

**ASSESSMENT OF ARSENIC AND CADMIUM CONTAMINANT LEVELS
IN DOMESTIC WATER SOURCES IN SELECTED OGUN STATE
COMMUNITIES**

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OCTOBER, 2021

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COMMUNITIES**

BY

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**A DISSERTATION SUBMITTED TO THE SCHOOL OF POSTGRADUATE
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THE AWARD OF MASTER OF ENGINEERING (M.ENG) DEGREE IN
CIVIL ENGINEERING IN THE DEPARTMENT OF CIVIL
ENGINEERING, COLLEGE OF ENGINEERING, COVENANT
UNIVERSITY**

OCTOBER, 2021

ACCEPTANCE

This is to attest that this dissertation was accepted in partial fulfilment of the requirements for the award of Master of Engineering (M.Eng.) degree in Civil Engineering, Department of Civil Engineering, College of Engineering, Covenant University, Ota.

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DECLARATION

I, **ARAOYE, OYINDAMOLA VICTORIA (19PCI01976)** declare that this research work was carried out by me under the supervision of Professor David O. Omole of the Department of Civil Engineering, Covenant University. I also solemnly declare that to the best of my knowledge, no part of this report either wholly or partially has been submitted here in Covenant University or elsewhere in a previous application for the award of a degree. All sources of data and scholarly publications have been duly acknowledged.

ARAOYE, OYINDAMOLA VICTORIA

Signature and Date

CERTIFICATION

We certify that this dissertation titled “**ASSESSMENT OF ARSENIC AND CADMIUM CONTAMINANT LEVELS IN DOMESTIC WATER SOURCES IN SELECTED OGUN COMMUNITIES**” is an original research work carried out by **ARAOYE, OYINDAMOLA VICTORIA (19PCI01976)** in the Department of Civil Engineering, College of Engineering, Covenant University, Ota, Ogun State, Nigeria under the supervision of Professor David O. Omole. We have examined and found this work acceptable as part of the requirements for the award of Master of Engineering in Civil Engineering.

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DEDICATION

I dedicate this research work to God Almighty for His guidance, wisdom, and strength given to me to carry out this research. I also dedicate this research to my parents and siblings, for their love and support towards fulfilling my goals.

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LIST OF ABBREVIATIONS

As	Arsenic
Cd	Cadmium
WHO	World Health Organization
USEPA	United States Environmental Protection Agency
NSDWQ	Nigerian Standard for Drinking Water Quality
MCL	Maximum Contaminant Limit
HHRA	Human Health Risk Assessment
ADD	Average Daily Dose
HI	Hazard Index
HQ	Hazard Quotient
ILCR	Incremental Lifetime Cancer Risk

ABSTRACT

The United Nations considers universal access to clean water an essential step towards improving health and living standards worldwide, as clearly stated in Goal 6 of the Sustainable Development Goals (SDG). However, access to potable water is made more difficult through water pollution arising from geogenic and anthropogenic activities such as industrial discharges, increased rural-urban migrations, and mining. Thus, there is a need for constant monitoring of the state of water resources from which citizens make withdrawals in order to ensure public health safety. This study aimed to assess the contaminant levels of Arsenic and Cadmium in domestic water sources in selected communities in Ogun State, Nigeria. According to the World Health Organization (WHO), Arsenic and Cadmium are classified as Group 1 carcinogens that pose dangerous health risks to humans and the general environment. Water samples were collected from hand-dug wells and boreholes in six selected communities in Ogun State, namely: Wasinmi, Olujobi, Papalanto, Itori, Onihale, and Ifo. A total of 60 samples (10 from each community) were collected and subjected to analysis using standard methods. The carcinogenic and non-carcinogenic health risks through ingestion and dermal routes were evaluated according to USEPA guidelines. The age groups selected for the health risk assessment in this study ranged from 1-<2 years, 2-<3 years, 3-<6 years, 6-<11 years, 11-<16 years, 16-<18 years, 18-<21 years, 21-<65 years, >65 years. Also, the public perception of domestic water uses and contamination problems was determined using questionnaires with the aid of face-to-face interviews. Data was collected through the questionnaires administered to residents (adults) of the six communities (N=180). The findings from this study revealed that the concentration of cadmium in all six communities ranged from 0.001mg/L to 0.530mg/L (Wasinmi community), while Arsenic concentration was below the detection limit. The mean Cadmium concentration from Olujobi, Wasinmi, Itori, Papalanto, Ifo, and Onihale communities were 0.001mg/l, 0.053mg/l, 0.0531mg/l, 0.001mg/l, 0.0157mg/l, and 0.0316mg/l respectively. The hazard index (HI) of cadmium in the water samples showed a high risk across the different age groups. The HI (via ingestion route) values for age groups 1 to <2 years and 2 to <3 years were the highest, followed by 3 to <6 years, 6 to <11 years and 11 to <16 years, demonstrating in general unfavourable non-carcinogenic risks, in which children and young adults were at severe risk. There was no risk recorded via dermal route. The incremental lifetime cancer risk (ILCR) of cadmium showed extremely high risk for the nine age groups, with children between ages 1 to <2 years having the highest ILCR value. The ILCR values ranged between Levels V to VII for most parts of the study areas. Onihale, Itori and Wasinmi communities had the highest population at risk through ingestion route compared to other communities. Furthermore, findings from the questionnaires revealed that the majority of the respondents got their drinking water from boreholes and packaged water, while hand-dug wells and boreholes were the major sources for other domestic water uses. A significant number of the respondents checked their water quality through taste, colour or smell. Only 15% of the respondents treated their drinking water, while 95% had no knowledge of Arsenic and cadmium as water contaminants. This research helped identify the affected population at risk of severe health effects from cadmium-polluted water sources in the study areas. This information can be shared with the authorities and the affected communities in order to mitigate the intake of polluted water.

Keywords: Arsenic, Cadmium, domestic water sources, groundwater, water pollution, carcinogen, health risk.