Environmental Baseline Study for the Proposed Expansion of the UNSOA Logistics Base

Mombasa, Kenya, 2010

FOI

UNEP

ENVIRONMENTAL BASELINE STUDY FOR THE PROPOSED EXPANSION OF THE UNSOA LOGISTICS BASE, MOMBASA, KENYA 2010

Location: Site Coordinates 4°00’47”S Long. 39°37’44”E

Area name: “AWL site”

Issued by: United Nations Environment Programme (UNEP)

Surveyor: Swedish Defence Research Agency (FOI)

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EXECUTIVE SUMMARY

The current site (from hereon referred to as the AWL site) for the Mombasa log base (Site Coordinates 4°00'47"S Long. 39°37'44"E) is located at Allied Warphage Limited (AWL), Refinery Road, Changamwe, Mombasa. The site is part of a larger industrial estate complex. The site is secured. Prior to being part of the industrial estate the site was underdeveloped.

The site is used by UNSOA (United Nations Support Office for AMISOM) for the reception, checking, storage, and subsequent delivery of goods to be used by the AMISOM (African Union Mission in Somalia) forces in Somalia. Goods are stored in warehouses prior to the shipment to Somalia.

Current adjoining land-use and activities include a soap manufacturer located to the west of the compound. To the east there is open land and to the north there are additional industrial units comprising mechanical shops, vehicle repair, and warehousing. To the south of the site are a set of railway sidings. The site is generally flat with natural and constructed drainage, mainly to the northwest. The site is accessed along a worn but heavily trafficked road shared within the larger AWL compound. This road joins a larger dirt road that connects to the main A109 highway into Mombasa.

Although no quantitative assessment of air quality was made, the main source of any reduced air quality is likely to be the traffic within the AWL compound and the refinery to the west and south. There is a single water abstraction point, a borehole, on the site. The water from this source is claimed not to be used for potable supply. Black and grey water is disposed of to a septic system with a soakaway (a pit filled with rubble into which rain or waste water drains), which is a sustainable way to disperse surface and storm water. The septic sludge is removed by a contractor hired by the AWL. There was a noticeable smell of sewage in the surface water drains on the site indicating a potential disposal of septic products into these.

Fuel for domestic use is stored in a 22m^3 underground storage tank connected to an above-ground fuel filling station located on a permeable base without spill management arrangements. Containers of materials for distribution to, and use by, UNSOA bases in Mogadishu are also stored on the site; some of the contents include bleach. Drums of bitumen were also identified to be stored externally. In an area directly adjacent to the UN compound a mining company, now shut down, cyanide was stored in barrels. Non-hazardous waste is disposed of by a local contractor. No medical or biohazardous material was identified, although a clinic will be located at the site that will give rise to certain amounts of such wastes. No radiological source was detected. A potential presence of asbestos and lead in the painting of the structure must also be included. No obvious electrical hazard was detected. A hazard was detected regarding fire safety due to the single, narrow, and often blocked access route to the compound. There were no obvious cultural, historical, or sensitive natural resources present at the site.

As the site is part of an industrial complex, and since there are underground fuel storage tanks and other hazardous materials' storage on and adjacent to the site, soil sampling, and analysis was conducted. No contamination levels above the standards (developed for similar type industrial sites) used for comparison were detected within the soil.

The conclusion of the environmental baseline study (EBS) is that the proposed UN compound is not exhibiting constraints that indicate that a potential liability exists.

1. INTRODUCTION

United Nations Support Office for AMISOM (UNSOA) is a logistics operation that supplies the African Unions Mission in Somalia (AMISOM) with necessary supplies and equipment. The Mombasa logistics base (log base) acts as a hub in this operation to which goods from different suppliers are tested for functionality and temporarily stored before being repackaged and shipped by sea to Somalia.

1.1 Objective/purpose

As required by the DPKO (UN Department of Peacekeeping Operations) /DFS (UN Department of Field Support) Environmental Policy for UN Field Missions, an environmental baseline study (EBS) is to be undertaken of all mission locations at the beginning of the mission and when the mission establishes a new location (DPKO and DFS 2009).

The purpose of this EBS is to identify, assess, and document the initial environmental conditions on the site. The results from the EBS will be able to serve as a future reference point (baseline), as the EBS is to be periodically updated for the location. In addition to internal use within the mission, the baseline study is also to be held on file for possible use, when required, in discussions with the host country, regarding damage or pollution claimed to have been caused by the mission.

This particular EBS will also provide baseline environmental data to be used in the Environmental Impact Assessment (EIA) performed for the UNSOA Logistic base.

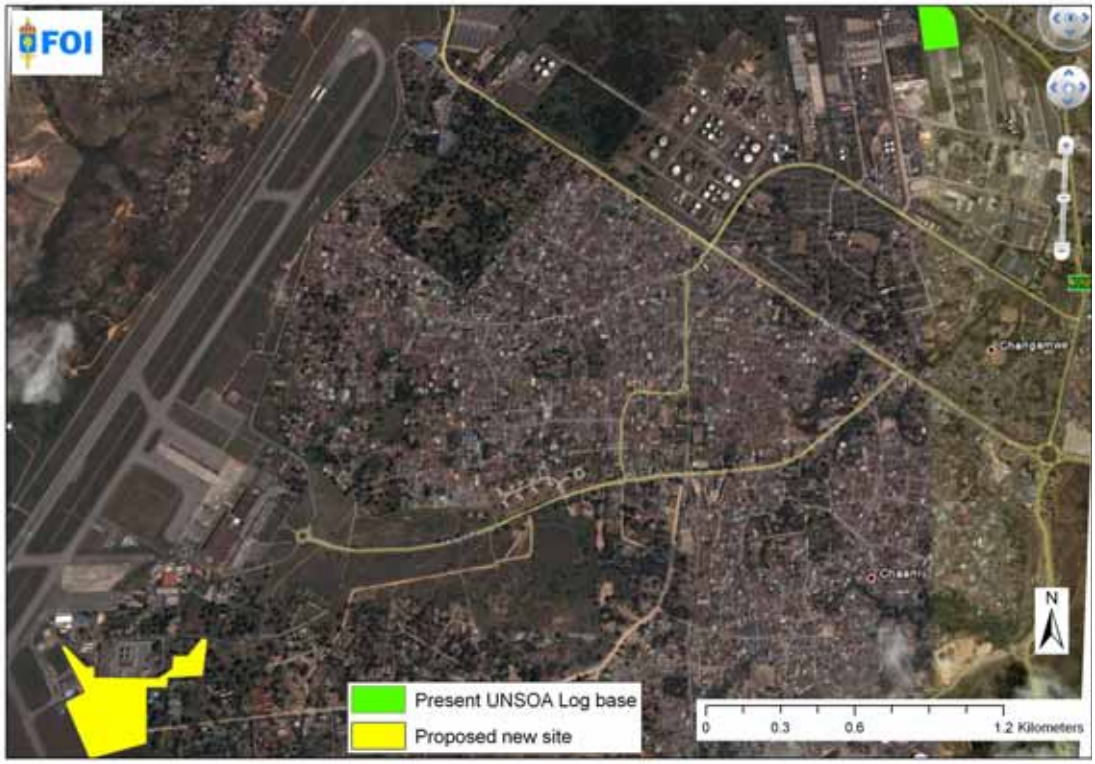

Figure 1. Satellite image showing the NW part of Mombasa and the locations of the two sites that are mentioned in this EBS.

1.2 Methodology

The methodology for performing the EBS followed the internationally accepted ASTM standard process form Environmental Baseline Surveys consisting of five discrete steps, which include:

1. Gathering of baseline data and information
2. Analysis of data and information
3. Determination of the environmental conditions of the site
4. Preparation of the EBS report (this report)
5. Updating of the EBS (not included in this survey)

The site was visited twice; in May 2010 for a first visual observation and to receive information on the area as a whole; and in August of 2010 when the sampling was performed.

In May, information regarding the plans and outlines for the premises was presented and a sampling plan developed accordingly as a basis for the visit in August. The sampling has been planned based both on grid patterns and with a systematic approach; hence, for instance concentrating some of the sampling spots at places associated with specific storage or activities such as fuelling, chemical storage, etc.

Interviews were conducted with UNSOA staff and engineers from AWL.

Limitations:

During the sampling, which was performed from August 25-26, the weather conditions were fine; partly cloudy, 26 degrees C, moderate wind (south) and no precipitation.

Due to delayed baggage some sampling equipment were missing initially and the field instruments could not be used at the site.

Source: (ASTM International 2005)

2. SITE/PROPERTY LOCATION

The base is located at Allied Warphage Limited (AWL), Refinery Road, Changamwe, Mombasa. Located at Lat. 4°00’47”S Long. 39°37’44”E. The site is secured.

3. GENERAL SITE SETTING

3.1 Current use(s) of the property

The log base was established in 2009. The premise is rented by the UN from Allied Wharfage.

Most parts of the surroundings in yard D are used for storage and handling of containers for further shipping through Mombasa harbour. There is extensive traffic of trucks and large machinery (tractors and fork- lifts) for loading of the containers on the trucks. Workshops and truck maintenance company are located within warehouses in yard A, which is the area planned to be used for extension of the present log base.

3.2 Past use(s) of the property

Yards B and C have been used for storage of several different industrial materials and components. Detailed information on all storage and activities in the area has not been available, but handling and storage of hazardous materials have been documented (e.g. in yard A) where toxic compounds containing cyanide have been stored.

3.3 Current uses of adjoining properties

In the western part of yard D, a soap manufacturing facility is located, and run off from this facility passes through the log base in the trenches (see photos in Appendix 2)

3.4 Past uses of adjoining properties

Information about the use of adjoining properties preceding current identified activities was not found.

3.5 Current or past use of the surrounding area

The site forms part of a large industrial estate within which a number of activities are undertaken.

3.6 Geologic, hydrogeologic, hydrologic, or topographic conditions

The area slopes gently to the northwest, creating a natural runoff from south to north. According to information from locals, the area was originally a swampy area and a layer of filling material (crushed coral, aka "*maram*") covers the premises. The thickness of this layer varies between 50 to 70 cm. Above this filling material, a thin layer of sand/silt is found, which provides the base for the bricklayer that covers the whole area

Groundwater is at a depth of 20 m (information provided by UNSOA from their on site water abstraction well). The groundwater is contaminated with sewage.

3.7 Facility information

In the eastern side of the log base, six warehouses/workshops cover an area of approx. 7500 sq. meters. They are made of concrete walls and floors and covered

with tin roofs (ridge roof). In the NW part of the log base two 50 × 5 m office buildings (containers, flat packs of approx. 500 sq. meters in total) are located. In addition to this, four ablution units are located adjacent to the office buildings.

3.8 Roads

The last 900m of unpaved road before reaching the guarded gate of the log base is of very poor quality. There were numerous large potholes and large stones making it difficult for both private cars and large trucks to go faster than 10 km/h. To avoid the worst obstacles the vehicles often have to go in the wrong direction of traffic, (i.e. the right-hand side of the road). This is the one and only entrance to the log base. Tin sheds housing basic services, such as cookshops, were present along parts of this unpaved road. This road then joins with a larger dirt road which after about 1 km connects to the main A109 highway into Mombasa.

3.9 Water supply

An on-site well (borehole), owned and maintained by the landlord of the site, (i.e. AWL), supplies non-potable water for the ablution and W/C units. The borehole is reported as being approximately 36 m deep with standing water from 20 m-- it is not fitted with a proper surface seal. There is currently no connection to any municipal water line. Potable water is supplied to the staff in the form of commercially packaged plastic bottles.

3.10 Sewage disposal system

Foul drainage is to a septic/sewage tank underground in yard C, installed by the UN. The septic sludge from the tank is emptied every three months, according to information from UN staff at site. It is not clear as to where the final destination for the fluid is.

Black and grey water from the ablution units and toilets is collected in this tank.

Surface water drainage is channelled to a point outside of the perimeter of the camp where it is collected in a sump and discharged to Mombasa municipal sewerage works. This process captures drainage from the Allied Wharf complex and, as a result, surface water runoff and additional illicit discharges to the surface water system are channelled through the UN log base.

3.11 Fire protection system

Fire extinguishers are located at strategic places at the site. No other own fire fighting capacity resources. Fire fighting support is received by the harbour, the refinery and a local fire fighting network.

4. INTERNAL AND EXTERNAL OBSERVATIONS

4.1 Hazardous material (HM) and petroleum products

A 'domestic supply' underground storage tank for gasoline/diesel is placed near the inner gate close to the fuel pump located just outside the gate. The underground tank, approx. 22 m^3, is around four years old and buried with its base at 4 m depth. The tank is claimed, by UNSOA site personnel, to be in good condition but has not been integrity tested and there is an absence of spill control equipment at surface fill points. The tank is connected to surface fill points supplied with an electrical pump. While there are no obvious signs of spillage of fuel there are no records to show that fuel has not been leaking. Normal operating practices for dispensing fuel are usually not undertaken with the environment in mind and such spillages are commonplace.

