APPENDIX 9

Response Strategies and Main Clean-Up Techniques – Technical Data Sheets (by CEDRE)

GUIDELINES FOR REPORTING OIL SPILLS
(AERIAL SURVEILLANCE)

The text of this Annex is reproduced from Chapter 5 of the document “Guide for Combating Accidental Marine Pollution in the Mediterranean Sea” published by REMPEC in 2000. This document constitutes Section 1 of Part D (Operational Guidelines and Technical Documents) of the Regional Information System of REMPEC (RIS/D1). It can be downloaded from the website of REMPEC following the link: http://www.rempec.org/rempec.asp?theIDS=2_215&theName=RIS&theID=15&daChk=2&pgType=1

Since 2000 several more complex, up-to-date and better illustrated guides on aerial surveillance were published by e.g. ITOPF (International Tanker Owners Pollution Federation Limited) or Cedre (Centre of Documentation, Research and Experimentation on Accidental Water Pollution).

Very good examples of such concise but complete guides are in particular:

The extract from the Operational guide “Aerial observation of oil pollution at sea” published by Cedre in 2004 (F)/2006 (E) which has 13 pages and can be downloaded form Cedre’s website following the link http://wwz.cedre.fr/en/content/download/1777/138724/file/extract-aerial-observation.pdf. It is noted that the complete Guide has some 60 pages.

Technical Information Paper 01 (Aerial observation of marine oil spills) published in 2001 and replacing its previous version from the 1980s has only 12 pages and can be downloaded from the website of ITOPF following the link http://www.itopf.com/knowledge-resources/documents-guides/document/tip-1-aerial-observation-of-marine-oil-spills/.

The national Operational Authorities may decide to replace the present text of this Annex with one of the two mentioned documents.

GUIDELINES FOR OBSERVATION AND REPORTING OIL SPILLS (AERIAL SURVEILLANCE)

1. INTRODUCTION

Aerial surveillance of oil spills is made either from helicopters or from fixed-wing aircraft. It could be made using sophisticated remote sensing equipment, however **visual aerial observation** is often the most convenient means of assessing oil pollution at sea and on shore, which if properly carried out, can give an important indication, sometimes of a decisive nature, concerning:

- the extent of pollution (overall surface totally or partly covered);
- the evolution of pollution and its follow-up;
- the quantity of floating oil;
- the evaluation of the threat;
- the selection of appropriate combating techniques;
- the evaluation of the effectiveness of means used;
- the assessment of damage.

Unfortunately, aerial surveillance is in most cases done by personnel not specifically trained in this activity (pilots, photographers, aerial navigators), which in turn often results in unreliable and inaccurate reports. In order to ensure that the information provided by observers is precise and quantifiable enough to be of use for the authorities responsible for pollution combating, an attempt has been made to prepare a set of basic instructions for observers and to standardize the terminology used in reports.

The objectives of this Annex are to instruct non-specialized observers on how:

- to know what to look for;
- to know to locate the pollution;
- to observe, describe and report the pollution;
- to prepare the information for further processing.

2. ORGANIZATION OF AN AERIAL OBSERVATION MISSION

- The aircraft (either helicopter or fixed-wing) chosen for aerial surveillance of oil spills should have **good all round visibility**.

