UNEP

OCHA United Nations Office for the Coordination of Humanitarian Affairs

Fuel Spill and Fire
Rapid Environmental Emergency Assessment

Mukuru-Sinai slum, Nairobi Kenya

October 2011

VEOLIA PROPRETÉ

GESTION DES DÉCHETS SPÉCIAUX

JOINT UNEP/OCHA ENVIRONMENT UNIT

Mobilizing and coordinating the international response to environmental emergencies

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Cover photo: Julius Mwelu, IRIN. Battling fires in post-election violence in Nairobi's Mathare slum. N.B. this is not the picture of the actual slum fire reported in this assessment.

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EXECUTIVE SUMMARY

On 12 September 2011, international media sources reported a major fuel pipeline explosion and fire in the Mukuru-Sinai slum of Nairobi, Kenya. Over 100 people were burnt to death, while an equal amount of people were hospitalized with serious burn wounds. On 23 September 2011, an official request for environmental emergency response services was made by the Kenyan Ministry of Environment and Mineral Resources (MEMR) through the United Nations Resident Coordinator (UNRC). The United Nations Office for the Coordination of Humanitarian Affairs (OCHA) and the United Nations Environment Programme (UNEP), through their Joint UNEP/OCHA Environment Unit, subsequently compiled an expert team to undertake a rapid environmental emergency assessment. The scope of the mission was to provide scientific information on the extent and nature of pollution and to assist the decision-making and priority-setting by the authorities and other actors for follow-up activities on the affected site. The mission took place from 9 to 16 October 2011.

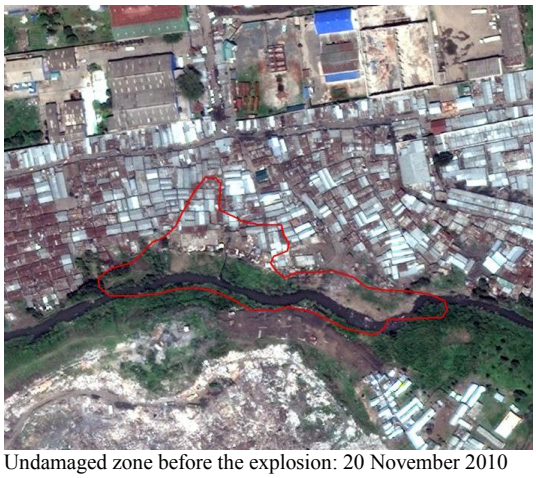
The main conclusion of the mission was that the fire was not caused by a pipeline explosion as reported initially in (international) media, but by an industrial accident that caused a large amount of unleaded petrol to enter a storm water drainage system. A further conclusion was that a repetition of a similar type of accident is considered as highly likely.

The area where the accident took place is affected by pre-existing, chronic pollution and therefore no immediate clean-up action is needed for the remaining residues of the accident. There is no immediate threat to the drinking water supply as a result of the accident.

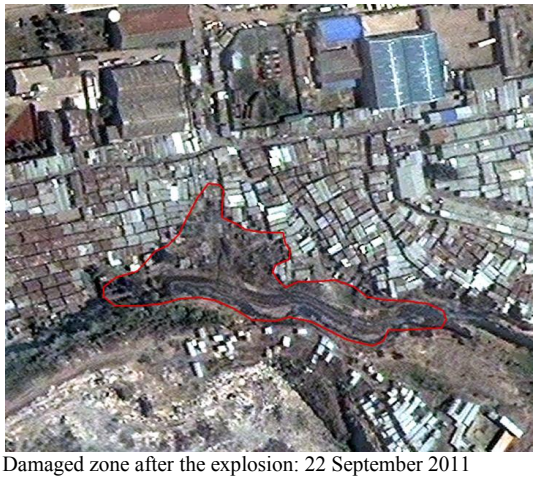
The mission established that there is a clear indication of other uncontrolled industrial effluents being released into the storm water drainage system and the Ngong River.

Detailed recommendations have been provided in the report detailing the immediate measures to take in order to prevent a re-occurrence of a similar type of accident. The competent authorities are urged to implement these measures without delay.

In addition, recommendations have been made to improve the preparedness for environmental emergencies both at the national level and at the local level, in particular through the implementation of UNEP's programme on Awareness and Preparedness at the Local Level (APELL).



Undamaged zone before the explosion: 20 November 2010



Damaged zone after the explosion: 22 September 2011

List of acronyms and glossary of terms

APELL	Awareness and Preparedness for Emergencies at Local Level
JEU	Joint UNEP/OCHA Environment Unit
KPC	Kenya Pipeline Company
MEMR	Ministry of Environment and Mineral Resources
NEMA	National Environmental Management Authority
OCHA	Office for the Coordination of Humanitarian Affairs
UNEP	United Nations Environment Programme
UNITAR	United Nations Institute for Training and Research
UNOSAT	United Nations Satellite Applications Programme
UNRC	United Nations Resident Coordinator

1. Introduction

FUEL EXPLOSION AND FIRE

On 12 September 2011, international media sources reported a major fuel pipeline explosion and fire in the Mukuru-Sinai slum of Nairobi, Kenya. Over 100 people were killed, while an equal amount of people were hospitalized with serious burn wounds.

Based on an analysis carried out by UNOSAT[1], using imagery of the situation before and after the explosion and fire, an estimated area of 10 600m had been seriously affected by the explosion. A further estimated 57 dwellings located in the area had been totally destroyed and 20 had been seriously damaged. The UNOSAT report also indicated that the Ngong River, downstream of the explosion site, appeared to be affected by the release of a large amount of petroleum products.

