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USE OF INDIVIDUAL PROTECTION EQUIPMENT AND COLLECTIVE IN CASE OF ACCIDENT DURING THE TRANSPORT OF RADIOACTIVE PRODUCT - CLASS 7

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ABSTRACT

The personal protective equipment (PPE) are devices used by professionals against potential radiological hazards that may threaten the health or safety in the event of an accident or incident during the transport of radioactive material.
The collective protection equipment (CPE) devices are used in place of the accident in order to protect people and the environment from risks such as safety signs, among others.
This work will be part of the new edition of the NBR 9735 - Set of equipment for emergencies in land transport of dangerous goods - edited by the Brazilian Association of Technical Standards / ABNT - National Standardization Forum which CNEN participates in the Study Committee - CB16 namely, dangerous, accounting for Class 7 radioactive materials.
The Standard 9735 establishes the minimum set of equipment for emergencies in inland transport of dangerous goods, consisting of protective equipment to be used by the driver and staff involved (if any) in the transport operations of transport units, equipment for signaling, isolation of the area of occurrence (fault, accident and / or emergency).
Thus, we will present a set of individual and collective equipment that must accompany the carriage of Class 7 products to meet the radiological accident situations and also establish a training base for the driver as the use of them.

1. INTRODUCTION

An accident or incident involving radioactive material requires special care, as well as personnel trained and qualified for their care, in view of the radiological hazards involved, provided the material when the leakage or accidental spillage, which may cause contamination and / or exposure to individuals and the environment.

In this sense, the performances emergency with radioactive material, it is extremely important that those involved in primary care use Personal Protective Equipment - PPE, according to the risks posed by radioactive substances involved, the volume of the spill, local activities and achieved starting to be realized.

By definition, the accident is the realization of a situation that may begin as an incident, but it should be noted that the accident may occur regardless of the previous occurrence of an incident, and an incident can turn into an accident, but the opposite will never occur.

According to Standard CNEN-NE-5:01 - Transportation of Radioactive Materials, published in August 1988, the requirements of radiation protection and safety requirements to ensure adequate control of the potential exposure of people, property and the environment to ionizing radiation, comprise specifications on radioactive materials transport; packed type selection; specification of design requirements and acceptance tests for packaged; provisions relevant to the transport itself and responsibilities and administrative requirements. In this paper we will only deal with the land transport of radioactive material, according to ABNT NBR 9735.

It is important to begin by putting that currently the applications of nuclear energy and sources of ionizing radiation has increased remarkably in the country, especially in the case of radioactive materials for medical applications, called radiopharmaceuticals, thereby, increases the likelihood of accidents / incidents and hence the need to prepare for the implementation of initial actions to radiological emergencies.

It is also important to add that the threshold of severity of an accident is mainly associated to its special location - transport on public roads for the most part, which is the main objective, as 80% of the movement of radioactive material in the country is radiopharmaceutical - the production unit to the place of use - hospitals and clinics in several states of Brazil.

In Brazil, until now there is no statistically but annually have 5-10 cases recorded, but no damage to the people involved as well as the environment.

2. LAND TRANSPORT OF RADIOACTIVE MATERIAL AND RISK ASSOCIATED

The transport of radioactive material may be carried in bulk or split.

Bulk transport is characterized by large volumes involved in a single container, usually having a single system loading and unloading, in case the radioactive material in question, are minerals associated with uranium and thorium - tantalite, columbite, cassiterite, among others are packed in big-bags a ton.

The transport fractionated characterized by storing small to medium volumes in one or several containers, as in the case of radiopharmaceuticals that are packed in special packages, which completely enclose the radioactive contents consisting of one or more envelopes, absorbent material structures spacing, for radiation shielding, and devices for cooling, absorbing mechanical shock and thermal insulation.

On March 20, 2013, the National Nuclear Energy Commission published in the Official Gazette the CNEN Resolution No. 148 which considers the need to track the vehicles used for the transport of radioactive materials, and the state of technological development and availability market vehicle tracking devices by using the global positioning system (GPS), decides to institute mandatory installation of tracking system positioning signals in vehicles used for the transportation of dangerous goods Class 7 (radioactive materials).

Furthermore, the Brazilian Institute of Environment and Renewable Resources/IBAMA and CNEN has been meeting to update the Terms of Reference for Activity Transport of Radioactive Material.

2.1. Radiopharmaceuticals

Radiopharmaceuticals is a radioactive material, or the drug exerts the function as any prescription drug, only to be labeled with a radioactive material takes on other functions, such as use for diagnosing diseases, tumors or malfunctions of the organism. The radiopharmaceutical may also be used in therapy, to assist in processing, then using the properties of radioactive materials which add to the properties of the drugs, the normal medicine.

Brazil is well developed in the area of radiopharmaceutical, and most of the domestic demand is met through the National Commission of Nuclear Energy / CNEN that until two years ago had a monopoly on the production and use of radioisotopes to make new molecules. The institutes of the CNEN, producing radiopharmaceuticals, are the Institute of Nuclear and Energy Research / IPEN in São Paulo - a large production unit of radioactive material in the country - the Nuclear Energy Institute / IEN, in Rio de Janeiro, the Development Centre Nuclear Technology / CDTN in Minas Gerais and the Regional Center of Nuclear Sciences Northeast / CRCN-NE, in Recife.

The distribution of radiopharmaceuticals to hospitals and clinics is made to all regions of the country - North, Northeast, Midwest, Southeast and South, by land or by land / air / ground to final destination.

Only IPEN, in 2012, made 4462 trips road transport of radiopharmaceuticals, and the number of packs of 53675.

