



## **THE REVISION OF THE NEW INTERNATIONAL BASIC SAFETY STANDARDS AND ITS EFFECTS ON THE IAEA REGULATIONS FOR THE SAFE TRANSPORT OF RADIOACTIVE MATERIAL**

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### **ABSTRACT**

The last version of the “International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources” (BSS), IAEA Safety Series No. 115, was incorporated into the IAEA Regulations for the Safe Transport of Radioactive Material, Edition 1996.

The main changes which were implemented into the transport regulations at that time refer to the revised  $A_1$  and  $A_2$  values and new radionuclide specific exemption values.

Within the IAEA in cooperation with other international organisations (WHO, NEA, UNEP, PAHO, EC and ILO) a new draft of BSS as DS 379 was developed based on the recommendation of the International Commission on Radiation Protection (ICRP) No.103.

It is foreseen, that the work for the new BSS is finished in 2010. Afterwards the requirements of the new BSS shall be incorporated into national and international rules and orders in the radiation protection field as well as into the IAEA Regulations for the Safe Transport of Radioactive Material.

The paper describes these changes coming from the latest draft of BSS which will have an effect on the IAEA Regulations for the Safe Transport of Radioactive Material TS-R-1. In particular the new exemptions values are being discussed with the focus on keeping them harmonized with the exemption values in TS-R-1.



## INTRODUCTION

The IAEA Regulations for the Safe Transport of Radioactive Material [1] “establish standards of safety which provide an acceptable level of control of the radiation, criticality and thermal hazards to persons, property and the environment that are associated with the transport of radioactive material.” (para. 101.)

These regulations are based inter alia on the International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources (BSS), Safety Series No.115 [2].

After a review of the BSS in 2005 and 2006, the IAEA General Conference decided in resolution GC(50)/RES(10)2006 to proceed with a new revision of the BSS. The Revised BSS [3] is jointly sponsored by the European Commission (EC), the Food and Agriculture Organization of the United Nations (FAO), the International Atomic Energy Agency (IAEA), the International Labour Organization (ILO), the Nuclear Energy Agency of the OECD (OECD/NEA), the Pan American Health Organization (PAHO), the United Nations Environment Programme (UNEP) and the World Health Organization (WHO). The Publication of the Revised BSS will offer updated requirements to be incorporated into future national and regional regulations, established on the basis of internationally recognized trends in exposure to ionizing radiation [4].

After the publication of the Revised BSS the transport “community” has to look over the new requirements which have an influence on the IAEA Transport Regulations.

The paper will show the first steps.

## THE NEW DRAFT OF THE REVISED BSS

### Structure

The structure of the draft of the Revised BSS [3] follows the new ICRP publication No.103:

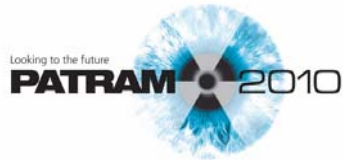
The approach has evolved from the process based approach of “practices” and “interventions”, as adopted in BSS (1996) to an approach based on the characteristics of radiation exposure situations [4].

Thereby, three types of situations of exposure are identified:

- planned exposure situations, including the intentional operation or use of sources;
- emergency exposure situations that may arise during operation or use in a planned situation;
- existing exposure situations, i.e. situations that already exist before a decision control is taken.

The new structure of the Revised BSS establishes three *categories* of exposure:

- Occupational exposure
- Public exposure and
- Medical exposure.



The content of the Revised BSS is as follows:

## 1. INTRODUCTION

Background  
Objective  
Scope  
Structure

## 2. GENERAL REQUIREMENTS FOR PROTECTION AND SAFETY

Definitions  
Interpretations  
Resolution of conflicts  
Entry into force  
Implementation of radiation protection principles  
Responsibilities of government  
Responsibilities of the regulatory body  
Responsibilities of other parties  
Management Requirements

## 3. PLANNED EXPOSURE SITUATIONS

Scope  
Generic requirements  
Occupational exposure  
Public exposure  
Medical exposure

## 4. EMERGENCY EXPOSURE SITUATIONS

Scope  
Generic requirements  
Public exposure  
Exposure of emergency workers  
Transition from an emergency exposure situation to an existing exposure situation

## 5. EXISTING EXPOSURE SITUATIONS

Scope  
Generic requirements  
Public exposure  
Occupational exposure

## SCHEDULES

Schedule I EXEMPTION AND CLEARANCE  
Schedule II CATEGORIZATION OF SEALED SOURCES  
Schedule III DOSE LIMITS FOR PLANNED EXPOSURE SITUATIONS  
Schedule IV CRITERIA FOR USE IN EMERGENCY PREPAREDNESS AND RESPONSE



In the following some short explanations are given with respect to the sections of the new Revised BSS as shown above:

#### Section 1:

In Section 1 the fundamental safety principals are described.

#### Section 2:

This section contains requirements that are applicable to all 3 exposures situations (planned, emergency, existing);

The radiation protection principles are introduced in Chapter 3 (Justification and optimization apply to all three exposure situations; dose limitation only apply to planned exposure situations, excluding medical exposure).