In one of the warehouses in yard C (warehouse 1) detergents are stored for further transportation to UN missions. The detergent is stored in 20 litre plastic cans. Approximately 10000 litres detergent were stored at the time for the visit in the warehouse. A few of the cans were leaking, and the liquid had an aromatic smell of solvents.

No evidence of any storage or handling of pesticides or herbicides was found at the site. UN staff supported that no such substances are, or have been stored or handled at the site.

Hazardous materials such as explosives or ammunition are not stored at the base.

4.2 Storage tanks

An underground storage tank for gasoline or diesel is placed near the inner gate close to the fuel pump located just outside the gate. The underground tank, approx. 22 m^3, is around four years old and buried with its base at 4 m depth.

4.3 Odours

There was no particular odour at the base in general except close to the gasoline station, workshop, and close to the soap factory. Furthermore, where there was water in trenches there was a noticeable smell of sewage. Some of the soil samples also had a distinct smell of chemicals: rubber or tar-like.

4.4 Pools of liquid

No pools of liquid were spotted at the site, except for water in some of the run-off trenches outside the warehouses. In one of these trenches being channelled along through the UN base, discharges of a liquid—believed to mainly consist of soap products and water from an adjacent soap manufacturing facility—was observed.

4.5 Drums

Outside the inner gate at the behind the entrance to the hazardous material area in yard A, a number of empty drums were stored.

Outside the inner gate, opposite to the fuelling station, rusty drums filled with asphalt/bitumen were stored and piled between the doors of warehouse in yard A and along the wall opposite the area for handling hazardous materials, as seen in Photo Appendix 6. Some of the drums were leaking their contents.

4.6 Hazardous waste (HW) and waste petroleum products

Solid waste is disposed of through contract arrangements with Allied Wharf, who take responsibility for the waste. This is then disposed of through contract with a local youth group who recover waste of economic value. Final wastes are believed to be dumped. No arrangements to segregate hazardous waste (e.g. oil filters) from non-hazardous waste was identified and therefore, there is a risk that it is polluted with hazardous substances.

4.7 Unidentified substance containers

No containers of unidentified substance were identified.

4.8 Electrical hazards

No obvious electrical hazards were observed. Principal electrical hazards exist in the form of domestic injuries caused by power disruption on office equipment (i.e. electric shock).

4.9 Radiological hazards

Radiological hazards in goods transferred at the site are not fully known.

4.10 PCBs

No electrical or hydraulic equipment likely to contain PCBs (Polychlorinated Biphenyls) were observed at the site. However, there may well be electrical substations located at the site in locations not viewed during the assessment or close to the site boundary.

4.11 Medical/biohazard waste

No medical waste was identified at the site.

4.12 Internal observations of facilities

4.12.1 Heating and cooling systems

Conditioning and some ventilation is provided in the form of split level air conditioning units – open windows and doors provide necessary air change. There are no heating units with the exception of hot water in the ablution units provided by solar thermal energy.

4.12.2 Stains and corrosion

Not assessed

4.12.3 Drains and sumps

Not assessed

4.12.4 Other

None observed

4.13 External observations

4.13.1 Pits, ponds, and lagoons

Stagnant water was present in the drainage channels on the site. No other bodies of water or other liquids that might contain hazardous materials were observed.

4.13.2 Stained soil or pavement

Other visible signs of spills were observed in the car washdown area, the re-fuelling point, and in yard A.

Spills of other substances were also observed in some locations.

4.13.3 Stressed vegetation

No signs of stressed vegetation were observed.

4.13.4 Non-hazardous solid waste

No disposal of solid waste was observed, other than that arranged for by the AWL.

4.13.5 Waste water

Waste water is directed into the surface water drainage system that passes through the site along runs oriented north/south. At the southern boundary it passes into a collection sump where it is discharged into the municipal system.

4.13.6 Wells

There is a single groundwater abstraction well on the site. This is used to provide water for ablutions. It is observed that the headworks or seal for the well is not present.

4.13.7 Septic systems

The site is serviced by a septic tank – emptied as required by AWL appointed contractors.

4.13.8 Ambient air quality

A quantitative assessment of ambient air quality has not been a part of this EBS. As the site is within a heavily used part of an industrial area in north-eastern Mombasa, traffic is high and the quality of the vehicles low, and as a result the ambient air would be expected to contain elevated levels of smog, smoke, and particles from combustion of engines. The wind direction at the time for the sampling was S-SE.

4.13.9 Noise

Noise is caused mainly by the use of heavy machinery (tractors, trucks, etc.) used to transport goods around the site and also from deliveries.

4.13.10 Electrical sources

Electrical supply will be maintained to the offices and warehouses. It is unlikely that there are any high voltage cables in the area (although this has not been confirmed). Back up generators are used in the event of a power cut.

4.13.11 Unexploded ordnance

No unexploded ordnance was discovered at the site nor would be expected to be t the site.

4.13.12 Natural resources

There are no known endangered species in the area. For further information see IA-report (ref).

4.13.13 Cultural resources

There are no known cultural or historical objects in the area.

5. ENVIRONMENTAL SAMPLING

5.1 Soil, sediment, and water investigation

In response to the observations arising from a preliminary assessment it was concluded that potential liabilities may be present as a result of activities arising from the operation of the site. These would include refuelling, maintenance, and waste disposal.

A sampling campaign was performed from August 26-29, 2010 and the methods, sampling plans, and analyses are presented in the preliminary result report (Appendix 1).

A total of thirty-eight samples were taken at the site (including three water samples and eight sediment samples). All samples were initially screened with field analysis instruments for heavy metals and volatile organic compounds (VOC) to allow prioritizing of samples to be sent to laboratory for further analysis. For sampling strategies and handling of samples see Section 5 and Appendix 1. All three water samples, three sediment samples (5, 15 and 20), and eleven soil samples (1, 9a, 9c, 10a, 11a, 11c, 12a, 12c, 13a, 13c, and 14) were sent to a laboratory for further analysis. Selected samples were sent for further laboratory analyses to Eurofins Scientific AG in Scönenwerd, Switzerland.

The following chemical compounds were analyzed by Eurofins in soil and sediment samples; Volatile hydrocarbons (VOCs), Benzene, Toluene, Ethylbenzene, o-/-m-/-p-Xylene (BTEX), Barium (Ba), Arsenic (As), Cadmium (Cd), Chromium (Cr), Cobalt (Co), Copper (Cu), Lead (Pb), Nickel (Ni), Vanadium (V), Titanium (Ti), Strontium (Sr), and Zinc (Zn). VOCs were not analyzed in the liquid samples.

The samples have been taken at a depth of 15 to 70 cm depending on the location. The bricklayer was removed and soil taken from the layers underneath. At some places the filling material was too thick to be able to sample the original soil. After sampling, the holes were refilled and the brick layer, where present, were restored. A summary of all sampling points together with the sampling protocols and EBS-checklists are presented in Appendix 1. All laboratory results are presented in Appendixes 3, 4, 5 and 6.

5.2 Environmental standards

To provide some indication of the relevance of the reported concentrations, comparisons of the results have been made against recognised national and international standards. In the case of the soil sample, results have been compared against Swedish Environmental Protection Agency (SEPA) data (SEPA 1999a).

The SEPA standards have been developed for commonly occurring toxic metals. Reference has been made to Dutch Standards regarding these metals that are a risk to plants, as well as the total oils/hydrocarbons. Currently, there are no Kenyan standards for soil-based concentrations for the range of chemicals tested.

Eleven soil, three sediment, and three liquid samples were sent to Eurofins Scientific AG for analyses (). Generally, the levels of the organic compounds analyzed were below the detection limit with one exception: sample spot 2 had1.6 mg/litre of toluene. This particular result was however below the limit value for polluted industrial area.

The laboratory results of inorganic compounds showed that the concentrations of Pb, Cu, and Zn were all high or very high above the limit value for polluted surface

water at samples 2, 16, and 19. The concentration of Cr was above the limit value for polluted surface water in sample 19, Fig 12. The concentrations of inorganic compounds in soil and sediment samples were **below** limit value for polluted industrial areas. Four sampling spots showed elevated levels of Ni, Cu, Cr, Pb, and Zn were not above limit values for polluted soil in industrial areas.

Many of the extracts from samples taken at the site had high pH-values. This indicates the presence of inorganic or organic chemicals with alkaline chemical properties.

6. DELETIONS AND DEVIATIONS

None to report.

7. FINDINGS AND CONCLUSIONS STATEMENT

According to the samples taken and analysis performed on this site, the pollution levels - compared to limit values for industrial areas – are low and are acceptable for an industrial setting such as this.

- Ground surface – the ground surface of the area consists mainly of bricks, joined together only by interlocking, thus allowing liquids to spread through the surface to the soil.
- Fuel station and car wash – there are an insufficient construction of the hard surface at the two locations; spills can easily migrate into underlying soil layers and eventually reach the ground water.

Given the broad spectrum of activities performed within the industrial estate as a whole, it is possible that pollution is present elsewhere; this has the potential to become part of the UN site as the site expands.

8. QUALIFICATION STATEMENT

The site assessments were completed by staff from FOI and UNEP.

9. REFERENCES

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Appendices

Appendix 1 – Environmental sampling for EBS-study

Appendix 2 – List of sampling spots and photos

Appendix 3 – Laboratory Results-XRF

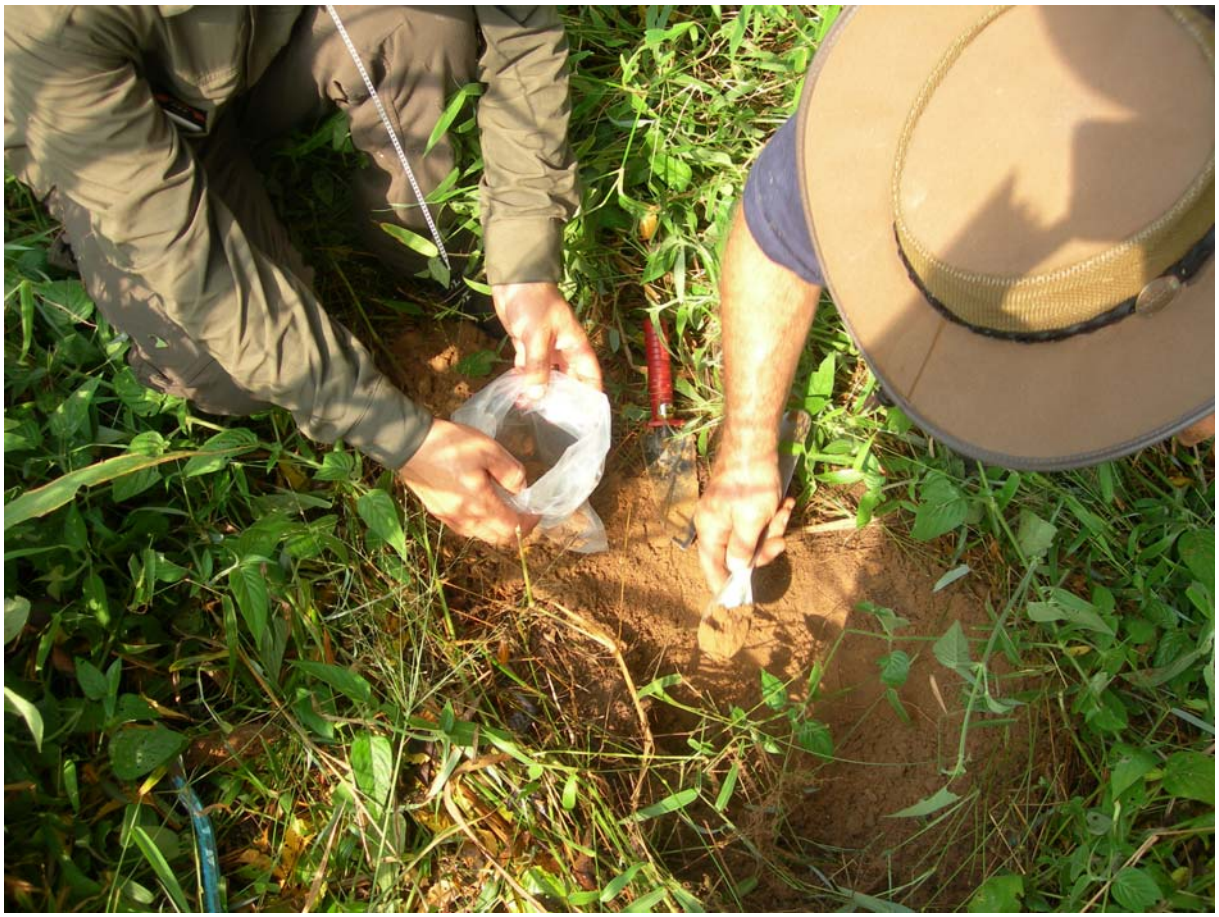
Appendix 4– Laboratory Results-soil

Appendix 5– Laboratory Results-sediments

Appendix 6– Laboratory Results-water

ENVIRONMENTAL SAMPLING FOR ENVIRONMENTAL BASELINE STUDY (EBS)

Preliminary results from sampling campaign Present UNSOA Log base and airport site, Mombasa August 26 to 29, 2010



Christina Edlund
Rune Berglind
Per Wikström

FOI,
Swedish Defence Research Agency

Content

1. Introduction

As a part of the environmental assessment to be done during planning for an eventual new location for the UNSOA Log base in Mombasa, a field investigation has been performed. As a part of a EBS (Environmental Base line Survey) included in the full Environmental Impact Assessment for Mombasa and Mogadishu of bases sampling has been performed at the two sites in Mombasa; the existing log base at Allied Wharfage Ltd and the new proposed site close to the Mombasa International airport. The aim of this EBS was to gather data about any environmental concern prior to a site being occupied, or being considered for occupation.

