GReSP – Groundwater Resources for Southern Province

GROUNDWATER QUALITY

Findings – Achievements - Sep 2007
Objectives of groundwater sampling

- Collect and prepare groundwater samples for analysis
- Conduct *in-situ* measurements of pH, redox potential, conductivity, dissolved oxygen and water temperature
- Orient the Water Quality Officer in groundwater quality sampling
- Identify groundwater quality risks
- Be able to characterize the overall groundwater chemistry
Groundwater Chemistry

- Major anion (HCO$_3^-$, SO$_4^{2-}$, Cl, NO$_3^-$) and cation (Na, K, Ca, Mg) composition is typical for continental groundwater with primarily meteoric origin.

- Bicarbonate >50% meq dominates the anion composition of groundwater.

- Calcium dominates cation composition but domination also varies strongly between earth alkali (Ca, Mg) and alkali ions (Na, K).

- *Mudstone* aquifers have high sodium content.

- *Shist or slate* and *sandstone or meta-sandstone* aquifers are in the transition zone between alkali and earth alkali water.

- Ion exchange reactions are responsible for local alkalinisation of groundwater.
Piper diagram showing major ion composition

Aquifer lithology
- Metamorphic, undiff.
- Carbonate, Dolomite, Meta-carb.
- Sandstone, Meta-Sandstone
- Shist, slate
- Mudstone
- Granite, Gneiss
- Basalt, Meta-Basalt
- Acid/interm. Intrusives
- Sediment, unconsol.
- unknown

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Groundwater Pollution

- Standards or guidelines used for water quality evaluation: ZABS or ZADWS, WHO, EU and SABS

- Overall groundwater quality is good. Localised contamination occurs

- Remarkable sample (Bbondo Clinic) - high solute content, electric conductivity (>2300 μS/cm) and sulphate (>>400 mg/L)

- About 10% of the boreholes were found to be unsuitable for drinking according to the ZDWS

- 12% of boreholes had EC values >1000 μS/cm threshold recommended for drinking water. If ZABS = 2,300 μS/cm is applied about 3% fail
Threats of groundwater pollution include:

- On-site sanitation e.g., in and around urban centres
- Application of fertilizers and other agro chemicals onto cultivated land, e.g., Nakambala Sugar Plantation in Mazabuka
- Poor or no sanitary disposal facilities
Water-related Diseases

- Water-related diseases reported (2005): diarrhoea, dysentery, schistosomiasis and cholera

  - Suspected cholera cases = 18 incidences
    - 11 infections (Livingstone District),
    - 3 (Siavonga District)
    - and 2 each in Choma and Mazabuka District

  - Dysentery cases highest in Zambia. Mainly in Gwembe and Sinazongwe

  - Schistosomiasis generally less common than dysentery. The highest number of cases reported in Choma and Monze districts. But heaviest burden per capita was along Lake Kariba

  - Diarrhoea infections highest among waterborne diseases. Highest no. of infected persons reported in Namwala
Incidence and total cases of diarrhoea (2005)
Water-Related Diseases Occurrence

- Generally waterborne disease burden highest the rainy season (November to April) due to surface runoff and poor sanitation conditions e.g., cholera

- Usually the fishing camps have poor sanitary conditions thereby increasing the risk of outbreaks of waterborne diseases.

- Transmission of urinary schistosomiasis in SP can be all year round, but with varying intensities during different seasons.
Conclusions—Groundwater quality

- Overall groundwater quality is good
- Localised contamination exists
- Reliability of laboratory results not always consistent
- Waterborne diseases could mainly be caused by poor hygiene practices and poor sanitary facilities in households.
END

THANK YOU FOR YOUR ATTENTION