



Community Civil Protection Mechanism European Commission

UKRAINE - Oil Spill in Kerch Strait, Black Sea

Final Report

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PREFACE

The team would like to thank:

- the Ukrainian authorities, and in particular the Ministry of Environmental Protection, the Ministry of Transport and Communications, the Ministry for Foreign Affairs and the Ministry of Emergencies and Affairs of Population Protection from the Consequences of Chernobyl Catastrophe;
- the regional Ministries and local authorities in Kerch, and in particular the Trade Port in Simferopol under the Ministry of Industry, Transport and Communication of the Autonomous Republic of Crimea for hosting the team;
- the EC Delegation in Kiev;
- the Directorate-General for External Relations of the European Commission;
- the Joint UNEP/OCHA Unit.

1 INTRODUCTION

1.1 Context

Following the disaster which took place in the Kerch Strait on Sunday 11 November, the Monitoring and Information Centre (the MIC) of the Civil Protection Mechanism of the European Commission monitored the situation closely and took contacts with other organisations concerned, such as the European Maritime Safety Agency (EMSA), the Black Sea Commission and the Joint UNEP/OCHA Environment Unit. On Wednesday 14 November 2007, letters were sent to both the Ukrainian and Russian authorities to offer assistance. On Friday 16 November 2007, the Ukrainian authorities expressed the wish to accept such assistance.

The MIC immediately sent a request to the 24 hour contact points of the 30 countries participating in the Mechanism to request experts. A team of five experts was appointed on the same day and deployed the following day to Ukraine. The MIC invited a member of the Joint UNEP/OCHA Environment Unit to join the mission in order to provide the international context and further develop working relations between the MIC and the Joint Unit. The team was in Ukraine from Sunday 18 November until Saturday 24 November 2007. The team held meetings with ministries at national and local level (see Annex I) and carried out site visits.

1.2 Scope and terms of reference

The Ukrainian authorities requested EU assistance “in preparing the environmental assessment as to the magnitude of the catastrophe as well as allocation of technical and financial resources to remediate its impact”. They also expressed the hope that “the EU would be able to use all available instruments to provide the necessary technical and financial help designated to overcome this ecological catastrophe”.

The objectives of the mission of the EU team were to: assist the Ukrainian authorities in assessing the environmental impact of the disaster; to observe the development of the pollution and to advise on immediate remediation needs.

The arrival of the team in Kerch was delayed due to poor weather conditions in the Kerch region in the first two days of the mission and circumstances beyond the control of the Ukrainian authorities, namely the mine explosion in the eastern Donetsk region on 18 November 2007 which meant that some resources planned for the oil spill mission had to be redirected to the mining disaster. In the three days that the team was able to spend in the Kerch region it was able to visit four sites in Ukraine, including Tuzla Island. The scope of the mission was to assist only the Ukrainian authorities, not the Russian authorities. The Russian Federation did not request assistance and the team therefore did not visit any sites on the Russian side of the Kerch Strait.

2 FINDINGS AND OBSERVATIONS

2.1 DESCRIPTION OF THE EVENT

On 11 November 2007, a strong storm in the Kerch Strait which connects the Sea of Azov with the Black Sea with winds of up to 35 m/s and waves of up to 5 metres resulted in 13 vessels being sunk, stranded or damaged. Four crewmen were confirmed dead and 19 men are still missing, presumed dead. The four vessels that sank were: motor tanker “Volgoneft-139” (Russian Flag); motor vessel "Volnogorsk" (Russian Flag); motor vessel "Nahichevan" (Russian Flag) and motor vessel “Kovel” (Russian Flag).

