

**A RESEARCH FROM THE DEPARTMENT OF GEOPHYSICS,
FEDERAL UNIVERSITY, OYE, OYE-EKITI,
EKITI STATE, NIGERIA.**

**TITLE: INTEGRATED USE OF GEOELECTRICAL IMAGING
AND HYDROCHEMICAL METHODS IN THE ASSESSMENT
OF THE IMPACT OF SOLID WASTE ON GROUNDWATER
AT ABULE-EGBA DUMPSITE, LAGOS, NIGERIA.**

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25-29th
September 2016

Montpellier, France
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PRESENTATION OUTLINE

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INTRODUCTION

- **Leachate generated from municipal solid waste sites have been identified to be a major source of pollution to groundwater.**
- **Poor management of solid waste materials lead potentially to disastrous environmental, health hazard and periodic epidemics of communicable diseases.**
- **Leakage from municipal solid waste deposits is generally associated with high ion concentrations and hence very low resistivities. This makes geoelectrical imaging techniques particularly interesting for mapping the two dimensional (2-D) extent of contamination around solid waste dumpsites.**

AIM OF THE STUDY

- **The aim of the study was for the detection of leachate migration and contamination of the geological formations/groundwater systems in the vicinity of the dumpsite, using geoelectrical and geochemical approaches.**

GEOLOGY AND HYDROGEOLOGY

- Abule-Egba area of Lagos state falls within the Dahomey Sedimentary Basin (Figure 2). The basin extends from eastern part of Ghana through Togo and Benin Republic to the western margin of the Niger Delta.
- The base of the basin consists of unfossiliferous sandstone and gravels weathered from underlying Precambrian Basement.
- Early literature on the hydrogeology of the area have shown that the sands of Abeokuta Group Coastal Plain Sands and Recent sediment constitute the aquifer units.

