



DANGEROUS GOODS PANEL (DGP)

TWENTY-FOURTH MEETING

Montréal, 28 October to 8 November 2013

Agenda Item 2: Development of recommendations for amendments to the *Technical Instructions for the Safe Transport of Dangerous Goods by Air* (Doc 9284) for incorporation in the 2015-2016 Edition

INTERNAL PRESSURE FOR PACKAGES OF RADIOACTIVE MATERIAL TRANSPORTED BY AIR

(Presented by the World Nuclear Transport Institute (WNTI))

SUMMARY

This working paper seeks the DGP's opinion on a WNTI proposal to modify IAEA SSR-6 text related to the pressure differential a package must be capable of withstanding without loss or dispersal of radioactive contents from the containment system of the package. The proposal was made to an IAEA Technical Meeting on the Environment to which Packages May be Subject During Transport and Related Issues Concerning the Regulations for the Safe Transport of Radioactive Material (Vienna, 15 to 19 July 2013). It was recommended that WNTI seek the opinion of the DGP before the next IAEA TRANSSC meeting (TRANSSC 27, November 2013).

Action by the DGP: The DGP is invited to express its opinion on the proposal made to the IAEA before the next TRANSSC meeting planned in the week commencing 11 November 2013 (the proposal may be rejected, accepted with modifications, or accepted without modifications).

1. INTRODUCTION

1.1 At the beginning of 2013, the International Atomic Energy Agency (IAEA) initiated a new review cycle of its Regulations for the Safe Transport of Radioactive Materials (IAEA SSR-6), and invited Member States and Observer Organizations to submit issues before 17 May 2013.

1.2 As an observer, the World Nuclear Transport Institute (WNTI) submitted a proposal regarding the pressure differential a package shall be able to withstand without loss or dispersal of radioactive contents from the containment system of the package (paragraph 621 of the IAEA SSR-6 – 2012 Edition, corresponding to Part 6; 7.2 of Technical Instructions).

1.3 For radioactive material, the current requirement does not make any difference between liquid, gaseous, powder or solid form and does not consider the level of dangerousness of the content. Furthermore, the pressure differential which should be taken into account is higher than for other dangerous goods (95 kPa plus maximum normal operating pressure (MNOP), MNOP being the maximum pressure above atmospheric pressure at mean sea level that would develop in the containment system in a period of one year under the conditions of temperature and solar radiation corresponding to environmental conditions in the absence of venting, external cooling by an ancillary system, or operational controls during transport).

1.4 The proposal, which is detailed in Appendix B to this working paper, introduces a graded approach taking account of the physical form (liquid, gas, powders or solid objects) and the level of dangerousness of the material transported, in order to match what is already the case for other dangerous goods. It is proposed to adapt the requirement with a view to make it easier to comply with, while achieving the main objective of the Regulations: proposing a graded approach based on the properties of the radioactive material transported.

1.5 Taking into account the form of the radioactive material and the risk level a release of this radioactive material out of the containment system of the package may induce for the aircraft security, its crew's and passengers' safety, a set of three situations and corresponding conditions are proposed:

- a) For the instances where dispersal of the radioactive material is improbable due to its form (special form, surface contaminated objects — SCO, solid low specific activity material — LSA in non-powder form, solid radioactive material in a Type A), and for LSA-I in powder form (LSA-I is a material, which can be carried unpackaged for the other modes and is the less dangerous material regarding the potential consequences of its dispersal), it is proposed that the package shall retain its radioactive content under a reduction of ambient pressure to 25 kPa (a package may be designed to offer radiation shielding. It is then important that the content remains in the package). This pressure corresponds to the pressure at sea level (100 kPa) less the highest pressure differential between sea level and the pressure within a non-pressurized or partially pressurized cargo compartment of an airplane (75 kPa) (see Note 3 of the introductory notes of Part 4 of the 2013-2014 Edition of Technical Instructions);
- b) For the cases of solid radioactive material in powder form other than LSA-I in non-approved packages, taking account of the relative high radioactive concentration those materials may reach, and taking account that the package may include a hermetically closed containment system, the requirement proposed is the same as for infectious substances (UN 2814, **Infectious substance, affecting humans** and UN 2900, **Infectious substance, affecting animals**): the package shall be able of withstanding, without loss or dispersal of radioactive contents from the containment system, a pressure differential of 95 kPa;
- c) For the other cases (liquids, gases, high radioactive material non-special form, and radioactive material in approved package type), for which significant pressure may develop within the containment system due to heating, radiolytic and or thermolytic decomposition of materials, the requirement adopted is the same as for liquid dangerous goods (see Part 4;1.1.6 a) of the 2013-2014 Edition of Technical

