Erika Oil Spill: Some Innovations in the French Shoreline Response and Beach Cleanup Methods

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Abstract

On December 12, 1999, the *Erika* tanker sank off the Southern coast of Brittany, France. About 20,000 tons of Bunker C leaked from the wreck for several weeks. More than 400 km of shoreline were affected by oil. Over a year later, beach cleaning operations continue. In the area of shoreline response, there were some innovations in the French oil spill organization, e.g., involvement of the French private oil company TotalFinaElf, the use of environmental expertise to define the cleaning procedures and to decide when beaches could be opened for recreational use, and a call for tenders put out for beach cleaning operations. Innovations in cleaning techniques and methods included recourse to professional climbers who worked at sites that were difficult to access, delineating specific botanical worksites, use of quads and specific geotextile sheets to limit degradation of the terrestrial vegetation, use of hot water without pressure for rock cleaning, and the use of anchored fishing nets to catch drifting oil. These innovations and the main phases of the *Erika* shoreline response are described in this paper.

1. General Overview of the Pollution and the Response

It is estimated that some 19,000 tons of oil spilled from the wreck. This oil had been drifting and weathering at sea for more than 10 days, through severe sea state conditions, before an estimated 30 to 40,000 tonnes of emulsion eventually reached the shore, spaced out over weeks and some 400 km of coastline. Every type of coastal characteristic, including sandy and rocky shores, dunes and cliffs, marshes and muddy flats, as well as highly anthropogenic shoreline, were impacted by the oil spill throughout the 400 km.

At the beginning of the spill, due to a combination of storms and spring tides, the oil was projected high along the coastline, beyond the normal sea-influenced tidal zone. The oil continued to leak from the wreck and oil trapped along the shoreline continued to be remobilised for months. Recurring illegal oil discharges have to be added to that. Some of the oil slicks sank or became trapped at low tide and are still regularly releasing oil, which continues to taint surrounding bays one year after the wreck. Large amounts of oil were washed up on highly mobile beaches and rapidly covered by clean sand during sediment recovery periods, resulting in large-scale burial of oil.

2. Successive Phases of Shoreline Cleaning

The bulk of the oil removal took place from December 24, 1999 to the end of January, 2000. This was a period of concentrated efforts on bulk cleaning of the massive slick landing and organization of a national cleanup plan.

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The shoreline cleanup effort involved a large mobilization of human resources and public means, including the participation of private companies on TotalFinaElf's and later the government's initiative. This phase lasted until the end of June, 2000 and then slowed down during the summer tourism season.

Large-scale cleanup operations resumed in the fall, with national human resources, such as the military, firefighters, and the civil security corps, progressively replaced by specialized private companies. These companies proved to be more efficient at final cleaning which requires more skills and techniques than bulk cleaning.

One and a half years after the accident, cleaning operations are still going on and should continue throughout the summer in some places. From December 28, 1999 to December 31, 2000, 201,919 tons of waste have been collected over a period of 309,355 working days.

The global strategy for the cleanup was based on three main objectives: to protect marine cultures; to limit the ecological impact of the spill; and to save the tourism season. The priority of these objectives depended on the relative importance of each one along the coastline.

The following are the intervention difficulties experienced during the *Erika* oil spill response:

- avoiding marine culture beds (shellfish and salt production) located at the bottom of large intertidal mud flats, where oil had reached through fast current tidal channels;
- establishing work sites within ecologically sensitive, natural protected areas;
- operating in remote areas that were difficult and dangerous to access;
- removing the oil buried under clean sediment such as sand or pebbles which could be more than a metre thick;
- removing the oil accumulations from terrestrial supratidal vegetation;
- removing underwater oil slicks trapped close to the coastline and which sporadically tainted surrounding areas; and
- providing instruction of cleaning teams in the field.

3. Innovations in the Response Organization and Management

New arrangements have been made to intensify human resources available as well as to ensure that environmental concerns are taken into consideration.

3.1 Involvement of the "Polluter" in the Cleanup

The oil Company TotalFinaElf, although not legally responsible, immediately got involved in the shoreline cleanup by actually cleaning some areas and by purchasing cleanup material to be place at the local authorities' (communes) disposal.

3.2 Creation of Short-term Jobs

The Department of the Environment budgeted specific funds to allow local authorities (communes) and nature protection associations to hire staff for a specific

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period. These people were essentially assigned to shoreline and bird cleanup, instructing operators, and archiving data.

3.3 Recourse to Private Companies

In France, shoreline cleanup has been a government responsibility carried out by the military, firefighters, and the civil security corps. Private companies were never involved in oil spill cleanup except in harbours. During the *Erika* oil spill cleanup, TotalFinaElf and then the state administrations called on private companies for assistance. These companies proved to be more efficient for carrying out final cleanup, which requires more skills and specific techniques than bulk cleanup. Cleanup has been carried out primarily by such companies since Fall, 2000.