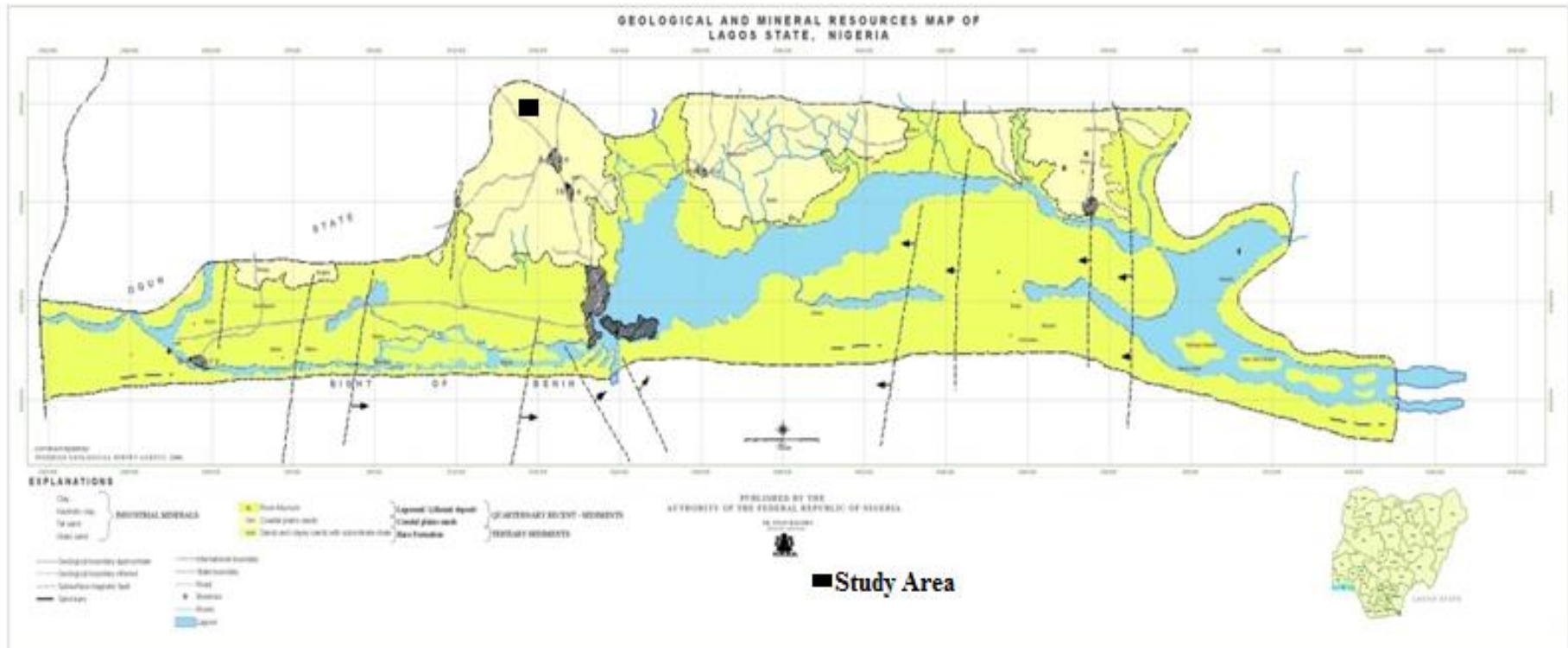


Figure 2: Geological Map of Lagos

MATERIALS AND METHODS

- **Two Traverses were occupied at both sides of the dumpsite.**
- **2-D resistivity imaging using Dipole-dipole profiling technique was carried out at both traverses to delineate the plumes migration.**
- **The 2-D imaging technique gives both the lateral and vertical variations in geoelectrical characteristics of the subsurface layers.**
- **The inter-electrode spacing of 5m was adopted while inter-dipole separation factor (n) was varied from 1 to 5.**
- **1-D resistivity investigation using Vertical Electrical Sounding (VES) with Schlumberger array was carried out at the two traverses. Six and five VES locations were occupied at traverses 1 and 2 respectively.**
