

# THE NAKHODKA OIL SPILL RESPONSE - THE TECHNICAL ADVISER'S PERSPECTIVE

Dr T.H. Moller

Technical Team Manager, International Tanker Owners Pollution Federation Ltd

*Paper presented at Petroleum Association of Japan (PAJ) Oil Spill Symposium 97, 10-11 July 1997, Tokyo, Japan*

## INTRODUCTION

The NAKHODKA oil spill is undoubtedly the most significant marine oil pollution incident to have occurred this year, and the most serious tanker spill ever in Japan. The oil spill response arrangements in Japan have been tested to the limits, and it is not surprising that in some instances shortcomings and the need for improvements have become apparent. The purpose of this paper is to review the incident in broad terms from the perspective of ITOPF, as technical advisers, and to identify the particular problems generated by the NAKHODKA oil spill, how they were tackled, and what improvements might be made for the future.

ITOPF staff have attended the NAKHODKA oil spill on behalf of the tanker owner, the United Kingdom Mutual Steam Ship Assurance Association (UK P&I Club) and the International Oil Pollution Compensation Fund (IOPC Fund). Their role is to provide advice on pollution damage and measures to prevent pollution damage in the context of the Civil Liability Convention, the Fund Convention and the 1992 Protocols, to which Japan is a party.

## THE INCIDENT

On 2nd January, 1997 the Russian tanker NAKHODKA (19,684 DWT), *en route* from Shanghai, China to Petropavlovsk, Russian Federation with a cargo of 19,000 tonnes of Medium Fuel Oil, broke up in heavy seas some 110 km north-east of the Oki Islands in the Sea of Japan. With the exception of the

master, all members of the crew were rescued by the Japanese maritime services. The tanker broke into two sections which resulted in a spill of some 6,200 tonnes of oil.

The stern section sank soon after the incident and lies at a depth of approximately 2,500 metres with an estimated 10,000 tonnes of cargo on board. The stern section has continued to leak oil at a rate estimated by the Japanese authorities to be between 3 and 15 m<sup>3</sup> per day. Observations in March and April showed that under the prevailing weather conditions, the released oil dissipated within 2 km of reaching the surface. Investigations with a deep-sea unmanned submarine have shown that the oil is leaking from two tanks, which together originally contained some 2,480 m<sup>3</sup>. A government committee has concluded that current technology does not offer any practical methods to stem the release, which is not considered to pose a significant threat to coastal resources.

The upturned bow section, which may have contained up to 2,800 tonnes of cargo, continued to drift towards the coast of Honshu, leaking oil at a slow rate. The tanker owner contracted a Japanese salvage contractor, Nippon Salvage, to fix a line to the bow but their attempts were unsuccessful due to the severe weather and lack of suitable attachment points. On 7th January, the bow section grounded on rocks, some 200 metres from the shore near the port of Mikuni, Fukui Prefecture. Following the grounding of the bow section, a substantial quantity of oil was released, causing heavy contamination of the adjacent coast.

Efforts by Nippon Salvage on behalf of the tanker owner to remove the remaining oil from the bow section, estimated to be between 1,000 and 1,500 tonnes, were hampered by adverse weather conditions and a strong swell. Control of this operation was taken over by the authorities on 14th January using a consortium of Japanese contractors. Most of the oil was transferred to small coastal tankers while the remaining oil-water mixture was pumped into road tankers via a temporary 175-metre causeway constructed to allow access to the wreck from the shore. In late April, salvors engaged by the tanker owner removed the bow section and associated debris, which was then transported to Hiroshima Prefecture for scrapping.

Although a proportion of the oil that was lost when the ship broke up dispersed naturally at sea, patches of heavily emulsified oil ranging in size from 1 to 100 metres in diameter drifted towards the coast. Several hundreds of tonnes of emulsion stranded at various locations from the Oki Islands, Shimane Prefecture in the west, to Akita Prefecture in the east, a distance of more than 1,000 kilometres covering

ten prefectures. The most severely affected shorelines were those in the immediate vicinity of the bow section, extending 20 kilometres to the north, and those along the north coast of the Noto peninsula. The shorelines of both Hyogo and Kyoto Prefectures were also heavily contaminated while those of Niigata, Yamagata and Akita were principally affected by tarballs, the level of contamination diminishing from severe along parts of the Niigata coastline to light in Akita.

