the fuel is to be used. If a machine is designed to run on HFO, then the fuel system components will have been designed to run at HFO temperatures (approximately 110-120°C). Depending on the fuel system configuration, it may be necessary to fit some or even all of the following:

- new fuel pumps
- fuel injector nozzles
- fuel line coolers to control the temperature of the gas oil in the fuel supply system to ensure correct atomisation
- new return lines may have to be installed if contamination by HFO is to be avoided
- the replacement or the addition of gear-type supply pumps may also have to be considered

The above list is not complete and may be expanded upon.

LOW TEMPERATURE PERFORMANCE

Due to the possibility of the low sulphur fuels having a substantial wax content, due diligence must be given to the temperature of these fuels at any point in the system. Ensure that the fuel temperature is not so reduced so that solidification or wax deposition problems occur. This can lead to problems with filter blockages and, consequently, fuel starvation of the machine. A note of the cloud point from the bunker delivery note for the fuel may be a good indication as to when this waxing may start to occur.

LUBRICITY AND LUBRICATION

Lubricity as a characteristic relates to boundary lubrication performance that affects the ability to generate a hydrodynamic lubrication film (oil wedge). Manufacturer's recommendations should be sought to ensure that the continuous use of gas oil is not detrimental to the lubrication of the fuel system components in the machine.

Where a low sulphur fuel is being used in two-stroke or four-stroke diesel engines, the engine builder's recommendations should be strictly followed with respect to cylinder lubrication Total Base Number (TBN). The running of an engine with incorrect cylinder oil lubrication for the fuel being used can very rapidly cause severe liner wear, piston ring wear, exhaust valve wear and turbocharger problems, to name but a few. Ultimately, it may cause engine failure. It may be prudent for the ship's medium speed engines to have an engine or engines permanently set up for running on gas oil only. These engines can then be used when the ship is berthed and would avoid the need to change the engine's crankcase oil to a lower TBN when using low sulphur gas oil rather than HFO. In all cases, the member is asked to contact the engine manufacturer for technical advice and recommendations.

v Fuel pump plunger scoring

DENSITY

Due to the density of gas oil, the actual quantity of fuel, in terms of tonnes, contained within a tank will be reduced as compared to residual fuels (HFO). This would be reflected in the amount of fuel injected per fuel pump stroke, resulting in a higher fuel rack-setting for a given load irrespective of the higher calorific value of the gas oil.

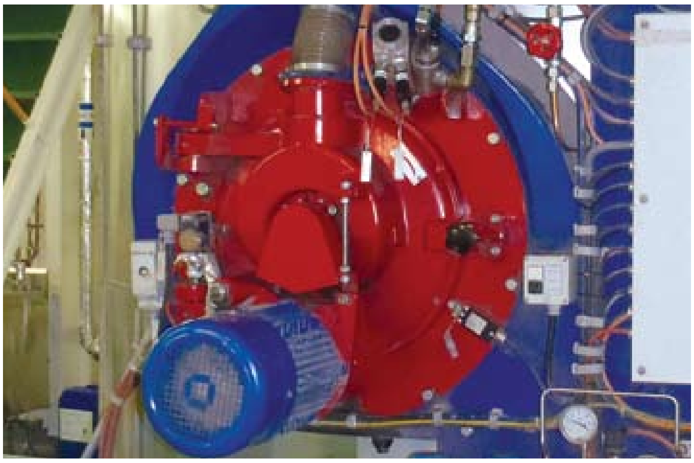
"Due to the density of gas oil, the actual quantity of fuel, in terms of tonnes, contained within a tank will be reduced as compared to residual fuels (HFO)."

POWER SHORTFALL
Problems with power shortfall may occur on engines that have higher running hours on the fuel injection equipment and hence have been subjected to wear. Fuel injection may not be affected when running on HFO at high fuel temperatures, but when subjected to the colder temperatures of running with gas oil, then problems with low fuel injection pressures may arise. The fuel pump's ability to generate the desired injection pressure may be dramatically reduced and, in extreme cases, the pumps may not be able to produce the desired pressure for effective injection. This may be caused by the pump clearances at the low temperature being too large to effectively pump the gas oil. The engine consequently may not be able to achieve full power or may not even start.

PRE-HEATING
Since the heating of gas oil is not required, the systems in place for the HFO fuel operation must be switched off. Trace heating of lines must be shut down during the use of gas oil and reinstated when using HFO.

SOLVENT CHARACTERISTICS
Gas oil will have a cleaning effect on systems normally run on HFO. This may clear accumulated sludge materials within the system, with the possibility of fuel filter fouling or fuel injection equipment faults. Additionally, seals and joints may leak due to the searching nature of gas oil. This is compounded by the reduced temperature of operation. There may also be an increased tendency for fuel dribble from injection nozzles that may cause combustion chamber faults such as diesel knock, piston crown burning or boiler burner firing problems.

v Boiler burner



MAIN, AUXILIARY BOILERS, INCINERATORS AND INERT GAS GENERATORS
The manufacturer of the boiler or burner control system has to ensure that the system is suitable for continuous operation on gas oil as well as HFO. Members may have been required to change the fuel nozzles and/or control system to adapt to the long-term use of gas oil. The furnace purging process must be functioning correctly and all combustion safety devices must be operating effectively. Flame monitoring sensors may not be suitable for gas oil use due to the differing spectral emission ranges, and this may result in false alarms, boiler shutdowns and, in the worst case, undetected flame failures. Combustion air settings may need to be readjusted for the use of gas oil. Members should ensure that boiler/burner manufacturer's advice is strictly followed at all times. In the case of incinerators, the member may find it an easier option to simply not run the incinerator whilst berthed.

APPROVAL OF MODIFICATIONS
All the proposed modifications to combustion equipment should have been assessed by a Hazardous Operations (HAZOP) workshop or other suitable risk assessment. Where any modifications have been made, then these must have been approved by the ship's classification society prior to their application.

CHANGEOVER PROCEDURES
It is important that a detailed changeover procedure is readily available and that the crew are well practised. Insufficient knowledge of the required actions may result in boiler shutdowns or engine failures. It is highly recommended, especially for ships that do not perform fuel changeovers on a regular basis, to practise their procedure for this in conjunction with manoeuvring trials before entering restricted navigable waters.

