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SUPPORT OF SAFETY IN THE TRANSPORT OF RADIOACTIVE MATERIAL: ACTIVITIES BY ISO

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1. INTRODUCTION

If there were no standards, we would soon notice. Standards make an enormous contribution to most aspects of our lives – although very often, that contribution is invisible. It is when there is an absence of standards that their importance is brought home. For example, as purchasers or users of products, we soon notice when they turn out to be of poor quality, do not fit, are incompatible with equipment we already have, are unreliable or dangerous. When products meet our expectations, we tend to take this for granted. We are usually unaware of the role played by standards in raising levels of quality, safety, reliability, efficiency and interchangeability – as well as in providing such benefits at an economical cost.

For example, the format of the credits cards, phone cards, and “smart” cards that have become commonplace is derived from an ISO international standard. Adhering to the standard, which defines such features as an optimal thickness (0,76 mm), means that the cards can be used worldwide.

International standards thus contribute to making life simpler, and to increasing the reliability and effectiveness of the goods and services we use.

ISO standards also have important economic and social repercussions. ISO standards make a positive difference, not just to engineers and manufacturers for whom they solve basic problems in production and distribution, but to society as a whole.

The international standards, which ISO develops, are very useful. They are useful to industrial and business organizations of all types, to governments and other regulatory bodies, to trade officials, to conformity assessment professionals, to suppliers and customers of products and services in both public and private sectors, and, ultimately, to people in general in their roles as consumers and end users.

The purpose of this paper is to show the benefit provided by international standards in the field of the transport of radioactive material and its safety.

2. WHAT IS ISO, THE INTERNATIONAL ORGANIZATION FOR STANDARDIZATION?

International standards are developed by ISO, the International Organization for Standardization.

International standardization began in the electrotechnical field: the International Electrotechnical Commission (IEC) was established in 1906. The International Federation of the National Standardizing Associations (ISA), which was set up in 1926, carried out pioneering work in other fields. The emphasis within ISA was laid heavily on mechanical engineering. ISA's activities came to an end in 1942.

In 1946, delegates from 25 countries met in London and decided to create a new international organization, of which the object would be "to facilitate the international coordination and unification of industrial standards". The new organization, ISO, officially began operations on 23 February 1947.

Now, ISO is a network of the national standards institutes of 158 countries (at 31 December 2006), on the basis of one member per country, with a Central Secretariat in Geneva, Switzerland, that coordinates the system. While the standardization work is the matter of several thousands of experts, there is only about one hundred and sixty full time staff in Geneva.

ISO is a non-governmental organization: its members are not, as is the case in the United Nations system, delegations of national governments. Nevertheless, ISO occupies a special position between the public and private sectors. This is because, on the one hand, many of its member institutes are part of the governmental structure of their countries, or are mandated by their government. On the other hand, other members have their roots uniquely in the private sector, having been set up by national partnerships of industry associations.

Therefore, ISO is able to act as a bridging organization in which a consensus can be reached on solutions that meet both the requirements of business and the broader needs of society, such as the needs of stakeholders groups like consumers and users.

3. WHAT IS AN INTERNATIONAL STANDARD?

Standards are documented agreements, containing technical specifications or other precise criteria to be used consistently as rules, guidelines, or definitions, to ensure that materials, products, processes or services are fit for their purpose.

One important characteristics of an ISO international standard is that it is achieved through consensus agreements, and this at two levels.

The first one is the national level. Each national standards institute has the duty to seek for a consensus between all the stakeholders in its country.

At the second level, an ISO international standard can only be approved and published when a consensus is reached between all the involved national delegations.

4. WHAT ARE THE ROLES OF THE IAEA REGULATIONS AND OF THE ISO STANDARDS

As regards the safe transport of radioactive material, the International Atomic Energy Agency (IAEA) has established the "Regulations for the Safe Transport of Radioactive Material", known as TS-R-1, which is the worldwide basis for all the national, regional and international regulations, such as:

- the European Agreement concerning the International Carriage of Dangerous Goods by Road (ADR)
- the Regulations concerning the International Carriage of Dangerous Goods by Rail (RID),
- the Technical Instructions (TIs) for the Safe Transport of Dangerous Goods by Air, set forth by the International Civile Aviation Organization (ICAO),
- the International Maritime Dangerous Goods (IMDG) code, set forth by the International Maritime Organization (IMO).

The IAEA Regulations acknowledge the importance of standards. Except for the lowest categories of packages, it is required, in its paragraph 638, that "the design and manufacturing techniques shall be in accordance with national or international standards, or other requirements, acceptable to the competent authority".

