WHAT WE KNOW ABOUT...

ANTIFOULING AND THE MARINE ENVIRONMENT

Antifouling coatings and their effects on the marine environment are explored in this fact sheet.

INTRODUCTION

Biofouling describes unwanted marine organisms such as barnacles and algae which colonise submerged structures, including the hulls of vessels. Biofouling can reduce the speed of a vessel, increase fuel consumption due to drag and can, on occasion, damage the structure of the vessel. It can also transfer invasive species.

Biofouling occurs in both salt and freshwater but is more rapid and intense in saltwater and research tends to concentrate primarily on estuaries and coastal sites. A review by Beswick (2002) found that limited information on the use or significance of antifoulants in freshwater environments is available, although the report noted that users take a responsible attitude to the use of antifoulant, being keen to minimise the effect on the wider environment and non-target species. With this in mind this fact sheet is primarily concerned with marine inputs.
HOW DO ANTIFOULANTS ENTER THE ENVIRONMENT?

Antifouling is released to the environment through two methods:

1. Through leaching directly from the paint; and
2. Through maintenance, removal and re-application of paints after each season.

A study commissioned by the Environment Agency and WRc (Boxall, Conrad & Reed 1998) concluded that the majority of copper in antifouling enters the marine environment through leaching, and that only a small proportion enters during the removal of antifouling paint, which occurs mostly by water blasting or mechanical scraping. However, the concentrated nature of the biocide in scrapings and cleaning residues may increase localised toxicity.

ANTIFOULANTS IN THE CONTEXT OF RECREATIONAL BOATING

The Green Blue has identified a wide range of studies that have been undertaken, both in the UK and overseas that have attempted to quantify the inputs from the recreational boating sector. These papers have been placed in a searchable online database at www.thegreenblue.org.uk.

It is not clear from existing studies what the percentage input from recreational boating is as the chemicals used in boat antifouling are also used for a large number of products and processes unrelated to recreational boating; for example preservatives, pesticides, fungicides, pest control, ceramics and environmental impacts of TBT were considered significant and led to a ban for recreational boat use (vessels under 25m) in 1987. Since then the majority of antifoulants have been copper based, in which the main biocide is cuprous oxide, which is toxic to marine life, thereby stopping the build up of organic fouling. Organic biocides are commonly added to copper-based antifouling preparations to boost performance. The most commonly used biocides in antifouling paints are Sea-nine 211, dichlofluanid, copper and , zinc pyrithione, zinc omadine and zineb. These are controlled under the Biocidal Products Directive (98/8/EC).

Some antifouling compounds, such as copper, can bioaccumulate in areas of high boating activity, leading to indirect impacts on marine wildlife further up the food chain. Heavy concentrations of boating related activity antifoulants have been proven to lead to damage in non target species, eg bi-valves and crustaceans. Impacts of TBT on dogwhelks has been well documented (Callow & Callow, 2002; Cefas, 2002, Thomas et al, 2001) but data on the effect of cuprous oxide is lacking although much work is currently underway for the new Biocide Directive.

WHAT ARE ANTIFOULANTS?

Biofouling is commonly prevented or impeded by the use of antifouling coatings. Antifouling can work in two ways:

1. By providing a sufficiently smooth surface that marine life can only weakly adhere to and can be removed manually. This paint is still largely in the development phase for slower recreational vessels, i.e. sailing boats, but can be used with some success on motorboats.
2. By containing one or more biocides that leach out into the environment and discourage the settlement of marine life.

Historically the main ingredients in biocidal antifouling coatings have been copper or tributyltin (TBT). However, the main biocide is cuprous oxide, which is toxic to marine life, thereby stopping the build up of organic fouling. Organic biocides are commonly added to copper-based antifouling preparations to boost performance. The most commonly used biocides in antifouling paints are Sea-nine 211, dichlofluanid, copper and , zinc pyrithione, zinc omadine and zineb. These are controlled under the Biocidal Products Directive (98/8/EC).

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glass, fabric and leather manufacture. Paths to the environment include sewage discharge, urban and agricultural run-off, industrial discharges and drains. The diffuse nature and wide range of these inputs poses difficulties for identification of single sources and further research is required to address this.

