Oil Spill Technical Report

Typhoon Haiyan/Yolanda

Estancia, Iloilo Province, Philippines

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Table of Contents

The Joint UNEP/OCHA Environment Unit (JEU) assists Member States in preparing for and responding to environmental emergencies by coordinating international efforts and mobilizing partners to aid affected countries requesting assistance. By pairing the environmental expertise of the United Nations Environment Programme (UNEP) and the humanitarian response network coordinated by the United Nations Office for the Coordination of Humanitarian Affairs (OCHA), the JEU ensures an integrated approach in responding to environmental emergencies. The Environmental Emergencies Centre (EEC) (www.eecentre.org) is an online tool designed to build the capacity of national responders to environmental emergencies developed by the JEU.

The Union Civil Protection Mechanism facilitates co-operation in disaster response, preparedness, and prevention among 32 European states (EU-28 and the Former Yugoslav Republic of Macedonia, Iceland, Liechtenstein and Norway). With the support of the European Commission, Participating States pool resources and experts that can be made available to disaster-stricken countries all over the world as well as for prevention and preparedness operations. When activated, the Mechanism coordinates the provision of assistance from its Participating states. The European Commission manages the Mechanism through the Emergency Response Coordination Centre (ERCC). Operating 24/7, the ERCC monitors risks and emergencies around the world and serves as an information and coordination hub during emergencies. Among other tasks, the ERCC also ensures that Participating States are fully aware of the situation on-site and can make informed decisions for providing financial and in-kind assistance. Since its creation in 2001, the Union Civil Protection Mechanism has been activated more than 180 times for disasters in Member States and worldwide, including recent activations in response to Typhoon Haiyan in the Philippines, forest fires in southern Europe and Syrian refugee crisis in neighbouring countries. For more information, please refer to the ECHO website and/or ERCC Portal. The Union Civil Protection mechanism closely cooperates with the United Nations and it participated in several joint missions.

Executive summary

On 8 November 2013, typhoon Haiyan (known locally as Yolanda) hit Guiuan in the Eastern Samar province of the Philippines, with winds gusts of up to 275 km/h leaving a wide path of damage, destruction and casualties. At the height of typhoon, Power Barge No. 103 operated by the Philippine's National Power Corporation (NAPOCOR), which was moored to the South of the town of Estancia, broke loose and ran ashore.

An oil known as *Bunker C Heavy fuel* spilled into the sea and washed ashore at Barangay Botongon, Estancia contaminating approximately a one kilometre stretch of Estancia's coastline. As the barge continued to leak, the size of the spill grew, with final estimations of between 500 to 900,000 litres spilt, affecting approximately 10km of coastline. Authorities evacuated 492 residential families in the immediate vicinity, due to health and safety concerns related to light volatile compounds evaporating from the oil. Following air monitoring and assessments, authorities allowed relocated families to return to their homes as of 19 December.

NAPOCOR initially contracted a salvage operator (Kuan Yu Global Technologies Inc. Technologies Inc.) for the unloading of the barge and the clean-up. Slow progress on containing the leaking oil and fears of weather changes leading to potential impacts on human health and the environment led the Environmental Management Bureau (EMB) to request international assistance on 22 November 2013 to expedite the clean- up. Following the request, a senior marine oil pollution expert, Ms. Florence Poncet from the Centre of Documentation, Research and Experimentation on Accidental Water Pollution (CEDRE) was deployed through the Joint UNEP/OCHA Environment Unit (JEU) and EU Civil Protection Mechanism from 27 November to 23 December 2013. The objective of her mission was to support EMB of Region 6 in the management of the oil spill clean-up, with the aim to reduce the impact on the affected population and the environment.

EMB together with a joint UNEP/OCHA/WHO team undertook an initial assessment of the spill noting recommendations to protect residents and workers from oil hazards. From 7 to 15 December, oil that remained in the damaged tanks of the power barge was pumped to a small tanker vessel (MT OBAMA). As of 16 December, EMB reported that a total of 809,000 litres of oil were recovered from the barge.

There is an immediate need to identify a location and prepare a temporary storage facility for oiled debris and waste. For that, segregation of oil-contaminated and uncontaminated debris should be considered to ensure proper waste management and disposal while complying with national environmental regulations. Ongoing clean-up of the oiled shoreline and oiled debris need to be intensified for reasons of public health concerns and to regain access to the sea and fishing grounds for the affected population to recover their livelihoods. Logistical support needs to be identified to evacuate oily debris and waste to accredited facilities for safe removal and disposal.

This technical report presents the key findings of the mission, a shoreline assessment as well as recommendations for clean-up techniques, the management of the clean-up operations, organization of the worksite, the possible treatment and disposal options and implementation of mitigation measures for affected areas including the grounded power barge, the damaged boat and coastal areas. The report covers the time period of the deployment of the oil spill expert and includes information and data until 23 December 2013.

List of acronyms and glossary of terms

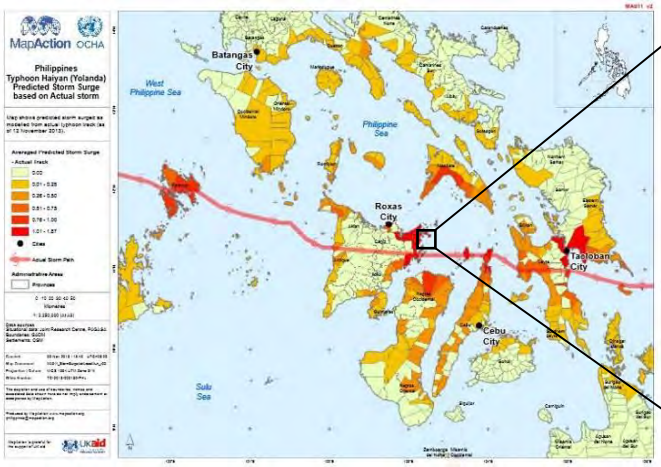
BFAR	Bureau of Fisheries and Aquatic Resources of the Philippines
CEDRE	Centre of Documentation, Research and Experimentation on Accidental Water Pollution
DENR	Department of Environment and Natural Resources
DoH	Department of Health
DSWD	Department of Social Welfare and Development
EC	European Commission
EIA	Environmental Impact Assessment
EMB	Environmental Management Bureau of DENR
EU CPM	European Union Civil Protection Mechanism
IARC	International Agency for Research on Cancer
ITOPF	International Tanker Owners Pollution Federation Limited
JEU	Joint UNEP/OCHA Environment Unit
KYGTI	Kuan Yu Global Technologies Inc. Technologies Inc.
NAPOCOR	National Power Corporation
NDRRMC	National Disaster Risk Reduction and Management Council
PCG	Philippine Coast Guard
PPE	Personal Protective Equipment
PSALM	Power Sector Assets and Liability Management
TPH	Total petroleum hydrocarbon (analysis)
UN OCHA	United Nations Office for the Coordination of Humanitarian Affairs
UNDAC	United Nations Disaster Assessment and Coordination

An environmental emergency is defined as a sudden onset disaster or accident resulting from natural, technological or human-induced factors, or a combination of these, that cause or threaten to cause severe environmental damage as well as harm to human health and/or livelihoods.

