OIL SPILL PREVENTION AND TREATMENT
IN OFFSHORE OIL INDUSTRY OF CHINA

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ABSTRACT: The China National Offshore Oil Corporation (CNOOC), established in October 1982, is the sole Chinese company dealing with offshore oil exploration, development, and production. It has four regional corporations and four specialized corporations, as well as seventeen joint venture corporations. CNOOC has four representative offices outside China.

Since the Sino-foreign cooperation for offshore oil exploration and development in China started, 360,000 line km of seismic survey have been shot, thirty-nine oil and gas bearing structures have been found, fifteen oil fields have been evaluated as having large hydrocarbon accumulations, nine oil fields have been developed and put into production, 179 exploratory wells have been drilled, and CNOOC has signed thirty-nine contracts with a total of forty-five foreign companies from twelve countries.

There are five laws and regulations in the PRC affecting offshore oil development and marine environmental pollution. In accord with these laws and regulations, CNOOC has reviewed four environmental impact statements for offshore oil fields received from its regional corporations. CNOOC has made oil spill contingency plans for the Cheng-Bei offshore oil field in Bo-Hai, and the Wei 10-3 offshore oil field in the Gulf of Bei-Bu. Some oil spill combating equipment is owned by the Bo-Hai Oil Corporation and the Nan-Hai West Oil Corporation, selected on the basis of the crude oil characteristics.

The China National Offshore Oil Corporation (CNOOC), established in October 1982, is the sole Chinese company dealing with offshore oil exploration, development, and production. It has four regional corporations and four specialized corporations, as well as seventeen joint venture corporations. CNOOC has four representative offices outside China. The four regional corporations are: (1) Bo-Hai Oil Corporation in Tang-Gu, Tian-Jin, responsible mainly for oil and gas exploration, development, production, and cooperation with foreign firms in the Bo-Hai Sea area; (2) Nan-Huai Oil Corporation in Shanghai, responsible mainly for oil and gas exploration, development, production, and cooperation with foreign firms in the South Yellow Sea and East China Sea areas; (3) Nan-Hai East Oil Corporation in Guang-Zhou, Guang-Dong, responsible mainly for oil and gas exploration, development, production, and cooperation with foreign firms in the east area of the Pearl River mouth basin of the South China Sea; and (4) Nan-Hai West Oil Corporation in Zhan-Jiang, Guang-Dong, responsible mainly for oil and gas exploration, development, production and cooperation with foreign firms in the Bei-Bu Gulf, Ying-Ge Sea and the west area of the Pearl River mouth basin, in the South China Sea (Figure 1).

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Related laws and regulations

There are laws and regulations in the People’s Republic of China (PRC) affecting marine environmental pollution during offshore oil activities, as follows:

1. The Environmental Protection Law of the PRC, of September 1979, deals with all environmental protection matters.
2. The Marine Environmental Protection Law of the PRC, of August 1982, is to protect marine environment and resources, prevent pollution damage, maintain ecological balance, safeguard human health, and promote the development of marine programs.
3. Regulations of the PRC concerning environmental protection in offshore oil exploration and exploitation of December 1983, are to prevent pollution damage to the marine environment by offshore oil exploration and exploitation.
4. Regulations of the PRC concerning the dumping of wastes at sea, of March 1985, strictly control the dumping of wastes at sea so as to prevent pollution damage to the marine environment.
5. Management guidelines on environmental protection at construction projects of the PRC, issued in March 1986, are to strengthen the management of the environmental impact assessment of construction projects.

Oil spill prevention

These laws and regulations require that, while drawing up an overall development program for an oil or gas field, an enterprise or operator also must prepare a marine environmental impact statement (EIS) and submit it to the National Environmental Protection Agency (NEPA). CNOOC has reviewed four EISs for offshore oil fields: two oil fields (BZ 28-1, BZ 34-2/4) in the Bo-Hai Sea; and the other two (HZ 21-1, XJ 24-3) in the Pearl River mouth basin.

The contents of an EIS for an offshore oil or gas field consist of the following:

1. The name, geographical location, and size of the oil or gas field, and a description of the project
2. A description of the natural environment and the condition of marine resources in the sea area where the oil field is located

Through examining and implementing the EIS, the effects of offshore oil development and production on the environment and the possibility of an oil spill can be reduced to a minimum. However, in normal operation produced water always contains a certain amount of oil, and only by separating this oil from the production water through the use of a suitable oil-water separator can the oil content of the water be reduced to an extent that meets the state's stipulated standards. In areas such as the Bo-Hai Sea, the oil content of discharged production water should not exceed 30 mg/L at the monthly average, and 45 mg/L at the maximum, while in areas such as the South China Sea, the oil content in discharged production water should not exceed 50 mg/L at the monthly average, and 75 mg/L at the maximum.

