THE LOSS OF THE CHEMICAL TANKER IEVOLI SUN IN THE ENGLISH CHANNEL, OCTOBER 2000

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The Centre for Environment, Fisheries & Aquaculture Science

Introduction

In October 2000, the chemical tanker *Ievoli Sun* travelling from Southampton to Genoa began taking in water due to bad weather in the English Channel. She was taken in tow by a French tug, but sank 24 hours later 11 miles northwest of Alderney.

Ths ship's cargo consisted of:

- 4,000 t styrene
- 1,000 t *iso*-propyl alcohol (IPA)
- 1,000 t methyl ethyl ketone (MEK)
- bunkers of 180 t intermediate fuel oil (IFO180) and 53 t of gasoil.

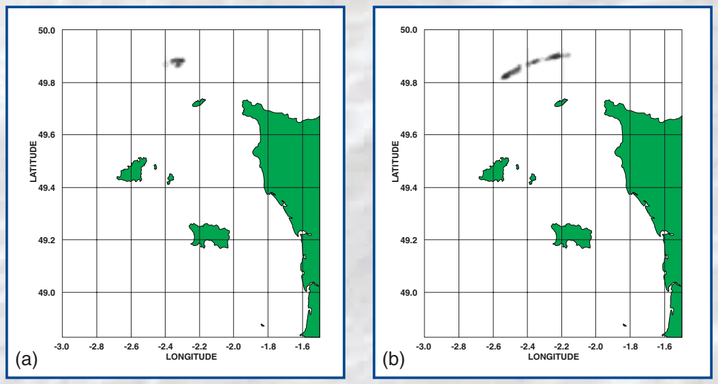
Under a bilateral agreement the French authorities took primary responsibility for salvage, although the vessel sank in UK waters. In such instances, CEFAS provides advice to DEFRA and the FSA on the behaviour, fate and effects of oils and chemicals, and their potential impact on both fish and shellfish stocks and human consumers.

Toxicity of chemicals - behaviour

IPA and MEK are volatile solvents, but are miscible and will become rapidly dispersed and diluted within the water column. Styrene is also volatile but is almost insoluble in water, and has a lower density than seawater. After release styrene will rapidly rise to the sea surface and evaporate. All three chemicals are of low to moderate toxicity to aquatic life and are not persistent, with a very low bio-accumulation potential in marine animals.

Styrene, however, can taint fish and shellfish, and is also considered a possible human carcinogen. There is some evidence that it may have endocrine disrupting properties. The chemical and ecotoxicological properties of Styrene are summarised in Table 1.

Bunker fuels: gasoil is toxic to marine life, but will rapidly disperse in seawater and/or evaporate from the sea surface. IFO180 is more persistent and would form a surface slick but should be

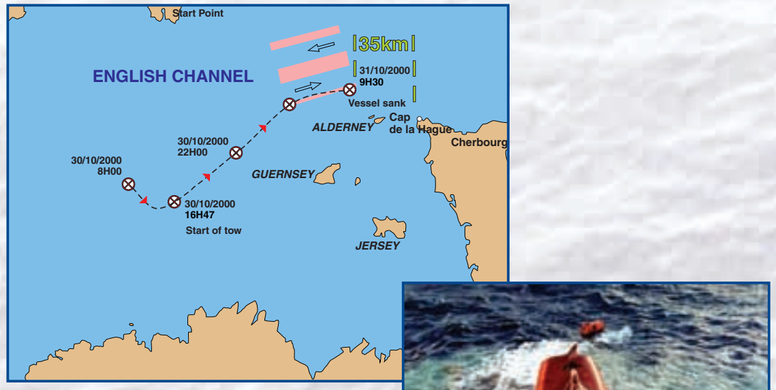


Predictive computer modelling of the movement of styrene on the sea surface, generated by an oceanographic particle-tracking model using real wind and tide conditions. (a) 0600h on 30 October; (b) 1800h on 30 October.

Initial assessment - modelling slick movement

Modelling showed that the combination of winds and tide would keep surface slicks to the north of Alderney, and that there was no immediate likelihood of them approaching land. Our initial assessment was that the spill posed no major threat to either marine life or human consumers. Although toxicity and contamination may be seen within the immediate vicinity of the wreck, it was likely to be both very localised and short-lived.