This report gives preliminary results from the analyses performed on samples taken at the two sites during August 26-29, 2010.

The investigation and sampling was performed by MSc. Christina Edlund, Dr. Rune Berglind and Dr. Per Wikström at the FOI, the Swedish Defence Research Agency.

Below the preliminary results from the field analyses are presented. In order to set the contamination into context; the Swedish EPA guidelines and threshold values have been used in this initial report.

2. Sampling

2.1 Present log base

As a total; 27 soil, 8 sediment and 3 water samples were taken (Figure 1). The soil samples have been analysed for heavy metals and presence of volatile organic hydrocarbons (VOCs) with portable field analysers. A toxicity test was also performed on all soil and sediment samples. A sampling plan was presented in June of 2010, after a first recce on site the sampling plan was revised according to Figure 1.
The samples have been taken at different depths depending on the characteristics of the spot, but most were taken in the top most 20 cm of the surface. At some location deeper samples were taken; e.g. from the original soil underneath the filling material (maram) at the present site (Figure 2).

No samples have been taken underneath the floorings inside the warehouses for several reasons; costs, lack of heavy machinery and mostly to avoid destroying the floors in areas and houses used in the every day work.

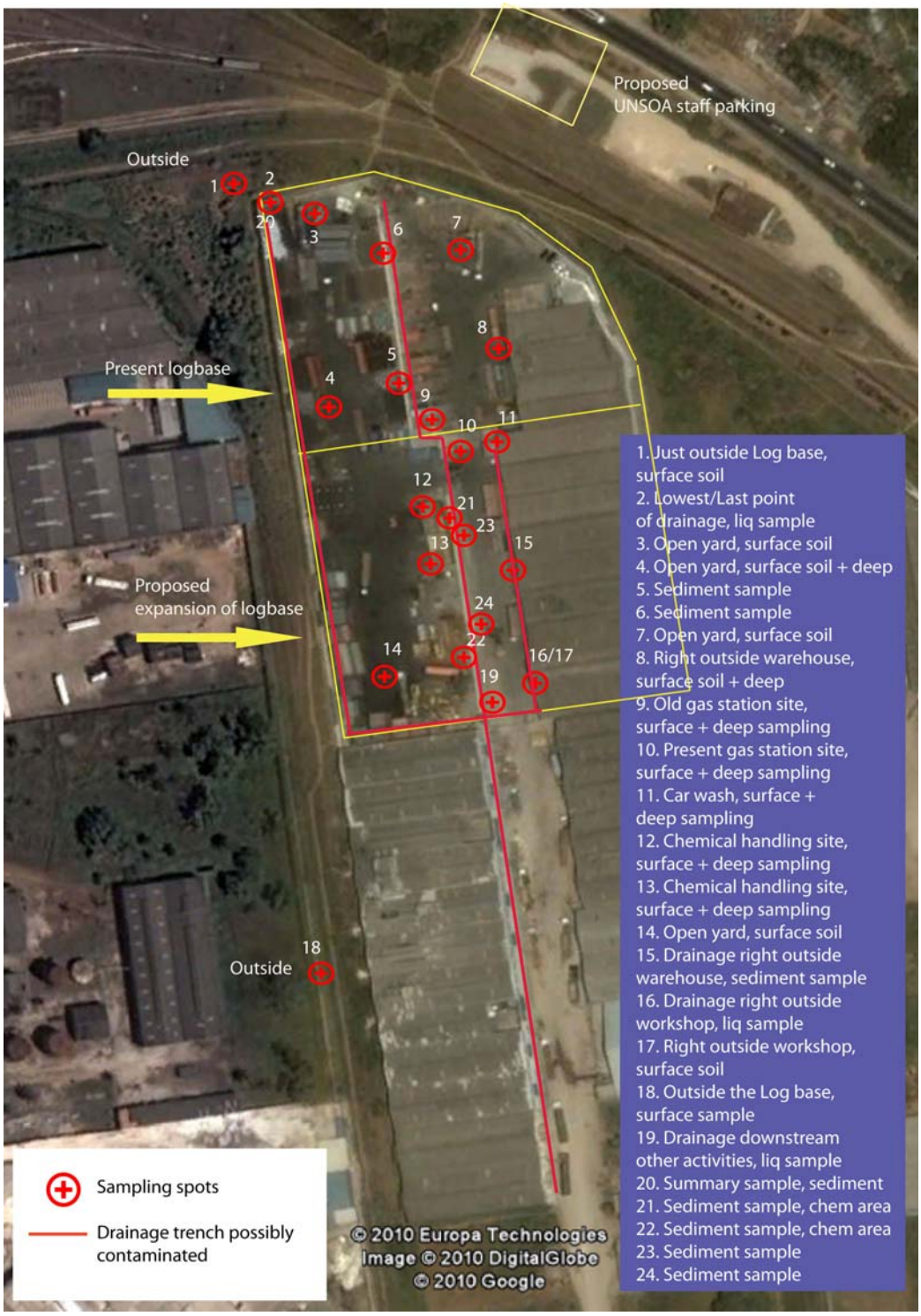


Figure 1. Sampling spots at present Log Base, 2010-08-25—26.

Figure 2. Sampling spots where samples were taken at two or three different depths.

2.1 New area, airport site

Only soil samples were taken at the new site, there were no water sources to sample. The nearby hospital have their own water supply, this was however not investigated further at this time.

A total of 28 samples were taken at 25 sites. Samples 119, 116 and 110 were taken at two depts. These locations are according to information received earlier possible sites for future fuel station, garbage collect and soak pit, see Figure 3.

Figure 3. Sampling spots at the new proposed area at the air field.

3. Methods On-site analyses

3.1 Heavy metals

Presence of heavy metals was analysed with a XRF, X-ray fluorescence detector, being able to measure the content of heavy metals in bulk samples in the field. The method is somewhat water sensitive, meaning that water interferes with some of the metals, giving an error in the case of moist samples. A laboratory test will show more detailed results, however, the XRF indicates high levels and was used as a tool for selecting samples to be sent to the laboratory for further testing.

3.2 Volatile organic hydrocarbons (VOC)

VOC are analysed with a portable photo ionisation detector (PID). All soil samples at the present site were analysed inside the sample bag (either on site or after a couple of hours). At some locations at the present site analyses were also made directly in the sample pit.

3.3 Rapid on-site toxicity system (ROTAS) (Cybersense)

All samples are analysed regarding toxicity in *Vibrio fischeri* with the ROTAS™ technology (Rapid On-site Toxicity Audit System). The test shows whether a soil sample extract is toxic to the bacteria or not. All soil and sediment samples were tested.

4. Laboratory analyses

Initially 19 samples were sent to a laboratory for further analyses. Sixteen samples were sent from the old site and three from the new site (Table 1). Duplicates of all samples, except for water samples have also been taken and brought to FOI (Sweden). If there is a need for further analyses to be performed such requirements can easily be met.

Table 1. Samples sent for analyses.

Present site	**New site**
1	110B
4B	122
5	138
9A	
9B	
10A	
11A	
11C	
12A	
12C	
13A	
13C	
14	
15	
20	
21	

5. Findings:

5.1 Present Log Base

Overall the surface of the area is made out of bricks, which are interlocked, resulting in a permeable surface, where spills can easily spread to underlying layers. Underneath the brick layer a layer of filling material is found; with a varying thickness of at least 50-70 cm. The filling material, “maram”, consisted of crushed corals, contributing to high levels of Calcium and Potassium in the samples tested. At some specific locations, such as parts of the fuel station, close to septic and fuel tank, and inside the warehouses there are concrete surfaces. These are however often cracked. At the old site for handling of chemicals an impermeable layer of bitumen or tar was found at a depth of approximately 60 cm.

On the southern side of the premises (toward the gate) lies a manufacturing facility for soap. The outlet from this facility enters the drainage system of the Log base at point 19 and runs along the western side of the premises (Figure 4).

Figure 4. Sampling points for water sampling. The outlet from the soap factory enters the area at point 19.

The area in the north eastern corner is a storage area for dormitory units, ablution units, generators etc. There are no batteries or chemicals fitted in the generators while stored at the Log Base.

5.1.1 Heavy metals

Generally there are relatively low levels of heavy metals in the soil samples, considering it

being located in an industrial area. In three of the sediment samples (6, 15 and 21) there are levels of zinc and lead that exceeds Swedish threshold values indicating polluted area.

At one location (sampling spot 8B) the soil sample showed levels close to threshold values; however not exceeding them. This sampling spot was just outside the entrance to Warehouse 1 where e.g. electronics, furniture, and detergents are and have been stored. There was a strong odour and visible leakage of detergents inside this building.

5.1.2 Volatile organic hydrocarbons (VOCs)

All soil samples have been analysed for VOC with a PID-detector, and there were generally low levels of VOC. However, the portable PID only gives an indication of VOCs present and cannot detect heavier hydrocarbons such as PAHs (polyaromatic hydrocarbons) and oils. These type of chemicals will be analyzed in laboratory tests.

5.1.3 ROTAS – On-site toxicology test

In nine sampling spots the activity of the bacteria, in the toxicity test, were affected. Many of these samples were taken at areas where chemicals have been or are handled. Further laboratory and statistical analyses will show if there are correlations between analyzed parameters and suggest the cause of the toxicity.

5.2 New area, airport site

The sampling at the new site was performed on August 27. There were heavy showers in the morning and therefore no analytical instruments were brought to and used at the field.

The site has, according to local residents living next to the site, been used for farming and was entirely cleared from bushes seven years ago. The site is now covered with bushes, up to 2 m of height at some locations. Still, some farming is done at the premises and at the time of the visit corn was grown just near the building in the middle of the site. Chickens and goats were also kept at the site.

At two locations signs were found indicating that these have been dump sites: at spot 128, near the eastern gate organic debris like branches, grass etc has been dumped. At spot number 111 shards of porcelain and glass were found approximately 10-15 cm below the surface (Figure 5).

Figure 5. Sampling spot 111 at airport site. Shards of glass and porcelain were found at approximately 10-15 cm.

5.2.1 Heavy metals

Generally only low levels of heavy metals were found at the new site. At one location, spot 134 a high reading of Cobalt (121 ppm) was shown in one of four measurements. In the other three the levels were below the instrument's level of detection.

Low levels of Arsenic were found in samples number 104, 110 and 111.

5.2.2 Volatile organic hydrocarbons (VOCs)

Five samples were analyzed for VOC; 122, 125, 135, 136 and 138. One of the sample (122) levels of VOCs, around 2 ppm, were detected. This sample is taken at the north fence adjacent to the oil deposit.

5.2.3 ROTAS – On-site toxicology test

Four samples indicated an impact of the activity of the microorganisms. Sample 104, 110, 119 and 121 were all taken in the southern part of the area.

6. Summary

During a field visit to present UNSOA Log Base and proposed new site in Mombasa between August 26 and 29, environmental sampling have been performed in order to examine the levels of possible contamination at the two sites. This field investigation is part of an EBS to be performed for the new Log Base and/or a possible expansion of the present one.

A total of 49 locations have sampled (water, sediment and soil) and initial analyses of toxicity, heavy metal and volatile hydrocarbons have been made.

7. Conclusions

No alarming levels of contaminants such as heavy metals and VOCs have been found in any of the samples from the two sites in the initial, preliminary analyses; however, some initial toxicity test indicates negative effect on microorganisms in the test model used.