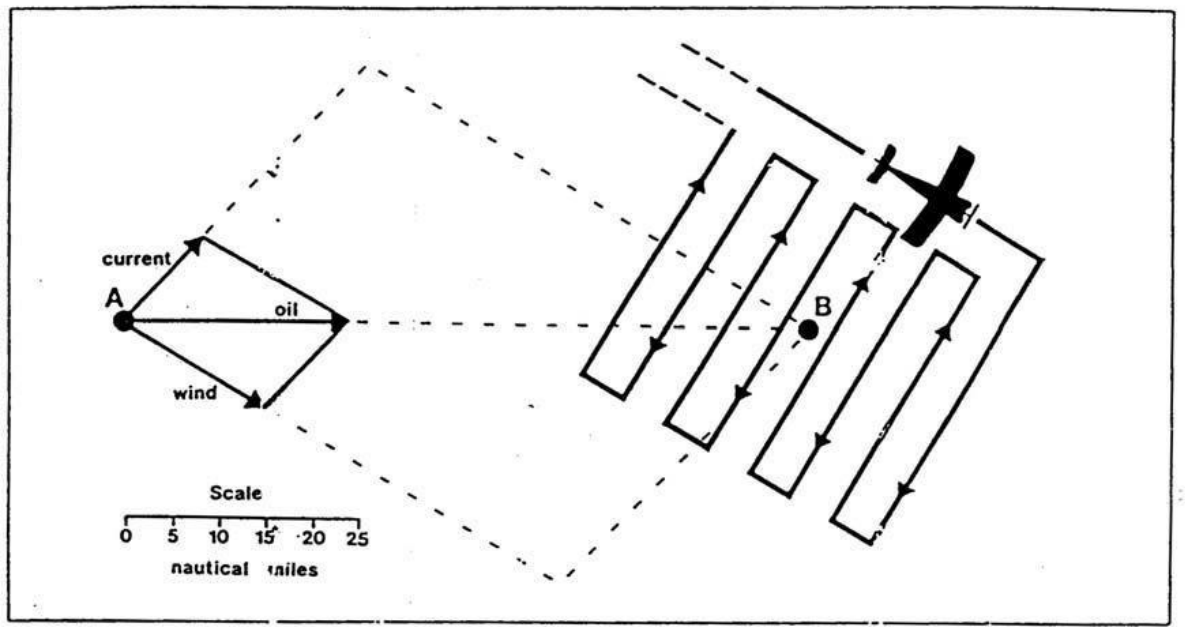
- **Helicopters** are more suitable for missions **near the shore**, while **fixed-wing aircraft** provide more speed and longer range for missions over the **open sea**.

- **Safety** of the crew and observers must always supersede all other considerations and therefore **multi-engined** (at least twin) **aircraft** should be used for all missions over remote sea areas.

- In order to reduce as much as possible the time spent searching for pollution, a **flight plan** should be prepared before the flight.

- Observers should be provided with the **charts** of the area. For more accurate identification of positions and reporting, it is useful to draw a **grid** on the chart using e.g. grid squares with the sides of 1 Nautical mile each.

- A "**ladder search**" (illustrated on the following page) across the direction of the prevailing wind is considered to be the most efficient method of surveying the area in which the oil might be found. A **systematic search** for oil over a large sea area is recommended since the forecasting of oil movement is intrinsically not very accurate, and accordingly oil might be found at larger distances or in directions different from those predicted on the basis of calculation.



Movement of oil from A to position B three days later, predicted by combining 100% of the current speed and 3% of the wind speed as shown. The arrows from A represent current, wind and oil movement for one day. A cross-wind ladder search pattern is shown over position B.

(Reproduced from "Response to Marine Oil Spills", International Tanker Owners Pollution Federation Ltd., 1987)

- When the visibility is good (in clear weather) a recommended **altitude** is approximately 500 m, however, in order to obtain better view of the oil, once found, it is necessary to drop to lower altitudes (200 m or less).

- In order to determine the **position** of oil sightings, the observer should be able to consult aircraft instruments, in particular when oil is found at open sea, far from shore and points of reference on the shore.

- In order to enable the undisturbed **communication** between the observer and the pilot of the aircraft, wearing of headsets is highly recommended.

- **Sun glasses** (with polarising lenses, if possible) will help detection of oil at sea under certain light conditions.

3. APPEARANCE OF OIL SPILLS

When spilled at sea, oil forms a **slick** which drifts with the wind and current, and subsequently breaks up into smaller **slicks (patches)**, usually interspersed with the areas of relatively thin **sheen**, and scatters over areas which, with time, become considerably large. With the changing in wind direction, the refloating of oil already deposited on shores might occur. After being at sea for a certain period oil can be mixed with algae and debris.

Three main groups of oil can be distinguished in accordance with their appearance when floating on the sea surface:

- **Light refined products** (petrol, gas oil, kerosene) which spread uniformly on big surfaces and undergo strong evaporation and rapid natural dispersion processes, often resulting in their total disappearance in 2 to 3 days. They form thin **sheens**.

- **Heavy refined products** (fuel No.6 and most types of fuel oils used by merchant ships) which are very viscous spread less rapidly and do not disappear naturally. These form **dark** thicker patches, separated by areas of intermediate and thin **sheens**.

- **Crude oils** whose characteristics and behaviour vary greatly according to their type and origin. Usually these rapidly break into areas of **dark**, thicker oil interspersed with areas of intermediate and thin **sheens**.

In general terms, the thick parts of an oil slick have **dull (dark)** colours, the colour of patches of intermediate thickness is **blue or iridescent (rainbow)**, and the thinnest parts of a slick appear as areas of **grey or silvery sheen**.

