OIL DISPERSANTS TESTED

Few things are as devastating to seashore environments as large oil slicks washed ashore. The oil clings to plants, sand, and rocks, and can kill fish, birds, insects, and vegetation. If detergents are used to remove it, these can cause even more damage to living things. The effects of alternatives—bull-dozing, steam-cleaning, and burning—can be just as drastic.

In 1967 the tanker *Torrey Canyon* ran onto rocks and was holed off a beach resort stretch of the coast of Cornwall, England. Oil poured out and was washed ashore with results that drew world-wide attention to the damage a large slick can do. In 1970 another tanker, the *Oceanic Grandeur*, ran aground and was holed much closer to home—in Torres Strait.

A series of Australian Federal–State meetings to draw up a 'National Plan to Combat Pollution of the Sea by Oil' began the following year. The plan is based on stockpiling dispersant around the Australian coastline. Its aim is to prevent damaging oil slicks coming ashore.

Spraying large quantities of dispersant onto the ocean is undesirable and should only be considered when the consequences of not doing so are likely to be bad. However, some dispersants are much more harmful than others. It was necessary to select a chemical that would disperse oil effectively and cause the least possible damage to marine life.

The committee appointed by the Australian Department of Transport to help it prepare the plan asked a group of scientists to prepare specifications for dispersants and to assess what was offering. Two of the scientists are from CSIRO—Dr Bill Mansfield, who was with the former Division of Applied Chemistry when the research was done and is now at the Division of Atmospheric Physics near Melbourne, and Mr David Tranter of the Division of Fisheries and Oceanography at Cronulla, south of Sydney. The others are Dr Douglas Kerr of the Department of Minerals and Energy and Mr Ken Pirani of the Department of Defence (Navy).

The product chosen by the Department of Transport on the scientists' advice appears to offer the best combination of efficiency and low toxicity, and to be superior to some that have been stockpiled overseas for oil slick control. The toxicity of mixtures of the dispersant and oil remains to be tested.

When oil is spilled on the ocean, its

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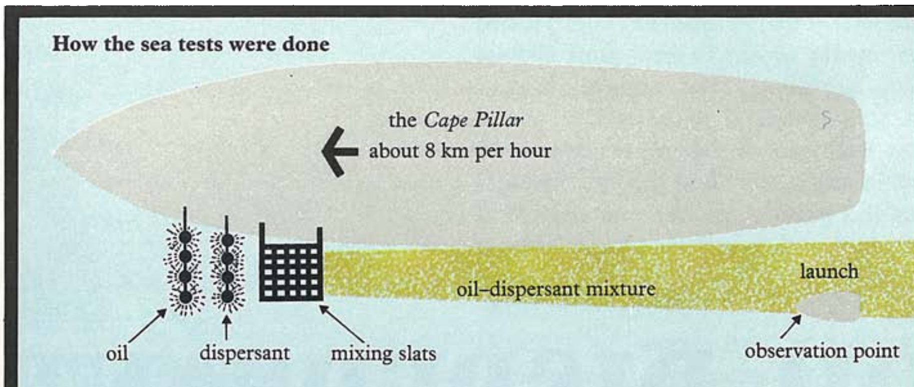
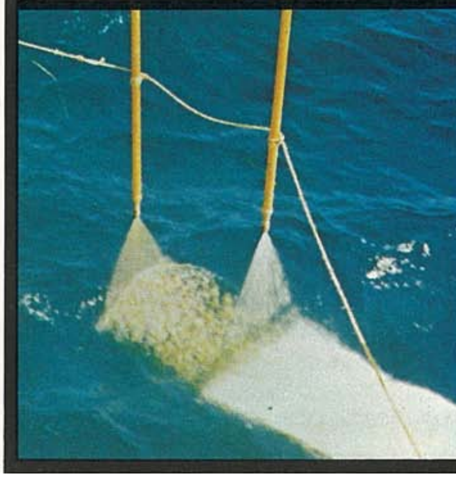
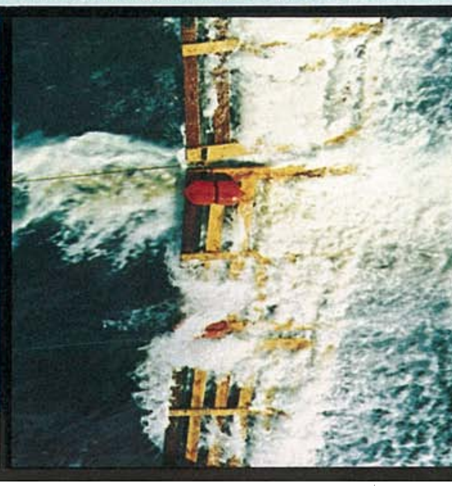
An oil-killed penguin found on Phillip Island, Vic.



Observers on the launch watch out for free oil. If the flow rate of oil from the *Cape Pillar* is low when they see it, the efficiency of the dispersant is poor. If the rate is high, so is the dispersant's efficiency.



