UK P&I CLUB

Carefully to Carry

Flashpoint contaminations of diesel oil and gas oil

The industry has a history of flashpoint contaminations of the next high flashpoint cargo loaded

Past history

The industry has a history of flashpoint contaminations of the next high flashpoint cargo loaded (e.g. diesel oil or gas oil) after the immediate previous discharge of a low flashpoint cargo, such as naphtha or gasoline. In the past such contaminations have led to significant delays and subsequent claims for flashpoint contaminations of the 'first-foots' of the gas oil/diesel oil next cargo loaded.

Disregarding the shoreline contamination scenario, with 'first-foots' so contaminated, there then follows the inevitable dispute as to whether the vessel can continue loading or whether the contaminated 'first-foots' have to be discharged ashore.

In the first case, after re-purging with inert gas, it is hoped that the cargo can be blended back within specification, by dilution with sound cargo. This option is considered to be risky as, if the end result does not conform to the hypothetical calculations undertaken, the vessel now has a full flashpoint contaminated cargo on board.

In the second case, the 'first-foots' are discharged ashore and the tanks re-purged with inert gas before resumption of loading. This option has, in the past, led to significant delays and sometimes substantial demurrage disputes between owners and charterers.

Common industry practice

When preparing cargo tanks to load the next high flashpoint cargo (i.e. gas oil or diesel oil), after a previous discharge of low flashpoint cargo (i.e. naphtha or gasoline), there are several options adopted within the industry:

1 The 'belt and braces' option whereby cargo tanks are hot water washed (not essential but speeds up[1] the subsequent gas-freeing operation) and gas-freed for man entry.

1 The use of hot water expedites tank cleaning and gas-freeing after discharge of low flashpoint cargoes. It removes oil films more quickly and, by raising the temperature of the tank atmosphere, promotes the release of any gas trapped in scale/tank coating and accelerates ventilation.

"The carrier shall properly and carefully load, handle, stow, carry, keep, care for and discharge the goods carried."

Hague Rules, Articles iii, Rule 2

Carefully to Carry Advisory Committee

This report was produced by the Carefully to Carry Committee – the UK P&I Club's advisory committee on cargo matters. The aim of the Carefully to Carry Committee is to reduce claims through contemporaneous advice to the Club's Members through the most efficient means available.

The committee was established in 1961 and has produced many articles on cargoes that cause claims and other cargo related issues such as hold washing, cargo securing, and ventilation.

The quality of advice given has established Carefully to Carry as a key source of guidance for shipowners and ships' officers. In addition, the articles have frequently been the source of expertise in negotiations over the settlement of claims and have also been relied on in court hearings.

In 2002 all articles were revised and published in book form as well as on disk. All articles are also available to Members on the Club website. Visit the Carefully to Carry section in the Loss Prevention area of the Club website www.ukpandi.com for more information, or contact the Loss Prevention Department.

This option clearly results in no flashpoint contaminations, of the next cargo loaded, and has the advantage of allowing man entry for subsequent inspection of the cargo tanks.

Given the past history of such claims we would always recommend that all cargo tanks were at least gas-freed for man entry, before re-inerting prior to loading the next high flashpoint cargo.

This option, of course, may not be available because of any commercial pressure to load the next cargo as quickly as possible.

2 The next best option[2] would be to cold water wash all tanks, ensuring that all liquid lines are flushed in the process, and to recover the sea water/oil slops into the vessel's slop tank(s).

The sea water can then be decanted overboard, from the bottom of the oil/water mixture, before recovering the oil part of the slops remaining into the vessel's oil retention tank.

All cargo tanks would then be purged with further inert gas until the hydrocarbon content of the vapour phase was *'less than 2% by volume'* (i.e. the industry accepted standard).

3 By far the most common option adopted, however, is simply to purge each cargo tank with inert gas until the hydrocarbon content of the vapour phase is *'less than 2% by volume'*.

Given past history this clearly is the most popular option because it is quicker and requires less manpower than the above two options.

Unfortunately the adoption of this option, when not carried out properly, has resulted in the majority of subsequent claims for flashpoint contaminations of the next cargo 'first-foots'.

Hydrocarbon content of the vapour spaces

For reasons given above it is clear that *Option 3* is the favoured option within the industry, even if it has resulted in the majority of claims for flashpoint contamination of the next cargo 'first-foots' loaded.