Sheen consists of only small quantities of oil but is the most visible proof of pollution. Frequently, thick patches are discovered in the midst and windward of an area covered by sheen (silver, grey or iridescent).

Thick patches represent big quantities of oil. Generally, **black or dark brown** at the early stages of pollution, most crude oils and heavy refined products, under the influence of sea movement (waves), show a tendency towards formation of water-in-oil emulsions, usually called chocolate mousse, which appear as **brown, red, orange or yellow** patches.

TABLE 1 gives an indication of relations between the **appearance** (colour) of an oil slick, **approximate thickness** of oil and the **approximate volume** of oil (in cubic metres) the slick contains per unit of surface area (square kilometres).

TABLE 1: APPEARANCE/THICKNESS/VOLUMEOF OIL ON THE SEA SURFACE

APPEARANCE / COLOUR	APPROX. THICKNESS (μm)	APPROX. VOLUME (m^3/km^2]
silvery sheen	0.02 - 0.05	0
grey sheen	0.1	0.1
Iridescent (rainbow) sheen	0.3	0.3
Blue	1.0	1
blue/brown	5.0	5
brown/black	15 - 25	15 - 25
dark brown/black	> 100	> 100
brown/red/orange/yellow mousse	> 1 mm	

Reproduced from "Manual on Oil Pollution at Sea: Securing Evidence on Discharges from Ships", Bonn Agreement, 1993

4. DESCRIPTION OF POLLUTION

It is recommended to endeavour to utilize the same observers during each particular pollution incident, in order to minimize disparity in reporting. However, if this is not possible, observers should be instructed to use the following terminology when reporting (describing) oil spills:

a) Sheen:

"light sheen" - sea surface covered with faint silvery sheen, barely visible under favourable light conditions;

"sheen" - sea surface covered with consistent silvery and grey sheen, no patches of thick oil;

"heavy sheen" - sea completely covered with grey sheen, occasionally having rainbow colours (iridescent), no patches of thick oil.

b) Patches:

"small patches" - less than 1 m^2, hardly visible from higher altitudes, ranging in colour from blue and brown to black;

"medium patches" - 10 - 100 m^2, clearly visible from the air, colours blue, brown or black.

"big patches" - large slicks of 100 m^2 and over, clearly visible, colours blue, brown or black.

In order to indicate what percentage of the sea area is covered by oil, the observer should describe the slicks as:

"scattered" - if 1 to 2% of the sea is covered;
"not too compact" - if up to 5% of the sea is covered;
"compact" - if up to 20% of the sea is covered;
"very compact" - if over 20% of the sea is covered.

In order to estimate as accurately as possible the percentage area of the sea covered by oil, it is recommended to view vertically down on the sea surface, to time overflying each type of oil (sheen, patch, mousse) at the constant (and recorded) speed of the aircraft, and to calculate the percentages on the basis of these records once the surveillance flight is over.

Big patches should be reported singly. The report should include the colour of the patch and information on (description of) any sheen (iridescence) present around these patches of darker oil. Particular attention should be paid to identifying brownish/red/orange/yellow colours which indicate the presence of chocolate mousse (this is important for the selection of response techniques, since the presence of reverse emulsions excludes the use of certain types of skimmers or dispersants).

If possible, colour or infra-red black and white photographs or slides, or video recording of the slick should complement each report.

5. REMARKS

- Often, up to 90% of oil is concentrated on 10% of the surface covered by a slick, in its downwind end. This phenomenon is more pronounced by cold sea and weather.
- A strong wind, of more than 20 knots, causes formation of separate windrows.

- The absence of iridescence (rainbow colour bands) is almost always an indication of slick weathering and emulsion formation.

- The appearance of a slick can change, depending on the position of the sun in relation to the observer. If there are any doubts, several overflights from different directions should be made in order to verify the initial observation.

- Certain phenomena (shadows of clouds, algae or seaweed under the sea surface, suspended sediments in an estuary) can be mistaken for oil slicks. If there are any doubts, the observer should request additional overflights of the suspicious area.

- During very strong storms (sea 6), even a major pollution can be difficult to notice and it may become visible only once the weather has calmed down (CAUTION: only large multi-engine aircraft could be used for aerial surveillance under such conditions).

6. METEOROLOGICAL CONDITIONS

The influence of meteorological conditions is as decisive for the observation of a spill as it is for its combating. TABLES 2, 3, 4, give standard scales for wind force (Beaufort wind force scale), sea state and nebulosity, respectively, which should be used by observers when reporting meteorological conditions in the surveyed area.

