

The "Baltic Carrier" Oil Spill – Monitoring and Assessment of Environmental Effects in Grønsund (DK).

On March 29th 2001, the oil tanker “Baltic Carrier” collided with the bulk carrier “Tern” at the western Baltic Sea, near the naval border between Germany and Denmark. The collision between the two vessels was caused by a mechanical defect in the steering mechanism of the “Baltic Carrier”. Because of the collision 2400 tons of heavy fuel oil leaked from the cargo tanks into the open sea. The spilled oil stranded along the shorelines of the sound Grønsund, on the islands of Farø, Bogø, Møn and the North-eastern Falster. So far, this oil pollution is the worst one in Danish coastal waters.

The action

Storstrøm County planned and carried out the environmental survey and monitoring programme in co-operation with the National Environmental Research Institute (NERI), Denmark, and Roskilde University (RUC) under the Grant Agreement SUB 01/323479.

Samples for chemical analysis were collected three times in the first year following the oil spill. In April 2001, shortly after the accident, the first sampling programme was initiated. In mid-June 2001 the second part of the sampling took place, and in December 2001 a third round of samples were collected. Biota samples, flounder and shrimps, were additionally sampled and analysed in May 2002.

Immediately after the oil spill, oil from the ship was analysed. Later, seawater, sediment and biota have been analysed for 86 different polycyclic aromatic hydrocarbons (PAHs), which are considered to constitute the most toxic fraction of the oil. The PAH levels measured in invertebrates and fish were used to evaluate potentially toxic effects to wildlife in the area. Furthermore the obtained data formed the basis of a human toxicology assessment used by the human health authorities in deciding on regulations on fishery and aquaculture in especially the Grønsund area.

In the survey the effects of the oil spill were investigated for the following topics: The acute toxicity of the oil to marine invertebrates was estimated on the basis of laboratory acute toxicity tests. The long-term effects on the macrofauna was assessed on the basis of benthic macrofauna analyses in the field and by comparison to international guidelines on levels of especially polycyclic aromatic hydrocarbons in the environment. Furthermore the effects on birds in the area and the impact of the cleaning operations on the flora were investigated. Finally the issue of human toxicology was assessed.

The aims

The aim of this monitoring programme has been to investigate and assess the environmental consequences of the oil spill after the “Baltic Carrier” in the western Baltic Sea.

In the project the extension and magnitude of the oil pollution after the “Baltic Carrier” incident, were investigated in order to successively provide the basis for information and recommendations to local municipal administrations, citizens, tourists, NGOs as well as relevant industries on the current pollution situation in affected areas. Based on the results of the project, decisions will be taken regarding further clean-up measures and development of long-term monitoring programmes in the area.

The results/impact for the future

Acute toxicity tests demonstrated that both the oil from the "Baltic Carrier" and its water-soluble components were highly toxic to pelagic organisms in concentrations realistic with respect to the situation in the Grønsund. The toxicity towards benthic fauna of sediments contaminated with oil from the "Baltic Carrier" was much lower. However, exposure of a selection of benthic species to oil-contaminated sediment for longer periods of time lead to increased mortality and sublethal effects, showing that realistic concentrations of the "Baltic Carrier" oil could have adverse effects to pelagic invertebrates representative of shallow subtidal habitats of the Grønsund.

Spilled oil may disappear and/or change in toxicological potency as a result of various processes. Analysis of the composition of the oil at a test locality show disappearance of the oil as a result of physical and chemical processes as well as biodegradation. In April 2001, PAH levels in seawater from the Grønsund were of the range 641 to 12 833 ng/L with a median value of 1 115 ng/L. Even after 2½ months, PAH concentrations in seawater had decreased to between 29 and 124 ng/L, close to baseline levels. In general the sediments were very heterogenous in PAH content. The largest petrogenic input was found at the southern coast of Møn, Bogø and Farø. PAH levels measured in sediments from April, 11 days after the oil spill, were in the range 90-4,119 µg/kg DW. In June the overall level was 46-1304 µg/kg DW, and in December total concentrations of 81-1018 µg/kg DW were measured in sediments from the area.

The PAH level in blue mussels only decreased slowly. In June concentrations of 132-1031 µg/kg ww were measured, while levels in December were 185-894 µg/kg ww. These later values are up to 5 times above levels measured elsewhere in Danish waters. PAH levels in shrimps from Grønsund decreased from 770 µg/kg ww by a factor of 10 during the first year after the "Baltic Carrier" incident.

The levels of PAHs in trout from aquacultures in the area created the basis for the recommendations by the National Veterinary and Food Administration. Both the sum of PAHs and the calculated benzo(a)pyren (B(a)P) TEQ values in contaminated fish 1½ months after the accident were of the same order of magnitude as calculated B(a)P-TEQ values from comparable Danish areas unaffected by the oil. Therefore it was considered safe to eat fish from the Grønsund area.

Levels of PAHs in seawater, sediments and biota were compared to the Ecotoxicological assesment criteria (EAC) defined by OSPAR. In April, immediately after the oil spill, concentrations of anthracene in water samples from the entire Grønsund region were at a level likely to cause detrimental long-term biological effects. In sediment samples from the same period especially pyrene exceeded international guidelines at several stations, thus indicating the risk of harmful effects to organisms in the area. Based on international guidelines the toxicological potential of both water and sediment has decreased during the three sampling periods described in this survey. In December, levels of all studied PAH compounds were stillexceeding the EAC values in the Bredemede Hage –Fanefjord area, while the rest of the area revealed concentrations below these valuesThe risk of long-term adverse biological effects in the Grønsund area as such, caused by PAHs from the oil spill, therefore seems limited outside the mentioned locations.

The oil accident had an immediate and lethal effect on all birds caught by the oil. The number of collected dead birds was relatively small (1750 birds), whereas the estimated number is much higher – maybe tenfold. One year after the oil accident, local breeding birds show fast recovery, except for breeding waders.

Apparently, the impact of the oil and the cleaning up has caused no irreversible damage to the flora in the affected areas. There is a notable difference in the degree of coverage between the affected and the unaffected test sections at the salt meadow and in the reed layer. The laying open of the sediment by the cleaning up gave way for several new species like marsh samphire and reflexed sea meadow grass, whereas perennial species are of more frequent occurrence in the unaffected test sections. The more rare perennial species like the sea rush and the hard rush are not found in the affected test sections.

Impact on tourism in year 2001 could not be recognized. The impact on fishery and private property resulted in compensation of in all 3,5 million Euro.

The following future actions were recommended:

- Further monitoring of the levels of oil compounds in both abiotic and biotic samples from the area until levels are normalized.
- Implement county wise survey on the coastline to map valuable habitats and human installations especially sensitive to oil contamination, and develop plans for protective measures for these areas in connection with oil spill situations.
- Establish basic contingency plans for environmental survey in connection with oil spill situations, and establish a standing advisory body with experts in modelling of oil drift and monitoring of especially oil and PAHs the environment.
- Develop more case specific guidelines for clean up methods, covering a broader range of different oil types and different impacted area types.
- Develop more robust and flexible contingency plans for disposal of oil waste.
- Establish a regulatory body to implement bans on fishing following major oil spills until surveillance shows acceptable concentrations of oil and oil components in affected seafood.
- Establish a national fund body providing funding of the initial monitoring phase in connection with oil spill situations.