POTENTIAL ENVIRONMENTAL IMPACT DUE TO MINING AND USE OF COAL in areas around MUI BASIN in Kenya

Presenter: GILBERT KIPRUTO
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Coordinators:
Dr. C.M.GICHABA
Dr. E.DINDI
A list of abbreviations

• TDS-Total Dissolved Solids
• TSS-Total Suspended Sediments
OVERVIEW

• Introduction
• Location of study areas
• Objectives
• Methodology
• Results
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INTRODUCTION

• The potential impact due to mining and use of coal on environment is an issue to be looked into considering the harmful effect that it can cause to environment and hydrogeology.

• Mui basin contain sulphur, iron, volatile matter, ash, carbon, nitrogen and traces elements like Cd, Se, Cr, Pb and Hg which are known to be environmentally unfriendly if poorly handled especially where there is inadequate information on geology, geological structures, soil, and groundwater, flow systems.

• Both open cast and underground mining method can be a recipe for water pollution. In the process of exploration in mining, huge amounts of water are discharged to facilitate the operations. This often contains high loads of TSS, TDS, hardness and heavy metals, which contaminate the surface and groundwater regime.

• The research is seeking to determine role of geology, geological structures, soils, surface and groundwater flow systems in transmission of coal related pollutants in Mui basin.
Geographical setting of Mui basin

- The 131.5 km² area of study lies within the larger Mui basin and is bounded by latitude 1°30'S and 1°1.03'S and longitudes 38°09'E and 38°17'E situated in Mwingi - Kitui county.
Basement rocks (Mozambiquan Belt)
Mui Basin

Mutomo
Kitui
Mwingi
Mutitu
Zombe
Voo
Endau
M
Iam
Ban
I
Athi
Yatta
Yatta
Mutha
Mutomo
Ikutha
Nzambani
Mui
Nu
Tseikuru
Tharaka Mivukoni
Katse
Ngomeni
Ukasi
M
Ig
Wani
Mutungoni
Matinyani
Ikangia
Kisasi
Mulu
Iwani
Kanziku
Kyuso
Kyuso
Endui

Malindi
Garissa
Kilifi
Taita Taveta
Kwale
Machakos
Meru
Embu
Isiolo
Lamu
Indian Ocean
Mombasa
Somalia
Tanzania
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OBJECTIVES

• To determine the potential pollution of water resources in Mui basin as a result of the mining of coal.
• To determine the potential environment pollution due to exposure of rare earth metals such as Cd, Se, As and many more and the radioactive elements such as uranium in the coal mine.
METHODOLOGY

• Use of scientific papers on geochemical, geophysical and geotechnical reports, obtained from the Department of Geology, UON and from Mines and Geological Department, MoE.

• Geochemical studies of soil and water samples for related pollutant.

• Gravity techniques to determine the geology in terms of density and minerology of rocks and the trend of structures.

• The geotechnical properties of soil types and permeability were used to determine the likelihood of soil acting to transmit pollutants whereas shear strength to determine their ability to withstand heavy machinery associated with the mining from which a mine design will be developed.
Results

• Gravity distribution of Mui basin is such that the area has low gravity values on the Northern side and increasing steadily Southwards hitting highs of 1065mgals and 1069mgals.

• Physical characteristics of soil is as follows;
  - **Soil types:** The area is defined by sandy, clay and mixture of sand and clay.
  - **Grain size:** Grain size follow the trend of the soil. Northern having coarse grained due to the sand cover, this is followed by medium size southwards through to the western side.
-**Consolidation of soil;** High values on settlement of soil occurs in the extreme south of the study area and reduces steadily northwards where the least vales are recorded on the NW area.

-**Permeability of the soil;** The high values of the permeability of the area are found in the NW as medium values dominate the central parts. Low values are scattered in the central part and some southwards.

-**Specific gravity of soil;** This is lowest on the north stretching through the western part southwards.

-**Swelling pressure;** Its values and their distribution appears to be the opposite of permeability in that the high value are found in the south while the lowest occur on the north especially on the NW.
Chemical characteristic of the soils include;

- **Sulphur content;** The value of sulphur ranges between 1 mg/L to 11 mg/L. Areas on the NE of the area have the least values. The values increase southwards with the area on the extreme south, around Mui having the highest level of pollution from sulphur that ranges from 9 mg/L to 11 mg/L.

- **Iron concentration;** The trend of iron is almost the same as that for sulphur i.e. the NW end has the least. The value steadily rises southwards with the highest recorded in areas around Mui i.e. on the south.

- **Bicarbonates concentration;** This was determined as total alkalinity of the soils. The least values were recorded at the extreme NE and rises towards the south. Highest values are recorded at Mui area and the extreme south. Notably, the values of concentration of all the elements tend to vary with the soil type in that areas overlain by sandy soils tend to have lesser concentration compared to those overlain by clays and silt.
Con`t

• Water analyses for the following tests;
  -Iron ;The concentration of iron is high in the waters in the NE area and almost extreme southern. Around the high concentrations the values reduce such that areas to the extreme NE record the lowest value followed by the mid part of the study area.

• Total hardness ;Highest values of total hardness are recorded on the exact east and NW of the area. Low values are noted almost in the entire SW. Areas around the south have recorded medium values followed by the northern half.

• Sulfates concentration;The entire middle strip recorded high concentrations, the values steadily reduces outwards to the least values on the NW and southern parts
conclusion

• The study has enabled an assessment of potential vulnerability of water resources and environment to pollution from coal mining in Mui basin (sedimentary area) through a Geological and Geological structure assessment

• Following the above results, the following conclusion were made;
  - The area has varying vulnerability potential with the northern area having the least, followed by the center part. The southern part has the highest risk to pollution.
• Factors that play role in transmission of coal related pollutants include the following:
  • Geology
  • Geological structures
  • Topography
  • Soil-sediment characteristics
RECOMMENDATIONS

Clean coal technologies
- The technologies to be used should be efficient and able to reduce the amount of pollutants freely released to the water regimes the surrounding environment. However, a technology coal desulfurization is recommended for coal in the entire area considering that the coal is averagely of low quality, high ash content and low calorific value and high sulfur content.

Post mining regeneration of land
- Post-mining regeneration is a follow up activity for the entire area. It is meant to restore land surface of sufficient quality to support post-mining land use potential, restoration of the ecological function of mined land and in the case of previously degraded land, the ecological function must be improved and efficient alternative use of mine infrastructure.
- It has three approaches i.e. restoration of land capability on mined land through rehabilitation and public-private partnerships to address pollution form old abandoned mine. Restoration of land capability first considers that currently, the land on the south unlike the north is being used for agricultural practices, after mining if this capability is not preserved, the government should liaise with the community so as to embrace a lower quality of rehabilitation.
- To conduct study of potential vulnerability due to the rare earth metals and the radioactive elements which are of great risk to man.
THANK YOU