

# **NEW ROMANIAN QUALIFICATION TESTING FACILITY FOR TYPE A, B AND C PACKAGES TO BE USED FOR TRANSPORT AND STORAGE OF DANGEROUS GOODS – CLASS # 7 RADIOACTIVE MATERIALS - 10333**

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## **ABSTRACT**

In accordance with the Economic Commission for Europe-Committee on inland transport (ADR- European Agreement-concerning the international carriage of dangerous goods by road, 2007 Edition) the Safety and Security of the dangerous goods Class 7 - Radioactive Materials during transport in all different modes - by road, by rail, by sea, by inland rivers or by air - have to be ensured at a very high level. The radioactive materials (RAM) packaging has to comply to all transport condition, routine or in accident conditions possibly to occur during transportation operations. It is well known that the safety in the transport of RAM is dependent on packaging appropriate for the contents being shipped rather than on operational and/or administrative actions required for the package. The quality of these packages–Type A, B or C has to be proved by performing qualification tests in accordance with the ROMANIAN nuclear regulation conditions provided by CNCAN Order no. 357/22.12.2005 - “Norms for a Safe Transport of Radioactive Material”, the IAEA Vienna Recommendation [1,2] stipulated in the Safety standard TS-R-1 Regulation for the Safe Transport of Radioactive Material, 2005 Edition, and other applicable international recommendations.

The paper will describe the components of the designed testing facilities, and the qualification testing to be performed for all Type A, B and C packages subjected to the testing.

Quality assurance and quality control measures taken in order to meet technical specification provided by the design are also presented and commented.

The paper concludes that the new Romanian Testing Facilities for RAM packages will comply with the national safe standards as well as with the IAEA applicable recommendation provided by the TS-R-1 safety standard.

## **INTRODUCTION**

The Institute for Nuclear Research (INR) Pitesti has designed and developed new Romanian Testing Facilities [4] which will allow carrying out the qualification tests for packages to be used for transport and storage of dangerous goods - Class 7 (radioactive)

materials in Romania. The Type A, B and C packages should be tested at these INR new testing facilities.

This facility has been constructed within the Scientific Research Excellence Project CEEX 7175/2006 (4) through National Accreditation Association (RENAR) Bucharest and in accordance with the following applicable national and international standards and documents:

- Order no. 357/22.12.2005 - “Norms for a Safe Transport of Radioactive Material”. issued by CNCAN – Romanian National Regulatory Body;
- IAEA Vienna Standard TS-R-1–“Regulation for the Safe Transport of Radioactive Material”, 2005 Edition;
- Recommendation of the EC - European Commission-DG Energy and Transport, Directorate for Security of Goods;
- UN – ECE (United Nations-Economic Commission for Europe-Committee on Inland Transport)- *ADR-European Agreement Concerning the International Carriage of Dangerous Goods by Road*, applicable as from 1 January 2007;
- Recommendation of the WNTI – World Nuclear Transport Institute, London, UK;
- Recommendation of IATA – International Air Transport Association,
- Recommendation of ICAO - International Civil Aviation Organization;
- Recommendation of IFALPA - International Federation of Airline Pilot’s Associations;
- Recommendation of ISO - International Standard Organization, Geneva, Switzerland;

## **TESTING FACILITY COMPONENTS**

An overview (a photo) of the New Romanian qualification testing facility for Type A, B and C packages [4] is shown in the Fig. 1, and Fig. 2 as follows:



Figure 1 – The entrance (the emblem) of the testing facilities.



Figure 2 – An overview of the New Romanian Testing Facility for Type A, B and C packages.

The main components are [4]:

- The target
- Thermal basin
- The slope
- The compression (stacking) platform
- The water spray test equipment.

These testing facilities allow the performing of the following qualifications tests [1,2,3,4]

- Water spray test
- Free drop testing from maximum 9m height (maximum package weight: 5 tons)
- The stacking (compression) test
- The penetration test
- The rolling down test on a slope (for Type A packages)
- The free drop test from 1m height on a bar rigidly mounted perpendicularly on the target; the dynamic crash test
- The thermal test
- The puncture/tearing test
- The immersion test.