LOW SULPHUR FUEL OIL FOR SHIP'S OPERATION CONT.

FREQUENTLY ASKED QUESTIONS

1 'AT BERTH' – WHAT IS MEANT BY THIS TERM?

This covers ships in EU ports that are secured at anchor, on moorings (including single buoy moorings) or alongside a quay or berth, irrespective of whether they are working cargo or not.

2 WHEN DOES THE REQUIREMENT TO USE FUEL NOT EXCEEDING 0.1% M/M MAXIMUM SULPHUR CONTENT ENTER INTO EFFECT AND CAN IT BE POSTPONED?

This requirement is now in effect as from 1 January 2010. The Directive does not allow for any delay, nor for exemptions other than those already included.

3 IS A SHIP EXEMPT WHEN THE CHANGEOVER OF FUEL IS UNSAFE BECAUSE THE NECESSARY MODIFICATIONS TO THE COMBUSTION EQUIPMENT HAVE NOT YET BEEN IMPLEMENTED?

No. Directive 2005/33/EC was published in 2005 and therefore plenty of time has been given to prepare for this and it does not justify non-compliance based on alleged emergency situations.

4 DOES THIS REQUIREMENT APPLY TO OTHER EUROPEAN COUNTRIES?

Generally, both Norway and Iceland have followed the EU approach as regards the Sulphur Directive. It is understood that Norway intends to apply the 'at berth' requirements; however, the situation as regards Iceland is unclear. Ships visiting Icelandic ports are therefore requested to verify whether the requirements apply and, if so, ensure that compliance is met.

5 COULD A RESIDUAL FUEL (HFO) BE USED 'AT BERTH'?

In theory yes, since it is only the maximum sulphur content that is stipulated, not the fuel type. However, in practice, it must be expected that generally only distillate type fuel oils will be produced that meet the 0.10% m/m maximum sulphur limit. If the ship is fitted with abatement technology, then HFO may be used as the exhaust emissions are practically sulphur-free and emissions monitoring is used.

6 WHAT ARE THE IMPLICATIONS FOR A SHIP THAT ALSO OPERATES OUTSIDE THE EU AND THAT DOES NOT HAVE THE CAPABILITY TO HANDLE TWO DIFFERENT GRADES OF GAS OIL?

Under these circumstances, it would be necessary that the ship only uses gas oil with a maximum content of 0.1% m/m even at sea and at ports outside the EU.

7 IF A SHIP ALREADY HAS GAS OIL ONBOARD EXCEEDING 0.1% M/M MAXIMUM SULPHUR CONTENT, CAN IT CONTINUE TO USE THIS FUEL?

No. As from 1 January 2010, only fuel not exceeding 0.1% maximum sulphur content can be used. The member must use bunker-compliant fuel for use in 'at berth' and use the non-compliant gas oil outside the port limits.

8 DOES THE CHANGEOVER REQUIREMENT APPLY TO ALL SHIPS THAT ARE 'AT BERTH' FOR LESS THAN TWO HOURS?

No, the two hours given in the directive only apply where there is a published timetable (i.e. in the case of ferries on scheduled services) that gives the time 'at berth' as less than two hours. There is not a general exemption for ships that will be 'at berth' for less than two hours.

9 WHAT ENGINES OR OTHER COMBUSTION DEVICES NEED TO BE CHANGED OVER TO A 0.1% M/M MAXIMUM SULPHUR FUEL?

Only those engines, boilers, incinerators or other combustion devices that are to be used whilst the ship is 'at berth' need to be changed over. Consequently, attention is also necessary to intermittently operated combustion machinery with separate, stand-alone, ready-use tanks, such as incinerators, to ensure that the fuel in those tanks is compliant.

10 DO THE 'AT BERTH' REQUIREMENTS APPLY TO MAIN ENGINES?

Only in machinery arrangements where the engines used for ship propulsion is also used for power supply or other purposes while the ship is 'at berth'. This includes diesel electric systems and de-clutched main engines powering pumps or other devices.

11 DO THE 'AT BERTH' REQUIREMENTS APPLY TO AUXILIARY BOILERS?

Yes. The requirements apply to any fuel oil used by any type or size of boiler. This can range from small domestic water heating boilers through to large water tube boilers. With all boilers, the manufacturers' advice must have been sought prior to operation on low sulphur gas oil. Many classification societies have produced guidance notes relating to this and the member should contact the relevant class society for this documentation.

12 DO THE REQUIREMENTS APPLY TO FUEL OIL-FIRED INERT GAS GENERATORS?

Although such units typically incorporate a water wash stage, which tends to remove most of the sulphur oxides from the exhaust stream, under normal operation, the gases produced do not vent directly to atmosphere unless the unit is on purge mode. In the directive, there is no exemption for this type of equipment and, therefore, it must be followed that the requirements apply in full. Application to the applicable authority may be sought to determine what its views are on this equipment. It should be noted that individual member states could take differing views on this point.

13 WHEN IS A SHIP CONSIDERED TO HAVE ARRIVED AT THE BERTH?

The point at which a ship is considered to have 'arrived' would be when the 'Finished with Engines' is given. Alternatively, for a ship anchoring, it could be when the anchoring crew are stood down.

14 IS THE ANCHORAGE OUTSIDE A PORT CONSIDERED AS PART OF THE PORT AS REGARDS THE APPLICATION OF THE 'AT BERTH' REQUIREMENTS?

The term 'Port' is not defined within the Sulphur Directive and is therefore subject to interpretation by the individual member states. Consequently, when a ship is directed to the anchorage, the member should seek clarification by the relevant authority as to whether the ship should be considered as being under the 'at berth' requirements.

15 HOW LONG SHOULD BE ALLOWED FOR THE CHANGEOVER TO 0.1% M/M MAXIMUM SULPHUR FUEL OIL?

No time is stipulated in the directive as this will differ from ship to ship. Whatever procedures are to be followed should commence as soon as is reasonably possible after arrival. The shipowner may just simply change over to a machine already set up to run on the low sulphur gas oil or follow a changeover procedure as in accordance with the machinery manufacturer's guidelines. The member should have established effective changeover procedures in order to meet ISM requirements to ensure that safe and efficient fuel changeover is carried out. These procedures, however, do not need to be specifically approved.

