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Caspian Environment Programme : Phase 2

# Environmental Management in the Caspian Oil Industry

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**Table of Contents**

**Chapter 1. Introduction** ..... **3**
**Chapter 2. Summary and Conclusions** ..... **4**
2.1. Oil Pollution by the Oil Industry ..... 4
2.2. Regulation and Monitoring ..... 4
2.3. International Sea Conferences ..... 5
2.4. Environmental Management in the Oil Industry ..... 5
2.5. Project Pipeline ..... 6
**Chapter 3. Review of Oil Emissions** ..... **8**
3.1. Introduction ..... 8
3.2. Summary ..... 8
3.2.1. Reference: Oil Pollution of the Seas ..... 9
3.3. Seepage and Erosion ..... 10
3.4. Oil Industry Activities ..... 11
3.4.1. Offshore Production ..... 13
3.4.2. Onshore Production ..... 13
3.4.3. Flooded Fields ..... 14
3.4.4. Transportation ..... 14
3.4.5. Coastal Refineries ..... 16
3.4.6. Catastrophic Events ..... 17
3.5. Regional and Extra-regional Municipalities and Industry ..... 17
3.6. Atmospheric Deposits ..... 18
**Chapter 4. Environmental Regulation** ..... **19**
4.1. Authorities and Regulations ..... 19
4.2. Enforcement ..... 19
**Chapter 5. Experience from Established Sea Conventions** ..... **20**
**Chapter 6. Environmental Management Practice** ..... **21**
6.1. Environmental Organisation ..... 21
6.2. Assessment of Performance ..... 21
6.3. Compliance Enforcement ..... 22
6.4. Other Drivers ..... 22
**Chapter 7. Project Proposals** ..... **23**
7.1. Review of Earlier Project Proposals ..... 23
7.2. Support to Oil Industry Environmental Management ..... 23
7.3. Flooded Fields Initiative ..... 24
**Chapter 8. References** ..... **25**
**Appendix I. Terms and Abbreviations** ..... **27**

# Chapter 1. Introduction

This report attempts to provide an assessment of the environmental management of the Caspian oil industry, as it relates to the control of the oil pollution of the Caspian Sea.

As a preliminary the report updates the available information on oil contamination of the Caspian Sea and summarizes the status as it appears to the Caspian Center for Pollution Control (CCPC) towards the end of 2001. The report then proceeds to review the relevant environmental regulations in the five Caspian states, followed by a brief discussion of the environmental results achieved through international conventions for other seas.

On this background the report arrives at an assessment of the environmental management, which shows a clear distinction between the generally adequate performances of the new projects operated by international oil companies, as opposed to the generally inadequate performances at the fields inherited from the past and operated by successor companies to Soviet-era organizations. The report concludes with project proposals that may assist the recovery of the environmental situation.

The report has been prepared by Peter Graversen, CCPC oil industry expert, and is based on published documentation, reports, questionnaires and interviews compiled and prepared by a range of CCPC experts during the existence of the Caspian Environment Programme. The work has benefited greatly from discussions with Latifa Guseynova, CCPC Technical Coordinator, and from contributions from the national oil pollution experts:

- Fuad, Azerbaijan
- Akimgali Kenghegaliev, Kazakhstan
- Aa, I. R. Iran
- Bb, Russia
- Cc, Turkmenistan

# Chapter 2. Summary and Conclusions

## 2.1. Oil Pollution by the Oil Industry

Review of the available data has generally confirmed the earlier conclusions, which were presented in the CCPC report: Oil Contamination of the Caspian Sea /1/:

- The oil pollution that is a direct result of the oil industry activities in the Caspian Region is a relatively minor, but locally damaging and totally avoidable contribution to the oil input to the Caspian Sea.

The best available estimate shows, that the oil industry input is around 5 % of the total input, and about 12 % of the regional anthropogenic oil input. This apparently minor contribution is nevertheless important because of the severe environmental impact that is evident in the vicinity of some of the oil production facilities, pipelines, shipping terminals, and refineries, which make up the infrastructure of the oil industry.

Further analysis shows that the bulk of this oil pollution comes from a group of successor organizations to the Soviet-era state oil companies. For a complex of reasons, the management has tolerated a situation where inadequate “housekeeping” and lack of maintenance resulted in permanent convenience discharges, leaks and spills.

There is no doubt that correcting the “sins of the past” will in some places require considerable resources. A particular problem is posed by the flooded and abandoned oil fields that have not been decommissioned and sealed. However, experience from well-managed oil production units leaves no doubt that proper environmental management, maintenance and operation of the existing facilities is the main key to eliminating oil pollution of the Caspian Sea from oil industry activities.

## 2.2. Regulation and Monitoring

For national and historical reasons, there is some variation in the institutional arrangements and the body of laws and regulations that control the environmental performance of the oil industry in the five states around the Caspian Sea. However, a review shows that in spite of differences the basic elements of environmental control are generally in place:

- A government operated permit system defining emission limits.
- Compliance monitoring and regular inspection by the environmental authorities.
- Requirement for environmental impact assessment (EIA) of major new projects.