A dispersant is tested at sea. Oil is sprayed from the first boom and dispersant from the second.



Slats agitate the oil–dispersant mixture in a sea trial.

outwards spreading begins at a rate of about 10 to 50 cm per second. The more oil there is, the longer spreading continues; 10 tonnes, for example, will spread until it covers an area about ½ km square. In a settled slick, the oil over perhaps a tenth of the area, at the centre, is about 2 mm thick. The rest is much thinner—mainly about 0·002 mm.

Slicks break up—with time

With exposure to the atmosphere and ocean, some components of the oil evaporate and water is absorbed by what remains. The mixture becomes less fluid and easier for waves and ocean swell to break up. In time—it may be only a few days but it can be much longer—the slick will fragment of its own accord and disperse. The accepted view is that, if the oil isn't going to come ashore, nature should be left to apply its slow but sure removal procedure. Dispersant should be used only when absolutely necessary.

In enclosed, calm waters, oil slicks can be removed using absorbent powders, sponges, and various skimming and sucking devices. But dispersal is, to date, the only effective means of attack in the open sea.

What dispersant chemicals do is encourage a slick, with help from the ocean waves, to break up into very small droplets, which spread out and are diluted to harmless concentrations. A fresh slick is much easier to break up in this way than one that has been exposed to the air and ocean for some time. One part of dispersant to ten parts of oil will do the job with a new spill, whereas an 'aged' slick, if it is going to respond at all, is likely to need one part to every four. So if there's doubt about whether a slick will come ashore and cause serious damage, a dilemma arises—to disperse or not to disperse?

Will it come ashore?

Findings by Dr Kevin Spillane of the Division of Atmospheric Physics should assist people who have to make this decision. He has shown that oil slicks move with wind at about one-fortieth of the wind speed measured 10 m above the ocean surface. If sea currents are known in a spill area, these, with meteorological data and Dr Spillane's or a similar formula, should make it possible to predict a slick's progress with reasonable accuracy. Unfortunately currents near the coast are more varied and changeable than those further out to sea, so the closer a slick is to the shore, the less predictable its course becomes.

The dispersing abilities of commercially available chemicals were tested in the laboratory and at sea. In the laboratory tests the scientists put sea-water, oil, and dispersant in a converted washing machine, agitated the mixture, and let it stand for 20 minutes. Then they removed samples from the bottom of the machine's tank. The oil content of these was highest when the most effective dispersants had been used; a good dis-

Cleaning an oiled beach is difficult and damaging. Here oil was washed ashore in Botany Bay, Sydney, when a pipeline ruptured.

Dispersant is sprayed onto oil spilled by the *Oceanic Grandeur* while another tanker offloads oil from the holed ship.

Oil from the *Oceanic Grandeur* breaks up after dispersant is added.

persant produced almost uniform mixing of oil and water, while a poor one allowed most oil droplets to float to the surface during the standing period.

The scientists found in these tests that some commercial dispersants did a much better job than others. They rated as highly efficient those that kept 70% or more of the oil dispersed. At the other end of the scale, they classed chemicals that kept less than 30% dispersed as not useful.

Tests at sea

The sea tests were done from a lighthouse tender, the *Cape Pillar*. A boom projecting from the side of the moving ship sprayed a small amount of oil onto the water, and another boom sprayed dispersant onto the developing slick. Wooden slats set up behind these booms agitated the mixture.

From a launch travelling beside the *Cape Pillar* behind the slats, researchers watched the sea. The people on the mother ship increased the oil flow rate until free oil was seen passing the launch. The maximum flow recorded varied with the dispersants used—a fast rate signified an effective one. The performance of chemicals in the sea trials was generally similar to their showing in the laboratory.

In assessing the toxicity of different dispersants, the scientists adopted the standard that this could not be considered low unless the concentration needed to kill 50% of brown shrimp kept in a dispersant-water mixture for 48 hours was more than 2000 parts per million. Virtually no testing with Australian species had been carried out, but the results of overseas tests suggested that none of the dispersants assessed as highly efficient would meet the criterion of low toxicity.

At this stage the scientists decided that they would have to recommend that two types of dispersant be stockpiled—one chosen for its high efficiency and the other for its low toxicity. However, they believed it should be possible to prepare a product combining these desirable characteristics.

Then the Department of Transport called for tenders from dispersant suppliers—based on the specifications prepared by the scientists—and in fact several high-efficiency low-toxicity products were offered. None was superior to the others in all respects, but the all-rounder selected, 'B.P.A-B', met all specifications and in some tests was the most effective.

Tests carried out at Monash University confirmed its low toxicity. However, so far, toxicity tests have been carried out only for the dispersant itself. The scientists say further work needs to be done on the toxicity of oil and dispersant mixed together.

More about the topic

Dispersing oil on the sea. D. Kerr, W. W. Mansfield, K. C. Pirani, and D. Tranter. *Search*, 1974, **5**, 424–8.