TABLE 2: BEAUFORT WIND FORCE SCALE

DESCRIPTIVE TERM	BEAUFORT NUMBER	LIMITS OF WIND VELOCITY		PROBABLE MEAN* HEIGHT OF WAVES in metres
		in knots	in m/sec	
Calm	0	<1	0 - 0.2	-
Light air	1	1 - 3	0.5 - 1.5	0.1
Light breeze	2	4 - 6	1.6 - 3.3	0.2
Gentle breeze	3	7 - 10	3.4 - 5.4	0.6
Moderate breeze	4	11 - 16	5.5 - 7.9	1.0
Fresh breeze	5	17 - 21	8 - 10.7	2.0
Strong breeze	6	22 - 27	10.8 - 13.8	3.0
Near gale	7	28 - 33	13.9 - 17.1	4.0
Gale	8	34 - 40	17.2 - 20.7	5.5
Strong gale	9	41 - 47	20.8 - 24.4	7.0
Storm	10	48 - 55	24.5 - 28.4	9.0
Violent storm	11	56 - 63	28.5 - 32.6	11.5
Hurricane	12	64 - +	32.7 - +	>14

* This column is only a guide, showing roughly what may be expected in the open sea, far from land.

TABLE 3: SEA STATE

Error! Bookmark not defined. DESCRIPTIVE TERM	SEA STATE	WAVE HEIGHT
Calm (glassy)	0	0
Calm (rippled)	1	0 - 0.1
Smooth (wavelets)	2	0.1 - 0.5
Slight	3	0.5 - 1.25
Moderate	4	1.25 - 2.5
Rough	5	2.5 - 4
Very rough	6	4 - 6
High	7	6 - 9
Very high	8	9 - 14
Phenomenal	9	>14

The sea state is completed with SWELL indications:

Height		Length	Direction
Small	0 - 2 m	Short	0 - 100 m If different of the wind
Moderate	2 - 4 m	Medium	100 - 200 m
High	4 m	Long	200 m

TABLE 4: NEBULOSITY

Part of the sky covered with clouds in oktas from 0 to 8

0: no clouds
8: entirely cloudy

Main clean-up techniques

Presentation of the main techniques used to clean up oil spills.

Techniques which can be implemented by local agents

- Leave alone or natural clean-up
- Principle of initial clean-up
- Skimming/pumping at the water's edge
- Pumping on the foreshore
- Containment and recovery of effluents on the water surface
- Containment and recovery of effluents on the foreshore
- Manual recovery

CEDRE Emergency hotline: +332 98 33 10 10 - 24h/24

Technical datasheets in PDF format are available for downloading at: http://www.cedre.fr/en/response/response-on-land/technical-datasheets.php

“LEAVE ALONE” or NATURAL CLEAN-UP

SCOPE

Substrates: all types
Pollution: light to moderate
Pollutant: all types
Sea: with or without tides

EQUIPMENT NEEDED

N/A

DESCRIPTION/PRINCIPLE

Natural clean-up is the result of natural physical and biochemical processes taking place along the coastline, especially involving wave and current energy, adhesion of oil to organic particles, bacterial and micro-organism activity, photo-oxidation, etc.
The so-called "leave alone" option, or non-response, should be viewed as a technique in the same way as any other response technique. It should be considered systematically in the event of a small spill in areas where response may be more harmful than the oil, due entirely to biological biotope sensitivity (reefs and mangroves for instance). It is all the more justified for a site that has not been heavily oiled and that has a good self-cleaning potential and that otherwise may present a safety hazard for responders (very wave beaten rocky headland or a barrier reef, for instance).

CONDITIONS OF USE

Pollution: all types of pollutant (if it is a small spill).
Substrate: all types.
Site: very exposed, difficult to access, or ecologically fragile.

IMPACT ON THE ENVIRONMENT

Physical: in the event of major accumulations, risk of formation of a crust of stones, for instance, causing the stones to be unable to absorb the shock of waves, and therefore no longer protecting against erosion.
Biological: persistence of the toxic effects of oil must not be underestimated; such effects will last for a variable amount of time and will need to be compared with the effects caused by response.

PERFORMANCE

Yield: N/A

Waste: N/A

The persistence of the pollutant is mainly dependent on its nature and the extent to which it traps, infiltrates or burrows in addition to the degree of exposure of the site to waves and other weathering agents.

