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CONSISTENT IMPLEMENTATION OF REGULATION 14.1.3 OF MARPOL ANNEX VI

Comments on proposals for the consistent implementation of regulation 14.1.3 of MARPOL Annex VI

Submitted by INTERTANKO

SUMMARY

Executive summary: This document comments on documents PPR 5/13/5 and MEPC 71/5/9 and reports case analysis with respect to fuel oil sulphur content testing and verification

Strategic direction: 1

High-level action:

Output: 1.17

Action to be taken: Paragraph 14

Related documents: PPR 5/13/5, PPR 5/13/11 and MEPC 71/5/9

Introduction

1 This document is submitted in accordance with the provisions of paragraph 6.12.5 of the *Organization and method of work of the Maritime Safety Committee and the Marine Environment Protection Committee and their subsidiary bodies* (MSC-MEPC.1/Circ.5) and comments on document PPR 5/13/5 (Austria et al.) and MEPC 71/5/9 (Belgium et al.).

Case analysis

2 INTERTANKO has recently received reports of cases where different approaches have been used in fuel oil sulphur content test and verification by test laboratories and port State authorities. Further investigations unveiled a degree of difference in applying regulation 14 of MARPOL Annex VI and its associated appendices. MARPOL Annex VI is not clear as to how many decimals should be used in writing the fuel oil sulphur content, which test verification procedures should be used and whether the same verification procedures should be used for both MARPOL samples and in-use fuel oil samples. The last third issue was already recognized by MEPC 71 and would be addressed by PPR 5 under its agenda item

on "Amendments to regulation 14 of MARPOL Annex VI to require a dedicated sampling point for fuel oil" (MEPC 71/17, paragraph 5.25). It is the view of INTERTANKO that the variances it has noted occur in many regions of the world, therefore, the current regulatory texts of MARPOL Annex VI need clarity.

Decimal placing

3 There were multiple cases where different decimal placing had been used in test reports giving rise to disputable situations. Subsequent verification and enforcement actions were based on the test laboratory's convention of decimal placing. There should be a single protocol regardless of where the sample is taken, i.e. a MARPOL sample, a commercial sample or an in-use fuel oil sample. Despite a small number of inconsistencies in reporting and readings, INTERTANKO has identified a need to clarify a test reporting and interpretation protocol that can be uniformly understood and applied in practice. This becomes even more urgent when the 0.50% m/m sulphur limit becomes effective on a global scale.

4 Regulation 14.1 of MARPOL Annex VI sets out the limit of sulphur content of fuel oil used on board ships. Regulation 14.4 sets the same limit for ships operating within emission control areas. According to appendix V to MARPOL Annex VI, the sulphur content (% m/m) of fuel oil shall be tested in accordance with ISO 8754:2003. This has been placed in a footnote which is not recognized as a regulatory requirement. It is noted that ISO 8754 is applicable to fuel oils having sulphur contents in the range 0.03% (by mass) to 5.00% (by mass). Paragraph 11 of ISO 8754 states that results should be reported to the nearest 0.01% (m/m) sulphur content for values between 0.10% (m/m) and 5.00% (m/m), and to the nearest 0.001% (m/m) sulphur content for values between 0.030% (m/m) and 0.099% (m/m). It should also be noted that MEPC.1/Circ.614 (15 April 2008) interpreted regulation 14 and required the limits to be expressed with two decimal digits. The revised MARPOL Annex VI adopted in 2008 changed the figures to two decimal places. In addition, in case where the test result yields, for example, 0.10245% m/m, the digits after the two decimal placing need to be rounded. In the rounding operation, accuracy of the test results should not be compromised by truncating numbers or cutting off some decimals. According to ISO 80000-1, Quantities and units, "rounding" means replacing the magnitude of a given number by "rounded number". Here the following rules apply:

- .1 the greater in magnitude multiple is selected as the rounded number if the last digit is ≥ 5 ; and
- .2 the lower in magnitude multiple is selected as the rounded number if the last digit is < 5 .

5 It is therefore INTERTANKO's view that the test result values should have an equal number of decimal places following ISO 8754 and rounded off using the above conventional rules. The principles of two decimal placing and rounding need to be explicitly codified in either MARPOL Annex VI, appendix VI or the PSC Guidelines as appropriate.

6 Verification procedures for MARPOL samples and in-use fuel oil samples, cases are as follows:

	Sampling and testing	Verification	Appendix VI of MARPOL Annex VI	ISO 4259 (if applied)
1	A ship's In-use fuel oil sample taken and tested by Test Lab A	Sulphur content found to be 0.11% m/m	Non-compliant if the average of four sub-sample tests is above the absolute limit.	Compliant

	Sampling and testing	Verification	Appendix VI of MARPOL Annex VI	ISO 4259 (if applied)
			If not, compliant. A deficiency note was issued.	
2	The same ship took a sample from the same location, and had it tested by Test Lab B	Sulphur content found to be 0.10% m/m	Compliant	Compliant

From the above cases, the following questions were raised:

- .1 did the authorities apply appendix VI of MARPOL Annex VI when determining the non-compliance? The answer was "not known";
- .2 does appendix VI to MARPOL Annex VI test procedures apply to in-use fuel oil sample tests, too? This question was already identified at PPR 3 (PPR 3/22, paragraphs 11.6 to 11.7). MEPC 71 agreed that this proposal should be considered at PPR 5; and
- .3 what is the difference between ISO 4259 and appendix VI of MARPOL Annex VI? As can be seen from the table below, the ISO 4259 test procedure uses a single test result as a starting point, whereas appendix VI uses two sample test results as a starting point.

