App. 4 Case study: JYEH power plant oil spill, Lebanon, 2006

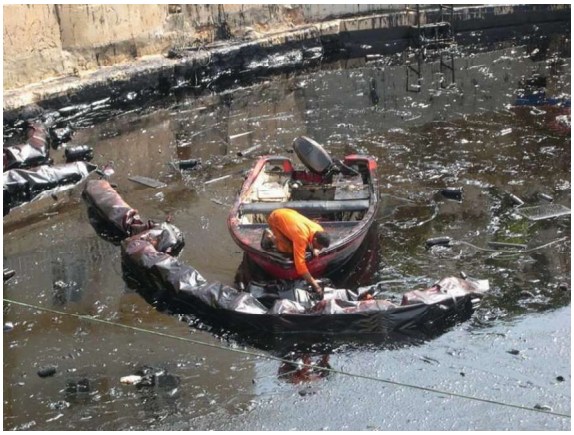
On the 13 and 15 July 2006, the Jyeh power utility located 30 km south of Beirut directly on the coastline was hit by Israeli bombs. Part of the storage tanks caught fire and were still burning 10 days on. The fuel that did not catch on fire was spilled into the Mediterranean Sea as a result of the blast.

Due to winds blowing south-west to north-east and water current movement, the oil spill was partly carried out to sea and partly dispersed along the coast of Lebanon. It affected 70 – 80 km of both public and private rocky and sandy beaches along the Lebanese coast including public and private marinas/ports for boats/ships of fishermen and tourist resorts from the Damour region south of Beirut through to Tripoli in the north.

(Source of text: http://www.moe.gov.lb/rescuelebanon.htm/)

Approximately 10,000 to 15,000 tons of unburned fuel oil were spilled at sea, and drifted to the north, pushed by south-westerly winds. The pollution impacted almost half of the 200 km of Lebanese coastline, affecting various substrates: sand, stones, rocks, port facilities. The product spilled appeared to be an IFO 150 (Intermediate Fuel Oil).

Oiled cobble and rocky shore



Oil slick and oiled debris trapped in a port

The waste collected was estimated as follow:

Update – July 2007	**Liquid/oil**	**Semi solid**	**Polluted sand**	**Polluted pebbles**	**Polluted debris ***	**Polluted equipments**
Total quantities removed (liquid and solid) **4 547 m^3**	567 m^3	173 m^3	1,814 m^3	264 m^3	1,969 m^3	60 m^3
		Total of 3,980 m^3				
		* including 1212m^3 of mixed semi-solid/sand/debris in unknown proportion				

One major problem was the large amount of debris that was already stranded on the coast of Lebanon and that became oiled, thus generating a large volume of polluted waste.

A study identified the existing treatment facilities available in Lebanon, and the methods that could be implemented in Lebanon.