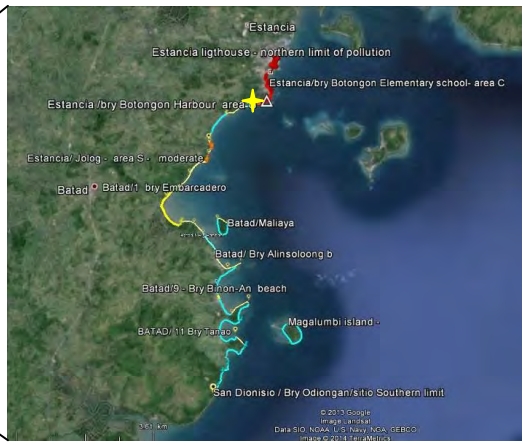
UNEP/GC.22/INF/5, 13 November 2002

1. Background and Context

Typhoon Haiyan (known locally as Yolanda) made first landfall in the early morning of 8 November 2013 in Guiuan, Eastern Samar province, with maximum sustained winds of 235 km/h and gusts of 275 km/h. Haiyan made subsequent landfalls in Tolosa (south of Tacloban City), Leyte province; Daanbantayan and Bantayan Island, Cebu province; Conception, Iloilo province (Panay island); and Busuanga, Palawan province. Experts estimate the storm was among the strongest ever to make landfall. It left a wide path of destruction and debris in its wake, with estimates of casualties and damage fluctuating considerably in the immediate aftermath.



Map shows the path of typhoon Haiyan across the Philippines (red line) and Estancia, Iloilo Province



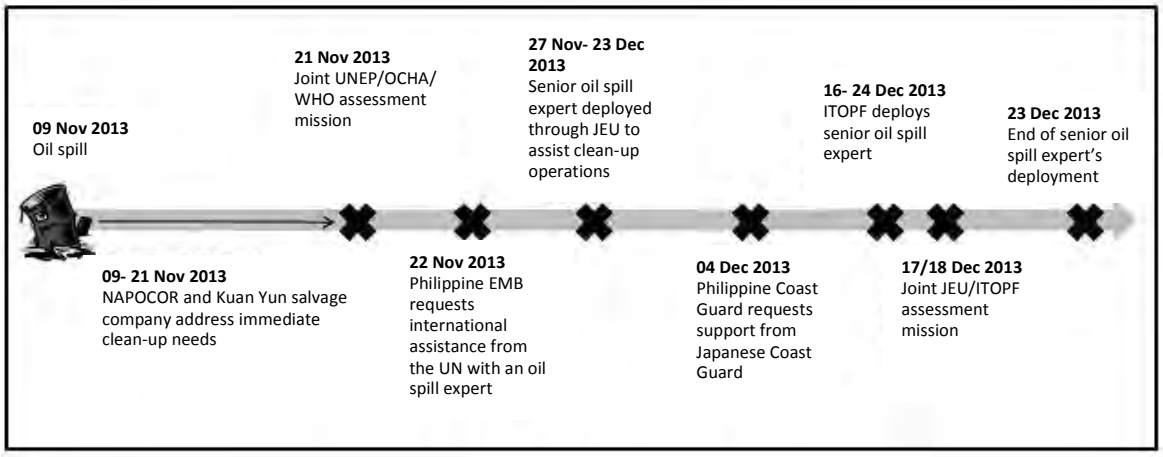
Map shows the location of the oil spill in Estancia

On 9 November, the Government accepted the United Nations' offer for international assistance. A global appeal for $301 million was launched on 12 November, with food and shelter requirements the top priorities. Access to people in need was initially severely limited due to damaged roads, fallen trees and debris. All main roads were passable as of 15 November, but debris continued to hamper access to remote areas. As of 30 December, the Department of Social Welfare and Development (DSWD) and the National Disaster Risk Reduction and Management Council (NDRRMC) reported 14.1 million affected people, 4.1 million people displaced, 1.1 million houses damaged, 6,155 reported deaths and 1,785 people still missing as result of the typhoon.

At the height of typhoon Haiyan, Power Barge No. 103, a 65 meter floating power plant operated by the Philippine's National Power Corporation (NAPOCOR) on behalf of the Power Sector Assets and Liability Management (PSALM) Corporation broke loose and ran ashore. The power barge was moored south of the town of Estancia, Iloilo Province, Western Visayas, Philippines.

1.1 Oil Spill from power barge in Estancia

According to initial reports from the Philippines Coast Guard and the media, approximately 200,000 litres of bunker oil spilled into the sea and washed mostly ashore at Barangay Botongon, Estancia. The spill contaminated approximately a one kilometre stretch of Estancia's coastline in the large tidal bay of the Visayan Sea.



Graph indicates a rough timeline of events on the Estancia oil spill and international assistance provided (source: JEU)

The NAPOCOR management of the barge had estimated the size of the spill to approximately 800,000 litres of Bunker C heavy fuel oil - around 21 November based on the assumption that the barge contained around 1,400,000 litres of oil when it ran aground. At the time of the initial assessment, between 21 and 23 November, most of the spilled oil had washed ashore, contaminating the coast and mangroves up to 10 kilometres downstream. Despite the efforts of the manager of the barge to pump seawater in the suspected damaged tanks, the power barge continued to leak. The initial in-house containment booms deployed were not sufficient to effectively contain all of the floating oil, with some oil blown ashore by South Eastern winds. It was feared that a change of wind direction or a tropical depression could further complicate the containment of the floating oil. On the shoreline, a huge amount of debris due to the typhoon destructions, were oiled and had complicated the response.

1.2 Initial joint assessment of UNEP/OCHA/WHO

To provide initial and immediate support, Mr. Dennis Bruhn- initially deployed as environmental expert with the UN Disaster Assessment Coordination (UNDAC) team- was sent to the oil spill site to undertake an UNEP/OCHA/WHO assessment in cooperation with the Environmental Management Bureau (EMB) of Iloilo province on 21 November 2013. This initial assessment had noted specific recommendations in order to protect local residents and workers with Personal Protective Equipment (PPE) involved in the clean-up operations from health and safety hazards. Further, the possible need for additional support (including expert advice) was discussed. On 23 November, Dr Nick Gent, Consultant in Health Protection, World Health Organization, visited the site of the oil spill and observed the vessel and the shore line.

Further, mitigation and clean-up measures were suggested as well as a detailed shoreline assessment in order to gauge the health and environmental impact of the oil spill. It was further recommended to request international assistance for a specialized expert to support the management of the oil spill clean-up operations. More detailed information on the joint assessment report from 30 November 2013 and its recommendations and key findings can be found on the Humanitarian Response website for the Philippines[1].

