

HAZARDOUS

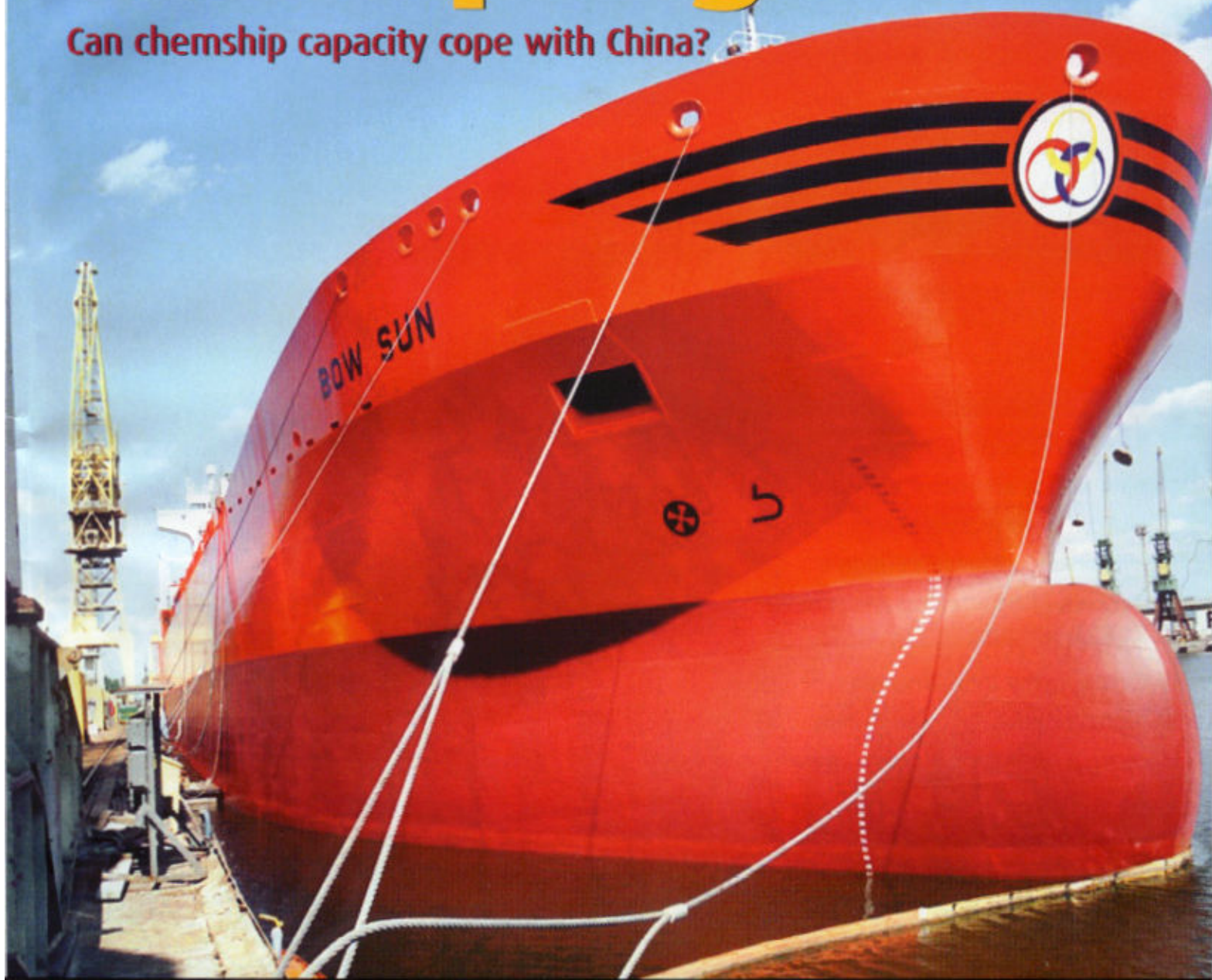
CARGO BULLETIN

HCB Covering the transport and handling of oils, gases and chemicals

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Response personnel deserve to be protected from dangerous vapours

String of beads

VAPOUR CONTROL In many VOC spill situations it is the vapour not the liquid that presents the greatest danger. Imbiber Beads® can help to prevent the development of an explosive or toxic atmosphere, their manufacturer claims

The February 25, 2003 edition of *USA Today* illustrated a danger to the public that many - including the 'experts' - are either not aware of or have chosen to ignore. A photo shows two firemen attempting to clean up gasoline that has leaked into a storm sewer in St Cloud, Minnesota. The accompanying caption states that they are using "absorbent pads" to clean up the spill.