3.4 Environmental Evaluation Commission

An Environmental Evaluation Commission was set up in each department in order to limit the potential impact of cleanup operations and to define priority and intervention limits especially by providing details on the ecological sensitivity of certain areas. This Commission was made up of environmental experts and scientists (botanists, geomorphologists, and biologists) mandated by the Department of the Environment, representatives of nature protection associations, CEDRE experts, state administration representatives, elected representatives, and professionals in marine activities.

3.5 Cleanup Evaluation and Termination Team

On the worksite scale, an evaluation team for cleaning operations wrote a detailed specification list for each site to be cleaned, i.e., beach, cove, for use by the cleanup crew in order to limit the impact of the cleanup. This included site description (configuration, characteristics), the degree of pollution, recommended techniques and limits of the cleanup, operational constraints (access, degree of danger, water supply), and environmental constraints (sensitivity of the vegetation cover, the presence of legally protected species, the coastline's sensitivity to erosion).

This team consisted of at least one environmental expert (botanist, geomorphologist), one CEDRE expert, one elected representative, and one member of the POLMAR Advanced Command Center. This group could ensure that recommendations were followed during the cleanup and terminate the cleanup operations.

The following were the criteria for completion of the cleanup at the worksite:

- absence of pollutant accumulations that the sea could mobilize at the surface, in the sediment, and within blocks;
- absence of significant traces of oil that could stain by contact on beaches and in the vicinity.

These criteria were enforced more or less rigidly based on the economic use and/or ecological interest of the concerned site.

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3.6 Procedure for Opening Public Beaches

Because of the concern about the toxicity of the oil, the Department of Health initiated a special procedure in June, 2000 in order to open beaches for recreational use. This procedure had health and economic objectives: to show that there was no health risk on the beaches and in the seawater and to allow shoreline communes to save the tourism season. The procedure was applied to every beach proposed by the communes or easily accessible by tourists. The criteria for opening beaches were based on:

- the visual aspect (free of oil) of wet and dry sand, pebbles, rocks in the vicinity of the beach, the absence of soiled algae, or rubbish;
- an analysis of sea water for polycyclic aromatic hydrocarbons (PAHs);
- the absence of oil pellets or small tarballs in the sand at three levels (high, mid and low beach) from the surface to a depth of 0.5 m. The sand was screened to detect pellets.

From the observation and analysis, the beaches were opened, opened with reservations that stipulated that parts of the beach on the periphery could be closed, or the beach was closed. Due to the priority given to beach cleanup prior to the summer, most beaches were officially opened at the end of June or by mid-July.

3.7 Technical Instruction in the Field

CEDRE was responsible for the theoretical and practical training of the military troops and firefighters. Training was carried out in the field when troops arrived and renewed when they were relieved, that is every 10 to 15 days.

4. Technical Innovations

4.1 Protection of Marine Cultures

Precautions were taken to prevent oil contamination of marine culture facilities. At salt production facilities, improvised filtration fences (poles, wire netting, straw, and absorbent), and earth dams with pipes equipped with valves were quickly constructed. Filtration devices were installed on water intakes and supplying channels in oyster beds.

4.2 Intervention on Underwater Slicks

At several locations, slicks settled under low-tide level or in shallow water channels and were sometimes covered by sand. Two difficulties arose: first the exact extent and location of the slick (requiring investigation and cartography), then its removal. For example, a slick was removed by dredging from the Pen Bron Channel, but five or six slicks remained underwater off Belle-île Island. Investigations and removal have been postponed because of the dangerousness of the approach. These slicks are located in swells, scattered with many rocks hazardous to navigation. Attempted removal operations with divers managed by TotalFinaElf were cancelled, as they were hazardous and inefficient.

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4.3 Intervention at Difficult-to-access Sites

The major innovation in the technical response on the coastline polluted by the *Erika* oil spill was the intervention of professional climbers with appropriate hoisting devices at inaccessible sites. Some of the impacted sites were high cliffs forming narrow creeks and caves in which significant amounts of oil accumulated, constituting obvious sources of recurrent pollution. In many cases, there was no footpath to reach dangerous cliffs more than 30 m high. Sea landing was very hazardous due to high waves and reefs. Such sites are located primarily within natural, wild, and protected areas. Intervention is generally not recommended at such sites due to the hazards involved, but was eventually attempted in this case because of the large amounts of trapped oil.

The first attempts to reach these sites were made by volunteers who intervened in accessible but turbulent and hazardous creeks. POLMAR (state) authorities then sent in a firefighting team specialized in climbing to recover the fuel. Volunteer mountain climbers from the Alps with the help of ropes also cleaned up creeks at the foot of small cliffs. Over time, such intervention became more accepted.

When TotalFinaElf became involved in the oil spill response, the company was soon called upon to clean oil from steep cliffs on Belle-île Island. As the "polluter", the company had a moral obligation to succeed and to deploy whatever means were necessary to do so. As access by sea was not possible, the company hired professional climbers and rope-workers, who used their hoisting techniques and climbing skills to carry out this work.