[1] https://philippines.humanitarianresponse.info/sites/philippines.humanitarianresponse.info/files/assessments/ATTFY4U8.pdf

1.3 Continued recovery work

In the meantime, a specialist recovery, cleaning and salvage operator (Kuan Yu Global Technologies Inc. Technologies Inc.) had been contracted by NAPOCOR for the unloading of the barge and the clean-up. On 22 November, EMB concluded that due to the collection of the spilled bunker oil done manually, a large volume still remained uncollected in the vicinity of the oil spill site. EMB further noted that more bunker oil continued to spill out from the damaged tanks of the affected power barge that could potentially pose a threat to human health and the surrounding environment if not immediately cleaned up. It was concluded that a faster on-water mechanical clean-up process preferably with oil skimmers was urgently required, along with guidance for the management of oiled debris.

The same day, the Director of EMB Philippines requested international assistance from OCHA to deploy an oil spill expert to assist in the oil spill clean-up operations. Through its emergency deployment procedures, the Joint UNEP/OCHA Environment Unit (JEU), called for offers of available expertise from partners. The offer from the EU Civil Protection Mechanism to deploy a senior marine oil pollution expert from the French Centre of Documentation, Research and Experimentation on Accidental Water Pollution (CEDRE) was accepted and Mrs. Florence Poncet deployed to the Philippines from 27 November to 23 December 2013.

Debris from destroyed houses, Batad Barangay Alinsolong, Iloilo Province, December 2013

On 4 December, a bilateral request from the Philippines Coast Guard to the Japan Coast Guard resulted in the deployment of a team of experts during three days. The team was able obtain an overview of the extent and scale of oiling of the coastline and assisted the Philippines Coast Guards with boom and waste storage management in Botongon harbour, close to the grounded barge in Estancia. Further, a private sector oil spill expert, Mr. Charles Frew, from Asiatic Marine Limited, undertook an assessment visit on 14 December of the oil spill site. Both expert missions provided conclusions and recommendations *pro bono* that are an integral part of this report.

From 16-24 December, an oil spill expert from the International Tanker Owners Pollution Federation Limited (ITOPF), Mr. Henk Renken, was also on mission to Iloilo province on behalf of the insurer of the barge, to provide an assessment of the status of oil contamination and on-going clean-up efforts.

Shoreline Assessment with Philipines Coast Guard and a representative of Kuan Yu in municipality of San Dionisio, 17 December 2013

Air monitoring conducted by the EMB team in Estancia, 6 December 2013

On 17 and 18 December, JEU and ITOPF experts, together with the Philippine Coast Guard, a representative from Kuan Yu Global Technologies Inc. and P&Y club, undertook joint surveys by boat down to the southern limit of the contaminated area (including small islands) to examine the scope of the spill and the shoreline contamination. ITOPF and JEU experts shared findings on the size of the spill and degree of coastline oiling, on the advanced stage of weathering of oil in the lightly oiled areas and on the priorities for clean-up, with priority on the highly polluted area close to the barge in Estancia.

1.4 Mission objective

The mission objective was to support the Environment Management Bureau of Region 6 in the management of the oil spill clean-up, with the aim to reduce the impact on the affected population and the environment.

The findings, conclusions and recommendations presented in this report are based on assessment visits, monitoring results by the expert and the Environmental Management Bureau of Region 6, as well as interviews with the Philippines Coast Guards, and a meeting of the Regional Committee for the oil spill, Task Force PB 103, in Iloilo city, on 2 December 2013.

2. Key Findings

The key findings in this report shall be considered complimentary to the initial key findings of the joint UNEP/OCHA/WHO assessment of early November.

2.1 Scope of the spill

The management of the barge had estimated the size of the spill at around 800,000 litres of bunker oil (type C) on 21 November that had spilled into the sea. This is based on the assumption that the barge contained nearly 1,400,000 litres of oil at the time of the accident. This information is supported by the key findings of the initial joint UNEP/OCHA/WHO assessment report. The oil continued to spill further into the month of December.

At the Regional Oil Spill Committee (Task Force PB 103) Meeting on 16 December, it was reported that a total of 809,000 litres of oil had been recovered from the barge and the sea (471,000 litres pumped from the barge, 338,000 litres recovered from the sea). In addition, with this type of oil, approximately 10% of the spilt oil can be expected to have evaporated.

It is always difficult to estimate the amount of oil spilled, and in later December different estimates emerged due to varying assumptions of the amount of oil contained in the barge before Typhoon Haiyan/Yolanda hit, and the fact that the remaining bunker oil in the barge was mixed with seawater in the punctured tanks after the accident. The size of the spill is therefore assumed to up to 900,000 litres of Bunker C Heavy oil. Between 14 November and 20 December 2013, EMB conducted four water surface analyses between 100m and 500m distance from the oil spill to evaluate the oil and grease contamination of the water (see Annex II).

2.2 Status of Recovery and Clean-up

After the spill, booms were deployed around the barge by the barge manager, and later additional booms were placed all around the harbour by Philippines Coast Guards in order to contain most of the floating oil leaking from the barge and to allow recovery. The recovery of the floating oil from the sea surface had been first undertaken only manually through scooping and later using mechanical skimmers and suction pumps. Local rice straw (*dayami*) was also used as an alternative sorbent to assist manual recovery.

Mechanical oil skimmers operating on oiled shoreline waters, 30 November 2013

Using rice straw (dayami) as sorbent (right side) for manual recovery, 15 December 2013

The pumping of the oil that remained in the damaged tanks of the power barge to a small tanker vessel (MT OBAMA) was started on 7 December and was completed on 15 December. On 16 December, successful recovery of oil that had been contained by booms on the sea surface was also achieved. While the collection of some of the oily debris in different municipalities had commenced by the end of the oil spill expert mission, the shoreline clean-up had barely began as the downloading of the barge and the recovery of floating oil were the first high priorities.

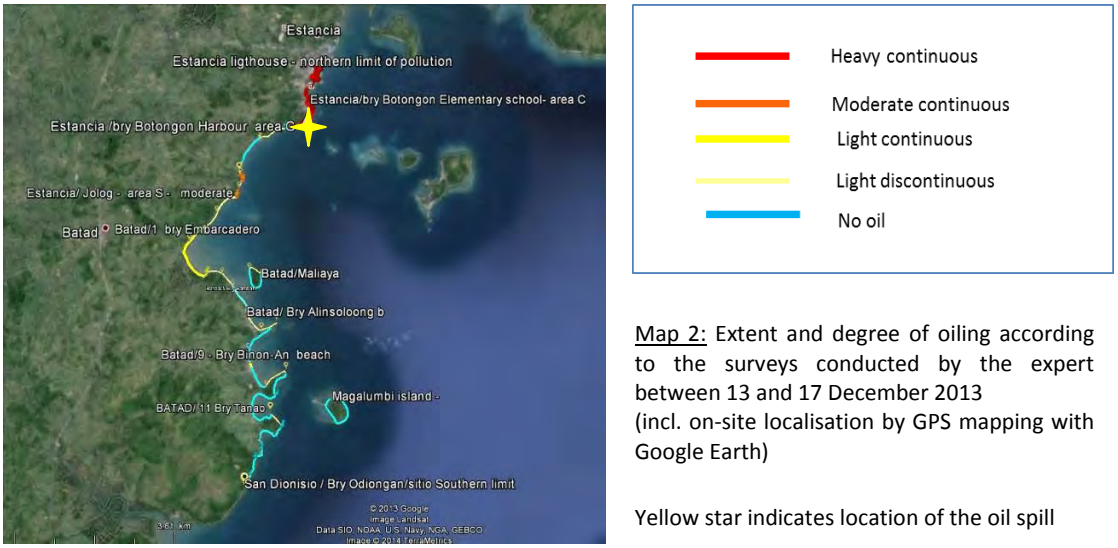
2.3 Situation at sea

During three boat surveys on 13, 17 and 18 December, no oil slick was observed at sea. Only a sheen and some patches of rainbow-coloured water caused by only a few oil droplets were observed on the sea surface approximately 500 metres south of the power barge on 13 December. A light sheen was still visible in the same area on 17 and 18 December. Several observers had reported the presence of this sheen visible from flight surveys in December. This very small amount of oil is the result of small leaks from the barge area and the natural clean-up of the oiled shoreline by the sea action (see section 2.4).