16 WHAT CHANGEOVER ARRANGEMENTS APPLY TO ENGINES OR OTHER COMBUSTION DEVICES THAT ARE NOT IN OPERATION WHEN THE SHIP ARRIVES BUT ARE SUBSEQUENTLY USED WHEN THE SHIP IS 'AT BERTH'?

The temporary allowance for non-compliance is only for the engines or devices running on arrival. Any other combustion machinery should have been suitably prepared prior to arrival to ensure compliance when used 'at berth'.

17 WHAT DEFINES DEPARTURE TIME?

Departure time should be set on the basis as when the engines are required in hours and minutes. It is recognised that the actual departure time from the 'at berth' may be later due to a number of factors that impact on a ship's leaving schedule.

18 WHEN SHOULD THE CHANGEOVER FROM A 0.1% M/M MAXIMUM SULPHUR FUEL OIL TO ANOTHER FUEL OIL (THAT IS HFO) COMMENCE?

The ship should have established procedures to ensure that when changeover to the other fuel (HFO) commences, the ship is in a safe position and the proven changeover procedures are strictly followed. In the case of diesel generators, the engine(s) must be satisfactorily running on the other fuel oil before dependent load is applied. In all cases, the member must be aware that safety of the ship and the environment is paramount.

19 WHAT TIMES SHOULD BE RECORDED IN THE SHIP'S LOGBOOK?

It is recommended that the member records three specific entries in the ship's logbook as part of a block of data:

- The time given for 'finish with engines'
- The time for the commencement of changeover
- The time at which it is considered that the machine is operating on the fuel to be used.

20 WOULD THESE CHANGEOVER RECORDS BE SUBJECT TO INSPECTION?

Yes, in addition to verifying that a fuel oil of the required sulphur content was being used, it is fully expected that inspectors will be particularly concerned as to whether the changeovers have been carried out promptly after arrival and not commenced too early upon departure.

21 ARE THERE ANY ALTERNATIVES TO USING 0.1% M/M MAXIMUM SULPHUR FUEL OILS?

The directive allows for the use of approved abatement technology. This can be the use of exhaust gas scrubbers or engines fitted with selective catalytic reduction systems (SCR). Whatever device is used, it must be fitted with continuous recorded emissions monitoring equipment and, in the case of scrubbers, the wash water must have no impact on the local ecosystems.

22 WHAT PENALTIES WOULD BE APPLIED IN THE CASE OF NON-COMPLIANCE WITH THE 'AT BERTH' REQUIREMENTS?

The Directive requires that each member state shall incorporate into the legislation penalties for non-compliance. This may be in the form of financial penalties or the ship being banned from the port.

23 WHILE 'AT BERTH', IS IT PERMITTED TO TEST EMERGENCY EQUIPMENT, SUCH AS ENGINE-DRIVEN FIRE PUMPS AND/OR GENERATORS ON FUEL OIL WITH A SULPHUR CONTENT ABOVE 0.1% M/M?

No. Since the requirements apply to all fuels used while at berth, it is necessary to ensure that the fuel oil in the emergency equipment fuel storage tank is compliant. If it is not intended to test such equipment while 'at berth', then the fuel in those tanks would not need to be compliant. The member must be made aware that some ship inspectors/surveyors may need to see emergency equipment run, and therefore it would be recommended to have all emergency equipment fuelled with 0.1% m/m maximum sulphur content to ensure compliance at all times.

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THE BENEFITS OF FUEL OIL ANALYSIS

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During a number of recent ship surveys and Member Risk Reviews, the club surveyors have noticed that a small but significant number of ships and members do not carry out laboratory analysis of bunkered heavy fuel oil. Although the testing of fuel oil is not a statutory or classification requirement, there is overwhelming evidence through experience that regular laboratory analysis of bunkered heavy fuel oil is a very effective tool in reducing the risk to the diesel engine machinery and ultimately the ship. The decision not to carry out representative sampling and detailed fuel oil analysis removes the ability of the company to identify off-specification fuel for its use onboard. Failure to detect low-quality or incompatible fuel oil before it enters the ship's fuel treatment and injection systems can result in serious operational difficulties and extensive machinery damage.

In addition, the club is assisting in a number of disputes and claims that arise from members as owners or charterers in respect to poor bunkers stemmed. The issue is complex and is inevitably difficult to defend if no fuel oil sampling and laboratory analysis is undertaken.

Lubricating oil analysis by approved organisations and the importance this tool affords in monitoring machinery and component condition continues to be recognised within the shipping industry. In view of the potential consequences to the propulsion and auxiliary machinery, and therefore the safety of the ship, crew and cargo, it is highly recommended that laboratory analysis programmes for fuel oil are implemented onboard and are closely monitored by the shore-based technical management. Procedures and requirements should be incorporated within the SMS and specific guidelines given with standard practices detailed within bunkering operational guidelines and checklists. Given the simple equipment required to carry out representative sampling, and the minimum effort and cost involved with conducting fuel oil analysis compared to the potential consequences, it is surprising how many ship owners and operators decide that fuel oil analysis is not necessary.

It is accepted that when the cost of fuel oil increases significantly, as experienced recently when the price of residual and distillate fuel reached record levels, there is a marked reduction of fuel oil quality and more operational difficulties are experienced and reported.

WHAT IS THE RISK?

Poor-quality fuel oil can very rapidly disable a ship, with the financial implications of returning an engine to full service being significant, notwithstanding any commercial repercussions. Crew and ship safety, cargo damage and pollution risk should also be considered in addition to any technical and commercial problems that are likely to be encountered.

