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• Albania National Radioactive Waste Storage Facility Contamination Monitoring

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Abstract

The Albanian National Radioactive Waste Storage Facility (NRWSF) is operated by the Institute of Applied Nuclear Physics (IANP) in accordance with internationally acceptance criteria, and is situated within IANP territory. This facility consists of two main parts: a] operational area; b] interim storage facility (area). Apart from office and sanitary space the building contains the following areas: An area for preparing the cement mixture at the top of the drawing; a waste receipt area for checking delivered waste and their documentation; an operating area for conditioning the wastes; a decay-storage area for waste with short half-lives; an operational storage area for the storage of delivered wastes prior to their conditioning.

The Albanian National Radioactive Waste Storage Facility (NRWSF) is licensed to receive low level waste/intermediate level waste (LLW/ILW) of non-nuclear power plant origin (health care, industry, agriculture, education and research).

In the IAEA TC Programme cycle 2018-2019 Albania had a National Project ALB 9010 titled “Upgrading the Radioactive Waste Storage Building According to International Standards”. In the frame of this project since 2018 was prepared and implemented a Radiological Monitoring Program for the National Radioactive Waste Storage Facility. This monitoring programme included contamination control of the NRWSF floor surface, conditioned drums surface and of DSRS surface contamination by Smear Test. All the contamination monitoring results showed that there is no contamination in the floor surface, on the conditioned drums or DSRS stored inside NRWSF. These results show that the operation of the storage facility is safe for the environment, public and employes working in Albanian National Radioactive Waste Storage Facility.

1. Introduction

IANP is the institution responsible for the processing of all radioactive waste and spent radioactive sources produced in Albania and is licensed by the Radiation Protection Commission (RPC) for the following activities: import - export, transport, treatment, processing and temporary storage of radioactive sources and waste.

The radioactive waste storage facility is located at IANP territory. The facility is operated by IANP, which was established and designated with the responsibility of radioactive waste management, including disused sealed radioactive sources in law no. 8025, dated 1995/09/11 "On protection from ionizing radiation", amended no. 9973, July 28, 2008. All operations for waste treatment, processing, storage and transport are carried out by IANP in the radioactive waste storage facility.

During the design of the construction of this type of facility, the principles of physical barriers were used, which keep the radioactive material inside the building in the designated place. For the safe work in the radioactive waste storage facility, IANP has prepared various administrative measures, which are in accordance with the quality assurance programs for radioactive waste management services [3].

These measures include the normal operation of the radioactive waste storage facility, as well as emergency situations that may occur within it. The radioactive waste storage facility in Tirana is also equipped with systems that ensure the physical protection of the building.

2. Methods

Albania joined IAEA TC Programme cycle 2018-2019 with a National Project ALB 9010 titled “Upgrading the Radioactive Waste Storage Building According to International Standards”. The two fundamental objectives of the project were:

(1) To ensure the protection of the public, workers and the environment; and

(2) to ensure retrievability of waste packages for final disposal

In the frame of this project since 2018 was prepared and implemented a Contamination Monitoring Program for the National Radioactive Waste Storage Facility. For contamination monitoring was use the device Ludlum Scaler/Ratemeter Portable Wipe Counter Model 2224.

The Model 2224-1 is a portable microprocessor-based radiation survey instrument used to measure and discriminate low-level alpha/beta radiation when used with an alpha/beta scintillation or proportional detector. The data is displayed by an analog ratemeter and a six-digit liquid crystal display (LCD) counter.

Minimum Detectable Count Rate (MDCR) for each channel by using the following formula for alpha or beta:

$$MDCR = 2.71 + 3.29 \cdot \sqrt{\frac{R_{bkd}}{t_{bkd}} + \frac{R_{bkd}}{t_{sam}}}$$

If the difference of the removable contamination with the background value is equal or more then MDCR then we record the measurement value. If it is lower then the MDCR then we record it as Non-Detectable Activity (NDA).

Figure Nr.1 Ludlum Scaler/Ratemeter Portable Wipe Counter Model 2224.