There is undoubtedly scope for implementation of integrated pollution prevention and control policies (IPPC), institutional strengthening, and development of monitoring and reference laboratories. In the context of oil pollution of the sea, the most striking feature is however the double-standard enforcement of the already existing environmental regulations, which apparently condones the continued severe pollution by some older

organizations while at the same time requiring strict compliance by the international operators of the new field developments.

The prompt enforcement of existing environmental regulations for all old as well as new oil industry activities will provide the essential motivation for the organizations to strengthen their environmental management practice.

## 2.3. International Sea Conferences

For most international water bodies, the bordering states have entered into conventions that have as one of their purposes to improve the environmental management and protection of the sea. These international conventions are today at different stages of development; the experience shows that they primarily contribute to the prevention of oil pollution from the oil industry activities by providing:

- A common framework for monitoring and reporting marine oil contamination.
- Common emission limit values.

The separate sea conventions supplement the regulations by the International Maritime Organization, which are intended to control worldwide the marine oil pollution from tankers (MARPOL 73/78).

The existing conventions provide a ready body of regulations that could be adapted and implemented for the Caspian Sea within a short timeframe.

## 2.4. Environmental Management in the Oil Industry

It was stated in section 2.1 above that the oil pollution from the regional oil industry comes from a group of older organizations. The following assessment is concerned with this “polluting” section of the oil industry.

The review of the oil industry has indicated that the marine oil pollution is mainly the result of the management philosophy that dominates parts of the older industry organizations. It would appear that maximizing of production has been given priority over all other concerns. What is clear is that industrial facilities, which have obviously been designed and built to meet acceptable environmental criteria, have in these organizations been allowed to fall into disrepair resulting in operational shortcuts, convenience discharges, and leaks and spills. It is important to note that the present situation is overwhelmingly a matter of inadequate operation and maintenance practices; the actual cost of timely intervention would in most cases be negligible.

The information compiled for this study indicates, that the basic structure of environmental management is generally in place; there is an identified environmental manager, who is typically supported by a (small) department and an environmental laboratory. The organizational status is less clearly understood. It appears that the main responsibility of the environmental manager is to meet the reporting and other requirements of the monitoring authorities.

In the face of what appears to be double standards in the enforcement of environmental regulations, it should probably not surprise that some organizations give low priority to environmental concerns. The limited information that is available indicates that oil pollution, when discovered, is fined lightly, and the fines are typically budgeted by the operators as part of the operating costs.

This analysis leads to the conclusion, that the main driver towards improved environmental performance of the "polluting" section of the oil industry will be strict and prompt enforcement of existing regulations. As in western industrial countries, an effective system of compliance enforcement would include substantial fines, withdrawal of operation permit for persistent polluters, and the possibility for criminal prosecution of the responsible management in extreme cases.

Other drivers that may in the future influence the environmental performance include:

- Economy – oil pollution is waste of valuable resources. At an E&P cost of 6-10 $/bbl and a market value of 16-20 $/bbl, recovered oil is a valuable resource that would contribute towards covering the cost of environmental control.
- Safety – oil pollution is risk. Uncontrolled release of hydrocarbons is the major cause of accidents in the oil industry, and a high level of safety is synonymous with good environmental practice.
- Peer pressure. High environmental standard is increasingly becoming a parameter of competition among oil companies.
- Public pressure. Environmental indignation expressed through NGO's and the political process has become a major factor in western industrial countries.

## 2.5. Project Pipeline

The following two project proposals have been developed to improve the environmental performance and eliminate oil pollution from the oil industry activities in the Caspian region:

- Support to Oil Industry Environmental Management.

  As discussed above, considerable reduction of oil pollution from operating oilfields could actually be achieved at quite moderate cost through a readjustment of oil company management priorities and "housekeeping" practices, encouraged by prompt and firm government enforcement of environmental regulations.

  The desirable development must necessarily originate "from within" the concerned organizations. In the current oil market situation the necessary resources could be allocated without straining the economy of the oil companies.

  To support the development it is proposed that the Caspian Centre for Pollution Control is staffed to provide advice on modern environmental management practice with specific competency in oil industry issues.

- Flooded Fields Initiative.

  A more substantial effort will be required to solve the problem of oil pollution from flooded and abandoned fields. It is doubtful, moreover, that any present oil company or organisation could be held liable for the ”sins of the past”.

  The Flooded Fields Initiative is proposed to address the technical, legal, and financial aspects of this problem. The project shall develop a comprehensive “package” that may be submitted for funding by the concerned governments in conjunction with relevant international aid agencies.

# Chapter 3. Review of Oil Emissions

## 3.1. Introduction

At the start of the Caspian Environment Programme (CEP), a report describing the status of oil contamination of the Caspian Sea was prepared and issued in February 2000 as one of the first results from the Caspian Centre for Pollution Control (CCPC) /1/.

During the following period, a considerable body of supplementary detailed information has become available at the CCPC from published sources, various reports, and through contacts to the industry and the authorities in the region. Much of this information was included in the pollution assessment reports, which were successively issued by the CCPC /2/ - /7/.

As part of the CEP Phase II working program, the CCPC has undertaken to review and supplement the information on man-made oil pollution from oil industry activities with emphasis on older existing offshore oil fields, oil terminals, marine transportation, and oil refineries. The information has been compiled by the CCPC in collaboration with national experts in the five coastal states.

