



RADIOACTIVE MATERIAL TRANSPORT – SAFETY AND SECURITY UPGRADE IN ALBANIA

Dritan Prifti*, Kozeta Tushe, Elida Bylyku, Brunilda Daci

Institute of Applied Nuclear Physics, University of Tirana, Tirana, Albania

Abstract. Institute of Applied Nuclear Physics (IANP) is the main user of radioactive sources in Albania and is licensed by Radiation Protection Commission by decision No. 385 dated 18.11.2016 for the activities of Use, Transport, Storage, Import-Export and treatment of radioactive waste and sources. The safety and security regime for the transport of radioactive materials addresses the radiological concerns and dangers associated with the transport of radioactive materials. IANP uses a new Volkswagen Crafter van, for the transport of radioactive materials for different private and state companies. The Van is equipped with a central locking system of all doors and with a container for the transport of radioactive sources, to increase transport safety and security and to protect radioactive packaging during any possible accident. IANP received also a container for the transport of radioactive materials from the International Atomic Energy Agency in 2020, which has significantly increased the physical security during transport of radioactive sources for transport of radioactive sources and also increased safety in transport to protect radioactive packaging during any possible accident. A physical security system with all security modules is installed to increase the physical security of radioactive sources of different categories that will be transported by this vehicle.

Keywords: radioactive waste, radioactive materials, security system, security modules

1. INTRODUCTION

The Republic of Albania is a non-nuclear country situated in the Balcan region. In Albania, radiation sources are mainly used in different applications including medicine, industry, agriculture, research, and education.

The Institute of Applied Nuclear Physics (IANP) was established in 1970 and is an object of special importance. IANP is the main user of radioactive sources in the country and is licensed by the Radiation Protection Commission (RPC) in accordance with Law No. 8025 dated 09.11.1995 amended by law 9973 date 28.07.2008 and by law 26/2013 date 14.02.2013 [1] by decision dated 01.12.2021 and No. 652. The previous experiences in the country as well as in many other countries require enforcement of rules and regulations on radiation protection to prevent any probable accident with radioactive sources [1-3].

IANP is the institution responsible for the processing of all radioactive waste and disused sealed radioactive sources and also for the transport of radioactive materials in Albania for different companies. Transport if performed in compliance with the national and international regulations on the transport of radioactive materials. [4-6]. In Albania there are different users of radioactive sources like State and Private Hospitals which use the radioactive sources in Nuclear Medicine or radiotherapy. There are also many other companies using radioactive sources in different industry fields like cement production, oil-welling, mining and beverages production. Another

licensed user only for its own transport of radioactive materials is the private owned International Hospital. The volume of transported radioactive materials each year is about 24 $^{99}\text{Mo}/^{99}\text{Tc}$ Generators with activity of 20 GBq, 300 ^{131}I in liquid and solid form in their own shielding and packaging with activity range of 185-3700 GBq for Nuclear Medicine Department of Mother Theresa Hospital and also different sources like ^{137}Cs , $^{241}\text{Am}/\text{Be}$, ^{60}Co , ^{133}Ba , ^{252}Cf of different activities for private companies.

IANP is equipped with an entry-exit control system, alarm system, fire protection system and camera surveillance system, which operate in cases where the following rules are violated, which are mandatory for all staff. In addition to the entry-exit control system, all premises where radioactive sources are located are equipped with an alarm system which operates in violation case of in force IANP entry-exit procedures at the location of radioactive sources, as well as a camera surveillance system which records and stores all events in the environment where the radioactive sources are located and around them [8-11].

The safety and security regime for the transport of radioactive materials in Albania addresses the radiological concerns and dangers associated with unauthorized movement, sabotage and other harmful acts involving radioactive materials.

It aims to complement the security regime created within:

1. Nuclear security which means the deterrence, detection, assessment, delay and response to theft, sabotage, unauthorized access, illegal transfer or other

* dritan.prifti@unitir.edu.al

harmful acts involving nuclear material or other radioactive materials or related objects.