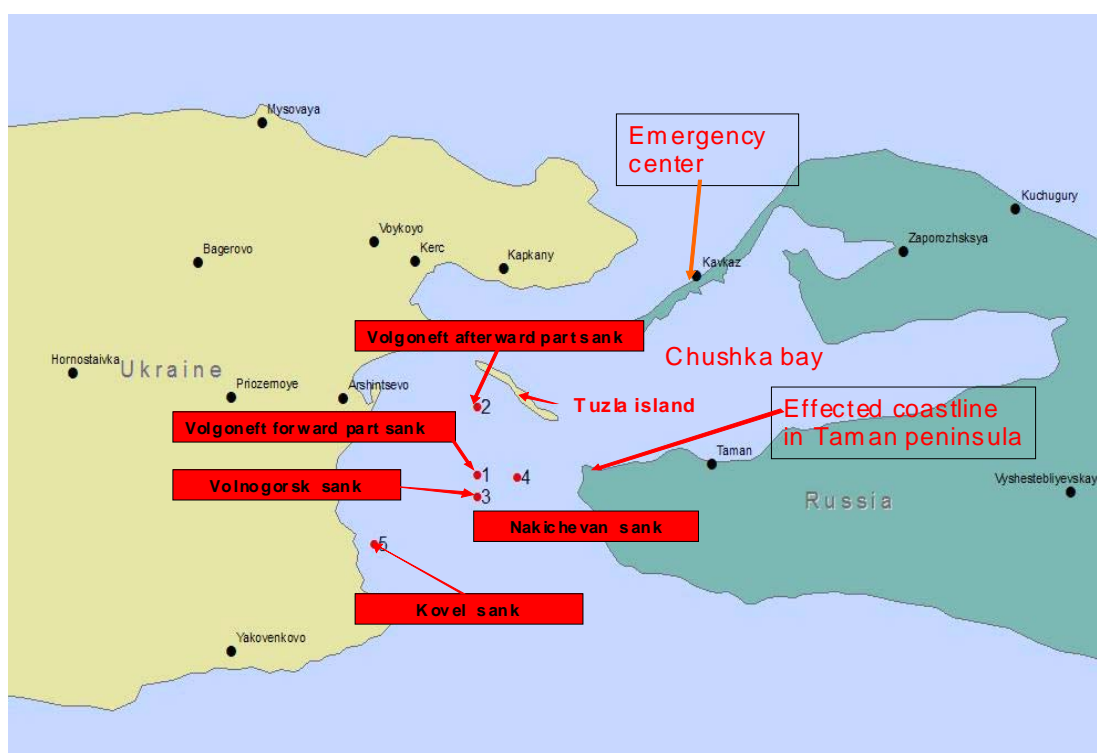


Figure 1 – Location of the sunk vessels [Source: website of Black Sea Commission]

Immediately after the accident, the weather conditions at sea (18-20 m/s wind, 2.5 m waves) made operations in the field difficult.

Based on information gathered during meetings with the authorities (see Annex I) and from the situation report of 18 November 2007 of the Ukrainian Ministry of Emergencies, the situation can be summarised as follows:

The motor tanker “Volgoneft-139” with 3463 tonnes of residual oil (heavy fuel oil type M-100 which corresponds to IFO 280-600)¹ sank on the muddy anchorage place n° 451, while the other vessels (each one of them carrying about 2000 tonnes of sulphur) did not sink, but drifted towards the coast of Ukraine (south of Tuzla Island). The motor tanker “Volgoneft-139” broke into two parts, leaving the front part anchored at 45° 13’ 01” N; 36° 31’ 06” E. The back part drifted to the position 45° 15’ 06” N; 36° 30’ 07” E causing an oil spill of about 1300 tonnes coming from its tanks. The oil that remained in the back part (1000 tonnes) was pumped out before it was towed to Kavkaz Harbour, which is located at the NW of the Strait on the Russian side. The grounded front part still contains about 1000 tonnes of oil with a small residual leakage. The spilled oil mainly drifted to the shoreline of Tuzla Island due to a sudden change in the wind direction.

The motor vessel "Volnogorsk" sank at 45° 11’ 05” N; 36° 31’ 07” E. It is now at a depth of 10.6m with 2436 tonnes of sulphur on board. There is no observed leakage of bunker oil i.e. marine diesel fuel.

The motor vessel "Nahichevan" sank at 45 ° 12’ 00” N; 36° 33’ 05” E. It is now at depth of 9.5m with 2365 tonnes of sulphur on board.

The motor vessel “Kovel” sank almost in the middle of the channel and has drifted to near the Ukrainian shoreline at 45° 09’ 02” N; 36° 26’ 06” E. It is now at a depth of 9.3m with about 2100 tonnes of sulphur on board. Divers surveying the vessel observed a slight marine diesel fuel leak due to the destruction of the engine compartment.

According to the data provided by the Ukrainian Ministry of Transport, as of 20 November 2007, the total amount of the immediate spillage was 1300 tonnes of heavy fuel oil, 2.3 tonnes of oil lubricants, 25 tonnes of marine diesel fuel oil and 5.5 tonnes of heating oil.

The dry cargo motor vessels “Volnorgorsk”, “Nahichevan” and motor vessel “Kovel” that sank do not present any immediate large-scale environmental danger in terms of the sulphur. The water toxicity is not an immediate problem as the potential spill will not lead to the presence of colloidal sulphur in suspension.

Due to the adverse weather conditions, the main activities performed in the first few days were search and rescue and manual shoreline cleaning operations.

According to the data provided by the Ukrainian Ministry of Transport, by 21 November 2007, more than 500 personnel from the Ministry of Emergencies and volunteers were involved in shoreline clean-up operations on Tuzla Island; 17 technical units were engaged

¹ An oil of this type has a mix of between 5 - 30% of some lighter fraction to make it suitable for the purpose. This light fraction will evaporate quite quickly even at temperatures below 10 C. The viscosity will go up to 10⁶ centistoke in 2 - 3 days. The oil will also emulsify rather quickly and after 2-3 days it would have taken up 30 - 70 % of water.

on beaches and 15 ships were performing oil spill contingency operations in the Kerch Strait.

By 21 November 2007, the total amount of the mixture of oil, sand, limestone and marine vegetation collected was approximately 1700 tonnes on the mainland and 4000 tonnes on Tuzla Island.

According to the State Ecological Inspectorate several analyses had been performed after the accident. In the first days the observed oil concentration was up to 70 times more than the normal concentration, while recent results (19 November) show values close to five times more than the normal concentration.

According to the data provided by the Ukrainian Ministry of Environmental Protection, as of 20 November 2007, 150 dead birds had been collected. Activities to clean oiled birds are ongoing.