The responsibilities for different parties (government, regulatory body and others) are set out, however the ability to transfer this to modal regulations needs particular attention.

#### Section 3:

The list of practices has been expanded for clarification;

Sources within practices and natural sources are the same; with the exception that the BSS now specifies levels of radioactive material containing natural radionuclides above which specified requirements apply.

The provisions for occupational exposure and public exposure are applicable for all practices, which means also for transport.

#### Section 4:

This takes into account the new definition for emergency workers: any person having a defined role as a worker in an emergency;

#### Section 5:

The requirements for existing exposure situations in this Section apply inter alia for exposure to natural sources and exposure of air crew. In addition exposure to radon in workplaces falls under this section in many cases.

#### Schedule I:

- The Criterion of 10  $\mu\text{Sv/y}$  for exemption is unchanged from the current BSS.
- Levels for exemption of moderate quantities of material without further consideration are shown in Table I-1
  - Additional radionuclides are included compared to the current BSS.
- The levels for clearance and for exemption of bulk quantities of material without further consideration are given in Table I-2
  - The values are coming from RS-G-1.7.



For the transport of radioactive material the provisions of the Section 3 (Planned exposure situations) and the Schedule I (Exemption and clearance) are especially important.

## **ISSUES OF THE REVISED BSS WITH INFLUENCE ON THE TS-R-1 REVISION**

The transport of radioactive material is part of the scope of the BSS:

1. as an “activity” (para. 1.7.) and
2. as a “practice” (para. 3.1.).

That means - in the first instance - all requirements for “activities” and “practices” are also valid for the transport of radioactive material.

But conversely it is necessary to clarify, whether the particular requirements are implemented in transport simply through compliance with TS-R-1. In the following, some main requirements of the draft of the Revised BSS [3] are discussed under this aspect.

### Section 3: PLANNED EXPOSURE SITUATIONS

#### - Requirement 7: Notification and authorization

The notification is required in the para. 555 of the TS-R-1 (2009 Edition) for certain types of packages, listed in para. 555 and for shipments under special arrangements.

The term authorization as such (registration or licensing) is currently not used in the TS-R-1 (2009 Edition), but the necessity of competent authority approvals is required as stated in para. 802. Competent authority approval shall be required for designs for special radioactive material, certain packages, special arrangements, certain shipments and Radiation Protection Programmes for special use vessels.

A footnote to this BSS requirement states “For material being transported in accordance with the IAEA Regulations for the Safe Transport of Radioactive Material, the requirements for notification and authorization are fulfilled by compliance with those regulations”.

As a result any authorization provisions for transport are to be found in TS-R-1 and if any additional provisions are necessary this should be discussed through the TS-R-1 review process.

The relationship between TS-R-1 para 308 and the BSS requirement for monitoring programmes (Para 3.136) leads to an apparent conflict between those responsible. In reality the application of paragraph 308 requires the compliance of the transport operators, and hence there is no actual conflict.

#### - Requirement 8: Exemption and clearance and Schedule I

This requirement is relevant to the transport of radioactive material.

In I-5 is written, that for transport purposes the values of TS-R-1 are applicable: “ ... material in transport for which either the activity concentration of the material or the total activity of



radionuclides in the consignment, does not exceed the relevant ‘basic radionuclide value’ and the footnote 47 says: “For purposes of material in transport, exemption means exemption from the requirements of the Transport Regulations.”

I-5 refers only to the Table I-1 of Schedule I.

This has the effect of maintaining the situation that the exemption criteria for moderate quantities in the BSS remain the same as those used in transport. This is based on a common methodology that is explained clearly in the BSS and applied in transport. It should be noted that the values in Table I-1 of Schedule I are appropriate “without further consideration”. In situations, such as transport, where further consideration may be justified, it could be possible to apply different values. However, the overall decision for TS-R-1 has been that there is sufficient benefit in being harmonised with the BSS that “further considerations” should not be taken into account. Were there greater differences between values calculated for transport and values calculated for the BSS (for example if the values in Table I-2 had become universal in the BSS) then it may be that different values for transport would have had to be applied.

The foreseen additional radionuclides from the Revised BSS, calculated by the Health Protection Agency of the UK will be inserted after the next Edition of the TS-R-1 as an addendum and also the  $A_1$  and  $A_2$  values need to be calculated (see requirement 12).

The dose criteria for the exemption ( $10\mu\text{Sv}$  or less in a year) from I-2, is valid also for transport as a “practice”. How this can be applied by, or on behalf of, the regulatory body (see footnote 44). How this can be applied in practice is still open for discussion. The desire to ensure harmonised international values for transport is important, while the desire to maintain harmonised values within a state is also important. It would not be sensible to exempt a source in all circumstances within a country except transport, since there would be no means of identifying the source when it came to be transported. Likewise, the difficulty at national borders where different exemption values apply in different states for transport would be difficult to cope with. The need for a holistic solution to the application of the criteria in I-2 is clear.

#### - Requirement 12: Dose limitation and Schedule III

The dose limits in the Draft Revised BSS for workers and for the public are unchanged from those in the current BSS.