2.4 Shoreline assessment

The oil spill expert undertook a complete shoreline assessment between 13 and 19 December 2013 in order to identify the extent of oiling and priorities for clean-up actions. Three different degrees of oil contamination were identified:

- a heavily oiled area of approximately 2 km of shoreline in the town of Estancia itself and in barangay Botongon;
- several medium polluted areas in inhabited areas (in barangays Da'an Banua and Jolog shoreline);
- lightly polluted areas made of continuous or discontinuous scattered oil patches already in an advanced stage of weathering on rocks and cobbled beaches or as an oil film on roots and trunks of mangrove trees.



Map 2: Extent and degree of oiling according to the surveys conducted by the expert between 13 and 17 December 2013
(incl. on-site localisation by GPS mapping with Google Earth)

Yellow star indicates location of the oil spill

The most heavily oiled area of 1.5 to 2 km of shoreline was located in the town and Barangay Botongon of Estancia municipality, mostly to the north of the damaged barge and a few hundred meters south down to Da'an Banua. The rest of the affected area lay south of the damaged barge.

Two stretches of approximately a hundred meters of shoreline were moderately affected in Barangay Jolog (Estancia municipality). A lot of light contamination was scattered along the shoreline down to Barangay Odiongan (San Dionisio municipality). Within the total affected area (of approximately 10 km) some shoreline segments were not affected at all.
Above map illustrates the observed level of contamination of the shoreline prepared on Google Earth, based on GPS (Global Positioning System) data collected during the survey and indicating heavily oiled areas, moderately oiled areas, lightly oiled areas (continuously or not), and unaffected areas.

A natural clean-up process was observed as on-going. This process is rather efficient due to the prevailing environmental conditions:

- wind direction: the coastline is mostly exposed to main wind direction winds from the southeast towards the coast and as a result hydrodynamic processes can be efficient;
- tidal range action: the southern part of the contaminated shoreline is regularly washed by tidal waves unlike the upper northern part of the shoreline, which was reached only by the higher waves caused by the typhoon (stagnation of oil in northern parts)
- photo-oxidation process: under the local climate conditions, the oil is being dried and weathered efficiently (breaking down of hydrocarbon molecules by the sun), and a high activity by micro-organisms can be expected.

Natural clean-up: scattered oil pollution on a rocky shoreline in Batad being weathered, 19 December 2013

Debris on Estancia Matta Beach, 10 December 2013

In most of the lightly polluted locations, the natural weathering of oil was well advanced.

Based on the detailed shorelines assessment from Estancia municipality to San Dionisio including the islets and islands of Magalumbi, Taboon, and Maliaya, clear priorities for clean-up have been identified and are reflected in the recommendations in section 4 of this report.

2.5 Waste management

As of 22 December, 594,000 litres of recovered oil had been shipped for thermal treatment in an accredited hazardous materials treatment facility in Meycauyan City, Bulacan (Far East fuel Corporation). The rest of the hazardous waste was stored in the harbour of Barangay Botongon, Estancia. Recovered oil was stored in drums, oiled rice straw soaked with oil was stored in bags, and large oiled debris were stored at open air and in a barge (LCM Divine Glory II) waiting for a destination for treatment.

A large quantity of oiled debris remained on the shoreline, mainly concentrated in the Barangay Botongon area of Estancia. Methods and facilities for safe handling of this hazardous waste were being proposed by EMB and discussed with the contractor and within the Regional Committee dealing with the oil spill in December.

The main challenges around the management include the logistics of shipping the oil contaminated waste to locations with accredited industrial facilities and the associated increase in costs; identification of most cost-effective approach to the clean-up methods and the identification of different treatment methods according to the different levels of oil contamination of the debris.

A transport permit for 2,200 tons of waste (liquid oil and oiled debris) was granted for transport to the "Far East Fuel Corporation", a thermal treatment facility close to Manila in Barangay Iba Meycauayan in Bulacan Province (Central Luzon island). This hazardous waste treatment facility is referenced in the list of DENR/EMB Registered Hazardous Waste treatment facilities /recyclers. A first shipment of 594,000 litres took place on 15 December. As the total volume of waste to be treated was not yet fully known, alternative solutions were still considered, as outlined in section 3.3.

More information for possible treatment and recommendations for disposal options for oily waste are listed in section 3.3.

2.6 Humanitarian situation

On 23 November, the authorities decided to evacuate residents in the immediate vicinity of the oil spill due to concerns for their health and safety in relation to light volatile compounds evaporating from the spilled oil. The evacuation centre in Estancia with evacuees from the oil spill was then the largest in the Western Visayas region (492 families) - while the other 17 evacuation centres in the Western Visayas hosted a total of 640 families. Of the total five villages/barangays relocated, two of those villages were severely affected by the oil spill.

The oil spill has had significant humanitarian consequences for the local people living along the coastal areas. The local population was unable to start recovery of their livelihoods as fishermen, as living in a temporary evacuation centre located inland and the contamination of their fishing grounds do substantially complicate or even make continuation of fishing activities impossible. This further increases the vulnerability of the relocated population that already lost the majority of their houses due to the typhoon. Hence, the recovery of livelihoods for the evacuated fisher families remains the main humanitarian concern. Delays to the clean-up of the coastline and fishing grounds will incur delays for the recovery of those livelihoods and increase dependency on humanitarian relief.

Following EMB air monitoring results (of benzene and hydrogen sulphide), the Governor announced on 19 December that the evacuees were allowed to return to their houses. Air monitoring was conducted throughout the month of December 2013. A potential health risk to the population returning to their homes close to the contaminated areas is related to the inhalation of evaporating volatile hydrocarbons and direct contact with the spilled oil, especially by children.

Access to the beach within 20 metres from the heavily affected shoreline was to remain prohibited until the end of the clean- up operations as protection measure for the affected population.

2.7 Occupational safety

Since the joint OCHA/UNEP/WHO initial assessment report in which concerns over the protection of clean-up workers had been raised and manual recovery in the water had been stopped, workers were provided with personal protective equipment (PPE) by 30 November and occupational safety improved considerably. As such, in December, manual recovery was able to commence again.