3. Results

Control of radioactive contamination inside the NRWSF is preformed periodically, by taking smear samples and following the instructions described for “Verification of contamination by wipe test method”.

Using the device Ludlum Scaler/Ratemeter Portable Wipe Counter Model 2224 and following the procedure described above we measured the contamination level of the NRWSF floor surface, conditioned drums surface and of some DSRS surface by Smear Tests.

Table Nr.I. NRWSF floor radiological control registration form. Radioactive surface contamination.

Position	Date	Alfa Measurements (Bq/cm²)	Beta Measurement (Bq/cm²)
1	19/06/2024	0.00017	NDA
2	19/06/2024	NDA	NDA
3	19/06/2024	0.00017	0.00013
4	19/06/2024	0.00011	NDA
5	19/06/2024	0.00017	0.0011
6	19/06/2024	0.00038	0.00028
7	19/06/2024	0.0014	0.0018
8	19/06/2024	0.00015	NDA
9	19/06/2024	0.00037	NDA
10	19/06/2024	0.0018	0.0012
11	19/06/2024	0.00011	0.0062
12	19/06/2024	0.0012	0.0032
13	19/06/2024	0.0011	0.0033
14	19/06/2024	0.00112	NDA
15	19/06/2024	0.00041	0.00047
16	19/06/2024	0.00049	0.00010
17	19/06/2024	0.00058	0.00013
18	19/06/2024	0.00068	NDA
19	19/06/2024	0.0027	0.0017
20	19/06/2024	0.00032	0.0053
21	19/06/2024	0.00132	0.0073
22	19/06/2024	0.00014	0.00052

Table Nr.II. Registration form of radiological controls of conditioned 200 L Drums. Radioactive surface contamination

Drum Nr	Date	Upper part Alfa Measurement (Bq/cm²)	Side Part Alfa Measurement (Bq/cm²)	Upper part Beta Measurement (Bq/cm²)	Side Part Beta Measurement (Bq/cm²)
1	19/06/2024	0.00014	0.0028	0.017	0.0012
2	19/06/2024	0.0028	0.00061	0.013	0.009
3	19/06/2024	0.006	0.0032	0.0021	0.014
4	19/06/2024	0.005	0.0046	0.0065	0.015
5	19/06/2024	0.0017	0.0038	0.0041	0.017
6	19/06/2024	0.0021	0.0025	0.0031	0.0043
7	19/06/2024	0.0019	0.0021	0.0011	0.013
8	19/06/2024	0.0028	0.0031	0.0014	0.027
9	19/06/2024	0.0041	0.0015	0.018	0.0042
10	19/06/2024	0.0033	0.0018	0.022	0.0063
11	19/06/2024	0.004	0.0013	0.027	0.0051
12	19/06/2024	0.0021	0.0017	0.0019	NDA
13	19/06/2024	0.0015	0.0016	0.042	0.0053
14	19/06/2024	NDA	0.0025	0.0011	NDA
15	19/06/2024	0.003	0.0022	0.0075	0.0048
16	19/06/2024	0.004	0.0022	NDA	0.00013
17	19/06/2024	0.005	NDA	0.006	NDA
18	19/06/2024	0.0012	0.0013	NDA	NDA
19	19/06/2024	0.005	NDA	0.004	NDA
20	19/06/2024	0.0018	0.0017	0.0023	NDA
21	19/06/2024	0.0042	0.0013	0.002	NDA
22	19/06/2024	0.0024	0.0011	0.003	0.013
23	19/06/2024	0.0055	0.0015	0.013	NDA
24	19/06/2024	0.0021	0.0047	0.005	NDA
25	19/06/2024	NDA	0.0011	0.021	NDA
26	19/06/2024	0.0005	0.0013	0.0007	0.005
27	19/06/2024	0.0011	0.009	NDA	0.0005
28	19/06/2024	NDA	0.00011	NDA	0.00011
29	19/06/2024	0.00013	NDA	0.00011	NDA
30	19/06/2024	0.004	0.0042	NDA	NDA
31	19/06/2024	NDA	0.00015	NDA	0.00021
32	19/06/2024	0.0007	NDA	0.006	NDA

Table Nr.III. DSRS radiological control registration form. Radioactive surface contamination.

