Environmental assessment at Maziwa Ng’ombe, Tanzania

- following a neurological disease outbreak -

Joint UNEP/OCHA Environment Unit
# Table of Contents

A. Overview 4

B. Context 5
   
   Background to the mission 5

C. Environmental Assessment Activities 7
   
   Background research 7
   Research meetings in Dar es Salaam 7
   Sampling activities 7
   Sample analysis 8
   Other activities 8

D. Observations and Findings 9
   
   Key environmental assessment findings 9
   Other findings 9
   General observations 10

E. Recommendations 11

Endnotes 12
Between May and June 2003 an unusually high number of unexplained cases of polyneuropathies were observed in Maziwa Ng’ombe, a village of about 3400 people on Pemba Island, Tanzania. Polyneuropathy is a neurological illness causing numbness and weakness in victims’ arms and legs, tightness in the chest and blurred vision.

The World Health Organization (WHO) and local authorities conducted three investigations into the causes of the illness in 2003. These proved inconclusive, but pesticide contamination was suspected as a possible cause. At the Government of Zanzibar’s request, a fourth joint mission was conducted between November 22-28 2004, involving: WHO, the Joint UNEP/OCHA Environment Unit (‘Joint Unit’), an environmental expert mobilized by the Joint Unit from the Dutch National Institute for Public Health and Environment (RIVM), and local health authorities.

The Joint Unit and RIVM conducted environmental assessments, and the WHO and local authorities conducted health assessments, to determine the cause of the polyneuropathies.

The main environmental assessment findings are that pesticides are not present in any samples, and that substances for which tests were conducted are within acceptable ranges.

This, combined with evidence from the health assessments, led to a conclusion by the joint mission that the illness results from complex causes related to malnutrition, including a possible vitamin B1 deficiency. Eating raw cassava, which contains cyanide, is a likely contributing factor. These problems are inextricably linked to poverty, vulnerability, and poor local environmental conditions in Maziwa Ng’ombe.

This report describes the environmental assessment component of the mission, and recommends steps that should be taken by national and international authorities to improve the health and environment of Maziwa Ng’ombe residents.

A final, integrated report including both environment and final health findings will be produced by the WHO, with support from the Joint Unit.
B. Context

Background to the Mission

Three investigations to determine the cause of polyneuropathies at Maziwa Ng’ombe were conducted by WHO and local health officials in 2003, at the request of the Government of Zanzibar. The third investigation included experts from the WHO Country Office, the Ministry of Health (MoH), the Government Chemist, the Government Public Health Laboratory and the Pemba Water Department.

These investigations provided no conclusive information on the cause of outbreak. However, pesticide poisoning, in particular from dumping obsolete stocks of organophosphate pesticides\(^1\) and/or insecticides, including malathion\(^2\), was identified as a possibility. This was based on local reports, as well preliminary samples of drinking water. However, no children were affected by the outbreak, which is noteworthy given that children are often more vulnerable than adults to the health impacts of exposure to chemical contamination.

Following these three investigations, the Ministry of Health in Zanzibar requested further assistance from WHO to determine the cause of the outbreak. Given the possible environmental linkages, WHO and the competent authorities of Zanzibar also requested assistance from the Joint Unit in a joint health and environment mission. A Joint Unit staff member was mobilized by OCHA. A second expert was mobilized through the Joint Unit by the Dutch National Institute for Public Health and Environment (RIVM) and the Dutch Ministry of Housing, Spatial Planning and Environment (VROM). These organizations agreed to support analysis of water and soil samples to determine whether chemical contamination is present.

The overall goal of the mission was to reduce risks to human health at Maziwa Ng’ombe.
Preparing cassava in Maziwa Ng’ombe. Uncooked, this staple contains toxins.
(Photo: R.Brooke/Joint Unit)
C. Environmental Assessment Activities

The following activities were undertaken as part of the environmental assessment to determine the presence of pesticides or other chemical contamination at Maziwa Ng’ombe:

1. Background Research

The Food and Agriculture Organization (FAO) was involved in a program during the 1990s that removed about 245000 kilograms of obsolete pesticide stocks, including DDT and malathion, from Zanzibar and Pemba Islands. FAO was contacted for background information, and reported that significant quantities of obsolete pesticides were unlikely to remain on Pemba Island following these earlier efforts.

