

**ENVIRONMENTAL RISK ASSESSMENT: A CASE STUDY OF
EBURRU GEOTHERMAL WELLHEAD POWER PLANT**

BARASA PHILIP JUMA

G296-03-008/2015

**Thesis Submitted in Partial Fulfillment of the Requirement
for the Award of Master of Science Degree in Geothermal
Energy Technology of Dedan Kimathi University
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OCTOBER 2017

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October, 2017

DECLARATION


I declare that this thesis is my original work and has not been previously submitted to this institution or to any other university for award of any type of academic degree or for any other purpose.

Signature.....  Date. 15/11/2017

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Dr. Jacques Varet

ABSTRACT

The broad objective of the study was to investigate potential environmental risks of Eburru wellhead geothermal power plant on the local community. Primary data on perception of the local community towards the potential risks was collected through focus group discussions, interviews and structured questionnaires. The questionnaires were administered to ninety five (95) households residing in four villages neighbouring the power plant in Eburru location, Gilgil Sub-county. Historical data on brine chemistry, noise and hydrogen sulphide (H_2S) gas was also reviewed and analyzed. Processing and presentation of primary data was achieved using Microsoft Excel. Data on brine chemistry, noise and H_2S gas was analyzed by making reference to the relevant environmental standards. Any parameter that exceeded the maximum recommended limit was considered to present an environmental risk. Results have been presented in form of frequencies, tables, bar graphs and pie charts. The study found out that the local community consider Eburru wellhead power plant to impact them negatively. In terms of severity of the impacts, the highest ranked risk was associated with H_2S gas odour, followed by noise emission, atmospheric venting of geothermal fluids and brine discharge. The chemistry of the brine did not meet the recommended limit for effluent discharge into the environment. The ambient H_2S gas levels measured outside the boundary of the power plant exceeded the 24 hour average tolerant limit of 0.0355 ppm up to a distance of 100 m in the northern direction. Ambient noise levels exceeded the tolerable limit of 35 dB (A) up to a distance of 1100 m from the boundary of the power plant. The ambient noise level does not warrant hearing impairment. Atmospheric brine spray can cause damage to the surrounding vegetation due to elevated levels of boron. Relocation of the affected persons within a radius of 1.5 km from the boundary of the power plant is recommended. Other measures include use of engineering measures to reduce noise, H_2S and atmospheric spray of brine, installation of a reinjection system and stepping up education and awareness among the locals. Precautionary principle should be considered in the initial design of future geothermal power plants. Further research should consider studies on diurnal variation of H_2S gas emission, epidemiological studies to determine real impacts of noise and H_2S on the health of the locals and an experiment to determine the fall out area of atmospheric brine spray and deposition.