TOTAL INDONESIE CONTINGENCY PLANNING IN THE MAHAKAM DELTA

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ABSTRACT: *TOTAL Indonesie has been active for 25 years in the Mahakam delta, an area with high ecological and socio-economic sensitivity. The last decade was characterised by an outstanding development of aquaculture activities closely overlapping the oil and gas operations, themselves expanding throughout the delta. To avoid potential conflicts arising from divergent interests and to ensure a harmonious coexistence between the different delta users, TOTAL Indonesie has developed a sound environmental management including a quick and effective Tier 1 spill response system based on a permanent brigade of skilled operators fitted with a large set of spill control equipment, and supported by risk assessment computerized tools allowing the optimisation in real time of the counter-measures to be applied. Additional resources can be made available at local, national and international levels thanks to the vertical integration of TOTAL Indonesie's spill response system into the vast national Oil Spill Response Network.*

TOTAL Indonesie, a subsidiary of TOTAL, a French international oil company, is one of the production-sharing contractors of PERTAMINA, the Indonesian state-owned oil company. TOTAL Indonesie (T.I.) has been active in the Mahakam Delta area since 1974, both in exploration and production. With its dense mangrove cover, the delta is characterised by a high sensitivity in terms of ecology and socio-economy.

Since 1990, the extension of T.I.'s activities throughout the delta and the burst of aquaculture, especially in the coastal fringe (Figure 1), led T.I. to revise its antipollution strategy and to reinforce its contingency planning and its capability of response to achieve a high level of preparedness whatever the diversity of its operational environment (offshore, delta, onshore) or of the potential pollutants.

Background and evolving activities

The Mahakam delta is located on the eastern coast of Kalimantan (Indonesian part of Borneo Island). Its size is approximately 70 by 40 km. The delta is covered with coastal swampy forests which represent key areas for biodiversity conservation. These types of habitats constitute vital nurseries for a large number of marine fish species and shrimp larvae, but also play a significant role in providing a protective screen against fluvial or marine erosion. Owing to the progressive mixing of fresh water and salt water throughout

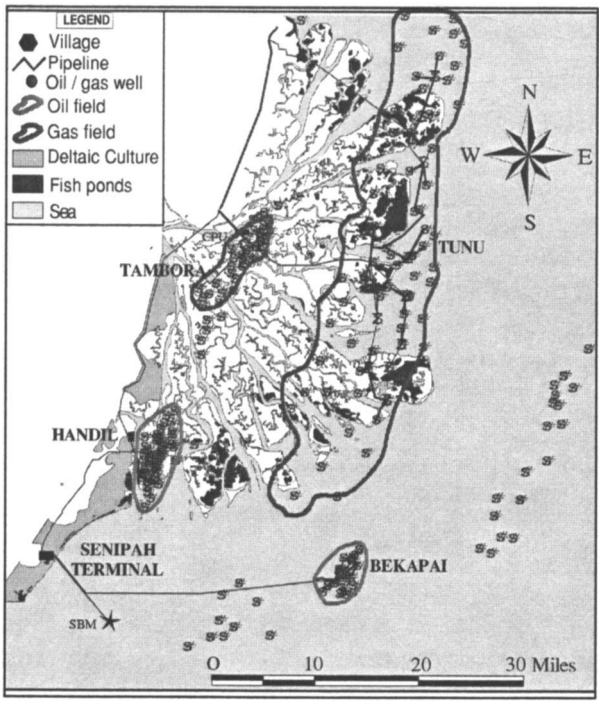

Figure 1. E&P and aquaculture coexisting in the Mahakam Delta (1996 status).

