Lessons learned the Godafoss accident in Feb. 2011.

Oil spill recovery at -20°C

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The Godafoss accident

At 20:00 hrs. on the 17th of February, as a cold spell had hit southern Norway, the Godafoss accident happened. The ship was leaving Fredrikstad by way of the Glomma River and heading out to sea. It was dark but clear. There was no wind and the visibility was good. Large amounts of ice were drifting down the river. The ship failed to make a starboard turn in time. It grounded on a rock; the signal light straight ahead. The speed is reported as having been 13 knots at the time of grounding. The accident is still under investigation.

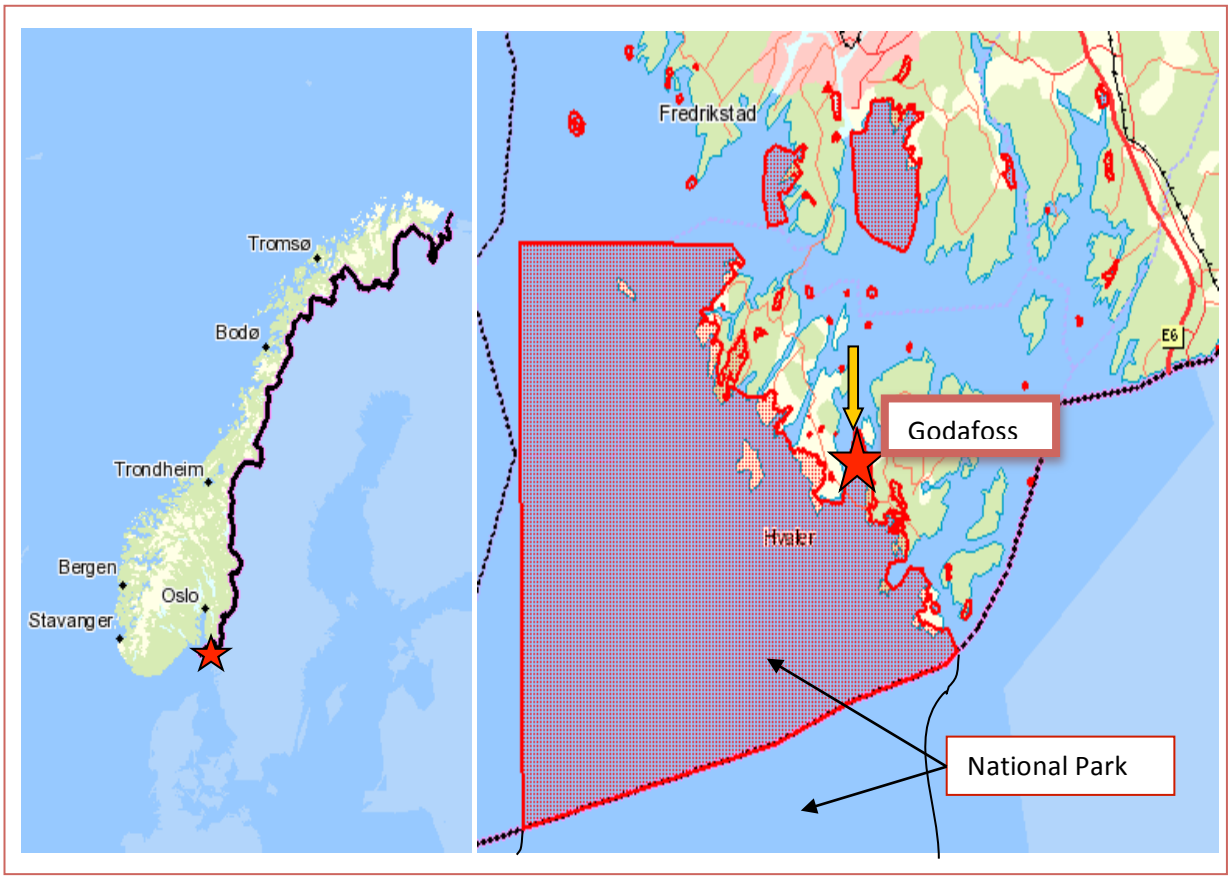


Fig.1. Map of the area

The accident was reported to the Norwegian Coastal Administration (NCA) at 20:00 hrs. Resources were mobilized from: local municipalities, the Norwegian Coast Guard, the Swedish Coast Guard and from NCA. When it was clear that oil was leaking from the ship, the NCA took control (24:00 hrs.). At 01:30 hrs. on the 18 Feb., oil booms were secured around the vessel. Shortly after, the Swedish Coast Guard

