CENTRE OF DOCUMENTATION, RESEARCH AND EXPERIMENTATION ON ACCIDENTAL WATER POLLUTION

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SHIP-SOURCE SPILLS

Collision on the Mississippi and light crude spill (Louisiana, US)

Early in the night of 17th February 2012, near Edgard on the Mississippi River (around 60 km upstream of New Orleans, Louisiana), a barge loaded with construction materials and towed by the *Alydar* collided with a 90 m oil barge, pushed by the *Clarence W. Settoon* and loaded with 3,180 m^3 of Louisiana sweet crude.

The USCG was immediately alerted of the incident which caused oil to begin to leak into the Mississippi from a 3 m by 1.5 m gash in the barge's double hull. A Unified Command (UC) was rapidly set up, gathering representatives of the USCG, the Louisiana Oil Spill Coordinator's Office (LOSCO), the Louisiana Department of Environmental Quality (DEQ), the Louisiana Department of Wildlife and Fisheries, as well as the towing company Settoon Towing. Scientific support from the National Oceanic and Atmospheric Administration (NOAA) was also called upon, in particular in terms of the assessment of the pollutant's fate and the risks generated in the event of a spill of the cargo from the barge.

Aerial surveys of the spread of the pollution were carried out by the USCG and the New Orleans Coast Guard Air Station on board a MH-65C Dauphin helicopter; as an initial measure, traffic was banned within a 8 km stretch downstream of the incident and, in the neighbouring parish (St Charles), various water intakes were shut down as a preventative measure.

Pending the results of the USCG enquiry into the respective responsibilities of those involved in the incident, the Oil Spill Liability Trust Fund was opened to cover the cost of response operations – for which two private companies (ES&H and OMI Environmental Solutions) were contracted. Around one hundred people (USCG and contractors combined) were mobilised for clean-up operations which, two days after the spill, resulted in the collection of 100 bags of miscellaneous oiled debris as well as 40 bags of oiled sorbents. Meanwhile, the remaining oil was removed from the tanker barge, enabling the volume spilt to be estimated at just under 30 m^3. The barge was then towed to a repair facility in Westwego, near New Orleans.

In total, 126 m^3 of miscellaneous oiled waste was collected and 1,430 m of sorbent booms were deployed. The Unified Command announced the end of recovery and clean-up operations some twelve days after the incident.

PIPELINE SPILLS

Crude oil spill in the Guarapiche River from a PDVSA pipeline (Monagas state, Venezuela).

On 4th February 2012, in the Venezuelan state of Monagas, a crack appeared in a pipeline operated by the State-owned company *Petroleos de Venezuela SA* (PDVSA). This 20" pipeline transports crude oil from the El Furrial field to the Jusepin oil complex. The incident caused a spill of between 7,150 and 19,100 m^3 of crude oil according to official sources – 9,500 m^3 according to others – onto the surrounding land then into the waters of the Guarapiche River.

The water intakes at the Jusepin power station and drinking water purification plants located along the river (supplying the majority of the state's inhabitants) were closed. The aqueduct carrying the water from the river to Maturin (capital of Monagas) was preventively shut off, affecting the drinking water supply to 80% of residents. A state of emergency was declared by the state of Monagas six days after the spill. Meanwhile, PDVSA and *Aguas de Monagas* (water supply and sanitation company) organised an alternative supply of drinking water to residents, by mobilising 17 super-tanker trucks and 70 tanker trucks as well as distributing bottles and barrels.

Faced with the risks of the slicks spreading to the San Juan and Caripito rivers (then to the Atlantic via the Gulf of Paria), spill response on the Guarapiche was jointly implemented by representatives of the oil company PDVSA and the Ministry of the Environment *(Ministerio del Poder Popular para el Ambiente – MINAMB)*, in collaboration with the fire brigade, the Monagas police as well as the National Guard.