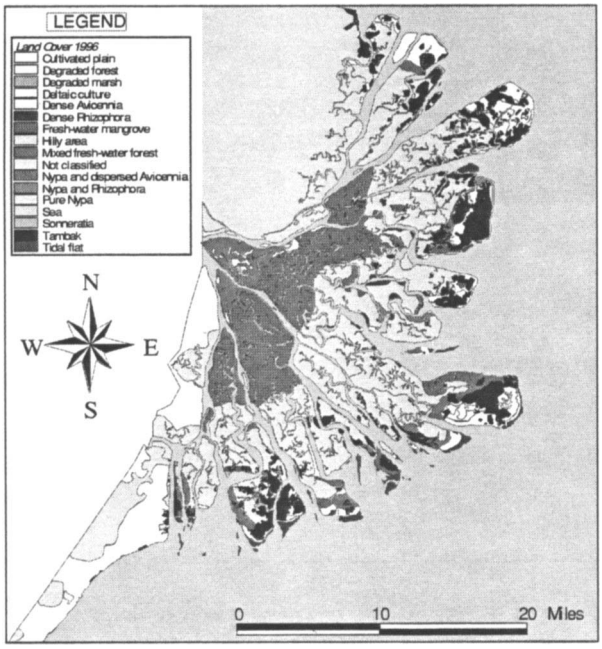

Figure 2. Mahakam Delta land cover.

whose influence on the ecosystem has been steadily increasing during this last decade, especially in the delta front where most of the fishermen villages are located.

The last 10 years have seen a real burst of aquaculture in the coastal fringe. In 1986, very few shrimp farms were to be found in the area. Today more than 150 km² of aquaculture ponds are being exploited (Figure 1), and many more ponds are under development, to the detriment of mangrove and especially the most sensitive part of this one (Alamsya Ch. *et al.*, 1996).

In the same time, T.I.'s activities spread from the southern tip of the delta, where the first oil facilities are located, to the central part (Tambora), and then almost to the whole delta with the ongoing development of the giant gas field of Tunu. In addition, several offshore fields are going to be developed in the next few years. However, the land occupancy and deforestation induced by T.I.'s activities are quite minor compared to those resulting from shrimp farm development (T.I. has used only 1.3 percent of the delta surface).

Environmental management

Thus, several activities are being carried out in the same area, creating potential environmental conflicts, especially where the oil industry is concerned. The sound management of all these factors requires two different types of tools:

- A geographical information system to allow better management of all the data available about the delta.
- A spill contingency system, including dedicated intervention team and equipment, for immediate response in case of accidental pollution.

TOTAL Indonesie has developed an analytical software called "GisOil Mahakam" (IARE, 1997) for better assessing and monitoring the environmental impacts of its operations in the sensitive zones of the Mahakam delta (Alamsya Ch. *et al.*, 1996). GisOil™ is an integrated software specially designed to facilitate the management of oil and gas fields, while "GisOil Mahakam" system contains an extremely large amount of data concerning the environment, the socio-economic situation and the activities in the delta. It represents the ideal supporting tool to manage the interfaces between the natural environment, the oil industry and the local fishing/aquaculture activities.

On the other hand, T.I., since the origin, has been deploying important efforts in oil spill preparedness. Considering the recent developments in its activities and the variety of situations in which they take place, T.I. has reworked its Oil Spill Contingency Plan (TEP/SEV and CEDRE, 1998) with the purpose, among others, of including the support of computerized tools such as GisOil Mahakam and OSIS ™ (*Oil Spill Information System*, a drift modeling tool which is a registered trademark of BMT Marine Information System). This job has been performed with the assistance of CEDRE, a French public agency specialised in oil spill response.

TOTAL Indonesie Tier 1 spill response strategy

In terms of oil spill response, T.I. has to face the following challenges:

- Various contexts of operation: offshore, coastal/delta, onshore
- Several types of possible pollutants with different behaviour and impact: waxy crude, light oil, emulsion, condensates
- Multiple potential sources of spillage scattered throughout the delta (wells, pipelines, processing units, rigs)
- A complex system of currents strongly influenced by the tidal pattern and the Mahakam River flow
- A sensitive natural environment in which effective clean-up is quite impossible to undertake
- A close overlapping of highly sensitive aquaculture activities with T.I.'s operations

From the above constraints, the only possible strategy is to implement an immediate response in order to ensure a quick control of the spill spreading and to minimise its adverse effects. So, T.I. decided to develop a high Tier 1 capability of response based upon an in-house dedicated brigade of skilled operators having at their disposal a large stockpile of antipollution equipment fitted to the specific characteristics of the delta and the potential pollutants. This supposes a great reactivity from the team and adequate logistic means accordingly. Moreover, in case of major spillage overwhelming T.I.'s brigade capability, or for consolidating the first-response counter-measures, T.I. can rely on additional resources to be mobilised at a local, national or/and international level.