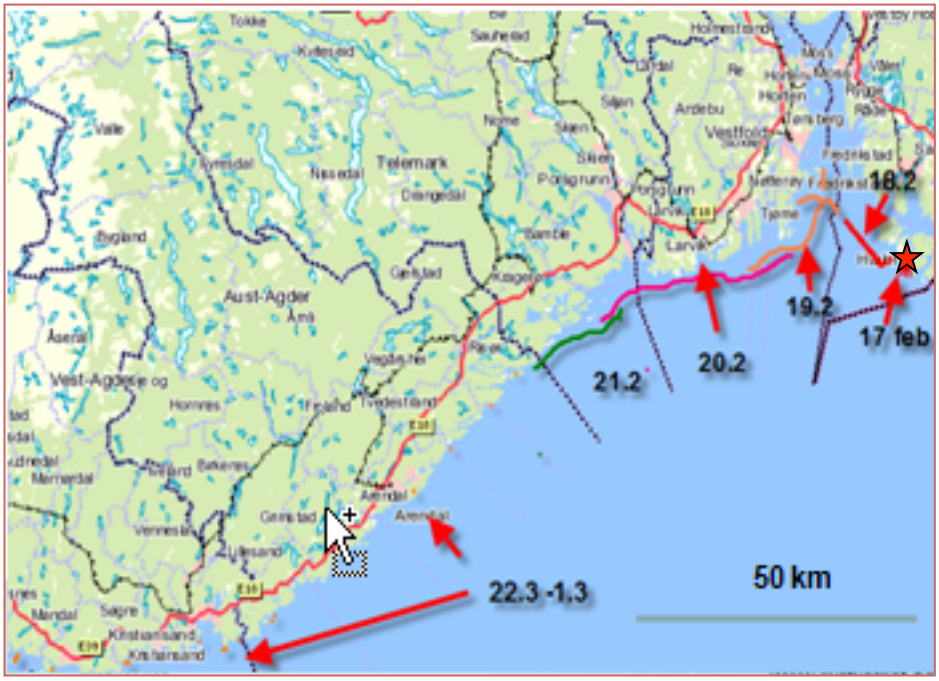
arrived with a ship specially designed for oil recovery operations in cold water. Many additional resources arrived during the night and the following day.

Due to the speed the ship held had when it grounded as well as the shape of the rock it hit, oil leaked out immediately from the HFO tanks 3, 4, 5, and 7. Later inspections showed damage from the bulb and 20 meters along the starboard side. Unloading of both oil and cargo was necessary in order to float the ship.

The HFO heating system was destroyed in the accident. Consequently, we could only pump 123 tons oil from the ship. The potential for oil leakage was estimated to approx. 500 tons. Later analysis showed that of these 500 tons, 112 tons leaked out during the first hour(s).

The sea operations

Use of modern technology on both planes and ships enabled us to “see”, follow and collect oil 24 hours a day during the entire open sea operation. Weather conditions were: cold weather, high pressure, and almost no wind during the first days of the operation. The oil followed the sea currents and mixed with the drifting ice forming long narrow bands. On the first day, it drifted northwards into the Oslo fjord. Then it turned southwards and followed along the coast to the southernmost tip of Norway (6-7 days). The east side of the Oslo fjord, where the accident happened, was hardly polluted with oil. On the west side of the fjord, some of the oil went into the archipelagos around Tønsberg- Nøtterøy. These were very cold days, the Oslo fjord



froze totally. The oil froze into the ice making collection highly difficult. Later the ice broke up and the oil was mechanically grinded into

Fig. 2. Oil drift from 17. February until 1. Mars

Thin layers. There was almost no wind for the 4 first days of the operation. The oil followed the currents and was mixed with drift ice in long narrow bands. With the use modern technology both on planes and ships we were able to “see”, follow and collect oil for 24 hours pr. day. After 4 days 50% of all the oil that leaked from Godafoss was collected at sea.

The sea operations faced other major challenges. The water was extremely cold (-2^{o}C). As a result, the oil was very thick. Pumps designed to pump heavy fuel oil were unable. Instead, we had to use conventional grabs to remove the oil out from the booms. As a consequence, a lot of ice was also collected. Boats with good heating systems to melt ice were highly valuable in this process. Where not available, the ice mixed oil was collected in containers to later be melted following the separation of water from oil. Problems on the ships created as a result of the cold, included frozen vents, hoses, connections, pipes, etc. Available hot water or steam was a necessity for working with these systems. In addition, ice and slush clogged the engine cooling systems on many boats.