Generally there were higher levels of pollution in the present site compared to the new site, which was expected when the present site is located in an industrial area. At the present site the results for heavy metal were in general higher in the sediment than in the soil samples.

All water samples have been sent to a laboratory for further analyses, and the results will be ready later.

A final report of the investigation and the EBS will be prepared by September 30, 2010.

A summary of sampling spots at the present UNSOA Lobase in Mombasa.

Spot No	**Photo**	**Comments: 2010-08-25—26, 26-28 degrees C, sunny, partly cloudy, wind speed appr 2-3 m/s (south)**
1	 	Utside wall, close to guard tower in north western corner Sample at 0-10 cm PID reading: 0,0 (in bag at hotel)
2 and 3		Water and soil sample Open space below guard tower Soil sample at 60-70 cm Filling material (maram) to appr,. 70 cm PID reading (in pit) - at 30 cm : 0,1 ppm - at 50 cm: 0,2 ppm

		
4 and 4B	  	Sampling at two depths **4A**: At 0-10 cm PID reading (in bag at site): 2,2 ppm PID reading (in pit) at: - 25 cm – 0,4 ppm - 40 cm – 0,0 ppm **4B:** Sample at 50 cm PID reading (in bag at site): 0,6-1 ppm Original soil (i.e. no filling material)

5		On the western side of wall Wet sediment Drainage from trench on the opposite side of the wall (sample 6)
6	 	On the eastern side of wall Dry sediment Drainage to trench on the opposite side of the wall (sample 5)
7		Sample at 0-10 cm Directly under bricks PID reading (in bag on site):. 0,9 ppm PID reading (in pit) at: - 30 cm: 0,0 ppm (maram – filling material)

8		At entrance to warehouse 1 (detergents) Sample at two depths **8A:** Sample at 0-10 cm (directly under bricks) PID reading (in bag on site) 0,4 ppm PID reading (in pit) at : - 20 cm 0,0 ppm **8B:** Sample at 33 cm Filling material - maram PID reading (on bag on site): - 0,3 ppm
9		Old fuel station (now guard shed) Sampling at two depths: **9A:** At 30 cm – filling material PID reading (in bag at hotel): 2,3 ppm **9B:** At 40 cm Original soil PID reading (in bag at hotel): 2,3 ppm

10	  	Current fuel station Sampling at 50 cm Filling material Strong odour of oil PID reading (in bag at hotel): 3,0 ppm
11		Car wash area Sampling at three depths Sample taken close to wall och soil surface (no bricks) **11A:** 0-5 cm PID reading (in bag at hotel) 2,4 ppm

	 	**11B:** Sampling at 45-50 cm Filling material PID reading (in bag at hotel): 2,3 ppm **11C:** Sampling at 60 cm Original (?) soil, lack (silt, clay) PID reading (in bag at hotel) 2,1 ppm
12	 	Old chem. site Sampling at three depths **12A:** Sampling at 0-30 cm Filling material PID reading (in bag at hotel): 2,3 ppm **12B:** Sampling at appr. 60 cm Tar or bitumen pieces (impermeable layer?) Smells of asphalt, bitumen, tar PID reading (in bag at hotel): 2,3 ppm **12C:** Sampling at 70-80 cm Smells of chemicals, rubber PID reading (in bag at hotel): 2,2 ppm

		
13	 	Samlpe at three depths: **13A:** 0-30 cm Smells of clay and POL PID reading (in bag at hotel): 2,1 ppm **13B:** 60 cm (tar/asphalt/bitumen) Smells of oil/arphalt PID reading (in bag at hotel) 2,0 ppm **13C:** 70 cm Luktar unket Original (?) soil
14		Sample at 0-10 cm Top soil (directly under bricks) PID reading (in bag on site): 1,5-1,6 ppm PID reading (in pit) at 22 cm: 0,3 ppm

15		
16	 	Mätte med PID inne i tunneln – inget utslag.
17		Outside truck assembly garage (non UN garage) Sampling at two sites **17:** Top soil, directly under bricks 0-10 cm PID reading (in bag on site): 0,3 ppm PID reading (in pit) at 15-20 cm: 0,0 ppm

		17B: Sampling at 34 cm Sand/filling material PID reading (in bag on site) 0,0 ppm
18		Outside wall, south west of area Appr. 25 m from wall Sample at 10-20 cm PID reading 0,0-0,1 ppm (in bag at hotel)
19		

		
20		
21		

22		Picture 1. Between sample point 21 and 22, leakage of tar/asphalt to drainage – tätskiktet från kemplattan?
23		
24		

Log base samples

Appendix 3

Results from measurements with XRF-instrument on site

All values in ppm (parts per million).
Below are mean values from two measurements.
Missing values are below limit of detection.

Sample no.	Sr	Pb	Zn	Cu	Fe	Mn	V	Ti	Cr	Sc	As	Ni
1Soil_XRF	36.5	26	51		6981	121	28.5	1369.5				
4Soil_XRF	199.5	19	57.5		14450	300.5	65.5	2601.5	65			
4BSoil_XRF	229	39	129		8047	158.5	30.5	794.5		337.5		
6Sed_XRF	261	181.5	901.5	67	25850	595	68.5	2564.5	94			
7Soil_XRF	286	21.5	128.5		10032.5	336.5	35	1657				
8Soil_XRF	258	21.5	249		17100	432	48.5	1914.5	81	209		
8BSoil_XRF	279.5	63	330	72	9031.5	179.5	38	1167		367	15	
9ASoil_XRF	202.5	17	138		7109.5	315	35	893	46	382		
9BSoil_XRF	183	19.5	120		6528	229	29.5	1001.5		280		
10ASoil_XRF	215	32	187	48	7787	295	39	1178.5	53	377		
11ASoil_XRF	158	38	285	38	12500	253	43	1513	82	211		
11BSoil_XRF	240	19	87.5		8653	276.5	39	1200.5	50	450		
11CSoil_XRF	64	16	29		3388.5	176.5	34	1166.5				
12ASoil_XRF	312.5	55			6007	176	25.5	286		676	12	
12BSoil_XRF	313				4566.5	144	34	228		808		
12CSoil_XRF	65.5				6009	205	35	1611.5				
13ASoil_XRF	401	19	31		12800	319.5	53	1775		213		
13BSoil_XRF	416		29	44	5166	237	20.5	561		412		
13CSoil_XRF	313.5				4934	180.5	32	805		446		
14Soil_XRF	221	22.5	65.5		15000	301.5	58.5	2730	66.5			
15Sed_XRF	291	135	2186	72	23767	500	65	2091				104
17Soil_XRF	227.5	21	76.5		9804.5	184.5	40.5	1374		238		
17BSoil_XRF	234.5	17	61		5941.5	140	32	959.5		286.5		
18Soil_XRF	45	15			2659.5	210	28.5	1174				
21Sed_XRF	252	85	698	65	21700	416	57	2252	74			102
23Sed_XRF	282	72.5	306.5	53	19350	512	69.5	2051.5			14	
24Sed_XRF	265	68	242	44.5	13550	344	39.5	1786.5				
Road dust	168	19	78.5		6507	144	34	1113.5				

Eurofins Scientific AG
Parkstrasse 10
Postfach
CH-5012 Schönenwerd

Telefon: +41 (0)62 858 71 00
Fax: +41 (0)62 858 71 09
www.eurofins.ch
e-mail: info@eurofins.ch

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United Nations Environment Progamme
Herr Thummarukudy
Post-Conflict & Disaster Management Branch
International Environment House-I, Room D705
1219 Châtelaine, Geneva

Fax: 022 917 80 64
Email: muralee.thummarukudy@unep.org;satu.ojaluoma@unep.

Eurofins Sample No: 10-00122728
Sample Description: Sample No 1
Soil
Sample Amount:
Remark:
Sample Entry: 31.08.2010
Start of Analysis:

Test	Result	
*Dry weight (dw)	**85.1**g/100 g	
*pH H2O	**7.7**	ISO 10390
*Measuring temperature (pH)	**21**°C	ISO 10390
Volatile Hydrocarbons MeC5-C10:		
*MeC5 - C8 included	**< 1.0**mg/kg dw	Internal Method
*> C8 - C10 included	**< 1.0**mg/kg dw	Internal Method
*Sum MeC5 - C10	**< 2.0**mg/kg dw	Internal Method
BTEX:		
*Benzene	**< 0.05**mg/kg dw	ISO 22155
*Toluene	**< 0.05**mg/kg dw	ISO 22155
*Ethylbenzene	**< 0.05**mg/kg dw	ISO 22155
*o-Xylene	**< 0.05**mg/kg dw	ISO 22155
*m-/-p-Xylene	**< 0.05**mg/kg dw	ISO 22155
*Barium (Ba)	**52.8**mg/kg dw	NF EN ISO 11885
*Arsenic (As)	**9.16**mg/kg dw	NF EN ISO 11885
*Cadmium (Cd)	**< 0.40**mg/kg dw	NF EN ISO 11885
*Chromium (Cr)	**13.3**mg/kg dw	NF EN ISO 11885
*Cobalt (Co)	**< 1.00**mg/kg dw	NF EN ISO 11885

Eurofins Scientific AG
Parkstrasse 10
Postfach
CH-5012 Schönenwerd

Telefon: +41 (0)62 858 71 00
Fax: +41 (0)62 858 71 09
www.eurofins.ch
e-mail: info@eurofins.ch

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United Nations Environment Progamme
Herr Thummarukudy
Post-Conflict & Disaster Management Branch
International Environment House-I, Room D705
1219 Châtelaine, Geneva

Fax: 022 917 80 64
Email: muralee.thummarukudy@unep.org;satu.ojaluoma@unep.

*Copper (Cu)	**9.68**mg/kg dw	NF EN ISO 11885
*Lead (Pb)	**22.7**mg/kg dw	NF EN ISO 11885
*Nickel (Ni)	**6.18**mg/kg dw	NF EN ISO 11885
*Vanadium (V)	**17.0**mg/kg dw	NF EN ISO 11885
*Titanium (Ti)	**42.5**mg/kg dw	NF EN ISO 11885
*Strontium (Sr)	**22.9**mg/kg dw	NF EN ISO 11885
*Zinc (Zn)	**47.0**mg/kg dw	NF EN ISO 11885

All used methods (if not indicated otherwise) are inside the accreditated area of Eurofins Scientific AG Switzerland. The measurement inaccuracy may be asked for on demand.

* This analysis has been performed by an accreditated Eurofins-laboratory.

TAMC = total aerobic microbial count / Gesamtanzahl aerober Mikroorganismen
TYMC = total combined yeasts/moulds count / Gesamtanzahl an Hefen und Schimmelpilzen

Kind regards
Eurofins Scientific AG
Schönenwerd, the 23.09.2010

For the Lab

Validated by Dr.Steffen Dietrich
Chemistry Manager

Eurofins Scientific AG
Parkstrasse 10
Postfach
CH-5012 Schönenwerd

Telefon: +41 (0)62 858 71 00
Fax: +41 (0)62 858 71 09
www.eurofins.ch
e-mail: info@eurofins.ch

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United Nations Environment Progamme
Herr Thummarukudy
Post-Conflict & Disaster Management Branch
International Environment House-I, Room D705
1219 Châtelaine, Geneva

Fax: 022 917 80 64
Email: muralee.thummarukudy@unep.org;satu.ojaluoma@unep.

Eurofins Sample No: 10-00122729
Sample Description: Sample No 9A Soil
Sample Amount:
Remark:
Sample Entry: 31.08.2010
Start of Analysis:

Test	Result	
*Dry weight (dw)	**89.8**g/100 g	
*pH H2O	**8.6**	ISO 10390
*Measuring temperature (pH)	**22**°C	ISO 10390
Volatile Hydrocarbons MeC5-C10:		
*MeC5 - C8 included	**< 1.0**mg/kg dw	Internal Method
*> C8 - C10 included	**< 1.0**mg/kg dw	Internal Method
*Sum MeC5 - C10	**< 2.0**mg/kg dw	Internal Method
BTEX:		
*Benzene	**< 0.05**mg/kg dw	ISO 22155
*Toluene	**< 0.05**mg/kg dw	ISO 22155
*Ethylbenzene	**< 0.05**mg/kg dw	ISO 22155
*o-Xylene	**< 0.05**mg/kg dw	ISO 22155
*m-/-p-Xylene	**< 0.05**mg/kg dw	ISO 22155
*Arsenic (As)	**3.45**mg/kg dw	NF EN ISO 11885
*Barium (Ba)	**68.7**mg/kg dw	NF EN ISO 11885
*Cobalt (Co)	**< 1.00**mg/kg dw	NF EN ISO 11885
*Chromium (Cr)	**15.5**mg/kg dw	NF EN ISO 11885
*Cadmium (Cd)	**< 0.40**mg/kg dw	NF EN ISO 11885

Eurofins Scientific AG
Parkstrasse 10
Postfach
CH-5012 Schönenwerd

Telefon: +41 (0)62 858 71 00
Fax: +41 (0)62 858 71 09
www.eurofins.ch
e-mail: info@eurofins.ch

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Herr Thummarukudy
Post-Conflict & Disaster Management Branch
International Environment House-I, Room D705
1219 Châtelaine, Geneva

Fax: 022 917 80 64
Email: muralee.thummarukudy@unep.org;satu.ojaluoma@unep.