It is clear, that the values in the Schedule III “Dose limits for planned exposure situations” are also relevant to the transport of radioactive material.

The para. 303 of the TS-R-1 (2009 Edition) should be in accordance with these requirements.

However, the ongoing review of the dose conversion coefficients by ICRP has still to be taken into account. This process will not be finalized within the planned drafting period of the Revised BSS. The Revised BSS will therefore refer to the latest officially published conversion coefficients in such a way that, after publication of updated conversion coefficients, the new coefficients can be issued without a full revision process of the BSS [4].

It has to be recognized, that a modified conversion coefficients can have an influence on the  $Q$ -values for inhalation ( $Q_c$ ) and ingestion ( $Q_d$ ) and thus on the  $A_1$  and  $A_2$  values.



- Requirement 24: Radiation Protection Programme (RPP) for occupational exposure

Attention should be paid to this requirement for the next review of the TR-R-1 and the TS-G-1.3, whether it has an influence on the *elements* of the RPP.

Section 4: EMERGENCY EXPOSURE SITUATIONS

The influence on the TS-G-1.2 “Emergency Planning and Preparing for Emergency Response to Transport Accidents Involving Radioactive Material” has to be checked by the IAEA with the next revision of this document.

Some remarks to the GLOSSARY:

There are some new terms or modified terms, which can have influence on the TS-R-1, e.g.:

- **representative person** (new term)

An individual receiving a *dose* that is representative of the more highly *exposed* individual in the population.

The “critical group” is replaced by “representative person” in para 559 of [1].

- **constraint** (modified)

A prospective and *source* related value of individual dose (dose constraint) or risk (risk constraint) used as a tool in the optimization of protection and safety of the source, which serves as a boundary in defining the range of options in optimization.

- For occupational exposure, a constraint on individual dose to workers established and used by registrants and licensees to set the range of options in optimizing the protection and safety of the source.

- For public exposure, the dose constraint is a source related value established or approved by regulatory body or relevant public health authority, taking into account the doses from planned operations of all controlled sources. The dose constraint for each particular source is intended, *inter alia*, to ensure that the sum of doses from planned operations of all controlled sources remain within the dose limit.

Dose constraints are already incorporated in TS-R-1 with the words “...and conservative model parameters”, the values are still appropriate -as set out in the segregation rules (para. 559 of [1]). The continued adequacy of these constraints is verified through routine reviews by Member States, including consideration of dose to workers and the public.

- **controlled area**. (modified)

A defined area in which specific *protection* measures and *safety* provisions are or could be required for controlling *exposures* or preventing the spread of *contamination* during normal working conditions, and preventing or limiting the extent of *potential exposures*.

Footnote 20 however notes that “The transport of radioactive material is regulated in accordance with the IAEA Regulations for the Safe Transport of Radioactive Material”



This is only the first assessment with regard to BSS issues, which should be considered for the next review of the TS-R-1. Other issues may impact on the transport requirements, for example the fact that aircrew exposure is clearly described as an existing exposure situation, removing the conflict between exposure due to flying and exposure due to carrying packages containing radioactive material (as a planned exposure situation).

Following the time plan, the last draft of the new BSS will be sent to the Commission on Safety Standards in March 2011 for endorsement, afterwards to the Board of Governors and to the General Conference in autumn 2011.

It is important to start the discussion on the above identified issues at the earliest time possible in order to ensure the continued harmonisation between TS-R-1 and the BSS.

## **CONCLUSIONS**

It is concluded, that the changes of the Revised BSS [3] are not so significant, that the content and the structure of the IAEA Transport Regulations, which are the basis of the regulations for the safe transport of radioactive material for all transport modes all over the world, have to be changed.

Nevertheless it is recommended, that specialists from both fields, radiation protection and transport, should have a look at the changes of the Revised BSS as soon as possible and make recommendations for a revised text of the Transport Regulations if necessary. The above mentioned proposals should be taken into account.

During this process all involved parties must bear in mind, that only harmonized provisions and rules in the BSS and the TS-R-1 can contribute to maintain or even increase the high level of safety in transport.

Also the harmonization of other new developed requirements with the IAEA BSS, e.g. the BSS of the European Union, is very important. In particular, a harmonized set of exemption values is not a major safety issue, but remains an important issue in terms of practical application. The scientific models used to determine such exemption values should not take precedence over the ability to apply the requirements. As in the past, the IAEA should play the leading role in establishing the necessary values into the Transport Regulations.

## **REFERENCES**

- [1] Regulations for the Safe Transport of Radioactive Material, 2009 Edition, Safety Requirements No. TS-R-1, International Atomic Energy Agency (IAEA), Vienna (2009)
- [2] International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources, Safety Series No. 115, IAEA, Vienna (1996)
- [3] International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources, Draft Safety Requirements, DS 379, Draft 4.0, 9 September 2010
- [4] R.Czarwinski, M.Crick: Occupational Exposure worldwide and the Revision of international Standards for Protection, will be published in Radiation Protection Dosimetry, 2011