Off 'spec' and poor-quality fuel can affect the running of a ship and its equipment in the following ways:

- poor-quality fuel oil can cause rapid problems with the ship's fuel treatment systems caused by incompatibility issues due to mixing of bunkered and existing fuel onboard (referred to as admixing). Incompatibility can result in total chemical breakdown of the fuel, which can separate into a light colourless inert liquid and heavy sludge that may require manual removal

- rapid choking of fuel filtration systems and centrifugal purifiers (see Figure 1) requiring round-the-clock maintenance to ensure machinery remains in service, albeit less effectively. This results in increased spare part costs and a drain on engineer resources

v Figure 1: Heavy sludge contamination

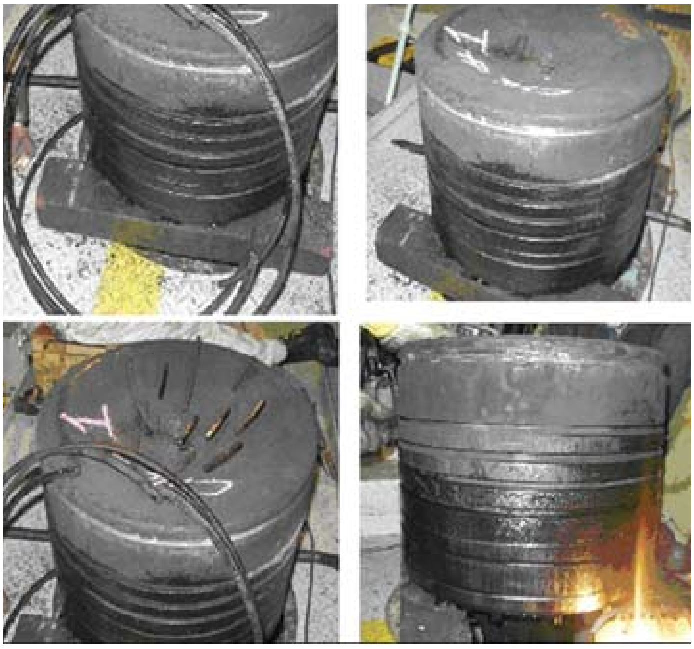
"The use of the incorrect fuel oil can lead to catastrophic damage to machinery, substantial claims, and can endanger the ship and those aboard."

- rapid wear of engine components such as fuel pumps, fuel injectors, cylinder liners and piston rings due to abrasive particles contained within the fuel see Fig 2. These abrasive particles, known as catalytic fines, are formed during the catalytic cracking process at the oil refinery. The aluminium and silicon content within the ISO standard sets the maximum levels of aluminium plus silicon at 80 mg/kg. Even with well-maintained fuel treatment systems and reduced treatment rates, it is difficult to totally remove or effectively reduce high abrasive particle levels within the fuel

- low and high temperature corrosion can develop due to the presence of vanadium, sodium and sulphur within residual fuel oil. Vanadium is present in soluble compounds, cannot be removed and high concentrations can cause high temperature corrosion
  - high temperature corrosion is directly caused by the presence of compounds of sodium and vanadium at temperatures over 500°C. Sodium and vanadium are found in heavy fuels up to 200ppm and 600ppm respectively, forming vanadium oxides, sodium oxides and, with sulphur also contained in the fuel, sulphates that are able to react further with vanadium oxides. The various compounds that may be formed from these have a wide variety of properties, the most significant of which is the melting points. At the moment of solidification, the compounds release oxygen, which can attack the metal surface. Oxygen may be reabsorbed into the deposits, thus forming an oxygen pump that aggressively attacks the surface of the metal during the melting and solidification processes at around 530 to 600°C. The parts of most concern in marine diesel engines are the exhaust valves, piston crowns as well as the main components of the turbocharger such as the nozzle ring and turbine blades

- sulphur can also lead to low temperature corrosion and is usually neutralised in the engine by correct cylinder lubricating oil and good combustion
  - low temperature corrosion is caused when the sulphur in the fuel combines with oxygen to form sulphur dioxide. Further combination of the sulphur dioxide with oxygen gives sulphur trioxide. When this comes into contact with moisture, it forms sulphuric acid vapours. If this acidic vapour contacts metal surfaces below 160°C (dew point), then sulphuric acid attack occurs resulting in rapid corrosion of the affected area

v Figure 2: Piston damage due to poor quality HFO



- the formation of SOx (sulphur oxides) during combustion has led to new legislation within the Marpol Convention under Annex 6, regulation 14 and a maximum sulphur content level of 1.0% within fuel oil is required for ships operating in Sulphur Emission Control Areas (SECAs) and 0.1% when the ship is 'at berth' in any EU port (Sulphur Directive 2005/33/EU)

- fouling of engine running components is also a common defect (see Figure 3), which reduces the mechanical and thermal efficiency of the engine. Fouling due to poor or incomplete combustion can rapidly increase wear rates, which may ultimately require a full overhaul of an engine as well as increasing the risk of scavenge and exhaust gas economiser fires occurring whilst in service

THE BENEFITS OF FUEL OIL ANALYSIS CONT.

THE ISO 8217 STANDARD

Requirements for the quality of marine fuel oil are detailed within the ISO 8217 specification and determine the criteria for correct onboard treatment and injection. ISO 8217, which is the international standard that governs the quality of petroleum fuels for use in marine diesel engines and boilers, was originally drafted in 1982 and came into force in 1987.

It is generally considered less critical when burning poorer-quality fuel in ships' boilers due to their design, construction and operating method; however, at the beginning of the 21st century, motor ships accounted for around 98% of the entire world fleet. The ISO standard is regularly revised to account for engine technology development and statutory environmental requirements such as Marpol Annex 6. Recent amendments in 2005 addressed the level of used lubricating oils contained within fuel oils.

The ISO 8217 standard defines maximum and minimum values for the following parameters, including:

- density, which is required to determine purification settings and is used to calculate the amount of fuel bunkered
- viscosity, which is expressed as a fluid's resistance to flow. In everyday terms for a fluid, it is its 'thickness'. Viscous (thick) fuels require preheating to reduce the viscosity to enable good purification, injection and combustion in the engine cylinder
- the flash point of the fuel indicates the temperature at which a fuel vapour is produced and is able to be ignited. In accordance with SOLAS requirements, the flash point must be above 60˚C. (This does not apply for fuel that will be used for emergency purposes such as generators, fire pumps and lifeboat engines)
- what does all this mean? Aluminium and silicon are naturally occurring in crude oil and are introduced during the cracking process at the refinery. These highly abrasive particles can cause rapid wear of engine components and can be difficult to remove or separate using the ship's fuel treatment equipment
- the ISO standard is not restricted to the above properties and further characteristics are contained within the ISO specification for residual and distillate fuels
- the ISO 8217 has now been revised and the updated version was issued in July 2010 as ISO 8217/Final Draft International Standard (FDIS) Rev.4. This new revision changes certain percentage constituents; however, it does not necessarily cover all the requirements that an owner may have with respect to fuel quality.

