SnT 2025 8 SEPTEMBER ONLINE DAY 9 TO 12 SEPTEMBER AT HOFBURG PALACE, VIENNA & ONLINE
CTBT: SCIENCE AND TECHNOLOGY CONFERENCE

P2.3-515

Review of Data from Radionuclide Monitoring (RN64) Station (2010–2024): Insights and Recommendations

V. Balobegwa, L. Nkuba and S. Sawe

Tanzania Atomic Energy Commission (TAEC), United Republic of Tanzania.

INTRODUCTION AND MAIN RESULTS

Anthropogenic radionuclides were observed at the RN64 station in Tanzania in September 2024, prompting a review of radionuclide monitoring data collected between January 2010 and October 2024. Key finding includes the detection of both natural and anthropogenic radionuclides (fission and activation products). However, the interest was on anthropogenic radionuclides (fission and activation products) which are on the list of Comprehensive Nuclear-Test-Ban Treaty (CTBT) relevant radionuclides as an indicator of a potential nuclear test. Detected anthropogenic radionuclides were; Co-60, Cs-137, Cs-134, Na-24, I-133, Nd-147, Zn-65, Nb-95, Zr-95, Sn-113 and Co-58. Detected natural radionuclides were Be-7, K-40, U-235, and decay products of Th-232 and U-238. These results indicate that there have been instances of air pollution due to anthropogenic radionuclides released from atmospheric nuclear weapon tests or operating nuclear facilities, such as nuclear power plants. Recommendations include: perform comprehensive investigation on the source and cause of the unusual emissions, analysis of aerosol samples coupled with Atmospheric Transport and Dispersion Modelling (ATDM), perform simulation model by available computer code simulation tool and dispersion modeling to establish the extent of anthropogenic radionuclides spread in the country.

This review is based on RN64 station monitoring and NDC records (2010–2024). Data are verified via CTBTO/PTS analysis. Interpretation should be used strictly for scientific and policy guidance.

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Introduction

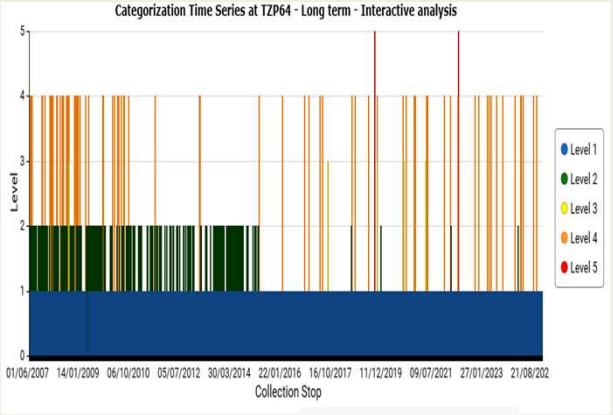
The United Republic of Tanzania hosts radionuclide monitoring station RN64 in Dar es Salaam, operated by the Tanzania Atomic Energy Commission (TAEC) since 2007 under the Comprehensive Nuclear-Test-Ban Treaty Organization (CTBTO) framework. The station continuously samples air particulates and transmits data to the International Data Center (IDC) in Vienna. In September 2024, the station detected Cs-137, triggering a comprehensive review of archived radionuclide data spanning 2010–2024. This study presents a systematic review of radionuclide detections at RN64, their implications, and recommendations for national monitoring

Materials and Methods

RN64 employs high-volume air sampling with subsequent gamma spectrometry using HPGe detectors. Daily data are transmitted to the IDC and reviewed by PTS analysts. For this study, radionuclide detections were reviewed from January 2010 to October 2024 using the RNToolkit v0.3.5 at the National Data Center (NDC). The dataset included both natural radionuclides (Be-7, K-40, U-235, Th-232, U-238 decay products) and anthropogenic radionuclides of CTBT relevance.

Results

The review confirmed daily detection of natural radionuclides, consistent with background levels. Anthropogenic radionuclides of interest were sporadically detected across the study period (Table 1). These detections include fission and activation products relevant for CTBT verification. Notable peaks included Cs-137 (71 μBq/m³ in 2011), Na-24 (>9 μBq/m³ in several years), and other radionuclides such as I-133 and Co-60. The temporal pattern suggests episodic inputs likely linked to regional or global nuclear activities.



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Results

Table 1. Anthropogenic radionuclides detected at RN64 (2010–2024).

Date	Radionuclides	Activity (uBq/m³)
21-09-2024	Cs-137	7.85
17-08-2024	Co-60	1.17E+00
25-03-2024	I-333	4.31E+00
22-01-2024	Cs-137	7.28E-01
26-06-2023	Na-24	7.24E+00
10-03-2023	Na-24	8.82E+00
10-03-2023	I-133	5.47E+00
07-09-2023	Nd-147	7.18E+00
29-04-2023	Zn-65	1.15E+00
27-10-2022	Co-60	8.10E-01
12-04-2022	Na-24	7.36E+00
12-04-2022	Nb-95	1.36E+00
29-04-2022	Zr-95	1.65E+00
28-01-2022	Sn-113	1.36E+00
20-01-2022	Na-24	6.42E+00
11-11-2021	Co-58	1.02E+00
10-05-2021	I-131	1.41E+00
25-04-2021	Cs-137	5.10E-01
07-12-2020	Cs-137	9.20E-01
07-12-2020	Cs-137	9.20E-01
08-09-2020	Cs-137	1.06E+00
18-12-2020	Na-24	7.79E+00
06-08-2020	Na-24	9.96E+00
13-08-2020	Na-24	8.40E+00
12-09-2019	Cs-137	7.93E+00
12-09-2019	Cs-134	1.18E+00
11-10-2019	Co-60	6.65E-01
11-10-2019	Na-24	5.77E+00
11-10-2019	Na-24	7.79E+00
18-12-2018	Na-24	7.14E+00
02-09-2017	Na-24	7.8
29-06-2017	Na-24	7.2
28-05-2017	Na-24	8.5
07-11-2016	Na-24	8.6
08-02-2016	Na-24	8.9
19-03-2015	Cs-137	57
14-02-2013	Cs-137	1.7
27-08-2011	Cs-137	71
12-03-2010	Cs-137	0.84
18-07-2010	Na-24	9.4
13-09-2010	Na-24	7.1
04-05-2010	Na-24	4.6
22-05-2010	Na-24	7.9
29-03-2010	Na-24	7.2

Discussion

The detection of anthropogenic radionuclides at RN64 underscores its vital role in CTBT verification. Elevated levels of Cs-137 and Na-24, among others, highlight episodic releases of artificial radionuclides into the atmosphere. While natural radionuclides dominate daily spectra, anthropogenic signals require further investigation to identify potential sources, such as nuclear facilities, power plants, or weapons tests. Strengthening dispersion modeling and regional sampling is critical to trace origins and assess public health risks.

Recommendations

- Continuation and strengthening of CTBTO collaboration
- perform comprehensive investigation on the source and cause of the unusual emissions
- Analysis of aerosol samples coupled with Atmospheric Transport and Dispersion Modelling (ATDM),
- Perform simulation model by available computer code simulation tool and dispersion modeling to establish the extent of anthropogenic radionuclides spread in the country.
- Use of dispersion modeling to map deposition of anthropogenic radionuclide
- Capacity-building for TAEC operators in IMS/IDC data analysis and security management

Conclusion

The RN64 station has reliably detected both natura anthropogenic radionuclides over 14 years monitoring. Occurrences of CTBT-relevant radionuc confirm Tanzania's importance in the global verific regime. Sustained monitoring, capacity building, advanced modeling are essential to strengthen nu security and environmental safety

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