Clean-up workers now equipped with personal protective equipment, 30 November 2013

However, it is recommended to continue thorough attention to and monitoring of occupational safety. The expert made additional recommendations including the regular changing of protective suits and the consistent wearing of gloves.

2.8 Environmental situation

No protected area was affected by the spill. The small areas of mangroves scattered along the shoreline were lightly affected, with an oil film covering the aerial roots and part of the trunks. Dead branches were observed, but no oil layer was seen on the ground neither infiltration in sediment. The main area of mangroves is located in Barangay Embarcadero and the whole area had been also lightly oiled. All the mangroves suffered typhoon damage, and as reported an expert for the authorities, Dr. Resureccion B. Sadaba, they were already defoliated due to the typhoon, before being oiled. Dr. Sadaba reported that recently planted mangrove trees died after the two events. On all observed sites, by mid-December new leaves were appearing. However, impact on mangroves may appear after weeks or months afterwards and monitoring is needed.

During the assessment surveys, no shellfish mortality was observed on the shoreline neither reported by services. No penetration of oil was observed in intertidal sediments. The oil was washed ashore mostly on bare sediment and rocks of the upper-shore with no fixed fauna. No oily seaweed nor sea grass beds were observed or reported. As long as the barge was not empty and still leaking with floating oil in the harbour, a strong odour of oil was perceptible close to the barge and along the heavily oiled shoreline of Estancia. Apart from the floating oil around the barge (the removal of which removal was mostly achieved on 15 December), and a light sheen in the same area, the sea water was clear.

Weathered oil on Avicenia roots on Maliaya Island, 13 December 2013

Lightly oiled mangrove shrubs in Batad /Embacadero, 15 December 2013

2.9 Environmental Impact Assessment

The Environmental Management Bureau and Dr Sadaba, expert for authorities, are planning a three-month environmental impact assessment (EIA). The EIA will include the following activities:

- Air: Monitoring in the area of the barge in Estancia for volatile fractions (benzene and hydrogen sulphide). The monitoring had started just after the spill, first on a daily bases and then each two or three days in December and was conducted by EMB;
- Water: Sea surface water sampling to measure oil, grease, and petroleum hydrocarbons is conducted in 10 locations from North to South. Samples are collected close to the shoreline and farther at sea (approximately 100 meters from the shore). The sampling is done every two to three weeks for oil and grease analysis. In December, the results show no compliance with local standards (3.0 mg/L) and will continue until this level is recovered. This analysis doesn't measure specifically the oil from the spill, as measurements of petrogenic PAH could do, but it will give a general information especially if a clear spike of contamination appear during the spill and the clean-up period.;
- Fish and shellfish: During the oil spill Committee meeting of 2th December It was indicated that the Bureau of Fisheries and Aquatic Resources (BFAR) will undertake shellfish sampling in the affected area for PAH analysis by the University of Iloilo.
- Mangroves: While some of the recently planted mangroves have died, others are developing new green leaves. It is therefore suggested not to use any cleaning products on the mangroves. Since the initial assessment in late November, natural clean-up by tidal movement of sea water has progressed. Green leaves were observed in all assessed areas. Dr Sadaba has reported that he observed In one location in Embarcadero, chlorosis of mangrove leaves on some trees. A continuous monitoring of the recovery status of the mangroves should be undertaken at least in the next three months.
- Sea grass: As long as sea grass did not come into contact with the oil, no effects are expected on these plants

2.10 Fisheries and fishing community livelihoods

Many oiled and broken fishing boats were observed in the area of the oil spill, with lots of fishing equipment visible among the oiled debris. In Embarcadero, Batad, fixed fishing nets (*puenots*) were totally oiled. During the oil spill Committee meeting of 2 December it was mentioned that the Bureau of Fisheries and Aquatic Resources (BFAR) had started an inventory of affected fishermen, damaged fishing boats and equipment. The question of compensation was still to be resolved as of the date of the departure of the oil spill expert.

Damaged and oil-contaminated boats in Estancia, 8 December 2013

Oiled fixed nets (puenots) in Embarcadero, Batad, 18 December 2013

3. Conclusions and further clean-up recommendations

The following conclusions and specific recommendations are based on the elaboration of the shoreline assessment of section 2 of this report.

3.1 Priorities for the clean-up

During the expert mission, the oil on rocks in the immediate surroundings of the barge was the highest priority and clean-up had already started. This means that large oiled debris was collected, floating oil and accumulations between rocks were collected with rice straw, and in the last two weeks of December 2013, some low pressure high volume flushing was tested.

- First priority of the clean-up was the heavily oiled 1.5 to 2 km long stretch of shoreline in the area of Barangay Botongon and Da'an Banua. This area contained houses lining the beach, and oil in sand which was still mobile under tidal and wave action.
  Recommendations for further clean-up are the following:
  - The shoreline clean-up should be undertaken from the upstream limit of the spill (Estancia Lighthouse) going southward. In the first stretch, a beach of around 200 metres is of high priority due to the presence of houses. In this area, a lot of oiled debris remains and the sand is contaminated up to a depth of 10 to 20 centimetres;
  - The rest of Barangay Botongon shoreline consist in concrete structures, pebbles and boulder beaches and should be systematically cleaned by high pressure washing (HPW). The houses and the school in this area are heavily damaged and were not in use at the end of December.
- As second priority, two moderately affected areas in Barangay Jolog (Estancia) should be cleaned up. Rocks and walls are oiled and some oil is buried in the sandy beach. Communities are living in the immediate vicinity of one of the beaches.
- A third priority for clean-up are the lightly affected areas close to inhabited beaches (Bry Salong, Ban-ban, Alinsuelong, Binon-an (in Batad municipality) for some of them only removal of oiled debris is required.

For the rest of the coastline, it is suggested to leave the light oil contamination to be cleaned up naturally. These areas do not seem to be in direct use and are difficult to access. The small amount of oil present in these areas as oil film on rocks or oily surface sediment is weathering rapidly and is already most dry in many locations.

Black colour of sediment due to natural lack of oxygen in muddy sediment (anaerobiose) Embarcadereo/Salong 17 December

The small mangrove areas along the shoreline and the main one in Barangay Embarcadero were lightly affected. An oil film is covering the aerial roots and part of the trunks and dead branches. Sometime the sand and pebbles among trees is lightly oiled but neither oil layer was observed on the ground, nor sediment infiltration. In some places the black colour of sediment is natural, due to lack of oxygen in

muddy sediment and should not be confused with oil.

As it is not possible to clean the roots and trunks (mechanically or by cleaning agent) without the cleaning action being more harmful to the trees, no clean-up action is recommended for the mangrove trees. The authorities' expert Dr Sadaba had regularly monitored the status of the mangroves, some of which are bearing new leaves.

Some public information directed at Barangay captains and local populations could be helpful to inform residents of the natural clean-up and weathering process of oil due to sun, rain, and seawater action for the lightly polluted areas.

3.2 Recommended techniques for shoreline clean-up

Technical data sheets on clean-up techniques and guidelines from CEDRE were provided to authorities (please see bibliography).