Supporting tools

The Oil Spill Contingency Plan (OSCP) represents the basic framework for the spill response. It establishes the organisation to be set up to tackle the problem and provides the decision-making processes for a correct risk assessment of the situation and for the right action plan(s) to be implemented, whatever the type and location of the spill. It contains as well all the useful information about the means and their mobilisation, the methodology to be applied and several typical action plans to respond the most classical type of spillage likely to be experienced.

In matters of risk assessment and of spill response strategy, the OSCP is supported by two interactive softwares working in real time, GisOil Mahakam for identifying the sensitive resources at risk, and OSIS™ for spill trajectory modeling. Measurements made at different locations in the delta and in the Macassar Strait were entered into a database to allow the computation of current patterns on which are based the OSIS™ simulations of spill drift. Figure 3 displays an example of expected drift for an offshore spill in the Bekapai area. Similar simulations can be carried out for incidents occurring in Mahakam channels, but the tidal pattern with current

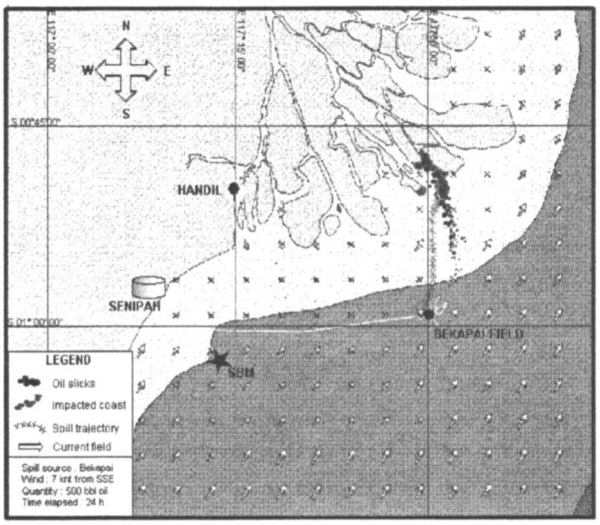

Figure 3. Drift modeling of an offshore spill (OSIS 2.2 software).

reversal four times a day and the presence of multiple secondary channels strongly increase the complexity of the problem. Nevertheless, these simulations can be available within a few minutes and provide, with a fairly acceptable accuracy, the foreseeable trajectory of the slicks, enabling T.I. to determine the areas under the direct threat of the spill.

At the same time, the sensitivity of the endangered sectors can be evaluated through GisOil Mahakam. According to ecological criteria, the sensitivity of the natural environment is rated from 1 to 9. For operational reasons, this accurate index is merged into three categories: low, medium and high sensitivity. In addition, human settlements and their dependencies, which are considered to be potentially the highest sensitive item, are given the sensitivity value of 10. The general sensitivity map of the delta is presented in Figure 4. But local sensitivity assessments can be carried out on a finer

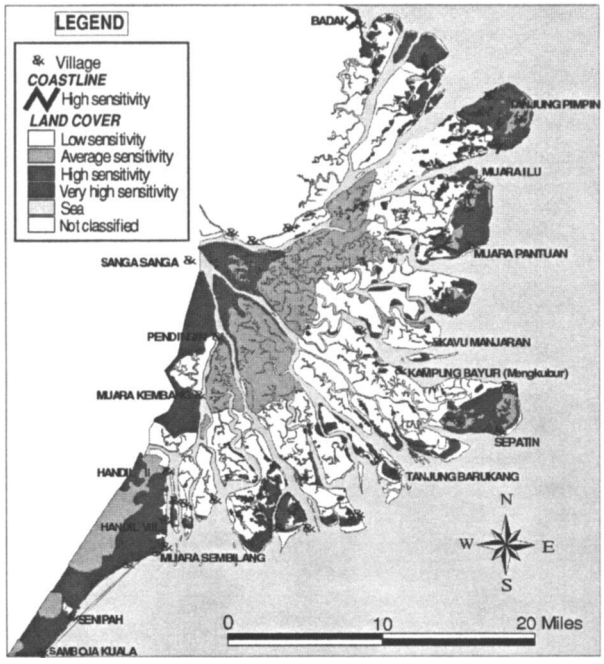

Figure 4. Sensitivity map of the delta.