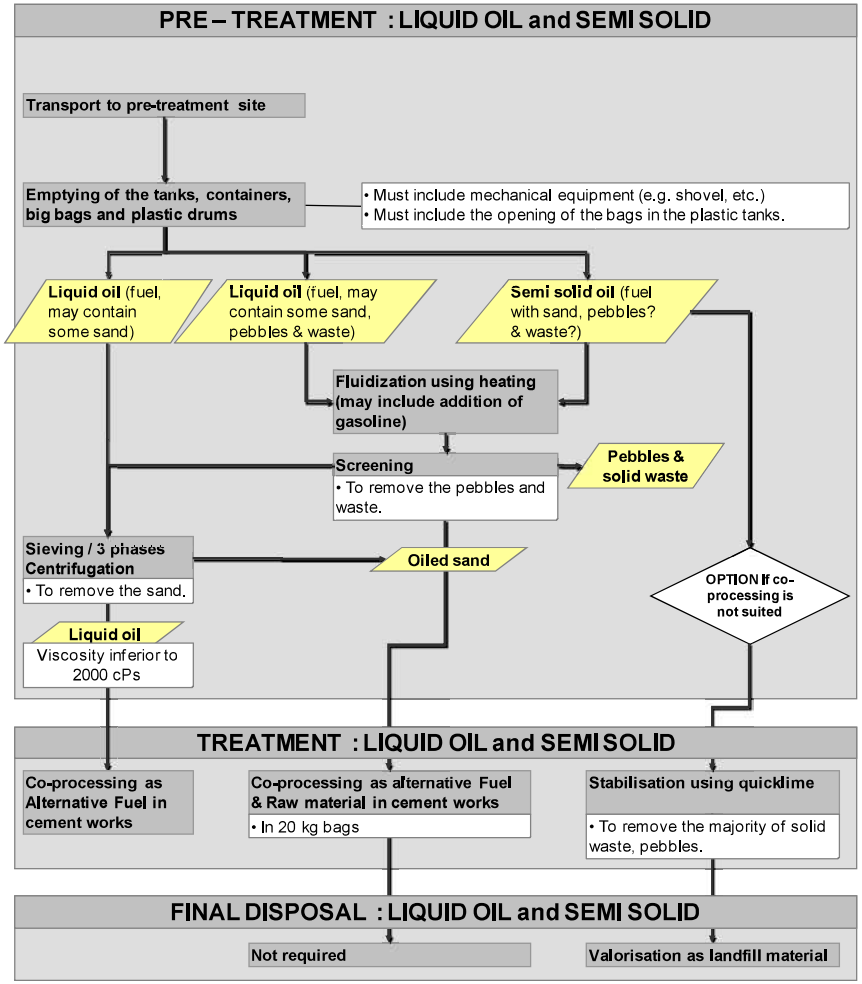
Treatment	Existing in Lebanon	Required external input
Settling / centrifugation / emulsion breaking	No facilities identified.	Site, equipment and expertise.
Washing (solid waste)	There are no existing washing facilities in Lebanon for the washing of oiled solid waste.	Site, equipment and expertise.
Washing of pebbles (using washing units or hot water/ high pressure for bigger pebbles)	There are no existing washing units or hot water and high pressure washing facilities in Lebanon for the washing of oiled pebbles.	Site to implement the operations. Expertise to setup the facility. Equipment could be found in Lebanon (concrete mixer, high pressure cleaner, sorbent, decanter, etc.)
Surfwashing (sand and pebbles on site)	Surfwashing has already been used successfully (on the sand beaches of Beirut and south of Beirut). Efficiency on weathered oil has to test.	Expertise to manage the operations. *Performed on site.* *Note. Equipment consists in earth moving machines, booms and sorbent which can be acquired in Lebanon.*
Stabilisation using quicklime (semi-solid and oily sands)	There is no existing stabilisation site in Lebanon.	Site to implement the operations. Expertise to manage the operations. Quicklime is used to stabilize the waste. Available earth moving machines can be used to mix the waste and quicklime.
Bio-treatments (lightly polluted waste)	There is no existing bio-treatment site in Lebanon.	Site to implement the operations. Expertise to manage the operations. *Note. Equipment consists mainly in earth moving machines.*
Incineration in domestic incinerators	There are no domestic incinerators in Lebanon.	.
Incineration in hazardous waste collection centre/ incinerator	There are no hazardous waste collection centres / incinerators in Lebanon.	Site, equipment and expertise for mobile incinerator.
Incineration in cement works/ industrial furnace as Raw Alternative material	Three cement works in Lebanon could potentially use oily waste as Alternative Fuel and Raw material, but only one was adequately equipped.	None for the treatment. Expertise (and equipment) may be required for the pre-treatment of the waste to ensure a correct incineration.
Low Temperature Thermal Desorption	There is one Low Temperature Thermal Desorption unit in Lebanon (Beirut).	Expertise, maintenance, manpower and energy.
Burning of lightly oiled vegetation, wood	Burning has already been performed for lightly oiled vegetation recovered from the beaches.	None.