2. Convention on the Physical Protection of Nuclear Material (CPPNM) [7], which deals with the international transport of nuclear material and related amendments, which extend, inter alia, to domestic transport.

In order to be in compliance with the national and international regulation for the physical security of radioactive materials and to increase the safety and security during transport [2], [3], IANP requested IAEA support on the upgrade of the security system on the transport Van in order to increase also the safety during transport.

2. SECURITY MANAGEMENT

2.1. Implementation and Responsibilities

The implementation of the safety and security issues is mandatory by all IANP employees responsible for the transport of radioactive sources and holds accountable anyone who violates it. The authority that regulates and supervises the entry into the premises where the radioactive sources are located and the use of the transport machine is the head of IANP [8]. Responsible for the implementation of this plan are IANP employees responsible for the transport of radioactive sources.

2.2. Staff Training Program

For the management and operation of the radioactive waste storage facility, as well as their transport, IANP trains staff to perform and cover all requirements and processes performed during the use and transport of radioactive sources. Staff training is done through participation in various training courses and workshops on various projects by the IAEA. Areas covered by these activities are:

- Nuclear technology and work with waste and radioactive sources;
- Radiological protection training, including the ability to create guidelines in the field of radiological protection;
- Transport training according to ADR;
- Training for protection when working with radioactive sources;
- Training for the implementation of measures in case of an emergency event and all related activities and instructions;
- Analytical and measurement techniques related to the characterization of radioactive waste, including sampling.

3. SECURITY SYSTEM

3.1. Safety and Security Analysis of the Vehicle Used for the Transport of Radioactive Sources in Case of Various Threats and Accidental Events

The main purpose of the vehicle used for the transport of radioactive sources is the transportation and storage of radioactive sources during transport,

used in industry, medicine, and research activities in the territory of Albania. The safety and security analysis of the vehicle used for the transport of radioactive sources identifies potential normal and extraordinary accidental events - which may cause the release of radioactive substances that affect the safety of employees responsible for the transport of radioactive sources, the population and the environment [13], [14]. Before each transport, is made the source identification and are recorded the dose rates in the van surface and 1 m distance and at the driver cabin. All the registered values are within the allowed limits of transport regulation and lower than before implementing the upgraded safety and security measures. All IANP personnel involved in the transport of radioactive materials is equipped with PRDs and TLDs (personal dosimeters) in order to monitor the dose rates during each transport.

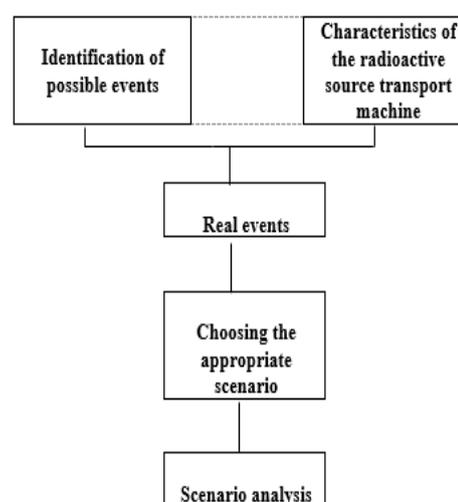


Figure 1. Schematic diagram of the methodology for the selection of realistic scenarios and their analysis.

The analysis of these events is given, based on the elimination criteria that determine the characteristics of the vehicle used for transport of radioactive sources (class and type of radioactive sources, location of the vehicle used for transport of radioactive sources, working conditions, etc.). Based on these realistic scenarios, the analysis and calculation of the radiological impact of these scenarios on the surrounding environment, employees and residents has been done. From the radiological impact analysis, follow the restrictions, conditions and control requirements, which will ensure the safe operation of the vehicle used for the transport of radioactive sources, the safety of employees, the population and the environment. The methodology used was developed based on the literature [2], [3], [7] and is shown in Figure 1.