OBSERVATIONS

- Often the best solution on sensitive sites.
- Only concerns small spills.
- Will require surveying of the affected size and monitoring of the pollution.
- Do not underestimate the persistence of some pollutants or the efficiency of natural clean-up, especially when the sea hardly ever reaches the heights required to clean the oiled surfaces.

PRINCIPLE OF INITIAL CLEAN-UP

SCOPE

Substrates : all types
Pollution : all types
Pollutant : fluid to highly viscous
Coastline

Manual collection – the Prestige *spill*

Mechanical recovery, the Erika *spill*

Pumping oil at the bottom end of the foreshore – the Tanio *spill*

EQUIPMENT NEEDED

Fluid oil: sewage suction systems / cleaning trucks / vacuum trucks, skimmers, skimming heads, pumps
Viscous oils: - manual collection: shovels, forks, pokers, rakes, buckets, scrapers, etc.
- mechanical collection: back-hoe loader, power shovel, grader, sand screener machine (highly viscous to solid pollutant).
Storage facilities, personal protective equipment suitable for oil spills.

DESCRIPTION/PRINCIPLE

Initial response and clean-up (removing the bulk of the oil) aims at recovering as quickly as possible as much of the bulk pollutant as possible that could be remobilised and pollute other sites that are protected or that have already been cleaned up, pushed by wind and currents. Final clean-up and restoration should only start once responders are sure that there will be no more massive beachings of oil on the coastline unless weathering processes complicate the clean-up operation.

Priorities

Once responder safety is secured, initial clean-up techniques have been defined and accepted and limits have been set:

- for beaches: pump floating slicks by the water's edge and collect the biggest patches deposited on the foreshore to avoid them being covered by incoming sand or being moved out by wind and tide action. Collect polluted macro waste, heavily oiled seaweed and oil that is easy to recover in sheltered waters. Every response operation has to be as selective as possible to avoid disturbing the geomorphological balance of the coastline in addition to reducing quantities to be treated.
- for rocky areas: collect accumulated oil from nooks and crannies in rocky areas where there is little wave action.
- for quaysides and beach access roads: clean up whatever may cause people or vehicles to skid or slide or else cordon the area off.

Tar balls on beaches, slightly polluted seaweed, accumulations of oil in rocky areas where there is a lot of wave action can be removed subsequently during final clean-up operations.

Methods

In the event of liquid oils, contain the slicks and pump them with honey wagons/vacuum trucks and other specialised clean-up equipment (such as sewage suction systems and clean-up trucks) or else use specific recovery systems (cf. data sheets "*N02 Ecrémage / pompage en bordure d'eau*", French version, or for tropical areas "*MT05 Skimming / pumping at the water's edge*"). With oils that are viscous and unpumpable, recover can be done by hand (scrapers, shovels, forks, rakes, pikes, buckets) but when oil coverage is very extensive and the site is amenable (easy access and load-bearing capacity) access will be possible for heavy duty equipment (screening machines, back hoe-loaders, power shovels and graders). Public works equipment and farming equipment can be used for facilitating the disposal of collected pollutants. Vehicle circulation lanes and access areas have to be clearly marked out to avoid burying the collected pollutant or causing harm to the environment. To begin with, waste will be prestored near the collection points in tanks or ditches. These storage areas will be dug, lined and protected by plastic tarpaulin sheets and must not be reachable by the tides. These prestorage sites also have to be easy to get to for the lorries that are to remove the collected waste. Be careful you do not overfill the storage capacities(skips, tanks) to ensure they do not spill over (cf. data sheet "*G08 Gestion des déchets*").

CONDITIONS OF USE

Pollution: massive beaching, heavy pollution, weathering processes may complicate the clean-up operations.
Substrate: sufficient load bearing capacity for men and machines.
Site: Access is suitable for the resources you are using and the site has been cordoned off.

IMPACT ON THE ENVIRONMENT

In a bid to limit the impact of clean-up operations on the environment (and especially erosion phenomena) you are advised to recover as little sand as possible when collecting oil and especially if you have to use public works equipment.
Furthermore, access areas and circulation lanes have to be clearly marked out. Always use already existing access areas and marshal machines and responders accordingly. If need be, protect the ground from heavy traffic (use tarpaulins, geotextiles and wickerwork fencing).