*Lead (Pb)	**18.5**mg/kg dw	NF EN ISO 11885
*Copper (Cu)	**12.6**mg/kg dw	NF EN ISO 11885
*Nickel (Ni)	**6.77**mg/kg dw	NF EN ISO 11885
*Titanium (Ti)	**267**mg/kg dw	NF EN ISO 11885
*Strontium (Sr)	**141**mg/kg dw	NF EN ISO 11885
*Vanadium (V)	**13.4**mg/kg dw	NF EN ISO 11885
*Zinc (Zn)	**134**mg/kg dw	NF EN ISO 11885

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TYMC = total combined yeasts/moulds count / Gesamtanzahl an Hefen und Schimmelpilzen

Kind regards
Eurofins Scientific AG
Schönenwerd, the 23.09.2010

For the Lab

Validated by Dr.Steffen Dietrich
Chemistry Manager

Eurofins Scientific AG
Parkstrasse 10
Postfach
CH-5012 Schönenwerd

Telefon: +41 (0)62 858 71 00
Fax: +41 (0)62 858 71 09
www.eurofins.ch
e-mail: info@eurofins.ch

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United Nations Environment Progamme
Herr Thummarukudy
Post-Conflict & Disaster Management Branch
International Environment House-I, Room D705
1219 Châtelaine, Geneva

Fax: 022 917 80 64
Email: muralee.thummarukudy@unep.org;satu.ojaluoma@unep.

Eurofins Sample No: 10-00122730
Sample Description: Sample No 9B Soil
Sample Amount:
Remark:
Sample Entry: 31.08.2010
Start of Analysis:

Test	Result	
*Dry weight (dw)	**86.4**g/100 g	
*pH H2O	**8.1**	ISO 10390
*Measuring temperature (pH)	**20**°C	ISO 10390
Volatile Hydrocarbons MeC5-C10:		
*MeC5 - C8 included	**< 1.0**mg/kg dw	Internal Method
*> C8 - C10 included	**< 1.0**mg/kg dw	Internal Method
*Sum MeC5 - C10	**< 2.0**mg/kg dw	Internal Method
BTEX:		
*Benzene	**< 0.05**mg/kg dw	ISO 22155
*Toluene	**< 0.05**mg/kg dw	ISO 22155
*Ethylbenzene	**< 0.05**mg/kg dw	ISO 22155
*o-Xylene	**< 0.05**mg/kg dw	ISO 22155
*m-/-p-Xylene	**< 0.05**mg/kg dw	ISO 22155
*Barium (Ba)	**100**mg/kg dw	NF EN ISO 11885
*Arsenic (As)	**4.77**mg/kg dw	NF EN ISO 11885
*Cadmium (Cd)	**< 0.40**mg/kg dw	NF EN ISO 11885
*Chromium (Cr)	**18.4**mg/kg dw	NF EN ISO 11885
*Cobalt (Co)	**< 1.00**mg/kg dw	NF EN ISO 11885

Eurofins Scientific AG
Parkstrasse 10
Postfach
CH-5012 Schönenwerd

Telefon: +41 (0)62 858 71 00
Fax: +41 (0)62 858 71 09
www.eurofins.ch
e-mail: info@eurofins.ch

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United Nations Environment Progamme
Herr Thummarukudy
Post-Conflict & Disaster Management Branch
International Environment House-I, Room D705
1219 Châtelaine, Geneva

Fax: 022 917 80 64
Email: muralee.thummarukudy@unep.org;satu.ojaluoma@unep.

*Lead (Pb)	**26.7**mg/kg dw	NF EN ISO 11885
*Copper (Cu)	**23.2**mg/kg dw	NF EN ISO 11885
*Nickel (Ni)	**8.29**mg/kg dw	NF EN ISO 11885
*Titanium (Ti)	**216**mg/kg dw	NF EN ISO 11885
*Strontium (Sr)	**207**mg/kg dw	NF EN ISO 11885
*Zinc (Zn)	**141**mg/kg dw	NF EN ISO 11885
*Vanadium (V)	**16.2**mg/kg dw	NF EN ISO 11885

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TYMC = total combined yeasts/moulds count / Gesamtanzahl an Hefen und Schimmelpilzen

Kind regards
Eurofins Scientific AG
Schönenwerd, the 23.09.2010

For the Lab

Validated by Dr.Steffen Dietrich
Chemistry Manager

Eurofins Scientific AG
Parkstrasse 10
Postfach
CH-5012 Schönenwerd

Telefon: +41 (0)62 858 71 00
Fax: +41 (0)62 858 71 09
www.eurofins.ch
e-mail: info@eurofins.ch

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United Nations Environment Progamme
Herr Thummarukudy
Post-Conflict & Disaster Management Branch
International Environment House-I, Room D705
1219 Châtelaine, Geneva

Fax: 022 917 80 64
Email: muralee.thummarukudy@unep.org;satu.ojaluoma@unep.

Eurofins Sample No: 10-00122731
Sample Description: Sample No 10A
Soil
Sample Amount:
Remark:
Sample Entry: 31.08.2010
Start of Analysis:

Test	Result	
*Dry weight (dw)	**86.4**g/100 g	
*pH H2O	**8.0**	ISO 10390
*Measuring temperature (pH)	**22**°C	ISO 10390
Volatile Hydrocarbons MeC5-C10:		
*MeC5 - C8 included	**< 1.0**mg/kg dw	Internal Method
*> C8 - C10 included	**< 1.0**mg/kg dw	Internal Method
*Sum MeC5 - C10	**< 2.0**mg/kg dw	Internal Method
BTEX:		
*Benzene	**< 0.05**mg/kg dw	ISO 22155
*Toluene	**< 0.05**mg/kg dw	ISO 22155
*Ethylbenzene	**< 0.05**mg/kg dw	ISO 22155
*o-Xylene	**< 0.05**mg/kg dw	ISO 22155
*m-/-p-Xylene	**< 0.05**mg/kg dw	ISO 22155
*Arsenic (As)	**4.42**mg/kg dw	NF EN ISO 11885
*Barium (Ba)	**144**mg/kg dw	NF EN ISO 11885
*Copper (Cu)	**35.7**mg/kg dw	NF EN ISO 11885
*Cobalt (Co)	**< 1.00**mg/kg dw	NF EN ISO 11885
*Cadmium (Cd)	**0.44**mg/kg dw	NF EN ISO 11885

Eurofins Scientific AG
Parkstrasse 10
Postfach
CH-5012 Schönenwerd

Telefon: +41 (0)62 858 71 00
Fax: +41 (0)62 858 71 09
www.eurofins.ch
e-mail: info@eurofins.ch

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United Nations Environment Progamme
Herr Thummarukudy
Post-Conflict & Disaster Management Branch
International Environment House-I, Room D705
1219 Châtelaine, Geneva

Fax: 022 917 80 64
Email: muralee.thummarukudy@unep.org;satu.ojaluoma@unep.

*Chromium (Cr)	**17.6**mg/kg dw	NF EN ISO 11885
*Lead (Pb)	**37.4**mg/kg dw	NF EN ISO 11885
*Nickel (Ni)	**8.87**mg/kg dw	NF EN ISO 11885
*Titanium (Ti)	**208**mg/kg dw	NF EN ISO 11885
*Strontium (Sr)	**204**mg/kg dw	NF EN ISO 11885
*Vanadium (V)	**19.2**mg/kg dw	NF EN ISO 11885
*Zinc (Zn)	**224**mg/kg dw	NF EN ISO 11885

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Kind regards
Eurofins Scientific AG
Schönenwerd, the 23.09.2010

For the Lab

Validated by Dr.Steffen Dietrich
Chemistry Manager

Eurofins Scientific AG
Parkstrasse 10
Postfach
CH-5012 Schönenwerd

Telefon: +41 (0)62 858 71 00
Fax: +41 (0)62 858 71 09
www.eurofins.ch
e-mail: info@eurofins.ch

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United Nations Environment Progamme
Herr Thummarukudy
Post-Conflict & Disaster Management Branch
International Environment House-I, Room D705
1219 Châtelaine, Geneva

Fax: 022 917 80 64
Email: muralee.thummarukudy@unep.org;satu.ojaluoma@unep.

Eurofins Sample No: 10-00122732
Sample Description: Sample No 11A Soil
Sample Amount:
Remark:
Sample Entry: 31.08.2010
Start of Analysis:

Test	Result	
*Dry weight (dw)	**82.3**g/100 g	
*pH H2O	**8.1**	ISO 10390
*Measuring temperature (pH)	**21**°C	ISO 10390
Volatile Hydrocarbons MeC5-C10:		
*MeC5 - C8 included	**< 1.0**mg/kg dw	Internal Method
*> C8 - C10 included	**< 1.0**mg/kg dw	Internal Method
*Sum MeC5 - C10	**< 2.0**mg/kg dw	Internal Method
BTEX:		
*Benzene	**< 0.05**mg/kg dw	ISO 22155
*Toluene	**< 0.05**mg/kg dw	ISO 22155
*Ethylbenzene	**< 0.05**mg/kg dw	ISO 22155
*o-Xylene	**< 0.05**mg/kg dw	ISO 22155
*m-/-p-Xylene	**< 0.05**mg/kg dw	ISO 22155
*Arsenic (As)	**5.10**mg/kg dw	NF EN ISO 11885
*Barium (Ba)	**307**mg/kg dw	NF EN ISO 11885
*Copper (Cu)	**26.1**mg/kg dw	NF EN ISO 11885
*Cobalt (Co)	**< 1.00**mg/kg dw	NF EN ISO 11885
*Cadmium (Cd)	**0.43**mg/kg dw	NF EN ISO 11885

Eurofins Scientific AG
Parkstrasse 10
Postfach
CH-5012 Schönenwerd

Telefon: +41 (0)62 858 71 00
Fax: +41 (0)62 858 71 09
www.eurofins.ch
e-mail: info@eurofins.ch

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United Nations Environment Progamme
Herr Thummarukudy
Post-Conflict & Disaster Management Branch
International Environment House-I, Room D705
1219 Châtelaine, Geneva

Fax: 022 917 80 64
Email: muralee.thummarukudy@unep.org;satu.ojaluoma@unep.

*Chromium (Cr)	**33.7**mg/kg dw	NF EN ISO 11885
*Lead (Pb)	**51.7**mg/kg dw	NF EN ISO 11885
*Nickel (Ni)	**8.60**mg/kg dw	NF EN ISO 11885
*Titanium (Ti)	**260**mg/kg dw	NF EN ISO 11885
*Strontium (Sr)	**128**mg/kg dw	NF EN ISO 11885
*Zinc (Zn)	**244**mg/kg dw	NF EN ISO 11885
*Vanadium (V)	**29.4**mg/kg dw	NF EN ISO 11885

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TYMC = total combined yeasts/moulds count / Gesamtanzahl an Hefen und Schimmelpilzen

Kind regards
Eurofins Scientific AG
Schönenwerd, the 23.09.2010

For the Lab

Validated by Dr.Steffen Dietrich
Chemistry Manager

Eurofins Scientific AG
Parkstrasse 10
Postfach
CH-5012 Schönenwerd

Telefon: +41 (0)62 858 71 00
Fax: +41 (0)62 858 71 09
www.eurofins.ch
e-mail: info@eurofins.ch

Analytical Report No:
AR-10-TT-017805-01

United Nations Environment Progamme
Herr Thummarukudy
Post-Conflict & Disaster Management Branch
International Environment House-I, Room D705
1219 Châtelaine, Geneva

Fax: 022 917 80 64
Email: muralee.thummarukudy@unep.org;satu.ojaluoma@unep.