The purpose of the present chapter is to summarize and present the status of oil contamination of the Caspian Sea as it is viewed by the CCPC based on the information available towards the end of 2001.

## 3.2. Summary

The current best estimate of the annual oil input to the Caspian Sea from all sources is summarized in Table 3.1.

The background and significance of the main sources of oil contamination – other than the oil industry - will first be reviewed below. The input from the oil industry activities will then be more closely analysed in the subsequent sections.

As indicated in the table, the quantitative estimates are subject to some uncertainty; however, the level and relative importance of the oil contamination sources are not in doubt. It may be noted in passing that:

- 1/8 of the oil input is due to natural seepage from the ground and erosion of surface deposits that are beyond environmental control.
- Nearly half the input is generated outside the region and carried to the Caspian Sea by the rivers, notably the Volga.
- 40 % of the total oil input originates from human activities around the Caspian Sea: 1/8 of the estimated regional man-made input is due to the oil industry activities.

**Table 3.1. Estimated Annual Oil Input to the Caspian Sea**

| | Oil input ton/y | Oil input range ton/y | % |
|---|---|---|---|
| Seepage and erosion | 20 000 | 10 000 – 50 000 | 12.5 |
| Oil industry activities | 8 000 | 5 000 – 13 000 | 5.0 |
| Municipalities | 21 000 | 10 000 – 40 000 | 13.1 |
| Other industry | 35 000 | 15 000 – 50 000 | 21.9 |
| Rivers | 75 000 | 50 000 – 260 000 | 46.9 |
| Atmosphere | 1 000 | 300 – 2 000 | 0.6 |
| Total | 160 000 | 90 000 – 300 000 | 100.0 |

While only 40 % of the oil contamination would thus be subject to regional control, it is important to note that these inputs in particular come from concentrated sources, typically coastal communities and industrial activities facing sensitive shallow water zones, where oil pollution accumulates with severe environmental consequences. The reduction and elimination of the man-made oil input from regional activities can therefore be expected to make a more than proportional contribution towards easing the environmental state of the Caspian Sea.

### 3.2.1. Reference: Oil Pollution of the Seas

It is instructive to consider briefly the estimated worldwide pollution of the marine environment by oil.

Several sources have published estimates, which vary in the numerical details but present the same overall picture. The figures in table 3.2 are based on information from NASA/Ocean Planet /16/.

Comparison of tables 3.1 and 3.2 shows that:

- Seepage and erosion are estimated to contribute 12.5 % of the total input to the Caspian Sea, while the worldwide relative contribution from this source is 8.7 %. The higher seepage is a result of the character of the oil reservoirs and deposits in the Caspian Region.
- Run-off and wastewater discharge from land based human activities (municipalities and industries directly and via the rivers) contribute as much as 86.9 % of the total input to the Caspian Sea, while the worldwide relative input from run-off is 51.4 %. The higher figure is a consequence of the very large

catchment area – particularly the Volga basin –, which is drained to the Caspian Sea.

**Table 3.2. Estimated worldwide marine oil pollution.**

| | Oil input ton/y | % | Production specific kg/ton | Shipment specific kg/ton | Population specific kg/inhabitant |
|---|---|---|---|---|---|
| Seepage | 200 000 | 8.7 | 0.06 | | |
| Drilling | 50 000 | 2.2 | 0.01 | | |
| Tanker cleaning | 445 000 | 19.4 | | 0.27 | |
| Tanker accidents | 120 000 | 5.2 | | 0.07 | |
| Runoff | 1 180 000 | 51.4 | | | 0.20 |
| Atmosphere | 300 000 | 13.1 | | | 0.05 |
| Total | 2 295 000 | 100.0 | 0.07 | 0.34 | 0.25 |

Note: specific pollution (kg/ton oil production, kg/ton oil shipped, kg/inhabitant) based on:

- World oil production (2000): 3 340 000 000 ton/y.
- Tanker shipment: 50 % of total production: ~ 1 670 000 ton/y.
- World population: ~ 6 000 000 000.

Table 3.2 provides the following specific key figures, which are further discussed in subsequent chapters:

- Spill from drilling operations provides an input of 0.01 kg/ton oil produced.
- Convenience discharges of ballast water, tank cleaning slop, and machine space bilge from tanker operation accounts for no less than 0.27 kg/ton oil shipped.
- The input from tanker accidents is 0.07 kg/ton oil shipped.
- The airborne yearly oil input from human activities is 0.05 kg/inhabitant.

## 3.3. Seepage and Erosion

The input from seepage and erosion was estimated in the earlier report at 20 000 ton/y /1/. There is no new information on this input source, and the estimate is unchanged.

## 3.4. Oil Industry Activities

Table 3.3 provides an overview of the oil production n the Caspian Region /14/. The table shows that:

- The large oil producers I. R. Iran and Russia have none of their production capacity in the Caspian Region.
- Oil production comes from the three medium/small oil producers Azerbaijan, Kazakhstan, and Turkmenistan with a total joint production in the Caspian Region of 33 million ton/y corresponding to 1 % of world oil output.
- 1/3 of the oil from the Caspian region is produced offshore, mainly in Azerbaijan.