- **Two tests boreholes were drilled to the depth of 30 m and 42 m respectively. Water samples were collected from the two boreholes\ and Five hand dug wells**

DATA PROCESSING AND PRESENTATION

- **The 1-D data were interpreted quantitatively by partial curve matching and forward modeling using Winresist software.**
- **The measured 2-D resistivity imaging data were processed using the DIPRO inversion software.**
- **The water samples were taken to the laboratory and were tested for major cations and anions.**

DEPTH SOUNDING CURVES

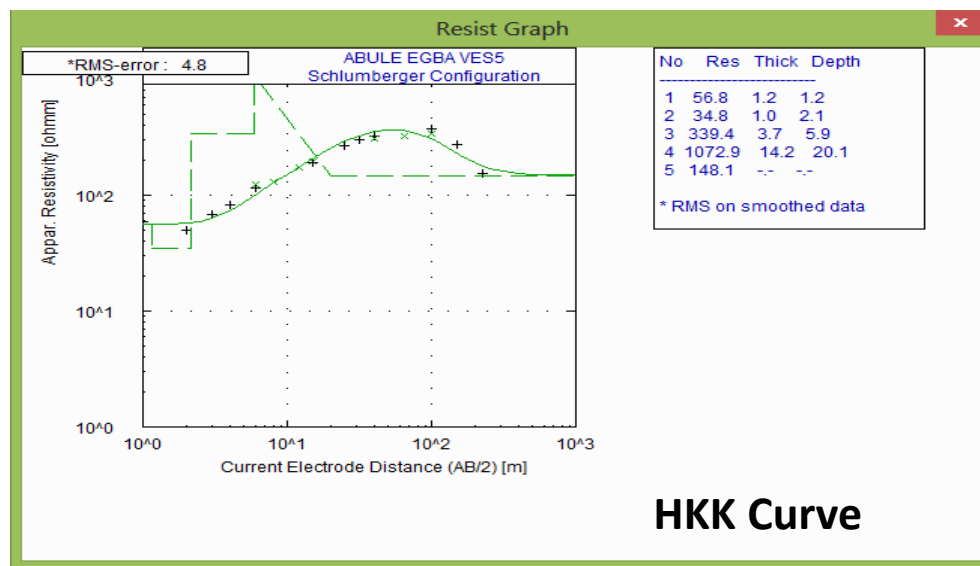
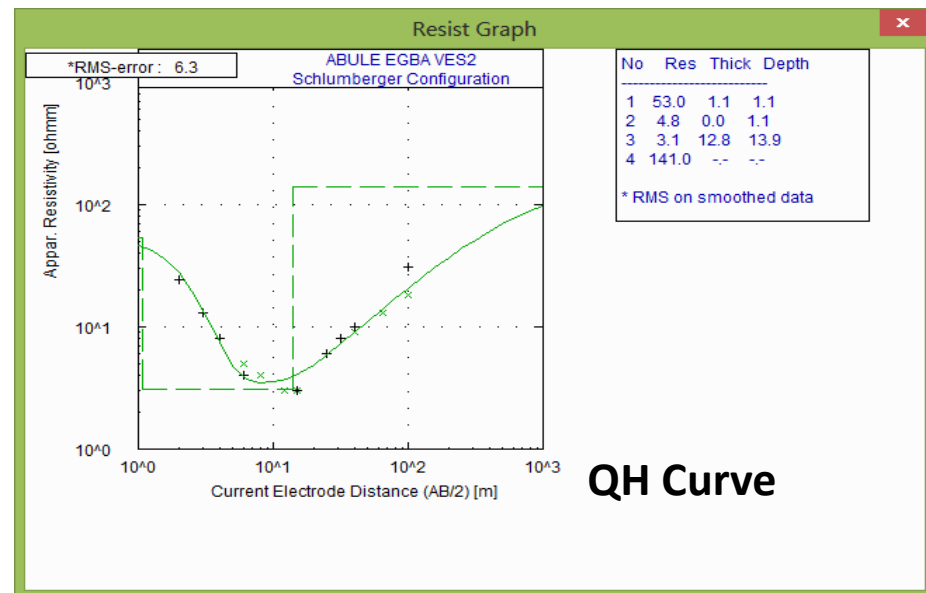
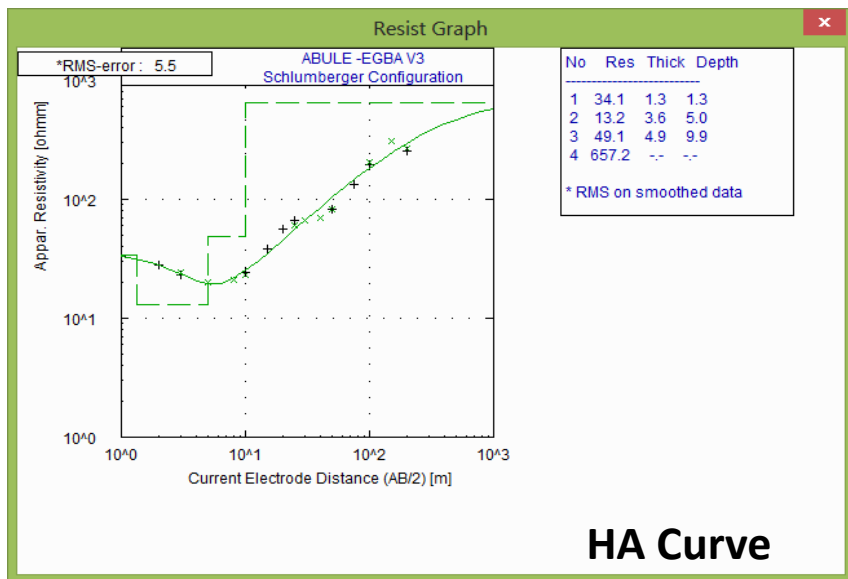


