Romanian Experience in The Conditioning of Radium Sources - 8311

Gh. Dogaru, F Dragolici, Gh. Rotarescu, M. Nicu

National Institute for Research&Development of Physics and Nuclear Engineering – Horia Hulubei

407 Atomistilor Street, Magurele, Ilfov, P.O.Box MG-6, 76900 Romania

ABSTRACT

Ra^{226} first radionuclide separated from pitchblende in 1898 by Pierre and Marie Curie was successfully used in medicine, industry as in other fields being the only one available radionuclide till 1940 when were produced other radionuclides in accelerators.

On long term the use of Ra^{226} sealed sources are not any more safe due to: the high specific activity, long half live, decays in Rn^{226} gas which increases the internal pressure of capsule leading in time to the leakage, the salts as raw materials from which the sealed sources are manufactured are soluble, there is a leak of information and records on the manufacture and operation.

Based on this consideration in Romania regulatory authority did not authorized any more the use of these sealed sources [1].

The paper presents some aspects from Romanian experience related to the collection and conditioning of radium sealed sources. Data relating the radium inventory as well as the arrangements made in order to create a workshop for the conditioning of radium sources are presented.

INTRODUCTION

Since 2000, regulatory authority in nuclear field has not authorized any more the use of radium in medicine. The entire radium inventory from medicine was transferred to Radioactive Waste Treatment Plant (RWTP) as radioactive waste. RWRP belongs to National Institute for Research&Development of Physics and Nuclear Enigineering – Horia Hulubei and it is

authorized by regulatory authority for collection, treatment, conditioning and disposal of radioactive waste including spent sealed radioactive sources. The waste acceptance criteria to predisposal as well as waste acceptance criteria to disposal which include also activity limits have been established by RWTP and approved by regulatory authority. The entire inventory of radium sources in Romania is larger than the inventory conditioned in RWTP in this program, a part of the spent radium sources were already disposed into repository and another one is still used in industry or research. [1], [2]

A storage facility consist of 5 storage rooms belongs to RWTP contains the entire inventory of radium which was stored over the time.

RADIUM SOURCES INVENTORY

In order to avoid any incidents or to repeat some mistakes, the management itself of radium sources for long term conditioning was very careful analyzed, developed and implemented. In development of this activity some aspects have been considered:

- regulatory requirements
- requirements of personnel
- requirements and availability of infrastructure and facility
- existing inventory of radium sources
- design of packaging
- design of stainless steal capsule
- design of workshop for conditioning
- operating procedures
- radiation protection measures
- track recording system. [3, 4]

The identification of radium sources started by look up into existing records of RWTP. After identification from records, the radium sources have been identified as location into those five rooms of storage facility. The handling of sources was made according to the existing procedure and performed with the domestic transport devices. The radiological characterization has been made for each piece of spent sealed sources into a special workshop and the results were recorded into a new register. For protection of personnel the

existing radiation protection measures had to be improved based on the radium hazards. Step by step working procedures were developed and implemented for this specific activity. The inventory of radium sources is presented in Table I. The sources mentioned at the last two positions in Table I are sources used in industry and they are no managed in this program, they are stored on site in storage facility.

Table I. Inventory of radium sources

No	Identification number	Source type	Dimensions (mm)	Activity (mCi)
1	365/AC-PL-04-01-05	needle		9.55
2	574/AC-PL-04-01-05	needle	Φ1.65 x 27.5	1.96
3	575/AC-PL-04-01-05	needle	Φ1.65 x 27.5	1.96
4	576/AC-PL-04-01-05	needle	Φ1.6 x 13.5	1.845
5	577/AC-PL-04-01-05	needle	Φ1.6 x 13.5	1.845
6	578/AC-PL-04-01-05	needle	Φ2 x 50	4.16
7	579/AC-PL-04-01-05	needle	Φ2 x 40	2.60
8	580/AC-PL-04-01-05	needle	Φ2 x 40	2.60
9	581/AC-PL-04-01-05	needle	Φ2 x 40	2.90
10	582/AC-PL-04-01-05	needle	Φ2 x 22.5	1.25
11	583/AC-PL-04-01-05	needle	Φ2 x 25	1.83
12	584/AC-PL-04-01-05	needle	Φ2 x 25	1.85
13	585/AC-PL-04-01-05	needle	Φ2 x 25	1.81
14	586/AC-PL-04-01-05	needle	Φ1.5 x 20	1.26
15	587/AC-PL-04-01-05	needle	Φ1.5 x 20	1.26
16	588/AC-PL-04-01-05	cell	Φ3.8 x 22.5	8.81
17	589/AC-PL-04-01-05	cell	Φ3.8 x 22.5	8.63
18	590/AC-PL-04-01-05	cell	Φ3.8 x 22.5	8.75
19	591/AC-PL-04-01-05	cell	Φ3.8 x 22.5	8.76
20	592/AC-PL-04-01-05	cell	Φ2.8 x 21.7	8.79
21	593/AC-PL-04-01-05	cell	Φ2.8 x 21.7	8.79
22	594/AC-PL-04-01-05	cell	Φ2.65 x 21.7	4.526
23	595/AC-PL-04-01-05	cell	Φ2.65 x 21.7	4.526
24	596/AC-PL-04-01-05	cell	Φ2.65 x 21.7	4.526
25	597/AC-PL-04-01-05	cell	Φ2.65 x 21.7	4.526
26	598/AC-PL-04-01-05	cell	Φ1.65 x 21.7	4.727
27	599/AC-PL-04-01-05	cell	Φ1.65 x 21.7	4.727
28	600/AC-PL-04-01-05	cell	Φ1.65 x 21.7	4.727
29	601/AC-PL-04-01-05	cell	Φ1.65 x 21.7	4.727
30	602/AC-PL-04-01-05	cell	Φ1.65 x 21.7	4.727
31	603/AC-PL-04-01-05	cell	Φ1.65x21.7	4.727
32	604/AC-PL-04-01-05	cell	Φ7.5 x 27	8.06
33	605/AC-PL-04-01-05	cell	Φ7.5 x 27	8.18
34	606/AC-PL-04-01-05	cell	Φ7.5 x 27	8.08
35	607/AC-PL-04-01-05	cell	Φ7.5 x 27	8.19
36	608/AC-PL-04-01-05	cell	Φ7.5 x 27	8.34
37	609/AC-PL-04-01-05	cell	Φ6.5 x 25	8.02
38	610/AC-PL-04-01-05	cell	Φ5.5 x 21	9.18
39	611/AC-PL-04-01-05	cell	Φ5.5 x 21	9.11
40	1123/AC-PL-04-01-05		ten sources	
41	1123/AC-PL-04-01-05		eight sources	3kBq total
42	1037/AC-PL-04-01-05	calibration source	Φ15 x 100	1.023