The satellite image on the left shows the industrial area of Lunga Lunga (in yellow) including a site of the Kenya Pipeline Company, the suspected pipeline (in green) and the affected area (in red adjacent to the Ngong River).

Image date: 22 September 2011 – UNITAR/UNOSAT – DigitalGlobe

Upon learning of the emergency OCHA and UNEP, through its Joint UNEP/OCHA Environment Unit (JEU), offered immediate technical support to the national authorities. On 23 September 2011, an official request for environmental emergency response services was made by the Kenyan Ministry of Environment and Mineral Resources (MEMR) through the United Nations Resident Coordinator (UNRC).

MISSION SCOPE

The JEU subsequently compiled an expert team and agreed with the authorities that the mission would provide scientific information on the extent and nature of pollution to assist the decision-making and priority-setting by the authorities and other actors for follow-up activities on the affected site. As such, it would not look into any liability-related issues of the accident, nor be involved directly in clean-up activities.

[1] http://unosat-maps.web.cern.ch/unosat-maps/KE/FR20110913KEN/UNOSAT_KEN_FR2011-Nairobi-Report_v1.pdf

The mission would focus on identifying the presence and concentrations of hydrocarbons in soil and surface water and provide recommendations for the mitigation measures; taking into consideration the means available locally. A sampling strategy will be deployed on the field in order to estimate the nature and the extent of the pollution.

Specific objectives include:

- on site sampling and/or analysis to determine the nature and extent of the pollution;
- assess the impact on environmentally sensitive areas and/or drinking/ground water supply/resources;
- recommendations to protect drinking water resources;
- provide recommendations for mitigation/remediation measures;
- support the dissemination of results.

The mission took place from 9 to 16 October 2011.

The mission team was composed of the following four experts:

- Professor BARY Abdouraman
  Programme Officer-Chemicals
  And Waste Focal Point for Military
  Environmental Agreements – United
  Nations Environmental Programme (UNEP)
- DOVEIL Laurent, generalist expert
  and team leader Veolia Propreté –Waste Force
- LICARI Antoine, specialist expert (chemist)
  Veolia Propreté –Waste Force
- PAILLER Delphine, generalist expert
  Veolia Propreté –Waste Force

L.DOVEIL / A.BARY / A.LICARI / D.PAILLER

EQUIPMENT

The following pieces of specialized equipment had been prepared and shipped to assist the expert team in the implementation of the mission terms of reference:

- Portable analyser enabling identification and quantification of Volatile Organic Compounds (VOC) in air, water, and soils. This equipment provides gas chromatography/mass spectrometry, and is specially adapted for the detection of hydrocarbon leaks and organic pollution identification;

- Total Petroleum Hydrocarbon Test Kit;

- pH determination by colorimetric tape.

LIMITATIONS

Not all equipment was cleared in time to provide the anticipated support during the mission. Therefore the team reviewed their strategy and with the help of the Total Petroleum Hydrocarbon Test Kit most of the mission objectives could be achieved.

Total Petroleum Hydrocarbon Test Kit

As a result, the possible pollution by other organic pollutants that may be present in the soils and river were not determined. A broader overview of the pre-existing environmental pollution is therefore not included in this report. However, a set of samples are being kept by UNEP for possible further analysis.

2. Assessment

The field observations and assessments were undertaken in two steps:

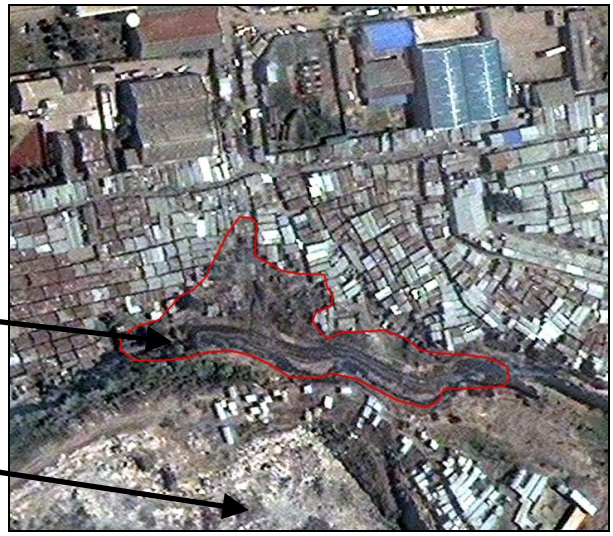
- A first overall reconnaissance visit was made on 11 October 2011. This enabled the experts to comprehend the layout of the affected site and its surroundings in order to make an evaluation of the residual environmental impact and to build a sampling strategy adapted to the situation in the field;
- A second site-visit was made on 13 October 2011, to take water and soil measurements and samples and collect supporting visuals (GPS data, photos, videos) for the correct understanding and interpretation of the collected data.

SITE OBSERVATIONS

The first reconnaissance visit on 11 October 2011 clearly highlighted that at the impacted site a number of pre-existing environmental problems existed:

- Suspected pollution of the river system upstream (large amounts of solid waste, water polluted with suspended matter, suspected presence of industrial pollution);
- An outlet into the Ngong River of all or part of the storm drainage system coming from the industrial area;
- Discharge of waste water from the slum dwellings into the river;
- The presence of a household waste landfill (5 hectares) located less than 200 meters from the affected disaster site, on the opposite side of the Ngong river, allowing the dispersion of leachates and biogas into the environment;
- Use of the river to clean plastic residues collected from the landfill for recycling.