The wide geographical distribution of oil, which is one of the key characteristics of the NAKHODKA incident, is the result of two factors. Whereas most major tanker spills occur close to the coast, the NAKHODKA broke up over 100 kilometres from the coast, thereby exposing the oil to the vagaries of offshore winds and currents, and bringing a longer stretch of coast under threat from pollution. Secondly, the Medium Fuel Oil cargo proved to form very stable and persistent water-in-oil emulsions which resisted physical degradation by wave action at sea, and caused an increase in the volume of pollutant by a factor of 4-5 since the water content of the emulsions reached over 80%. The increased persistence of the emulsified oil allowed it to travel great distances.

## **OIL SPILL RESPONSE MEASURES**

The Maritime Safety Agency (MSA) is the lead government agency for salvage and clean-up operations but looks to the tanker owner to provide equipment and manpower resources to supplement its own capability. A contract was signed on behalf of the tanker owner with the partly government-funded Japan Marine Disaster Prevention Centre (MDPC) to organise the clean-up operations using commercial contractors. In addition, the Petroleum Association of Japan (PAJ) provided coastal booms, skimmers, portable storage tanks and a number of trained operators. This equipment was used to protect sensitive areas and to recover floating oil. Electricity generating companies deployed several kilometres of boom to protect water intakes to seven nuclear power stations within the affected area.

More than 80 vessels belonging to MSA and the Japan Self Defence Force were engaged in oil recovery operations. Following a Japanese Government request for assistance, the Russian Ministry of Merchant Marine (MNS) dispatched four vessels equipped with oil recovery systems to assist MSA. Crane barges chartered by MDPC and by prefecture governments were comparatively effective at collecting the highly viscous emulsified oil from the sea surface using clam-shell buckets. In addition, several hundred fishing

boats from eight prefectures were mobilised to collect oil manually into drums. Helicopters were used to spray a limited amount of dispersant, primarily to deal with oil escaping from the bow section.

Since there was a risk that the bow section would break up before the oil could be removed, ITOPF recommended that, as a contingency measure, the local offshore response capability should be supplemented with equipment from the East Asia Response Ltd (EARL) stockpile in Singapore. Two recovery systems were airlifted to Osaka and then transported to Mikuni by road, arriving on 13th January. One unit was installed on a salvage tug and the other on a supply vessel. Both units were deployed in an attempt to recover heavily emulsified oil off Noto Hanto. The equipment and personnel were returned to Singapore on 5th February.

Shoreline clean-up was organised by local fishery associations, prefecture and municipal authorities, primarily using manual methods. Most of the oil stranded on the shoreline had been removed by mid-February. In the five most heavily contaminated prefectures more than 500,000 man-days were expended on shoreline clean-up. About half of this effort was provided by volunteers from all over Japan. The remainder of the work-force comprised fishermen, local residents, municipal workers, firemen and the Self Defence Force. During the period of most intensive clean-up activity towards the end of January and early February, weather conditions were severe with almost continual strong winds, sleet and snow.

Final clean-up is largely being undertaken by contractors engaged by the municipal authorities in the removal of tar balls from amenity beaches using a combination of techniques such as sieving, beach cleaning machines and surf washing. The other main activity is the removal of viscous water-in-oil emulsions from within the structure of tetrapod sea defences. The difficulty of deciding when to end shoreline cleaning efforts is a familiar one in any major oil spill, but the issue has arisen more frequently in the NAKHODKA incident by virtue of the large number of clean-up sites and the different standards for cleaning applied in different prefectures. By the end of May, all prefectures had declared the clean-up operations to have been completed.

Several large pits were excavated for the temporary storage of the large volumes of collected oil, water and sand. The high viscosity and the emulsified nature of the collected oily waste created enormous problems in terms of both storage and disposal. In order to reduce the handling and cost of disposing of

the water locked up in the water-in-oil emulsions, attempts were made to break the emulsions with chemicals and heat treatment in temporary storage pits, with varying success. Only the waste collected in bulk could potentially be treated this way, whereas bagged waste was disposed of *in toto*.

The total quantity of collected waste is estimated to be some 50,000 tonnes, which has been transported by road, rail and sea to industrial disposal facilities, mainly incineration plants, all over Japan. The quantities involved overwhelmed the capacity of these facilities, leading to considerable delays for vessels carrying cargoes of oily waste which had to wait for discharge berths at destination ports. Lightly oiled sand was buried at the beach margins, while moderately oiled sand was buried at industrial land fill sites.