43	1038/AC-PL-04-01-05	calibration source	Φ15 x 100	0.12
44	1039/AC-PL-04-01-05	calibration source	Φ15 x 100	0.095
45	1040/AC-PL-04-01-05	calibration source	Φ15 x 100	0.005
46	1041/AC-PL-04-01-05	calibration source	Φ15x100	0.01
47	1042/AC-PL-04-01-05	calibration source	Φ15x100	0.01
48	1043/AC-PL-04-01-05	calibration source	Φ15x100	0.01
49	1044/AC-PL-04-01-05	calibration source	Φ15x100	0.7
50	1174/AC-PL-04-01-05	Source used in industry		20
51	1175/AC-PL-04-01-05	Source used in industry		50

LONG TERM CONDITIONING OF RADIUM SOURCES

A workshop for characterization of each of radium sources and for long term conditioning of them was developed into a room which contained some non radioactive scrap metals. In the Fig. 1 is presented the aspect of room at the beginning of process.

Fig. 1. The initial and final aspect of the workshop for long term conditioning of radium sources

The planning of operations was made considering as most important aspects the limiting of personnel exposure as well as limiting of contamination of personnel. The following steps in the development of the workshop for long term radium conditioning were carried out:

- release of the non radioactive scrap metals from room
- monitoring of dose rate as well as of floor and wells radiological contamination

- painting of wells as well as of ceiling
- liner of floor with epoxy liner
- arrange of rotating table for welding of capsules
- commissioning of welding devices
- arranged of the shielding devices made by lead breaks
- training of personnel who perform the welding
- training of personnel for long term conditioning of radium.

In order to fulfill the regulatory requirements as well as the management system implements in the institute the following procedure were developed for this specific activity, as it is mentioned in Table II.

Table II. The working procedures developed for long term conditioning of radium sources

No.	Procedure	Identification number
1	Radiation protection measures for conditioning of radium	AC-PO-DMDR-05
2	Checking and Limiting of contamination	AC-PL-DMDR-22
3	Packaging for handling and long term conditioning of radium sources	AC-PL-DMDR-23
4	Stainliss steal capsule	AC-PO-DMDR-04
5	Check, testes, controls, records for conditioning of radium sources	AC-PO-DMDR-03

The preparation of packaging as well as of the stainless steal capsule followed the technical specification prior approved. Different types of stainless steal capsule were created and each of them was marked and the content was recorded. Three packaging was manufactured for different type of stainless capsule but only one is filled with radium sources. Each location performed into packaging was permanently marked on the packaging. According to the procedure each capsule was permanently marked with a unique identification number which was recorded as well as the location into the packaging. In Fig. 2 and Fig. 3 the stainless steal capsule and the packaging are presented.

Fig. 2. The stainless steal capsule for long term conditioning of radium sources

Fig.3. The packaging for long term conditioning of radium sources

CONCLUSIONS

The total inventory of radium conditioned for long term is about 280 mg about 280 mCi.
Different types of stainless steal capsule were created and each of them was permanently marked and the content was recorded. Three packaging was manufactured for different types of stainless capsule but only one is filled with radium sources.
The long term conditioning of radium sources was performed without incidents or overexposure of personnel.

REFERENCES

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