Damage Zone after the explosion
Image date: 22 September 2011 - UNITAR/UNOSAT - DigitalGlobe



Overview of Ngong river and the household waste landfill

The affected area had been entirely cleared before the first field visit took place and only a few remnants, such as the floors of the destroyed dwellings and burned vegetation, were still visible.

The primary affected site is centred on the outlet of a storm water drainage system situated approximately 15 meters from the Ngong River (marked red in the picture below).

The outlet runs into an open gutter which flows into the Ngong River.

The site visit also allowed the identification of a second area affected by the fire, further downstream of the Ngong River. The primary and secondary site have been visualised on the satellite imagery below. The distance between the two sites is approximately 80 meters.

Image date: 22 September 2011 - UNITAR/UNOSAT - DigitalGlobe

REDEFINITION OF THE CRISIS SITUATION

Based on the information available to the team before the departure, the understanding was that an explosion of a pipeline had occurred. However, it was determined that the actual chain of events was quite different.

The press release issued by the Kenya Pipeline Company (KPC) on the 12th September 2011 accident and a Control Audit Report of the National Environmental Management Authority (NEMA) indicated that an accidental leak of petroleum products from the KPC deposit facility, located in the industrial area of Lunga Lunga, southeast of Nairobi, had occurred. Both the audit report and the press release are annexed to this report.

Photography of the KPC petroleum deposit facility - www.kpc.co.ke

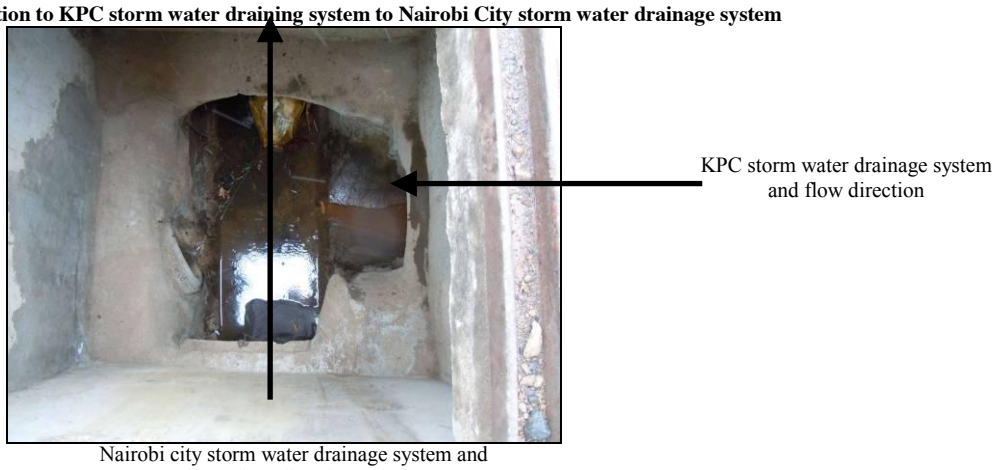
The KPC deposit facility is the terminal point of the Nairobi-Mombasa pipeline and the departure point of pipelines towards Western Kenya.

According to KPC staff interviewed, construction works had recently been conducted on the site in order to connect the Nairobi-Eldoret pipeline to the main Nairobi-Mombasa pipeline, when a leak accidentally occurred in the by-pass located between the pipelines.

As a result, it was reported that an estimated 18 000 litres of unleaded gasoline had been released. An indeterminate portion of the fuel reached the storm water drainage system in this area of the KPC petroleum deposit facility. The storm water drainage system is not connected to the oil/water separator on the KPC site.

Notably, the KPC underground storm water drainage system, composed of a concrete culvert network, is connected, outside the deposit facility, to the underground storm water draining system of the City of Nairobi.

Photography of connection to KPC storm water draining system to Nairobi City storm water drainage system



According to the KPC press release, as soon as the leak had been detected, KPC stopped the supply of oil in the Nairobi-Mombasa pipeline and took immediate mitigation measures. Nevertheless, part of the fuel had already reached the city's storm water drainage system.

Located at one kilometre downstream of the leaking area, the city's storm water drainage system washed out in the Ngong River, by a 15 meter long open ditch, located in the middle of the Mukuru-Sinai slum.

The main hazards linked to unleaded petrol justifying the flammable or explosion risk include:

- extreme flammability (ignition temperature < -40°c);
- product vapors are heavier than air which can lead to vapor intrusion through soil and water contamination and possibly cause illness;
- friction linked to the outflow of the product can create electrostatic charges capable of producing sparks;

- unleaded gasoline is potentially carcinogenic, and it is recommended not to be exposed to this product for a long time or regularly.

View of the outlet of the storm water drainage network in the slum

Regarding the human, material and environmental damages which followed, the most probable scenario that took place at the day of the accident seems to be as follows:

At the open outlet of the city's storm water drainage system, extremely flammable vapors formed on the surface of the hydrocarbon spill and created an explosive atmosphere in the slum and the surrounding dwellings. The flammable vapor cloud was dispersed following the flow direction of the petrol spill in the Ngong River.

In these conditions, any spark caused by metal contact, a discarded cigarette, or an open fire in a dwelling could have caused the ignition of petrol fumes present in the atmosphere. The ignition could have taken place at different places due to the dispersion of the vapor cloud from the ditch to the river, as well as the movement of burned people and animals.

SAMPLING AND ANALYSIS

The aerial photography below shows the location of GPS data-collected waypoints on 13 October 2011, focused on the two main areas affected by the fire.