**Table 3.3. Oil production in the Caspian Region.**

| Crude oil production 2000 ton/y | | Caspian offshore ton/y | Caspian Region ton/y |
|---|---|---|---|
| Azerbaijan | 12 837 000 | 10 500 000 | 12 000 000 |
| I. R. Iran | 174 284 000 | None | None |
| Kazakhstan | 31 222 000 | None | 16 000 000 |
| Russia | 316 210 000 | None (?) | None (?) |
| Turkmenistan | 7 121 000 | 398 000 | 7 000 000 |
| Total: | 541 664 000 | 10 900 000 | 33 000 000 |

About 60 % of the total regional production in 2000 came from two new large fields, which have been developed and operated to international standards:

- Azeri-Chirag -Guneshli, Azerbaijan (Operator: BP): 5 700 000 ton/y
- Tengiz, Kazakhstan (Operator: Chevron): 13 700 000 ton/y

Most of the remaining production – corresponding to about 13 600 000 ton/y - comes from older fields inherited from the past, operated by the successor organisations to the Soviet-era production units organised under the umbrella of the state oil companies:

- SOCAR, Azerbaijan
- KazakhOil, Kazakhstan
- Turkmenneft, Turkmenistan

These older production facilities – together with the Caspian tanker fleet and the coastal oil refineries of comparable age – are the main source of the oil input to the Caspian Sea from oil industry activities presented in table 3.4.

**Table 3.4. Oil input to the Caspian Sea from oil industry activities.**

| | Oil input ton/y | Oil input range ton/y | % |
|---|---|---|---|
| Offshore production | 1 000 | 500 – 5 000 | 12.5 |
| Onshore production | 2 000 | 500 – 5 000 | 25.0 |
| Flooded fields | 2 500 | 300 – 3 000 | 31.2 |
| Transportation | 2 000 | 1 000 – 4 000 | 25.0 |
| Refineries | 500 | 250 – 1 000 | 6.3 |
| Total | 8 000 | 5 000 – 13 000 | 100.0 |

Note: Excluding oil contamination from catastrophic events:

- Well blow-outs
- Tanker accidents
- Storage tank failures
- Pipeline ruptures

There is no good reason to accept an oil contamination of the sea in the order of 8 000 ton/y from oil industry sources. Design and operation of the production, transport, storage and processing facilities in accordance with a few basic principles can effectively eliminate or reduce oil emissions from the whole Caspian oil industry to a regular level of less than 800 ton/y. If desired, zero-discharge to the sea can be achieved by re-injection of residual oil contaminated waste streams into exhausted oil reservoirs.

The level of pollution varies considerably from one installation to another. Some well-managed production units have achieved close to zero-discharge; this has primarily been achieved through observance of proper operation procedures and adequate maintenance. In other units, failure of responsible management has created a situation where irregular discharges – convenience discharges, leaks and spills – are the norm, with serious consequences for workers health, safety and the environment.

At the time of writing there are regular news reports of plans for renovation and production expansion at some of the older onshore – and to a lesser extent offshore – oil fields with collaboration from international partners. This development will extend the commercial viability of existing fields, and could in the long run have a positive effect on the environmental situation as well; however, CEP has no detailed information on the plans and terms for operation of the new ventures.

### 3.4.1. Offshore Production

#### Inherited Fields

The Soviet-era offshore production in Azerbaijan and Turkmenistan was generally developed with conventional technologies designed to minimize oil pollution of the sea. Produced water and oily wastewater should generally be re-injected or piped to shore. However, oil pollution is only too obvious in some locations.

Oil leaks from corroded and damaged inter-field and field-to-shore undersea pipelines is a particular concern. An example is the leaking pipeline from the Lam and Zhdanov fields to the shore in Turkmenistan /12/.

The Gum Adasi offshore production unit east of Baku Bay demonstrates that operation without discharge of oil is feasible with Soviet-era equipment /11/.

The earlier report estimated the oil pollution from offshore production at 1 000 ton/y; in the absence of more reliable new data the previous estimate is maintained.

#### New Fields

Drilling and production from new offshore fields are being developed by international oil companies, and follow generally acceptable standards; any oil input to the sea is likely to be negligible.

#### Drilling Operations

Controlled discharge of spent drilling mud and cuttings has in the past been allowed offshore Azerbaijan: however, the declared policy is that drilling wastes should be re-injected or carried to shore. Facilities for reception, recycling and deposit are operated by:

- SOCAR: used mud is recycled, while cuttings are transported to a dedicated landfill close to Primorsk.
- BP/AIOC: spent drilling mud goes to MI Drilling, which provides treatment of mud. Drilling cuttings are transported to a landfill at Saranja.

The only operator currently engaged in exploration offshore Kazakhstan is Agip/OKIOC: because of the low water depth en the sensitive environment at the Kashagan field, all drilling wastes are transported to the shore base at Bautino near Fort Shevchenko /11/.

No information was obtained concerning the handling of drilling wastes in Turkmenistan.

### 3.4.2. Onshore Production

The oil pollution from onshore oil production along the coast of the Caspian Sea is comparable to the situation in the offshore fields inherited from the past. Basically sound facilities, capable of controlling oil discharge, have been allowed to fall into disrepair, and this failure of proper field management has resulted in extensive local oil pollution.