The IAEA Regulations is supported by a companion document, namely the "Advisory Material for the IAEA Regulations for the Safe Transport of Radioactive Material", known as TS-G-1.1. The rationale for the requirement to use standards is given in paragraph 638.1 of TS-G-1.1:

"Many national and international standards exist covering an extremely wide range of design influences and manufacturing techniques, such as pressure vessel codes, welding standards or leaktightness standards, which can be used in the design manufacturing and testing of packages. Designers and manufacturers should, wherever possible, work to these established standards in order to promote and demonstrate adequate control in the overall design and manufacture of packages. The use of such standards also means that the design and manufacturing processes are more readily understood by all relevant people, sometimes in different locations and Member States, involved in the various phases of transport; most importantly, package integrity is much less likely to be compromised."

In the mean time, four ISO standards are included in the IAEA Regulations (TS-R-1), while eleven are mentioned in the "Advisory Material for the IAEA Regulations for the Safe Transport of Radioactive Material" (TS-G-1.1).

The four ISO standards included in TS-R-1 are:

- Radiation Protection - Sealed Radioactive Sources - Leakage Test Methods (ISO 9978),
- Series 1 Freight Containers - Specifications and Testing - Part 1 : General Cargo Containers (ISO 1496 - 1),
- Packaging of Uranium Hexafluoride (UF_6) for Transport (ISO 7195),
- Sealed Radioactive Sources - Classification (ISO 2919).

The eleven ISO standards mentioned in TS-G-1.1 are:

- Series 1 Freight containers - Specifications and Testing - Part 1 : General Cargo Containers (ISO 1496-1),
- Packaging of Uranium Hexafluoride (UF_6) for Transport (ISO 7195),
- Safe Transport of Radioactive Material - Leakage Testing of Packages (ISO 12807),
- Radiation Protection - Sealed Radioactive Sources - Leakage Test Methods (ISO 9978),
- Series 3 Tank Containers for Liquids and Gases - Specification and Testing (ISO 1496-3),
- Radioactive Materials - Packaging - Test for Contents Leakage and Radiation Leakage (ISO 2855),
- Sealed Radioactive Sources - Classification (ISO 2919),
- Quality Systems - Model for Quality Assurance in Design, Development, Production, Installation and Servicing (ISO 9001),
- Series 1 Freight Containers - Specification and Testing - Part 3 : Tank Containers for Liquids, Gases, and Pressurized Dry Bulk (ISO 1496-3),
- Discussions on a Unified Method of Test for Quasi-Static Fracture Toughness (N128 : 1994),
- Nuclear Energy - Fissile Materials - Principles of Criticality Safety in Storing, Handling and Processing (ISO 1709).

5. WHAT ARE THE DIFFERENT ASPECTS OF INTERNATIONAL STANDARDS IN SUPPORT OF THE SAFE TRANSPORT OF RADIOACTIVE MATERIAL?

5.1 From requirements to guidance

Clearly, it belongs to the International Atomic Energy Agency (IAEA) and to the modal regulations, such as the International Civile Aviation Organization (ICAO) and the International Maritime Organization (IMO), to establish the requirements which are necessary to assure the safe transport of radioactive material. ISO standards are not requirements by themselves. ISO standards are companions to the IAEA Regulations. The following examples illustrate how they support the IAEA Regulations. They can be directly associated to the requirements (though, as explained previously, not being intrinsic requirements) or be guidance.

5.1.1 Requirements

Uranium hexafluoride, or UF_6, is transported worldwide, with the same equipments, which are well adapted to all the facilities where this material is processed. There is a need for international standardization in this field, and there is an international standard for that topic, ISO 7195 standard: “Packaging of Uranium Hexafluoride (UF_6) for Transport”. In the course of its development, all the aspects, and particularly all the hazards of the transport of this material, were taken into account. As a consequence of the value of this standard, the IAEA Regulations require UF_6 to be transported in packagings that meet ISO 7195 standard. The compliance with ISO standards allows taking into account appropriately the chemical toxic hazard of the material.

In such a case the compliance with ISO standard is a requirement of the IAEA Regulations (paragraph 629).

5.1.2 Alternative requirements

The IAEA Regulations set forth requirements for what is called Industrial Packages, or IPs in short.

In the meantime, there is an ISO standard that deals with the freight containers which are commonly used to ship goods. This standard is ISO 1496 standard: “Series 1 Freight Containers – Specifications and Testing – Part 1 : General Cargo Containers”.

The use of the containers which meet this standard provides an equivalent level of safety to Industrial Packages (IPs) for the transport of Low Specific Activity (LSA) material or Surface Contaminated Objects (SCOs). This is recognized in IAEA Regulations. In that case, the compliance with ISO standard is an alternative requirement to this of the basic IAEA Regulations, duly recognized in this latter (paragraph 627).

5.1.3 Guidance

Eleven ISO standards are mentioned in the guide “Advisory Material for the IAEA Regulations for the Safe Transport of Radioactive Material” (TS-G-1.1).