N

15 m

Aerial photography of GPS waypoints data – Campaign on the 13th of October 2011

The references of the field survey are listed in the following table:

GPS waypoints N°	Description	Results from Explosimeter measurements	Photos N°	Samples for analysis
100	Ending point storm water draining system - Sinaï Slum (cf point A)	0	1813	Water (PE4) Soil (PS4)
101	Overview south bank of the river (landfill side)	0	1822, 1823, 1824	
102	Switch of direction – upstream river	0	1826, 1829, 1830, 1831	Water (PE1) Soil (PS1)
103	East Edge – islet (landfill side)	0	1832, 1833	
104	West Edge front islet (landfill side)	0	1837	
105	West Edge –accident triangle	0	1839, 1841	Water (PE2) Soil (PS2)
106	West Edge – front islet (accident side)	0	1842	
107	Release point –ditch storm water draining system	0	1843, 1845, 1846	
108	East Edge – accident triangle	0	1850	
109	East Edge front islet (accident side)	0	1851	
110	Switch of direction – downstream river	0	1854	Water (PE3) Soil (PS3)
111	Manhole on waste water network	0	1859	
112	Burying point piped network	0		
113	North Edge – accident triangle	0	1861, 1862	
114	Release from KPC network towards municipal storm water draining system	0	1869, 1870	Water (PE5)

A list of photographic references is available in the Annexes.

Based on the field observations described above, representative measurements and samples of soil and water were taken at four separate points at the affected sites. During the entire field visit, the portable explosimeter did not detect any explosive conditions.

The analysis of soil samples focused on the possible presence of residual pollution of unleaded petrol. The analysis shows that this pollutant was present in all collected soil samples, ranging from 64 to 264 parts per million (ppm), with a significant increase of petrol in the soil from upstream to downstream in the affected area (following the river flow). This means that the area surrounding the affected site was already polluted with hydrocarbons prior to the accident. The pre-existing chronic hydrocarbon pollution upstream from the main point of the disaster (GPS point N°105 in the picture below), and the analysis results (hydrocarbon content below 500 ppm of total petroleum hydrocarbons (TPH) in all samples) shows that the disaster had no significant additional impact on the already polluted soil in this area; where soil samples with more than 500 ppm require remediation efforts as established by the European Union[2].

A rapid pH measure was conducted on water samplings with strips of pH paper. The results highlight that collected water in the river has a good homogeneity with a neutral pH of 7. However, water samplings in the terminal point of the municipal storm water drainage system show a high pH (basic) of 10. This result clearly indicates that there are other substances than rainwater run-off being released in the storm water drainage network.

Aerial overview of sampling locations

[2] http://environment-agency.gov.uk/research/planning/33714.aspx

The analysis results can be summarized as follows:

GPS waypoints	Water	Soil	
		Unleaded Gasoline Presence	Concentration
100	**pH = 10**	Yes	64 ppm
105	pH = 7	Yes	118 ppm
102	pH = 7	Yes	158 ppm
110	pH = 7	Yes	264 ppm

In addition to the high pH value measured, a number of subsequent observations support the suspicion that substances other than rain water are being released through the storm water drainage system. Possible observations to consider are:

- A significant volume flow was observed through a manhole of the storm water drain located in the industrial area during the field campaign on 11 October during dry weather conditions;
- Witness of accident victims in an article of the newspaper « Daily Nation » published on 12 October 2011 (cf. Annex 2): « *...Something was different about the fuel leak that caused the explosion. People use sponges to soak up the spillage but that day everyone had a jerrycan.* »;
- Extract from the KPC press release (cf. Annex 4) indicating: « *It has come to our attention that some members of the public are in possession of the spilled product* ».

These effluents could not only affect the health of the local population (health risk due to contact with the river water, chemical reactions linked to a mixture of incompatible products which could create toxic fumes and fire hazard), but also affect the environment. Due to the missing equipment, it could not be verified which substances were being released.

IMPACT ON SURFACE WATER MANAGEMENT

During the second field visit on 13 October, construction works were observed on the outlet of the storm water drainage system, connecting it to the municipal waste water system (GPS waypoint N°111 and see pictures below).

The outlet of the storm water drainage system before (left) and during (right) the alterations

Although the exact reasons for this construction work could not be verified on-site, it should be noted that if this is intended to avoid the collection of potential hydrocarbon releases in the storm water drainage system by the slum inhabitants, there will be limitations to achieving this, because:

- In case of newly released inflammatory products in the storm water drainage system, the hydrocarbon spill would be dispersed in the waste water network, releasing flammable vapors in the inspection hole (especially in the manhole identified by GPS waypoint N°111) and the explosive conditions in the slum would still be present;
- The municipal waste water network runs into one of the waste water treatment plants of Nairobi. However, as waste water treatment plants of the city are exclusively equipped for the treatment of domestic effluents, the risk of the treatment facility malfunctioning due to the existence of possible industrial releases could be realized;
- Due to the small diameter of the two connected networks (storm water draining system in Ø 800 mm and the municipal waste water network in Ø 300 mm) high hydraulic pressures could destroy the current construction works under way, causing a possible leak at the connection point and further risks of pollution.

One of the most obvious potential sources of pollution of the storm water drainage system, which could cause a similar type of accident with grave human and environmental consequences, was observed at a loading bay and parking for tank vehicles. Tank vehicles, which can contain up to 30,000 liters of petrol, are parked on the sidewalk, without any specific precautions. The parking areas are not equipped in case of accidental leak nor is there any regard or enforcement of basic safety regulations such as a ban on smoking or the use of potential heat sources. As no retention basins exist to contain a potential leak, or the polluted water from simple washing of the trucks, any spilled petrol will penetrate the soil or, if in large enough quantities, flow into the storm water drainage system.