Instructions): the package shall be capable of withstanding, without loss or dispersal of radioactive contents from the containment system, an internal pressure that produces a pressure differential of not less than the maximal gauge pressure that may be developed in the package at 55°C when it has been filled at 15°C (or the *maximum normal operating pressure — MNOP*) multiplied by a safety factor of 1.5, with a minimum of 95 kPa, or as an alternative, the package shall be able of withstanding a pressure differential of the total gauge pressure developed in the package at 55°C plus 75 kPa with a minimum of 95 kPa (covers any foreseen situations).

1.6 As a result of the IAEA General Conference resolution GC(53)/RES/10, September 2009, the IAEA organized from 15 to 19 July 2013 a “Technical Meeting (TM) on the Environment to which Packages May be Subject During Transport and Related Issues Concerning the Regulations for the Safe Transport of Radioactive Material” (IAEA TM-44891) held in IAEA headquarters in Vienna.

1.7 During that TM, that proposal was considered, and it was recommended that WNTI introduces it to the DGP/24 with a view to obtaining the DGP’s opinion on it before the next IAEA TRANSSC meeting (TRANSSC 27 is planned from 11 November 2013).

1.8 The proposal to modify the IAEA SSR-6 text can be found at Appendix B to this working paper.

1.9 If recommended by the DGP to TRANSSC, this proposal would then be translated as part of the harmonization between the SSR-6 and the Technical Instructions as presented in Appendix A.

APPENDIX A

PROPOSAL TO MODIFY PART 7 OF THE TECHNICAL INSTRUCTIONS

Part 6

PACKAGING NOMENCLATURE, MARKING, REQUIREMENTS AND TESTS

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Chapter 7

REQUIREMENTS FOR THE CONSTRUCTION, TESTING AND APPROVAL OF PACKAGES AND MATERIAL OF CLASS 7

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7.2 ADDITIONAL REQUIREMENTS FOR PACKAGES TRANSPORTED BY AIR

7.2.1 The temperature of the accessible surfaces must not exceed 50°C at an ambient temperature of 38°C with no account taken of insolation.

7.2.2 Packages must be designed so that, if they were exposed to ambient temperatures ranging from -40°C to +55°C, the integrity of the containment would not be impaired.

7.2.3 ~~Packages containing radioactive material must be capable of withstanding, without leakage, an internal pressure that produces a pressure differential of not less than maximum normal operating pressure plus 95 kPa.~~ Packages containing radioactive material shall conform to the most appropriate condition among the following ones:

a) the following packages shall retain their radioactive contents under a reduction of ambient pressure to 25 kPa:

i) packages containing only special form radioactive material or SCO-I or SCO-II,

ii) excepted packages, industrial packages and type A packages, containing solid radioactive material, excluding powders,

iii) packages containing LSA-I material in powder form;

b) excepted packages, industrial packages and type A packages containing solid radioactive material in powder form other than LSA-I, shall be cable of withstanding, without loss or dispersal of radioactive contents from the containment system, a pressure differential of 95 kPa;

c) other packages containing radioactive material shall be capable of withstanding, without loss or dispersal of radioactive contents from the containment system, an internal pressure that produces a pressure differential of not less than the maximal gauge pressure that may be developed in the package at 55°C when it has been filled at 15°C (or the maximum normal operating pressure) multiplied by a safety factor of 1.5, with a minimum of 95 kPa.