3.2. Identification of Possible Events

Regarding the location of the vehicle used for the transport of radioactive sources, its technical characteristics, of radioactive sources of categories I, II and III, we have identified possible events, which are

part of normal operation or extraordinary events in the vehicle used to transport radioactive sources that may affect employees, residents and the environment. A set of possible events have also been considered in accordance with the international recommendations given in the literature [2], [7].

A. Events during normal operation

1. External radiation, as a result of normal and regular transport and storage during transport of radioactive sources.

2. Contamination of employees responsible for transport as a result of surface contamination that sources may have.

B. Possible extraordinary accidental events

1. Spills of radioactive sources in liquid state during transport;

2. Distribution of radioactive sources during transport;

3. Direct exposure to radioactive sources;

4. Direct contact with radioactive sources;

5. Drop of containers with radioactive sources;

6. Explosion in the car used for transport of radioactive sources;

7. Explosion in the vicinity of the vehicle used for transport of radioactive sources;

8. Fire in the car used for transport of radioactive sources;

9. Floods (high amount of atmospheric precipitation, floods due to the increased level of rivers);

10. The crash of the aircraft into the vehicle used for the transport of radioactive sources;

11. Terrorist attack during the transport of radioactive sources.

Normal operational events are a consequence of normal operation and they are real during the transport of radioactive sources.

Possible accidental events are discussed on the basis of specific criteria which are determined by the characteristics of the vehicle used for the transport of radioactive sources and the characteristics of the packaging of the radioactive sources.

3.3. Characteristics of the vehicle used for the transport of radioactive sources

During the process of determining the potential impact of the vehicle used to transport radioactive sources to the responsible employees, residents and the environment, it is necessary to take into account the following elements, which determine the possible routes of its impact:

- Type of radioactive sources and types and ways of their packaging;
- Construction of the vehicle used for the transport of radioactive sources and its location;
- Working conditions for normal and emergency situations - accidental;

The vehicle used for the transport of radioactive sources is intended for the transport and storage during the transport of solid and liquid radioactive sources. Extraordinary accidental events that may occur during the transport of radioactive sources are related to external events or accidents and catastrophes during the transport of radioactive sources.

Based on the characteristics of the vehicle used to transport the radioactive sources, three different types of elimination criteria can be defined that we have used to select the actual events:

- Characteristics of radioactive sources (type of sources, packaging ...),
- Location of the vehicle used for the transport of radioactive sources, its characteristics and technical systems,
- Administrative processes (work procedures and instructions).

4. VEHICLE SECURITY SYSTEM UPGRADE USED FOR TRANSPORTATION OF RADIOACTIVE SOURCES AND SECURITY ASSESSMENT

4.1. Electronic Security System for Monitoring Radioactive Sources during their Transport

As part of the Global Threat Reduction Initiative, through the United States Embassy in Tirana, the US Department of State through the EXBS program has donated to the Institute of Applied Nuclear Physics a new Volkswagen Crafter van, manufactured in 2016 to be used by IFBZ for the transport of radioactive materials with a carrying capacity of 1.5 tons. The van is equipped with a central locking system of all doors thus increasing safety during the transport of various radioactive sources. IANP received also a container for the transport of radioactive materials from IAEA in 2020 with a total weight of 550 kg, which has significantly increased the physical security during transport of radioactive sources and safety in transport to protect radioactive packaging during any possible accident. This container is removable from the van according to the transport weight limits. All possible scenarios for radiological accidents during transport of radioactive materials are taken in consideration and analyzed in the Radiological Emergency Response Plan during transport of radioactive sources approved by RPC [15].

The upgrade of a physical security system of the van used for the transport of radioactive sources was also required from IAEA and the procurement process for the installation of the physical security system is already finished and its installation also.

The following security modules are installed in this system to increase the physical security of radioactive sources of different categories that will be transported by this vehicle.