Environmental monitoring is still in progress involving several Ukrainian national institutes and research centres.

2.2 SITE ASSESSMENTS

The Kerch Strait is 41 km long and 4.5-15 km wide and is formed by an eastern extension of Crimea and the peninsula of Taman, a kind of continuation of the Caucasus. This in ancient times seems to have formed a group of islands intersected by arms of the Kuban River (Hypanis) and various sounds now silted up.

Increasing activities of ship transportation, with up to 40 vessels per day, means that there is a high risk of vessel accidents in the Kerch Sea Basin which is compounded by the type of cargo being transported. Fisheries are an important economic sector in the region as it is the migration route for fish between the Azov and Black Seas.

Due to the weather conditions, two areas of the Ukrainian coastline were most affected by the oil pollution:

- The eastern Crimean coast near Kerch, from Heroivske up to the northern Cape Karantynny. The shoreline is mainly composed of sedimentary limestone rocks with sporadic narrow sand beach where the spilled oil was trapped in different layers;
- The south-western coast of Tuzla Island. This island is located to the south east of the town of Kerch and is a long sandy band which is 6 km long and 500 m wide. It has a north-west/south-east orientation, perpendicular to the drift of the slicks of hydrocarbons at the time of arrival, acting as a natural boom. It is a low-lying island whose height does not exceed 1.5 metres. The island consists of sand sediments covered

with some vegetation in the central part. The sediment mainly consists of coarse-grained sand with intrusions of small pebbles and shells.

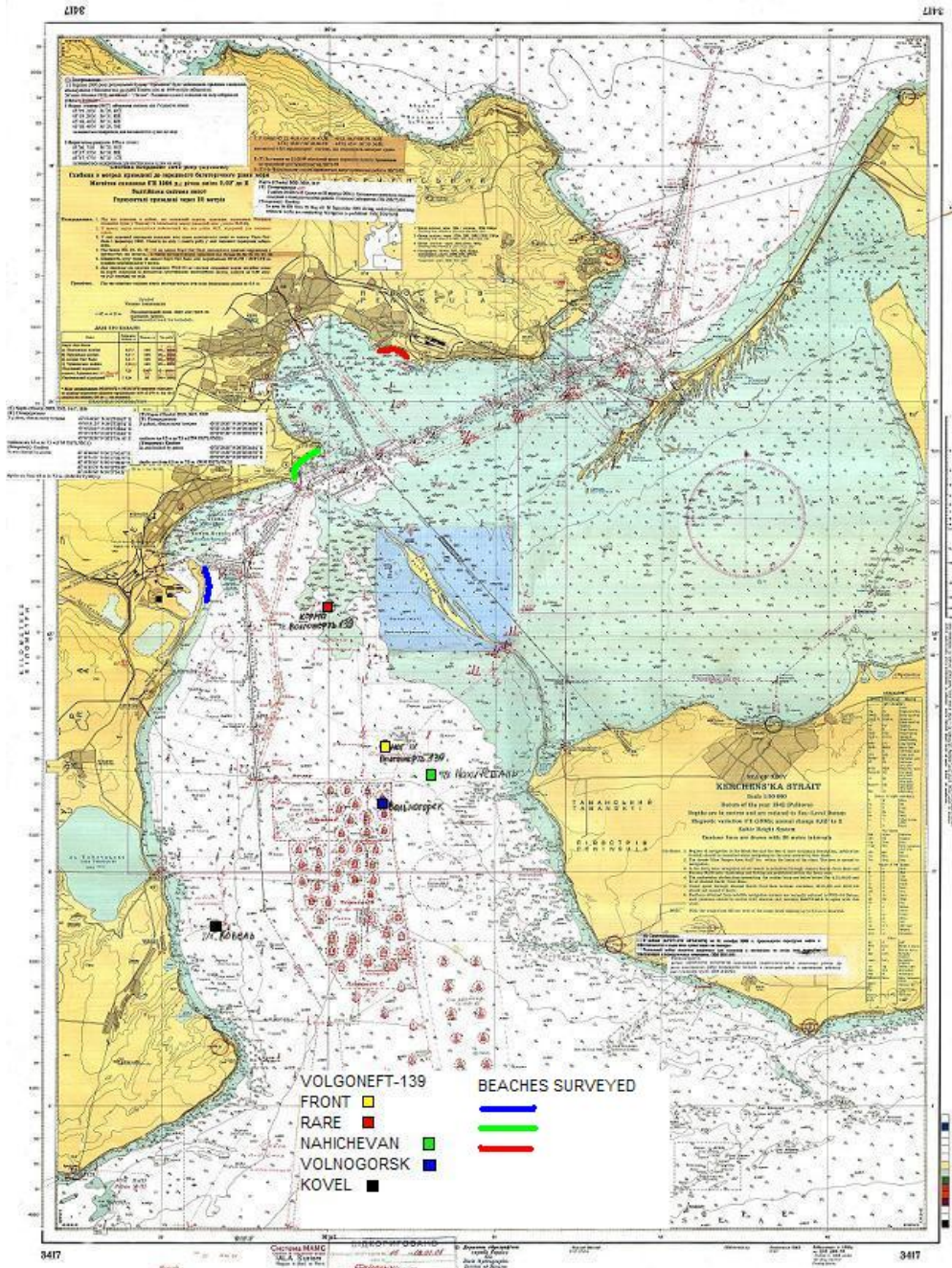


Figure 2 – Surveyed areas

The team visited four sites:

2.2.1 Site 1 – Kerch coast - Cape Karantynny (21 November 2007)

This part of the coast is made up of cliff of friable limestone rock varying from 4 to 10 metres in height. At the foot of these cliffs, the shoreline consists of a series of small sandy coves from 3 to 4 m wide with some friable and porous stone. The sediment consists of sand and dead shell.