The earlier report estimated the input from offshore oil production at 2 000 ton/y with a range of 500 – 5 000 ton/y /1/. The Baku Bay Study independently estimated that the marine oil pollution from the Bibi Heybat field alone could be as high as 1 800 ton/y /15/. This indicates that the earlier reported figure may be on the low side. However, in the absence of comparable information from other onshore oilfields it is suggested to maintain the earlier estimate unchanged.

### 3.4.3. Flooded Fields

It is difficult to accurately estimate the extent of seepage from oil wells in the sea, especially those that were on land but are now flooded and those that have been abandoned and not properly sealed. The Baku Bay Study has estimated that about 200 wells in the area have been abandoned and not properly decommissioned. Flooded wells on the Kazakhstan coast and to a lesser extent in Turkmenistan are also leaking and creating local risks.

Leaking under the ice from an abandoned flooded Kazakh well during the winter 2000 – 2001 dramatically highlighted the issue. Intervention was made very difficult because of the frozen sea. Eventually 100 tons spilled oil were recovered, indicating a total spill of several hundred tons from a single event /11/.

No new data have been obtained as basis for change of the overall estimate.

### 3.4.4. Transportation

#### Oil Tanker Operations

There is a considerable and increasing transportation of oil by tanker across the sea from Aktau, and to a lesser extent Turkmenbashi to Baku, as well as Cheleken to Neka. Total transfer was around 7 million ton/y in 1997 /10/, and may possibly have increased to 9 million ton/y in 2000. The scope for further growth in tanker traffic is however limited, as pipeline transport is being developed (The CPC pipeline capable of transporting 25 million ton/y from Kazakhstan to the Black Sea was inaugurated in November 2001 after some initial delays).

The majority of tankers in the Caspian Sea are operated by Caspian Shipping Company (CSC), Azerbaijan, and Volgotanker, Russia. The tankers are relatively small, in the range 5 000 – 10 000 dwt. There are reports that their navigation systems are inoperative, safety is inadequate, and the general state of maintenance is poor.

Potential sources of oil pollution from tanker operations are:

- Oil contaminated ballast water discharged at the ports of loading (Aktau, Turkmenbashi).
- Oil slop from cleaning of tanks.
- Bilge from machinery spaces.

Properly operated tankers will clean and discharge their oily wastewater (gravity separation for 24 hours in one of the tanks will reduce the oil concentration in the water phase below the limit of 5 mg/L permitted under MARPOL 73/78). The skimmed-off oil may be “topped-up” in one of the crude tanks, or discharged to reception facilities in ports.

Facilities with berths for tanker cleaning and reception of oily wastes have been identified at:

- UG-Tanker, Astrakhan, Russia: the recovered oil is recycled and sold with profit.

Other ports employ the traditional Soviet-era system with small, dedicated vessels collecting the solid and liquid wastes from the visiting ships, including oily waste for treatment. The following operators have been identified in the Caspian Region:

- Baku International Marine Trade Port (BMITP), Azerbaijan: oily wastes go to Azerneftyag Refinery, Transoceanic/Ecoservice Alliance or Azeco for treatment and recovery.
- Aktau Marine Trade Port, Kazakhstan.
- Turkmendenizyollari, Turkmenbashi, Turkmenistan: transporting oily waste to Oil Transit Base.

There are varying reports on the actual operation and utilization of these waste recovery schemes. Without prompt and strict enforcement, it seems likely that at least some tanker operators prefer to save cost and time, and discharge their oily waste at sea.

In the absence of more precise information, it is assumed that the input to the Caspian Sea is comparable to the discharge from worldwide tanker operations. Based on the estimated discharge factor of 0.27 kg/ton oil shipped – discussed in chapter 3.2.1 above -, the annual waste oil discharge from tanker transportation of 7 – 9 million ton/y is estimated at 2 000 ton/y.

### Terminals

Table 3.5 summarizes the main results of a survey of the coastal oil terminals in the Caspian Region.

The availability of facilities for reception and treatment of ballast water and oily waste from tankers has already been discussed above.

It is seen from the table that bunds for spill protection have been omitted in several locations. Oil terminals and tank farms are not considered sources of continuous oil pollution to the sea, however the absence of bunding is a cause for concern because of the risk of major local oil spills in case of tank failures.

**Table 3.5. Coastal oil terminals in the Caspian Region.**

| Country: | Location: | Oily waste facility | Bunded tanks |
|---|---|---|---|
| Azerbaijan | Dyubendi | No | Yes |
| | Azpetrol, Baku | Collection ships. | Yes |
| | Transserv | Not in operation. | No |
| | AIOC, Sangachal | Pipeline terminals: no tanker traffic. | Yes. |
| | Dashgil Oil Terminal | | Yes |
| | Gum Adasi | | No |
| I. R. Iran | Anzali | No | No |
| | Noshahr | No | No |
| | Neka | No | Yes (reported inadequate) |
| Kasakhstan | Aktau | Collection vessel | Yes |
| Russia | Makhachkala | No | No |
| Turkmenistan | Aladja | Collection vessels | No information. |
| | Ufra, Turkmenbashi | | |
| | Okarem | | |

### 3.4.5. Coastal Refineries

There are four large Soviet-era refineries located along the coast of the Caspian Sea, as summarized in table 3.6. These refineries were all designed to treat a mixture of Russian and local crude oil within the centralized Soviet energy supply system. After independence, the capacity of the refineries far exceed the domestic demand of the new states, and – with the possible exception of Turkmen Refinery – they are today operated well below their nominal capacity.