## **COSTS, LOSSES AND COMPENSATION**

This is the first major pollution incident to occur since the 1992 Protocols to the 1969 Civil Liability Convention and the 1971 Fund Convention entered into force. Japan is a party to the Protocols and has implemented them in its Oil Pollution Compensation Law. However, since the Russian Federation, the flag state of the NAKHODKA, is a party to the 1969 Civil Liability Convention and 1971 Fund Convention but not to the Protocols, the tanker owner's limit of liability is governed by the 1969 Civil Liability Convention. In the case of the NAKHODKA it is approximately 1.6 million Special Drawing Rights (SDRs) (about ¥300 million or US\$ 2.3 million). Additional compensation is payable by the International Oil Pollution Compensation Funds (1971 Fund and 1992 Fund), up to a total amount of 135 million SDRs (approximately ¥26 billion or US\$ 192 million), inclusive of the compensation paid by the tanker owner. Preliminary estimates of the quantum of potential claims indicate that there is a risk that the upper limit of the 1992 Fund may be exceeded and, as a consequence, the 1991 and 1992 Funds have, for the moment, set a limit on payments of 60% of any substantiated claims.

Claims for clean-up costs as at the end of May were estimated to be in the region of ¥9.5 billion (US\$71 million), including ¥2.3 billion (US\$17 million) in respect of the fishermen's involvement in the clean-up operation, ¥3.9 billion (US\$29 million) for the clean-up costs incurred by six of the ten prefectures involved, and a further ¥3.3 billion (US\$25 million) for MDPC clean-up contractors' costs.

Claims for the transport and disposal of oily waste are expected to reach ¥2.0 billion (US\$15 million). The wide distribution of the spilled oil and the proliferation of clean-up operations in each of the affected prefectures is undoubtedly the main cause of the high costs for shoreline clean-up and disposal.

Pollution damage claims are anticipated from two main sectors, tourism and fisheries, but as yet no indication has been given of the likely amounts, partly because until recently potential claimants have been fully occupied assisting in clean-up operations. The tourist and fishery sectors are closely linked, not only because visitors are attracted to this coast to consume fresh seafood, but also because a substantial proportion of the many guest houses and restaurants are owned by fishermen. Although the main tourist season commences in July, the local crab fishery attracts winter visitors and sightseers begin arriving in greater numbers in Spring.

Claims are anticipated for business interruption to fisheries and some limited claims as a result of contamination of large complex set nets. It is alleged that prices of fish and other marine products were depressed as a result of the spill. On the rocky shores throughout the affected area naturally occurring edible seaweeds are harvested commercially and for self-consumption. Harvesting of this seaweed was abandoned for the season as a result of the spill.

## **SPILL RESPONSE PROBLEMS AND THEIR RESOLUTION**

1. Although Japanese regulations require the tanker owner to undertake clean-up operations and a contract was signed on the owner's behalf with MDPC, the relatively low limit of liability in the NAKHODKA case meant that the owner's financial limit was soon reached. The incident has served to highlight one of the problems which can be faced in those CLC and Fund countries which expect or require the shipowner to participate in the clean up. In this case the considerable shortfall between the owner's limit and the anticipated claims for clean-up costs has been met temporarily by a substantial loan (¥9 billion) to MDPC from the Government of Japan, pending settlement and payment by the IOPC Funds. Similar loans of substantial amounts have been made to the prefecture governments within the affected area.

MDPC is jointly funded by government and industry and can respond either under the direction of MSA or under contract to the spiller. The arrangement whereby MDPC operates under the terms of a contract with the tanker owner leads to a curious situation of divided loyalties for MDPC which is a quasi-government organisation. Once the standard contract with MDPC has been signed, the tanker owner has no control over the appointment by MDPC of subcontractors and associated expenditure. In future cases involving passing tankers this circumstance is likely to create reluctance on the part of the tanker owner to enter into what is in effect an open-ended contract with no safeguards against incurring costs which may be deemed unreasonable and inadmissible under the terms of the compensation conventions.

2. A striking feature of the NAKHODKA oil spill response, from an international perspective, has been the enormous volunteer effort to remove oil from contaminated shorelines. The scale of the public contribution is the greatest in the history of tanker oil spills since TORREY CANYON in 1967, and reflects the concern generated by the NAKHODKA incident, throughout Japan. The public reaction also represents a potent political statement which the government and public authorities were bound to acknowledge. One manifestation of government responsiveness was the deployment of all available spill response resources, whether appropriate or not, in an effort to collect as much of the spilled oil as soon as possible. Whilst a laudable aim in itself, this strategy is not necessarily the most effective and may lead to restricted cost recovery under the compensation conventions.