Oil spill contingency plans for offshore oil fields

Oil spill accidents are often unavoidable in the oil field development and production process. From the time of the initial offshore oil field activities in our country to 1987, there have been approximately fourteen oil spills from various causes, and six oil spills amounting to one ton or more (Table 1). All these accidents occurred in the Bo-Hai area, since it is the location of the earliest oil field activities in our country.

In order to deal with oil spills more effectively, it is necessary for the enterprise or operator to draw up an oil spill contingency plan, as stipulated by the related laws and regulations. CNOOC now has reviewed two oil spill contingency plans, one for the Chong-Bei oil field in Bo-Hai, and the other for the Wei-Zhou 10-3 oil field in Bei-Bu Gulf.

The contents of the oil spill contingency plan consist of the following:

1. General description of the project
2. Environmental conditions, including geography, oceanology, and meteorology, sedimentology, and sensitive zones
3. Risk analysis
4. Organization and responsibilities (Figure 2)
5. Oil spill response procedures
6. Methods to treat spilled oil at sea

In drawing up an oil spill contingency plan, some points must be taken into account: (1) there is no special spilled oil recovery company in China which can provide personnel and oil recovery equipment to oil companies and help them to handle an accident in case it occurs; and (2) the government authorities in China do not have any oil recovery means except that the port authorities of the Ministry of Communications do own some spilled oil recovery boats and recovery equipment for coastal or in-port oil recovery. Such equipment, while it may be used in oil spills near shore or along the coastline, is not suitable for handling accidents that occur in an offshore oil field.

Thus, the oil companies are in a position to handle small-to-

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### Table 1. Offshore oil spills

<table>
<thead>
<tr>
<th>No.</th>
<th>Date</th>
<th>Location</th>
<th>Pollution source</th>
<th>Cause of accident</th>
<th>Amount of oil spilled</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1978, May</td>
<td>Central part of Bo-Hai</td>
<td>Drilling platform</td>
<td>Oil well No. 18—blow out under high pressure of oil layer</td>
<td>113 tons of crude oil</td>
</tr>
<tr>
<td>2</td>
<td>1979, May 9</td>
<td>Bo-Hai</td>
<td>Production platform—Bo-Hai No. 4</td>
<td>Oil leak by negligence</td>
<td>6.6 tons of crude oil</td>
</tr>
<tr>
<td>3</td>
<td>1979, July</td>
<td>Bo-Hai port</td>
<td>Drilling ship—Bo-Hai No. 3</td>
<td>Oil leak by negligence</td>
<td>14 tons of diesel oil</td>
</tr>
<tr>
<td>4</td>
<td>1979, August</td>
<td>Bo-Hai</td>
<td>Production platform—Bo-Hai No. 4</td>
<td>Tank cleaning under repair</td>
<td>38 tons of crude oil</td>
</tr>
<tr>
<td>5</td>
<td>1981, February 14</td>
<td>Bo-Hai port</td>
<td>Supply ship</td>
<td>Collision of ship No. 216 with another ship while unloading—tank valve broke</td>
<td>5.7 tons of diesel oil</td>
</tr>
<tr>
<td>6</td>
<td>1986, August 20</td>
<td>Bo-Hai</td>
<td>Supply ship</td>
<td>Collision of supply ship No. 241 with drilling ship No. 8—oil tank of ship No. 241 broke</td>
<td>3.5 tons of machine oil</td>
</tr>
</tbody>
</table>
medium-scale (and chiefly small-scale) oil spill accidents only. International assistance will certainly be needed in case a medium or large scale oil spill accident occurs. As the related Chinese laws and regulations stipulate, the oil companies should have a contingent capability to deal with oil pollution accidents and be equipped with oil-fencing and cleanup facilities compatible with the scope of their respective oil exploration and development activities. In this connection, the oil spill contingency plans drawn up by each oil and gas company must list available spilled oil recovery equipment. Recovery equipment which has been purchased by the CNOOC system up to the end of 1987 is listed herewith in Table 2.

In China, the method for handling spilled oil is mainly mechanical, while the use of chemical dispersants is considered supplementary. The Chinese Government has issued strict regulations on the use of chemical dispersants. (1) When an oil spill accident occurs, a small amount of dispersant may be applied to a limited amount of oil which is indeed unrecoverable, provided that recovery measures have been taken. (2) The total amount of dispersant (including its solvent) that may be used shall be separately prescribed by the competent authority as appropriate for different sea areas and other conditions. The operator shall submit a report to the authority under the relevant legal provisions and may use the dispersant only after permission is granted. (3) In an emergency in which an oil spill that is unlikely to be recovered may cause a fire or present a serious threat to the safety of human life and properties, and where by use of a dispersant the potential pollution can be mitigated and the consequences of the pollution can be alleviated, the dispersant may be used only after approval has been obtained from the relevant authority.