Although little detail is provided in our information sources[1], the operations, which reportedly mobilised 1,500 people (including local residents), appear to have included recovery operations on the water (containment and pumping, by vacuum trucks together with skimming heads; manual

[1] A press release was made available on the PDVSA website, providing a few figures
http://www.pdvsa.com/index.php?tpl=interface.sp/design/biblioteca/readdoc.tpl.html&newsid_obj_id=9934&newsid_temas=111

collection of accumulations in calm areas using loose sorbents and scoop nets) and bank clean-up operations (an estimated 140 km of oiled banks covering a surface area of 19 ha).

Eight days after the spill, MINAMB announced "We have fully controlled the oil spill; 90% of the oil is within the barriers", and at the end of February, PDSVA indicated that 95% of the oil spilt into the Guarapiche River had been recovered, although no more detail was provided. The crude oil recovered was sent to the Jusepin Complex for treatment.

Volunteers deploying a permanent boom (source: El Universal)

Containment (floating and sorbent booms) and recovery (oleophilic drum skimmer) (source: Agencia Venezolana de Noticias)

Containment and spreading of loose sorbent (peat) prior to manual recovery (source: El Universal)

While the environmental impact was not specified, fish mortalities appear to have been reported within the affected stretch of the Guarapiche. The water contamination was monitored by Intevep (Venezuelan Institute of Petroleum Technology); less than a month after the incident (1st March), the water supply was declared to be fit for consumption by MINAMB, with analyses reporting pollutant concentrations below accepted health levels.

The causes of the incident have not yet been revealed, although certain sources in the press suggest the possibility of an explosion due to negligent maintenance.

Spill in a remote, difficult access area: process water leak (Alberta, Canada)

On 19th May 2012, near Rainbow Lake in the north-west of the province of Alberta (Canada), aerial inspection of facilities by an oil company led to suspicion of an oil spill from a Pace Oil & Gas pipeline. The leak was confirmed and originated from above-ground piping connecting an underground pipeline to a well used for process water injection. This water, composed of a mixture of water and light crude oil (sweet, or low-sulphur, Bluesky oil) in a 70/30 proportion, spread to the adjacent wetlands, covering 4.3 hectares with an initially estimated volume of 3,500 m^3 (i.e. just over 1,000 m^3 of crude oil). On 6th June, the estimation of the volume spilt was lowered to 800 m^3.

The polluted areas, composed of muskegs – acidic peat bogs formed on permafrost in boreal areas –, imposed logistical constraints for the response: remote and difficult to access, with a low load-bearing capacity and sensitive to trampling. Response to the pollution therefore required stabilised access routes to be built – by laying logs – to provide access to teams and response equipment as well as a base camp to be set up to accommodate some 50 responders (from companies contracted by the polluter). These people were mobilised for clean-up as well as for prior environmental surveys to determine the soil remediation potential. A local wildlife management company, based near Rainbow Lake, was put in charge of implementing deterrent devices: noise devices, barriers (snow or silt fences), etc. were deployed around the oiled area.

Clean-up was carried out under the supervision of the Energy Resource Conservation Board (ERCB, now Alberta Energy Regulator) and Alberta Environment and Sustainable Resource Development (AESRD). Drainage operations for oil that had infiltrated into the ground were conducted by trenching the spill perimeter, with containment by building embankments. These operations were completed by pumping the oil into tanks. Two days after the spill was detected, Pace Oil & Gas reported the recovery of 588 m^3 of water/oil mixture.

On 20th June, following mechanical recovery operations on the free oil, two in situ burning operations, planned and supervised by AESRD, were conducted on the remaining oil to conclude clean-up actions. Long term restoration work could then begin: bioremediation was conducted on the majority of the site (the method used was not disclosed in our sources) in order to minimise surface disturbance.

The immediate environmental impact was apparently limited, with one dead duck found following the spill. The results of the monitoring programme for oil concentrations in the air, soil and water (including groundwater) eliminated the hypothesis of significant contamination of these compartments due to the incident.

