

# **Outbreak of Neurological Illness of Unknown Etiology in Cacuaco Municipality, Angola**

**WHO rapid assessment and cause finding mission,  
2 November - 23 November 2007**

## **Executive Summary**

Prepared by

Dr Kersten Gutschmidt  
WHO/ Public Health and Environment  
HSE/PHE

Dr Pascal Haefliger  
WHO/ Public Health and Environment  
HSE/PHE

Prof Thomas Zilker  
Medizinische Klinik Rechts der Isar,  
Munich, Germany



**World Health Organization  
WRO Angola, AFRO, HQ**

## 1. Executive summary

An outbreak of acute neurological disease of unknown origin occurred in Cacucaco municipality, Luanda Province, Angola from October to December 2007. The first cases occurred on 2 October and were officially reported on 24 October. Symptoms included tiredness, blurred vision, dizziness, weakness and difficulties in speaking and walking. Following the Angolan Ministry of Health (MINSA)'s request for support, WHO Country Office conducted initial investigations on 24 October and 30 October. Symptoms observed suggested that the disease might be of toxic origin but the exact cause could not be identified. On 30 October 2007, WR Angola requested support from WHO Headquarters (HQ) and Regional Office for Africa (AFRO) to investigate this outbreak.

On 2 November, WHO HQ and AFRO deployed an investigation team consisting of a clinical toxicologist, an epidemiologist, an environmental investigator, a laboratory specialist and a team coordinator. The purpose of the mission was: (i) to assist MINSA in investigating the possible toxic/chemical cause of the outbreak, (ii) to support toxicological, clinical, epidemiological, environmental and analytical investigations, and (iii) to make recommendations on diagnosis, treatment, surveillance and risk management and mitigation.

Activities were immediately undertaken in the field in collaboration with the national authorities to rapidly assess the situation, to strengthen surveillance and case management and to support communication efforts. In parallel, the investigation team carried out cause finding activities including an exhaustive clinical and neurological examinations of over 50 patients and an epidemiological study aimed at identifying the source of exposure. At the same time, blood, urine, food and water samples were collected, processed and shipped to international laboratories for toxicological analysis.

Neurological examination showed that patients had extreme somnolence. On awakening they had ataxia, lasting several days. The central nervous system (CNS) was affected, particularly the cerebellum (altered balance and coordination). All other vital parameters were normal. In particular, there was no sign of peripheral neuropathy. No vomiting nor diarrhoea were consistently reported. Differential diagnosis supported a toxic origin, likely through a substance affecting the gamma-aminobutyric acid (GABA) -receptors.

The epidemiological investigation showed that the disease primarily affected children (64% of cases were below 15 years old) and females (62%). Cases tended to cluster among families living in the same household. However, not all household members were affected. The epidemiological curve did not suggest a typical bacterial or viral infection. Initial interviews of affected cases and case control individuals did not reveal an obvious source of exposure which would be common only to the persons presenting symptoms.

Blood and urine samples collected were analysed by toxicological laboratories in Germany and the United Kingdom with particular focus on substances affecting the CNS. A total of more than 7000 substances were tested, including benzodiazepines, gamma-hydroxybutyrate (GHB) and analogues, pharmaceutical and metabolites, organic solvents, heavy metals and bromide. On 19 November, the German laboratory detected very high concentrations of bromide ranging from 1000 to 2450 mg/L in 6 out of 7 blood samples analysed. These concentrations are 20-50 times higher than physiological concentrations. On 21 November, bromide concentrations between 1140 and 2570 mg/L were detected by the United Kingdom laboratory in another set of 6 blood samples from different patients. These results are consistent with the findings of the neurological examination and with most of the signs and symptoms observed among cases. Food and water samples collected on the field were then tested for bromide in Germany and Switzerland and on 21 November, results showed that 4 out of 6 table salt samples contained at least 80% of sodium bromide. Two other food items that were in contact with this salt were also found positive for bromide. These laboratory results provided a strong indication that this outbreak of acute

neurological disease was most likely due to bromide poisoning which occurred through ingestion of table salt contaminated with sodium bromide.

Following these findings, public health actions were immediately initiated to control the outbreak, including awareness raising and provision of treatment advice to hospital and health care facilities. Information was provided on a simple qualitative test to distinguish between sodium bromide and sodium chloride, and testing of salt was implemented. Due to time constraints, it was not possible to undertake further risk mitigation activities. Thus, it is recommended that the following public health actions be undertaken by a follow-up mission: (i) MINSA should inform all hospitals and health care facilities nationwide about the signs and symptoms of bromide intoxication, including case definition; (ii) all patients should be treated with sodium chloride infusions according to the treatment protocol described in Section 7.2 of this report; (iii) surveillance and reporting should be further strengthened and extended nationwide; (iv) risk reduction measures should be extended, including awareness raising, salt replacement and identification of the source of the contamination; (v) a large scale survey should be conducted to estimate the overall exposure of the population to the contaminated salt; and (vi) laboratory capacities should be established to allow for the specific and quantitative analysis of bromide in both serum and food samples. In the longer term, it is also recommended to undertake further capacity building activities to prevent other outbreaks to occur in the future. In particular, it is necessary: i) to strengthen national chemical and food safety programmes, ii) to establish a national poison center with clinical and analytical toxicological capacities, iii) to include bromide analysis in food monitoring programmes, and iv) to strengthen national coordination and collaboration mechanisms.

This incident turned out to be the largest outbreak of bromide poisoning ever reported in the literature; a total of 467 cases were officially identified from 2 November to 5 December 2007. Fortunately, this event did not cause any fatalities, since the 3 deaths reported early in the outbreak were considered unlikely to be due to bromide intoxication.

The identification of bromide as causative agent was challenging because: i) limited analytical laboratory capacities were available on the ground, ii) mass bromide poisoning is very rare and therefore doesn't immediately come to the mind of the medical community, and iii) the presentation of the intoxication was atypical in this particular outbreak; clinical features observed among cases did not fully fit with acute single dose nor with chronic intoxication because bromide uptake actually occurred as a result of cumulative exposure over a period of several days.

It is unclear how sodium bromide, a chemical commonly used in Angola in the oil-drilling industry, entered the food chain. However, it is clearly a result of sub-optimal chemical management. Thus, this incident highlights the importance and the need to implement effective national chemical safety programmes, especially in developing countries introducing new technologies. Finally, this event has also shown that international assistance in the form of human resources, technical expertise and laboratory support was crucial to support the Angolan MINSA to rapidly identify the causative agent of the mass poisoning and control the outbreak.