Eurofins Sample No: 10-00122733
Sample Description: Sample No 11C Soil
Sample Amount:
Remark:
Sample Entry: 31.08.2010
Start of Analysis:

Test	Result	
*Dry weight (dw)	**87.9**g/100 g	
*pH H2O	**7.8**	ISO 10390
*Measuring temperature (pH)	**21**°C	ISO 10390
Volatile Hydrocarbons MeC5-C10:		
*MeC5 - C8 included	**< 1.00**mg/kg dw	Internal Method
*> C8 - C10 included	**< 1.00**mg/kg dw	Internal Method
*Sum MeC5 - C10	**< 2.00**mg/kg dw	Internal Method
BTEX:		
*Benzene	**< 0.05**mg/kg dw	ISO 22155
*Toluene	**< 0.05**mg/kg dw	ISO 22155
*Ethylbenzene	**< 0.05**mg/kg dw	ISO 22155
*o-Xylene	**< 0.05**mg/kg dw	ISO 22155
*m-/-p-Xylene	**< 0.05**mg/kg dw	ISO 22155
*Arsenic (As)	**4.50**mg/kg dw	NF EN ISO 11885
*Barium (Ba)	**37.8**mg/kg dw	NF EN ISO 11885
*Copper (Cu)	**5.07**mg/kg dw	NF EN ISO 11885
*Cobalt (Co)	**< 1.00**mg/kg dw	NF EN ISO 11885
*Cadmium (Cd)	**< 0.40**mg/kg dw	NF EN ISO 11885

Eurofins Scientific AG
Parkstrasse 10
Postfach
CH-5012 Schönenwerd

Telefon: +41 (0)62 858 71 00
Fax: +41 (0)62 858 71 09
www.eurofins.ch
e-mail: info@eurofins.ch

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Herr Thummarukudy
Post-Conflict & Disaster Management Branch
International Environment House-I, Room D705
1219 Châtelaine, Geneva

Fax: 022 917 80 64
Email: muralee.thummarukudy@unep.org;satu.ojaluoma@unep.

*Chromium (Cr)	**9.70**mg/kg dw	NF EN ISO 11885
*Lead (Pb)	**14.2**mg/kg dw	NF EN ISO 11885
*Nickel (Ni)	**3.47**mg/kg dw	NF EN ISO 11885
*Titanium (Ti)	**46.4**mg/kg dw	NF EN ISO 11885
*Strontium (Sr)	**61.8**mg/kg dw	NF EN ISO 11885
*Vanadium (V)	**10.5**mg/kg dw	NF EN ISO 11885
*Zinc (Zn)	**31.1**mg/kg dw	NF EN ISO 11885

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Kind regards
Eurofins Scientific AG
Schönenwerd, the 23.09.2010

For the Lab

Validated by Dr.Steffen Dietrich
Chemistry Manager

Eurofins Scientific AG
Parkstrasse 10
Postfach
CH-5012 Schönenwerd

Telefon: +41 (0)62 858 71 00
Fax: +41 (0)62 858 71 09
www.eurofins.ch
e-mail: info@eurofins.ch

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United Nations Environment Progamme
Herr Thummarukudy
Post-Conflict & Disaster Management Branch
International Environment House-I, Room D705
1219 Châtelaine, Geneva

Fax: 022 917 80 64
Email: muralee.thummarukudy@unep.org;satu.ojaluoma@unep.

Eurofins Sample No: 10-00122734
Sample Description: Sample No 12A Soil
Sample Amount:
Remark:
Sample Entry: 31.08.2010
Start of Analysis:

Test	Result	
*Dry weight (dw)	**91.2**g/100 g	
*pH H2O	**8.5**	ISO 10390
*Measuring temperature (pH)	**21**°C	ISO 10390
Volatile Hydrocarbons MeC5-C10:		
*MeC5 - C8 included	**< 1.00**mg/kg dw	Internal Method
*> C8 - C10 included	**< 1.00**mg/kg dw	Internal Method
*Sum MeC5 - C10	**< 2.00**mg/kg dw	Internal Method
BTEX:		
*Benzene	**< 0.05**mg/kg dw	ISO 22155
*Toluene	**< 0.05**mg/kg dw	ISO 22155
*Ethylbenzene	**< 0.05**mg/kg dw	ISO 22155
*o-Xylene	**< 0.05**mg/kg dw	ISO 22155
*m-/-p-Xylene	**< 0.05**mg/kg dw	ISO 22155
*Arsenic (As)	**11.0**mg/kg dw	NF EN ISO 11885
*Barium (Ba)	**10.9**mg/kg dw	NF EN ISO 11885
*Copper (Cu)	**< 5.00**mg/kg dw	NF EN ISO 11885
*Cobalt (Co)	**< 1.00**mg/kg dw	NF EN ISO 11885
*Cadmium (Cd)	**< 0.40**mg/kg dw	NF EN ISO 11885

Eurofins Scientific AG
Parkstrasse 10
Postfach
CH-5012 Schönenwerd

Telefon: +41 (0)62 858 71 00
Fax: +41 (0)62 858 71 09
www.eurofins.ch
e-mail: info@eurofins.ch

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United Nations Environment Progamme
Herr Thummarukudy
Post-Conflict & Disaster Management Branch
International Environment House-I, Room D705
1219 Châtelaine, Geneva

Fax: 022 917 80 64
Email: muralee.thummarukudy@unep.org;satu.ojaluoma@unep.

*Chromium (Cr)	**10.1**mg/kg dw	NF EN ISO 11885
*Lead (Pb)	**< 5.00**mg/kg dw	NF EN ISO 11885
*Nickel (Ni)	**5.10**mg/kg dw	NF EN ISO 11885
*Vanadium (V)	**11.3**mg/kg dw	NF EN ISO 11885
*Titanium (Ti)	**69.1**mg/kg dw	NF EN ISO 11885
*Strontium (Sr)	**413**mg/kg dw	NF EN ISO 11885
*Zinc (Zn)	**10.4**mg/kg dw	NF EN ISO 11885

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Kind regards
Eurofins Scientific AG
Schönenwerd, the 23.09.2010

For the Lab

Validated by Dr.Steffen Dietrich
Chemistry Manager

Eurofins Scientific AG
Parkstrasse 10
Postfach
CH-5012 Schönenwerd

Telefon: +41 (0)62 858 71 00
Fax: +41 (0)62 858 71 09
www.eurofins.ch
e-mail: info@eurofins.ch

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United Nations Environment Progamme
Herr Thummarukudy
Post-Conflict & Disaster Management Branch
International Environment House-I, Room D705
1219 Châtelaine, Geneva

Fax: 022 917 80 64
Email: muralee.thummarukudy@unep.org;satu.ojaluoma@unep.

Eurofins Sample No: 10-00122735
Sample Description: Sample No 12C Soil
Sample Amount:
Remark:
Sample Entry: 31.08.2010
Start of Analysis:

Test	Result	
*Dry weight (dw)	**91.7**g/100 g	
*pH H2O	**8.3**	ISO 10390
*Measuring temperature (pH)	**22**°C	ISO 10390
Volatile Hydrocarbons MeC5-C10:		
*MeC5 - C8 included	**< 1.0**mg/kg dw	Internal Method
*> C8 - C10 included	**< 1.0**mg/kg dw	Internal Method
*Sum MeC5 - C10	**< 2.0**mg/kg dw	Internal Method
BTEX:		
*Benzene	**< 0.05**mg/kg dw	ISO 22155
*Toluene	**< 0.05**mg/kg dw	ISO 22155
*Ethylbenzene	**< 0.05**mg/kg dw	ISO 22155
*o-Xylene	**< 0.05**mg/kg dw	ISO 22155
*m-/-p-Xylene	**< 0.05**mg/kg dw	ISO 22155
*Barium (Ba)	**50.7**mg/kg dw	NF EN ISO 11885
*Arsenic (As)	**7.72**mg/kg dw	NF EN ISO 11885
*Copper (Cu)	**< 5.00**mg/kg dw	NF EN ISO 11885
*Cobalt (Co)	**< 1.00**mg/kg dw	NF EN ISO 11885
*Cadmium (Cd)	**< 0.40**mg/kg dw	NF EN ISO 11885

Eurofins Scientific AG
Parkstrasse 10
Postfach
CH-5012 Schönenwerd

Telefon: +41 (0)62 858 71 00
Fax: +41 (0)62 858 71 09
www.eurofins.ch
e-mail: info@eurofins.ch

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United Nations Environment Progamme
Herr Thummarukudy
Post-Conflict & Disaster Management Branch
International Environment House-I, Room D705
1219 Châtelaine, Geneva

Fax: 022 917 80 64
Email: muralee.thummarukudy@unep.org;satu.ojaluoma@unep.

*Chromium (Cr)	**12.3**mg/kg dw	NF EN ISO 11885
*Lead (Pb)	**9.10**mg/kg dw	NF EN ISO 11885
*Nickel (Ni)	**6.18**mg/kg dw	NF EN ISO 11885
*Titanium (Ti)	**219**mg/kg dw	NF EN ISO 11885
*Vanadium (V)	**17.1**mg/kg dw	NF EN ISO 11885
*Strontium (Sr)	**32.0**mg/kg dw	NF EN ISO 11885
*Zinc (Zn)	**21.2**mg/kg dw	NF EN ISO 11885

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Kind regards
Eurofins Scientific AG
Schönenwerd, the 23.09.2010

For the Lab

Validated by Dr.Steffen Dietrich
Chemistry Manager

Eurofins Scientific AG
Parkstrasse 10
Postfach
CH-5012 Schönenwerd

Telefon: +41 (0)62 858 71 00
Fax: +41 (0)62 858 71 09
www.eurofins.ch
e-mail: info@eurofins.ch

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Herr Thummarukudy
Post-Conflict & Disaster Management Branch
International Environment House-I, Room D705
1219 Châtelaine, Geneva

Fax: 022 917 80 64
Email: muralee.thummarukudy@unep.org;satu.ojaluoma@unep.

Eurofins Sample No: 10-00122736
Sample Description: Sample No 13A Soil
Sample Amount:
Remark:
Sample Entry: 31.08.2010
Start of Analysis:

Test	Result	
*Dry weight (dw)	**93.4**g/100 g	
*pH H2O	**9.0**	ISO 10390
*Measuring temperature (pH)	**22**°C	ISO 10390
Volatile Hydrocarbons MeC5-C10:		
*MeC5 - C8 included	**< 1.0**mg/kg dw	Internal Method
*> C8 - C10 included	**< 1.0**mg/kg dw	Internal Method
*Sum MeC5 - C10	**< 2.0**mg/kg dw	Internal Method
BTEX:		
*Benzene	**< 0.05**mg/kg dw	ISO 22155
*Toluene	**< 0.05**mg/kg dw	ISO 22155
*Ethylbenzene	**< 0.05**mg/kg dw	ISO 22155
*o-Xylene	**< 0.05**mg/kg dw	ISO 22155
*m-/-p-Xylene	**< 0.05**mg/kg dw	ISO 22155
*Arsenic (As)	**8.24**mg/kg dw	NF EN ISO 11885
*Barium (Ba)	**46.8**mg/kg dw	NF EN ISO 11885
*Copper (Cu)	**< 5.00**mg/kg dw	NF EN ISO 11885
*Cobalt (Co)	**< 1.00**mg/kg dw	NF EN ISO 11885
*Cadmium (Cd)	**< 0.40**mg/kg dw	NF EN ISO 11885

Eurofins Scientific AG
Parkstrasse 10
Postfach
CH-5012 Schönenwerd

Telefon: +41 (0)62 858 71 00
Fax: +41 (0)62 858 71 09
www.eurofins.ch
e-mail: info@eurofins.ch

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Herr Thummarukudy
Post-Conflict & Disaster Management Branch
International Environment House-I, Room D705
1219 Châtelaine, Geneva

Fax: 022 917 80 64
Email: muralee.thummarukudy@unep.org;satu.ojaluoma@unep.

*Chromium (Cr)	**21.8**mg/kg dw	NF EN ISO 11885
*Lead (Pb)	**7.01**mg/kg dw	NF EN ISO 11885
*Nickel (Ni)	**10.4**mg/kg dw	NF EN ISO 11885
*Vanadium (V)	**26.2**mg/kg dw	NF EN ISO 11885
*Titanium (Ti)	**385**mg/kg dw	NF EN ISO 11885
*Strontium (Sr)	**381**mg/kg dw	NF EN ISO 11885
*Zinc (Zn)	**31.3**mg/kg dw	NF EN ISO 11885

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Kind regards
Eurofins Scientific AG
Schönenwerd, the 23.09.2010

For the Lab

Validated by Dr.Steffen Dietrich
Chemistry Manager

Eurofins Scientific AG
Parkstrasse 10
Postfach
CH-5012 Schönenwerd

Telefon: +41 (0)62 858 71 00
Fax: +41 (0)62 858 71 09
www.eurofins.ch
e-mail: info@eurofins.ch

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United Nations Environment Progamme
Herr Thummarukudy
Post-Conflict & Disaster Management Branch
International Environment House-I, Room D705
1219 Châtelaine, Geneva

Fax: 022 917 80 64
Email: muralee.thummarukudy@unep.org;satu.ojaluoma@unep.