Alternative to c):

c) other packages containing radioactive material shall be capable of withstanding, without loss or dispersal of radioactive contents from the containment system, an internal pressure that produces a pressure differential of not less than the maximal gauge pressure that may be developed in the package at 55°C when it has been filled at 15°C (or the maximum normal operating pressure) plus 75 kPa, with a minimum of 95 kPa.

APPENDIX B

THE PROPOSAL TO MODIFY THE IAEA SSR-6 TEXT

1.1 Existing regulatory text (IAEA SSR-6 2012 Edition):

621. Packages containing radioactive material to be transported by air shall be capable of withstanding, without loss or dispersal of radioactive contents from the containment system, an internal pressure that produces a pressure differential of not less than maximum normal operating pressure plus 95kPa.

1.2 Proposed new regulatory text (IAEA SSR-6):

621. Packages containing radioactive material to be transported by air shall conform to the most appropriate condition among the following ones:

(a) the following packages shall retain their radioactive contents under a reduction of ambient pressure to 25 kPa:

(i) packages containing only special form radioactive material or SCO-I or SCO-II,

(ii) excepted packages, industrial packages and type A packages, containing solid radioactive material, excluding powders,

(iii) packages containing LSA-I material in powder form;

(b) excepted packages, industrial packages and type A packages containing solid radioactive material in powder form other than LSA-I, shall be cable of withstanding, without loss or dispersal of radioactive contents from the containment system, a pressure differential of 95 kPa;

(c) other packages containing radioactive material shall be capable of withstanding, without loss or dispersal of radioactive contents from the containment system, an internal pressure that produces a pressure differential of not less than the maximal gauge pressure that may be developed in the package at 55°C when it has been filled at 15°C (or the maximum normal operating pressure) multiplied by a safety factor of 1.5, with a minimum of 95 kPa.

Alternative to (c):

(c) other packages containing radioactive material shall be capable of withstanding, without loss or dispersal of radioactive contents from the containment system, an internal pressure that produces a pressure differential of not less than the maximal gauge pressure that may be developed in the package at 55°C when it has been filled at 15°C (or the maximum normal operating pressure) plus 75 kPa, with a minimum of 95 kPa.

1.3 Existing advisory text (IAEA SSG-26 corresponding to SSR-6 2012 Edition):

621.1. This is a similar provision to that required by the ICAO [10] for packages containing certain liquid dangerous goods intended for transport by air. This includes the requirement for the package to withstand, without loss or dispersal of radioactive contents from the containment system, a pressure differential of 95 kPa. In the 1996 Edition of the Transport Regulations the provision was expanded to include all forms of radioactive material.

621.2. Pressure reductions due to altitude will be encountered during flight (see para. 578.1). The pressure differential that occurs at an increased altitude should be taken into account in the packaging design. The pressure differential of 95 kPa plus the MNOP (see paras 229.1–229.3) is the pressure differential to be accommodated, without loss or dispersal of radioactive contents from the containment system, by the package designer. This design specification results from a consideration of aircraft depressurization at a maximum civil aviation flight altitude together with any pressure already inside the package, with a safety margin.

621.3. If, within the definition of MNOP, the phrase “conditions of temperature and solar radiation corresponding to environmental conditions” is interpreted to include consideration of conditions specific to air transport (para. 620), then the MNOP does provide a suitable basis for specifying this requirement. If the temperature range contained in para. 620 (–40°C to 55°C) is used, self-heating of the package contents is taken into account, and the solar radiation input is considered to be zero, as the package is inside an aircraft, and hence the MNOP is consistent with the ICAO approach.