PERFORMANCE

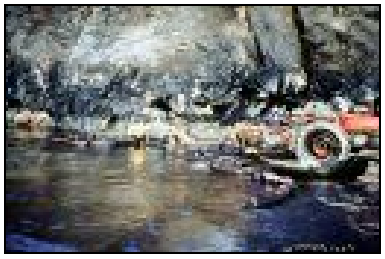
Yield: variable depending on the type of pollutant and the size of the spill (volume, surface area), what human resources and machines you have in addition to sea state and weather conditions.
Implementation: optimise the collection - transfer - storage - evacuation chain for transport to the treatment centre
Waste: pollutant + sediment + macro waste + soiled personal protective equipment+ waste water

OBSERVATIONS

- Bar access to the public so as to protect them and avoid disseminating oil elsewhere (burying, polluting surrounding areas…): set up signposts and posters that people can see and read.
- In the interest of safety for all concerned, vehicles and responders will use different circulation patterns and lanes.
- Solid preparation and good knowledge of the area will be the key to the success of the operation.
- Knowing what the oil is going to do next depending on weather conditions, sea state and tidal coefficients will always be essential to the overall strategy and response.

SKIMMING/PUMPING AT THE WATER'S EDGE

SCOPE
Substrates: all types Pollution: heavy to very heavy Pollutant: all types (pumpable) Sea: with or without tides



EQUIPMENT NEEDED

Basic equipment:	Extra equipment:
- Skimmer, skimming head - Pump, vacuum truck - Storage facilities	- Floating boom - Worksite boom, sorbent boom - Small boat (where necessary)

DESCRIPTION/PRINCIPLE

Consists of skimming/pumping large accumulations of floating oil by the water's edge from the shore. Pumping units will be needed (pumps or vacuum trucks) fitted with a floating skimmer, a floating suction head or a flat nozzle.
The oil will have to be contained in a floating boom, where necessary a shore-sealing boom. Containment may consist of a boom laid in herringbone mode to intercept drifting slicks (choose the right place depending on drift and storage facilities) or a containment boom to encircle the slick and stop it from leaving a creek, for instance. In places where tidal activity is minimal, laying a boom preventively along the water mark on a slightly exposed site can prevent the pollutant from stranding and yet will allow pumping.
The pollutant must be jetted towards the suction head with small worksite booms, if necessary from a dinghy.

CONDITIONS OF USE

Pollution: pumpable oil; massive arrivals or heavy pollution.
Substrate: good load bearing capacity; access for bringing equipment onto the beach.
Site: Accessible to farm tractors, public works machinery, sanitation trucks. Try to use the inshore current patterns to deflect the oil towards ditches or booms.

IMPACT ON THE ENVIRONMENT

Physical/biological: light to moderate, depending on circulation of machinery on the beach and to a possible transfer of the pollution; potentially serious impact if storage pits are dug on the upper foreshore or back beach.

PERFORMANCE

Yield: variable (from a few m^3 to several dozen m^3 per hour) depending on the pumping/skimming means used and pollutant viscosity. Count on anywhere between 1/4 and 1/5 of the theoretical pumping rate for downtime owing to various factors (clogging, blocking, solid waste, agitation of the water surface, etc.), in addition to pressure losses due to the viscosity of the pollutant and the height and length of suction or delivery.
Minimum workforce required: 2 to 3 people per recovery/storage unit.

Waste: oil, emulsified to a varying extent, pollutant containing free water, with sediment and diverse debris in varying quantities depending on the system used and the location.

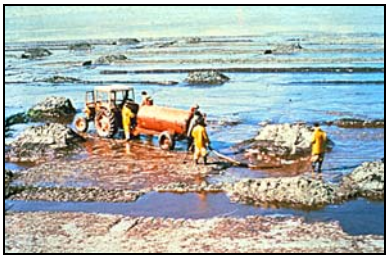
OBSERVATIONS

- Prioritise selectivity: thicken slicks for suction.
- The emulsion may be broken at this stage on the beach, by injecting an emulsion breaker into the pollutant if tests prove that it is worthwhile.
- Ensure that the pump is suited to the characteristics of the pollutant and the site.
- Always make sure you install a protective liner for substrates (use tarpaulins) and traffic lanes so as to mitigate the spreading of pollution.
- Consider the need to demobilise equipment and personnel every day from the scene of operations depending on prevailing local characteristics and tidal conditions during the response.
- Plan on removing storage facilities (specialised tanks are preferable to ditches).