A short description of the testing facility components is provided:

### **THE TARGET**

The target [1,2,3,4] is a flat, horizontal surface (para 717 from the IAEA's safety standard TS-R-1 as well as provisions from ADR recommendation) built in such a way that: "any increase in its resistance to displacement or deformation upon impact by the specimen would not significantly increase damage to the specimen".

To have an unyielding target for large packages requires a steel plate, wet floated onto a homogenous block of concrete which is at least 10 times the mass of any specimen to be dropped onto it. The steel plate is of 40 mm thick with protruding fixed steel structures on its lower surface, which are securely set in the concrete. The target is shown in the Fig. 3.

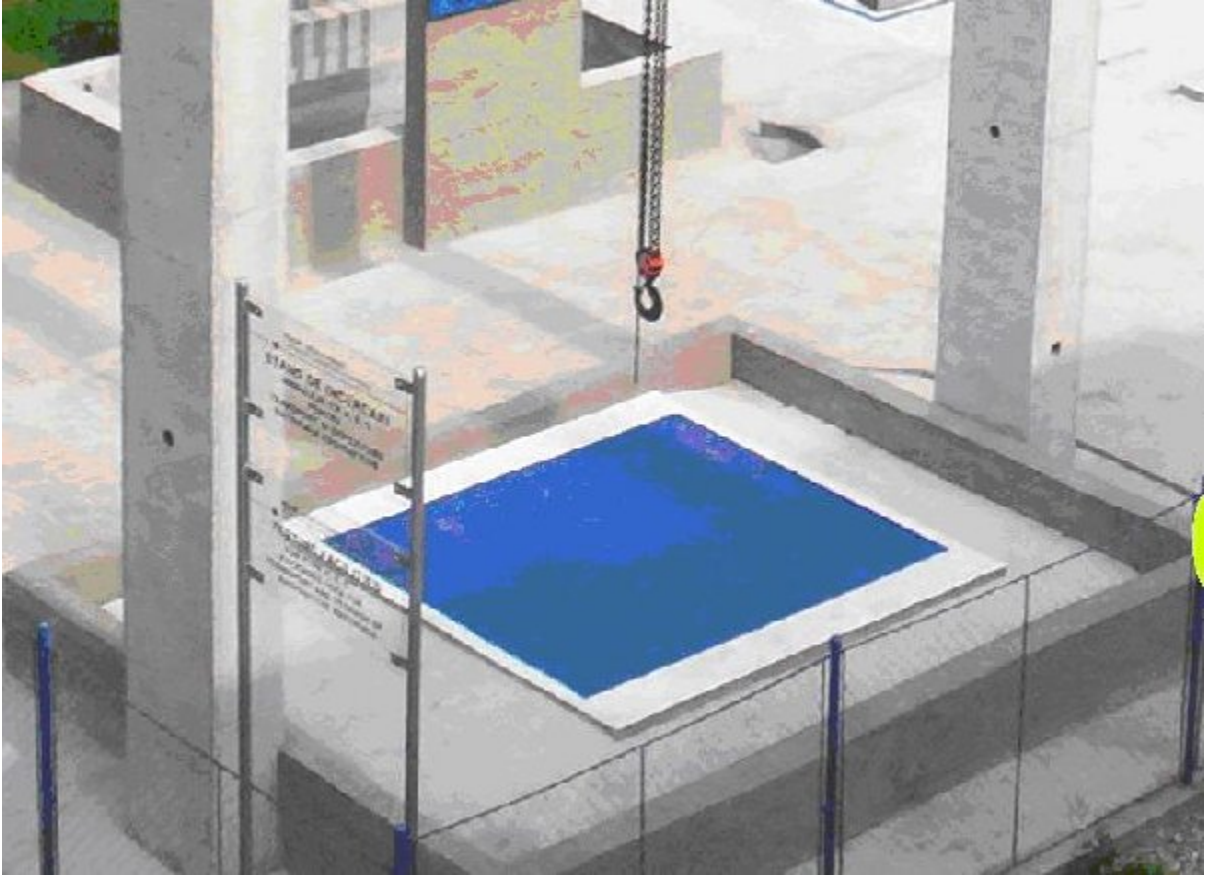


Figure 3 – The target.

