Suggestion of a screening scheme for unusual radiation exposure in Korea

Wanook Ji[+], Ji-Yong Shin and Eun-Hee Kim[*]
Department of Nuclear Engineering, Seoul National University, 1 Gwanak-ro, Gwanak-gu, Seoul, Korea
[+] jwo86@snu.ac.kr; [*]*corresponding author: eunhee@snu.ac.kr*

1. Introduction

Multiple radiation exposure incidents in daily life have been reported since 2011. Mattresses with parts containing naturally occurring radioactive material (NORM) made a big issue in the sense that radiation exposure occurs via commercial products. NORM in the building materials also has raised concerns about the radiation exposure of residents in building at dose levels over a regulatory limit. On July 16 in 2019, the Nuclear Safety and Security Commission (NSSC) has announced the amendment of 'Act on Protective Action Guidelines against Radiation in the Natural Environment' [1] ('the Act' here after) for intensifying the safety management system against public exposure to NORM. The NSSC coined the expression 'unusual radiation exposure' to describe the exposure from unexpected artificial sources [2].

In this work, we investigated the management system abroad regarding the public exposure to radiation and accidental exposure of radiation workers. We reviewed the reports on unusual radiation exposure incidents until 2018 and their countermeasures taken by NSSC, the designated national authority. Suggestions are given on the scheme of dealing with unusual incidents in Korea. We named the radiation exposure of the public from unexpected sources of unusual radiation level as 'unusual radiation exposure.'

2. Management system of unusual radiation events abroad

The basic concept commonly taken by the national authorities abroad is to keep records of unusual radiation events. The objective is to prevent the same or similar radiation incidents.

2.1 Nuclear Material Events Database (NMED) of Nuclear Regulatory Commission (NRC) − USA [3]

The NRC of USA has published the annual NMED reports since 1993. The annual report contains records of recent 10 years' events involving nuclear materials. The NMED enables evaluating statistical significance of individual events and characterizing the occurrence of event. By understanding why the events occurred and how they proceeded, the designated authority would better identify actions required to improve the efficiency of regulatory system. Events are classified into eight categories according to §76.120 'reporting requirement' of 10 Code of Federal Regulations.

2.2 Australian Radiation Incident Register (ARIR) of Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) − Australia [4]

The ARIR is a repository of the radiation incidents reported by each of Australian Government Entities including the Commonwealth, two States and six Territories. The Schedule 13 of Radiation Protection Series No. 6 specifies the type of incidents that should be reported to ARPANSA for compilation in ARIR. ARPANSA expects to raise awareness of the risk from common tasks and share the lessons of incidents. ARIR has the records of the incidents related to non-ionizing radiation such as laser and UV as well. The major cause of incidents was analyzed to be human error.

2.3 Designed system of Radiation Accident Registry (RAR) of Health Canada − Canada [5]

The RAR was devised in 2011 to include the National Dose Registry (NDR). The NDR is a data repository of individuals who are monitored as radiation workers. RAR is the system designed to record radiation exposure of the public, who are unintentionally exposed to radiation or may have been exposed to radiation, for effective follow-up management and long term evaluation. Registration of accidents in the RAR system proceeds by immediate screening measurement and dose assessment for exposed individuals and the report of the exposure situation. Considering the significance level, long-term monitoring is made for some of exposed individuals.

3. Management system of radiation events in Korea

According to the ratings of nuclear events by the International Nuclear Event Scale (INES) [6], the unusual radiation exposures reported in Korea since 2011 can be categorized as 'incidents'. The NSSC has responded to those unusual radiation exposure events by measuring the 'unusual radiation level', estimating the

radiation doses to the exposed member of the public, and taking away the radiation sources of unusual activity levels.

Currently, the Comprehensive Information System on Radiation in the Natural Environment (CISRAN) [7] is operated by the Korea Institute of Nuclear Safety (KINS), the affiliated organization of NSSC, for the registry of unusual radiation exposure incidents. The events of radiation exposure from industrial and medical sectors are registered to the Radiation Safety Information System (RASIS) [8] operated by KINS.