### Table 2. Principal oil spill cleanup equipment in the PRC

<table>
<thead>
<tr>
<th>Type</th>
<th>Quantity</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ro Boom 1500</td>
<td>400 m</td>
<td>Bo-Hai Oil Corp.</td>
</tr>
<tr>
<td>Ro-Trawl-net skimmer 1500</td>
<td>1 set</td>
<td>Bo-Hai Oil Corp.</td>
</tr>
<tr>
<td>Kew 4203V-109 hot water and steam cleaner</td>
<td>1 set</td>
<td>Bo-Hai Oil Corp.</td>
</tr>
<tr>
<td>Heavy oil Desmi DS 150 skimmer</td>
<td>1 set</td>
<td>Bo-Hai Oil Corp.</td>
</tr>
<tr>
<td>Vikoma boom</td>
<td>400 m</td>
<td>Bo-Hai Oil Corp.</td>
</tr>
<tr>
<td>Seaskimmer 50</td>
<td>1 set</td>
<td>Bo-Hai Oil Corp.</td>
</tr>
<tr>
<td>Dispersant spray equipment</td>
<td>3 sets</td>
<td>Bo-Hai Oil Corp.</td>
</tr>
<tr>
<td>Ro-Trawl-net skimmer</td>
<td>1 set</td>
<td>Nan-Hai West Oil Corp.</td>
</tr>
</tbody>
</table>

### Table 3. Major characteristics of oil from Chinese offshore fields

<table>
<thead>
<tr>
<th>Oil field</th>
<th>Location</th>
<th>Density (kg/m³ at 15°C)</th>
<th>Wax content (weight percent)</th>
<th>Pour point (°C)</th>
<th>Viscosity (cP)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wei Zhou 103</td>
<td>Bei-Bu Gulf</td>
<td>858</td>
<td>27/29</td>
<td>35/38</td>
<td>4.7 (50°C)</td>
</tr>
<tr>
<td>Cheng-Bei</td>
<td>Bo-Hai</td>
<td>955</td>
<td>5.74</td>
<td>7.7</td>
<td>7.5 (50°C)</td>
</tr>
<tr>
<td>BZ 28-1</td>
<td>Bo-Hai</td>
<td>830</td>
<td>15/20</td>
<td>33</td>
<td>3.7 (50°C)</td>
</tr>
<tr>
<td>BZ 34-2</td>
<td>Bo-Hai</td>
<td>854</td>
<td>15.42</td>
<td>15/30</td>
<td>9.1 (40°C)</td>
</tr>
<tr>
<td>Xi-Jiang 24-3</td>
<td>Pearl River Mouth Basin</td>
<td>858</td>
<td>45</td>
<td>40</td>
<td>8.3 (54°C)</td>
</tr>
<tr>
<td>Huei-Zhou 21-1</td>
<td>Pearl River Mouth Basin</td>
<td>800</td>
<td>15.6</td>
<td>25/30</td>
<td>2.7–4.2 (50°C)</td>
</tr>
</tbody>
</table>
accident prevented from expanding, the amount of such dispersant to be used and the relevant procedures for reporting may be exempt from the restrictions stipulated in (2). The facts of such an accident and of the use of the dispersant shall be reported in detail to the competent authority after the accident has been dealt with. (4) Only the dispersant which is approved by the competent authority may be used.

In view of the above, chemical dispersants are not applied in normal circumstances, and at present there is only one kind of chemical dispersant—the Shuang-Xiang brand—produced in China. For contingency purposes, however, the oil companies are supplied with a limited amount of chemical dispersant and dispersant spray equipment at the shore bases and at their offshore facilities.

The selection of spilled oil recovery equipment should be done very cautiously. This is because the offshore crude oil which is now being produced or will be produced possesses certain characteristic features (i.e., relatively high specific gravity, wax content, pour point, and viscosity—Table 3) which make it difficult to clean up with available spilled oil recovery equipment. We have consulted many suppliers abroad and could not find a suitable one. We did select some equipment finally with the hope that it may work.

**Conclusion**

Under the present circumstances in China, in order to prevent and to properly handle oil spill accidents, a Chinese oil company must prepare an environmental impact statement (EIS) and draw up an oil spill contingency plan in accordance with the related laws and regulations stipulated by the government during the development stage of an oil or gas field. The purpose of the EIS is to prevent oil spills in the course of the normal production process, while the oil spill contingency plan serves to prevent and handle oil spill accidents. These are the measures considered to be effective in China.

At present, medium- and large-scale oil spill accidents are difficult for oil companies themselves to cope with using only the available domestic equipment. International assistance is certainly needed. This situation will surely change as China's policy of opening to the outside world and revitalizing its domestic economy continues.

In view of the high density, high pour point, and high wax content offshore crude oil, the available chemical dispersants and mechanical recovery equipment are not suitable for handling offshore oil spills in China. A method must be found to handle such offshore crude oil spills.