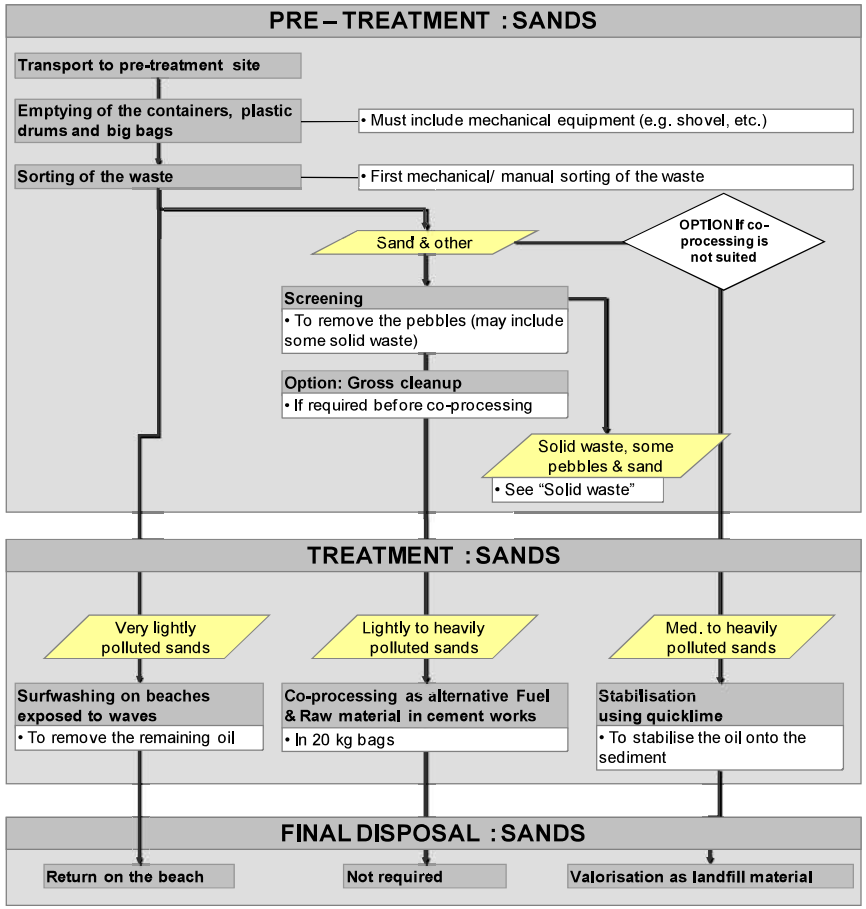
The final disposal options available in Lebanon were also identified.

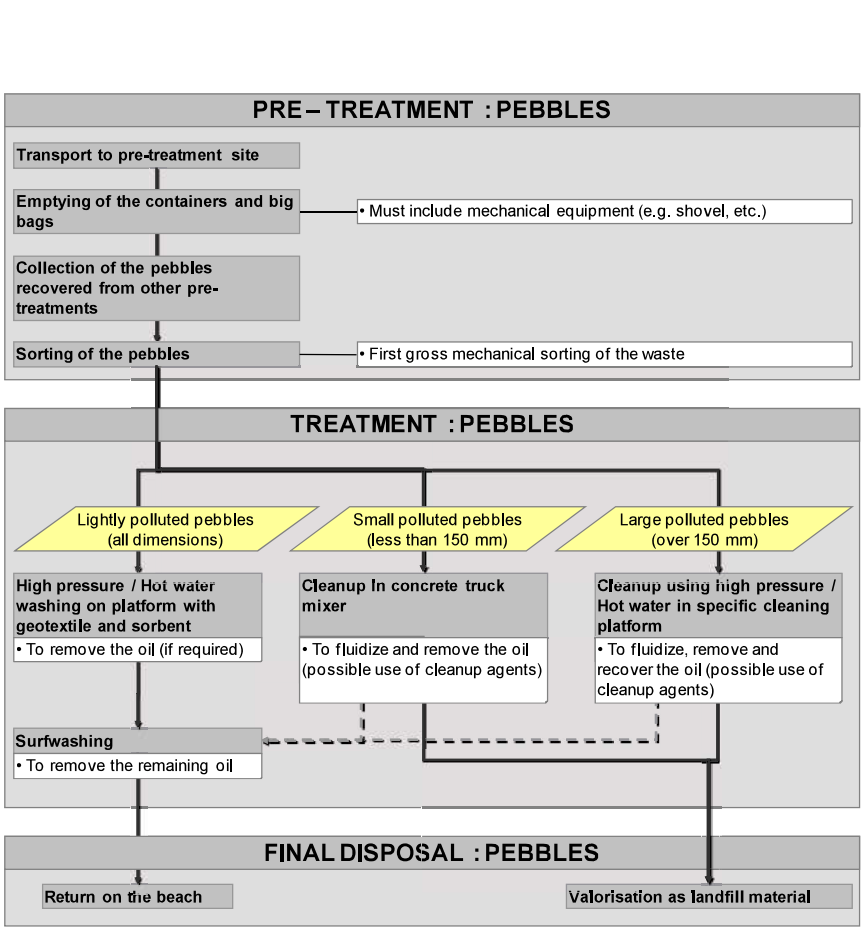
Treatment	Existing in Lebanon	Required external input
Return of clean sediment on site	Clean sediments have already been returned on site during clean-up operations.	None.
Discharge in natural environment	Water from clean-up operations has already been discharged in the environment during clean-up operations (after decantation).	None.
Storage (controlled containment and/ or landfills)	Three landfills were identified, but are considered nearly full.	Expertise for long term storage of waste. Equipment for storage (cells).
Re-use as road work material	There is no example of re-use as road work material in Lebanon.	Road work site.
De-ballasting station	There are no de-ballasting stations in Lebanon.	Site, equipment and expertise.
Evapo-incineration	There are no existing evapo-incineration facilities in Lebanon.	Site, equipment and expertise.