The Civil Liability Conventions and the Fund Conventions provide for compensation to be paid for reasonable measures undertaken to prevent or minimise pollution damage. The criteria followed for judging whether a claim is admissible are primarily technical. For example, the scale of the response measures should be in proportion to the size of the spill, the expected level of success, and the ability to direct and control operations effectively. The application of such criteria results in limits being imposed on the type and extent of oil spill response activity that can be considered reasonable in the context of compensation payable under the Conventions.

The effectiveness of offshore recovery gradually decreases after oil has been spilled due to the tendency for oil to spread and become scattered over a wide area. Operations should be terminated as soon as there are no significant and recoverable amounts of oil remaining at sea, or the amount of oil being recovered will not significantly reduce the impact on shorelines or sensitive resources.

In February, at a stage when oil had become very widely scattered across the Sea of Japan, there were over 100 sea-going patrol/oil recovery vessels involved in NAKHODKA oil spill response activity, as well as several hundred fishing boats. There were ships deployed by MSA, the Japan Marine Self-Defence Force (MSDF), Ministry of Transport, Russian MSN and the tanker owner. Given the decreasing quantity of oil afloat, there can have been no prospect for utilising this number and size of craft in reasonable oil pollution preventive measures. Furthermore, even this number of craft did not succeed in reducing shoreline impact of oil to any significant degree. This observation applies to most vessels participating in the offshore response, albeit to varying degrees.

3. The performance of the Russian vessels provided to assist in the offshore oil collection was poor. Amongst several reasons, the lack of experience of operating in Japanese waters and of working in collaboration with Japanese authorities must have been significant. In other countries reliant on close international co-operation, such as the Baltic countries, frequent exercises are held to overcome the inevitable obstacles posed by different languages, logistics requirements, operating systems and command structures.

It is relevant to note here that a meeting of the UNEP Regional Seas Action Plan for the Protection, Management and Development of the Marine and Coastal Environment of the Northwest Pacific Region (NOWPAP) will be held in Toyama, 23-25 July 1997. The member states of NOWPAP are China, Japan, North Korea, South Korea, Russian Federation and Taiwan. The aim of the meeting is to promote oil spill preparedness and response within the region. A regional contingency plan along with a Memorandum of Understanding is to be developed.

4. The characteristics and behaviour of the oil spilled in the NAKHODKA incident determined the tactics employed for collecting oil from the sea surface. The emulsification process transformed the liquid oil into semi-solid lumps which could be collected more effectively and more cheaply with crane barges fitted with clam-shell buckets than with conventional booms and skimmers. The large quantities of free water collected with the oil lumps could be easily decanted.

5. The oil recovery systems supplied by EARL consisting of booms and skimmers were primarily intended as a contingency measure in case of a second release of fresh, liquid oil from the bow section. Although no such release occurred, the equipment was deployed for several days to collect emulsified oil offshore



until it became apparent that the benefits did not justify the costs involved. The equipment and operating personnel were promptly demobilised and returned to Singapore. In addition to the point described under 4. above, it was clear that the EARL personnel had difficulties communicating and operating with the Japanese crew on the vessels of opportunity (tug & supply vessel) provided for the deployment of EARL equipment.

6. The fact that supplementary EARL resources were considered necessary highlights a gap in the spectrum of oil spill response equipment provided by the public and private spill response sectors in Japan. There is a need for small, flexible oil recovery units capable of operating in nearshore waters where the room and depth for manoeuvring may be restricted. Of equal concern is the current lack of trained personnel well-practised in the skills of operating complex equipment in restricted waters. The language barrier and logistic considerations makes it unrealistic to rely on foreign response groups filling this gap in Japan's oil spill response capability.

7. The key to effective response action is good organisation. Although there were large quantities of equipment and materials available for the spill response, the resources were not utilised in a fully co-ordinated manner, with a singly entity in overall charge to implement a coherent strategy. Many of the prefectures instigated their own clean-up operations with little or no attempt to co-ordinate their activities with neighbouring prefectures or with MDPC. With ten prefectures involved in oil spill response to varying degrees, a chaotic situation developed and resources were wasted. An integrated national contingency plan covering all levels of oil spill response would help to alleviate this problem in the future.