Aerial overview of the tank vehicles parked in the industrial area of Lunga Lunga

Overview of parking and washing of tank vehicles

IMPACT ON DRINKING WATER RESOURCES

The information collected and the observations made on the field do not indicate, *a priori*, an immediate risk for drinking water supplies of Nairobi inhabitants. Drinking water is supplied by a network of dams and reservoirs.

Regarding the Mukuru-Sinaï slum, lifting or pumping wells have not been observed in the visited areas. According to the information collected in the field, the water of the slum inhabitants is supplied by informal connections to the supply network of the Municipality of Nairobi.

A hydrogeological study was not readily available during the time of the mission. This study would have allowed for the review of the presence and directional flow of underground water directly vertical to the impacted area and to the city.

3. Conclusions & recommendations

Based on the observations, interviews and measurements taken in the field, the following conclusions and recommendations can be made.

3.1 CONCLUSIONS

Residual pollution resulting from the 12 September 2011 accident with unleaded petrol has been measured at the affected site. However, the levels of pollution are not considered significant in view of the pre-existing and chronic background pollution found to be present in the soil samples measured upstream. Due to the levels of pollution falling below the threshold level of 500 ppm, a cleanup operation of the soils in the affected area would thus, not be not justified.

It is reasonable to assume that industrial effluents are being released into the storm water drainage system. The nature of these releases has not been established as part of this mission, but they can possibly pose a direct health risk to the population, a risk to the environment and a risk of further explosion/fumes.

The probability of a new accident occurring with potentially similar human and/or environmental consequences is considered to be very likely.

3.2 PRIORITY RECOMMENDATIONS

Based on the above, the expert team makes the following recommendations to be implemented with utmost urgency. The immediate recommendations focus on the following three issues:

- Detailed environmental assessment of the pollution of the Ngong River, upstream and downstream of the storm water drainage system release;
- Mapping of the entire storm water drainage system and sewage system in the Lunga Lunga industrial area;
- Prevention of industrial releases into the municipal storm water drainage system.

DETAILED ENVIRONMENTAL ASSESSMENT OF THE NGONG RIVER

A detailed environmental assessment should be undertaken of the Ngong River to establish the levels and types of pollution in the river, upstream and downstream of the storm water drainage system outlet. As a first step, samples should be analysed according to international standards for organic and mineral compounds.

The analysis results would allow classification of the chemical and potentially hazardous compounds present in the water, either by nature or by quantity, and to reliably define the sources of the pollution.

MAPPING OF STORM WATER DRAINING AND SANITATION SYSTEMS

No overview of the storm water drainage system was available at the time of the mission. If no such map exists, the following techniques could be used to map the underground networks of the Lunga-Lunga industrial area:

- Fluorescent flow tests;
- GPS locations of manholes for different stretches, combined with flow directions
- TV inspection of the networks with associated tracing.

Once this mapping is completed it will be possible to identify the locations where the release can potentially diffuse into the Sinai slum. It will be important to carefully distinguish the nature of the releases, such as whether it is a storm water drainage release or a sewage water release.

PREVENTION OF INDUSTRIAL RELEASES INTO THE MUNICIPAL STORM WATER DRAINAGE SYSTEM

It is important to distinguish between two types of industrial releases in the municipal storm water drainage system: regular industrial release and accidental industrial releases. In both cases, the following recommendation directly refers to the 12th of September accident:

- Equip where necessary, the connections to the storm water draining system with an oil/water separator of correct dimensions to contain the downstream dispersion of pollutants. These separators require regular maintenance.

For regular releases, unannounced and/or periodical inspections can be undertaken, including the manholes of the storm water drainage system located near the industrial sites (in dry weather conditions). Suspected industrial releases should be sampled for analysis.

- Each industrial facility should have an evaluation of the impact of a possible release of effluents in the storm water drainage system. Such an evaluation would include an accident scenario with associated health and environmental impacts and should be carried out in partnership with the operators of the sites. A prioritization of the identified risks of the entire industrial area should also form part of this (see also recommendations on UNEP, APELL on next page).

3.3 LONG-TERM AND NON-SITE SPECIFIC RECOMMENDATIONS

In order to improve the water quality of the Ngong River, similar environmental assessments and mitigation measures as described above should be replicated at points where anthropogenic effluents enter the river system.

Considering the multiple suspected pollutants in the surface water and the possible migration of hydrocarbons towards the groundwater table, the undertaking of an assessment of the groundwater to determine possible pollution thereof is recommended.

The groundwater assessment should be comprised of the following steps:

- Hydro-geological study aiming to qualify the groundwater table under the accident site and on a similar area of the other bank of the Ngong River (on the same side as the landfill);
- Drilling bore holes in order to define the flow direction of the groundwater table;
- Placement of at least three piezometers for periodical follow-up for the evolution of underground water quality. These meters should be located (1) upstream of the impacted area (ideally upstream the industrial area), (2) near the Ngong River (between the impacted area and the landfill), and (3) upstream from the landfill;
- Develop and follow a sampling program, in order to follow the relevant parameters (of which organic pollution should be part of), by upstream/downstream measurements.

