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No. 3

THE CAVTAT INCIDENT

On 14th July, 1974 at 04.00 hrs in the morning a collision occurred between two ships, the m.v. Cavtat of 2500 g.r.t. (Yugoslavian flag) and the m.v. Lady Rita of 18,000 g.r.t. (Panamanian flag) at a point some 6.4 km south east of Capo d'Otranto. The m.v. Cavtat was badly damaged and after about 3 hours sank in 95 m of water. Fortunately there was no injury to persons - the 28 crew and 2 passengers having been transferred to the m.v. Lady Rita, which then proceeded to Taranto for repairs.

Under normal circumstances this event would have resulted in little more than a short paragraph in local newspapers. As it happened, however, the m.v. Cavtat was carrying a cargo of Antiknock Compound in 900 drums (496 on deck and 404 below deck) and the presence of this material resulted in a spate of rumours and predictions of disasters of "unimaginable proportions". In articles which have appeared in the Press all over Europe, and from as far afield as San Francisco, it has been suggested that the Adriatic will become a 'Dead Sea' and that up to 60 million people could be killed.

What then is the truth regarding this accident and what are the hazards which might in future be encountered?

Antiknock Compound - which is used world wide in the manufacture of motor gasoline - consists largely of chemical substances known as lead alkyls, for example tetra ethyl lead (TEL) and tetra methyl lead (TML). The total quantity on board the m.v. Cavtat was 325,408 kg of Antiknock Compound containing 178,312 kg of lead alkyls or the equivalent of 128,178 kg of metallic lead.

Lead alkyls are poisonous, as are most lead compounds. but there are many chemicals widely used in industry which are much more poisonous. The particular property which makes the manufacture and handling of lead alkyls more difficult than other lead compounds is their volatility - which means that even at ordinary temperatures they give off vapours, exposure to which over a period of time can

lead to poisoning and even death. This vapour hazard has, of course, no significance in the present case where the material is under 95 m of water.

The drums used for carrying Antiknock Compound are specially made, using high grade steel plate 2.5 mm thick. They are zinc sprayed and then painted. It has been shown that they will withstand external pressure, equivalent to that found at a depth in excess of 200 m of sea water, without leaking.

After a long period in the sea, corrosion will result in leaks and Antiknock Compound will escape into the sea. It is not possible to predict with any accuracy the time required for all 900 drums to empty but it could be as long as 10 years.

This statement, which was first made in April 1975, has been misinterpreted in many places. For example, it is sometimes assumed that after 10 years all the drums will suddenly collapse and release their contents - some 300,000 Kg of Compound into the sea. This is not so. At the time of sinking the drums on the m.v. Cavtat varied in age between 1 and 8 years, and their failure will be spread, in random fashion, over the 10 years mentioned.

Antiknock Compounds are liquids, much heavier than water (S.G. 1.6) and under no circumstances would material float up to the surface or be washed ashore. Full drums weigh over 470 Kg and it is quite inconceivable that they could be 'washed ashore' from a depth of 100 m about 7 km from the coast.

Lead alkyls will dissolve in water up to a maximum concentration of about 9 ppm (parts per million) as lead for TML and 1 - 2 ppm (as lead) for TEL. The rate of solution of these materials is very slow and water must remain in contact with them for many days before a saturated solution can be achieved.

It is known that the ocean current flow over the wreck of the m.v. Cavtat is about 15 m/min ($\frac{1}{2}$ knot) in a south easterly direction, i.e. away from the land. It has been shown experimentally that water flowing at such a rate over the surface of Compound will only dissolve sufficient material to give a concentration of, typically, 0.01 ppm (as lead) and that only a layer of water a few centimetres thick will be involved. Exposure to such low concentrations even for protracted periods, would not result in deleterious effects in fish.

Such dissolved material will be further diluted by lateral and vertical diffusion into the main body of sea water. Without more knowledge of the exact direction and

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of the sea bed it is not possible to calculate with any precision the degree of dispersion which will occur. Estimates show, however, that dilution by dispersion will be somewhere between 100 and 1000 times at a distance as little as 10 km from the wreck.

Tetra ethyl and tetra methyl lead are unstable compounds and, in solution in sea water, rapidly decompose to give, first tri alkyl lead and then eventually inorganic lead compounds. The rate of decomposition of tetra ethyl lead is such that after as short a period as 96 hours only 1% of the lead is present as the tetra compound and 99% has decomposed. The decomposition of tetra methyl lead is less rapid but only 1% remains as such after about 28 days.

The rapid decomposition of tetra alkyl lead compounds is of great significance since the tri alkyl compounds are very much less toxic to marine organisms than are the tetra compounds.

For example, tests with fish have shown that tri methyl lead compounds are about 250 times less toxic than is tetra methyl lead and that tri ethyl compounds are about 10 times less toxic than is tetra ethyl lead.

The sea bed in the vicinity of the wreck is reported to be sand covered with a layer (depth unknown) of silt, with occasional small boulders. Antiknock Compound leaking from drums would sink to the sea bed and would destroy marine life (e.g. molluscs, marine worms, etc.) over a limited area around the wreck. No reports of dead fish have been received.

We have experience of one other incident involving shipwreck and Antiknock Compound. In July 1966, a ship (the Seafarer) was run aground on rocks in 6 m of water within 300 m of the promenade of a populous seaside resort. The ship was carrying 190 drums of Antiknock Compound. Due to heavy seas the ship broke up before salvage could be effected and only 33 drums were recovered. No evidence of any lead, or of any ill effects due to lead have ever come to light.

Some fish were killed but the local Government Health Authority diagnosed death to be due to pentachlorophenol, a considerable quantity of which was being carried on the ship.

Following the sinking of the m.v. Cavtat, the Italian Government appointed a Commission of experts to review the problems of contamination etc. The result of the Commission's investigations was published on May 12th, 1976 as follows:

"The presence on the bottom of the Otranto Channel of the m.v. Cavtat, which sank to the bottom with its cargo of Tetra ethyl lead, is not dangerous. This was established unanimously by a Commission convened by the President of the Council of Ministers."

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A group of international experts in marine sciences, convened by the Marine Science Panel of the Scientific Affairs Division of N.A.T.O. met on August 30th 1976 to discuss the m.v. Cavtat.

This group endorsed the conclusions of the Italian Commission and, like that group, made recommendations for further studies to extend our knowledge, especially of the dispersal of materials in the sea.

Octel has consistently advised the authorities that the best course of action is to leave the cargo where it is. Salvage would be difficult and possibly dangerous - not because of the nature of the materials but because of the depth of the water and the hazards associated with deep diving.

G.F. Harrison
20th October, 1976

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