Rocks, blocks, boulders, concrete structures:

- Flushing (low pressure and high water volume): to remove accumulations on surface or trapped between rocks and boulders;
- High pressure washing (HPW): for heavily oiled pebbles and cobble stones can be washed under high pressure in cages or in portable tanks to avoid the pebbles to be projected. Due to the type of oil, hot water will probably be necessary.
- Less heavily oiled rocks and boulders can be wiped with rice straw or other sorbent in order to remove the stickiness of oil. The black colouring will progressively disappear with the weathering by the sun.

Example of high pressure washing with oily water recovery downstream in pits with sorbent, Loire estuary (France) 2008
Photo: CEDRE

- Cleaning agent: if the oil is difficult to remove from rocks, concrete, or boulders, the use of non-emulsifying products can facilitate desorption of the oil from rocks. This allows washing of the rocks and recovery of the oil further downstream after it is flushed off the rocks. Emulsifying products also facilitate the desorption of the pollutant from the rocks, but as they disperse the pollutant in the environment there is a risk of contamination of sea water and sediment depending on the length of shoreline to be treated and it's degree of oiling. The use of dispersants on the shoreline is therefore forbidden in many countries.

Sand:

- Removal of heavily oiled layer (will produce oily waste that will need to be treated);
- Surf washing which needs oil still fresh enough and some agitation (by waves or with shovel). It aims to separate the pollutant from the sediment with water, on site. The sediment is moved towards the low part of the beach (medium tide level) to subject it to the natural cleaning action of the sea. The pollutant can be recovered manually after being trapped by rice straw or another sorbent;
- Washing in portable tanks;

- Scarification can be done on coarse sand and gravel, which is lightly to moderately oiled, in order to prevent the hardening of the oiled layer (becoming asphalt pavement) and to enhance weathering by aeration.

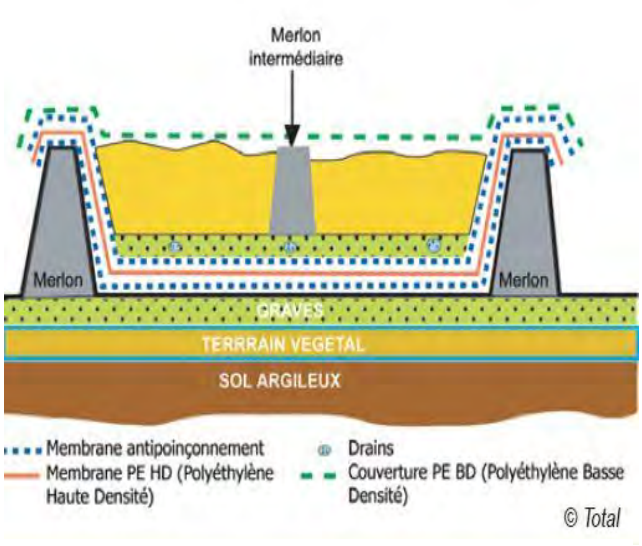
3.3 Waste management, treatment and disposal

There is no industrial waste treatment plant or cement factory able to treat oily waste in the Panay islands. As a consequence, for thermal treatment options the waste will need to be shipped to another island with accredited facilities. As the shipping of waste will add cost and constraints, other solutions may be studied in order to select the more cost effective one, depending on the degree of contamination and type of waste.

The sorting and reduction of waste volume is of high importance in this context: a maximum of clean-up and separation of oil should be done on the shoreline before treating the waste. The expert advised to sort the debris according to the type and the severity of oil contamination - and therefore suitability - for different treatment methods such as burning in an industrial waste thermal plant or in a cement kiln, disposal in specially prepared landfill etc.

If necessary, a specially prepared landfill could be an alternative for parts of the waste, such as lightly contaminated debris, sand or rice straw.

Waste storage facilities should be systematically equipped with a system to ensure that they are watertight in order to reduce the impact on the environment and in particular to prevent infiltration and contamination by run-off. Water tightness can be ensured using different types of materials like plastic liners (high-density polyethylene is resistant to hydrocarbons). The ground should also be prepared accordingly by placing a layer of sand as lowest layer in order to reduce the risk of the liner being pierced.



Graph: cross-section of final oiled waste storage facilities for the Erika pollution. (Donges, Loire-Atlantique, France)
Source: CEDRE

The graph on the left illustrates the applied waste storage facility of the Erika pollution incident as an example that could be applied to the Estancia oil spill.

Possible treatments and disposal options recommended for oil- contaminated waste

Situation in December 2013

Waste type	Possible treatments and disposal options
594,000 litres of liquid oil (more or less emulsified and containing some salt) recovered from the barge and sea surface ***High oil contents, high, risk of contamination by leaching***	Already shipped for reprocessing/Thermal treatment (far East Fuel Corporation)
65,400 litres of liquid oil recovered from sea surface stored in drums/lorries in the harbour ***High oil contents, high risk of contamination by leaching***	To be shipped by barge for thermal treatment in accredited facility for industrial waste,
94,000 litres (estimate of 16 December) of rice straw soaked with oil (removal of floating oil in harbour) stored in rice bag doubled with plastic sheet. ***High oil content, seeping, risk of contamination***	To be shipped by barge for thermal treatment in accredited facility for industrial waste or: - thermal treatment in cement kiln - incineration in mobile incinerator - stabilization with quick lime and landfill
Rice straw with small oil content to be collected all along the shoreline during the clean-up process ***Low content of oil, leaching risk limited***	To be shipped by barge for thermal treatment in accredited facility for industrial waste or: - thermal treatment in Cement kiln - incineration in mobile incinerator - specially prepared landfill in Estancia
Contaminated sand? (will depend on volume directly linked to the clean-up techniques to be used on shoreline) Stored in rice bag doubled with plastic film ***Seeping risk is limited if not exposed to rain***	To be shipped by barge for thermal treatment in accredited facility for industrial waste or: - thermal treatment in Cement kiln - incineration in mobile incinerator - specially prepared landfill in Estancia
Polypropylene sorbent booms and sorbent, used protective equipment ***Limited seeping risk if not exposed to rain***	To be shipped by barge for thermal treatment in accredited facility for industrial waste or: - thermal treatment in Cement kiln - incineration in mobile incinerator - specially prepared landfill in Estancia
Debris soaked with oil: plastic, wood, fabrics, clothes ***Risk of seeping***	First step: drip and let dry at open air Next step: evacuate in a specially prepared landfill or mobile incinerator, if available
Large debris (wood, metal, plastic) ***No seeping expected when dry***	First step: let debris dry in open air Next step: evacuate in a specially prepared landfill or mobile incinerator, if available Consider re-use of wood and metal
Large debris lightly polluted (stains)	Segregate and remove from the oiled debris to be disposed with common waste or reuse Consider re-use of wood and metal

3.4 Public Health

On 19 December, based on the latest air monitoring results, the evacuees were allowed to return to their houses. Access to the beach within 20m from the heavily affected shoreline was to remain prohibited. This measure was put in until the end of the clean-up operations to avoid direct contact and inhalation of the affected population with the oil and to place to protect their health.

