

## TECHNICAL MEMO

DATE: May 2012

SUBJECT: INCINERATOR USE CONSIDERATIONS IN SPECIFIC TRADES

During the MCRIP conferences and surveys of vessels in a specific trade it became apparent that there are some unique bilge water and sludge management issues that deserve further consideration.

The subject vessels have a sound and effective bilge and sludge management system, but certain aspects may require a higher level of regulatory interpretation to ensure that all stake holders agree that the process has been fully optimized. These issues are summarized in this tech memo, and relate to fuel regeneration in the composite boiler and sludge incineration.

This tech memo is prepared to promote a unified approach to determine the optimal solution that reduces the shipboard workload and meets (and exceeds where possible) all MARPOL and Flag State requirements. Initially this tech memo is circulated between shipboard personnel and shipboard technical personnel that are familiar with technical and operational aspects of these vessels to ensure that the information contained in the memo is correct and to select the optimal approaches from a workload point of view.

***\*\*Eventually the updated memo will be provided to ABS and USCG for review and the final memo will be incorporated into the vessel bilge water management procedures. (Engine Room Bilge Water and Waste Oil (Sludge) Management Procedure (MARPOL Annex I) for Northwest US trade vessels)***

### BACKGROUND: FUEL REGENERATION:

The vessels are fitted with an Aalborg composite boiler that provides auxiliary steam to the ship's plant. These boilers also serve as the vessel's fuel regenerators and, as such, these boilers are fitted with a sludge burner to allow that function.

This boiler is listed for sludge disposal on the vessels' IOPP's and described as follows in the vessel's operation description:

*Through fuel regeneration, these vessels can fully incinerate all sludge that is produced aboard the vessels in these boilers, and due to steam needs during maneuvering the sludge is generally incinerated in this boiler during the vessel's long port approaches in Puget Sound and various Alaskan port approaches. During full steaming periods offshore, the boiler is not used and plant steam needs are provided through the economizer.*

*This process is effective and adequately allows combustion as fuel of sludge during these "inshore" periods in combination with boiler fuel.*

A question was raised whether it is appropriate to burn sludge in port approaches since this may be interpreted as a method to dispose of undesirable fuel components in areas that may have emission restrictions. (The auxiliary boiler is never fueled with heavy fuel oil or sludge along the berth due to concerns raised by longshoremen.)

In particular MARPOL Annex VI regulation 16.5 (as per MARPOL consolidated edition 2006. It is regulation 16.4 in the "Revised Annex VI" booklet)<sup>1</sup> states "Shipboard incineration in auxiliary boilers of sludge oil generated during the normal operation of a ship shall not take place inside ports, harbors and estuaries".

This regulation indicates that this type of incineration is not allowed in the large estuaries in which the vessels operate.

It is noted that the use of an ANNEX VI approved incinerator is not specifically prohibited in MARPOL Annex VI (see Regulation 16.1 both in consolidated 2006 and "Revised Annex VI") inside ports, harbors and estuaries.

Technically it is not clear why Annex VI restricts auxiliary boiler incineration through fuel regeneration, but not stand alone incinerators, since the stack discharges will not be different as far as sludge pollutant levels is concerned. It is also not clear if Puget Sound or Cook inlet fits the definition of "estuary" noting that it is possible to be more than 12 miles from shore (probably the most applicable distance where ship discharges are not "inshore"), and while it is rumored that

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<sup>1</sup> Shipboard personnel will tend to refer to the latest MARPOL consolidated edition (2006 at this time of writing), where it is regulation 16.5. IMO has rewritten Annex VI, but not yet issued it as a consolidated MARPOL revision and in the "Revised Annex VI" (officially named: ANNEX 13 RESOLUTION MEPC.176(58), adopted on 10 October 2008, AMENDMENTS TO THE ANNEX OF THE PROTOCOL OF 1997 TO AMEND THE INTERNATIONAL CONVENTION FOR THE PREVENTION OF POLLUTION FROM SHIPS, 1973, AS MODIFIED BY THE PROTOCOL OF 1978 RELATING THERETO (Revised MARPOL Annex VI)) it is now Regulation 16.4. It could be argued that shipboard personnel should be aware of this latest regulation numbering, but this would require that ships are issued with non-consolidated MARPOL regulations. This "Revised Annex VI" is available in booklet form.

MARPOL somewhere defines the term “estuary”, it is not an ANNEX VI definition. There may also be additional Washington State or Alaska State regulations.

MEPC. 1/ Circ. 736 supports the type of sludge incineration that takes place aboard these vessels, where example #9 in this circular provides an entry for regeneration of fuel from sludge.

The regeneration of sludge into fuel is much preferred over simply incinerating sludge since incineration increases a vessel’s carbon footprint, while the use of sludge as a fuel reduces fuel consumption and carbon footprint. If the vessels were to use the auxiliary boiler as an offshore incinerator when adequate economizer steam is available, it would simply result in poor sludge combustion (since the boiler is not operating at optimal load and fuel/sludge ratios), increased carbon footprint, increased fuel consumption and increased operational workload.