The refineries at Atyrau and Turkmenbashi are currently being renovated and adjusted to the new market situation, and reconstruction plans have also been announced for the two Azeri refineries. A new refinery is reportedly under construction in Dagestan, but CCPC has not obtained any detailed information.

**Table 3.6. Coastal oil refineries in the Caspian Region.**

| Country: | Refineries: | Nominal capacity ton/y | Throughput 2000 ton/y |
|---|---|---|---|
| Azerbaijan | Azerneftyag, Baku | 11 900 000 | ~ 4 800 000 |
| | Azerneftyanajag, Baku | 10 100 000 | ~ 4 000 000 |
| I. R. Iran | (None) | - | - |
| Kazakhstan | ANPZ, Atyrau | 5 200 000 | ~ 2 000 000 |
| Russia - Dagestan | Dagestan Oil, Makhachkala | 200 000 (?) | - |
| Turkmenistan | Turkmen Refinery, Turkmenbashi | 5 800 000 | ~ 5 000 000 |
| Total | | 33 200 000 | ~ 15 800 000 |

The wastewater from the ANPZ refinery in Atyrau is discharged to a large evaporation field /11/, while the oily wastewater from the other refineries reach the Caspian Sea after varying degree of treatment. Observation during site visits indicate that the reported oil discharge of around 250 ton/y is probably underestimated by a factor two or more /12/, confirming the earlier estimate of 500 ton/y for the refinery input.

### 3.4.6. Catastrophic Events

Major oil spills – as caused by well blowouts, tanker accidents, and storage tank and pipeline failures – will often catch the attention of the public, but are statistically of limited significance compared to the continuous oil input sources discussed above. Catastrophic events can nevertheless result in serious local environmental damage, and the following give particular cause for concern:

- The Caspian Sea is located in a region of high seismic activity.
- The general safety standard of the operating oil tankers is reportedly low.
- Oil tanks - often in poor conditions - are rarely provided with secondary safety barriers in the form of bunding (Table 3.5).

## 3.5. Regional and Extra-regional Municipalities and Industry

The oil input from the regional municipalities and non-oil industry has been reviewed and raised to include the contribution from the northern coast of I. R. Iran, /4/ + /8/.

The estimate of the oil pollution carried with the rivers from municipalities and industry outside the Caspian Region has been confirmed by the latest available data /8/.

### 3.6. Atmospheric Deposits

The input from atmospheric deposition shall not be neglected as it may have a significant local effect. The estimate of 350 ton/y presented in the earlier report /1/ appears to be on the low side when compared with the worldwide estimate of airborne hydrocarbon pollution in table 3.2. For an average input from this source of 0.05 kg/inhabitant it may be assumed that the ~ 20 million regional inhabitants generate an atmospheric input which is closer to 1 000 ton/y.

# Chapter 4. Environmental Regulation

## 4.1. Authorities and Regulations

The assessment Reports, /2/, /3/, /5/, /6/, and /17/ provide detailed review of the organization of the environmental authorities in the five riparian states.

For national and historical reasons, there is some variation in the institutional arrangements and the body of laws and regulations that control the environmental performance of the oil industry in the five states around the Caspian Sea. However, a review shows that in spite of differences the basic elements of environmental control are generally in place:

- A government operated permit system defining emission limits.
- Compliance monitoring and regular inspection by the environmental authorities.
- Requirement for environmental impact assessment (EIA) of major new projects.

## 4.2. Enforcement

There is undoubtedly scope for implementation of integrated pollution prevention and control policies (IPPC), institutional strengthening, and development of monitoring and reference laboratories. In the context of oil pollution of the sea, the most striking feature is however the double-standard enforcement of the already existing environmental regulations, which apparently condones the continued severe pollution by some older organizations while at the same time requiring strict compliance by the international operators of the new field developments.

The prompt enforcement of existing environmental regulations for all old as well as new oil industry activities will provide the essential motivation for the organizations to strengthen their environmental management practice.

# Chapter 5. Experience from Established Sea Conventions

For most international water bodies, the bordering states have entered into conventions that have as one of their purposes to improve the environmental management and protection of the sea.

Table 5.1 presents a summary of established sea conventions with indication of the covered area. The separate sea conventions supplement the regulations by the International Maritime Organization, which are intended to control worldwide the marine oil pollution from tankers (MARPOL 73/78). Table 5.1. further indicates the sea areas that are designated by MARPOL as special areas; for these areas the convention specifies a maximum allowed oil concentration of 5mg/L in water discharged from the shipping.

