The application and use of marine coatings are under increasing regulatory scrutiny because marine coatings are known to have a positive effect on the structural integrity of a vessel by reducing corrosion when properly selected and applied. In particular, seawater ballast tank coatings have received a lot of attention, starting with the corrosion prevention regulation in SOLAS II 1/3-2 (IMO resolution A 798[19]). This regulation, the first attempt to improve the quality of coatings used to protect ballast tanks, specified particular types...
of coatings and detailed how they should be applied to give long life protection. This regulation, however, applied only to bulk carriers and tankers.

Building on this start, more comprehensive regulations and standards were developed, initially as an industry-led exercise and now with the full backing of the International Maritime Organization (IMO), resulting in the latest regulation, MSC 215(82), the Performance Standard for Protective Coatings (PSPC). This standard applies to all ships over 500 GRT (gross register tonnage) after July 1, 2008, and replaces the above corrosion prevention regulation in SOLAS. However, it also applies to all vessels being constructed after December 8, 2006, under the International Association of Classification Societies (IACS) Common Structural Rules. IACS has issued Procedural Requirement (PR 34) on Application of the IMO PSPC, Resolution MSC.215 (82) under IACS Common Structural Rules for Bulk Carriers and Oil Tankers. PR 34 is to be read in conjunction with PSPC and, under IACS, the PSPC becomes mandatory. It defines the IACS verification role, not the day to day application and inspection. PR 34 aims to enable uniform understanding of IMO PSPC requirements and will expire on July 1, 2008.

A further regulatory step taken by the IMO was to control the type of antifouling hull coatings that can be used.
Your coating has to be tough enough to stand up to the most extreme environments imaginable. And the most scrutinizing coating inspectors. That's why Sherwin-Williams offers the industry’s most complete range of corrosion-resistant coatings and linings engineered for the harshest environments to provide superior protection and minimize costly downtime.

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Coating systems as tough as your inspector.
While ballast tank coating regulations are directed toward safety and performance, regulations for anti-fouling coatings are environmentally driven.

This was not a safety/performance regulation, but an environmental one. The most common biocide used in antifouling coatings was TBT (tri-butyl tin), which has been found to be harmful to non-target marine organisms and the marine ecosystem. The anti-fouling convention was approved in 2001, with a date of entry into service set for January 1, 2008—assuming that it has been ratified by the required number of flag states. This required number was reached in September 2007 when Panama signed the treaty, and the convention will enter into force on September 17, 2008. After this date, ships will no longer be permitted to apply or re-apply organotin-based antifouling systems and may not have these compounds on their hulls or external parts unless they have a barrier coating that will prevent the biocide from leaching out.

It is not surprising that, at a recent Lloyd's List-organized conference on Managing and Preventing Marine Corrosion (London, November 21–22, 2007), many of the presentations covered aspects of the above coating regulations in relation to their implementation. These aspects are discussed below.

Ballast Tank Coatings and Ship Construction

In his presentation, “The Current Problems with Ballast Tank Coatings,” Les Callow of Amtec Consultants Ltd, discussed how his experiences with inspecting older vessels revealed evidence of how construction factors can affect the service lifetimes of ballast tank coatings. In general, it was evident that

- cut edges tend to fail prematurely;
- welds tend to fail earlier than flat surfaces;
- areas of burn-through damage fail early;
- flat areas are generally the last to fail by corrosion; and
- ballast tank under deck areas usually fail first.

The new IMO regulations aim for a 15-year target life, with the remaining coating in good condition. As defined in IACS Rec 8, good means that rust spots on flat surfaces must cover less than 3% of the area under consideration and that there must be less than 20% breakdown on welds and edges. The new regulations aim to achieve these longer coatings lifetimes through improved new construction practices that address the areas of failure noted above by regulating the surface preparation and coating application.

Marcus Cridland (ABS) described how the Ballast Tank Coating Regulations (MSC 215 [82], Performance Standard for Protective Coatings, PSPC) were being addressed within a classification society and what the society is doing to help its customers.

The ability of coatings to resist corrosion over extended periods of time is an important contributor in safeguarding the capital investment of a vessel. Correctly functioning coatings can reduce the rate of corrosion, thereby potentially delaying the use of corrosion margins in a vessel's structural scantlings (dimensions of the ship's structural parts). In recent years, the Class Societies have permitted optimization of scantlings, which has resulted in thinner steel plates being used and subsequent reductions in overall weight of vessels. This meant that coatings were playing an increasingly important role, but their use was unregulated—hence the need for the PSPC.