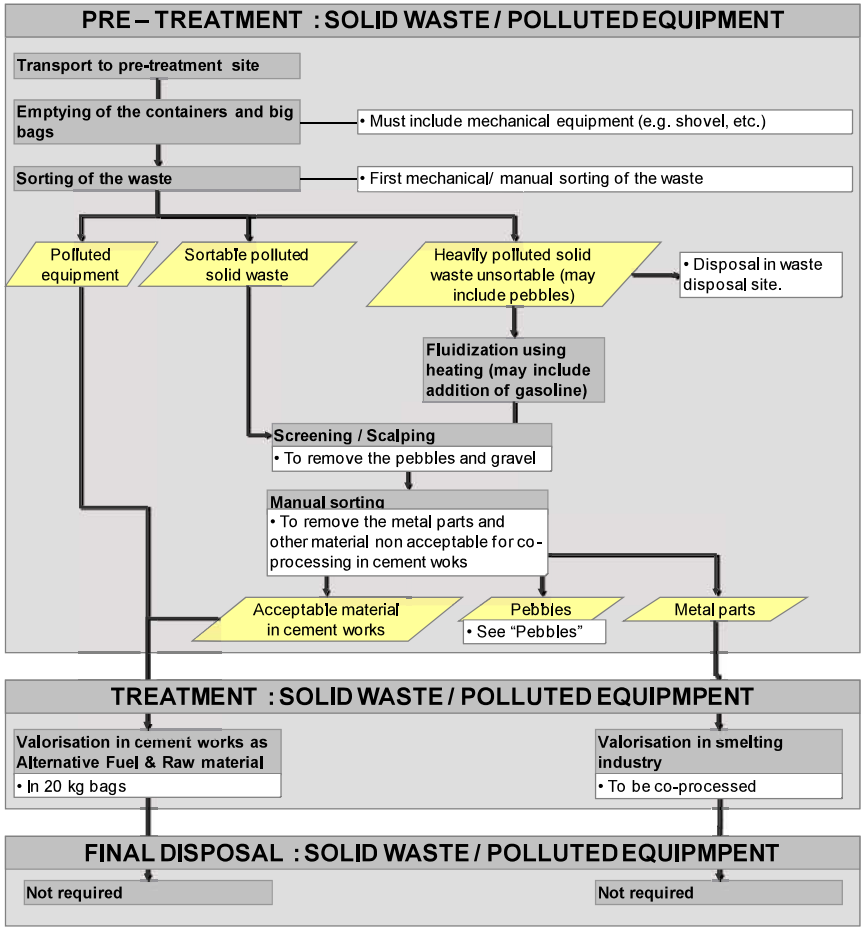
Based on these treatments and final disposal options, the operational, environmental and legal constraints, the following pre-treatment, treatment and final disposal options were proposed to dispose of the oily waste collected on the shoreline of Lebanon following clean-up operations (see next pages).