Given this, an explanation of the likely reasons for such contaminations is necessary.

2 The Energy Institute *Guidelines for the cleaning of tanks and lines for marine tank vessels carrying petroleum and refined products (HM50) – Section 2.5.2* gives these tank washing guidelines, when changing from light volatile low flashpoint cargoes (i.e. naphtha) to high flashpoint cargoes (i.e. gas oil). They not a legal requirement but, because they are based on sensible practice, owners should give serious consideration to adopting such advice.

After discharge of a cargo such as naphtha or gasoline the cargo tank vapour spaces will consist of a mixture of inert gas and predominantly C_{5+} (with some C_3 and C_4 present) hydrocarbon vapours.

Such hydrocarbon vapours are approximately twice as heavy as the inert gas vapours (consisting mostly of nitrogen). Given this disparity in density it is inevitable that the hydrocarbon vapours will want to settle towards the bottom of each cargo tank.

The industry accepted standard, with regard to flashpoint contamination, is to purge cargo tank vapour spaces with inert gas until the hydrocarbon content is less than 2% by volume.

This corresponds approximately to 100% of the lower explosive limit (LEL) of the hydrocarbon vapours present but concerns flashpoint contamination criteria only.

By purging the cargo tanks, with inert gas (inlets at the top of the tank and venting from the top of the tanks), it is assumed that this 'dilution method' is sufficient to reduce the entire vapour space hydrocarbon content to less than 2% by volume.

Unfortunately this is not always the case and a layer of heavier density hydrocarbon vapour is left in the bottom of the cargo tank. This layer of hydrocarbon vapour is absorbed into the 'first-foots' of the next cargo loaded and results in the flashpoint contaminations experienced.

Option 3 – operational recommendations

If *Option 3* is to be the preferred option then the following operational procedures are recommended to ensure that the cargo tank vapour spaces are clear (i.e. lower than the 2% by volume maximum) of hydrocarbon vapours before loading the next high flashpoint cargo:

1 Ensure that all cargo lines and cargo tank sumps are completely empty of the previous low flashpoint liquid cargo.

2 Set the cargo lines so that inert gas is delivered to the top of the tank (as per normal) but that the tanks are vented to atmosphere *from the bottom of the tanks*. This can usually be achieved by opening the liquid lines to the liquid cargo manifolds and, if possible, connecting this outlet to the vent upriser(s).

3 Start inerting 1P/S[3] and venting the bottom of the tanks to atmosphere, via the liquid manifolds. This 'layering method' is considered to be far more

3 This gives the next tanks in line more time for the heavier hydrocarbon vapours to settle to the bottom, thereby improving the efficiency of the overall purging operation.

economical than the 'dilution method' and will ensure that all hydrocarbons are removed from the bottom layers of each cargo tank. 1 to 1½ volume changes should be sufficient for each tank.

4 Continue to inert gas purge each pair of wing tanks in turn (2P/S and so on) until the purging operation is complete.

5 Take hydrocarbon readings from the middle and bottom (i.e. bottom 1 metre level) and confirm that hydrocarbon readings are below the 2% by volume. If the LEL scale is used[4] then a 50% LEL reading will be equivalent to approximately 1% by volume.

6 If this method is used diligently then we consider it unlikely there will ever be any flashpoint contamination problems caused by the vessel.

4 Great care should be taken when using multi-gas detectors in inert gas atmospheres (usually with oxygen contents below 5% by volume). Gas detectors that use *non-dispersive (NDIR) detectors* can be used safely in inert gas atmospheres to give direct gas concentrations in both the *%Volume* and the *%LEL* modes. Some types of gas detector, however, operate using *dual catalytic sensors*. In the *%Volume* mode, with correction factors applied, they will give the correct gas concentrations. In the *%LEL* mode, however, these sensors can only be used in inert gas atmospheres that contain at least 10% by volume oxygen. They cannot be used in normal inert gas atmospheres (i.e. less than 5% by volume oxygen) and, if used in such circumstances, will give unreliably erratic readings.

For further information please contact:
Loss Prevention Department, Thomas Miller P&I Ltd
Tel: +44 20 7204 2307. Fax +44 20 7283 6517
Email: lossprevention.ukclub@thomasmiller.com