PUMPING ON THE FORESHORE (TRENCHES OR BUNDS)

SCOPE

Substrates: sand
Pollution: heavy to very heavy
Pollutant: fluid to slightly viscous
Sea: with or without tides



EQUIPMENT NEEDED

Basic equipment:
- Pump
- Vacuum tanker
- Storage facilities

Extra equipment:
- Power shovel (digging trenches, forming bunds)
- Plastic sheeting, geotextile (protection)
- Machine with front rubber scraper blade
- Manual scraper (as used in pig sties)

DESCRIPTION/PRINCIPLE

Consists of pumping accumulations of oil concentrated at collection points:
- (case 1) on the mid-foreshore, in a shore-sealing boom or a bund (a small embankment) on a slope, or in shallow pits if the foreshore is subhorizontal.
- (case 2) on the upper foreshore, in a trench with a bund.

In the first case, the fluid oil is scraped, mechanically or manually, towards trenches around 0.5 m deep.
In the second case, a trench is dug at low tide along the high tide mark of the day, the sand is removed to form a protective bund on the land side of the trench and the trench is covered with a tarpaulin.

CONDITIONS OF USE

Pollution: pumpable oil with low to moderate viscosity – heavy pollution
Substrate: tamped, fine-grain sand, good load-bearing capacity, sufficient thickness of sediment (for trenches/bunds).
Site: accessible to public works machinery; very wide foreshore (case 1); small relatively sheltered beach (case 2).

IMPACT ON THE ENVIRONMENT

Physical: digging trenches: risk of temporary formation of quicksand after filling by the following tides.
Biological: toxic effects in the long term if the pollutant persists in the trenches after filling; otherwise temporary disturbance; recolonisation in the long run.

PERFORMANCE

Yield: variable according to the pumping means used.
Minimum workforce required: 2 to 3 workers per pumping unit; more if scraping is manual.
Waste: pollutant mixed with varying quantities of sand.

OBSERVATIONS

- Case 1 should only be considered in the case of a major spill of a fluid pollutant and exclusively on a foreshore where a large area is uncovered by the tides.
- Case 2 = difficult to implement; accurately assess the day's high tide level and the sea state; protect bunds or trenches using a tarpaulin in order to prevent the bund from collapsing and to restrict the mixing of sand and oil in the trench.
- Clean out the trenches and remove the tarpaulins before leaving the worksite.
- Pumping using vacuum trucks is the most appropriate method: use vacuum trucks which can be opened to remove the sand.
- Assess the possibility of injecting a demulsifier during pumping.

CONTAINMENT AND RECOVERY OF EFFLUENTS ON THE WATER SURFACE

SCOPE
Substrates: all types Pollution: light to very heavy Pollutant: all types Sea: with or without tides

EQUIPMENT NEEDED	
Basic equipment: - Small floating booms, worksite booms, shore-sealing booms - Skimmers/pumps - Sorbents, landing nets	Extra equipment: - Land- or sea-based logistical support (equipment deployment, waste disposal…)

DESCRIPTION/PRINCIPLE

Involves setting up a system to recover effluents floating in front of worksites where washing operations are being carried out. Containment is conducted using floating booms attached to the shore, set up in a U-shaped configuration. The oil is recovered by absorption or pumping from within the boom from the beach (using weir or oleophilic skimmers…) or from the water surface (using a barge/pontoon, a conveyor belt skimmer or weir skimmer etc., with an integrated or coupled storage capacity). The size of the system will depend on the volume of pollutant and the size of the worksite.

CONDITIONS OF USE

Pollution: moveable and pumpable oil.
Substrate: all types.
Site: relatively sheltered (at least during operations), for preference constantly underwater or narrow foreshore.

IMPACT ON THE ENVIRONMENT

Physical: light to none
Biological: very light (except for the spreading of pollution to the lower foreshore if the effluents have to travel over too great a distance before reaching the water, or oil mixed with sediments flowing into a subtidal zone).

PERFORMANCE

Yield: variable according to the volume of oil mobilised, the site and the recovery means.
Waste: emulsified oil, polluted water, fine sediments and various types of oiled debris.

OBSERVATIONS

- Requires massive logistic support (mobile recovery/waste disposal area) plus a methodical organisation of the worksite so as not to oil coastal areas that have already been cleaned up, or not yet been oiled.
- The concomitant use of bulk or conditioned sorbents on the water surface and the foreshore can be beneficial especially if the sediments are fine or the water turbid.
- Should only be considered for narrow beaches.