It is significant to note that sludge, by itself, does not contain excess pollutants of the type that are being tracked in air emission standards such as SOX producers (NOX producers are negligible in incinerator and boiler operation) (Since purifiers do not separate sulfur from fuel oil, sludge does not contain a higher percentage sulfur than the purified fuel oil). The sludge that is produced does contain catalytic fines, some of which are metals, ash and low grade oils. Since sludge is a relatively small percentage of the fuel burned in the auxiliary boiler it is not clear if combustion of sludge in combination with regular fuel (which, even when purified, still contains many of the impurities noted above) in an estuary is any more harmful than combustion offshore, and offshore combustion of sludge is inherently more wasteful since it does not produce useful steam.

As such, the following questions are raised:

1. Is the present approach legally acceptable?
2. Is there a specific point where an estuary starts and ends?
3. Can the present practice continue?
4. Are there alternatives?

Without being the least cynical, the MARPOL approach to incineration is to solve pollution through dilution (burn offshore for greater dispersal of any potential pollutants)

Within this context, the issue can be formulated as follows:

Use sludge to reduce carbon footprint with a possible lower dispersal of potential pollutants in estuaries?

Or

Burn sludge offshore with greater dispersal of potential pollutants but increase carbon footprint?

The established alternatives are:

1. Delivery of shipboard sludge to ports for shore disposal, but we do not have concise technical information that shore disposal is more environmentally effective than combustion in the auxiliary boiler for useful steam generation in estuaries<sup>2</sup>.
2. Potentially, the installation of a dedicated incinerator, but a dedicated incinerator does not produce useful steam or reduce pollutants. Oddly, at present, it appears that a dedicated incinerator can be operated in estuaries.

The issue was background researched during the period June through August 2011, with ship personnel discussions and discussions at MCRIP conferences. In addition, an investigation was made to determine if the Aalborg auxiliary boiler sludge burning capacity was equivalent to a standalone incinerator.

We received the following response from Aalborg:

Unfortunately it will not be possible to reclassify the boiler as "incinerator" because for an incinerator there are requirements for minimum furnace and exhaust gas temperatures that are impossible to meet with a boiler, which - despite of a furnace temperature around 1150 degrees C - has normally exhaust gas temperatures less than 400°C. MARPOL stipulates 850°C minimum during continuous feeding (liquid waste). Practically these temperatures are exceeded inside a boiler furnace but

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<sup>2</sup> Even the most responsible trucking and processing of sludge increases carbon footprint. Next, it is not clear if shore disposed sludge is simply incinerated ashore, landfilled, transshipped to third world countries or rebled into ship fuels.

theoretically (and that is what counts in the papers) the measurable exhaust gas temperature of the boiler is way less than the MARPOL limit.

However, I do think that you can continue to burn sludge oil and waste oil in the boilers, at least if properly blended, so that no visible emissions are created. Even with the new MARPOL regulations in force, boilers are still an accepted means of sludge/waste oil disposal.

We have recently equipped a brand new vessel for coastal trade in Canada with a boiler/burner system that features automatic blending to a stable mixture whenever sludge/waste oil is fired. We are using HFO for blending as this is emulgating best with the sludge. Whenever this vessels boiler runs on sludge, the blend consists of stable fractions of 50% sludge and 50% HFO.

The complete system has been designed, commissioned and approved as a means of sludge oil disposal. The sludge oil itself of course has to meet the requirements for max. heavy metal content, but that has nothing to do with the hardware but is an operational issue.

Actually waste motor oil from cars, which is not that far off from the average content of the marine waste oil tank, is burnt in land-based boilers (also in Alaska) with full approval from authorities.

[http://www.columbiaboiler.com/waste\\_oil/](http://www.columbiaboiler.com/waste_oil/)

<http://www.cleanburn.com/index.html>

Therefore I am pretty confident that you should not run into any problems regarding your method of waste oil disposal on subject vessels. If the performance is in doubt or the emissions from the boiler when operating in sludge/waste oil mode need to be confirmed, a full combustion measurement and proof of emissions should be sufficient to satisfy port state control or other authorities.

Based on the above, it is noted that these boilers cannot function as incinerators, but at the same time there is no significant technical argument for not allowing sludge combustion in the port approaches where a MARPOL incinerator can be used. (Regardless, the operator will continue its policy of not incinerating sludge alongside the berth.)

#### **SLUDGE INCINERATION PROPOSED SOLUTION APPROACH:**

Based on available information on August 2011 the following solution approach was suggested as technically optimal:

1. For this class of vessels (which are in dedicated service) establish specific operational areas where auxiliary boiler steam production takes place.
2. Determine the reasonable amount of required auxiliary boiler incineration time for normal levels of produced sludge.
3. Prepare a specific incineration track (area) for these vessels that achieves incineration as far from shores as possible while auxiliary boiler steam is being produced.
4. Discuss this procedure with all stake holders.
5. Obtain USCG and ABS approval of the procedure.

This approach remains technically the most valid since it aims to optimize the use of sludge for useful steam generation.

The simplest solution is to restrict sludge combustion to offshore passages only and to generate useful steam. However, at this stage it is not entirely clear if offshore combustion of sludge combustion generates any useful steam, noting that probably the economizer generates sufficient steam.

At the time of the writing of this memo, and in weighing the alternatives, there is a developing consensus that sludge will be burned in the boilers during offshore passages regardless of the ability to generate useful steam and regular fuel will be used to generate steam during the port approaches, but as noted above this approach is open to improvement from a pure environmental, technical and efficiency approach.