Figure 3. Typical Depth Sounding Curves Obtained from the Dumpsite

RESULTS AND DISCUSSION

The results of the interpretation of the VES curves were used to generate geoelectric sections. Also 2-D electrical resistivity images were generated from the dipole-dipole data.

TRAVERSE 1

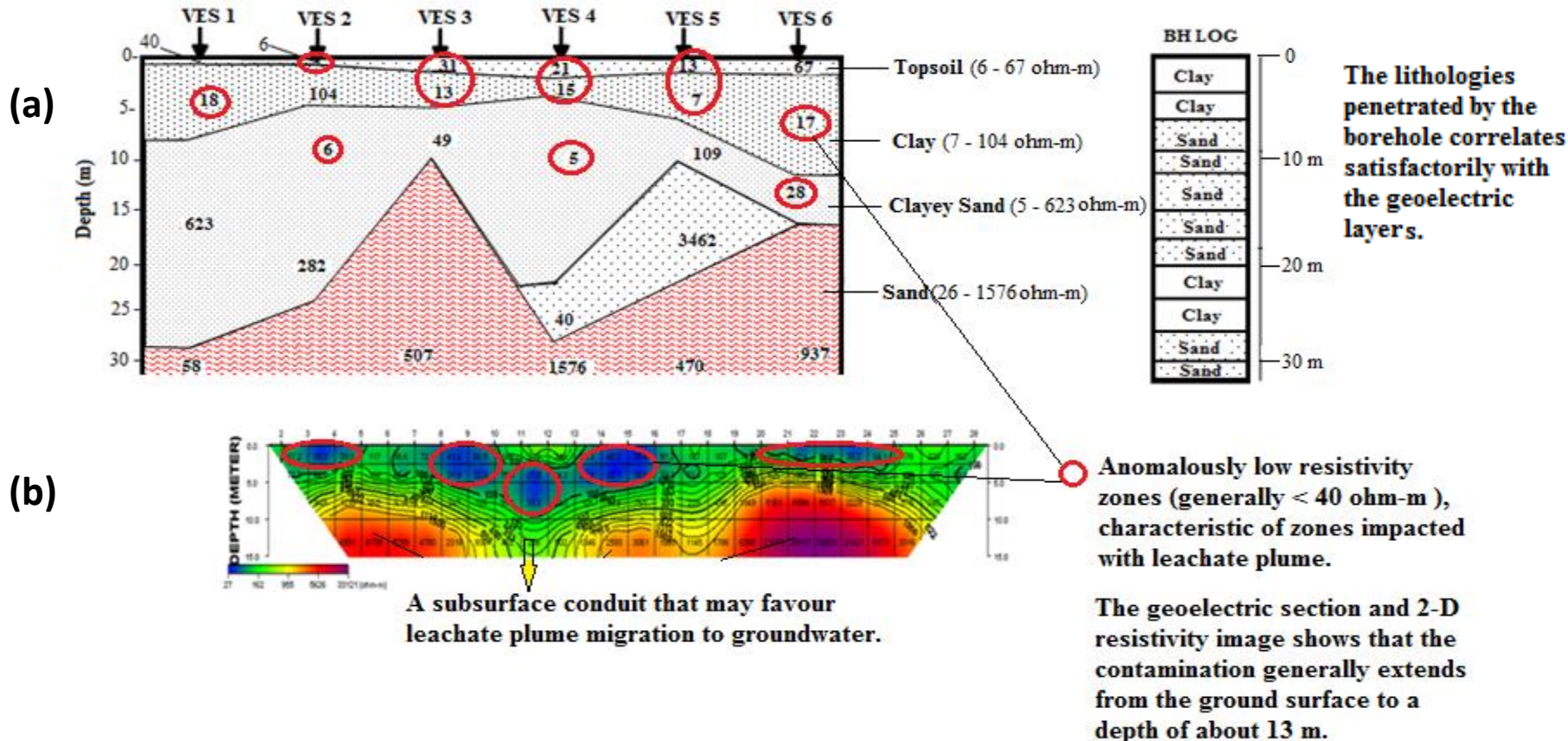


Figure 4. (a) Goelectric Section (b) 2-D Electrical Resistivity Image, beneath Traverse 1

Areas within the greenish colour band on the 2-D image have been moderately impacted, while zones within the yellowish/reddish/purple colour bands are devoid of leachate impact. However the identified conduit poses a threat to the sand groundwater aquifer.

