International Civil Aviation Organization

WORKING PAPER

DANGEROUS GOODS PANEL (DGP)

TWENTY-SEVENTH MEETING

Montréal, 16 to 20 September 2019

Agenda Item 2: **Managing air-specific safety risks and identifying anomalies**
    2.2: Develop proposals, if necessary, for amendments to the *Technical Instructions for the Safe Transport of Dangerous Goods by Air* (Doc 9284) for incorporation in the 2021-2022 Edition

REVISIONS TO FORMULAS TO CALCULATE CRITICALITY SAFETY INDEX OF PACKAGES CONTAINING FISSILE MATERIAL

(Presented by Aidong Song)

SUMMARY

This working paper proposes to revise the formulas to calculate the criticality safety index (CSI) of packages containing fissile material.

Action by the DGP: The DGP is invited to consider the amendment proposed in the appendix to this working paper.

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1.   **INTRODUCTION**

1.1   The formulas to calculate the criticality safety index (CSI) of the fissile material package in the International Atomic Energy Agency (IAEA) Regulations for the Safe Transport of Radioactive Material are as follows:

"REQUIREMENTS FOR PACKAGES CONTAINING FISSILE MATERIAL
. . .

674. *Packages* containing *fissile material* that meets the requirements of para. 674(d) and one of the provisions of para. 674(a)–(c) are excepted from the requirements of paras 676–686.

(a)   *Packages* containing *fissile material* in any form provided that:
            . . .

(ii) The *CSI* of the package is calculated using the following formula:
$CSI = 50 \times 5 \times \{$[mass of uranium-235 in *package* (g)]/Z
$+$ [mass of other *fissile nuclides*[1] in *package* (g)]/280$\}$
where the values of Z are taken from Table 13.

...

(b)   P*ackages* containing *fissile material* in any form provided that:
...

(iii)   The *CSI* of the *package* is calculated using the following formula:
$CSI = 50 \times 2 \times \{$[mass of uranium-235 in *package* (g)]/Z
$+$ [mass of other *fissile nuclides*[1] in *package* (g)] / 280$\}$
where the values of Z are taken from Table 13.

...

(c)   P*ackages* containing *fissile material* in any form provided that:
...

(iii)   The *CSI* of the *package* is calculated using the following formula:
$CSI = 50 \times 2 \times \{$[mass of uranium-235 in *package* (g)]/450
$+$ [mass of other *fissile nuclides*[1] in *package* (g)] / 280$\}$
..."

1.2   But in the Technical Instructions Part 6;7.10.2, the formulas to calculate the CSI of the fissile material package have some differences from the IAEA Regulations. So revisions should be made to the formulas to conform with the IAEA regulations.

2.   **ACTION BY THE DGP**

2.1   The DGP is invited to consider the revisions to formulas to calculate CSI as shown in the appendix to this working paper.

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APPENDIX

PROPOSED AMENDMENT TO PART 6 OF THE TECHNICAL INSTRUCTIONS

Part 6

PACKAGING NOMENCLATURE, MARKING, REQUIREMENTS AND TESTS

. . .

Chapter 7

REQUIREMENTS FOR THE CONSTRUCTION, TESTING AND APPROVAL OF PACKAGES FOR RADIOACTIVE MATERIAL AND FOR THE APPROVAL OF SUCH MATERIAL

. . .

   7.10.2   Packages containing fissile material that meet the provisions of subparagraph d) and one of the provisions of a) to c) below are excepted from the requirements of 7.10.4 to 7.10.14.

   a)   Packages containing fissile material in any form provided that:

   i)   the smallest external dimension of the package is not less than 10 cm;

   ii)   the criticality safety index of the package is calculated using the following formula:

$$CSI = 50 \times 5 \times \left[\left(\frac{Mass \text{ of U-235 in package(g)}}{Z} \right) + \left(\frac{Mass \text{ of other fissile nuclides}^* \text{in package (g)}}{280} \right) \right]$$

   where the values of Z are taken from Table 6-6.

   *   Plutonium may be of any isotopic composition provided that the amount of Pu-241 is less than that of Pu-240 in the package

   iii) the CSI of any package does not exceed 10;

   b)   packages containing fissile material in any form provided that:

. . .

   iii)   the criticality safety index of the package is calculated using the following formula:

$$CSI = 50 \times 2 \times \left[\left(\frac{Mass \text{ of U-235 in package(g)}}{Z} \right) + \left(\frac{Mass \text{ of other fissile nuclides}^* \text{in package (g)}}{280} \right) \right]$$

   where the values of Z are taken from Table 6-6.

   *   Plutonium may be of any isotopic composition provided that the amount of Pu-241 is less than that of Pu-240 in the package

   (iv)   the criticality safety index of any package does not exceed 10;

   c)   packages containing fissile material in any form provided that:

   i)   the smallest external dimension of the package is not less than 10 cm;

. . .

    iii) the criticality safety index of the package is calculated using the following formula:

$$\text{CSI}=50\text{x}2\text{x}\left[\left(\frac{\textit{Mass} \text{ of U-235 in package(g)}}{450}\right) + \left(\frac{\textit{Mass} \text{ of other fissile nuclides}^* \text{in package (g)}}{280}\right)\right]$$

    *   Plutonium may be of any isotopic composition provided that the amount of Pu-241 is less than that of Pu-240 in the package

. . .

— END —