Eurofins Sample No: 10-00122737
Sample Description: Sample No 13C Soil
Sample Amount:
Remark:
Sample Entry: 31.08.2010
Start of Analysis:

Test	Result	
*Dry weight (dw)	**92.1**g/100 g	
*pH H2O	**8.4**	ISO 10390
*Measuring temperature (pH)	**22**°C	ISO 10390
Volatile Hydrocarbons MeC5-C10:		
*MeC5 - C8 included	**< 1.0**mg/kg dw	Internal Method
*> C8 - C10 included	**< 1.0**mg/kg dw	Internal Method
*Sum MeC5 - C10	**< 2.0**mg/kg dw	Internal Method
BTEX:		
*Benzene	**< 0.05**mg/kg dw	ISO 22155
*Toluene	**< 0.05**mg/kg dw	ISO 22155
*Ethylbenzene	**< 0.05**mg/kg dw	ISO 22155
*o-Xylene	**< 0.05**mg/kg dw	ISO 22155
*m-/-p-Xylene	**< 0.05**mg/kg dw	ISO 22155
*Barium (Ba)	**27.6**mg/kg dw	NF EN ISO 11885
*Arsenic (As)	**5.80**mg/kg dw	NF EN ISO 11885
*Chromium (Cr)	**10.1**mg/kg dw	NF EN ISO 11885
*Cadmium (Cd)	**< 0.40**mg/kg dw	NF EN ISO 11885
*Cobalt (Co)	**1.09**mg/kg dw	NF EN ISO 11885

Eurofins Scientific AG
Parkstrasse 10
Postfach
CH-5012 Schönenwerd

Telefon: +41 (0)62 858 71 00
Fax: +41 (0)62 858 71 09
www.eurofins.ch
e-mail: info@eurofins.ch

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United Nations Environment Progamme
Herr Thummarukudy
Post-Conflict & Disaster Management Branch
International Environment House-I, Room D705
1219 Châtelaine, Geneva

Fax: 022 917 80 64
Email: muralee.thummarukudy@unep.org;satu.ojaluoma@unep.

*Copper (Cu)	**5.86**mg/kg dw	NF EN ISO 11885
*Lead (Pb)	**7.07**mg/kg dw	NF EN ISO 11885
*Nickel (Ni)	**4.20**mg/kg dw	NF EN ISO 11885
*Vanadium (V)	**11.1**mg/kg dw	NF EN ISO 11885
*Titanium (Ti)	**58.6**mg/kg dw	NF EN ISO 11885
*Strontium (Sr)	**368**mg/kg dw	NF EN ISO 11885
*Zinc (Zn)	**19.3**mg/kg dw	NF EN ISO 11885

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Schönenwerd, the 23.09.2010

For the Lab

Validated by Dr.Steffen Dietrich
Chemistry Manager

Eurofins Scientific AG
Parkstrasse 10
Postfach
CH-5012 Schönenwerd

Telefon: +41 (0)62 858 71 00
Fax: +41 (0)62 858 71 09
www.eurofins.ch
e-mail: info@eurofins.ch

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United Nations Environment Progamme
Herr Thummarukudy
Post-Conflict & Disaster Management Branch
International Environment House-I, Room D705
1219 Châtelaine, Geneva

Fax: 022 917 80 64
Email: muralee.thummarukudy@unep.org;satu.ojaluoma@unep.

Eurofins Sample No: 10-00122738
Sample Description: Sample No 14 Soil
Sample Amount:
Remark:
Sample Entry: 31.08.2010
Start of Analysis:

Test	Result	
*Dry weight (dw)	**94.2**g/100 g	
*pH H2O	**10.1**	ISO 10390
*Measuring temperature (pH)	**22**°C	ISO 10390
Volatile Hydrocarbons MeC5-C10:		
*MeC5 - C8 included	**< 1.0**mg/kg dw	Internal Method
*> C8 - C10 included	**< 1.0**mg/kg dw	Internal Method
*Sum MeC5 - C10	**< 2.0**mg/kg dw	Internal Method
BTEX:		
*Benzene	**< 0.05**mg/kg dw	ISO 22155
*Toluene	**< 0.05**mg/kg dw	ISO 22155
*Ethylbenzene	**< 0.05**mg/kg dw	ISO 22155
*o-Xylene	**< 0.05**mg/kg dw	ISO 22155
*m-/-p-Xylene	**< 0.05**mg/kg dw	ISO 22155
*Barium (Ba)	**88.4**mg/kg dw	NF EN ISO 11885
*Arsenic (As)	**2.78**mg/kg dw	NF EN ISO 11885
*Copper (Cu)	**8.95**mg/kg dw	NF EN ISO 11885
*Cobalt (Co)	**< 1.00**mg/kg dw	NF EN ISO 11885
*Cadmium (Cd)	**< 0.40**mg/kg dw	NF EN ISO 11885

Eurofins Scientific AG
Parkstrasse 10
Postfach
CH-5012 Schönenwerd

Telefon: +41 (0)62 858 71 00
Fax: +41 (0)62 858 71 09
www.eurofins.ch
e-mail: info@eurofins.ch

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United Nations Environment Progamme
Herr Thummarukudy
Post-Conflict & Disaster Management Branch
International Environment House-I, Room D705
1219 Châtelaine, Geneva

Fax: 022 917 80 64
Email: muralee.thummarukudy@unep.org;satu.ojaluoma@unep.

*Chromium (Cr)	**27.4**mg/kg dw	NF EN ISO 11885
*Lead (Pb)	**10.2**mg/kg dw	NF EN ISO 11885
*Nickel (Ni)	**13.4**mg/kg dw	NF EN ISO 11885
*Vanadium (V)	**35.5**mg/kg dw	NF EN ISO 11885
*Titanium (Ti)	**687**mg/kg dw	NF EN ISO 11885
*Strontium (Sr)	**93.2**mg/kg dw	NF EN ISO 11885
*Zinc (Zn)	**67.5**mg/kg dw	NF EN ISO 11885

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Kind regards
Eurofins Scientific AG
Schönenwerd, the 23.09.2010

For the Lab

Validated by Dr.Steffen Dietrich
Chemistry Manager

Eurofins Scientific AG
Parkstrasse 10
Postfach
CH-5012 Schönenwerd

Telefon: +41 (0)62 858 71 00
Fax: +41 (0)62 858 71 09
www.eurofins.ch
e-mail: info@eurofins.ch

Analytical Report No:
AR-10-TT-017742-01

United Nations Environment Progamme
Herr Thummarukudy
Post-Conflict & Disaster Management Branch
International Environment House-I, Room D705
1219 Châtelaine, Geneva

Fax: 022 917 80 64
Email: muralee.thummarukudy@unep.org;satu.ojaluoma@unep.

Eurofins Sample No: 10-00122742
Sample Description: Sample No 5 Sediment
Sample Amount:
Remark:
Sample Entry: 08.09.2010
Start of Analysis:

Test	Result	
*Dry weight (dw)	**77.2**g/100 g	
*pH H2O	**8.5**	ISO 10390
*Measuring temperature (pH)	**21**°C	ISO 10390
Volatile Hydrocarbons MeC5-C10:		
*MeC5 - C8 included	**< 1.7**mg/kg dw	Internal Method
*> C8 - C10 included	**< 1.7**mg/kg dw	Internal Method
*Sum MeC5 - C10	**< 3.4**mg/kg dw	Internal Method
BTEX:		
*Benzene	**< 0.05**mg/kg dw	ISO 22155
*Toluene	**< 0.05**mg/kg dw	ISO 22155
*Ethylbenzene	**< 0.05**mg/kg dw	ISO 22155
*o-Xylene	**< 0.05**mg/kg dw	ISO 22155
*m-/-p-Xylene	**< 0.05**mg/kg dw	ISO 22155
*Vanadium (V)	**17.8**mg/kg dw	NF EN ISO 11885
*Titanium (Ti)	**329**mg/kg dw	NF EN ISO 11885
*Strontium (Sr)	**284**mg/kg dw	NF EN ISO 11885
*Lead (Pb)	**25.5**mg/kg dw	NF EN ISO 11885
*Cobalt (Co)	**< 1.00**mg/kg dw	NF EN ISO 11885

Eurofins Scientific AG
Parkstrasse 10
Postfach
CH-5012 Schönenwerd

Telefon: +41 (0)62 858 71 00
Fax: +41 (0)62 858 71 09
www.eurofins.ch
e-mail: info@eurofins.ch

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United Nations Environment Progamme
Herr Thummarukudy
Post-Conflict & Disaster Management Branch
International Environment House-I, Room D705
1219 Châtelaine, Geneva

Fax: 022 917 80 64
Email: muralee.thummarukudy@unep.org;satu.ojaluoma@unep.

*Copper (Cu)	**21.9**mg/kg dw	NF EN ISO 11885
*Cadmium (Cd)	**< 0.40**mg/kg dw	NF EN ISO 11885
*Chromium (Cr)	**21.6**mg/kg dw	NF EN ISO 11885
*Zinc (Zn)	**239**mg/kg dw	NF EN ISO 11885
*Barium (Ba)	**132**mg/kg dw	NF EN ISO 11885
*Arsenic (As)	**3.05**mg/kg dw	NF EN ISO 11885
*Nickel (Ni)	**9.60**mg/kg dw	NF EN ISO 11885

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TYMC = total combined yeasts/moulds count / Gesamtanzahl an Hefen und Schimmelpilzen

Kind regards
Eurofins Scientific AG
Schönenwerd, the 23.09.2010

For the Lab

Validated by Dr.Steffen Dietrich
Chemistry Manager

Eurofins Scientific AG
Parkstrasse 10
Postfach
CH-5012 Schönenwerd

Telefon: +41 (0)62 858 71 00
Fax: +41 (0)62 858 71 09
www.eurofins.ch
e-mail: info@eurofins.ch

Analytical Report No:
AR-10-TT-017742-01

United Nations Environment Progamme
Herr Thummarukudy
Post-Conflict & Disaster Management Branch
International Environment House-I, Room D705
1219 Châtelaine, Geneva

Fax: 022 917 80 64
Email: muralee.thummarukudy@unep.org;satu.ojaluoma@unep.

Eurofins Sample No: 10-00122743
Sample Description: Sample No 15 Sediment
Sample Amount:
Remark:
Sample Entry: 08.09.2010
Start of Analysis:

Test	Result	
*Dry weight (dw)	**97.4**g/100 g	
*pH H2O	**8.3**	ISO 10390
*Measuring temperature (pH)	**21**°C	ISO 10390
Volatile Hydrocarbons MeC5-C10:		
*MeC5 - C8 included	**< 1.0**mg/kg dw	Internal Method
*> C8 - C10 included	**< 1.0**mg/kg dw	Internal Method
*Sum MeC5 - C10	**< 2.0**mg/kg dw	Internal Method
BTEX:		
*Benzene	**< 0.05**mg/kg dw	ISO 22155
*Toluene	**< 0.05**mg/kg dw	ISO 22155
*Ethylbenzene	**< 0.05**mg/kg dw	ISO 22155
*o-Xylene	**< 0.05**mg/kg dw	ISO 22155
*m-/-p-Xylene	**< 0.05**mg/kg dw	ISO 22155
*Arsenic (As)	**8.28**mg/kg dw	NF EN ISO 11885
*Barium (Ba)	**515**mg/kg dw	NF EN ISO 11885
*Cadmium (Cd)	**0.46**mg/kg dw	NF EN ISO 11885
*Cobalt (Co)	**< 1.00**mg/kg dw	NF EN ISO 11885
*Chromium (Cr)	**35.5**mg/kg dw	NF EN ISO 11885

Eurofins Scientific AG
Parkstrasse 10
Postfach
CH-5012 Schönenwerd

Telefon: +41 (0)62 858 71 00
Fax: +41 (0)62 858 71 09
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e-mail: info@eurofins.ch

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Herr Thummarukudy
Post-Conflict & Disaster Management Branch
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Fax: 022 917 80 64
Email: muralee.thummarukudy@unep.org;satu.ojaluoma@unep.

