

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

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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](http://www.unep.org/CotedIvoire)

# SITE 3: VRIDI CANAL 2 (PETROCI)

## Site Description

Site name: Vridi Canal 2 (Petroci)  
UN Environment site reference no: 3



## Spill History

The site is located along the same road as Site 2, within the Vridi Canal industrial zone, on grounds owned by the Ivorian national oil company, Petroci. The site of interest represents the location at which the pipe connected to the drain into which Probo Koala wastes were dumped at Site 2 intersects with a concreted canal flowing to the lagoon. The pipework and canal were reportedly remediated by Trédi in 2006-2007, and continue to carry drainage to the lagoon.

## Approach

One air sample, one groundwater sample and one surface water sample were collected at this site. As the pipe and canal were concreted, no soil samples were retrieved from this location.

## Assessment Criteria

Three key sets of parameters were analyzed for groundwater samples, which together would constitute a theoretical “fingerprint” of the Probo Koala wastes: (i) sulfur; (ii) phenols; and (iii) hydrocarbons. In addition, a number of heavy metals that were included in the Government’s contract for soil clean-up were also analyzed.

Results for **groundwater** quality were compared against control site values (Site 19 at Anyama) and, in the absence of national standards for water quality, Dutch intervention values. 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

## Laboratory Analysis Findings

| Air                      |         | Site 3        | Control site 21 |
|--------------------------|---------|---------------|-----------------|
| Parameters/units         |         | Vridi Canal 2 | Agboville       |
| Dimethyl sulfide         | ppm v/v | < 0.1         | < 0.1           |
| Ethyl mercaptan          | ppm v/v | < 0.1         | < 0.1           |
| Methyl ethyl sulfide     | ppm v/v | < 0.1         | < 0.1           |
| Carbonyl sulfide         | ppm v/v | < 0.1         | < 0.1           |
| Tertiary butyl mercaptan | ppm v/v | < 0.1         | < 0.1           |
| Hydrogen sulfide         | ppm v/v | < 0.1         | < 0.1           |
| Methyl tert-butyl ether  | µg/m3   | ND            | ND              |
| Benzene                  | µg/m3   | ND            | ND              |
| Toluene                  | µg/m3   | 110           | ND              |
| Ethylbenzene             | µg/m3   | ND            | ND              |
| m,p-Xylene               | µg/m3   | ND            | ND              |
| o-Xylene                 | µg/m3   | ND            | ND              |
| Naphthalene              | µg/m3   | ND            | ND              |
| TPH (C4-C6)              | µg/m3   | 22            | 10              |
| TPH (C6-C8)              | µg/m3   | 180           | 20              |
| TPH (C8-C10)             | µg/m3   | 60            | 35              |
| TPH (C10-C12)            | µg/m3   | 37            | 53              |
| TPH (C4-C12)             | µg/m3   | 300           | 120             |
| Aliphatic (C4-C6)        | µg/m3   | 22            | ND              |
| Aliphatic (C6-C8)        | µg/m3   | 72            | 17              |
| Aliphatic (C8-C10)       | µg/m3   | 28            | 31              |
| Aliphatic (C10-C12)      | µg/m3   | 35            | 53              |
| Aromatic (EC5-EC7)       | µg/m3   | ND            | ND              |
| Aromatic (EC7-EC8)       | µg/m3   | 110           | ND              |
| Aromatic (EC8-EC10)      | µg/m3   | 33            | ND              |
| Aromatic (EC10-EC12)     | µg/m3   | ND            | ND              |

# SITE 3: VRIDI CANAL 2 (PETROCI)

| Surface water<br>Parameters (µg/l) | Site 3<br>Vridi Canal 2 |
|------------------------------------|-------------------------|
|                                    | Surface water drain     |
| Total Hy C5-35                     | 75,100                  |
| Benzene                            | < 7                     |
| Ethylbenzene                       | < 5                     |
| Toluene                            | < 4                     |
| Xylene                             | < 11                    |
| Free sulfur                        | < 150                   |
| Pb                                 | 21                      |
| Cd                                 | < 0.25                  |
| As                                 | 7                       |
| Cr                                 | 15                      |
| Ni                                 | 51                      |
| Co                                 | 2                       |
| Hg                                 | 2.3                     |
| Cu                                 | 46                      |
| Zn                                 | 470                     |

| Groundwater<br>Parameters (µg/l) | Site 3<br>Vridi Canal 2 | Control site 19<br>Anyama | Dutch intervention values<br>(µg/l) |
|----------------------------------|-------------------------|---------------------------|-------------------------------------|
|                                  | Well 3 m                | Borehole                  |                                     |
| Total Hy C5-35                   | < 10                    | < 10                      | 600,000                             |
| Benzene                          | < 7                     | < 7                       | 30                                  |
| Ethylbenzene                     | < 5                     | < 5                       | 1 000                               |
| Toluene                          | < 4                     | < 4                       | 150                                 |
| Xylene                           | < 11                    | < 11                      | 70                                  |
| Free sulfur                      | < 50                    | < 50                      | -                                   |
| Pb                               | 1.3                     | < 0.25                    | 75                                  |
| Cd                               | < 0.25                  | < 0.25                    | 6                                   |
| As                               | 3.3                     | < 0.25                    | 60                                  |
| Cr                               | 7                       | 0.41                      | 30                                  |
| Ni                               | 13                      | 1.5                       | 75                                  |
| Co                               | 1.5                     | 1.4                       | 100                                 |
| Hg                               | 0.41                    | < 0.25                    | 0.3                                 |
| Cu                               | 6.8                     | 1.8                       | 75                                  |
| Zn                               | 78                      | 5.4                       | 800                                 |

## Conclusions and Recommendations

The results of the air quality analysis can be summarized as follows:

- Mercaptans, hydrogen sulfide and related components cannot be detected in this site, nor the control site. This is significant considering that the key odorants in the Probo Koala wastes were most likely hydrogen sulfide and mercaptans.
- Concentrations of the various analytes at the affected site are comparable to the concentrations found at the control site.

Two observations can be made regarding the analysis groundwater quality for this site:

- The sample collected near this site does not show the combined presence of sulfur and hydrocarbons, which could have been indicative of leachate contamination from sites impacted by the Probo Koala wastes.
- Mercury concentrations, however, exceed Dutch intervention values and are above background levels. As conventional treatment systems for drinking water do not remove heavy metals, their concentrations in drinking water supplies should be monitored regularly and treatment such as carbon filtration should be introduced if needed.

Surface water quality results for Site 3 show high levels of hydrocarbons, which is indicative of industrial pollution from local sources. In addition, heavy metal pollution is observed in the surface water samples, which is also to be expected in urban industrial areas and municipal waste disposal sites.

The following recommendation can be made to address these issues: the Government should establish environmental monitoring systems for the Vridi industrial zone, based on sound environmental standards, to ensure that pollution is not draining into and further contaminating Ébrié Lagoon.

# SITE 3: VRIDI CANAL 2 (PETROCI)

## Site Photos



Source: UN Environment



Source: UN Environment

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Source : UN Environment



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