The maximum weight of the specimen (package) to be dropped is set to be 5 tons. The following tests are performed on this target: the free drop test from maximum 9 m height, the penetration tests, the puncture/tearing test, the free drop test from 1m height on a bar rigidly mounted perpendicularly on the target, and the dynamic crush test.

### **THE THERMAL BASIN**

This facility consists [4] of a basin having the following dimensions: 4m x 2m x 2m (length x height x width). The specimen subjected to the thermal test (according to the para 728 of TS-R-1) is arranged on a special support existing just above the basin and the fire will come from below this support. Inside the basin is water at a level of 1m and above is the flammable (diesel fuel). The thermal basin is shown in the Fig. 4.



Figure 4 – The thermal basin.

Within the basin the water spray test is also performed.

### **THE SLOPE**

In order to check and demonstrate the ability of a package to resist impacts with hazard, lateral surfaces the specimen is subjected to the slope (inclined plane) test [3]. The Type A package is rolled down on the slope and will impact a perpendicular wall. This qualification test is made in Romania according with the Romanian Regulations just to put in evidence the possible lateral damage of the package. The platform for rolling down is situated at the height of 2 m with a slope of 30°.

## THE STACKING PLATFORM

In the stacking test [1,2,3,5], the specimen is required to withstand for a period of 24 hours, whichever is the greater of either five times the package weight stacked on top or 13kPa (0.13 kgf cm<sup>-2</sup>) multiplied by the vertically projected area of the package. For packages for fissile material this test is intended to ensure that the effectiveness of the containment shielding and any spacers is maintained when the package is stacked in a manner that is likely to occur during normal loading, unloading, transport and intermediate storage. The test neither is nor required for a package whose shape effectively precludes stacking. This facility is used only for stacking test and the special platform has dimensions in the range of 2m x 2 m. The platform is made from special concrete. It is a horizontal surface, hard and able to support the package itself plus the 5 times its weight. (para 723 from IAEA's TS-R-1 Regulations).

## PENETRATION TEST

This test is intended [1,2,3] to demonstrate the capability of the package to withstand the type of puncture that may arise during normal transport from causes such as sharp object falling onto the package or damage from loading hooks. To prove that packages can withstand puncture, a metal bar of weight 6 kg and 3,2 mm diameter and having a hemispherical end, is dropped onto a packages from a height of 1m (para. 724 a) and b) from IAEA TS-R-1). The direction and point of impact must be chosen to cause the maximum damage to the containment system.

## TESTING OF THE TYPE C PACKAGES

For Type C packages [1, 2, 5], the following qualification tests can be performed within the new testing facility at the INR Pitesti:

- **The mechanical test** in accordance with the para. 727 (c)–IAEA TS-R-1. The specimen is subjected to a dynamic crush test by positioning the specimen on the target so as to suffer maximum damage by drop of a 500 kg mass from 9m onto the specimen. The mass shall consist of a solid mild steel plate 1m by 1m and shall fall in a horizontal attitude. The height of the drop shall be measured from the underside of the plate to highest point of the specimen. The target on which the specimen rests shall be as defined in para. 717 of the IAEA's TS-R-1.
- **The puncture/tearing test** in accordance with the para 735–IAEA TS-R-1. The specimen shall be subjected to the damaging effects of a solid probe made of mild steel. The orientation of the probe to the surface of the specimen shall be such as to cause maximum damage at the conclusion of the test sequence specified in para. 734 (a).
- **Enhanced thermal test** in accordance with the para. 736. IAEA TS-R-1. The conditions for this test shall be as specified in para. 728, except that the exposure to the thermal environment shall be for a period of 60 minutes.



## **QUALITY ASSURANCE**

All the qualification testing are performed under a strict quality assurance programme based on the specific procedures prior approved by the Romanian Nuclear Regulatory Body (CNCAN-National Commission for Nuclear Activity Control). These procedures reflect the requirements of the Romanian Regulations as well as the requirements of the IAEA's safety standard TS-R-1 and the advisory document TS-G-1.1.

### **References**

1. IAEA Safety Standards for protecting people and the environment- Regulations for the Safe Transport of Radioactive Material, 2005 Edition, TS-R-1.
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5. ECONOMIC COMMISSION FOR EUROPE-Committee on Inland Transport ADR- European Agreement, Vol. I and II, applicable as from January 2007.