The investigation conducted by the ERCB determined that the incident had been caused by a leak at a corrosion point – probably accelerated by a stray electrical current (of undetermined origin). In late September 2012, Pace Oil & Gas announced that the costs of site clean-up and remediation totalled an estimated $25 million, covered by the firm's insurance.

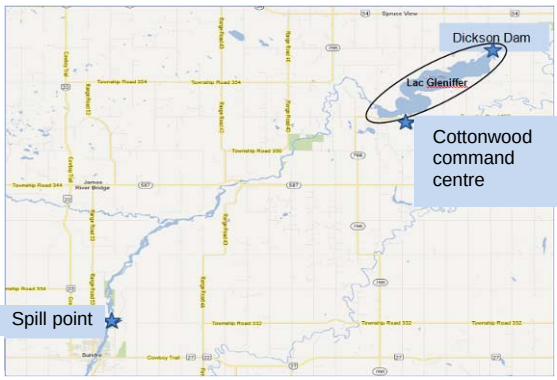
For further information:
http://www.marketwired.com/press-release/pace-oil-gas-ltd-containment-and-recovery-update-rainbow-lake-crude-emulsion-leak-tsx-pce-1662676.htm

Pollution of a river and a lake by Rangeland South Pipeline (Alberta, Canada)

On 7th June 2012, in the Calgary region (Canadian province of Alberta), the Plains Midstream Canada (PMC) control centre detected a pressure abnormality in Rangeland South Pipeline, an underground pipeline over 40 years old. This line, which transports high-sulphur light crude oil, was not in service at the time. The operator immediately isolated the relevant section by shutting off the valves, however, less than an hour later, the Sundre Petroleum Operators Group (SPOG)[2] notified PMC that sheen had been detected on Red Deer River, as well as on the surface of Gleniffer Lake – over 30 km downstream: the line had released a quantity later estimated at between 460 and 470 m^3 of light crude oil[3] into the river.

PMC immediately collaborated with the Province's relevant authorities (in particular Alberta Environment and Sustainable Resource Development, Alberta Energy Regulator, Alberta Emergency Management Agency, Alberta Health Services and the emergency response services). The firm mobilised logistical and human resources for the emergency response, which primarily aimed to protect the reservoir, which is used for hydroelectric power generation, drinking water supply intakes and various leisure activities. A plug was installed on the leaking section of pipeline and booms were deployed at the mouth of Red Deer River (this containment set-up was reinforced in the 48 hours following the incident). Meanwhile, facilities' water intakes were shut off 56 km downstream of the leak point. An onsite command centre was set up at the mouth of the lake at Cottonwood Community Centre.

Aerial view of the spill the day after the release (source: Plains Midstream Canada)



Location of the spill and operations (adapted from Plains Midstream Canada)

The river in spate (melting snow and heavy rainfall) was liable to cause the oil to spread rapidly, and the inaccessibility of certain banks required surveys to be conducted from craft with low draught (flat-bottomed boats or hovercraft).

Aerial view of Cottonwood onsite command centre, set up by Plains Midstream -June 2012 (source: Plains Midstream)

Surveying the banks from hovercraft (source: Plains Midstream)

Three days after the incident, the majority of the floating oil had been contained, mainly on the lake. The remaining free oil was recovered: (i) from the banks, using vacuum pumping equipment in some cases together with oleophilic skimmers (in particular drum skimmers), and (ii) on the water from small boats equipped with bow skimmers. Conditioned sorbents (booms, pads, etc.) were also used. At the

[2] Organisation founded in the 1990s by oil and gas companies operating in the Sundre region in a bid to pool and better coordinate their response capacity in the event of an oil spill.
[3] PMC estimation established in October 2012.

height of the response, up to 400 people were involved in Gleniffer Lake clean-up operations.

From the end of June, various sections of the banks of the river and lake were cleaned up manually, in particular with vegetation scything and the collection of oiled debris (trunks, branches, etc.). At the leak point and the run-off point into the river, the pollution remaining at the soil surface was cleaned up using sorbents.

Soil remediation actions were also initiated at several cleaned sites along Red Deer River and in Cottonwood recreation area, including landfarming and phytoremediation techniques (using a combination of planting and weeding operations).