Potential adverse health effects from exposure to the spill of bunker oil depend on the route, quantity and duration of exposure. Exposure can occur from skin contact, ingestion, or inhalation. Bunker oil is not highly volatile, however there may be some vapours at high temperatures and mist may be generated by high pressure hose cleaning, which pose human health risks through inhalation and eye exposure. Prolonged or repeated skin exposure can result in drying, reddening and irritation of the skin. Ingestion of oil may occur from contaminated food or water, however, most people can smell or taste oil contamination at low levels Ingestion of contaminated food or water may cause gastro-intestinal irritation. Bunker C is classified by IARC as possibly carcinogenic to humans (Group 2B). Some of the constituents of Bunker C heavy fuel are known to be carcinogenic following chronic occupational exposures. However, short-term exposure is unlikely to increase the lifetime risk of developing a cancer. Exposure to the fumes or vapour has been reported to cause headache, itchy eyes, nausea, vomiting, dizziness, throat irritation and respiratory symptoms. There may be an exacerbation of pre-existing respiratory conditions such as asthma. In most cases the adverse effects will disappear over a few days once the person is removed from exposure. Workers involved in clean-up activities may develop prolonged respiratory symptoms that last 1 to 2 years after exposure. People involved in clean-up operations are likely to have prolonged and close contact with the bunker oil if they do not use adequate personal protective equipment

3.5 Occupational Safety

The protection of the workers was identified as a main occupation safety priority already in the first assessment. Further regular attention is required until the end of shoreline clean-up process involving manual labour. In addition to protection suits, boots and oil resistant gloves, workers involved in high pressure washing operations, workers must be protected by mask and goggles to avoid oil projections.

3.6 Livelihoods Recovery

The effects of the oil spill on livelihoods and fisheries were still to be assessed by EMB at the departure of the oil spill expert. The question of compensation for affected populations, especially those living of fisheries, has yet to be resolved. The BFAR is responsible for the inventory of work equipment of affected fishermen, damaged fishing boats and equipment. It is highly recommended to start livelihood recovery programs in close consultation with the affected population to identify their needs.

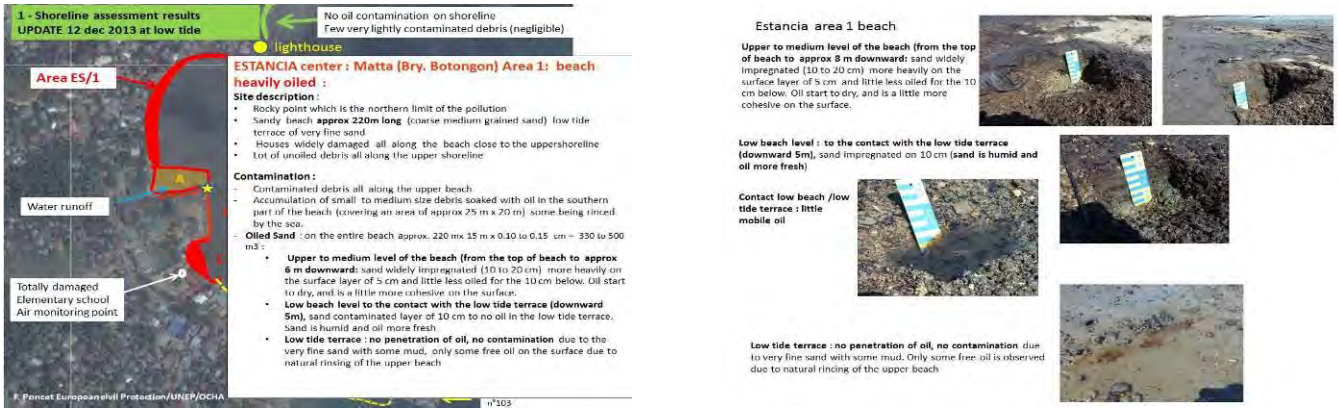
4. Recommendations for Estancia oil spill clean-up

General recommendations

- Continue the environmental impact assessment as outlined in section 3.4
- Resolve the challenges around livelihood recovery and compensation in consultation with affected populations and the BFAR regarding damaged fishing boats and equipment (see also section 2.9 and 3.7)
- Provide information to and raise awareness among returning population about the health risks of potential evaporation and direct contact with oil
- Conduct regular aerial surveys to monitor the changes of the oil contamination on sea
- Segregate the oil- contaminated materials and ensure proper disposal, subject to national environmental regulations
- Dry out any hay used as an absorbent to lessen its weight/volume before disposal

Recommendations by assessed areas

4.1 Area 1- Shoreline area in direct vicinity of the oil spill



Area 1- detailed map, site description, level of contamination and assessment results

A) <u>Management and organization of the worksite</u>

- Identify access for mechanical support to evacuate oily waste
- Define location and prepare temporary waste storage
  - Remove unoiled debris to create a flat area for the temporary storage site
  - Protect the ground with plastic film for drums, rice bags and oily debris

B) <u>Mitigation measures and clean- up operations</u>

- Rocky point
  - Flush out the oil to remove potential accumulations of oil among rocks
  - HPW to remove the sticky oil

- Oiled sand in the vicinity of the oil spill
    - Do not use flushing, as this could lead to the adverse effect of a deeper contamination of mixing sediments
    - Separate the oil from the sand could be tried by surfwashing (waves of agitation by shovel is needed), where the oil is still fresh, such as in the lower part of the beach
    - In areas where the oil is weathered and dry, surfwashing will not be sufficient. There are different options to clean weathered oil :
        - Remove the most contaminated surface layer (5cm) for disposal or treatment to lay open the less contaminated layer of sand for it to get weathered by the sun and repeat the process
        - To allow access to the sea for fishermen, first identify access routes and then clean access routes by removing of oily sediments
        - Wash the sediment (especially the more dry ones) directly on the beach in fast thanks used in the harbour for liquid oil storage
    - Do not use dispersant or any chemical as dispersant, if the oil is difficult to separate. This would increase the contamination of the water and marine life.

4.2 Area 2- Estancia/Matta- low tide terrace moderately oiled

Area 2- detailed map, site description and level of contamination

A) <u>Management and organization of the worksite</u>

- Identify access for mechanical support to evacuate oily waste
- Define location and prepare temporary waste storage
    - Remove unoiled debris to create a flat area for the temporary storage site
    - Protect the ground with plastic film for drums, rice bags and oily debris

B) <u>Mitigation measures and clean-up operations</u>

- Remove the oily debris and floating oil along the southward wall limiting the area of the landfill
- Do not use flushing, as this could lead to the adverse effect of a deeper contamination of mixing sediments
- Place sorbent booms at the outlet of the area where liquid oil is evacuated at low tide and the area be rinsed naturally

- Manually remove the thin polluted layer by either:
  - Moving it downstream in small quantities to be washed by the sea and be contained by the boom and collected with rice straw or sorbents at the level of the outlet
  - Removing the thin layer of oily sediment and evacuating it for final treatment or disposal
- Flush the concrete wall by the landfill of the public garden or use HPW, if necessary