Currently there are private hospitals, radiopharmaceuticals producers in the North and East, but there is an ongoing expansion into other regions.

The biggest risk associated with radiopharmaceutical, in case of an accident where the packaging suffers material loss is that of personal contamination.

2.2. Other types of radioactive material

The handling of ores containing uranium (U) and thorium (Th), by road, is usually made in the North to the Southeast, for bi-truck train, carrying about 35 tons of ore per shipment.

The risk associated with the ore, in the event of an accident where there is dispersion of material with the breakup of the big bag, is that of personal contamination by inhalation of particulate.

There are also transport radiators, which are carriers of equipment radioactive sources as Cobalt-60, Selenium-75 and iridium-192, with high penetrating power, used in industrial gammagraphy, with movement in the Southeast, Northeast and South to many states.

The risk associated with radioactive sources, in case of accident, where the source is exposed is the exposure.

Another type of radioactive material that circulates by land, the fuel elements are manufactured by the Nuclear Industries of Brazil / INB in Resende for nuclear plants, Angra dos Reis, both units are located in the state of Rio de Janeiro. This work does not intend to explore the transport of fuel elements, to be very specific and there are many technical details that are not considered in the regular transport of radioactive materials and whose history no effective contribution to the topic of this work.

3. TYPES OF PACKAGING FOR TRANSPORTATION

Ensuring security in the transport of radioactive materials depends largely on the quality of used packaging that should be a lining to protect against the effects of radiation, to avoid unwanted reaction.

The packages are sorted linking activity and physical form of the material and should be designed in such a way to withstand mechanical shocks from falls, punctures from sharp surfaces, chemical corrosion, etc.

A transport unit shall be provided with a system for securing the load is still needed mechanism for manual or mechanical handling of cargo (forklifts, cranes, freight elevators, etc.) and methods for weather protection.

The general requirements for packaging design contained in the regulations of the National Commission of Nuclear Energy apply to all packaging and aim to ensure that they can be handled safely and easily, with proper protection and can withstand the effects of any acceleration and vibration occur during the transport operation.

The four main types of packaging, designed according to the activity and the physical form of the radioactive material, are:

- Packaging Type A - limited quantities and medium-activity radiopharmaceuticals
- Packaging Type B - unlimited quantities and high activity - source of Co-60
- Industrial Packaging - bulk and low activity - fuel elements
- Exceptive Packaging - Bulk - ores containing U and Th

Proportion to the risk they present, the packages go through different mechanical and thermal testing to ensure their integrity, such as testing water jet, penetration, freefall stacking.

4. STANDARD NBR 9735 – NEW CONSIDERATIONS FOR CLASS 7

The Standard 9735 - Emergency Equipment Set the Land Transport of Dangerous Goods, revised in January 2012, establishes the minimum set of equipment for emergencies in land transport of dangerous goods, consisting of protective equipment to be used by the driver and personnel involved (if any) in the transport operations of transport units, signaling equipment, isolation of the area of occurrence (fault, accident and / or emergency).

In the case of radioactive material - Class 7, currently the standard establishes the basic PPE is the helmet and gloves of appropriate material to the product transported.

This statement is totally at odds with the basic principles of radiation protection and nuclear safety in the establishment of a set of equipment that meets the initial conditions in a radiological emergency by the driver of the vehicle.

It is noteworthy that in radiological emergencies, the shipper is responsible for mitigating actions. CNEN has service to emergency care situations beyond the control of the sender.

The minimum set of PPE that should be included in the transport unit will serve to act in both cases dispersion of radiopharmaceuticals (liquid) as in the case of minerals (powder or granules), as this will prevent the driver in direct contact with the material radioactive.

The minimum set should consist of:

- 01 Overall Tyvec consisting of jumpsuit and hood with zipper front closure, elastic wrists and ankles
- 02 pairs sneaker plastic
- 02 pairs of latex gloves synthetic
- 02 breathers with nose clip and elastic with exhalation valve
- 02 large plastic bags, and high strength
- 03 Paper stack absorber
- Canvas

The PPE must be cleaned, free from contamination and stored in an easily accessible place, inside the cab of the vehicle.

As for the number of CPE should include this, just tape to isolate the area with possible radiological risk.

Importantly, in cases of accidents involving high activity sources, the risk exposure is thus no way to define a basic PPE activities, unless the CPE to make the isolation of the area until the team reaches the CNEN the location.

As for the basic training that must be given to the driver of the transport unit, the Standard CNEN-NE-5:01 states that workers involved in transport must meet the radiological risks associated with the transportation and should be adequately trained, as necessary and as type of work and the precautions to be observed, to perform their tasks safely.

5. CONCLUSION

When an accident happens we try to check the event's impact on society and ways to avoid or minimize similar events in the future, identifying the probable causes of the accident, and design strategies for solving the problems generated by it.

The work on radiological emergencies is exclusive activity of CNEN, only one team can and must be prepared to act in such a situation, in this way, as part of the CNEN Study Committee - CB16, (dangerous products, representing Class 7 materials radioactive) and has been active in reviewing various ABNT for inclusion in this class, it was requested that we change what is given in the January, 2012, since the set is not consistent with the recommendations of radiological protection.

The minimum set which was established taking into account the requirements of the standard CNEN-NN-3.01/2011: Basic Guidelines on Radiological Protection, that: "An intervention is justified only when it expects to achieve a greater benefit than harm, taking into account health factors, social and economic".

Therefore, it is established that the carriers of radioactive material should be included in their transport unit the basic kit foregoing.

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