CONTAINMENT AND RECOVERY OF EFFLUENTS ON THE FORESHORE

SCOPE

Substrates: all types
Pollution: light to very heavy
Pollutant: all types
Sea: tidal

EQUIPMENT NEEDED

Basic equipment:
- Shore-sealing boom
- Shovels, power shovels, planks
- Skimmers/pumps, sorbents, landing nets

Extra equipment:
- Storage tanks/bins
- Land-based logistical support (to deploy equipment/for waste disposal…)

DESCRIPTION/PRINCIPLE

Consists of recovering effluents from washing and draining operations on the beach. The aim is to channel the effluents to a pumping/skimming point. The effluents are channelled using trenches (protected with tarpaulins) and planks set up in a V-shaped configuration towards the lower foreshore. Retention should be as close to the worksite as possible to reduce the distance over which the effluents must flow. The effluents can be contained using shore-sealing booms, windrows made of sand and covered with tarpaulins or simple pits protected with geotextiles. Recovery is carried out by absorption or pumping, depending on the volume of pollutant.

CONDITIONS OF USE

Pollution: moveable and pumpable oil
Substrate: all types
Site: all types

IMPACT ON THE ENVIRONMENT

Physical: very limited, temporary disturbance to the areas where channels are dug.
Biological: risk of residual pollution if the pollutant is not recovered or becomes buried, due to the collapse of trenches or pits; delayed recolonisation in these areas.

PERFORMANCE

Yield: variable
Waste: emulsified oil, polluted water, fine sediments and various types of oiled debris.

OBSERVATIONS

- The retention/recovery phase should be defined and the system put in place before the washing/draining phase.
- Anticipate the need for plastic sheeting and geotextiles along the run-off channels and containment pits in order to reduce the infiltration of the pollutant and reinforce the system (prevent collapse).

MANUAL COLLECTION

SCOPE

Substrates: all
Pollution: very light to very heavy
Pollutant: all
Sea: with or without tides

EQUIPMENT NEEDED

Basic equipment:	Extra equipment:
- Scrapers, rakes, brushes, forks, etc. - Landing nets, shovels etc.	- Big-bags, bins, bags - Tractor with loader (for removal)

DESCRIPTION/PRINCIPLE

The pollutant, polluted sediment and debris are removed by hand or with the help of manual tools and then stored for disposal.
The waste can be in bulk or put in bags, plastic rubbish bags, big-bags (providing the transport facilities and the intermediary storage facilities can cope with them) and is then disposed of by hand or better still with assistance from flat-bottomed boats.

CONDITIONS OF USE

Pollution: all types; most often scattered pollution; on widespread pollution, only if use of other techniques is impossible.
Substrate: all types; sufficient load bearing capacity for pedestrians and possibly light machinery.
Site: all types if they are sufficiently workable and providing they can cope with a high level of trampling.

IMPACT ON THE ENVIRONMENT

Physical: impact ranges from insignificant to high depending on the substrates. Risk of deconstruction of soil on marshland. Erosion.
Biological: same applies. Potentially destructive effects on flora (dunes, marshland).

PERFORMANCE

Yield: this will vary with the type of pollution and the site (from 0.2 to 2 m^3 at the most per day per person).
Minimum workforce required: (order of magnitude for average sandy beach, 100 to 200 linear metres per day per team of 10 workers, including waste removal).
Waste: polluted debris and sediments with variable oil-content: 10 to 30% on scattered pollution but much more, especially during the first few days, in the case of a massive HFO spill.

OBSERVATIONS

- Ensure responders have at least the minimum in terms of protective clothing: overalls, boots, gloves, etc. depending on the nature of the pollutant, exposure and responder activity.
- Difficult working conditions: aim for optimum comfort in terms of equipment (innovate if necessary), logistics, supplies (water, coffee, meals…)
- This is a very selective technique, although it requires a lot of time and personnel.
- Organise the response: give the responders well-defined responsibilities (collection, raking, piling in heaps, putting waste in rubbish bags and disposal) and have strike teams rotate. The use of a loader replaces the latter two positions: the waste collected is directly placed in the loader and is then evacuated to an intermediate storage facility.
- Organise a chain to evacuate waste in places that are hard to reach.
- Ensure personal safety (signposting, supervision, no isolated individual should be out of sight etc.).
- Restrict the spreading of the pollution: set up traffic lanes, protect ground (geotextile), provide a decontamination area near the worksite exit.
- Always comply with environmental and safety instructions.