The traces of visible pollution are very limited with some slightly contaminated algae and rocks. From the physical survey carried out by the experts, the pollutant appears to be heavy fuel oil in the range of IFO 280 and IFO 600. It is a heavy fuel oil of average viscosity but uncharacteristically it remains soft and is easy to clean off tools and hands (low adhesion).

The cove is located at the exit of the city and has already been 90% cleaned.



Figure 3 - Panoramic view of the Cape Karantynny coast



Figure 4 – a) oil sheen in water; b) sea plants polluted by oil

2.2.2 Site 2 – Kerch coast – Cape Ak-Burun (21 November 2007)

The cove is in the process of being cleaned and it is very easy to observe the successive layers of pollutant on a 40cm thickness of sand. It is possible to distinguish three layers composed of waste from algae and shells mixed with approximately 30% hydrocarbon in volume. These three layers seem to correspond to three successive storms. They are from 2 to 3cm thick. The quantity of pollutant to the linear metre varies from 1 to 10 litres.

The recovery operations are being done manually using shovels. Approximately 30 operators were present on a stretch of 100 metres.

The collection of oil-polluted sand using shovels results in a high ratio of sand to oil. The bags of waste weighing 20-40kg were being carried manually to the top of the cliff.

At the site, a small submerged patch of oil of about 3 m long, 1 m wide and 10 cm deep was observed. It is assumed that the oil had been mixed with sediment and therefore submerged.

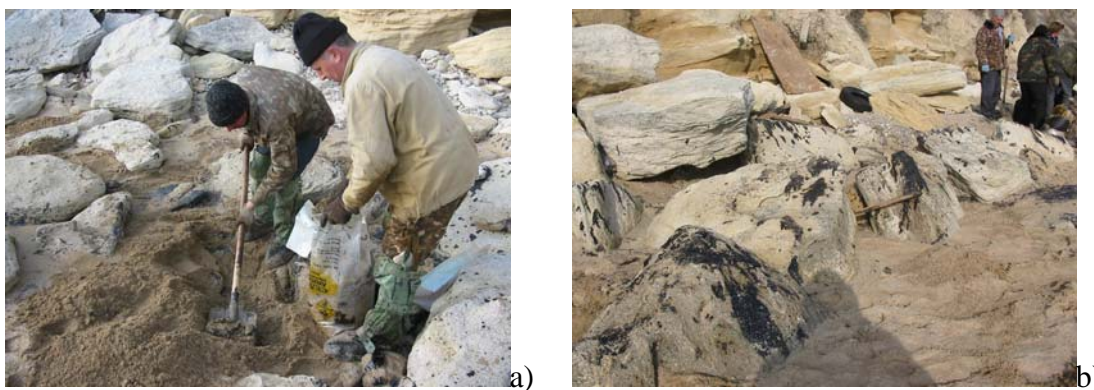


Figure 5 – a) oil/soil mixture collecting activities; b) oil polluted rocks

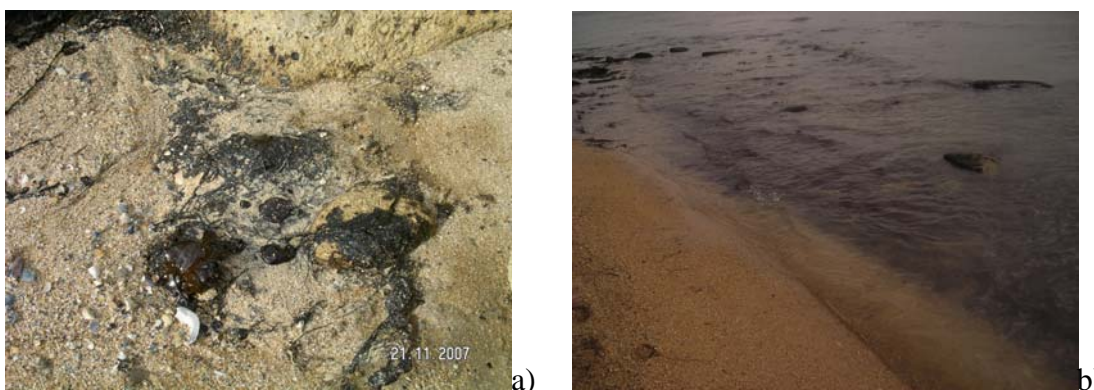


Figure 6 – a) traces of different oil pollution; b) oil sheen in the water

2.2.3 Site 3 – Kerch coast – Heroivske (21 November 2007)

The site consists of a coarse band of sandy beach which is east-facing. This beach was immediately cleaned after the arrival of pollution, avoiding the presence of buried layers of oil. No pollution was observed.