Beach Cleaning

The oil that froze into the ice (from drifting on ice-free water) was hard to collect. Visually there appeared to be large amounts of oil frozen into the new ice. After collecting it with excavators placed on a barge, the amount of oil collected as compared to ice was miniscule. With ice thickness up to 25 cm., 1000 sq. meters of oily ice gave only 1 liter of oil after melting. Therefore, following these initial tests, collecting ice was not carried out. Some of the drift ice that had mixed with free floating oil inside the booms was collected. The percentage of oil versus ice/water was then 3-5%.

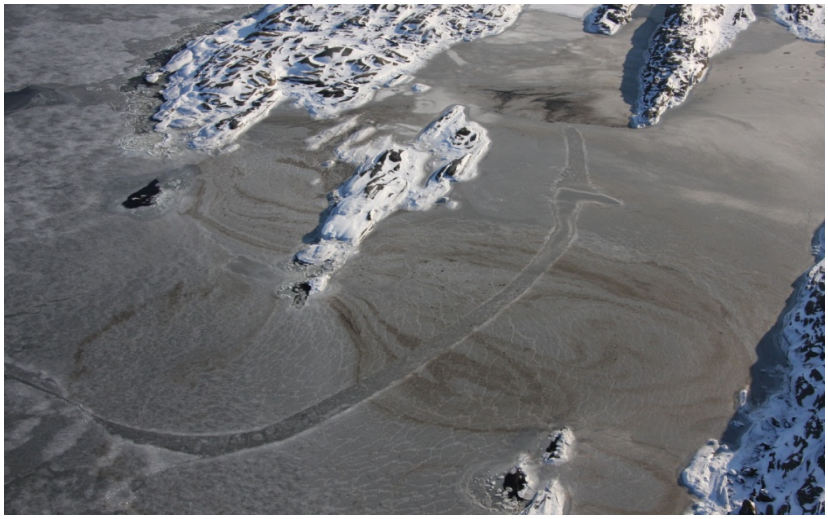


Figure 3 Oil frozen into ice in the Niteroi archipelago.

As long as the temperature was below freezing, all oil grounded on shores was easily collected. Almost 5 m3 of oil was “rolled off” the bedrock at the Ryvingen lighthouse. Later, when the temperature rose above freezing, the oil became more “normal”: sticky, running into crevasses and in-between rocks and pebbles. By late spring and early summer, priorities were to clean-up bird sanctuaries and public beaches. Most of the work was done before the breeding season and the summer vacation started. Some minor cleanups were done during the autumn. At a sandy beach resort, the oil

got mixed with sand and formed tar-balls that washed up during the summer. Most sites of oil spills that have been worked on have now been inspected and declared “clean”. This spring a few locations will be checked again to see if any further work has to be done. Already we know of one location where we will have to do a new cleaning of a public beach this spring.