2. Meetings in Dar es Salaam

In Dar es Salaam, meetings were held to determine whether anyone had experience with cases similar to that of Maziwa Ng’ombe, to determine the nature of current pesticide use, and to gather information on obsolete pesticide stocks. Meetings were held with:

- The non-governmental organization AGENDA, active in a range of sound management of chemicals issues.
- The Dean of Faculty of Mechanical and Chemical engineering from the University of Dar es Salaam, who also acts as the Intergovernmental Forum for Chemical Safety Vice President for Africa.
- Tanzanian Ministry of Agriculture.
- Tanzanian Ministry of Health.
- National Environmental Management Council.

A phone interview was also conducted with US AID in Dar es Salaam.

The main conclusion was that pesticide use was reported to be very limited on Pemba Island.

3. Sampling activities

At Maziwa Ng’ombe, the following activities were undertaken to determine whether pesticide or other chemical contamination is present:

- Site visit and informal discussions with village inhabitants to identify possible sources of contamination, including visits to the wells and a cave used for drinking water.
- Sampling at all 15 wells and a cave in Maziwa Ng’ombe. Limestone and soil was also sampled. Water samples were taken at 4 wells in Kiuyu, a control village of similar size about 4 kilometers north of Maziwe Ng’ombe.
Analysis of WHO questionnaires to identify possible links between definite cases of polyneuropathy and specific wells.

A wide variety of organophosphorous compounds derive their toxicity by inhibiting the enzyme *cholinesterase* in the human body. A screening test that indicates the presence of cholinesterase inhibiting substances, and permits better selection of samples, was therefore conducted on water and soil samples from Maziwa Ng’ombe and the control village.

4. Sample analysis

Screening tests (noted above) showed no evidence of cholinesterase inhibiting substances. Water, soil and coral samples were subjected to laboratory analysis following the mission to determine the presence of pesticides, heavy metals, and other elements. This included tests for arsenic, which has been linked to effects similar to those reported in Maziwa Ng’ombe. There was no evidence of pesticides in any sample. All substances for which tests were conducted are within acceptable ranges, with the exception that most water samples exhibit salinity.

5. Other activities

In conjunction with WHO, background information was gathered on other issues raised by village residents, local staff and WHO as possible contributors to the polyneuropathies. These issues are:

- Toxic algae blooms that may affect, for example, fish catches.
- Use of pesticides in fishing.
- Bitter and/or undercooked cassava, which contains toxins (see below).
- Possible dietary sources of vitamin B1. A lack of this vitamin could cause or contribute to polyneuropathies.
- Use of potentially toxic plants for medicinal purposes.
- Military base activities, based on indications from residents that a smell lingered in the village following activities on the base.
D. Findings

Key environmental assessment finding

- No evidence of pesticides was found in either screening tests or subsequent laboratory analysis of samples. This analysis is supported by a) the fact that no pesticide use was in evidence or reported during discussions b) the lack of children with polyneuropathies reported in the WHO analysis c) reports from FAO that obsolete pesticide stocks had been removed from the island d) the fact that organophosphates, even had they been present, would likely degrade quickly in the environment e) the likelihood that economic conditions severely limit the acquisition of pesticides.
- In the samples taken, there is no evidence of heavy metals or elements, including arsenic, outside acceptable ranges.