Gasoline is a member of a group of hazardous liquids referred to as 'volatile organic compounds' or VOCs. These materials have an odour, have a very low flash point, and surround us in large volumes as we go about our daily routines. It is obvious from the photo that the firemen are unaware of the danger they have placed themselves in and the danger they are presenting to the surrounding area. Aromatic VOCs release hazardous vapours very readily - and it is the vapours that are toxic and that

support combustion.

Unfortunately, while the firemen are cleaning up the spill, they are actively encouraging the generation of combustible and toxic vapours.

The material they are using to mop up the liquid relies for its effect on providing a huge surface area to which the liquid adheres. Technically speaking, it is an adsorbent pad and not an 'absorbent', as the article suggests. A lack of understanding of the difference between adsorbents and absorbents has unfortunately been promoted by the proliferation of dozens of similar sorbent products available to spill cleanup teams.

The range of adsorbents - surface coating materials - on the market includes products such as polypropylene pads, peat moss, cat litter, sawdust and sand. In each case, however, the increase in surface area, which works well to mop up the liquid, actively en-

courages the generation of vapours - and this will be the case no matter how much adsorbent material is used. The use of such sorbents is particularly hazardous in confined spaces, such as sewer systems, where VOC vapours can build up to dangerous levels.

Here's the difference

Since the spilled liquid is contained on the surface of an adsorbent, it can also be removed. This may be important if separation following recovery is required. However, it can also be detrimental: the spill may be removed from the adsorbent inadvertently by water used in the cleanup; it can leak during transport to the disposal site; and it can contaminate personnel that are dealing with the removal of the waste.

Vapour generation is often suppressed by the use of foam, which blankets the VOC liquid. Such techniques are effective so long as the foam is not disturbed. However, where there is running water, such as in a sewer, it is difficult to maintain the foam blanket and, so long as the spilt product remains in a liquid state, it will continue to have the potential to generate vapour.

The only method of eliminating 'free liquid' and the potential to generate flammable and/or toxic vapour is to apply an *absorbent*. The difference between adsorbents and absorbents is illustrated by the definition of the latter in the *World Catalog of Oil Spill Re-*

pollution control



Blanketed by beads, the fire is manageable

(Blanketed by Beads, the fire is manageable)

response Products: "Absorption only includes those cases in which the oil combines with the sorbent material in such a way that it neither leaks out nor can it be squeezed out."

The Catalog - which is widely recognised as the authoritative source book for the oil spill response industry - also says that the only known products that currently meet this definition are Imbiber Beads®, manufactured by Imbibitive Technology Inc (Imtech) of Midland, Michigan, US. Imbiber Beads are solid plastic spheres, about the size of table salt (150 to 400 microns diameter). Rather than soaking liquid up into pores or voids in the beads, the solid structure of the absorbent swells and contains the liquid within its solid matrix on a molecular level. The liquid cannot leak out, even if the beads are sliced in half.

Imbiber Beads are engineered to absorb a broad range of organic oils and chemicals. Their polymer is cross-linked in such a way that, rather than dissolving in gasoline or another solvent, it loses rigidity, becoming at first sticky then swelling to an equilibrium point.

The beads maintain their structural integrity at the maximum swell point, even in excess liquid. Once liquid is absorbed into the beads, it cannot be re-released; the beads cannot be wrung out or cleaned out in a centrifuge. Depending on the liquid being absorbed, the beads can hold up to 27 times their own volume of solvent.

Tests verified to Environment Canada standards have shown that, over a 12-hour period at a temperature of 22°C, Imbiber Beads swelled to 27.6 times their volume



Without blanketing, the fire is intense

(Without blanketing, the fire is intense)

when placed in xylene (representing aromatic liquids) and 22.4 times their volume in No 2 diesel fuel (representing aliphatic liquids). By contrast, adsorbent materials cannot adsorb more than their own volume, even under ideal conditions, because of the mechanism involved.