2.2.4 Site 4 – Tuzla Island (22 November 2007)

According to the data provided by the Ukrainian Ministry of Emergencies, during the period from 13 November to 22 November 2007 at least 500 people per day and 159 technical units such as tractors and excavators were engaged in beach clean-up operations on Tuzla Island. A total amount of 4000 tonnes of sand and oil mixture was collected and is being transferred to a barge for further transfer to asphalt cement factories located on the Crimean peninsula. A high ratio of sand to oil was observed.

On the basis of a rapid assessment of the south-western coast of the island, the team was able to formulate the following observations:

The layer of pollution was 5cm thick and covered in places with a mixture of sand, marine vegetation and shells (Figure 7 a) and b)). The polluted band is 25 m wide along the entire south-western coast of the island.

Several tens of tonnes of waste are stored in 50 litre bags waiting to be taken away by a barge with a capacity of 600 tonnes (Figure 10). This barge is moored with a floating crane for the trans-shipment of waste.

The coast on the other side of the island was not contaminated. Part of the vegetation behind the beach is soiled by waste of contaminated algae carried by the wind. Even though the clean-up operations produced excellent results in term of quantity and speed, there are still significant amounts of pollutant present, especially in the sub-surface. Some oiled seabirds are still being recovered on the island (Figure 9).



Figure 7 – a) and b) stratification of pollutant

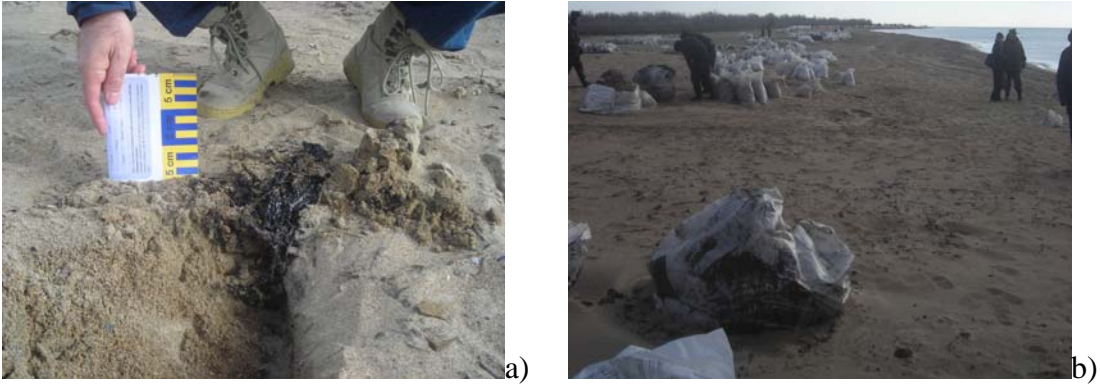


Figure 8 – a) oil/sea-plant mixture; b) collecting activities



Figure 9 – a) temporary collected mixture storage; b) oiled bird



Figure 10 – a) and b) temporary storage barge

2.3 OIL ON SEABED

There are three factors in this case which would increase the probability of the fuel oil sinking to the sea bed and thereby posing a risk of further pollution of the shoreline in the future and increasing the concentration of hydrocarbons in the sea. These are:

- the lower than average salinity of the sea water in the Sea of Azov, Kerch Strait, and Black Sea due to the high inflow of fresh water;
- the water temperature which is around 10° C at this time of year;
- the storms which influence the circulation of water and sediment, creating a high probability of fuel oil mixing with sediments, such as sand and clay. Such phenomena can increase the density of the mixture which can lead to the precipitation of the pollutant. This risk is higher closer to the shoreline.

However, the absence of tides and the severe storms meant that the fuel oil had only a short distance to travel before reaching the shoreline. As a result, the team considers that it is unlikely that a substantial amount of heavy oil sank to the seabed. Nevertheless, the situation should be monitored over the next few months, especially when the water temperatures rise during the spring/summer season. If there are oil products left on the seabed as a result of the factors mentioned above, they will tend to appear when the water temperatures increase above 10°C. Additional local clean-up operations may therefore be necessary along the shorelines during the period from late spring to early summer.

2.4 SUNKEN SULPHUR CARGO

According to the data provided by the Ukrainian Ministry of Environmental Protection, the sulphur is in a granular form and confined inside the three mentioned sunken ships. As reported in literature (see Annex IV), sulphur in granular form has a low speed of reaction with water and therefore does not pose an immediate acute risk to the environment.

However, there is little practical experience with this type of accident and it is recommended that the cargo be removed in the medium term. If sulphur reacts with seawater at a higher rate, the release of sulphur could be a concern for the marine fauna, flora and humans.

In addition, as there is no information available about pH levels in the vicinity of the sunken ships, it was not possible to assess the situation during this mission. Further measurements of pH and sulphur concentrations in biota should be carried out.