TRAVERSE 2

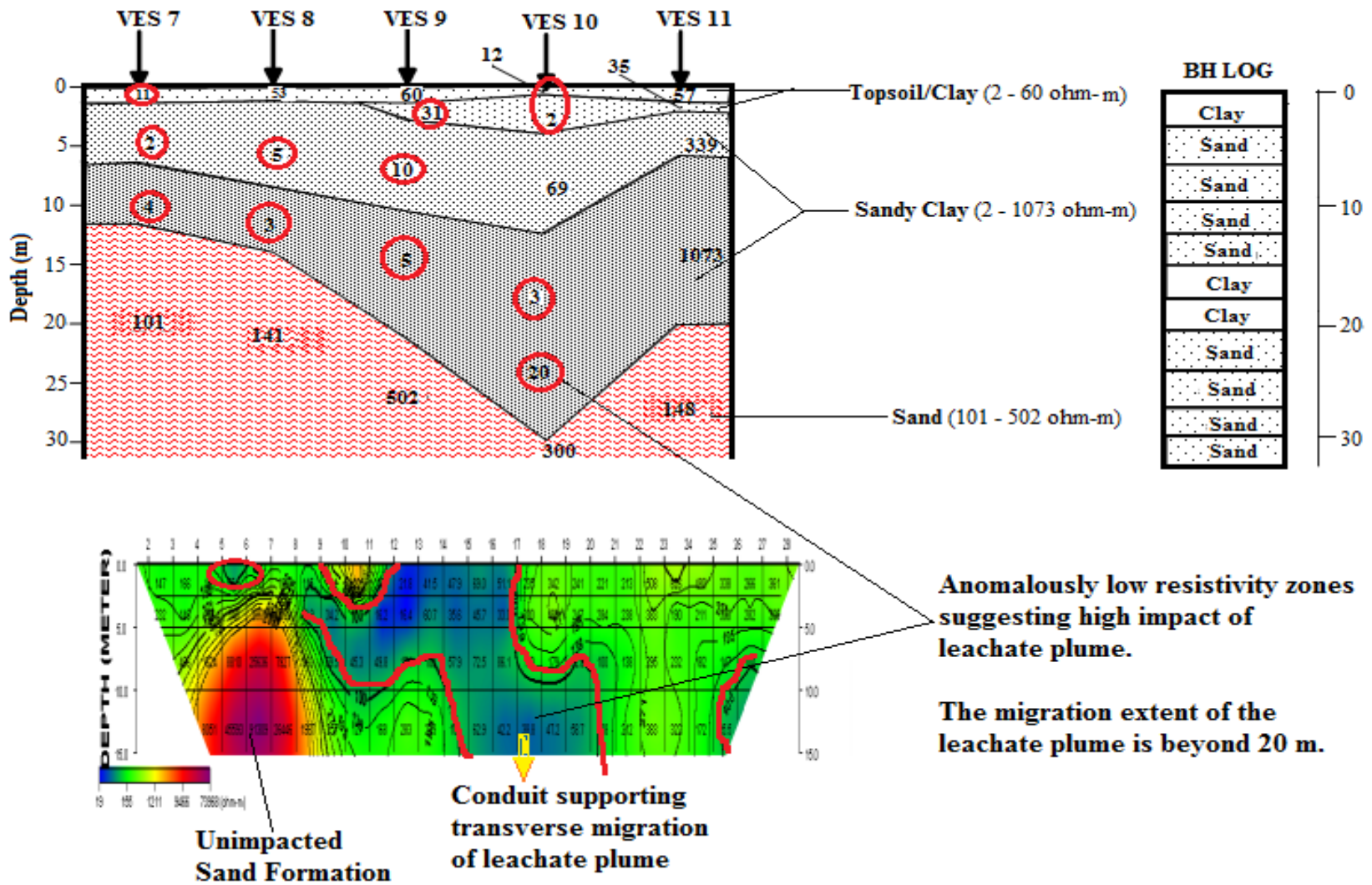


Figure 5. (a) Goelectric Section (b) 2-D Electrical Resistivity Image, beneath Traverse 2

The extent of contamination beneath Traverse 2 is greater than that observed on Traverse 1.

The groundwater aquifer is also threatened.

GEOCHEMICAL ANALYSES

Table 1: Results of Geochemical Analyses

Parameters	Well A	Well B	Well C	Well D	Well E	BH 1	BH 2	WHO
Turbidity (NTU)	1.53	1.0	1.53	4.52	4.56	4.51	4.54	1-5
TSS (mg/L)	18	18	30	31	38	38	40	500
TS (mg/L)	122	44	1140	2550	2580	2582	2620	500
pH (pH unit)	5.95	5.82	7.15	7.55	7.01	7.10	7.12	6.6-8.5
Conductivity (μS/cm)	172	50	1750	2660	3440	3480	3480	1500
TDS (mg/L)	110	22	1120	2500	2550	2580	2588	500-1000
Ca²⁺ (mg/L)	3.03	2.14	14.02	66.06	68.00	70.22	71.10	75-200
Mg²⁺ (mg/L)	1.18	1.12	1.92	1.88	2.99	19.0	18.2	50-150
Na²⁺ (mg/L)	38.50	4.01	90.11	220.00	180.22	230.02	225.00	20-200
K⁺ (mg/L)	1.50	1.00	150.20	266.00	251.00	260.20	266.00	100
NO₃⁻ (mg/L)	1.00	1.02	58.02	64.00	66.00	68.00	72.00	45-50
% Potability	18	9	27	18	27	18	18	

KEY

- Satisfies WHO Standard
- Below WHO Standard
- Above WHO Standard

➤ The results show that the water samples collected around the waste dumpsite have concentrations generally higher than the WHO permissible limits for potable water.

➤ The high electrical conductivity values, total solids, total dissolved solids and nitrate levels are indicative of pollution arising from the release of leachate generated at the dumpsite.

➤ The high EC values corroborates the anomalously low resistivity values obtained from the near-surface layers.

The cumulative potability of the water samples collected around the dumpsite is about 19.3%. This indicates an extent of pollution of about 80.7%.

Based on the locations of the wells and boreholes with respect to their extents of pollution, a southward migration of leachate plume is presumed.

CONCLUSIONS

- **The results of the geoelectric and geochemical investigations carried out at the Abule-Egba Waste dumpsite, Lagos have revealed that the migration of the leachate plumes emanating from the dumpsite poses a threat to the groundwater systems in the vicinity of the dumpsite.**
- **This study also highlighted the efficacy of integrated geoelectric and geochemical investigations as relevant tools for monitoring leachate plume migration and groundwater contamination in the vicinity of a dumpsite.**

THANK YOU FOR LISTENING



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