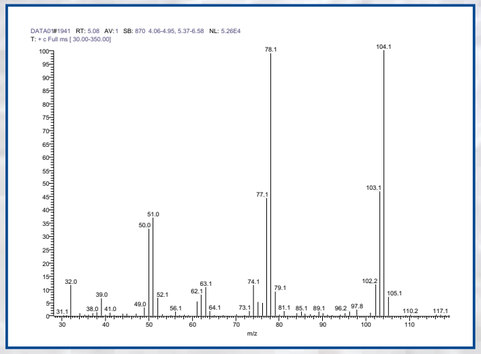
Styrene leakage from the vessel (identified by overflights) consisted of small surface slicks of approximately 1 t, which rapidly evaporated from the sea surface. Northerly winds resulted in chemical smells being reported on Alderney and a monitoring station was set up on the island. On-site monitoring was carried out by the counter-pollution vessel *Neuwerk*. About 1,000 t of styrene was believed lost during the incident.



The English Channel, showing where the Ievoli Sun was abandoned on the morning of 30 October, where she was taken under tow by the evening of the same day, and where she sank on the morning of 31 October 2000.

Contamination of shellfish

Crabs recovered from pots within the 3 mile navigational exclusion zone around the *Ievoli Sun* were recovered and analysed by CEFAS and IFREMER. Styrene was confirmed to be present in their tissues, at concentrations from 7 to 500 µg kg^{-1} wet weight. Such concentrations pose a negligible risk to human consumers. Also, as styrene is rapidly eliminated from tissues, these concentrations represented "worst-case" conditions, and further tainting of fish and shellfish beyond the exclusion zone was unlikely.



GC/MS spectra confirming the identity of styrene in one of the three samples of crabs taken from within the navigational exclusion zone.

Wreck investigation

Remotely Operated Vehicles (ROVs) were used to survey the vessel on the seabed. Following these surveys, the leaks observed in the vessel's hull were sealed, and salvage operations awaited better weather in spring 2001.

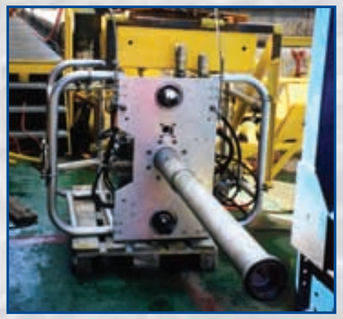
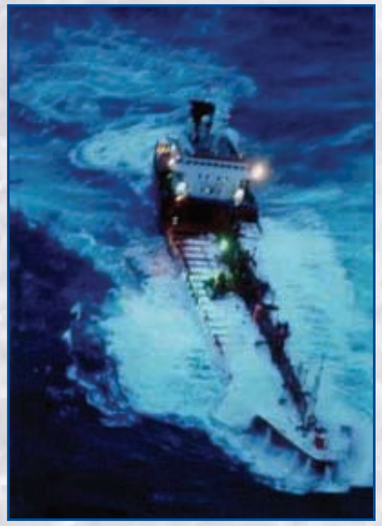


Table 1: Chemical, toxicological and ecotoxicological properties of styrene.

CAS registry number	100-42-5
Specific gravity	0.909
Boiling point	145-146°C
Solubility in water	> 300 mgl^{-1} at 20°C
Vapour pressure	4.5 mm Hg at 20°C
Volatisation $t_{1/2}$	1-14 hours
Ozonolysis/hydrolysis $t_{1/2}$	3.5-9 hours
Biodegradability in lake and groundwater	$t_{1/2}$ in water > 20-30 days
Log K_{ow}	2.95 - 3.05
Bioaccumulation factor	Low, 13-70 in fish
Accute toxicity to aquatic organisms (mainly freshwater data)	2 to 726 mgl^{-1} depending upon species
Predicted chronic no-effect concentration for aquatic organisms	41 $µgl^{-1}$ (hardly any data)
Oral LD_{50} in the mouse	316 mg/kg body $weight^{-1}$
WHO No-observed-advers effect level (NOAEL)	7.7 mg/kg body weight
Tainting threshold in water for fish	250 $µgl^{-1}$ in yellow perch
Taste threshold	94 $µgl^{-1}$
Odour threshold	3.2-2600 $µgl^{-1}$ in water
'Tentative' EQS values (UK):	Annual average 50 $µgl^{-1}$ Maximum allowable concentation 500 $µgl^{-1}$

Cargo removal from ship

The cargo was removed from the ship in April-June 2001. The styrene and IFO180 were recovered, and the MEK and IPA released to the sea in a controlled manner as they presented little threat.



Conclusions

- Over 1,000 t of styrene were lost from the vessel, leading to slight contamination of shellfish in the immediate area.
- 3,000 t styrene and IFO180 were recovered from the wreck on the seabed, and the remaining cargo was released in a controlled manner.
- Initial assessments of the likely impact of the incident made were fully borne out by subsequent events.

Acknowledgements

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Further information

www.equipement.gouv.fr/ievoli.sun

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