For instance, one of them is the ISO best seller, ISO 9000, dealing with quality management systems. This is a good example with the guidance, which is provided by ISO standards, guidance that is duly recognized in TS-G-1.1.

5.1.4 Additional guidance

At last, beside IAEA Regulations (TS-R-1) and their advisory material (TS-G-1.1), ISO international standards provide guidance and recognized methods in many fields.

ISO standards are used every day in manufacturing, whether it is for the radioactive material itself, or the packaging for this material, or the conveyance to carry the package. This is because ISO standards are available to cover for instance material and welding techniques, but also measurement, testing or control process. The benefit provided by this situation has been previously explained in the paragraph 4, supported by paragraph 638.1 of TS-G-1.1.

5.2 Domains covered by ISO standards

Another possibility to consider standards is to look at the domains they cover. ISO supports the safe transport of radioactive material through a large number of international standards, from the most general ones to very specific standards.

5.2.1 Transport of radioactive material

First of all, transport of radioactive material is a service, which has many common characteristics with other services. This is why general standards that apply to all services are also applicable to transport of radioactive material. The ISO 9000 standard, about quality management systems, is an example of these general standards also applicable to the transport of radioactive material.

5.2.2 TRANSPORT of radioactive material

Transport of radioactive material is also transport. Standards that apply to transport also apply to the safe transport of radioactive material. An example is provided by the standard about freight containers, ISO 1496 standard: “Series 1 Freight Containers – Specifications and Testing – Part 1: General Cargo Containers”, already mentioned in paragraph 5.1.2.

5.2.3 Transport of RADIOACTIVE MATERIAL

Transport of radioactive material deals with radioactive material. Standards about, for instance, radioactive sources are relevant. This is the case of ISO 2919 standard "Sealed Radioactive Sources – Classification" (ISO 2919), which provides alternative requirements to those of the basic IAEA Regulations, duly recognized in this latter (paragraph 709), in a same manner as the standard about freight containers, as explained in paragraph 5.1.2.

5.2.4 TRANSPORT OF RADIOACTIVE MATERIAL

At last, there are a few standards dedicated to the transport of radioactive material.

A first typical example is ISO 7195 standard "Packaging of Uranium Hexafluoride (UF_6) for Transport", for which the compliance with is a requirement included in the IAEA Regulations.

Another example is ISO 12807 standard "Safe Transport of Radioactive Material – Leakage Testing of Packages". This is a standard mentioned in TS-G-1.1.

5.3 Equipments or methods

It is also interesting to distinguish two kinds of standards: the first category describes materials and equipments, whilst the second describe methods. The first category describes **what** is a material; the second one describes **how** to reach a target.

The first category includes standards like ISO 7195 "Packaging of Uranium Hexafluoride (UF_6) for Transport", already mentioned several times previously: it provides, among other things, a specification (geometry, materials, components…) for the manufacturing of the cylinders to transport uranium hexafluoride.

In the second category (methods) falls ISO 12807 "Safe Transport of Radioactive Material – Leakage Testing of Packages". It describes several methods, which are recognized as appropriate. It does not describe the equipment, but it specifies the performances which are expected.

6. WHY TO USE INTERNATIONAL STANDARDS FOR THE TRANSPORT OF RADIOACTIVE MATERIAL?

An international standard is the result of a large consensus (within each country, and between countries). The direct consequence is that the contents of the standards are widely recognized, and the benefits of this situation are several.

First, using standards allows demonstrating to the authorities that the overall operations are mastered. This can be true for all phases of transport, ranging from packaging design, to packaging manufacturing, from preparation of shipment to effective realization of transport.

Second, the use of standards facilitates understanding by all directly involved organizations. Transport is an activity where many people intervene: they have different positions, and are also in different countries. An international standard is a tool that is easily shared by all these people.

At last, using international standards can also increase public confidence in the safety of the transport of radioactive material. Using an international standard is using a tool which has been largely discussed and finally widely accepted.

7. WHICH CHALLENGES FOR THE FUTURE?

The content of a standard is the best practices, or the highest recommendation, of what is known when it is issued. In the mean time the techniques and know-how are still progressing. The first challenge is to keep the door open to innovative solutions, even when requiring explicitly or implicitly the implementation of a standard.

The second challenge stems directly from the first one. When new solutions are enough developed, it is important that the existing standards are updated rapidly, or that new standards are developed in a short time.

Finally, it has been mentioned several times that the strength of a standard is largely due to its elaboration process: an ISO standard is the result of a consensus. But a consensus is only valid if there are enough people involved when it is prepared. That means that we can progress if many experts are interested. The last challenge is not the least: to prepare standard must provide attractive perspectives to the most knowledgeable experts.