The household waste landfill across from the accident site falls outside the scope of this mission. Nevertheless, regarding its immediate proximity and the uncontrolled release of leachates and biogas into the environment (and especially towards the Ngong River), it is

recommended to consider the main environmental impacts of this landfill when implementing the site specific recommendations. As such, due consideration should be given to determine and control the quality and quantity of leachates into the Ngong River and groundwater.

The situation of a densely populated area adjacent to an industrial site is most likely not limited to the Lunga Lunga industrial area and the Mukuru-Sinai slum. A national level hazard inventory of industries using hazardous materials should be undertaken as part of the national disaster management and/or contingency planning process. Environmental emergencies should be fully integrated into the national humanitarian response system.

UNEP together with the private sector has developed a proven process that prepares for potentially serious accidents and which creates a coordinated emergency response capability for all aspects of industrial disasters. Awareness and Preparedness for Emergencies at the Local Level (APELL) brings economic and public relations benefits over and above ensuring public safety and environmental quality. This process provides a tool for preventing accidents and minimizing their impact through the assistance of decision makers and technical personnel in increasing community awareness and preparing coordinated response plans involving governments, industry and the local community. It should be considered to apply the APELL process in the Lunga Lunga/Mukuru-Sinai area, and possibly at other sides. Available at http://www.unep.fr/scp/sp/

ANNEX I: LIST OF PHOTOGRAPHIC REFERENCES FROM THE SECOND FIELD VISIT, 13 OCTOBER 2011


ANNEXE 4 – Photo 1830


ANNEXE 4 – Photo 1831


ANNEXE 4 – Photo 1832


ANNEXE 4 – Photo 1833


ANNEXE 4 – Photo 1837


ANNEXE 4 – Photo 1839


ANNEXE 4 – Photo 1841


ANNEXE 4 – Photo 1842


ANNEXE 4 – Photo 1843


ANNEXE 4 – Photo 1845


ANNEXE 4 – Photo 1846


ANNEXE 4 – Photo 1850


ANNEXE 4 – Photo 1851


ANNEXE 4 – Photo 1854


ANNEXE 4 – Photo 1859

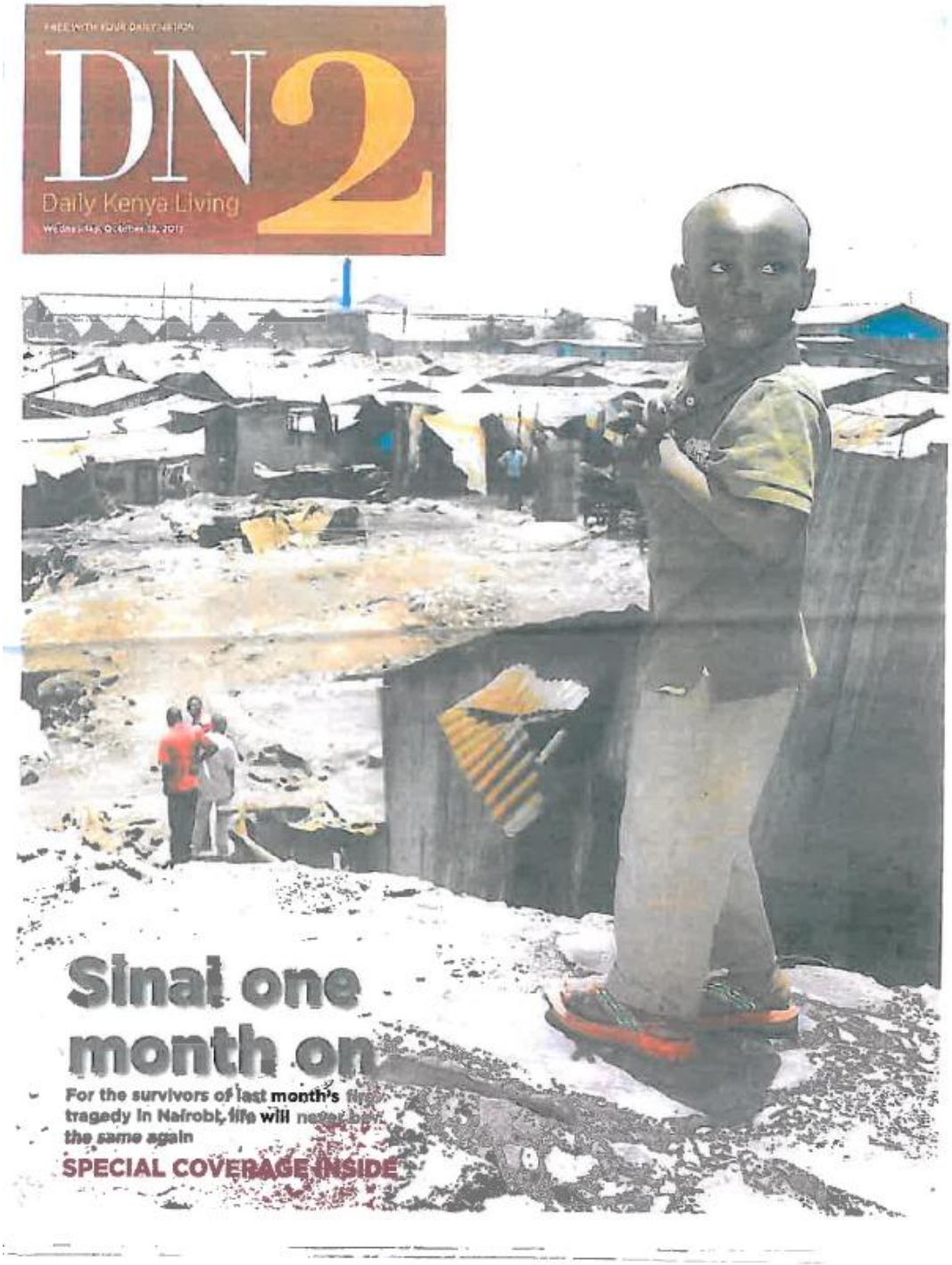

ANNEXE 4 – Photo 1861


ANNEXE 4 – Photo 1862


ANNEXE 4 – Photo 1869


ANNEXE 4 – Photo 1870

ANNEX II: EXTRACT FROM THE DAILY NATION NEWSPAPER, 12 October 2011, “SINAI ONE MONTH ON”