1.4 Proposed new advisory text (IAEA SSG-26):

621.1. This is a similar provision to that required by the ICAO [10] for packages containing ~~certain~~ liquid dangerous goods or infectious substances intended for transport by air. Taking account of the form of the radioactive material and of the risk level a release of this radioactive material out of the containment system of the package may induce for the aircraft security, its crew’s and passenger’s safety, a set of three situations and corresponding conditions were defined:

- (a) For the cases where dispersal of the radioactive material is improbable due to its form (special form, SCO, solid LSA in non powder form, solid radioactive material in a Type A), and for LSA-I in powder form, it is required that the package shall retain its radioactive contents under a reduction of ambient pressure to 25 kPa. This pressure corresponds to the pressure at sea level (100 kPa) less the highest pressure differential between sea level and the pressure within a non-pressurized or partially pressurized cargo compartment of an airplane (75 kPa) (see note 3 in introductory notes of Part 4 of ICAO-TI 2013-2014 Edition);
- (b) For the cases of solid radioactive material in powder form other than LSA-I in non approved packages, taking account of the relative high radioactive concentration those materials may reach, and taking account that package may include a hermetically closed containment system, the requirement is the same as for infectious substances (UN2814 and UN2900): the package shall be able of withstanding, without loss or dispersal of radioactive contents from the containment system, a pressure differential of 95 kPa;
- (c) For the other cases (liquids, gases, and high radioactive material non-special form, and radioactive material in approved package type), for which significant pressure may

develop within the containment system due to heating, radiolytic and or thermolytic decomposition of materials, the requirement adopted is the same as for liquid dangerous goods (see Part 4, Chapter 1, para 1.1.6 a) of ICAO-TI 2013-2014 Edition): the package shall be capable of withstanding, without loss or dispersal of radioactive contents from the containment system, an internal pressure that produces a pressure differential of not less than the maximal gauge pressure that may be developed in the package at 55°C when it has been filled at 15°C (or the *maximum normal operating pressure - MNOP*) multiplied by a safety factor of 1.5, with a minimum of 95 kPa.

Alternative to (c)

- (c) For the other cases (liquids, gases, and high radioactive material non-special form, and radioactive material in approved package type), for which significant pressure may develop within the containment system due to heating, radiolytic and or thermolytic decomposition of materials, the requirement adopted is the same as for liquid dangerous goods (see Part 4, Chapter 1, para 1.1.6 a) of ICAO-TI 2013-2014 Edition): the package shall be capable of withstanding, without loss or dispersal of radioactive contents from the containment system, an internal pressure that produces a pressure differential of not less than the maximal gauge pressure that may be developed in the package at 55°C when it has been filled at 15°C (or the *maximum normal operating pressure - MNOP*) plus 75 kPa, with a minimum of 95 kPa.

621.2 Several possibilities to comply with the requirements in 621 (a) may be used:

- use of a packaging which is able to withstand the pressure differential of 75 kPa, or
- use of a packaging equipped with valves and filters to allow pressure equilibrium without dispersal of radioactive solid material content (when the content can be subject to dispersal like LSA-I, or small dispersal like SCO-I and SCO-II), or
- use of valves without any supplementary equipment (if the content is not subject to dispersal, like special form);

621.3. If, within the definition of MNOP, the phrase “conditions of temperature and solar radiation corresponding to environmental conditions” is interpreted to include consideration of conditions specific to air transport (para. 620), then the MNOP does provide a suitable basis for specifying this requirement. If the temperature range contained in para. 620 (–40°C to 55°C) is used, self-heating of the package contents is taken into account, and the solar radiation input is considered to be zero, as the package is inside an aircraft, and hence the MNOP is consistent with the ICAO approach.

1.5 Existing regulatory text (Technical Instruction 2013-2014 Edition, Part 6;7):

7.2.3 Packages containing radioactive material must be capable of withstanding, without leakage, an internal pressure that produces a pressure differential of not less than maximum normal operating pressure plus 95 kPa.