SITE 13: AKOUÉDO 3

ENVIRONMENTAL AUDIT OF THE SITES IMPACTED BY THE "PROBO KOALA" TOXIC WASTE DUMPING IN ABIDJAN, CÔTE D'IVOIRE

This series of fact sheets was prepared as part of UN Environment's environmental audit of the sites impacted by the "Probo Koala" toxic waste dumping in Abidjan, Côte d'Ivoire. The fact sheets provide complete analysis results, observations and the recommendations for each of the sampling sites. They should be read in conjunction with the full assessment report, available at: www.unep.org/CotedIvoire

SITE 13: AKOUÉDO 3

Site Description

Site name: Akouédo 3
UN Environment site reference no:13

SITE 13: AKOUÉDO 3

Spill History

This spill site is the third within Abidjan's municipal waste disposal site at Akouédo. It is located in a low-lying depression close to the walled eastern boundary of the site. Wastes from the Probo Koala were not actually dumped here; rather, they flowed downstream from Site 11 nearby – approximately 200 m to the west. It is reported that during clean-up operations by Trédi in 2006-2007, contaminated materials were excavated and treated on site.

Approach

Two surface (0-20 cm) soil samples were taken near the concrete perimeter wall where the spilled material flowed to from Site 11 to the west.

In addition, two surface water samples were collected from a pond, and one sample of comestible vegetation (gombo/okra) was taken from a plant growing at the site.

Assessment Criteria

Based on the different analyses of the chemical composition of the samples taken onboard the Probo Koala in 2006, as well as those undertaken on samples collected on the dumping sites, UN Environment considered the following groups as the key contaminants of interest for the audit:

- Petroleum hydrocarbons;
- Sulfur compounds; and
- Heavy metals.

The speciation of contaminants to be analyzed within the above three groups was primarily determined by what was present in the Probo Koala waste as well as the environmental standards set by the Government of Côte d'Ivoire for clean-up. In addition, the impact of high levels of sodium hydroxide was measured through the pH value of the soil.

The results obtained from the analyses of **soil** samples were screened according to the following process:

1. Findings were first compared with relevant national standards. In this case, results for soil from all the sites where Probo Koala wastes were dumped and which had undergone remediation were compared with the environmental standards set by the Government of Côte d'Ivoire for clean-up operations conducted by Biogénie at Alépé. If the values obtained were lower than the standards set by the Government, UN Environment considered that no additional clean-up intervention was necessary on the site.

2. If laboratory results for a given parameter showed values exceeding the clean-up standards set by the Government or contractor, results were then compared with the internationally recognized Dutch soil remediation standards (intervention values) to see if further immediate action was needed from an environmental point of view. Dutch standards have been in existence for over 30 years and are used as a basis for contaminated site assessment and clean-up in many parts of the world, when local standards are not available. For most parameters of analysis, however, the Government's clean-up standard was more stringent than the Dutch values.

3. Results were also compared with the control sites to see if the observed pollution was also present in the background.

SITE 13: AKOUÉDO 3

It was not possible to compare **surface water** results, however, as Côte d'Ivoire does not have a national standard for surface water quality, and surface water was not sampled at any of the control sites.

Fruit and vegetable samples were tested using similar protocols as those used for analysis of soil and water samples. In the absence of national food quality standards, the European Commission's maximum levels of certain contaminants in food stuffs (EC regulation 1881/2006) are used for comparison. It should be noted that as it was found that there were interferences from naturally occurring substances with the hydrocarbon analyses, the analytical results relating to hydrocarbons were discarded.

Laboratory Analysis Findings

Soil Parameters (mg/kg)	Site 13 Akouédo 3		Government standard (mg/kg)
	0-20 cm	0-20 cm	
Total Hy C5-C44	12.2	41.3	1,000
Benzene	< 0.009	< 0.009	1
Ethylbenzene	< 0.003	< 0.003	25
Toluene	< 0.002	< 0.002	5
Xylene	< 0.009	< 0.009	5
Total sulfur (%)	< 0.02	0.0211	10
Pb	20	230	400
Cd	0.16	2	20
As	31	7.1	37
Cr	85	54	130
Ni	7.5	29	140
Co	1.5	5.9	240
Hg	0.074	0.540	7
Cu	5.2	120	190
Zn	36	810	9,000
pH	5.63	7.52	

SITE 13: AKOUÉDO 3

Surface water Parameters (µg/l)	Site 13 Akouédo 3	
	Pond	Pond
Total Hy C5-35	< 10	130
Benzene	< 7	< 7
Ethylbenzene	< 5	< 5
Toluene	< 4	< 4
Xylene	< 11	< 11
Free sulfur	< 50	< 50
Pb	100	0.69
Cd	2.7	< 0.25
As	4.3	1.2
Cr	17	0.94
Ni	28	10
Co	7.6	3
Hg	4	< 0.25
Cu	130	13
Zn	660	16

Fruit and vegetable Parameters (mg/kg)	Site 13 Akouédo 3	Control site 21 Agboville	EC regulation (mg/kg)
	Gombo/okra	Pomegranate	
Total sulfur (%)	0.0583	0.0547	
PAH	< 0.118	< 0.118	
Pb	< 0.7	< 0.7	0.1
Cd	0.0825	< 0.02	0.1
As	< 0.6	< 0.6	
Cr	2.41	1.62	
Ni	0.797	0.82	
Co	0.143	0.149	
Hg	< 0.14	< 0.14	
Cu	8.88	3.85	
Zn	76.5	22.9	

SITE 13: AKOUÉDO 3

Conclusions and Recommendations

The laboratory results show that the current concentrations of the contaminants of concern in soil are all below the standards set by the Government of Côte d'Ivoire for clean-up. Likewise, hydrocarbon levels in the sample analysed are well below Dutch intervention values. Furthermore, the pH values are not in the caustic range (9 or above), demonstrating that the impact of the disposal of caustic substances can no longer be detected. No further action is therefore needed on this site to remediate the soil impacts of the 2006 toxic waste dumping from the Probo Koala.

Surface water quality analysis shows heavy metal pollution in samples taken at the site, which is to be expected in a municipal waste disposal site. To address this, a leachate monitoring plan should be made for the Akouédo municipal waste disposal site, covering its operational lifecycle, including decommissioning.

Based on the fruit and vegetable results, the following observations can be made:

- All samples, including the pomegranate sample from Control Site 21 at Agboville, show the presence of various analytes and heavy metals. Fruits and vegetables naturally accumulate heavy metals from the soil. As most of the heavy metals are essential to human health in small quantities, their uptake through fruits and vegetables is not considered to be a risk.

- The EC standard for lead is below the detection limit of the laboratory analyses. However, considering that all samples, including control samples, show comparable heavy metal values, these results are not considered to warrant further follow up.

Site Photos

Source: UN Environment

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