How Sinai fire changed our lives

Nineteen-year-old Anthony Ajumbo knew something was different about the fuel leak that caused the explosion. People usually use sponges to soak up the spillage but that day everyone had a jerrycan.

When the fire started Anthony was walking back to his house to grab his own fuel container. He tried to escape the flames by climbing a tree. But suddenly, everything was engulfed in fire. He suffered severe burns on the legs and arms and watched as his home burnt to the ground. Luckily, his parents and three siblings were not injured.

Anthony says he plans to return to selling CDs when he is released from Kenyatta National Hospital, but he has several skin graft procedures to get through first.

Julius, a cobbler, was standing near a gate with about a dozen other men when the fire erupted. As they attempted to flee, they found that the gate was stuck and would not open. Julius' legs caught fire as he struggled to escape, burning into his skin the Sh3,000 he had in his pocket. Seven of his neighbours died in the fire. "God willing, I will move to Humias to be with my wife in when I am healed," he says.

Stephen recalls seeing people lying unconscious on the riverbank, thanks to the petrol fumes. Before he could make it to the river, he saw the first explosion and fled. As he ran, a burning victim grabbed his arm, leaving him with severe burns. His boss, Sebastian Kotua, died in the explosion, leaving Stephen jobless.

"I want to move, but where can I go?" he asks.

ANNEX III: NATIONAL ENVIRONMENT MANAGEMENT AUTHORITY REPORT

NATIONAL ENVIRONMENT MANAGEMENT AUTHORITY

CONTROL AUDIT REPORT FOR KENYA PIPELINE COMPANY LTD-NAIROBI TERMINAL

SEPTEMBER 2011

1

1.0 INTRODUCTION

1.1 Background Information

The Kenya Pipeline Company Nairobi Terminal is located in Nairobi's industrial area, Sekondi road, off Nanyuki road. It is at this terminal that the Mombasa -Nairobi pipeline terminates and the western Kenya pipeline starts. Currently construction works are on going to connect a pipeline to Eldoret from the main Mombasa –Nairobi pipeline.

1.2 Audit Scope

The areas covered by the audit is the Kenya Pipeline Company terminal in industrial area Nairobi and associated facilities:- Tank farm, Workshop, Motor vehicle garage, Oil water separator, Clinic, Test rig area, Pump raft, Quality control laboratory, Generator room, Metering area and storm water drains.

Areas of interest were but not limited to:

- Waste generation, management and disposal
- Environmental degradation
- Air quality
- Noise generation and control

1.3 Audit Objectives

- To establish the current status of the terminal and associated facilities
- To determine whether the terminal complies with environmental regulations
- To establish pollution control measures in place and
- To determine the degree and scope of necessary improvements or remedial works in case of non compliance.

1.4 Audit Team

1.	Margaret Njuki	NEMA	Team Leader
2.	Simon Mathenge	DOSHS	Member
3.	Benjamin Kirongo	NEMA	Member
4.	Titus Simiyu	NEMA	Member
5.	Kainga Mario	CCN	Member
6.	Sophie Mutemi	NEMA	Member
7.	Peter Watoro	NEMA	Member
8.	Mwaura Murigi	WRMA	Member
9.	Selelah Okoth	NEMA	Secretary

1.5 Methodology

There was an initial meeting held under the chairmanship of the audit team leader. The meeting helped agree on the audit scope and objectives. The audit activities to be undertaken were also identified. The activities identified included;

- An Opening meeting with the Managing Director, Kenya Pipeline Company
- A walk through the terminal and associated facilities
- Review of environmental records in place and any other relevant documents
- Closing meeting with the Managing Director, Kenya Pipeline Company

2.0 AUDIT FINDINGS

2.1 Fire Station

Different fire equipments are in place to fight fires. These include, fire engines, foam, fire extinguishers to name but a few. There is standby generator at the fire station to be used just in case of an electricity outage during a fire outbreak. Oil spillages were observed near the standby generator. The Company regularly does fire audits. A vopy of the report for the year 2011 was issued to the team.

2.2 Process Area

There were construction works going on in this area to connect line four (Line IV) to line one (Line I). It is at this point that a gasket gave in to pressure causing an oil spill that passed into the storm drains and into the Sinai Slums. The construction works have an EIA licence Number 1989 of 2008. Within the process area, it was observed that there were a lot of spillages and the floor was not impervious. A polythene sheet was laid under some gravel to prevent the oil from seeping into the soil. The soils in this area showed signs of contamination. The process area was not connected to the oil water separator

2.3 Tank Farm

At the entrance of the tank farm there is proper signage to guide anyone entering into the area. Workers and visitors are also provided with proper protective equipment before entering the area. The tank farms had bunds all around the oil storage tanks. The floor of the bunded area where the tanks stood was also made of an impervious material. The tanks were fitted with foam pipes which would transport foam to the tanks in case there was a fire outbreak. It was however noted that one of the tank farms floor was not impervious but instead had gravel.