3 CONCLUSIONS

- The oil spill clean-up activities were well under way and much progress had been made.
- There was no need for assistance with the immediate emergency response or for equipment.
- According to the Ukrainian authorities there was no more free-floating oil on Ukrainian waters and all sources of pollution had been contained. No aerial surveillance images were available but the team observed no free-floating oil during the crossing from the mainland to Tuzla Island.
- Sulphur does not pose an immediate environmental threat but, as little is known about the possible future impacts, it is recommended that the sunken ships with sulphur on board are salvaged so that the sulphur can be appropriately processed.
- This was a relatively small-scale disaster and the short-term impacts were limited to coastal pollution and approximately 150 dead birds on the Ukrainian side. The medium and long-term environmental impact could not be assessed during this mission.

4 RECOMMENDATIONS

4.1 Minor improvements could be made to increase the efficiency of clean-up operations.

- It would be possible to improve selectivity by using forks of the type used following the Prestige and Erika accidents and to use shovels only to remove the unpolluted layers of sand;
- Preliminary rinsing with water of the polluted sand using fire hoses would allow access to the polluted amalgam and also increase selectivity thus decreasing the percentage of sand in the waste;
- On the first two sites visited it is not possible to mechanise the operations for obvious reasons of accessibility;
- Collection by mechanical sifting could have been an appropriate option on the wide beach of Tuzla Island as well as on some locations on the Crimean east coast where there is road access. However, manual operations gave very good results.
- A quick way to optimise the beach cleaning operation in order to avoid extra weight due to the large amount of sediments that could be attached to the oil is to wash the mixture using the seawater on the shoreline on site (preferably with a boom to protect the washing area) (Figure 11 a) and b).



Figure 11 – a) oil/sea-plant/sand mixture; b) oil/sea-plant/sand mixture after washing

The following suggestions are specific to Tuzla Island:

- In the final stages of the clean-up operations, manual or mechanised sieving should be carried out.
- A structured inspection of the presence of buried layers of pollution would make it possible to identify contaminated and clean areas and the production of a pollution situation map. Small and large specialised machines for sieving and riddling are available. These machines make it possible to treat a band of 1-2 m wide and up to 20cm deep. This special equipment accelerates and facilitates the work by limiting the sand extraction.

- In-situ rinsing operations also give good results. These various techniques would make it possible to limit considerably the quantity of sand exported towards the mainland.
- To remove the residual traces of pollution in the sand, the usual operation is to wash the upper layer of the beach using the mechanical energy of the surf zone. This operation allows the separation of the oil from the sand and the natural relocation of the sediments. These operations can be carried out when the weather gets warmer in order to prepare the beach for the tourist season.
- In terms of cleaning oiled bird, the authorities could explore the use of special cleaning techniques and specialised equipment that are used in other countries, in particular in France.

Protective clothing

The operators on the contaminated area do not appear to be wearing appropriate clothing for the handling of hydrocarbons (see Annex V) for a detailed description of suggested PPE). While not a major problem if this last for only a few days, it could become a problem for human health if workers are handling hydrocarbons over a period of several weeks.

Possible oil on seabed

To establish whether there is any oil on the sea bed which poses a risk of resurfacing at a later stage, it is recommended that the seabed is screened for any sunken oil. This could easily be done with dredging techniques, for example using a chain. At regular intervals, the chain should be checked for oil and the location mapped. Further manual clean up operations can than take place using divers.

4.2 An environmental assessment should be made of the long-term environmental impacts of the oil spill on the Sea of Azov.

The impacts of the current oil spill in the medium and long term should be assessed. Plans are already underway by the Ukrainian authorities and, where possible, the international community should support these activities. Efforts should be deployed to undertake such an assessment taking an ecosystem based approach in order not to limit the findings and conclusions to country borders.

4.3 A lessons learned exercise from this accident should be undertaken and national and regional oil spill contingency plans updated accordingly.

A lead agency should be appointed to undertake a lessons learned or evaluation exercise, while all other relevant actors (ministries, departments, local and national authorities, agencies and institutions) should fully participate. Strengths and weaknesses in the response to this disaster should be identified and, where gaps exist, procedures should be

developed to prevent them from happening again during the response to any future disasters. Streamlining of local, national and regional response plans should be one of the objectives of the lessons learned exercise.

ANNEXES

- I. List of meetings held
- II. Generic environmental impacts of marine oil spills on birds
- III. Generic environmental impacts of marine oil spills on mammals
- IV. Sulphur and its generic environmental impacts
- V. Oil spills and Personal Protective Equipment
- VI. Useful contacts of specialised organisations