The affected section of pipeline was removed in late August, and handed over to AESRD for investigation into the causes of the leak. Before official confirmation could be obtained, the hypothesis of soil erosion due to precipitation, exposing the line to debris swept along by the river, was put forward.

A control visit to cleaned sites was conducted at the end of summer 2012 and a few additional clean-up actions were recommended, to be finalised in October, i.e. before operations were suspended over the winter. The following spring and summer, inspection of the affected sites (conducted jointly by the official agencies and PMC) concluded that no significant pollution remained and vegetation regrowth was satisfactory: the clean-up sites were therefore shut down.

2013: vegetation regrowth in inspected segments (source: Plains Midstream)

In terms of environmental impacts, air and water quality monitoring programmes began the day after the incident at several measurement points along Red Deer River and in Gleniffer Lake. The results of these measurements proved negative, with the exception of one value in the water (the first day upstream of containment systems in the lake), indicating the presence of traces of oil, although below drinking water thresholds in Alberta. In early July 2012, Alberta Health Services (AHS) authorised facilities to resume water withdrawal from the reservoir, and lifted the ban on tourism and leisure activities (although fish consumption was still banned). In conjunction with AESRD, the monitoring of contaminants in fish flesh and surface waters was maintained longer term, via 4 sampling campaigns between spring and autumn 2013[4].

	Reptiles	***Mammals***	***Birds***	***Fish***
Oiled	10	5	4	0
Dead	0	6 (2 beavers; 4 mice)	14 (4 geese; 7 crows; 2 birds of prey; 1 unspecified)	25

Overview of impacts on wildlife between summer 2012 and spring 2013

Wildlife deterrents (source: Plains Midstream)

The visible impacts on wildlife appeared to be relatively limited, only a few oiled birds, mammals and reptiles were reported between the incident and summer 2013 (Cf. table above). Similarly, no apparent alteration to wildlife frequency or diversity was detected.

To help mitigate impact, wildlife deterrent devices (flags, scarecrows...) were installed in oiled areas during response activities.

The total cost of clean-up and restoration was estimated at $53 million. A class-action lawsuit was launched by the residents of the oiled area, seeking $75 million in compensation for the drop in their property values around the affected river.

For further information: http://www.plainsresponds.com/

[4] This monitoring programme, still ongoing at the time of writing, appears to indicate oil levels below the authorised limits.

SPILLS FROM ON-LAND FACILITIES

Diesel leak from a pipeline at a fuel depot (New Jersey, US)

On 11th January 2012, at a bus depot fuel storage facility in Gloucester Township (New Jersey), a faulty gasket connecting two underground diesel storage tanks caused a diesel fuel spill. Virtually the entire contents of the tanks (each with a 75 m^3 capacity) infiltrated into the ground. A quantity estimated at 100 m^3 ran into 2 lakes (Grenloch Lake and Blackwood Lake) next to the depot, via the rainwater drainage network.

The emergency response was not initiated until the following day by fire-fighters, after local residents complained about diesel odours and depot workers noticed fuel seeping to the surface[5]. The transport company implemented clean-up operations, under the supervision of State authorities (New Jersey Department of Environmental Protection, New Jersey Division of Fish and Wildlife) and local authorities (Gloucester Township and Camden County emergency services).

A specialised firm, Clean Venture LLC, was contracted to implement the response, which included containing the diesel – spread widely across the water surface – using containment booms together with sorbent booms. The fuel was partly recovered manually, using sorbents, but mainly pumped using vacuum trucks.

In total, around 35 m^3 of diesel (settled volume) was recovered on the water. As can be expected with this type of light fuel, a significant share of the pollution dissipated naturally (evaporation, dissolution, etc.).

On land, according to the New Jersey Department of Environmental Protection (NJDEP), some 680 tonnes of soil had been excavated by late May, adding to the 140 tonnes of polluted waste (sorbents and miscellaneous debris) generated by the response. Following clean-up, site restoration actions were performed, including replanting vegetation in the most vigorously cleaned areas.