4.4 Cleanup of Oiled Vegetation

Original cleanup operations were carried out in places where the terrestrial vegetation had been strongly impacted by wave-projected fuel. These operations were decided upon by the Environmental Evaluation Commission and supervised by botanists. The work consisted in gently removing the oil from the vegetation and the soil using small gardening tools. The objective was to preserve soil, seeds, and root systems to allow a quick recolonization.

4.5 Intervention in Ecologically Vulnerable Areas

Many worksites were established in wild, natural areas. With the aim of limiting degradation of the vegetation (moors, salt marsh grasses, and dunes) by intensive pedestrian and mechanical traffic, the following precautions were taken:

- use of vehicles with low-pressure tires, such as quads;
- laying of geotextile sheets either specifically designed for permitting vehicle traffic or simple sheets to create a pedestrian path;
- canalising of the circulation;
- carrying out a botanical investigation before any worksite installation in order to define the exact location for setting up the equipment, such as high-pressure cleaners, water tanks, and lifting gear.

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4.6 Removal of Tarballs from Sandy Beaches

The usual towed beach cleaners, such as a screening-conveyor belt were used to remove tarballs from sandy beaches. While this kind of equipment is widely used on resort beaches, it has limitations and drawbacks, including its potential ecological impact on the "embryonic dunes" (the restrictions on use in these areas were not always taken into consideration). This equipment is only operational on wide beaches with an appropriate access. Because of this, small, motorized screening machines were used on pocket beaches. This equipment can also break up tarballs into microballs after 2 or 3 successive runs and it is only effective on the top 20-cm layer of sand.

Other methods used were manual screening using mason sieves. Gravel-washing equipment/apparatus was used for screening. Surf washing was carried out by transferring the contaminated sand from the upper levels of the beach to the high-energy wave-breaking zone. Small mesh nets were anchored in the sand to recover the remobilised oil.

4.7 Cleanup of Rocks and Other Hard Surfaces

Rocky areas were cleaned using high-pressure, high-temperature cleaners. The following innovations were applied to this widely used technique.

- Pressure was adjusted depending on the rock hardness.
- Hot water without pressure was used. It appeared that a preliminary pouring of hot water on the pollutant largely facilitated the high-pressure cleanup and made this technique less detrimental to the rock. The method consisted of removing the spray tip from the high-pressure cleaner in order to pour hot water directly on the oil to liquefy and release it. A subsequent high-pressure treatment completed the cleanup. This technique has the advantage of limiting projections and allows a better canalisation and recovery of the most polluted effluent.
- In order to avoid soiling clean or cleaned adjacent surfaces, soft geotextile sheets were spread on rocks or cliff vegetation adjacent to areas being cleaned.
- This same type of geotextile sheet was spread at the foot of rocks to facilitate filtration and recovery of the polluted effluent.
- Vegetation growing in cracks between the rocks was protected with absorbent fenders during the high-pressure cleanup.

Other cleaning techniques were used on particularly hard surfaces. These included cryogenics or projecting ice microballs to clean up the wooden and plastic hulls of boats. Low-pressure hydro-blasting with glass silicate was used on harbour structures (wooden pontoons and aluminium structures) associated with simultaneous effluent recovery by an air-conveyor system.

4.8 Cleanup of Pebbles

No new techniques were used to clean up pebbles. In general, the usual methods recommended by CEDRE for oil spills in France and abroad were used (Kerambrun, 1995). These included cleanup in cement trucks, concrete mixers, in-situ cleanup on an elevated grid, and surf washing in the high-energy wave-breaking zone. The main innovation was anchoring one end of small mesh fishing nets around

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and above the pebble piles to collect oil accumulations expelled from the piles. This technique proved to be very efficient and was consequently used in surf cleaning methods and preventively in cleaned areas to collect new oil arrivals.

5. Conclusion

The *Erika* oil spill required a significant shoreline response in terms of human resources, as well as material and financial resources. The innovations in the response process will be documented in French oil spill response planning. Notable among these innovations are the use of private companies, the creation of short-term jobs dedicated to shoreline cleanup, the use of professional climbers to clean up otherwise inaccessible sites, and the establishment of technical and environmental commissions.

As "polluter", the private oil company TotalFinaElf accepted a moral obligation to succeed and to deploy whatever means were necessary to do so. Its involvement in the response operations led to and facilitated at least two of these innovations. The juxtaposition of response workers from private companies and of POLMAR (state) response workers, consisting of non-specialized and frequently relieved personnel from the military and firefighting units, quickly revealed that the private companies were better and more efficient at the detailed, final cleanup which requires specific skills and techniques. This in turn motivated state authorities to call for tenders for the final cleanup operations.

From a technical point of view, the major innovation in the *Erika* oil spill shoreline response was the involvement of professional climbers and rope-workers using hoisting techniques to clean up oil from cliff faces and creeks. Until now, intervention at such sites was never considered because of the danger involved and the technical impossibility of reaching these sites. These restrictions were overcome in the *Erika* oil spill shoreline cleanup. From now on, such professional rope-workers will likely be called upon to clean up cliffs and creeks contaminated by future oil spills.

6. References

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