2.4 Slope Tanks

These tanks store the mixed fuels such as diesel and super petrol which occurs during the injection process since the facility uses only one line for this process. The fuel injected into the slopes tanks, however is not disposed off but rather concentrated with the highest composition of the fuel type that formed part of the interface and later sold out for consumption. The process of confirming the composition involves analysis to determine the quantities injected.

2.5 Storage of Sludge

Sludge from cleaning activities is first stored in drums before being transported to Sultan Hamoud for final disposal. The drums are stored in the open.

2.6 Storm Drains

The storm drains are all made of concrete and discharge into the City Council of Nairobi storm drains

2.7 Clinic

The terminal has a clinic that serves the staff members and their families. Waste from the clinic is properly segregated, and stored in biohazard containers before being disposed off through Kenya Medical Research Institute (KEMRI) who are licensed handlers and Green City for incineration.

2.8 Vehicle Workshop

The workshop is used for servicing of company vehicles. The waste from the garage is temporarily stored before disposal through licensed handlers. The service pits are left open even when not in use

2.9 Laboratory

The laboratory is used for quality assurance of the product. The workers are provided with some personal protective equipment. It was however not possible to establish whether the PPE provided was adequate and appropriate since the workers were out on lunch break. The laboratory staff and all other employees who work in areas where level of exposures are high undergo regular medical check ups

The waste water from the lab is discharged through the sewer line and the storm drains

3.0 COMPLIANCE TO ENVIRONMMENTAL REGULATIONS

3.1 Environmental Impact Assessment and Audit Regulations of 2003

The terminal has submitted their initial environmental audit reports and subsequent self audit reports
The terminal has also been issued with an Environmental Impact assessment licence for the construction works currently going on (Line IV which is meant to serve Western Kenya).

3.2 Environmental Management and Coordination (Waste Management) Regulations, 2006

The company segregates waste and disposes the waste through licensed handlers. The vehicle that transports waste sludge to Sultan Hamoud has also been issued with a waste transport licence.

3.3 Environmental Management and Coordination (Water Quality) Regulations, 2006

The grey water from the washrooms is connected to the City Council of Nairobi sewer line. All the water passing through the oil- water separator is discharged into the storm water drains. The July analysis of the waste water indicates that the waste water does not meet the standards as stipulated in the third schedule of the regulations. (Annex). The terminal has also not applied for an effluent discharge licence.

4.0 AUDIT ACTION PLAN

	Areas for Improvement	Proposed Mitigation	Time frame
1.	Oil spillages	1. Clean up the contaminated soil in the process area. 2. Replace the polythene paper used in the process area with an impervious surface. 3. Provide a tray at the fire station to collect any spillages from the diesel pump 4. Control the storm drains to ensure no oil spillages are discharged into the environment. 5. Ensure the floor of the tank farm is made of impervious material	
2.	Storage of sludge in the open	1. Construct a bunded rainproof temporary storage for sludge.	
3.	Workers safety	1. Ensure workers in the laboratory are provided with adequate protective equipment 2. Provide covers for the garage service pits while not in use.	
4.	Compliance with environmental regulations and standards	1. Apply for an effluent discharge license. 2. Ensure the waste water released through the interceptor meets the required standards 3. Ensure wastewater from the laboratory is treated before discharge or is connected to the sewer line	Immediate

ANNEX IV: KPC PRESS STATEMENT, 12 SEPTEMBER 2011

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PRESS STATEMENT

September 12th, 2011

There was spillage of petroleum products from the by-pass between Nairobi-Mombasa pipeline (Line I) and Nairobi-Eldoret pipeline (Line IV).

Upon detection of product spillage, the Nairobi-Mombasa pipeline was shut down immediately and Nairobi Terminal receiving Station isolated. The section of the pipeline was depressurized and emergency response initiated to the site to contain spillage which had flowed to the storm water drain leading to Mukuru-Sinai Area.

A team of KPC Engineers was immediately dispatched to the site and the storm drain was blocked to stop further product flow into the storm drain.

KPC also dispatched Security and Administration Police to Mukuru-Sinai area to carry out crowd control and further surveillance to ensure safety. Later, smoke was noted billowing from the Mukuru-Sinai area as fire had apparently broken out.

With the ensuing fire at Mukuru-Sinai a number of lives have been lost, a number of people injured and property destroyed. At the moment the exact number has not been confirmed.

The incident is regrettable and sincere condolences go to the families and friends of those affected by the unfortunate fire incident.

We also wish those injured during this unfortunate incident quick recovery.

The Company contacted the following institutions to reinforce, the KPC team that had already dispatched 2 fire engines to the scene.

- Kenya Police
- G4S
- Kenya Airports Authority
- Nairobi City Council Fire Brigade
- National Disaster Centre
- Kenya Army
- St John's Ambulance

Oil Marketers were alerted to initiate their emergency response plan.

KPC is grateful that all these institutions promptly responded to our call for help.

It has come to our attention that some members of the public are in possession of the spilled product. We wish to caution that the product is highly inflammable and must not be used.

Members of the public are advised not to buy petroleum products from unlicensed persons.

We further wish to assure our stakeholders and the general public that the situation has been brought under control. KPC has set up an information desk at Kenpipe Plaza to deal with inquiries. We can be reached on **020-26065600-4.**

Mr. Selest Kilinda
Managing Director,
Kenya Pipeline Corporation