A study which looked at water and sediment quality across the Essex estuaries European Marine Site (Chesman et al, 2006) addresses the spatial extent of the issue for recreational boating inputs. Studies undertaken showed the highest levels recorded are concentrated around marinas and boatyards where boats are stored and maintenance is carried out. This is confirmed through other reports including Thomas et al, 2001 and CEFAS 2003 which all conclude that impacts decrease with distance away from such sites.

A large number of the studies undertaken to date have focused on products now banned for use in antifouling coatings. For example TBT, banned from leisure craft in 1987, has been well studied to determine its impact on the marine environment. Studies have shown that concentrations of TBT in both sediment and water have decreased, however, hotspots still persist in areas of high recreational boating use (Chesman et al, 2006, Thomas et al, 2001).

This persistence of TBT in the environment, which leads to higher concentrations in sediments around marinas, presents a potential problem for dredging operations, which can lead to re-suspension of contaminants. Legislation and guidance is in place to monitor and control dredging activity and this will continue to be assessed on a case by case basis.

Of those products that are used for antifouling, copper antifouling paints currently presents the Best Practicable Environmental Option (BPEO) available to the marine industry, however, there are a number of potential environmental impacts that may occur from using copper antifouling paints and this is driving the marine industry to trial and research new materials and methods for antifouling of boats.

One area where boat owners can act positively and minimise their impact is through control of wastes from in-water cleaning and wash down and re-application of paints. Guidance provided in this fact sheet and in other publications such as the Environment Agency Pollution Prevention Guidelines 14 for marinas and craft will help boat owners to reduce any impacts from antifouling use.

There is a separate fact sheet available about the use of close loop wash down systems for removal of antifoul residues.

REGULATORY FRAMEWORK

Manufacture
The EU Biocides Directive is concerned with the regulation of biocidal products on the market and applies to a wide range of products including antifouling paints. The Directive is implemented through the Biocidal Products Regulations 2001, applicable in England, Wales and Scotland and through the Biocidal Products Regulations (Northern Ireland) 2001 as amended for Northern Ireland.

Under these regulations, all of the biocides used in the marine industry in the UK had to be evaluated by 2008 with regard to their efficacy and safety to humans and the environment. Only substances having passed this evaluation, as ‘low risk’ or ‘basic’ substances, will be listed in Annex I of the Directive and can be placed on the market. This review led to the subsequent banning of Diuron and Irgarol 1051 for use in antifouling on vessels less than 25m in length.

Use
No specific legislation is in place to regulate the use of antifouling paints by boat owners, however general provisions under the Water Resources Act 1991 regulate any polluting matter entering controlled waters. In addition any waste material collected from boat wash down and maintenance is classified as a hazardous material and will require disposal under the Hazardous Waste Regulations in an appropriate manner.

One area where historic use of TBT in particular becomes a concern is where TBT has built up in sediments. This is often the case in marinas and boatyards and the need for dredging to maintain access can release contaminants back into the environment. CEFAS have issued guidelines for limits on levels in dredge spoil for licencing of disposal at sea to ensure levels do not exceed environmental standards.
BEST PRACTICE ADVICE

Topside and antifouling paints and varnish including used brushes, solvents, rollers and trays are hazardous waste and should be disposed of accordingly.

The key is to prevent anti-fouling from unnecessarily entering the water. Skirt the hull when scrubbing down or painting the hull and use a tarpaulin to catch the flakes and drips. Don’t leave a coloured patch under your boat!

If washing off on a slipway, use a device such as loop of rope to trap any paint particulates and then sweep up and dispose as hazardous waste.

Look into alternative hull paints, such as hard vinyl, silicone or Teflon, which are suitable for in-water hull cleaning systems.

Dust from sanding paint and antifouling coatings is toxic. Using a dustless vacuum sander will also protect your health.

If you use scrubbing piles, only scrub off the fouling and not residue paint – be careful not to let old or new paint enter the water.

Select a marina, club or boatyard which has a closed loop scrub-down facility which collects residues and wash down.

Select the right type of antifouling for your craft and boat usage – take advice from your chandlery. Use water-based paints where possible or low VOC (Volatile Organic Compounds) paints.

Apply the right amount of antifouling required and do not spill it – when applying use a sheet to collect drips.

REFERENCES