v Figure 3: Exhaust valve carbon build-up

NEW ADDITIONS IN ISO 8217: 2010 FDIS REV.4:

Aluminium and silicon (Al+Si)

- Compared to ISO 8217: 2005, the level of aluminium and silicon in the 8217: 2010 has been reduced and the new maximum limits range from 25 mg/kg for the lowest residual grades to 60 mg/kg for the highest grades. This revision should reduce the risk of too-high levels of abrasive particles reaching the engine's inlet

Sulphur content

- Limit values are no longer included in the ISO 8217: 2010 standard at all. Instead, it is up to the bunker purchaser to specify the maximum sulphur content of fuels to the supplier in line with the regulatory requirements for the use of that fuel

Amendment to Clause 5 of ISO 8217

- The general requirements in Clause 5 have been expanded to include more reference to materials that render marine fuels unacceptable for use in diesel engines. Both ISO and CIMAC have initiated research on the analysis and interpretation of the chemical composition of waste materials, as well as the levels at which these materials may start to cause engine problems

Ash, vanadium and sodium

- Similarly, the vanadium and ash limits specified in the 8217: 2010 for most residual grades are now reduced. Maximum levels for sodium are also added as a new parameter. Traditionally, sodium is associated with sea water contamination, but this element may also originate from the pre-treatment of crude oils at the refineries. Experience has shown that sodium from this source may not be removed from the fuels by onboard treatment and could contribute to post-combustion deposits

Calculated Carbon Aromaticity Index (CCAI)

- This is calculated from the density and viscosity and provides an estimate of the ignition delay of the fuel. CCAI is now included in the specification for all residual grades. The revised maximum limit is 870

Hydrogen sulphide (H2S)

- This is aimed to add protection to onboard staff whilst storing and handling fuels

Lubricity test (distillates)

- Lubricity testing is required only for marine fuels with sulphur levels lower than 0.050% mass (500mg/kg). If the fuel lubricity is too low, fuel pumps in diesel engines may experience wear from prolonged operation on such fuel

It is accepted that the majority of fuel-related machinery problems are attributable to poor-quality residual fuel oil. However, problems with distillate fuels such as marine diesel oil or marine gas oil are also reported and microbial contamination is a common problem. The presence of micro-organisms (bugs) in distillate fuel can lead to rapid choking of filtration systems, fuel starvation and engine shutdown. Microbial contamination can also cause corrosion within fuel tank structures. Although the risk of problems with distillate fuel may be relatively low, its use at ambient temperature can increase the risk of microbes developing.

Onboard testing of these fuels using a suitable kit is considered advisable. Good fuel housekeeping can prevent the risk of serious operational problems occurring. Should operational problems develop, the hazy appearance of a sample may indicate microbial contamination, although this should be confirmed by a laboratory. Professional assistance should be sought if microbial contamination develops and the use of biocides is necessary as part of the treatment process. Without water, it is not possible to have microbial growth. Thus, the first line in prevention is the removal of water. As a general rule, the more water the greater will be the problem.

However, it is inevitable that there will always be some water with the fuel oil, whether brought in when bunkering, through leaks or through condensation. Therefore, the need to constantly purify a system is necessary. This is seen on fuel systems where fuel oil is taken from a settling tank to a service tank where it overflows back to the settling tank. It should be noted that purifiers can act as a source of cross-contamination between an infected tank and a non-infected tank, and thus rigorous sterilisation after their use on a system is highly recommended. Tanks should be fitted with drain cocks at their lowest points and should be drained regularly as part of the routine watchkeeping duties.

"It is accepted that the majority of fuel-related machinery problems are attributable to poor-quality residual fuel oil."

APPROVED OR RECOGNISED FUEL OIL TESTING ORGANISATIONS

There are a number of approved and certified organisations providing established fuel oil testing services. These are often associated with the classification societies and/or the oil majors/fuel oil suppliers. Technological advances and communications available to ships allow fuel oil test results to be available online within three days of sending samples ashore.

In addition to the benefits of conducting detailed laboratory analysis, onboard fuel oil test kits are available that allow ship's staff to test fuel density, viscosity and compatibility that may help to indicate fuel quality defects soon after bunker operations have been completed and before the fuel is used. It is highly recommended where practicable to keep any freshly bunkered fuel completely separate from existing onboard fuel until the bunker sample laboratory results have been analysed. If it is not possible to keep the fuel separate, then every measure should be taken to not use the fuel in the engines until the results of the fuel sample are returned.

These approved organisations also provide regular advice and warnings when poor-quality fuel has been found to be supplied from a particular port or country. The disparity of fuel oil supplied even from well-regulated ports can be astonishing.

RISK ANALYSIS

If, for whatever reason, a company has decided that fuel analysis is not necessary, then a full and formal risk analysis should be carried out to support that decision. The relatively minor costs of regular fuel oil analysis, compared with the cost of the fuel, far outweigh the potential damage and resulting costs that are associated with mechanical failure due to poor fuel quality.

Conducting representative sampling, laboratory analysis and onboard testing provides an effective tool to identify poor-quality fuel and a method of avoiding serious operational problems and expensive mechanical repairs.

CHARTERPARTY DISPUTES – THE BUNKER CLAUSE

The company must be clear in its view in respect to the bunker clause and what it will accept. It is a clause that is often not given much consideration and often it is blindly accepted that if the bunkers supplied are within the ISO 8217 standard then that is as far as the clause needs to go. That is not the case. The ISO 8217 standard is now revised as noted above; however, the high fuel oil price, the introduction of low sulphur fuel oils and the recession have made the issue complex. Fuel oil providers in some jurisdictions are cutting fuel oil with ingredients that still allow compliance with the ISO standard but can be detrimental to the engine or the engine's output.

CONCLUSION

- carry out routine fuel oil analysis on all bunkered heavy fuel oil
- do not use the fuel until analysis results have been received and approved
- keep newly bunkered fuel oil separate from that already onboard
- make sure your bunker clause is fit for purpose

DANGER OF HOT WORK NEAR CONTAINERS

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Recently, the club was involved with a claim in which an onboard fitter was fatality injured whilst carrying out hot work near a container in the hold of a container ship.