8. Good use was made of the equipment and services provided by PAJ to support the shoreline clean-up effort. However, once the equipment had been deployed and demonstrated there was a tendency for operating problems to develop after PAJ personnel had departed from the scene. A programme of equipment exercises to thoroughly familiarise operators with the running and maintenance of PAJ equipment should help to reduce this problem.

9. The large volunteer force was mobilised in part as a consequence of the experience after the Kobe Earthquake when an elaborate volunteer organisation was developed. Although there are obvious advantages in utilising volunteer labour, there are also difficulties to contend with such as variable

personal fitness for strenuous physical work. It has also sometimes proved difficult to control and direct the work of volunteers who often reject outside supervision.

10. The cleaning of oiled breakwaters and sea defences often present the problem that the oil penetrates deep into the structure leading to the concern that it will act as a reservoir for oil leaching out over a period of time. It cannot be considered reasonable to completely dismantle sea defences constructed of tetrapods or rocks in order to expose trapped oil, firstly, because the effects of the oil are unlikely to be prolonged, and secondly, the costs involved are likely to far exceed the level of claims that short-term leaching might cause.

11. The cleaning of shorelines required an enormous effort since poor access to clean-up sites made it necessary to rely mainly or exclusively on manual labour. Much of the most strenuous work involved bagging and transferring collected oil to and from temporary storage sites. The key to cost-effective shoreline clean-up, oil transport, and disposal is to minimise the number of steps in handling collected oily waste. In the NAKHODKA clean-up operation there was too much double-handling of waste. Earlier use of 1-tonne flexible containers ('Flecon' bags) to hold the many small plastic bags filled at the clean-up sites would have greatly eased the subsequent task of transporting bagged waste to and from temporary storage sites.

12. At some beach locations excessive quantities of oily beach material were accumulated through the use of unsupervised mechanical equipment. At Katano beach near Kaga City in Isikawa Prefecture over 18,000 m<sup>3</sup> of oily sand was collected in this way. Secondary separation of the collected material was then required in order to avoid astronomical disposal costs. With careful supervision of the initial beach cleaning these problems could have been avoided.

13. In the NAKHODKA incident too few disposal options were available for clean-up managers to consider. There was little or no opportunity to encourage competitive bidding amongst potential disposal contractors. Although bagged and bulk waste were carefully segregated during storage, no separation and recycling of free oil from the bulk waste was achieved. As part of the national contingency plan review, efforts should be made to identify more economically viable options for separating oily waste and recycling recovered oil.

## CONCLUSIONS

Whereas past spills have typically been small affairs involving exclusively Japanese interests, the NAKHODKA oil spill presented Japan with an unfamiliar situation. This was a major offshore incident involving a foreign tanker owner with no presence or business representation in Japan. No part of the response community, including maritime lawyers and marine surveyors was prepared for such a big event. No country can claim to be fully prepared for dealing with a maritime incident of such proportions, but the NAKHODKA incident has highlighted some issues needing to be addressed in order to improve oil spill preparedness in Japan.

The efforts to collect oil in the open sea were greatly hampered by severe winter weather and sea conditions, and by the wide distribution and fragmentation of the oil. As a result it proved impossible to prevent or reduce shoreline pollution to any significant extent. Although some success was achieved with crane barges operating in calm weather the quantities of pollutant recovered were small in percentage terms.

The shoreline clean-up operation was well organised locally and successful in quickly removing the bulk of the pollutant from the tideline into temporary storage pits. However, the lack of plans for an operation on this scale led to temporary storage sites being overwhelmed and also to multiple handling of collected waste.

The quantity of oil spilled in the NAKHODKA incident was magnified by the formation of stable water-in-oil emulsions. In addition to the sheer volume, the increased viscosity of the emulsified oil created problems in handling, pumping, transporting and disposing of the collected waste. Only limited success was achieved in attempts to break water-in-oil emulsions at temporary storage sites.

Various parts of local and national contingency arrangements for oil spill response warrant a thorough review in order to improve the capability in Japan for dealing with major pollution incidents in the future. There would be merit in reviewing available oil spill response methods and equipment in order to re-define the optimum selection of techniques for the conditions prevailing in Japan. Probably the most important aspect of the contingency planning review is to improve the co-ordination of diverse resources and organisations to create a proper integration of currently very fragmented response capabilities.