1. GPS system connected to the software on the central computer at the Central Alarm Station, for locating the location of the van during the whole time of transport;

2. Sensor and rear door magnetic contacts, to detect forcible opening of doors and entry into the van of unauthorized persons, connected to the alarm system;

3. Motion detectors inside the rear of the car to detect forcible opening of doors and entry into the car of unauthorized persons, connected to the alarm system;

4. Camera system inside and outside the car, for recording images during transport of radioactive sources;

5. Locking system from inside the doors, to restrain and delay the entry into the car of unauthorized persons, connected to the alarm system.

This platform makes it possible to configure alerts according to priority, makes it possible to associate alerts with automatic instructions, acknowledgment, voice messages, Email, Forward, etc.

After installation of the above safety and security system the safety and security measures during transport are increased. As result we have better protection of the radioactive sources during transport regarding the safety and security issues.

4.2. System Modules

For the control of unauthorized entrances and exits in the part of the vehicle where the radioactive sources are located, the following security systems are installed. The following components are installed for the alarm system of sensitive environments:

- a. Motion detectors,
- b. BMS magnetic contacts,
- c. sirens,
- d. Door locking system,
- e. GPS system for locating the location of the car during the whole time of transport,
- f. Camera surveillance system.

Their purpose is to generate alarm in case of entry of unauthorized persons and in case of unauthorized movement of radioactive sources.

4.3. Delays, Detection and Alarm Assessment Measures

After the upgrade of the physical security system of the vehicle used for the transport of radioactive sources, the system provides physical protection of the vehicle, which includes video surveillance inside and outside the vehicle, alarm systems as well as anti-theft signaling and container for transporting radioactive sources. An integral part of these protection systems is the surveillance throughout the transport time through the GPS system that is connected to the online monitoring center at IANP by the state police.

The alarm will be generated in all cases when:

1. The entry-exit procedures in the premises of the vehicle where the radioactive sources are located are not applied. In this case, an alarm is generated directly from the system located at the entrance of the premises where the radioactive sources that are transported are located. The alarm status is also ascertained by the staff located in the online monitoring center in IANP in charge of guarding the vehicle during transport,

2. If the personnel guarding the vehicle during transport to the monitoring center notices through the cameras placed at the respective entrances that the procedures for entering and exiting the premises with radioactive sources are violated, or there is the presence of unauthorized persons or vehicles, they must notify the nearest State Police Station to send the intervention team,

3. In cases when smoke or fire is noticed in the part of the vehicle where the radioactive sources are stored during transport, the personnel responsible for transport activates the alarm and notifies the security personnel of IANP, the State Police, the person in charge of the administration of the Institute for security, as well as Radiation Protection Office. In this case, the State Police in charge of guarding IANP immediately takes measures to control all operations at the location where the radioactive source transport vehicle is located.

5. RESPONSE TO EMERGENCY SITUATIONS OF RADIOACTIVE SOURCES TRANSPORT

Planning and maintenance of vehicle readiness measures used for the transport of radioactive sources, in emergency situations - accidental events is a legal obligation of IANP defined in the law on protection from ionizing radiation. In accordance with the laws and regulations, responsibilities have been identified, which are important for the design of measures in case of accidental events. These are:

- Organizing and carrying out the transport of radioactive sources and waste;
- Storage of radioactive sources during their transport;
- Preservation of damaged radioactive sources, which arise as a result of radiological accident.

Based on these obligations, IANP has prepared a draft of measures in case of emergency situations, accidental events that shows how IANP responds in an organized and efficient manner in cases of emergency events during transport with radioactive materials and other radiological accidents, which generate radioactive waste [12], [15].

6. CONCLUSION

Albania has been working closely with the IAEA in the field of safety and security of radioactive materials. Albania has prepared and approved the integrated nuclear security support plan (INSSP). In this framework Albania's has prepared and approved by RPC regulations specifically related to nuclear security issues (physical protection, illicit trafficking, import-export, border control, waste and DSRS management, penalties), taking into account international legal instruments, recommendations and IAEA guidelines,

Role of the Radiation Protection Commission is very important in implementing the requirements for the safety and security of radioactive materials in Albania.

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