**Table 5.1. Summary of established sea conventions.**

| Acronym | Title | Covered area | MARPOL special area |
|---|---|---|---|
| | Barcelona Convention | Mediterranean Sea | Yes |
| | Bucharest Convention | Black Sea | Yes |
| | Cartagena Convention | Caribbean Sea | |
| HELCOM | Helsingfors Convention | Baltic Sea | Yes |
| | Kuwait Convention | Persian Gulf | Yes |
| OSPARCOM | Oslo – Paris Convention | Northwest Atlantic | |

These international conventions are today at different stages of development; the experience shows that they primarily contribute to the prevention of oil pollution from the oil industry activities by providing:

- A common framework for monitoring and reporting marine oil contamination.
- Common emission limit values.

The existing conventions provide a ready body of regulations that could be adapted and implemented for the Caspian Sea within a short timeframe. By analogy with the Mediterranean and Black Seas, it can be expected that the environmentally sensitive Caspian Sea would also be designated a special area.

# Chapter 6. Environmental Management Practice

It was found in chapter 3 above that the oil industry in the Caspian Region may be divided into two distinct groups on the basis of their environmental performance:

- The new oil fields operated by international oil companies, as well as some well-managed older organisation, follow generally acceptable environmental standards; their contribution to the oil input to the Caspian Sea is negligible.
- The bulk of the oil pollution comes from a group of successor organizations to the Soviet-era state oil companies. For a complex of reasons, the management has tolerated a situation where inadequate “housekeeping” and lack of maintenance resulted in permanent convenience discharges, leaks and spills.

The following assessment is concerned with the “polluting” section of the oil industry.

## 6.1. Environmental Organisation

The information compiled for this study indicates, that the basic structure of environmental management is generally in place; there is an identified environmental manager, who is typically supported by a (small) department and an environmental laboratory.

The organizational status is less clearly understood. It appears that the main responsibility of the environmental manager is to meet the reporting and other requirements of the monitoring authorities.

## 6.2. Assessment of Performance

The review of the oil industry has indicated that the marine oil pollution is mainly the result of the management philosophy that dominates parts of the older industry organizations. It would appear that maximizing of production has been given priority over all other concerns. What is clear is that industrial facilities have in these organizations been allowed to fall into disrepair resulting in operational shortcuts, convenience discharges, and leaks and spills. It is important to note that the present situation is overwhelmingly a matter of inadequate operation and maintenance practices; the actual cost of timely intervention would in most cases be negligible.

Much has been made of the claim, that the production facilities inherited from the Soviet period employ outdated – often pre-1960’s – technology. However, this does not explain – let alone justify – the serious oil pollution of land and sea, which is all too obvious around some of the older installations in the Caspian Region. In spite of their present appearance, these installations were undoubtedly designed on the basis of sound principles. When operated and maintained according to their design, they would achieve regular oil emissions in line with modern standards, and certainly without any visible oil pollution of the surroundings.

An example of such early technology is provided by the skimming ponds, which are widely used at old on-shore as well as near-shore oil fields to remove the free oil from the produced wastewater. The ponds are typically the size of a football field, and are dug out

in the ground or surrounded by dikes; on porous ground the ponds may be lined with clay. The produced water and other oil polluted wastewater streams are collected in open channels and sent to the pond, where oil and water separate by gravity; the water is then discharged to the sea or a nearby stream, while the lighter oil is skimmed from the surface and recovered.

These ponds are not a pretty sight; the evaporating oil is a source of severe air pollution and a possible explosion risk, and the ponds must be a death trap to any bird or wild animal that comes near. Nevertheless, the long residence time provides quite efficient oil/water separation in the ponds, and there is no reason to doubt that the low oil concentrations that have been quoted for the discharged water can actually be achieved in regular operation with such “open air processing systems”.

## 6.3. Compliance Enforcement

In the face of what appears to be double standards in the enforcement of environmental regulations, it should probably not surprise that some organizations give low priority to environmental concerns. The limited information that is available indicates that oil pollution, when discovered, is fined lightly, and the fines are typically budgeted by the operators as part of the operating costs.

This analysis leads to the conclusion, that the main driver towards improved environmental performance of the “polluting” section of the oil industry will be strict and prompt enforcement of existing regulations. As in western industrial countries, an effective system of compliance enforcement would include substantial fines, withdrawal of operation permit for persistent polluters, and the possibility for criminal prosecution of the responsible management in extreme cases.

## 6.4. Other Drivers

Other drivers that may in the future influence the environmental performance include:

- Economy – oil pollution is waste of valuable resources. At an E&P cost of 6-10 $/bbl and a market value of 16-20 $/bbl, recovered oil is a valuable resource that would contribute towards covering the cost of environmental control.
- Safety – oil pollution is risk. Uncontrolled release of hydrocarbons is the major cause of accidents in the oil industry, and a high level of safety is synonymous with good environmental practice.
- Peer pressure. High environmental standard is increasingly becoming a parameter of competition among oil companies.
- Public pressure. Environmental indignation expressed through NGO’s and the political process has become a major factor in western industrial countries.

# Chapter 7. Project Proposals

## 7.1. Review of Earlier Project Proposals

The previous CCPC study of oil pollution issues concluded with the following project proposals /1/:

- Renovation of offshore production units in Azerbaijan and Turkmenistan.
- Upgrading of environmental and safety management of state oil companies in Azerbaijan, Kazakhstan and Turkmenistan.
- Environmental and safety awareness of the employees of state oil companies and the inhabitants of Azerbaijan, Kazakhstan and Turkmenistan.
- Reclaiming of Bibi-Heybat oil- and gas production unit.
- Establishment of reception facilities for tanker ballast water in the riparian countries of the Caspian Sea.