C) Management of oiled and damaged boats

- Flush the debris in which mobile oil is trapped

4.3 Area 3- Estancia, Barangay Botongon- heavily oiled

Area 3- detailed map, site description and level of contamination

A) Management and organisation of the worksite

- Identify possible access routes
- Define the location and prepare the temporary waste storage facility
- Protect the ground with a plastic film for drums, rice bags and oily debris

B) Mitigation measures and clean-up operations

- Flush to remove potential accumulation of oil among rocks and cobbles
- HPW the area to remove sticky oil
- Engage in same treatment of oily sand as in section 4.2.1
- Let the landfill soil and grass that is lightly contaminated (distance from cliff 03-10cm) dry and cut the grass when oil film is dried ; if necessary, rake the oil surface to remove oiled soil
- If the wall will be rebuilt, there is no need for a deep cleaning
  - Flush the coral cobbles and the wall and them dry in the sun for the muddy sediments by the small cliff
  - Do not flush the muddy sediment and let the oil layer turn into an asphalt pavement (after some months) and let
- Flush the heavily oiled coral cobbles in the south (off the landfill) and let them dry
- Flush and let dry the continuous film of oil on the concrete wall (and repeat the process)

4.4 Area 4- Heavily oiled wall and damaged quay

Area 4- detailed map and level of contamination

Mitigation measures and clean-up operations

- Immediately clean the stairs of the elementary school by flushing (if necessary, HPW) to ensure continuation of school service to students
- Flush the blocks and concrete to remove any possible accumulation of oil
- If necessary, HPW and let the concrete dry in the sun (repeat the process until clean)

4.5 Area 5- NAPOCOR office and pier

Area 5- detailed map, photos and level of contamination

Note : This area does not require deep cleaning if the concrete wall will be rebuilt on top of the existing wall

Mitigation measures and clean-up operations

- Remove the accumulations of oil associated with the sorbent booms used for containment
- Use rice straw to accelerate the drying of residual oil and let them dry in the sun

4.6 Area 6- Grounded power barge

Area 6- detailed map, photos and level of contamination

Mitigation measures and clean-up operations

- Remove the oiled debris from the site
- Remove the unoiled debris from the site and store separately from the oiled debris
- Flush and rinse oiled cobbles and pebbles
- Use rice straw to accelerate the drying of residual oil and let them dry in the sun
- Use HPW (if necessary) to remove sticky oil from large oiled rocks, blocks and walls

5. Bibliography

- CEDRE (Centre of Documentation, Research and Experimentation on Accidental Water Pollution), Cross-section of final oiled waste storage facilities for the Erika pollution (graph), Donges, Loire-Atlantique, France
- ITOPF (International Tanker Owners Pollution Federation Ltd) (2011): Clean-up of Oil from Shorelines, Technical Information Paper N°7, London/UK: ITOPF (International Tanker Owners Pollution Federation Ltd)
- Joint UNEP/OCHA Environment Unit (JEU)/WHO, Oil Spill in Estancia, Joint Assessment Report,
  30 November 2013, Geneva/Switzerland
- Kerambrun, L. (2004): Guide de nettoyage du littoral suite à un déversement de pétrole, rapport R.04.36.C. Brest: CEDRE.

Documents provided to EMB include:

- Centre of Documentation, Research and Experimentation on Accidental Water Pollution (CEDRE), 2004, Oil spill waste management, Operational Guide.
- Oiled shoreline clean- up, POSOW manual, www.posow.org
- Technical datasheets provided to EMB and Philippine Coast Guards:
- http://www.cedre.fr/en/response/response-on-land/technical-datasheets.php

ANNEX I- Water surface monitoring by Environmental Management Bureau

Results for the oil and grease analysis on different days in various locations, as of 14 November 2013

Station	Coordinates	Results
Stn. 1 (Upstream of Power Barge 103) 100 m from PB 103	N 11 26 35.1 E 123 9 7.68	4.0 mg/L (above standards)
Stn. 2 (Estancia Fish Port) 500 m from PB 103	N 11 27 20.94 E 123 9 14.4	6.0 mg/L (above standards)
Stn. 3 (Brgy. Poblacion, Zone 2) 200 m from Stn. 2	N 11 27 20.94 E 123 9 14.4	6.0 mg/L (above standards)
Stn. 4 (Deepwell of Lian Bernadas Residence) 150 m from PB 103	N 11 27 5.8 E 123 9 14.58	2.0 mg/L (above standards)

20 November

Station	Coordinates	Results
Stn. 1 Brgy. Embarkadero, Batad	N 11 24 56.22 E 123 7 39.72	11.0 mg/L (above standards)
Stn. 2 Brgy. Binon-an, Batad	N 11 23 37.2 E 123 8 36.66	13.0 mg/L (above standards)
Stn. 3 Brgy. Tanao, Batad	N 11 23 5.1 E 123 8 38.88	6.0 mg/L (above standards)

23 November

Stations	Results
Station 1 PPA Port, Estancia	Viscous & conc. Sample
Station 2 Estancia Fishport	4.0 mg/L (above standards)
Station 3 Zone 2, Brgy. Poblacion, Estancia	13.0 mg/L (above standards)
Station 4 Purok 1, Brgy. Tanza, Estancia	16.0 mg/L (above standards)
Station 5 Brgy. Embarkadero, Estancia	11.0 mg/L (above standards)

20 December

6	Brgy. Embarkadero, Batad	12.0
7	Brgy. Banban, Batad	8.0
8	Brgy. Alinsolong, Batad	25.0
9	Brgy. Binon-an, Batad	9.0
10	Brgy. Tanao, Batad	8.0
11	Sitio Malawig Balas, Brgy. Odiongan, San Dionisio	8.0
12	Brgy. Odiongan Proper, San Dionisio	7.0

ANNEX II Request for expertise

Republic of the Philippines
Department of Environment and Natural Resources
ENVIRONMENTAL MANAGEMENT BUREAU
DENR Compound, Visayas Avenue, Diliman, Quezon City, 1116
Telephone Nos.: 3001135 927-15-17, 928-01-96
Email: emb@emb.gov.ph
Visit us at at http://www.emb.gov.ph

November 22, 2013

MS. VALERIE AMOS
Undersecretary General for Humanitarian
Affairs and Emergency Relief Coordinator

ATTN: Mr. Dennis Bruhn
Associate Market Director/Environment Expert
Email ad: dennis.bruhn@grontmij.dk

Dear Ms. Amos:

This pertains to the oil spill incident that happened on November 8, 2013 due to Typhoon Yolanda. The oil spill come from the National Power Corporation (NAPOCOR) Power Barge 103 stationed at Brgy. Botongon, Estancia, Iloilo which until now a large volume of bunker oil within the surrounding area remains uncollected as the process of collection oil is done manually. It appears that more bunker oil continues to spill out from the fuel tanks of the power barge which may pose danger to the environment and human health if not immediately collected and cleaned up.

In this regard, may we request for your assistance by providing an expert on oil spill clean up to work in that area with our Environmental Management Bureau in Region 6.

We hope for your positive response on this urgent matter.

Very truly yours,

ATTY. JUAN MIGUEL T. CUNA
Director