

## Regulation on safety management of the orphan and used radioactive sources in Vietnam

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### 1. Introduction

The responsibility of ensuring safety of radioactive sources primarily belongs to the owner and the licensee, followed by the responsibility of the regulatory authority to issue relevant legal regulations. When these radioactive sources are no longer in use or the orphan radioactive source, it is important to manage, especially for radioactive sources with high activity. In this study, the current international and Vietnamese regulations relating to the management of these radioactive sources are investigated and analyzed.

In order to research the current issues and information related to the orphan and the used radioactive sources with high activity, the relevant documents published by the International Atomic Agency (IAEA), and management experience in South Korea were reviewed, then linked to practices based in management in Vietnam.

### 2. Methods and Results

#### 2.1. The orphan and used radioactive source

Orphan radioactive sources are defined as the sources, which are not under regulation control or abandoned, lost, misplaced, stolen or illegally transferred, etc. The used radioactive sources are the under administrative control and in the process of use, and the activity is still at a high level as classified in Table 1. The used radioactive sources, of course, include the spent fuels from the nuclear reactors, or sources of radioactive in industry for nondestructive testing, nuclear medicine. They have a very high risk of serious accidents, even disaster on the environment and fatal for the public.

Monitoring of radioactive contamination sites is essential in order to minimize the exposure of radiation to workers and the public. On the basis of ensuring safety in the management of this type of radioactive sources, the international organization has issued a numerous of regulations such as: 1. International Atomic Energy Agency, Code of Conduct on the Safety and Security of Radioactive Sources, IAEA/CODEOC/2004, IAEA, Vienna (2004); 2. IAEA, Guidance on the Import and Export of Radioactive Sources, IAEA/CODEOC/IMP-EXP/2005, IAEA, Vienna (2005); 3. ANGUS, M.J., CRUMPTON, C., McHUGH, G., MORETON, A.D., ROBERTS, P.T., Management and Disposal of Disused Sealed Radioactive Sources in the European Union, EUR 18186EN, European Commission, Luxembourg (2000).

Table 1. Activities corresponding to the thresholds for categories of radioactive sources

Radionuclide	Category 1 1000 × D (TBq)	Category 2 10 × D (TBq)	Category 3 D (TBq)
Am-241	6 E+01	6 E-01	6 E-02
Am-241/Be	6 E+01	6 E-01	6 E-02
Cf-252	2 E+01	2 E-01	2 E-02
Cm-244	5 E+01	5 E-01	5 E-02
Co-60	3 E+01	3 E-01	3 E-02
Cs-137	1 E+02	1 E+00	1 E-01
Gd-153	1 E+03	1 E+01	1 E+00
Ir-192	8 E+01	8 E-01	8 E-02
Pu-147	4 E+04	4 E+02	4 E+01
Pu-238	6 E+01	6 E-01	6 E-02
Pu-239/Be	6 E+01	6 E-01	6 E-02
Ra-226	4 E+01	4 E-01	4 E-02
Se-75	2 E+02	2 E+00	2 E-01
Sr-90 (Y-90)	1 E+03	1 E+01	1 E+00
Tm-170	2 E+04	2 E+02	2 E+01
Yb-169	3 E+02	3 E+00	3 E-01
Au-198 <sup>a</sup>	2 E+02	2 E+00	2 E-01
Cd-109 <sup>b</sup>	2 E+04	2 E+02	2 E+01
Co-57 <sup>a</sup>	7 E+02	7 E+00	7 E-01
Fe-55 <sup>a</sup>	8 E+05	8 E+03	8 E+02
Ge-68 <sup>b</sup>	7 E+02	7 E+00	7 E-01
Ni-63 <sup>b</sup>	6 E+04	6 E+02	6 E+01
Pd-103 <sup>b</sup>	9 E+04	9 E+02	9 E+01
Po-210 <sup>b</sup>	6 E+01	6 E-01	6 E-02
Ru-106 (Rh-106) <sup>b</sup>	3 E+02	3 E+00	3 E-01
Tl-204 <sup>b</sup>	2 E+04	2 E+02	2 E+01

<sup>a</sup> Criticality issues and issues relating to accounting and control of nuclear material will need to be considered for sources with large multiples of D.

<sup>b</sup> These radionuclides are very unlikely to be used in individual radioactive sources with activity levels that would place them within categories 1, 2 or 3.

These radioactive sources can be either natural, man-made, or artificial. The management of radiation safety for the orphan radioactive sources therefore belongs to the Government and Regulatory Authorities. Meanwhile, ensuring radiation safety for used sources belongs to the owner and licensee.

In order to detect and classify to properly assess the level of radiation it is necessary to follow the control procedure, referring to Fig. 1. The classification of radioactive sources will help improve the treatment of these radioactive sources in later stages when landfilling or conditioning. Meanwhile, it will provide the basis for the provisions in procuring and training human resource to meet the management needs and preparedness emergency responses.