The project for reclaiming of the Bibi-Heybat field outside Baku is currently being developed by the Coordination Unit of the CEP.

The remaining project proposals have been reconsidered from the standpoint, that the desirable development must necessarily originate “from within” the concerned organizations. In the current oil market situation the necessary resources could be allocated without straining the economy of the oil companies. It is therefore proposed to reorient and consolidate the earlier projects into the following two proposals:

- Support to Oil Industry Environmental Management
- Flooded Fields Initiative.

## 7.2. Support to Oil Industry Environmental Management

The older oil production units offshore and onshore are in many cases operated with a doctrine that places a low level of importance on health, safety and the environment. Changing the operating practises should start with re-orienting all levels of management and strengthening the departments in the national oil companies responsible for these aspects of production. Only after considerable capacity building to introduce a more environment and safety-conscious mentality throughout the industry, should individual rehabilitation and de-commissioning programmes be designed.

Some of the most promising fields are already receiving assistance from the international oil industry to improve economic efficiency, through joint production and development agreements. This development could have a positive effect on the environmental situation as well, and the new economic viability should embolden government authorities to enforce environmental regulations.

To support the development it is proposed that the Caspian Centre for Pollution Control is staffed to provide advice on modern environmental management practice with specific competency in oil industry issues.

## 7.3. Flooded Fields Initiative

As discussed above, considerable reduction of oil pollution from operating oilfields could actually be achieved at quite moderate cost through a readjustment of oil company management priorities and “housekeeping” practices, encouraged by prompt and firm government enforcement of environmental regulations.

A more substantial effort will, however, be required to solve the problem of oil pollution from flooded and abandoned fields. It is doubtful, moreover, that any present oil company or organisation could be held liable for the ”sins of the past”.

Sealing of several hundreds of flooded and abandoned wells in the coastal areas of Azerbaijan, Kazakhstan and Turkmenistan would undoubtedly be expensive and take time. Government funding will be essential, possibly with international assistance from development organisations.

A phased program is required to reach the goal, and it may be desirable to start with the simpler tasks. Many coastal oil wells that are currently partially flooded, or are at sufficiently low altitude that they may be flooded by a further rise in sea level, should be identified and registered now. Such wells should be made safe while it is still reasonably easy to do so.

The Flooded Fields Initiative is proposed to address the technical, legal, and financial aspects of this problem. The project shall develop a comprehensive “package” that may be submitted for funding by the concerned governments in conjunction with relevant international aid agencies.

# Chapter 8. References

## CEP Reports

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/6/ Assessment of Pollution Control Measures Turkmenistan. CCPC, May 2000.

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/8/ Transboundary Diagnostic Analysis. CEP, December 2001.

/9/ End of Mission Report No. 3 (Arne Jensen). CCPC, October 2000.

/10/ End of Mission Report No. 10 (Peter Graversen). CCPC, June 2001.

/11/ End of Mission Report No. 15 (Peter Graversen). CCPC, August 2001.

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## CCPC Industry Questionnaires and Visit Reports

The CEP reports are supported by a body of industry questionnaires, visit reports, and minutes of meeting, which are prepared by the CCPC national and international experts and kept at the CCPC.

## Other reference documents

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# Appendix I. Terms and Abbreviations

AIOC Azerbaijan International Oil Consortium

BAT Best available technology

BATNEEC Best available technology not entailing excessive cost

BEP Best environmental practice

CEP Caspian Environmental Project

CCCD Caspian Centre for Combating Desertification

CCER Caspian Centre for Emergency Response

CCLREI Caspian Centre for Legal, Regulatory, and Economic Instruments

CCMB Caspian Centre for Management of Bioresources

CCPC Caspian Centre for Pollution Control

CCPD Caspian Centre for Protection of Biodiversity

CCPM Caspian Centre for Pollution Monitoring

CCSDPH Caspian Centre for Sustainable Development and Public Health

CCWLF Caspian Centre for Water Level Fluctuations

CPC Caspian Pipeline Consortium

EU European Union

EBRD European Bank for Reconstruction and Development

EU TACIS EU Technical Assistance to the Community of Independent States

HELCOM Helsinki Commission, Helsinki Convention 1972/81, 1991

IPIECA International Petroleum Industry Environmental Conservation Association

MARPOL International Convention for the Prevention of Pollution from Ships, 1973, as modified by the convention of 1978

OKIOC Offshore Kazakhstan International Oil Consortium

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|---|---|
| OPRC 1990 | International Convention on Oil Pollution Preparedness, Response and Co-operation |
| OSPARCOM | Oslo – Paris Commission |
| PCU | Programme Coordination Unit, Baku, Azerbaijan |
| SAP | Strategic Action Plan |
| SOCAR | State Oil Company of the Azerbaijan Republic |
| TDA | Transboundary Diagnostic Analysis |
| UNDP | United Nations Development Programme |
| UNEP | United Nations Environmental Programme |