A container was loaded with approximately 16 tonnes of non-ferrous aluminium scrap metal bound for Pakistan. The container was stuffed in Northern Europe and subsequently loaded onto a container ship soon after. The scrap cargo had a high value and was understood to be a by-product from a computer recycling process. The scrap cargo was a mixture of loose aluminium foil in strips and small reels of compressed aluminium tape, some of which were loosely wound.

During the voyage, the fitter was required to carry out some hot work repairs on the hold platforms. The following procedures were carried out:

- identification of any International Maritime Dangerous Goods (IMDG) containers nearby
- risk assessment
- permit to work that required atmospheric testing to confirm oxygen, toxic gas and flammable gas concentrations
- tool box meeting; two personnel working as a team
- full protective equipment worn

As the fitter was cutting steel plate with an oxyacetylene torch close to the door of this particular container, there was an explosion, which killed the fitter instantly.

THE INVESTIGATION

An investigation was carried out by an expert firm of consultants, which found the following:

- the container was a standard 20ft unit, with a plywood floor in satisfactory condition, fitted with small ventilation openings on the side walls with perforated plastic covers.
- the container was approximately 70–80% full
- the floor edge was detached at the rear of the container, the walls of which appeared to have ‘bulged’ out; the doors also showed damage as a result of the explosion. The container had been damaged as a result of an internal explosion
- there was no evidence of oily substances, solvents or extraneous material within the cargo
- there was a significant thin oxide film on aluminium strips within the container and on samples removed from the container
- samples of cargo were recovered and placed in airtight drums. These were shipped to a laboratory and the air space above the metal samples was tested. Analysis showed that hydrogen gas was present in all the air spaces that were tested at a concentration of up to 1.37% by volume. This corresponded to 34% of the lower explosive limit (LEL) for hydrogen. This provided evidence that the cargo was susceptible to evolve hydrogen and could potentially produce levels of hydrogen sufficient to form an explosive mixture in air
- it is possible that flame-cutting sparks were propelled to the edges of the container doors through which a flammable hydrogen-air mixture was present

HYDROGEN

Hydrogen is a colourless, odourless gas, normally present in air at concentrations of about 5ppm. When mixed in the correct proportions in air and ignited in a confined space, hydrogen burns rapidly, generating high rates of pressure rise. The minimum concentration of hydrogen in air to form a flammable mixture (the LEL) is 4% by volume.

Hydrogen is a much lighter gas than air and would initially tend to rise and accumulate near the top of a sealed or enclosed space such as a container. The relatively high permeability of hydrogen allows good mixing to the extent that homogeneous mixtures can form and also leak from, say, a container. The ventilation grills on the container may have been taped over, preventing the hydrogen from escaping. In any event, forced ventilation within the hold is unlikely to have any material diluting effect on a localised volume of a flammable gas at the container walls and doors that is accessible to flying sparks from hot cutting or welding operations. The generation of hydrogen from the cargo could have been caused by one of a number of mechanisms, including chemical contamination, reaction with moisture, an effect of the manufacturing process and/or the subsequent storage of the material. It is unlikely on this occasion that a galvanic reaction between the aluminium and steel caused the build-up of hydrogen.

In any event, the relatively high specific surface area of the aluminium tape may have been the overriding factor that facilitated the generation of sufficient hydrogen to form a flammable atmosphere in the container.

It was noted that according to the ship’s container stowage plan, this container was in fact not stowed in the correct bay.

LESSONS LEARNT

Ship’s masters should be aware that scrap aluminium metal and also other scrap metals may produce hydrogen gas, particularly if they become wet or moist. It is not usual for ships to have gas meters onboard to specifically detect hydrogen gas. However, conventional explosimeters are usually carried onboard and these will determine whether there is a potentially flammable gas mixture present, although they will not identify the nature of the gas.

"Ship's masters should be aware that scrap aluminium metal and also other scrap metals may produce hydrogen gas, particularly if they become wet or moist."

IF CARRYING OUT HOT WORK IN OR NEAR CONTAINERS:

DO

- always check and identify the cargoes in containers adjacent and near to where the work is to be carried out. If in doubt, do not attempt any hot work
- always carry out a risk assessment
- check that the containers stowed in the area being worked on comply with the cargo plan
- always carry out a hot permit to work. This permit is only valid for a limited time, usually 12 hours
- ensure the ship is equipped with calibrated explosimeters. Do not take a chance
- within holds, ensure that good ventilation is available and that fans are on and operating
- consider if the work can wait until a downtime or repair period
- consider including in the company procedures that all hot work outside of the engine room should be reported to the technical office for authorisation complete with a risk assessment

DO NOT

If scrap metal, including aluminium scrap in containers, is being carried in a hold:

- no hot work should be carried out in that hold unless the safety of the ship is threatened
- do not believe that the use of forced ventilation and fans may have any material diluting effect on hydrogen gas at the boundaries of a container of scrap aluminium in the area where hot work is being carried out. The gas may be inside the container and may be seeping out, and a spark is all that is needed for ignition

Full knowledge of what is stowed inside a container is not always available or reliable. Use caution when proceeding with hot work nearby.

Acknowledgements:
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Dr J H Burgoyne & Partners LLP

Burgoyne's is a pre-eminent practice of consulting scientists and engineers specialising in the forensic investigation of fires, explosions, engineering failures and other incidents. The organisation provides expert witness services to the legal, insurance and commercial sectors. The practice celebrated its 40th anniversary in 2008.

It has offices throughout the UK, Singapore, Hong Kong and the USA. To enquire about our services or to instruct us, contact one of our offices using the listings at www.burgoynes.com or by telephone on +44 20 7726 4951.

SAFETY & LOSS DEPARTMENT'S SURVEY RECORD 2009/2010

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One of the prime tasks of the club's safety and loss department is to carry out condition surveys and Member Risk Reviews. The Member Risk Review is a review of a member's SMS; this is carried out on all new members. These are a major tool in the club's assessment of exposure to risk. It is fundamental to how the club ensures that the quality of ships entered into the club remains high.