#### 2.2. Regulation on management of radioactive sources with high activity

Strict management of highly active radioactive sources is necessary to avoid incidents and accidents, for example the incidents occurred in 1983 in Mexico (CNSNS<sup>B</sup> 1984), in 1985 in Brazil (IAEA 1988), in

1994 in Estonia (IAEA 1998), in 1997 in the Republic of Georgia (Gonzalez 1999), and in 1998 in Turkey (Gorwdez 1999)<sup>[2]</sup>. To minimize the continuation of these radiation incidents, the IAEA has recommended that the strengthening of each regulatory infrastructure national, priority and continuing to strengthen the international standard system for radioactive source safety.

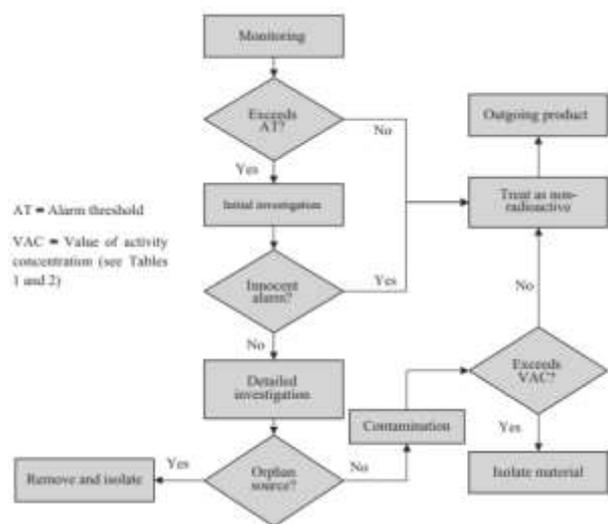


Fig 1. Steps involved in monitoring for radioactive material

Statistics show that the incidence of cancer increases when the radiation dose is more than 100 mSv, and the likelihood of fatal from cancer decreases when the dose is below 0.02 mSv. In fact, a number of countries have a quite complete regulatory framework for the management for the orphan and used radioactive sources which highly radioactive. However, the IAEA still recommends that it is necessary to continue to develop international standards for safe use of radiation, as there are many countries with incomplete legal systems.

On the basis of references to international code of conducts and regarded to actual situation, Vietnam has issued relevant legal documents, the following and so on:

- Nuclear Energy Law,
- The Circular No. 22/2014/TT-BKHCN Regulation on management of radioactive waste and used radioactive sources,
- The Circular No. 25/2014/TT-BKHCN Regulating the preparation and response to radiation and nuclear incidents, preparing and approving radiation and nuclear incident response plans,
- The Circular No. 23/2012/TT-BKHCN Guideline on the safe transportation of radioactive materials,

- The Circular No. 36/2015/TT-BTNMT Regulation on hazardous waste management,
- The Decree No. 107/2013/ND-CP Regulation on the sanctioning of administrative violations in the field of atomic energy.

### 3. Conclusions

Throughout this study, overall perspectives for current status in management for the orphan and used radioactive sources have been reviewed and analyzed.

The ultimate goal of managing the orphan and used radioactive sources with high radiation level is minimize their adverse effects on the environment and human. This study also focuses on general regulations in terms of administrative management not on the technical aspects of treatment such as deep geological repository, disposal or conditionality. On the basis of the study, it is necessary to make recommendations to the Vietnamese legal authorities in drafting and amendment legal regulations for the management of the orphan and used radioactive sources.

At the dawn in beginning of the establishment the atomic energy industry in the 60s of the 20th century, Vietnam has constantly issued and developed a legal framework related to radiation and nuclear safety. Therefore, the legal infrastructure of nuclear safety in Vietnam has partly met the management needs and aimed to meet the current international standards. However, in general, the regulation system on ensuring radiation safety for the orphan and used radioactive sources with high activity still needs to be studied and completed, towards ensuring safety in conservatives for the environment and public.

Therefore, there will have to be further studies and suggestions to enhance safety in the application of nuclear energy in production and life.

### REFERENCES

- [1] Control of orphan sources and other radioactive material in the metal recycling and production industries, IAEA safety standards series No.SSG-17, Vienna, 2012.
- [2] Radioactive materials in recycled metals, Joel O. Lubenau and James G. Yusko, 1995, Health Physics Society.
- [3] Radiological risks from potential exposure of the population to radiation from orphan radioactive sources Ioannis Tsilikis, Ioannis Pantos, Ifigeneia Zouliati, Antonios Koutras, Georgios Kalinterakis, and Athanasios Syllaios.
- [4] Safety and security of radiation sources in the aftermath of 11th September 2001, Joel O. Lubenau and Daniel J. Strom, August 2002, The Health Physics Society.
- [5] Volume XXVIII Number 5, The Health Physics Society's newsletter For Specialists in Radiation Safety, May 2000, International Agencies Act on Disused Source Problem, Joel O. Lubenau.

<sup>A</sup> International Atomic Energy Agency

<sup>B</sup> Comision Nacional de Seguridad Nuclear y Salvaguardias