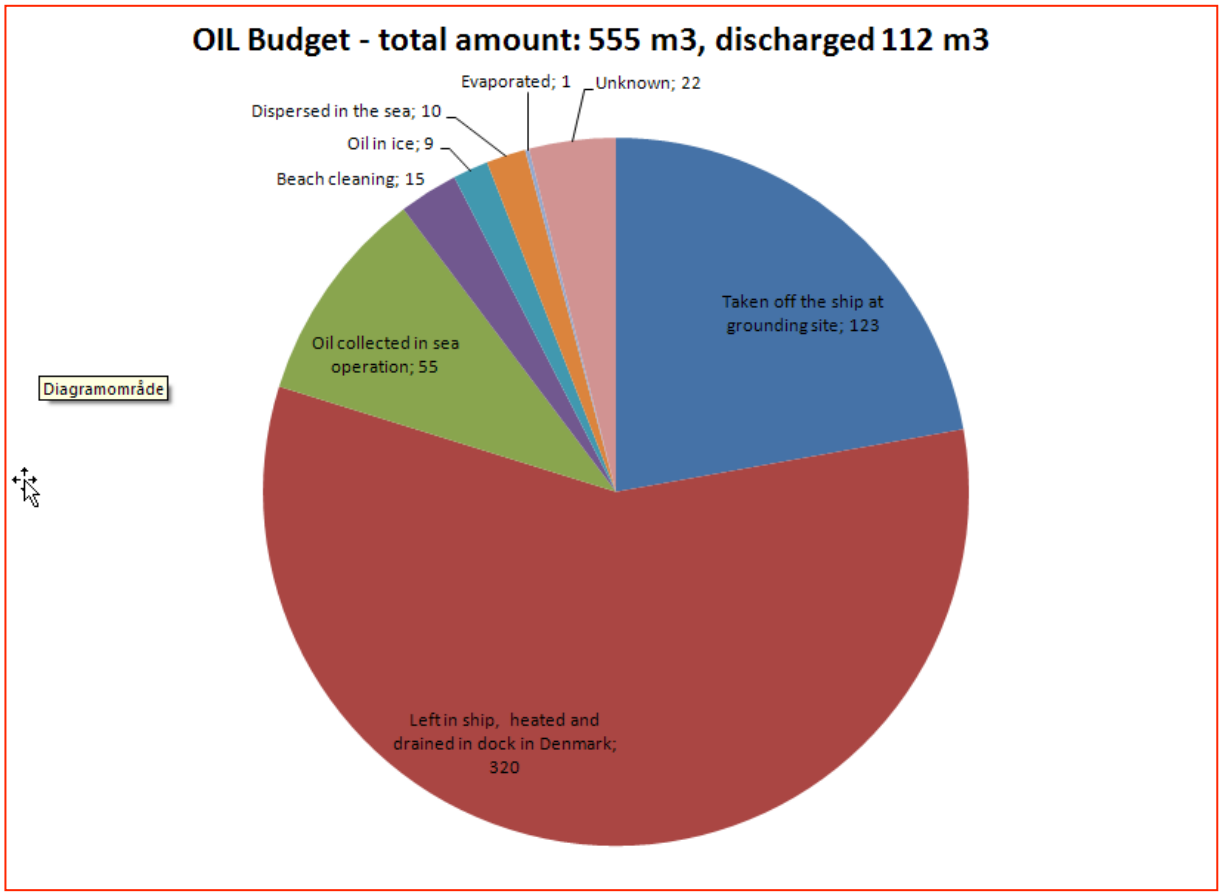


Fig. 4 Oil budget, heavy fuel oil (IFO 380) in cubic meters

Environmental effects of the oil spill

As mentioned above, almost 50% of the discharged oil was collected at sea within the four days following the accident. Normally we have only been able to collect 10 – 15 % at sea. As a consequence of this substantial increase, beach cleaning was easier and the overall impact on the environment was lowered.

Godafoss grounded upstream in a national park. But, the heavy fuel dissolved very slowly in the cold water. And, the currents carried the oil away from the national park to the other side of the Oslo fjord. No effects from oil pollution were found in fish,

crabs or lobster. In blue mussels, an increase in PAH's found initially lasted for less than 6 months.

The most severe effects of the spill were the effects on seabirds. Seabirds tend to seek out visible stripes in the sea currents for food. As the oil follows these stripes, a large number of seabirds were oiled. In the cold weather, the effects of oil in the feathers were severe. These birds died quickly. The final report, awaited from a seabird scientist, has not yet been published. Eider ducks seem to be the species most affected with more than 1000 dead birds. The same eider population was affected by the Full City accident in Tidemark in 2009.

Lessons learned

The NCA is still in the process of working with the Godafoss accident. As a result, evaluation of the overall operation is yet to be done. The list presented here does not, therefore, provide the overall picture. Nonetheless, it likely gives the most important findings.

Positive experiences

- The Incident Command System implemented in Norway before the accident worked well concerning both sea operations and work with local municipalities
- Night capacity on oil recovery ships, use of drift buoys, 24 hours/day, made it possible to follow and collect the oil for almost 4 continuous days.
- Advisors were sent from NCA to local municipalities at the start of the accident. This helped the get the work on the right track and ensured good documentation of strategic choices, efforts and costs.
- Sea operations with Norwegian -Swedish cooperation worked well. The use of different ships' sizes and equipment gave the necessary flexibility to work in open sea, in shallow waters and in ice.
- Airplanes, helicopters and drift buoys provided updated and important information about oil drift.
- Use of large double boom systems with a small opening, followed with a ship with sweeping arms that collected oil worked well.
- Heating systems in Swedish ships enabled efficient and continued use of the ships in extreme cold
- Hard working crews in all positions
- No accidents in spite of cold water an iced seashore

Room for improvement

- Not enough knowledge in NCA about the capacity/equipment on Swedish Coast Guard boats in the initial phase of the operation
- Unloading of oil and containers (explosives) on Godafoss went according to plan, but the ship drifted before oil recovery systems were on site and ready (no spill occurred).
- Limitations of booms, pumps etc., in cold weather and collection of heavy fuel with extreme viscosity.
- Before towing, the outside of the hull should have been inspected and cleaned (diving dangerous in ice and river current).
- Early warnings to other nations before a ship enters their territorial waters, so that they could implement necessary to precautions
- Not enough hot water or steam for disconnecting hoses, equipment etc. Many boats had problems with ice/slush in the cooling system