DSRS ID	Date	Radioisotope	Location	Alfa Measurement (Bq/cm²)	Beta Measurement (Bq/cm²)
1	19/06/2024	Co-60	DSRS storage room	NDA	NDA
2	19/06/2024	Co-60	DSRS storage room	NDA	NDA
3	19/06/2024	Cf-252	DSRS storage room	0.0016	0.011
4	19/06/2024	Cf-252	DSRS storage room	0.009	0.012
5	19/06/2024	Cf-252	DSRS storage room	0.002	NDA
6	19/06/2024	Cf-252	DSRS storage room	0.0006	0.005
7	19/06/2024	Ir-192	DSRS storage room	0.0005	0.006
8	19/06/2024	Ir-192	DSRS storage room	0.0009	0.008
9	19/06/2024	Co-60	DSRS storage room	NDA	NDA
10	19/06/2024	Co-60	DSRS storage room	NDA	NDA
11	19/06/2024	Co-60	DSRS storage room	NDA	NDA
12	19/06/2024	Co-60	DSRS storage room	NDA	NDA
13	19/06/2024	^{241}Am/Be	DSRS storage room	NDA	NDA
14	19/06/2024	^{241}Am/Be	DSRS storage room	NDA	NDA
15	19/06/2024	^{241}Am/Be	DSRS storage room	0.001	0.002
16	19/06/2024	Ra-226	DSRS storage room	0.0005	NDA
17	19/06/2024	Ra-226	DSRS storage room	NDA	0.0007
18	19/06/2024	Cs-137	DSRS storage room	NDA	NDA
19	19/06/2024	Cs-137	DSRS storage room	0.0003	NDA
20	19/06/2024	^{241}Am/Be	DSRS storage room	NDA	NDA
21	19/06/2024	^{241}Am/Be	DSRS storage room	NDA	NDA
22	19/06/2024	Th-232	DSRS storage room	NDA	NDA

4. Discussion

Across all surveyed areas of the national radioactive waste storage facility (floor, drums, and DSRS), contamination levels appear low, generally below commonly accepted clearance levels for alpha and beta surface contamination, which are typically:

- Alpha: ~0.04 Bq/cm²
- Beta/gamma: ~0.4 Bq/cm²

Most readings in this survey are several orders of magnitude below these thresholds, indicating good radiological control and effectiveness of the existing safety and containment protocols.

5. Conclusions

All the contamination measurements of the radioactive waste storage facility floor surface, conditioned drums surface, and DSRS surface showed that there is no contamination inside the storage facility. All measured surface contamination levels both alpha and beta are well below internationally accepted limits.

No value exceeds 0.042 Bq/cm² (beta) or 0.009 Bq/cm² (alpha), which is significantly lower than standard contamination thresholds (typically 0.4 Bq/cm² for beta, 0.04 Bq/cm² for alpha). These results show that the operation of the storage facility is safe for the environment, public and employes working in Albanian National Radioactive Waste Storage Facility.

To ensure the safe operation of the facility, the conditions of radiological protection must be met, which will ensure that the impact of the facility is in accordance with the relevant regulations.

These restrictions are in accordance with international recommendations and and EU provisions. Measurements are necessary to ensure that the work in the storage facility is consistent with previous measurements made, so that the work in the storage facility does not have an impact on the environment. Limits for radioactive contamination of the environment are determined by Regulation No. 313 dated 9.05.2012 "For the protection of the public from discharges into the environment, determination of samples, regions and frequencies of measurements. The effective dose limit for individuals from the population reference group is 1 mSv/year.

The NRWSF demonstrates an overall high level of radiological safety and contamination control. Minor localized elevations in some readings are within acceptable safety limits and do not indicate any loss of containment or elevated risk. Continued adherence to routine monitoring, targeted inspections (especially on certain drums and Cf-252 DSRS), and periodic reassessment of hotspots will ensure the ongoing safety of personnel and the environment.