Testing and using

These properties reported by the manufacturer, have been corroborated by independent testing. The Maritime Disaster Prevention Centre (MDPC) in Tokyo, Japan tested Imbiber Beads against a locally produced powdered gelling (or 'thickening') agent. One significant difference is that Imbiber Beads have a specific gravity of 0.96, allowing them to settle into the test liquids, whereas the gelling agent has a specific gravity of 0.4 and had to be stirred to facilitate contact with the liquid.

Partly as a result of this, the test showed that, for Imbiber Beads, the solidification process was almost immediate with most of the test liquids.

It was felt that this was an advantage in terms of protecting response personnel and minimising secondary contamination. MDPC found that, of the 35 liquids tested, 23 were immobilised completely by Imbiber Beads within five minutes. This list includes seven of the top ten hazardous substances imported into Japan, namely xylene, benzene, styrene, toluene, cyclohexane, acrylonitrile and ethylene dichloride.

The MDPC test confirmed that Imbiber Beads immediately reduce the rate of vapour release by between 83 and 95 per cent, depending on the vapour pressure of the liquid involved. MDPC also recognised that in many incidents (especially those involving volatile products), it is the vapour generation that presents the greatest risk during response operations.

The fact that products such as gasoline evaporate readily means that the long-term environmental impact of a spill is usually limited, but in the immediate response phase personnel can be put at risk by flammable or toxic vapours.

These test results have been confirmed in the field by a large US chemical company, which applied Imbiber Beads during two incidents involving the release of styrene. The company says that the measured concentration of styrene vapour in the air was immediately reduced by 97 per cent when the beads were applied. The same company also notes that, while the beads are much more expensive than conventional adsorbent pads, the fact that they can soak up much more spilt liquid means that, in application, they are cost-competitive.

Another testimonial comes from Pacific Environmental Corp (Penco), which used a blanket of Imbiber Beads on a gasoline spill at a service station in Kailua, Hawaii in March 2003. The spill had accumulated in a manhole in the storm drain system, where the VOC vapour concentration was very high.

Penco says that, within minutes of applying the blankets, the vapour readings dropped to less than 1 per cent, quickly elim-

inating the explosion risk and allowing personnel to proceed with the cleanup.

Imtech says that telecommunications company Verizon has also begun using Imbiber Beads exclusively when removing migrant hydrocarbons from its manholes and vaults across the US.

Serve the public

Imbiber Beads are not, however, a solution for every spill, as the developer acknowledges. They should not, for instance, be used in the case of a spill involving an oxidising substance or with potentially reactive mixtures.

On the other hand, they can be applied to non-oils such as chlorinated solvents and the polymer material is completely hydrophobic, so it absorbs no water at all.

The fact that the amount of material needed to collect a spill is so much smaller than is the case with traditional adsorbents also makes a difference when it comes to disposing of the waste material. Firstly, the volume of waste to be hauled away is less. Furthermore, one user reports that they can be easily incinerated, having a high thermal value and leaving little ash. Disposal must, of course, be undertaken in accordance with locally applicable environmental legislation.

"The public at large has become comfortable and complacent with the fact that they are exposed to ever-increasing amounts of hazardous materials as they go about their daily routines," says John S Brinkman, president of Imtech. "In many instances they are not aware of the dangers that surround them, as is evident by watching any gasoline service station and the number of times someone will casually fill up while their automobile engine is running, an ignition source such as a lit cigarette is within close proximity, or in spite of repeated warnings concerning the use of cell phones while refuelling.

"It is our contention that industry at large is not prepared to deal effectively with a major hazardous chemical release", Brinkman continues, "in spite of what we are led to believe by most response organisations." He makes the point that high-profile spill events, such as the *Exxon Valdez* accident in 1989, have encouraged governments, the media and response organisations to focus on the prevention of oil spills, leaving the public unprotected from the dangers of spills involving VOCs.

"In the past, emergency spill response procedures (for VOCs) amounted to little more than evacuating the hazard zone and waiting for Mother Nature to deal with the situation, either through evaporation or dissipation into a water column," Brinkman says. "In today's environmental climate and increased public awareness, neither of these options is acceptable."

More information on the Imbiber Beads technology and applications can be found at www.imbiberbeads.com. The website also has details of Imtech's offices in North America, as well as contact details **ICB**