scale and provide details such as the type of fishing performed or the gears employed as well as the average productivity or income.

The combination of both softwares quickly provides an accurate assessment of the potential consequences of any spill incident and allows to optimise the action plan to remediate the problem. Of course, these softwares have both been used in a preventive way during the Oil Spill Contingency Plan revamping. Stochastic simulations have been performed on the basis of the most credible types of incident likely to occur on each facility.

First response brigade and equipment

The antipollution brigade is constituted of permanent personnel mobilisable at any time for immediate intervention. The brigade *sensu stricto* includes 11 persons, with at least 5 skilled operators and 2 supervisors on duty. Moreover, the antipollution vessel crews can provide 10 helpers. On the whole, 17 people are on duty, but up to 25 persons can be mobilised. Additional helpers and supervisors can also be made available from other departments when necessary.

The oil production and loading activities represent the main spill risk and are located in the southern part of the delta, so the antipollution base has been settled in Handil (Figure 1). The brigade members have at their disposal three antipollution vessels, one for offshore which is permanently based in the Bekapai area, the second for shallow water intervention, moored at Handil. The third one is a barge which can be used in both situations for equipment transportation and/or for oily waste recovery and storage. Moreover, they can rely on a large fleet of extra boats (from supply to speed boat) easily mobilizable by the Logistics Department from the Handil area.

The specific antipollution equipment is mainly stored in the Handil warehouse but some pieces are distributed on board the antipollution vessels or at other production sites. The Indonesian regulations do not allow the use of dispersant as primary spill response, even in offshore incidents. So, the first response is essentially based on mechanical containment and recovery. TOTAL Indonesie is equipped with a large set of offshore, coastal and river booms and dynamic or static skimming units. Dispersant gears are however, available, as well for offshore treatment of non-recoverable slicks. Equipment and personnel are assembled in different pollution fighting modules, the nature and number of which are defined according to the characteristics of the incident. It can be reasonably stated that T.I. is able to successfully face a spillage up to 1,000 barrels with its own resources.

The brigade is self reliant and ensures the maintenance of the equipment. Training is maintained as well through frequent drills or full scale exercises, either in an internal way or in joint programs with other regional operators. T.I.'s first generation equipment has been recently renewed. In order to homogenise the pool of equipment and to allow their compatibility, suitable standards have been adopted by the different regional operators (Suwasono and Putri, 1997).

Regional integration

To ensure additional resources to the operating companies in case of major spillage, the national authorities have set up a federating process between the companies' own resources. T.I. has entered mutual assistance agreements with the other local operators (Unocal, Vico...) and is a key partner in the East Kalimantan Oil Spill Contingency Plan established by the national company, PERTAMINA. In addition, T.I. may have access to international back-up resources, either through PERTAMINA (e.g., EARL, Singa-

pore), or through TOTAL Group direct membership in OSRL (Southampton).

Conclusion

All the interfaces between the different in-house or external resources presented above are managed through T.I.'s Oil Spill Contingency Plan. With such a vertically structured plan, T.I. can deploy a very significant spill response backed by modern tools and, in addition, can rely on the assistance of local, national and international extra resources. As part of T.I.'s strong commitment to a sound environmental management, the spill response system contributes to support a harmonious coexistence between the E & P operations and the traditional or developing activities such as fishing and aquaculture.

Biography

Michel Grandprat is an environmental engineer of the Safety and Environment Division of Total Exploration Production. He is more particularly in charge of spill contingency planning.

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