

## Bulletin 234 - 02/02: Phosphoric acid damage to tanks

### Phosphoric acid damage to ship's tanks

Over the last few months, an increasing number of incidents of phosphoric acid damage to stainless steel ship's tanks have been observed. Typical phosphoric acid damage is manifest as general steel wastage and/or elephant skin. Phosphoric acid is a crude product and therefore the varieties are legion. Generally, stainless steel tanks found in chemical tankers are resistant to phosphoric acid attack; however, excessive fluoride within the phosphoric acid can initiate corrosion attacks allowing for continuation of the attack by the phosphoric acid itself. Excessive fluoride in phosphoric acid is usually inhibited by the presence of iron and aluminium and therefore it is only in those cargoes which have insufficient iron and aluminium that the fluoride-initiated attack will take place. Recently, however, more incidents of ship's tank damage have been observed with high levels of iron and aluminium which are clearly not fluoride-initiated attacks, but have been caused by some other element. Further research has led to the belief that chlorides (600-800ppm) initiated the corrosion. Although chloride corrosion attacks are typically in the form of pitting, it has come to light that if chlorides initiate the corrosion, phosphoric acid will then continue to attack so that the resulting damage is in the form of general steel wastage and/or elephant skin.

There are of course other corrosion stimulators and inhibitors in phosphoric acid:

CORROSION STIMULATORS		CORROSION INHIBITORS	
Impurity	Action	Impurity	Action
HCl	Spoils passivity, may cause pitting	Fe <sub>2</sub> O <sub>3</sub>	Passivates the steel
HF	Spoils passivity	Al <sub>2</sub> O <sub>3</sub>	Neutralises HF
H <sub>2</sub> SO <sub>4</sub>	Lowers pH, liberates HF action	SiO <sub>2</sub>	Neutralises HF
Solids	May cause crevice corrosion	CaO	Neutralises H <sub>2</sub> SO <sub>4</sub>
		MgO	Neutralises HF

The obligation upon charterers is the implied term not to load dangerous cargoes. Dangerous cargoes are those that are likely to cause damage or delay to the vessel. However, it is always easier to bring claims on behalf of owners against charterers as timecharterers cover a range of cargoes that are rarely individually specified. It is more difficult when vessels are voyage chartered to carry a named cargo of phosphoric acid, such as *Phosphoric Acid – 52/57% Concentration, Max Loading Temperature 45 °C, Max 1% Sediments, SG 1.63/1.7*; because the cargo may meet that specification, but nevertheless be exceptionally aggressive. In such a case, it will be necessary to establish that the cargo was of an entirely different or unusual character from that which was agreed. It is to be noted that stainless steel manufacturers have generally imposed a new, reduced safe loading temperature for phosphoric acid of 35°C.

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