Containment and recovery of diesel fuel (source: gloucestertownship.patch.com)

According to the NGO Tri-State Bird Rescue and Research, 125 dead animals were reported in the affected area, including around one hundred turtles emerging from hibernation (month of March) and 2 dozen animals, including waterbirds (mainly Anatidae) and mammals (beavers and muskrats). Around 170 animals (including around 50 turtles) were caught for rehabilitation and subsequent release into the environment. No significant fish mortality was observed.

Air and water quality monitoring (including many private wells in the polluted area) showed oil concentrations which were below the standards in force.

The ban on recreational activities on Grenloch Lake, instigated by NJDEP, was lifted 4 months after the incident, with the completion of clean-up and given the negative results of environmental monitoring (contaminant levels in water, sediment and fish flesh).

• Main spills of other hazardous substances worldwide

Phenol spill in the Yangtze River, from the chemical tanker *Gloria* (Zhenjiang, China)

On 2nd February, the South Korean chemical tanker *Gloria*, while docked in the port of Zhenjiang (Jiangsu province, China), released an undetermined quantity of phenol into the Yangtze River, leaking from a faulty valve on one of its tanks.

The phenol (or hydroxybenzene – also known as phenic acid or carbolic acid) is a corrosive, irritating substance that dissolves in water. In this incident, it entered the city's drinking water supply and was detected by the residents of Zhenjiang who reported a suspicious smell in the tap water. This triggered a rush to buy bottled water. The quality of the water supply was announced to have been restored to normal 2 days after the incident and emergency decontamination measures – by activated carbon treatment – were initiated. The water contamination was analysed twice a day until 7th February by Zhenjiang Environmental Protection Bureau.

The Wuhan Maritime Court, which has jurisdiction over the waters of the Jiangzu province, ordered the vessel to be detained in Nantong, setting 20.6 million yuan bail (2.6 million euros). Furthermore, the ship owner was threatened with legal action, unless a compensatory arrangement could be found

[5] Strong controversy arose over this delay in the implementation of emergency procedures.

with the local drinking water plant.

Sulphuric acid spill in a river by a tank wagon (Lime Creek, Kansas, US)

On 8th January 2012, due to an impact between two tank wagons during a shunting manoeuvre at Herrington rail yard (Kansas, US), a tank containing 42 m^3 of 93% sulphuric acid ruptured, releasing part of its contents. Around 11 m^3 leaked onto the railway tracks and surrounding ground, before entering Lime Creek through the drain ditch next to the line.

Technical and financial arrangements for the emergency response were made by the tank owner and operations were supervised by the Kansas Department of Health and Environment (KDHE) and the Dickinson County Emergency Management Agency.

An embankment was built between the railway line and the river, and the contaminated soil was drained, excavated or treated with lime by specialised contractors.

The pollutant remaining in the drainage ditch was pumped out, while in the creek the focus was on neutralising the water and containing the corrosive and sinking substance (density of 1.5). Given these characteristics, 3 successive filter dams, made of limestone aggregate (to neutralise the acid in the water and restrict its spread), were built downstream of the spill.

The acid led to a decrease in pH (which dropped to 1 at the spill point) in the water and caused high fish mortality according to the Kansas Department of Wildlife Parks and Tourism.

A limestone filter dam across Lime Creek downstream of the spill point. (source: KDHE)

Local residents and farmers were instructed by the public powers not to use or consume the water from Lime Creek. The acidity level in the water returned to normal one week after the incident (pH of 5.8 to 6 downstream of the filter dams). The incident was closed on 22nd February, once water monitoring had confirmed that normal pH levels had been restored.

• Containment/recovery

Inland waters oil spill response vessel

View of the spill response vessel Hebo-Cat 7 (source: Hebo Maritiemservice)

In 2012, the oil removal vessel *Hebo-Cat 7* was delivered to the service provider *Hebo Maritiemservice*, whose activities include spill response in the ports of Rotterdam and Dordrecht (Netherlands). This specialised vessel is over 50 metres long and 12 metres wide and is built to Lloyd's Register standards (Class: +100A1 [+] LMC UMS Oil Recovery vessel).

