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

P2.3-002

# AIR ACTIVITY CONCENTRATION OF NATURALLY OCCURRING RADIOACTIVE MATERIAL (NORM) IN THE ENVIRONMENT OF THE NUCLEAR POWER RESEARCH ORGANIZATION, NATIONAL RESEARCH AND INNOVATION AGENCY, SOUTH JAKARTA, INDONESIA IN 2023

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## INTRODUCTION AND MAIN RESULTS

This study aims to identify the variety of NORM (Naturally Occurring Radioactive Material) radionuclides in the Nuclear Energy Research Organization, National Research and Innovation Agency, Pasar Jumat, South Jakarta, Indonesia, along with the concentration levels received by workers and to see the influence of radionuclides from countries outside Indonesia during 2023. Air sampling using the High Volume Air Sampler (HVAS) and Snow White tools. The results of NORM measurements in the air were analyzed by gamma spectrometry using a High Purity Germanium Detector (HPGe) detector. The highest concentration detected by the snow white tool was K-40 with an average concentration of around $8.19\times10^{-4} \pm 2.65\times10^{-5}$ Bq/m³, followed by Th-232 with a concentration of around $1.29\times10^{-5} \pm 3.67\times10^{-6}$ Bq/m³, Th-228 Around $8.78\times10^{-6} \pm 1.23\times10^{-6}$ Bq/m³, and Ra-226 As the lowest around $7.75\times10^{-6} \pm 6.43\times10^{-7}$ Bq/m³. The results of NORM radionuclide concentrations from air monitoring with the HVAS tool are lower than the results from the Snow White tool. The concentration results are still below the threshold value of the activity concentration set by BAPETEN (Nuclear Energy Regulatory Agency) regarding the radiation safety of NORM storage, namely Ra-226 around 0.05 Bq/m3, Th-228 around 0.003 Bq/m$^3$, Th-232 around 0.006 Bq/m$^3$, and K-40 around 3 Bq/m$^3$.

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## Introduction

Indonesia has numerous non-nuclear industries that produce Naturally Occurring Radioactive Material (NORM) or even utilize byproducts containing NORM. Industrial processes such as fossil fuel mining, soil mineral extraction, and fertilizer use can increase the concentration of NORM to which humans are exposed. The high level of use of raw materials containing NORM makes monitoring the spread of radionuclides in the environment necessary to prevent unwanted impacts. This study was conducted by analyzing NORM using a High Volume Air Sampler (HVAS) and Snow White devices, using spectrometry with a High Purity Germanium (HPGe) detector. Sampling with the HVAS was conducted every 7 days (168 hours), while sampling with the HVAS device was conducted once a week (24 hours) in 2023. The measurement sites were selected with the aim of identifying all types of NORM present in the Nuclear Power Research Organization, National Research And Innovation Agency, BRIN, Pasar Jumat area, Jakarta, Indonesia, representing all regions in Indonesia.

## Methods/Data

Air measurements were carried out using HVAS (High Volume Air Sampler) with a flow rate of 1000 $m^3/s$ for 168 hours and snow white 700 $m^3/h$ for 24 hours.

NORM measurements in the air were analyzed by gamma spectrometry using a High Purity Germanium Detector (HPGe) detector.

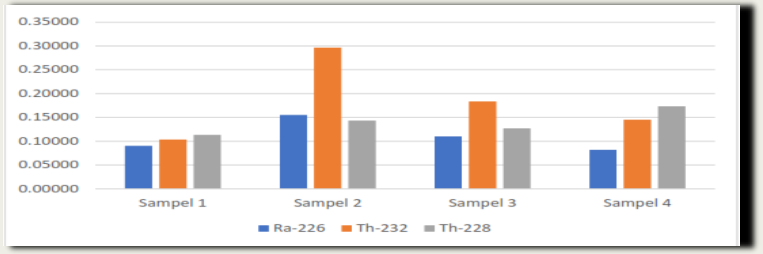
a. HVAS


b. Snow White

## Results

Measurement results of the radionuclides concentration using HVAS

| No. | Radionuclides | Concentrations | | | |
|---|---|---|---|---|---|
| | | Cons (Bq/g) | Unct (Bq/g) | Cons (Bq/m3) | Unct (Bq/m3) |
| Sample 01 (23/01/2023 — 30/01/2023) | | | | | |
| 1. | Ac-228 | 0,047 | 0,026 | 0,0000029 | 0,0000016 |
| 2. | Pb-212 | 0,036 | 0,010 | 0,0000022 | 0,0000006 |
| 3. | Tl-208 | 0,045 | 0,012 | 0,0000027 | 0,0000007 |
| 4. | TL-208 | 0,038 | 0,004 | 0,0000023 | 0,0000002 |
| 5. | Be-7 | 13,712 | 0,440 | 0,0008362 | 0,0000269 |
| Sample 02 (30/01/2023 — 06/02/2023) | | | | | |
| 1. | Pb-212 | 0,005 | 0,002 | 0,0000003 | 0,0000001 |
| 2. | K-40 | 0,177 | 0,018 | 0,0000090 | 0,0000009 |
| 3. | Be-7 | 36,347 | 0,895 | 0,0018537 | 0,0000456 |
| Sample 03 (06/02/2023 — 13/02/2023) | | | | | |
| 1. | Pb-212 | 0,045 | 0,012 | 0,0000027 | 0,0000007 |
| 2. | Tl-208 | 0,011 | 0,003 | 0,0000007 | 0,0000002 |
| 3. | U-238 | 0,726 | 0,436 | 0,0000435 | 0,0000261 |
| 4. | Be-7 | 38,466 | 0,893 | 0,0023034 | 0,0000535 |
| Sample 04 (13/02/2023 — 20/02/2023) | | | | | |
| 1. | Pb-212 | 0,023 | 0,032 | 0,0000010 | 0,0000014 |
| 2. | Pb-212 | 0,078 | 0,021 | 0,0000033 | 0,0000009 |
| 3. | Tl-208 | 0,181 | 0,02 | 0,0000078 | 0,0000008 |
| 4. | Be-7 | 46,008 | 1,108 | 0,0019745 | 0,0000475 |




Measurement results of the radionuclides concentration using Snow White instrument.

## Conclusions

The highest concentration detected by the snow white tool was K-40 with an average concentration of around $8.19\times10^{-4} \pm 2.65\times10^{-5}$ Bq/m³, followed by Th-232 with a concentration of around $1.29\times10^{-5} \pm 3.67\times10^{-6}$ Bq/m³, Th-228 Around $8.78\times10^{-6} \pm 1.23\times10^{-6}$ Bq/m³, and Ra-226 As the lowest around $7.75\times10^{-6} \pm 6.43\times10^{-7}$ Bq/m³. The results of NORM radionuclide concentrations from air monitoring with the HVAS tool are lower than the results from the Snow White tool. The concentration results are still below the threshold value of the activity concentration set by BAPETEN (Nuclear Energy Regulatory Agency) regarding the radiation safety of NORM storage, namely Ra-226 around 0.05 Bq/m3, Th-228 around 0.003 Bq/m³, Th-232 around 0.006 Bq/m³, and K-40 around 3 Bq/m³.

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