I. List of meetings held

Date	Authority	with	attended
19/11/07 am Kiev	Secretariat of the President of Ukraine	Mr Oleksandr Chalyi, Deputy Head of the Presidential Secretariat, Mr Ihor Dir, Director of the Main Foreign Policy Office of the Presidential Secretariat	Mr Ian Boag (Head of EC Delegation), Mr F Bensarsa (DG RELEX), Ms E Dobson (DG ENV)
19/11/07 am Kiev	Ministry of Foreign Affairs	K. Yeliseyev, Deputy Minister for Foreign Affairs of Ukraine	Mr Ian Boag (Head of EC Delegation), Mr F Bensarsa (EC, DG RELEX), Ms E Dobson (EC, DG ENV)
19/11/07 pm Kiev	EC Delegation	Head of EC Delegation	Expert team, Ms E Dobson, Mr R Nijenhuis, Mr R Dufлот, Ms H Zatlakajova
19/11/07 pm Kiev	Ministry of Environmental Protection	Mr D Vorona (Deputy Minister) and delegation	Mr F Bensarsa, expert team, Ms E Dobson, Mr R Nijenhuis
20/11/07 am Kiev	Ministry of Transport and Communications	Mr G Rak (Director) and Capt. S Mykola (Deputy Director)	Expert team, Ms E Dobson, Ms H Zatlakajova
21/11/07 am Kerch	City of Kerch	Deputy Mayor of Kerch, Deputy Minister of Transport and Communications, the Coordinator of the emergency operation and Mr V Cherevko (First Deputy Head of the State Ecological Inspectorate)	Expert team, Ms E Dobson, Mr R Nijenhuis, Ms H Zatlakajova
22/11/07 pm	Ministry of Environmental Protection	Mr S Kurulenko (First Deputy Minister and President of the Black Sea Commission)	Ms E Dobson, Mr R Nijenhuis, Mr P Richard
22/11/07 pm and	Operations Centre, Kerch	Deputy Minister of the Ministry of Emergencies,	Expert team, Ms E Dobson, Mr R Nijenhuis, Ms H Zatlakajova

23/11/07		Operations centre response team, duty officers	
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II Generic environmental impacts of marine oil spills on birds

The first, and often most important, effect on birds is external contamination of the feathers from contact with oil (Figure 12). This can cause a disruption of the delicate feather structure which traps warm air next to the body and keeps cold air and water away from the skin. Oil contact temporarily disrupts this intricate structure of barbs and barbules, thus interfering with the bird's ability to thermo-regulate.

Most animals in these circumstances quickly become hypothermic (or hyperthermic) and will seek shelter to stay alive. Those reaching shore are often unable to find food, because of the individual's inability to return to the sea to feed. They become dehydrated and hypoglycaemic and are prone to predation.

The internal effects of oil come mainly from ingestion through preening, feeding on oiled prey or vegetation, or drinking contaminated water. Such effects can be from the physical presence of oil in the gastro-intestinal tract, as well as the absorption of poisonous components of the petroleum product such as polycyclic aromatic hydrocarbons (PAHs).

Dehydration may result from decreased food consumption, increased metabolic demand due to hypothermia or hyperthermia, fluid loss through diarrhoea and decreased absorption due to irritation in the gastro-intestinal tract.

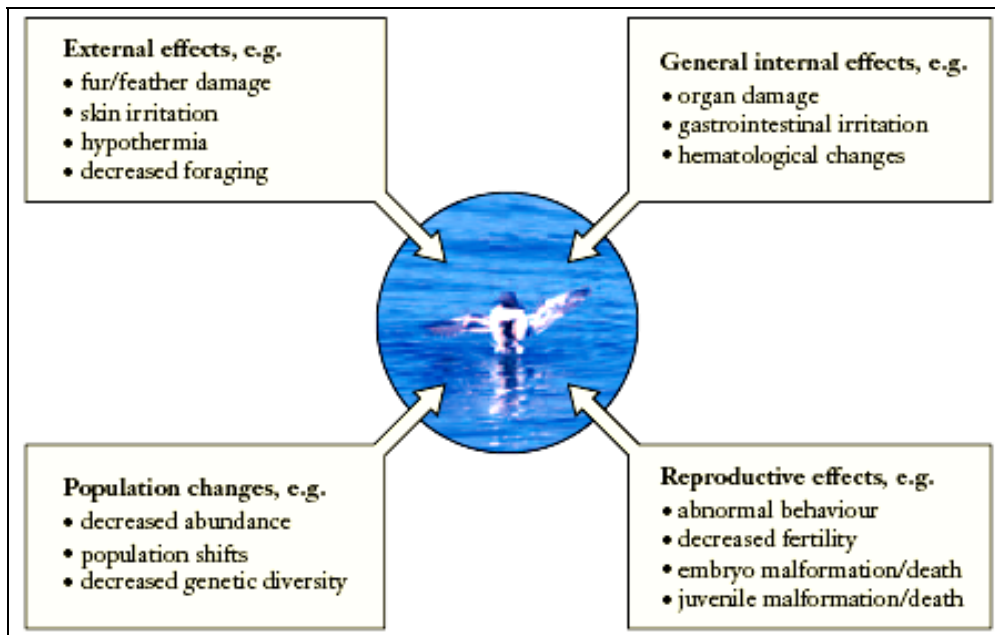


Figure 12 – Effects of oil on the birds (IPIECA – 2004)

Gastro-intestinal impacts may include general irritation, ulceration and destruction of the microstructure of the actual tract. Ingestion of oil may also have toxic effects on the liver

and other organs through detoxification and excretion of PAH metabolites, as well as leading to anaemia and suppressed immune system function by destruction and/or decreased production of avian blood cells. It should be noted that dehydration, starvation and stress may all contribute to anaemia and immuno-depression, and that the relationships between lesions on major organs in birds and hydrocarbons are not entirely clear.