(Source: KESSACI C. (ANTEA), PAGE-JONES L. (ANTEA), ROUVREAU L. (ANTEA), PONCET F. (CEDRE), 2007. Study for the management of oily wastes generated by the cleaning operations of the Lebanese coast following the oil spill of JIYEH. Report A 47 825 / B, Project No: METP070010, France, 85 p.


PRE – TREATMENT : LIQUID OIL and SEMI SOLID
Transport to pre-treatment site
Emptying of the tanks, containers, big bags and plastic drums
• Must include mechanical equipment (e.g. shovel, etc.)
• Must include the opening of the bags in the plastic tanks.
Liquid oil (fuel, may contain some sand)
Liquid oil (fuel, may contain some sand, pebbles & waste)
Semi solid oil (fuel with sand, pebbles? & waste?)
Fluidization using heating (may include addition of gasoline)
Screening
• To remove the pebbles and waste.
Pebbles & solid waste
Sieving / 3 phases Centrifugation
• To remove the sand.
Oiled sand
OPTION If co-processing is not suited
Liquid oil
Viscosity inferior to 2000 cPs
TREATMENT : LIQUID OIL and SEMI SOLID
Co-processing as Alternative Fuel in cement works
Co-processing as alternative Fuel & Raw material in cement works
• In 20 kg bags
Stabilisation using quicklime
• To remove the majority of solid waste, pebbles.
FINAL DISPOSAL : LIQUID OIL and SEMI SOLID
Not required
Valorisation as landfill material


PRE – TREATMENT : SANDS
Transport to pre-treatment site
Emptying of the containers, plastic drums and big bags
• Must include mechanical equipment (e.g. shovel, etc.)
Sorting of the waste
• First mechanical/ manual sorting of the waste
Sand & other
OPTION If co-processing is not suited
Screening
• To remove the pebbles (may include some solid waste)
Option: Gross cleanup
• If required before co-processing
Solid waste, some pebbles & sand
• See "Solid waste"
TREATMENT : SANDS
Very lightly polluted sands
Lightly to heavily polluted sands
Med. to heavily polluted sands
Surfwashing on beaches exposed to waves
• To remove the remaining oil
Co-processing as alternative Fuel & Raw material in cement works
• In 20 kg bags
Stabilisation using quicklime
• To stabilise the oil onto the sediment
FINAL DISPOSAL : SANDS
Return on the beach
Not required
Valorisation as landfill material


PRE – TREATMENT : PEBBLES
Transport to pre-treatment site
Emptying of the containers and big bags
• Must include mechanical equipment (e.g. shovel, etc.)
Collection of the pebbles recovered from other pre-treatments
Sorting of the pebbles
• First gross mechanical sorting of the waste
TREATMENT : PEBBLES
Lightly polluted pebbles (all dimensions)
Small polluted pebbles (less than 150 mm)
Large polluted pebbles (over 150 mm)
High pressure / Hot water washing on platform with geotextile and sorbent
• To remove the oil (if required)
Cleanup in concrete truck mixer
• To fluidize and remove the oil (possible use of cleanup agents)
Cleanup using high pressure / Hot water in specific cleaning platform
• To fluidize, remove and recover the oil (possible use of cleanup agents)
Surfwashing
• To remove the remaining oil
FINAL DISPOSAL : PEBBLES
Return on the beach
Valorisation as landfill material


PRE – TREATMENT : SOLID WASTE / POLLUTED EQUIPMENT
Transport to pre-treatment site
Emptying of the containers and big bags
• Must include mechanical equipment (e.g. shovel, etc.)
Sorting of the waste
• First mechanical/ manual sorting of the waste
Polluted equipment
Sortable polluted solid waste
Heavily polluted solid waste unsortable (may include pebbles)
• Disposal in waste disposal site.
Fluidization using heating (may include addition of gasoline)
Screening / Scalping
• To remove the pebbles and gravel
Manual sorting
• To remove the metal parts and other material non acceptable for co-processing in cement woks
Acceptable material in cement works
Pebbles
• See "Pebbles"
Metal parts
TREATMENT : SOLID WASTE / POLLUTED EQUIPMPENT
Valorisation in cement works as Alternative Fuel & Raw material
• In 20 kg bags
Valorisation in smelting industry
• To be co-processed
FINAL DISPOSAL : SOLID WASTE / POLLUTED EQUIPMPENT
Not required
Not required