4. Discussion

Since the enforcement of the Act, almost 160 cases of civil complaints have been received by NSSC and KINS. The CISRAN functions well as an integrated system for the communication between the public and radiation safety professionals about the risk of radiation exposure. Nevertheless, the system can be reinforced to manage the follow-up to share the lessons from incidents and relieve unfounded or exaggerated anxieties of the public. We suggest that the existing report system CISRAN be reinforced by importing a process to comply with the recent regulation [1] that consumer products should not contain natural radioactive materials transferrable to the human body and to respond to the complaints in the transition period about the consumer products on the market before amendment of the Act that would contain natural radioactive materials.

Fig. 1 depicts the process through which the 'unusual radiation exposure' is declared. Once the event (the presence of unexpected sources) is defined, it can be identified as 'unusual radiation exposure' due to (1) contamination with artificial radioactive materials, (2) consumer products containing natural radioactive materials transferrable to the human body, or (3) remotely used consumer products containing natural radioactive materials that would cause doses over 1 mSv/y. Otherwise, the event is terminated.

Glossary

• Event (사건) – any occurrence of unintended radiation exposure, the consequences or potential consequences of which are not negligible from the point of view of protection or safety.

• Accident (사고) – any event that has led to significant consequences to the people, the environment or the facility.

• Incident (사건) – any event that had not led to significant consequences to the people, environment and the facility.

Acknowledgment

This research was funded by the Korea Foundation of Nuclear Safety through the Nuclear Safety Research Program funded by the Nuclear Safety and Security Commission in Korea (No. 1305010-0517-SB110).

REFERENCES

[1] Act on Protective Action Guidelines against Radiation in the Natural Environment, amended on July 16 (2019).
[2] Nuclear Safety and Security Commission, Press release: Results of analytical investigation of contamination of kitchen utensils with radioactive isotopes at unusual level. Jan. 16 (2012).
[3] Nuclear Regulatory Commission, Nuclear Material Events Database Annual report (2018).
[4] Australian Radiation Protection and Nuclear Safety Agency, Australian Radiation Incident Register Annual report 1 January 2017 to 31 December 2017 (2018).
[5] Jing Chen, Bob Seely, Lauren Bergman, Deborah Moir, The design of radiation accident registry, Radiation Protection Dosimetry Vol. 144(1-4), pp. 551-554 (2011).
[6] International Atomic Energy Agency, INES: The International Nuclear and Radiological Event Scale User's Manual, Emended version (2013).
[7] Comprehensive Information System on Radiation in the Natural Environment, http://cisran.kins.re.kr/
[8] Radiation Safety Information System, https://rasis.kins.re.kr/

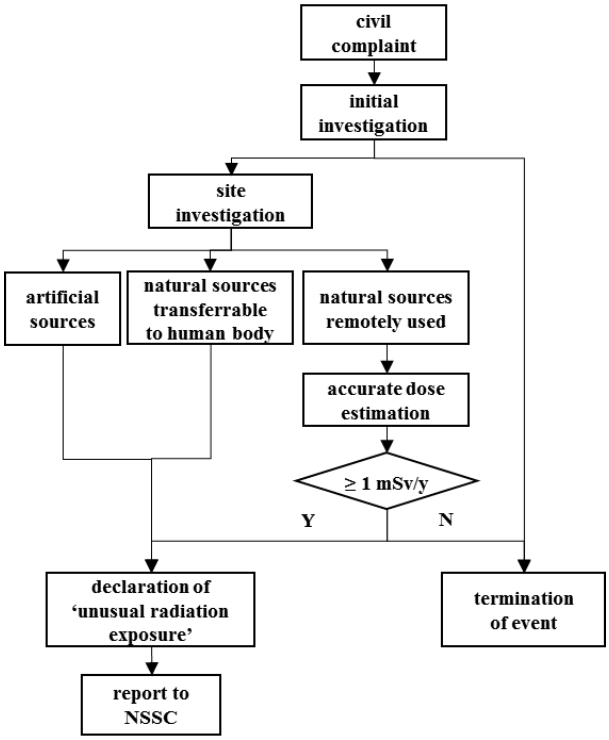

Fig. 1 A scheme for screening out unusual radiation exposures.