Inhalation of volatile fumes can damage lungs and cause inhalant pneumonias, as well as neurological impairment such as ataxia. Long-term effects may include decreased reproduction through altered breeding behaviour, as well as adverse effects on eggs and embryos and impaired growth/malformations of hatchlings.

III. Generic environmental impacts of marine oil spills on mammals

Many of the effects on mammals are similar to those on birds. While many marine mammals depend on layer of blubber to insulate them and maintain body temperature in a cold environment, some species, such as otters and fur-seals, depend upon their fur in a similar fashion to birds' dependence on their feathers. Oil can coat the fur on these animals and collapse the layer of air trapped within, quickly leading to hypothermia or hyperthermia as well as affecting their ability to swim. It also causes irritation to the eyes and skin, and ingestion or inhalation may damage the liver and kidneys as well as lead to pneumonia. Adult seals do have the ability to metabolize and excrete some oil through the liver and kidneys but this is less developed in the young and is not effective in cases of high exposure.

Effects on mammals can include abnormal reproductive behaviour, increased embryonic death, lowered survival rates of young and increased rates of abandonment.

IV. Sulphur and its generic environmental impacts

When it comes to Hazardous and Noxious Substances (HNS) and in particular sulphur some prerogatives should be borne in mind:

- Marine pollution caused by HNS differs from oil pollution in having a range of potential fate and behaviour once released into the marine environment.
- Responder and public safety risks and impacts associated with HNS can be potentially more severe than with oil. The selection of the appropriate response option(s) to an HNS incident requires detailed knowledge of the involved substance's physical and chemical properties. Compared to oil, different specialised knowledge and operational expertise are required for an effective response to HNS marine pollution.
- Sulphur can be transported in the form of a solid (in powder) or liquid (ambient pressure and temperature of at least 136°C). It is not volatile, but sulphur dust dispersed in the air can form explosive and flammable mixtures when exposed to a flame or heat.
- Sulphur is flammable and burns with an almost invisible flame, giving off a very toxic gas: sulphur dioxide (SO₂).
- In the event of fire, responders must be equipped with protective clothing, breathing apparatus and explosimeters.
- When spilt into water, liquid sulphur forms a paste and sinks, without dissolving, creating a localised deposit on the seafloor.
- Solid sulphur stored in bulk naturally releases a small amount of hydrogen sulphide from the initial concentration (200 to 300 ppm) which varies according to where and how it is manufactured, but this release is very slow.
- Only in very exceptional cases will a sulphur spill lead to the presence of colloidal sulphur in suspension thus harming the aquatic biocenosis (effects observed at concentrations of between 1.6 and 10 g/l). On land, the biocidal properties of sulphur on plant parasites (vines in particular) are well known.
- In water, sulphur can gradually oxidise into sulphates by microbial action. In soil, sulphur is more rapidly bio-transformed by micro-organisms.
- Solid or molten sulphur sinks. In shallow waters, it can be recovered by suction or dredging. It can then be placed in temporary storage tanks for subsequent treatment.
- Recovered sulphur must never be directly discharged into surface waters or sewer systems.
- Burning is generally advised against as its combustion releases sulphur dioxide (SO₂). Sulphur can be covered or mixed with calcium carbonate (3 times the mass of sulphur in CaCO₃), and buried on a site for dangerous waste.

Toxicity of Sulphur:

- Fish acute toxicity
LC50: > 4000 mg/l (Salmo gairdneri e Cyprinus carpio; 96h)
- Daphnia acute toxicity
EC50: > 665 mg/l (Daphnia magna; 48h)
- Algae acute toxicity
EC50: 232 mg/l (Ankistrodesmus bibrainus; 72 h)

V. Oil spills and Personal Protective Equipment

As a minimum, staff should be equipped with personal protective equipment (PPE) as follows:

- Field team: oil impermeable overalls, rubber boots, hard hats, nitrile gloves;
- Working with animals: oil impermeable overalls, nitrile gloves, safety glasses;
- Washing animals: waterproof clothing, nitrile gloves, safety glasses.

Other important health and safety issues	
Legislation	In any plan it is important to be fully aware of, and fully understand, any local, national and international health and safety legislation.
Safe working conditions	Risk assessments need to be made for each part of the operation, resulting in a site safety plan covering each work site.
Training and safety instructions	Orientation to the worksite. Identification of potential dangers, including details of how to handle animals. Untrained volunteers should not be allowed to handle animals.
Stress	All people, especially those in authority, should be aware of signs of stress among the staff, and take appropriate action to alleviate it.
First aid and medical care	Each operation should have access to a first aider and first aid equipment. Medical facilities should be informed about the wildlife response in order that they can assess the risks (zoonoses, bites) and take precautionary measures, e.g. availability of vaccinations.
Liability	Every plan should clearly identify who has the ultimate responsibility (and liability) for the operation of the plan. This responsibility may not rest within the response team.
Insurance cover	It should be made clear who is responsible for ensuring that all people involved in the response have adequate insurance cover. Insurance cover need not be at the wildlife response level; there might be a 'blanket' cover for the whole operation which might offer better protection.

VI. Useful contacts of specialised organisations

For more information on techniques to use in oil spill response, in particular the cleaning of animals, the following organisations can provide useful information.

Sea Alarm Foundation
Quai aux Briques 22
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