*Copper (Cu)	**73.5**mg/kg dw	NF EN ISO 11885
*Lead (Pb)	**86.9**mg/kg dw	NF EN ISO 11885
*Strontium (Sr)	**219**mg/kg dw	NF EN ISO 11885
*Titanium (Ti)	**289**mg/kg dw	NF EN ISO 11885
*Vanadium (V)	**23.8**mg/kg dw	NF EN ISO 11885
*Zinc (Zn)	**724**mg/kg dw	NF EN ISO 11885
*Nickel (Ni)	**18.5**mg/kg dw	NF EN ISO 11885

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TYMC = total combined yeasts/moulds count / Gesamtanzahl an Hefen und Schimmelpilzen

Kind regards
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Schönenwerd, the 23.09.2010

For the Lab

Validated by Dr.Steffen Dietrich
Chemistry Manager

Eurofins Scientific AG
Parkstrasse 10
Postfach
CH-5012 Schönenwerd

Telefon: +41 (0)62 858 71 00
Fax: +41 (0)62 858 71 09
www.eurofins.ch
e-mail: info@eurofins.ch

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Herr Thummarukudy
Post-Conflict & Disaster Management Branch
International Environment House-I, Room D705
1219 Châtelaine, Geneva

Fax: 022 917 80 64
Email: muralee.thummarukudy@unep.org;satu.ojaluoma@unep.

Eurofins Sample No: 10-00122744
Sample Description: Sample No 20 Sediment
Sample Amount:
Remark:
Sample Entry: 08.09.2010
Start of Analysis:

Test	Result	
*Dry weight (dw)		
*pH H2O	**9.5**	ISO 10390
*Measuring temperature (pH)	**21**°C	ISO 10390
Volatile Hydrocarbons MeC5-C10:		
*MeC5 - C8 included	**< 2.5**mg/kg dw	Internal Method
*> C8 - C10 included	**< 2.5**mg/kg dw	Internal Method
*Sum MeC5 - C10	**< 5.0**mg/kg dw	Internal Method
BTEX:		
*Benzene	**< 0.05**mg/kg dw	ISO 22155
*Toluene	**< 0.07**mg/kg dw	ISO 22155
*Ethylbenzene	**< 0.07**mg/kg dw	ISO 22155
*o-Xylene	**< 0.07**mg/kg dw	ISO 22155
*m-/-p-Xylene	**< 0.07**mg/kg dw	ISO 22155
*Cadmium (Cd)	**< 0.40**mg/kg dw	NF EN ISO 11885
*Barium (Ba)	**283**mg/kg dw	NF EN ISO 11885
*Arsenic (As)	**4.92**mg/kg dw	NF EN ISO 11885
*Lead (Pb)	**73.2**mg/kg dw	NF EN ISO 11885
*Copper (Cu)	**42.4**mg/kg dw	NF EN ISO 11885

Eurofins Scientific AG
Parkstrasse 10
Postfach
CH-5012 Schönenwerd

Telefon: +41 (0)62 858 71 00
Fax: +41 (0)62 858 71 09
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e-mail: info@eurofins.ch

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Herr Thummarukudy
Post-Conflict & Disaster Management Branch
International Environment House-I, Room D705
1219 Châtelaine, Geneva

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Email: muralee.thummarukudy@unep.org;satu.ojaluoma@unep.

*Chromium (Cr)	**48.0**mg/kg dw	NF EN ISO 11885
*Cobalt (Co)	**< 1.00**mg/kg dw	NF EN ISO 11885
*Vanadium (V)	**21.6**mg/kg dw	NF EN ISO 11885
*Titanium (Ti)	**331**mg/kg dw	NF EN ISO 11885
*Strontium (Sr)	**235**mg/kg dw	NF EN ISO 11885
*Zinc (Zn)	**382**mg/kg dw	NF EN ISO 11885
*Nickel (Ni)	**20.7**mg/kg dw	NF EN ISO 11885

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Kind regards
Eurofins Scientific AG
Schönenwerd, the 23.09.2010

For the Lab

Validated by Dr.Steffen Dietrich
Chemistry Manager

Eurofins Scientific AG
Parkstrasse 10
Postfach
CH-5012 Schönenwerd

Telefon: +41 (0)62 858 71 00
Fax: +41 (0)62 858 71 09
www.eurofins.ch
e-mail: info@eurofins.ch

Analytical Report No:
AR-10-TT-017784-01

United Nations Environment Progamme
Herr Thummarukudy
Post-Conflict & Disaster Management Branch
International Environment House-I, Room D705
1219 Châtelaine, Geneva

Fax: 022 917 80 64
Email: muralee.thummarukudy@unep.org;satu.ojaluoma@unep.

Eurofins Sample No: 10-00122745
Sample Description: Sample No 2 Water
Sample Amount:
Remark:
Sample Entry: 08.09.2010
Start of Analysis:

Test	Result	
*pH	**11.0**	NF T 90-008
*Measuring temperature (pH)	**19**°C	NF T 90-008
BTEX:		
*Benzene	**< 0.5**µg/l	ISO 11423-1 (BTEX)
*Toluene	**1.6**µg/l	ISO 11423-1 (BTEX)
*Ethylbenzene	**< 1**µg/l	ISO 11423-1 (BTEX)
*o-Xylene	**< 1**µg/l	ISO 11423-1 (BTEX)
*Xylene (meta-, para-)	**< 1**µg/l	ISO 11423-1 (BTEX)
*Arsenic (As)	**< 0.01**mg/l	EN ISO 17294-2 mod.
*Cadmium (Cd)	**< 0.01**mg/l	EN ISO 17294-2 mod.
*Chromium (Cr)	**0.01**mg/l	EN ISO 17294-2 mod.
*Copper (Cu)	**0.04**mg/l	EN ISO 17294-2 mod.
*Lead (Pb)	**0.02**mg/l	EN ISO 17294-2 mod.
*Nickel (Ni)	**0.01**mg/l	EN ISO 17294-2 mod.
*Zinc (Zn)	**0.11**mg/l	EN ISO 17294-2 mod.
*Barium (Ba)	**45.1**µg/l	EN ISO 17294-2 mod.
*Vanadium (V)	**142**µg/l	EN ISO 17294-2 mod.
*Strontium (Sr)	**211**µg/l	EN ISO 17294-2 mod.
*Titanium (Ti)	**245**µg/l	EN ISO 17294-2 mod.

Eurofins Scientific AG
Parkstrasse 10
Postfach
CH-5012 Schönenwerd

Telefon: +41 (0)62 858 71 00
Fax: +41 (0)62 858 71 09
www.eurofins.ch
e-mail: info@eurofins.ch

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United Nations Environment Progamme
Herr Thummarukudy
Post-Conflict & Disaster Management Branch
International Environment House-I, Room D705
1219 Châtelaine, Geneva

Fax: 022 917 80 64
Email: muralee.thummarukudy@unep.org;satu.ojaluoma@unep.

*Cobalt (Co)	**< 0.40**µg/l	EN ISO 17294-2 mod.

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TYMC = total combined yeasts/moulds count / Gesamtanzahl an Hefen und Schimmelpilzen

Kind regards
Eurofins Scientific AG
Schönenwerd, the 23.09.2010

For the Lab

Validated by Dr.Steffen Dietrich
Chemistry Manager

Eurofins Scientific AG
Parkstrasse 10
Postfach
CH-5012 Schönenwerd

Telefon: +41 (0)62 858 71 00
Fax: +41 (0)62 858 71 09
www.eurofins.ch
e-mail: info@eurofins.ch

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Herr Thummarukudy
Post-Conflict & Disaster Management Branch
International Environment House-I, Room D705
1219 Châtelaine, Geneva

Fax: 022 917 80 64
Email: muralee.thummarukudy@unep.org;satu.ojaluoma@unep.

Eurofins Sample No: 10-00122746
Sample Description: Sample No 16 Water
Sample Amount:
Remark:
Sample Entry: 08.09.2010
Start of Analysis:

Test	Result	
*pH	**8.05**	NF T 90-008
*Measuring temperature (pH)	**19**°C	NF EN ISO 15587-2
BTEX:		
*Benzene	**< 5**µg/l	ISO 11423-1 (BTEX)
*Toluene	**< 10**µg/l	ISO 11423-1 (BTEX)
*o-Xylene	**< 10**µg/l	ISO 11423-1 (BTEX)
*Ethylbenzene	**< 10**µg/l	ISO 11423-1 (BTEX)
*Xylene (meta-, para-)	**< 10**µg/l	ISO 11423-1 (BTEX)
*Arsenic (As)	**< 0.01**mg/l	EN ISO 17294-2 mod.
*Cadmium (Cd)	**< 0.01**mg/l	EN ISO 17294-2 mod.
*Chromium (Cr)	**0.01**mg/l	EN ISO 17294-2 mod.
*Copper (Cu)	**0.04**mg/l	EN ISO 17294-2 mod.
*Lead (Pb)	**0.02**mg/l	EN ISO 17294-2 mod.
*Nickel (Ni)	**0.02**mg/l	EN ISO 17294-2 mod.
*Zinc (Zn)	**0.16**mg/l	EN ISO 17294-2 mod.
*Barium (Ba)	**99.6**µg/l	EN ISO 17294-2 mod.
*Vanadium (V)	**15.3**µg/l	EN ISO 17294-2 mod.
*Strontium (Sr)	**637**µg/l	EN ISO 17294-2 mod.
*Titanium (Ti)	**626**µg/l	EN ISO 17294-2 mod.

Eurofins Scientific AG
Parkstrasse 10
Postfach
CH-5012 Schönenwerd

Telefon: +41 (0)62 858 71 00
Fax: +41 (0)62 858 71 09
www.eurofins.ch
e-mail: info@eurofins.ch

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Herr Thummarukudy
Post-Conflict & Disaster Management Branch
International Environment House-I, Room D705
1219 Châtelaine, Geneva

Fax: 022 917 80 64
Email: muralee.thummarukudy@unep.org;satu.ojaluoma@unep.

*Cobalt (Co)	**< 0.40**µg/l	EN ISO 17294-2 mod.

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Kind regards
Eurofins Scientific AG
Schönenwerd, the 23.09.2010

For the Lab

Validated by Dr.Steffen Dietrich
Chemistry Manager

Eurofins Scientific AG
Parkstrasse 10
Postfach
CH-5012 Schönenwerd

Telefon: +41 (0)62 858 71 00
Fax: +41 (0)62 858 71 09
www.eurofins.ch
e-mail: info@eurofins.ch

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Herr Thummarukudy
Post-Conflict & Disaster Management Branch
International Environment House-I, Room D705
1219 Châtelaine, Geneva

Fax: 022 917 80 64
Email: muralee.thummarukudy@unep.org;satu.ojaluoma@unep.

Eurofins Sample No: 10-00122747
Sample Description: Sample No 19 Water
Sample Amount:
Remark:
Sample Entry: 08.09.2010
Start of Analysis:

Test	Result	
*pH	**6.75**	NF T 90-008
*Measuring temperature (pH)	**20**°C	NF EN ISO 15587-2
BTEX:		
*Benzene	**< 5**µg/l	ISO 11423-1 (BTEX)
*Toluene	**< 10**µg/l	ISO 11423-1 (BTEX)
*Ethylbenzene	**< 10**µg/l	ISO 11423-1 (BTEX)
*o-Xylene	**< 10**µg/l	ISO 11423-1 (BTEX)
*Xylene (meta-, para-)	**< 10**µg/l	ISO 11423-1 (BTEX)
*Arsenic (As)	**< 0.01**mg/l	EN ISO 17294-2 mod.
*Cadmium (Cd)	**< 0.01**mg/l	EN ISO 17294-2 mod.
*Chromium (Cr)	**0.15**mg/l	EN ISO 17294-2 mod.
*Copper (Cu)	**0.16**mg/l	EN ISO 17294-2 mod.
*Lead (Pb)	**0.22**mg/l	EN ISO 17294-2 mod.
*Nickel (Ni)	**0.09**mg/l	EN ISO 17294-2 mod.
*Zinc (Zn)	**1.66**mg/l	EN ISO 17294-2 mod.
*Barium (Ba)	**970**µg/l	EN ISO 17294-2 mod.
*Vanadium (V)	**105**µg/l	EN ISO 17294-2 mod.
*Titanium (Ti)	**2 160**µg/l	EN ISO 17294-2 mod.
*Strontium (Sr)	**2 220**µg/l	EN ISO 17294-2 mod.

Eurofins Scientific AG
Parkstrasse 10
Postfach
CH-5012 Schönenwerd

Telefon: +41 (0)62 858 71 00
Fax: +41 (0)62 858 71 09
www.eurofins.ch
e-mail: info@eurofins.ch

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Fax: 022 917 80 64
Email: muralee.thummarukudy@unep.org;satu.ojaluoma@unep.

*Cobalt (Co)	**4.61** µg/l	EN ISO 17294-2 mod.

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Kind regards
Eurofins Scientific AG
Schönenwerd, the 23.09.2010

For the Lab

Validated by Dr.Steffen Dietrich
Chemistry Manager

More technical information available at:
http://www.unep.org/disastersandconflicts/
or: postconflict@unep.org


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