During the 2009/10 policy year, the club had 2,684 ships on risk; the aim was to survey approximately 10% of the fleet on risk annually and a high proportion of the condition surveys are for new entries. During the year, the department carried out 300 condition surveys, of which nearly 40% were conducted by the in-house surveyors based in London. The surveys carried out have included ships of all the IACS classification societies and major Flags.

Some of the results are interesting:

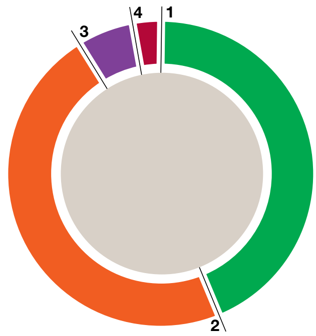
- 45% of surveys resulted in a clean pass and 48% passed with recommendations for repairs or amendments to procedural deficiencies. 6% of surveys were passed after repairs were required and some of these required to be surveyed again. A very small number of ships failed the follow-up surveys, where repairs were not completed to the club's satisfaction
- 24% of all defects reported from the condition surveys were structural. This is a disappointing statistic and indicates that owners and class are not picking up on all structural defects
- nearly 50% of bulk carriers and general cargo ships had defects with hatch covers and closing appliances. The weathertightness of hatch covers is an important aspect of cover. Nearly 50% of all claims are cargo claims and a significant number of these are related to wet-damaged cargo caused by poor hatch covers
- 15% of all defects related to environmental and pollution-related equipment, predominantly from unprotected oil leaks and issues with the operation of the oily water separator. Although pollution claims represent only 2% by number of all claims during the past five years, they represent 6% in terms of cost
- bulk carriers and RoRo cargo ships have more defects than other ship types
- very few statutory defects, defects with ship certificates and classification surveys were found. This would indicate that the issue of having the correct certificates is being controlled by the ISM systems and port state control amongst others

CONDITION SURVEYS COMPLETED 2009/2010

The analysis that follows is based on club entry, routine and follow-up surveys that took place in the 2009/10 policy year – in total, 300 surveys.

SURVEY RESULTS (2009/2010)

1	Pass (134)	**45%**
2	Recommendations (146)	**48%**
3	Repairs (17)	**6%**
4	Fail (3)	**1%**

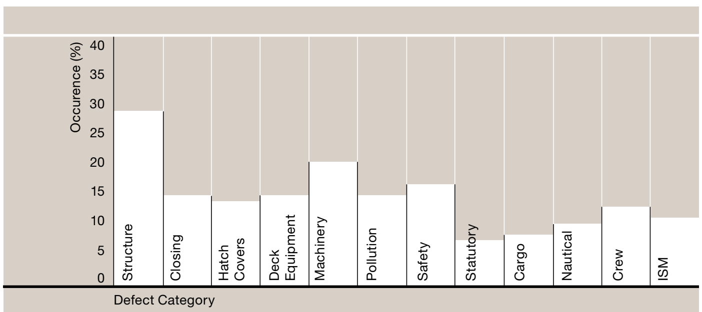


SURVEY DEFECTS (2007/2010)

In the last three policy years, the department has recorded in-depth the ship defects (12 main categories, which are further broken down into specific defects). In total, during the past three years, 871 surveys were carried out with 1,420 defects recorded.

The graph below shows the survey defects as a percentage for all ship types:

ALL SURVEY DEFECTS BY OCCURRENCE (2007/2010: 871 SURVEYS)



MEMBER RISK REVIEWS (2009/2010)

In addition to condition surveys, the managers' surveyors are all experienced ISM lead auditors and have carried out 39 management risk reviews during the past year.

The Member Risk Reviews are used to assess the members' systems and procedures in key areas of management that affect risk and claim exposure. These include:

- management, leadership, control
- shore personnel
- shipboard personnel
- technical maintenance
- navigational safety
- cargo and ballast operations
- mooring equipment and lifting appliances
- management of change
- accident investigation and near miss
- safety management
- environmental management
- emergency preparedness
- inspection, measurement and analysis
- loss prevention

Overall, the Member Risk Reviews have indicated that the SMSs are generally in good shape. As mentioned in the article on the ISM Code, there is apparent room for improvement in the effectiveness of internal audits and master's reviews.

"During the year, the department carried out 300 condition surveys, of which nearly 40% were conducted by the in-house surveyors based in London. The surveys carried out have included ships of all the IACS classification societies and major Flags."

INTERNATIONAL MARITIME SOLID BULK CARGOES (IMSBC) CODE

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The first reference source for the carriage of bulk cargo should be the International Maritime Solid Bulk Cargoes (IMSBC) Code, issued by IMO. It was revised and reissued in 2009, and there are some changes of which members should be aware.

The IMSBC Code replaces the previous BC Code – the Code of Safe Practice for Solid Bulk Cargoes. It can be applied from 1 January 2009 and will become mandatory on 1 January 2011 under SOLAS. This is a Code that should be onboard all bulk carriers.

Changes include:

- updated information on various bulk cargoes
- new information relating to:
  - DRI (Direct Reduced Iron)
  - Chopped plastic/rubber insulation
  - Granulated tyre rubber
  - Alternative forms of bulk sulphur
  - references to SOLAS 1974
  - updated information with respect to the IMDG Code

The new information on DRI provides comprehensive guidance on this potentially dangerous bulk cargo.

The IMSBC Code also includes the Code of Practice for the Safe Loading and Unloading of Bulk carriers (BLU Code) and recommendations on the use of pesticides in cargo holds. It also provides the contact details of the national competent authorities responsible for the safe carriage of solid bulk cargoes and of grain. The IMSBC Code is not appropriate to the safe carriage of grain cargoes; refer to the IMO Grain Rules.

SURVEYOR'S NOTES

We have highlighted the issue of enclosed space entry – particularly tank entry – in the previous two issues of Standard Safety. It continues to be an issue of great concern. Recently, we have become concerned that the message of safe tank entry is not getting through to the seafarer.

Our surveyors continually see the most astounding actions when asking crews to prepare for tank entry before inspecting a ballast tank for example. All enclosed space entries require a safe entry procedure to be followed before entry.

On a recent survey of a dry cargo ship, the club surveyor prevented a chief officer from entering a recently opened ballast tank because a proper tank entry procedure had not been followed. The chief officer, who was halfway down the tank, retorted that it was 'OK' to enter the tank because he had the oxygen meter strapped to his leg. As he went into the tank, he argued the O_2 meter would alarm before he would breathe in the affected air.

