

**DETERMINATION OF HEAVY METALS IN WATER, PLANT
EFFLUENTS, DAM TAILINGS, FLUORSPAR ORES, SOILS AND
ROCKS: A CASE STUDY OF KERIO RIVER.**

BY

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Abstract.

The study was to determine the levels of the heavy metals in various rocks and in soils from the highlands and Kerio Valley of Keiyo district. Heavy metals in fluorspar ores, plant effluents, dam tailings and in rivers (Mong, Kimwarer and Kerio) were also determined.

The study showed that rocks had the highest contents of heavy metals, with nickel and iron ranging from: 26.5 - 103750 and 174.5 - 4985 mg/kg respectively. Lead and copper in rocks also ranged from: 2.1 - 4000 and 0.1 - 137.50 mg/kg respectively. Soils had also high heavy metal levels with lead ranging between, 20 - 255 mg/kg and cadmium between, 2.8 - 370.3 mg/kg. Iron concentrations was the highest in soils with levels falling between, 300 - 1284.2 mg/kg. The fluorspar ores, plant effluents, and the dam tailings also contained meaningful amount of heavy metals. The fluorspar ores contained iron ranging from: 556.6 - 685.7 mg/kg and nickel ranging from: 734.2 - 841.0 mg/kg. With respect to the heavy metals in the plant effluents, the iron concentrations, was the highest with values being between, 159.5 - 192.6 mg/l. These high levels of lead, iron, nickel, and copper could be attributed to the association of these metals with fluoride deposits.

Analysis for heavy metals in water during the dry season showed iron concentration being the highest with levels being between, 0.1 - 38.6 mg/l while lead was found to range from, 0.00 - 0.43 mg/l. The wet season indicated heavy metal content of iron to range from, 0.44 - 3.71 mg/l. These levels are above the threshold values especially at sites after the convergence of the effluents with the river(s). The copper and zinc levels fall within the standard limits whereas lead, cadmium, iron, chromium, and nickel levels are above the threshold limits especially at sites of convergence between the effluents and Kimwarer River. Statistical analysis showed no significant differences in the heavy metal in the river waters during the wet and the dry season.

RIVER AND GROUND WATER QUALITY:

A CASE STUDY OF MIGORI TOWN

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A B S T R A C T

The inhabitants of Migori town use polluted water from River Migori, boreholes and shallow wells as sources of water for drinking and bathing. As a result, they suffer from many gastro-intestinal diseases that adversely affect their productivity and sometimes cause death. The purpose of this study was to identify some of the major pollutants in water from these sources and to assess the level of pollutant concentration.

A six month sampling and analysis programme was undertaken. Water samples were examined for the levels of microbial organisms, heavy metals and health related inorganic constituents. Bacteriological determination was carried out in two phases; initially to determine the levels of both Total coliforms and *Escherichia coli* by the most probable number (MPN) technique. The second phase was to differentiate between the various pathogenic organisms present in these water sources. Heavy metals were analyzed by Atomic Absorption Spectrophotometry (AAS) while methods described by American Public Health Association (APHA) were adopted in the determination of all the other parameters.

The mean Total coliform numbers (1006.9 ± 921.7 per 100 mL) in the river and (768 ± 606.9 per 100 mL) in ground water were higher than the values recommended in drinking water. Likewise, the mean *E. coli* numbers (24.3 ± 33.3 per 100 mL) and (20.8 ± 54.5 per 100 mL) in the river and ground waters respectively were high. In this study, the following microbes were identified: *E. coli*, *Salmonella*, *Shigella*, and *Faecal streptococcus* which imply gross faecal pollution. The highest Total coliform numbers were observed in November whereas the highest *E. coli* numbers were observed in September and November in river and ground waters respectively.

Generally, the river water samples showed a higher level of pathogens than ground water samples. Levels of other parameters like iron (0.43 mg/L) and total suspended solids (490 mg/L) were above the recommended guideline values by WHO, US-EPA, EU and Canada, whereas cadmium levels (16.2 µg/L) in the ground water sources and (10.9 µg/L) in the river were unacceptable according to these standards. Levels of lead (26.48 µg/L) and copper (22.15 µg/L) were however within the recommended limits.

Bacteriological and chemical data from this study suggest that river and ground water in Migori town is of poor quality. The water is a potential source of intestinal infestations amongst people, especially children living in this town. To control these infestations in the long term, improvements to water and sanitation infrastructure are urgently recommended. In addition, maintaining drinking - water free from faecal contamination and focus on peoples hygiene - related behaviour and public health education are also relevant to the control of diarrhoeal diseases in Migori.