The PSPC addresses key points by adopting industry best practices as minimum requirements, setting clear production QC standards; imposing explicit inspection testing and verification; and requiring appropriate documentation of production, inspection, and testing activities. General help is contained in the ABS Guide for CPS Notation and the 3rd edition of the ABS Guidance Notes on the Inspection, Maintenance, and Application of Marine Coating Systems, updated to include PSPC requirements. For example, there is a coating process flow diagram, cross referenced to the PSPC review steps, and examples of typical required daily log of records, although it was noted that some interpretations of the Standard still need to be debated by IACS.

Anti-fouling Regs and Paint Companies’ Responses

In response to the Anti-fouling Systems Convention (AFSC), the major marine paint manufacturers voluntarily decided to withdraw tin containing
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TZ 904 is a high-build modified epoxy coating engineered to provide outstanding protection for steel structures in tidal splash zones and other immersion environments. Easily applied, it offers a fast cure time, excellent adhesion, and outstanding film build in a single coat — with no sag. All of which means rapid application with less maintenance downtime.

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antifouling hull coatings from the market before the IMO convention enters into force. The EU also passed legislation that bans the application of tin-containing coatings and prohibits vessels with tin-based antifoulings from entering EU ports.

The paint industry responded to these regulations by further developing anti-fouling coating technology based on other fouling control mechanisms. The first coating developed uses alternative active species (biocides) in formulations similar to the banned tin-based systems. However, Edward Kleverlaan of IMO, in an update of the AFSC, noted that the effect of some of these active species on the environment and humans was being studied.

The other new technology is based on non-stick (fouling release) coatings, and examples of these were given by three suppliers. Martin Pauwels and Martin Weightman (Subsea Industries) described their totally non-toxic system based on a vinyl ester resin containing a high loading of glass platelets. This system can provide a very smooth, tough coating that is effective against corrosion and fouling. Fouling does not easily adhere to this smooth surface, which can be regained by in-water polishing to extend lifetime further.

Torben Rasmussen (Hempel) described a fouling release coating based on silicone resin and gave evidence of how the coating reduced hull skin friction and optimized fuel consumption.

John Willsher (International Paint) described fouling release coating technology based on silicone resin technology and the latest development using fluoropolymers. Silicone fouling release systems contain no biocides, have low surface energy due to a very smooth, "slippery" surface, and work well for fast and active vessels. Fluoropolymers are purported to create smoother, tougher coatings with better fouling release and static properties, and can be used on more vessel types/trading patterns.

**Challenges: Present and Future**

Andrew Alderson, Director Technical Excellence Centre, Registro Italiano Navale, summed up the latest regulations and, looking to the future, highlighted the challenges these regulations raise for the coatings industry. Alderson is also chairman of the IACS Expert Group on Coatings and sits on various industry technical panels.

The PSPC for dedicated seawater ballast tanks in all types of ships and double side skin spaces of bulk carriers is prescriptive for the types of coatings and control needed, said Alderson. It is not, however, a barrier to innovation. Article 5 invites governments to encourage the development of new technologies and alternative coating systems and to keep the Organisation advised of any positive results. These alternatives to the specified coating can include special steels or alternative coatings (e.g., quick dry).

Alderson also raised several questions. What about alternatives to the inspector or methods of inspection? As required in the PSPC, this has a large resource requirement and is slow. There are quick drying coatings available, but are there quick inspections? Possibilities include automated inspection using robots and smart coatings (self-indicating, optical coatings) but how can these be validated?

Future regulations are underway to cover the coating requirements in voids and cargo spaces of oil tankers and for the inspection, maintenance and repair of marine coatings. Can we use certified coatings for cargo tank coatings in crude oil tankers? What is the composition of the crude oil being carried and how will the ship master know if his coatings are compatible?

For inspection, maintenance, and repair, guidelines are being developed based on IACS Rec 87. The guidelines for ships’ staff need to be simple and clear, or do we need qualified inspectors onboard?

Another IMO Regulation is the Ballast Water Convention. This is not a coatings regulation, but it impinges on coating performance or lifetime. This convention aims to stop the transport of invasive marine species from one part of the globe to another in the ballast water by ensuring the water is treated before discharge into the sea or is discharged into fixed onshore facilities where it can be treated.

Several onboard systems have been developed, but the question remains: should these ballast water treatment processes be compatible with the prescribed coatings, or should coatings be compatible with the systems?

It is obvious that the marine coating industry is in a dynamic era, with more and more regulatory input. This can only improve the performance obtained from coatings, but can this be achieved without excessive cost to the industry—which negates any advantages gained from longer lifetimes? Only time will tell.
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