Designed to operate in inland waters, and more specifically in the Rhine-Meuse Delta, it has a high storage capacity of 199 m^3 fluid waste and 60 m^3 (4 x 15 m^3) of solid waste. The bow of the vessel is fitted with a conveyor belt to recover floating waste.

In terms of oil recovery, the *Hebo-Cat 7* is equipped with a detachable rigid sweeping arm (12 m; built by Koseq) fitted with a pump with a nominal flow rate of 300 $m^3.h^{-1}$.

Finally, the vessel is equipped with a Consilium Selesmar (X-band radar) oil detection system and a Consilium Salwico system for gas detection in the atmosphere.

12 m rigid sweeping arm + pump (source: Hebo Maritiemservice)

For further information:
http://www.hebo-maritiemservice.com/en/material/oil-removal-vessels/hebo-cat-7.html

Small disposable floating booms

The manufacturer DESMI Ro-Clean has developed a small, lightweight, floating boom known as the A-Boom for the protection of sensitive sites in calm waters (lakes, ports, etc.). This boom (freeboard:

25 cm, draught: 50 cm) is designed to be deployed by 1 or 2 people in an emergency.

Not only can it be rapidly deployed without requiring any specialised equipment, the materials used – high density polyethylene blocks for the floats, polypropylene sleeve and skirt, bamboo stiffeners – mean that it can be incinerated after use, with the exception of the skirt ballast chains. This boom is thus designed as a disposable or single-use product.

For further information:
http://www.desmi.com/UserFiles/file/oil%20spill%20response/e-leaflet/03-02_A-BOOM.pdf

• Remote sensing

Non-contact near-field oil sensors

In 2012, the German firm Optimare, well established in the marine pollution detection market with its remote sensors designed for aircraft, launched SpillWatch, a stationary, non-contact system for the detection of oil in water.

It is in principle intended to monitor potential pollution from industrial facilities (chemical plants, petrochemical plants, pipelines, etc.). With this in mind, and like certain analogue systems marketed by other firms – in particular SlickSleuth by US firm InterOcean Systems, Inc. – this system is fitted to a stationary structure (dock, pillar, etc.) overlooking the area to be investigated, which is analysed using technology based on oil fluorescence detection (with excitation by an UV light-emitting diode).

With a vertical range of 2 to 5 m, the advantages put forward by the SpillWatch constructor are the low maintenance required by the system (no operations over a 2-year period) and a design which filters out ambient fluctuations (e.g. variability in sunlight), thus ensuring that the sensor is very reliable in a wide range of light conditions, climate conditions, etc.

As for the InterOcean Systems Inc. sensors, the SlickSleuth range has been extended in order to be applied in various fields, ranging from inland waters, ports, etc. (vertical range of up to 8 metres according to models) to offshore installations (SS360-Rig Guard model with a range of 20 m).

Finally, the Estonian firm Laser Diagnostic Instruments (LDI) also markets a sensor based on analogue technolgy, the Remote Oil Watcher. With a 10 m high range, it is designed for applications comparable to those of the Optimare and InterOcean solutions.

For further information:
http://www.optimare.de/cms/fileadmin/PDF/GB_MMS/optimare_product_mms_spillwatch_120215pt.pdf
http://www.slicksleuth.com/prod.html
http://www.ldirow.com/LDI_ROW_tech_data_sheet.pdf

• Conferences & events

2012 Freshwater Spills Symposium cancelled

The 8th edition of the Freshwater Spills Symposium (FSS), an event organised by the US Environmental Protection Agency, due to be held in 2012, has been cancelled. Held every second year from 2002 to 2006 then every third year until 2009, and apparently postponed indefinitely, this is one of the few cycles of conferences specifically devoted to accidental pollution in inland waters (feedback from past incidents, recent and future issues, etc.). Although mainly supported by North American partners (US Coast Guard, National Oceanic & Atmospheric Administration, Great Lakes Commission, etc.), the event included some international input with, for instance in 2009, the presence of South American, European, African and Asian speakers (*Cedre* presented a conference in 2009).