Consider the level of ignorance or lack of training that is required to give a senior officer the feeling that all was 'OK' if the O_2 meter was strapped to his leg before he entered a tank – a tank that had not had its atmosphere previously checked. Consider also the failing in the SMS, the failure of training, the failure in the permit-to-work system, and the failure in the safety culture of the ship and company.

Enclosed space entry must be high on the agenda of training sessions, safety meetings, officer's conferences and so on. Make it a priority on your ship to make sure everyone knows what the proper tank entry procedure is. IMO and Flag require that the atmosphere is tested before tank entry with a calibrated O_2 meter.

Ref: IMO res A.864 (20)

^ Ballast tank access within a hold without lighting

^ Entering an enclosed space – proceed with caution

Inside a ballast tank

Ballast tank access

SURVEYOR'S NOTES
CO_2 FIXED FIRE FIGHTING SYSTEMS OPERATION AND MAINTENANCE

The club continues to see major fire casualties where failure to release the CO_2 in a timely and correct manor has contributed to the fire's devastating effect. Officers and crew simply did not know how to activate the CO_2 fire extinguishing equipment.

This article is focussed on CO_2 systems, but it also applies to fixed fire fighting systems of all types.

CASE STUDY: CO_2 FIRE EXTINGUISHING SYSTEM NOT PROPERLY ACTIVATED

A large bulk carrier experienced an oil leak on a low pressure lubricating oil line, which sprayed oil onto a hot exhaust. The fire rapidly took hold in the engine room and the engine room was evacuated, all vents and fans shut down and closed. Fuel trips were activated. The chief engineer went to activate the fixed CO_2 fire extinguishing system situated in the CO_2 room and did so by pulling the appropriate handles – or at least he thought he had activated it. The fire burnt for a number of days with the CO_2 failing to have effect. The engine room was completely destroyed and the ship was a constructive total loss.

The fire was investigated and it was found that the CO_2 system had not actually been released and the CO_2 remained in the bottles. It was also found that the fire dampers in the ventilation ducts had not been fully closed.

It is imperative that all officers, particularly all senior officers, have a full understanding of how to activate the CO_2 fire extinguishing system. In the above case, the officer had failed to open all the delivery valves. Apart from being a familiarisation requirement when first joining a ship, training should be given at regular intervals, especially to new joiners in how the CO_2 or fire protection/smothering systems operates.

^ Ensure that the ship's vents are shut down effectively

^ The result of an engine room fire

^ Switchboard after an engine room fire

^ Know how your CO_2 system works

All ships must have:

- familiarisation procedures for critical equipment
- clear instructions available in the CO_2 room showing how to activate the system
- annual Flag/Class safety equipment surveys
- training that checks that officers know the system
- company inspections to ensure that officers are aware of how to operate the fixed fire-fighting systems

Ideally, every member of the ship's crew should be taught how to release the CO_2 and be given appropriate training in safety drills.

UNDERSTANDING CO_2 FIXED FIRE FIGHTING EQUIPMENT SYSTEMS

The club's surveyors recently have seen a number of occasions where the senior officer accompanying the surveyor was unable to demonstrate how the CO_2 and other fire fighting systems should be operated. This includes:

- master and chief officer on an oil floating storage tanker
- second engineer on an offshore anchor-handling ship
- chief engineer on a passenger ferry

In each case, the officer said that he needed to read the instructions before being able to operate the equipment and then proceeded to demonstrate the operation of the equipment incorrectly. If errors are made during a demonstration, who knows what will happen during the crisis of a major fire?

In addition, it has been seen that often the operating instructions are not complete or clear. It is important to make sure that the instructions are clear and operating valves clearly marked. In a true emergency, there is often panic and stress and so officers need be fully familiar with how to operate the system.

UNDERSTANDING THE ENGINE ROOM LOCALISED CO_2 RELEASE SYSTEMS

During a recent survey, one of our surveyors saw the following sign on the local engine room fixed fire fighting CO_2 release box, located outside of the engine room. It states:

"Caution – Do not open and do not touch! Opening this box will cause the main engine to stop suddenly when underway???"

"Do not use the CO_2 box key without the consent of the Master, Chief Engineer/2nd Engineer"

This indicates a complete lack of knowledge of what will occur when the localised CO_2 control box is opened. The box will activate an alarm, which is supposed to indicate to any personnel within the engine room that CO_2 is about to be released into that space and the engine room ventilation fans will shut down. It does not shut down the main engines. If there is this level of misunderstanding of the CO_2 release system, then an efficient release in an emergency is unlikely. It should be a part of the safety checks that the cabinet alarms and ventilation stops are operational

^ A warning sign, good or bad?

CO_2 FIXED FIRE-FIGHTING EQUIPMENT MAINTENANCE

The fixed fire-fighting systems should be included in any planned maintenance system and regular statutory inspections and tests carried out. Fixed fire-fighting systems should also be checked by ship's personnel after any shore maintenance has been carried out to ensure that the system has been left in an operational state. This therefore requires senior officers to know their systems well.

During a routine survey of a passenger/freight ferry, the engine room CO_2 fixed fire-fighting system had been recently checked by shore technicians and the surveyor noticed that a screw cap fitting that blanks off the pipeline testing connection had accidently been left off. The system had been reinstated and was thought by all personnel to be in a state of readiness. Had the CO_2 been released, then the gas would have filled the CO_2 room and not been dispersed into the engine room. Check your CO_2 system after routine maintenance.

On another survey, a senior deck officer was unable to identify a series of large valves situated on the main deck. The surveyor then explained that this was the water drenching system for the ro-ro decks. The senior officer, although new to the ship, had been onboard for a month. Good familiarisation is key when taking over a new ship.

These examples are isolated, but significant in number to be of concern. Most ships do have the necessary familiarisation procedures in place.

SURVEYOR'S NOTES CONT.
CO_2 FIXED FIRE-FIGHTING SYSTEMS OPERATION AND MAINTENANCE

^Sprinkler instruction chart in a language unfamiliar to the officers and crew

^CO_2 release systems can be complex. Have clear signage

^Sprinkler valves on the main deck. No instruction or identifying stencils

^Cap left off

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