

1. Background

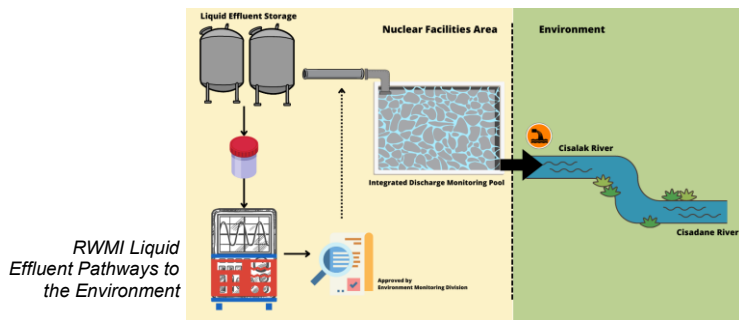
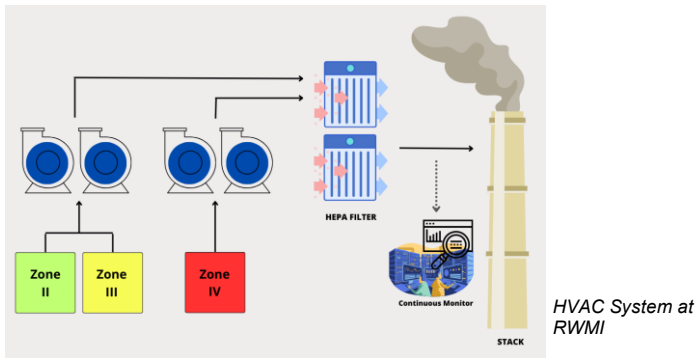
Monitoring and analysis of gas and liquid effluents are carried out based on the concentration of radionuclide activity that is permitted to be released into the environment as regulated in the Safety Analysis Report of Radioactive Waste Management Installation (RWMI) document.

Characteristic of the RWMI Effluents:

Effluent type	Gaseous	Liquid
Dominant radionuclide	Cs-137	Cs-137, Co-60, Zn-65
Duration	40 hours/week	temporary
Volume	25.000-45.000 m ³ /week	5-50 m ³ /tank

2. Methods

Effluent monitoring at IPLR is carried out in two ways according to the type of effluent. Monitoring of gaseous effluent is carried out continuously using a stack monitor instrument. Liquid effluent monitoring is carried out by the sampling method to be analyzed for radionuclides using a Multi-Channel Analyzer (MCA).



3. Analysis

- Gaseous Effluent: Analysis of gross alpha and beta/gamma radioactivity concentration using the iCam stack monitor. The allowable limits for activity concentration values for radionuclide release into the air are $A_i \leq 11.1 \text{ Bq/m}^3$ for alpha emitters and $A_i \leq 111 \text{ Bq/m}^3$ for beta/gamma emitters.
- Liquid effluent: sample analysis using a Multi-Channel Analyzer (MCA) gamma spectrometer. The limit value for the release of radionuclides into the environment through water bodies is $A_i \leq 2.24 \times 10^8 \text{ Bq per year}$.

4. Results and Discussion

4.1. Gaseous Effluent

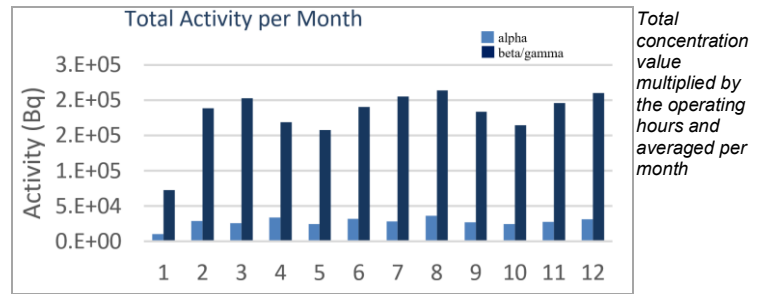
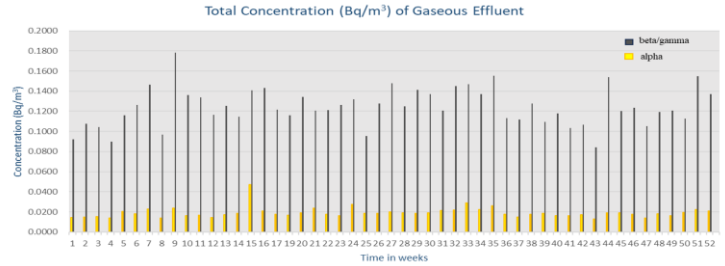
The results for data on the total concentration of gas effluent in 2022 meet the highest concentration of total effluent gas for the alpha emitter was 0.0470 Bq/m^3 and for the beta/gamma emitter was 0.1785 Bq/m^3 .

5. Conclusions and Acknowledgement

The highest levels of activity concentration in the gas effluent were 0.0470 Bq/m^3 (for alpha emitters) and 0.1785 Bq/m^3 (for beta/gamma emitters). The total liquid effluent volume in 2022 is 103 m^3 with a total activity of: $2.49 \times 10^4 \text{ Bq/year}$ (for Cs-137), $9.607 \times 10^6 \text{ Bq/year}$ (for Co-60), and $6.579 \times 10^6 \text{ Bq/year}$ (for Zn-65). The radionuclide with the highest concentration in liquid effluent is Co-60. Based on the effluent release limits in the Safety Analysis Report, the radionuclide concentrations contained in gas and liquid effluents are still below the required limits.

Thanks to the Occupational Safety Division and Treatment Operations Division at RWMI for their participation and cooperation. The authors acknowledge the facilities and scientific and technical support from the Personal Dose and Environmental Monitoring Laboratory, National Research and Innovation Agency through E-Layanan Sains-BRIN.

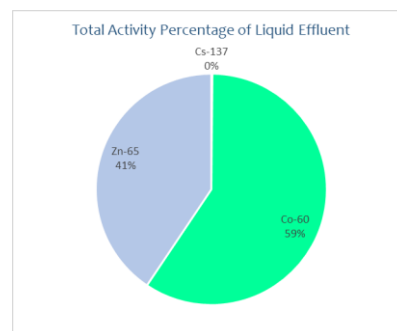
The data total concentration of gaseous effluent in every weeks are:



4.2 Liquid Effluent

During 2022, the total volume of liquid waste from facility activities will experience a decrease in volume from 177.5 m^3 in 2021 to 103 m^3 in 2022.

Source	Volume (m ³)	Radionuclide (Bq)	Total Activity (Bq)
Doubtful Effluent	15	Cs-137 (1.215E+04 Bq) Co-60 (9.96E+04 Bq) Zn-65 (4.605E+04 Bq)	1.578E+05
Active effluent (Treatment Product R22001 D)	35	Co-60 (3.098E+06 Bq) Zn-65 (2.82E+06 Bq)	5.918E+06
Doubtful Effluent	15	Cs-137 (1.275E+04 Bq) Co-60 (1.806E+05 Bq) Zn-65 (1.118E+05 Bq)	3.051E+05
Active Effluent (Treatment Product R22001 D)	38	Co-60 (6.229E+06 Bq) Zn-65 (3.602E+06 Bq)	9.83E+06
Total			1.621E+07



The total concentration value for each radionuclide meets the requirements limit, which is $2.49 \times 10^4 \text{ Bq}$ (for Cs-137), $9.607 \times 10^6 \text{ Bq}$ (for Co-60), and $6.579 \times 10^6 \text{ Bq}$ (for Zn-65).