Other findings

- Toxic algae blooms can affect humans through either fish consumption or direct consumption. However, no blooms were reported by villagers, and seaweed is not reported to be consumed in the village.
- In one-on-one discussions, many residents of Maziwa Ng'ombe stated that they eat raw cassava during its preparation, for leisure, and for food. It is generally eaten in small pieces but in some cases, entire tubers are consumed if the cassava is sweet. This is noteworthy given that raw cassava contains cyanoglycosides, which turn into the toxin cyanide in the body. Continuous doses could cause or contribute to polyneuropathies.
- There is nothing grown or eaten in Maziwe Ng'ombe that appears to provide a source of sufficient vitamin B1 (e.g. no legumes). The available rice in the village is unfortified.
- A species of *Datura* observed growing in several locations in the village is known to contain potent cholinesterase inhibitors. This plant has a history of use in traditional medicine and as a hallucinogen. This information was conveyed to WHO authorities.
- Military training conducted near the village is, according to local authorities, limited to artillery testing. Moreover, as noted above, no chemical contamination was found in any of the samples taken.

General observations

- While Pemba Island is generally green and fertile, the area surrounding Maziwa Ng'ombe is drier and less fertile, with only light soil cover over coral. This coral bedrock is plainly visible above ground and in the walls and bottoms of wells. Ground cover comprises scrub, and some palm trees. These conditions limit agricultural options. No sustainable farming or fishing programs were reported to have taken place in Maziwa Ng'ombe to make best use of this environment.
Residents of Maziwa Ng’ombe are quite evidently very poor. Household possessions are generally limited to a few essentials such as tin pots for cooking. There is no running water, and no electricity in the area. The majority of men in the village leave for several months at a time to fish, for which they earn about 10,000 Tanzanian shillings (about 10 USD) per month. This was the only source of income identified.

The main sources of food are subsistence farming and fishing. Subsistence farming consists primarily of cassava and sweet potatoes, and the techniques appear rudimentary.

Many children are present in the village at all times, and are therefore not in school. There is no primary school in or within close proximity to the village.

Standing pools of water caused by spillage from the wells could form a breeding ground for mosquitoes and contribute to diseases such as malaria. A lack of running water limits options for sanitation.

These findings, combined with WHO’s medical analysis, led the joint mission to a conclusion that the outbreak has complex causes related to malnutrition, including a likely vitamin B1 deficiency. Eating raw cassava, which contains toxins, is a likely contributing factor. These problems are inextricably linked to severe poverty, vulnerability, and poor local environmental conditions in Maziwa Ng’ombe.

Environmental conditions, in particular the combination of a lack of soil fertility and a lack of appropriate farming techniques to make best use of existing land, would likely contribute to poor health, malnutrition, poverty and susceptibility to disease, including polyneuropathies.
E. Recommendations

The Joint Unit participated in the joint mission based on the possibility that chemical contamination caused the outbreak of polyneuropathies. The fact that no environmental emergency or chemical contamination was found eliminates possible causes, and helps health and development authorities to focus on the issues that are at the root of the illness.

The Joint Unit offers the following recommendations to the authorities best place to assist the residents of Maziwe Ng’ombe:

1. WHO has started follow-up to address the health dimensions of the outbreak. Their efforts are central to improving the situation at Maziwa Ng’ombe and should be supported by relevant partners.

2. Authorities such as the WHO vector control program should address environmental risks from the standing pools of water by the wells.

3. Long-term environmental issues such as the combination of poor background conditions and a lack of sustainable farming techniques need to be addressed by relevant authorities as part of a comprehensive development approach. Donors, UN agencies, government ministries and others should therefore be made aware of the joint mission, its findings, and the needs of Maziwa Ng’ombe so that appropriate steps can be taken based on final assessments. The World Health Organization in cooperation with competent local authorities should take a lead role in this regard. The Joint Unit could play a supporting role, including using the Environmental Emergency Partnership network to disseminate information.

(Photo: R.Brooke/Joint Unit)
Endnotes

1 See [http://www.epa.gov/pesticides/op/](http://www.epa.gov/pesticides/op/) for general information on organophosphates.


4 [www.humanitarianinfo.org/eep](http://www.humanitarianinfo.org/eep)