The FSS offered a significant opportunity for exchanges on response in continental waters, on regulatory, operational, strategic and technical aspects, but also for examining lessons learnt from past incidents through case studies. We are unable to relate the content of the 2012 edition, however we note that the archives of the previous editions are still currently available at the following address: http://www.epa.gov/OEM/content/fss/index.htm.

• Impacts/environmental restoration

Restoration of biodiversity and biological functions on the Crau plain

On 7th August 2009, the rupture of a 1 m diameter pipeline, operated by SPSE (*Société du Pipeline Sud-Européen*), led to a spill of around 4700 m^3 of Russian Export Blend in the Coussouls de Crau nature reserve (Bouches-du-Rhône). Five hectares of a geological formation which constitutes a priority sensitive habitat, protected at European level (*Natura 2000* reserve), were contaminated (*Cf*. LTEI n°13).

In 2012, clean-up operations were still in progress[6], as was soil restoration work. In terms of restoration, the monitoring committee called upon by the Bouches-du-Rhône local authorities opted, in late 2010, to implement a programme based on ecological engineering techniques: various research teams (CNRS[7], IRD[8] and the universities of Avignon and Aix-Marseille) were thus called upon to put forward measures designed to promote the structural and functional rehabilitation of this type of environment (Mediterranean pseudo-steppe).

With this as a backdrop, experiments are being carried out in the reserve with a view to assessing the results of various soil transit methods in areas laid bare due to the excavation of surface soil (too polluted to be returned on-site after treatment). Various original procedures are thus being tested (supply of various thicknesses; compacting or not, etc.), with supplies of indigenous soil (from a neighbouring area, also with a high heritage value, exempt from pollution in 2009 but affected by a quarry extension project).

In order to accelerate the restructuring of biological communities, in addition to soil transit, tests were carried out on the reintroduction of so-called "soil engineers", in this case functional entomofauna species (in particular ants, notably the seed-eating species *Messor barbarus* whose activity is expected to promote the reinstallation of plant species in restored soil). According to CNRS, these developments constitute a world first.

Furthermore, in terms of groundwater contamination, laboratory incubation experiments on sediment collected in situ in the groundwater, or on recovered oil, are being carried out in order to better understand (i) the natural degradation potential by resident bacterial communities and (ii) environmental factors restricting the action of these communities.

This project, which is without doubt set to expand knowledge in terms of mitigating the impact of soil contamination by oil, involves many parties, including SPSE, the Provence-Alpes-Côte d'Azur *Conservatoire d'Espaces naturels* (natural areas conservatory), the Coussouls de Crau national nature reserve, the Bouches-du-Rhône Chamber of Agriculture, the Bouches-du-Rhône General Council, the PACA Region and INRA-Avignon.

In terms of legal proceedings, in October 2012 the SPSE case came before Tarascon high court: 7 of the charges were dismissed (endangerment, harm to a non-domestic animal in a nature reserve, destruction of a specific environment, illegal release, deterioration of the specific environment of a protected species, harm to plants and destruction of species), but SPSE still had to answer to the charges of unintentional pollution.

In March 2013, the Aix-en-Provence court of appeal annulled the dismissal decisions made in October 2012 – with the exception of that of endangerment, which was confirmed – and sent SPSE before the criminal court charged with the release by a legal person of a harmful substance into surface waters. The case was still open in late 2013.

For more information on restoration using ecological engineering methods:
CNRS journal **n° 245;** http://www2.cnrs.fr/sites/communique/fichier/dpingenierieecologique_1.pdf

[6] In 2012, SPSE pumped around 200 litres of pollutant a week from the surface of the groundwater.
[7] French National Center for Scientific Research
[8] French Institute of Research for Development