Table 1: Comparison between appendix VI and ISO 4259/8754

Limit in regulation ¹⁴ (% m/m)	Sulphur test result per ISO 8754	
	Lower limit (% m/m)	Upper limit (% m/m)
0.50	0.47	0.53
0.10	0.090	0.11

In addition, they have different approaches in dealing with the sulphur content limits.

Absolute limit verification approach

7 Regulation 14 of MARPOL Annex VI sets out sulphur limits as absolute numbers, i.e. "the sulphur content of any fuel oil used on board ships shall not exceed the following limits". The 2009 Guidelines for port State control under the revised MARPOL Annex VI (resolution MEPC.181(59)) also use the same language that the sulphur content of fuel oil used on board ships is required not to exceed these limits.

8 Document BLG 12/6/17 (Norway) discussed that the sulphur limits in regulations 14(1) and 14(4)(a) were absolute and specifically excluded reference to any relevant test methods' repeatability and reproducibility limits being adopted. No one would disagree. However, a test result can never be any more than 95% confident and to this extent one result to another may vary within the standard deviation curve of test results depending on how many are carried out hence the logic of the ISO 4259. From the fuel suppliers' perspective, the supplier shall ensure that the limit is not exceeded in accordance with the precision limit given in the test method i.e. the target is limit minus the 0.59R so for 0.50% m/m limit, it will be 0.47%. This allows for any exceedance to fall below the given limit as supplied.

9 As far as the regulatory tests of regulations 14 and 18 are concerned, the sulphur limits as absolute limit do not appear to be problematic provided that two decimal placing and rounding are uniformly applied. Here, a true value or an absolute limit, is meant to be an average of an infinite number of measurements scattered randomly throughout a given sample. Thus, finding a true value in statistics is only feasible in theory since it is impossible to collect an infinite number of measurements from a given sample. Appendix VI of MARPOL Annex VI does not refer to ISO 8754, however, it encompasses the principles of repeatability (r) and reproducibility(R). The mere fact that appendix VI applies r and R according to ISO 8754 implies that there is no absolute limit.

10 It is noted that testing fuel oil with ISO 8754 entails the application of repeatability (r) and reproducibility (R). ISO 8754 specifies that the precision (of tests) was determined by statistical examination, in accordance with ISO 4259, petroleum products – determination and application of precision data in relation to methods of test, of inter-laboratory test results on a matrix of samples (ISO 8754, paragraph 12.1).

95% confidence limit approach

11 If the 95% confidence principle is applied, an acceptable range below and above the absolute limits or true values according to ISO 4259 is allowed. The complexity of the subject lies in the fact that ISO test methods are referenced in MARPOL Annex VI in various forms of language making it difficult for ship operators and PSC authorities to understand the overall picture. ISO 8217, which specifies the requirements for fuel oils for use in marine diesel engines and boilers and provides purchasers with different grades of residual fuels and distillates, recognizes ISO 8754 as the reference test method for sulphur content. In case of disputes of not only sulphur but also other properties such as viscosity, density and flash points, ISO 4259 should be used, which covers the use of precision data in interpretation of test results.

12 ISO 4259, which is referenced by ISO 8754 (included in a footnote to appendix V), recognizes the concept that any two or more test measurements of the same property of the same sample by any test method would not usually give exactly the same result. The usual approach adopted is in terms of 95% confidence – i.e. that a single test result either satisfies or does not satisfy a specification limit. This means that in 95% of all measurements, the true value of sulphur content of a given sample will be within the confidence interval, e.g. between the upper limit and the lower limit. Both appendix VI of MARPOL Annex VI and ISO 4259 refer to R (reproducibility) and r (repeatability). The reproducibility (R) of the test method for 0.10% sulphur is 0.0203 as $R = 0.0812 \cdot (\text{criteria} + 0.15)$. Applying 95% confidence yields 0.59 R which equals to 0.01197. Hence, the upper limit is 0.11%. This approach recognizes the common understanding widely shared in science and engineering disciplines that all measurement devices and methods have some degree of uncertainty and depending on who conducts the measurement test results would have some variances.

13 If the Sub-Committee considers it necessary to take into account the 95% confidence limits in regulation 14, INTERTANKO is of the view that, in addition to reproducibility (R) and repeatability (r) of test methods, the 95% confidence limit should explicitly apply and be stated accordingly in appendix VI.

Action requested of the Sub-Committee

14 The Sub-Committee is invited to consider the different views expressed so far and complexities involved in this discussion, and in view of the future work on alignment of verification procedures for both MARPOL samples and in-use fuel oil sample, it is also invited to consider the proposals in paragraphs 5 and 12 in this document.