

## Comments on the Proposed Resolution of MS/IO 120 D Comments And Draft 2.4 of TS-R-1 20XX Edition

- 144 comments;
- purely editorial: 22
- Table 2 footnote (h): 5
- IATA proposal: 9;
- Transitional arrangement: 11
- Fissile: 18

Com ment No.	120-day Commen t No.	Para No.	Proposed texts TRANSSC 22 conclusions	Reasons of objection
CDN/D 24/01		General	T22:	The review of the revised version of TS-R-1 (ver. 2.4) has proven to be very difficult as the disposition table provided (name of the file to be inserted here) was not complete since it did not include the final disposition of all of the member state comments. In addition the header of the last column (Recommendation) did not include a full list of the various CS and other meeting where the comments were discussed which made it difficult to follow.
CDN/D 24/02		General	T22:	The disposition of the Member state comments should be revised to include a proper rationale for the rejection with perhaps extract from the meeting report as it is not always clear as to why a comment was rejected and later re-inserted by another CS and finally rejected again.
CDN/D		General	T22:	Since the revised copy of TS-G-1.1 has not been included, it is

24/03				difficult to see if all instances where comments are to be addressed in TS-G-1.1 are adequately covered and this may have an impact on the acceptability of some of the proposed text in TS-R-1.
IAEA/ D24/0 1		General	T22:	Any issues raised by Fukushima accident that may require revision at a future date should be noted. This should not delay the approval and publication process as changes can be included at a later date. However, it is important to be aware of these and to be able to deal with any comments raised by MS
IAEA/ D24/0 2		General	T22:	Note 2 on the front cover states that there is one more Annex that is not attached. ANNEX IV – Guiding principles underlying the IAEA Transport Regulations which is related to the BSS. As it appears to be a new Annex to TS-R-1, it would be appreciated if a copy of this Annex could be provided.
E/D24 /15	<a href="#">CS-32</a>	107 (d)	T22:	<p>The ICAO has recently introduced a similar provision for the in the 2011-2012 Edition of the Technical Instructions (Part 1, Chapter 6, page 1-6-1, paragraph 6.1.4, <i>add</i> new sub-paragraph b):</p> <p><i>b) a person who has been subject to accidental or deliberate intake of or contamination from radioactive material and is to be transported for medical treatment, taking into account the necessary radiological protection measures with respect to other passengers and crew, subject to approval by the operator;</i></p> <p>It is considered necessary to try to harmonize as much as possible both provisions.</p>

AUS/D 24/01	<a href="#">RCM NORM, TRANSSC 21</a>	107 (f)		<p>This section now effectively means “All materials containing naturally occurring radionuclides” - Everything is either “natural material” or “natural material that has been processed”. Applying the factor of 10 increase in exemption concentration to virtually all material containing natural radionuclides results in materials with quite high external dose rates being exempted.</p> <p><b>Australia recommends that the version in the 2009 Edition be maintained.</b></p>
AUS/D 24/02	<a href="#">CS-29</a>	07 (f) bis		<p>What degree of departure from strict equilibrium is allowable before the para 405 requirements must be made? Unprocessed ores are not always in equilibrium, and even a small amount of processing can further upset equilibrium. This further confuses the exemption but no change would be necessary if the version in the 2009 Edition is maintained.</p> <p><b>Australia recommends that the version in the 2009 Edition be maintained.</b></p>
CDN/D 24/04	<a href="#">RCM NORM, TRANSSC 21</a>	107(f)	<p>Keep text of the 2009 Edition</p> <p><b>T22:</b></p>	<p>The propose change will create an inconsistency between the exemption quantities found in the BSS and those found in TS-R-1 as there is now a blanket exemption for NORM material up to 10 times the exemption quantity found in Table 2. If the reasoning for this change is based on the fact that the exemption values are too low, it would be more reasonable to change those values rather than keeping those values and then exempting them in para 107. Canada</p>

				supports the comment from France <a href="#">F/120D/02</a> .
IAEA/ D24/0 4	New	108	<p>These regulations do not <del>specify controls such as</del> <a href="#">include</a> routing or physical protection <del>that may be instituted</del> <a href="#">measures</a> for reasons <a href="#">nuclear or</a> other than radiological safety. Any such controls shall take into account radiological <a href="#">radioactive material while in transport</a>. <a href="#">Physical protection measures for nuclear</a> and <del>non-</del> <a href="#">radioactive material in transport</a> is specified in IAEA Nuclear Security Series No.13 <a href="#">“Recommendations for Physical Protection of Nuclear Material</a> and shall not detract from the standards of safety that these Regulations are intended to provide. <a href="#">Nuclear Facilities (INFCIRC/225/Rev.5)”</a> and IAEA Nuclear Security Series No. 14 <a href="#">“Recommendations on Security of Radioactive Material and Associated Facilities</a>.</p> <p><b>T22:</b></p>	
IAEA/ D24/0 6		108 Refere nce	<p><b>T22:</b></p>	<p>Also insert a reference to the recommendations document on RAM, this should read:</p> <p>INTERNATIONAL ATOMIC ENERGY AGENCY, Recommendations on the Security of Radioactive Material and Associated facilities, IAEA Nuclear Security Series No.14, IAEA, Vienna 2011.</p>
IND/D 24/06	New	108	<p>Para 108. These regulations do not <del>include</del> <b>specify controls such as</b> routing or physical protection measures for nuclear or other radioactive material while in transport; <b>which may be instituted for reasons other than radiological safety</b>. Physical protection measures for</p>	<p>Reasons:</p> <p>1) If we use ‘include’ instead of ‘specify controls such as’, proposed para 108 will be contradictory to para 109. The Regulations mention about the security, physical</p>

			<p>nuclear and other radioactive material in transport <del>is</del> <b>are</b> specified in IAEA Nuclear Security Series No.13 “Recommendations for Physical Protection of Nuclear Material and Nuclear Facilities (INFCIRC/225/Rev.5)” and IAEA Nuclear Security Series No. 14 “Recommendations on Security of Radioactive Material and Associated Facilities”.</p> <p><b>Any such controls shall take into account radiological and non-radiological hazards and shall not detract from the standards of safety which these Regulations are intended to provide.</b></p>	<p>protection etc.; but, do not elaborately specify necessary measures.</p> <p>2) The last sentence of the original para is very important. We cannot afford to lose it.</p>
IAEA/ D24/0 5		108, Refere nce[I- 2]	<b>T22:</b>	INTERNATIONAL ATOMIC ENERGY AGENCY, Recommendations on the Physical Protection of Nuclear Material and Nuclear Facilities (INFCIRC/225/Revision 5), IAEA Nuclear Security Series No.13, IAEA, Vienna 2011.
UA/D2 4/01	New	2xx  DEFINI TIONS	<p>Add the term “<u>subcritical system</u>” to the Section “DEFINITIONS” with the following definition: “<u>subcritical system is a system that contains fissile materials and whose neutron multiplication factor remains lower than 0.95 with conservative credit of process tolerances and calculation errors under optimal neutron moderation conditions</u>”</p>	<p>In reactor core calculations, simulation or critical and subcritical assemblies, and various critical experiments, a subcritical system is one whose effective neutron multiplication factor is lower than 1. In nuclear safety assessments of fissile material transport systems, all countries (including USA, Great Britain, France, Germany, Russia, Ukraine, etc.) consider that a surely subcritical system is one whose calculated neutron multiplication factor remains lower than 0.95 with conservative credit of process tolerances and</p>

				calculation errors under optimal neutron moderation conditions
D/D2 4/01	New see <a href="#">USA/D24/14</a>	220	<b>T22:</b>	<p>Consistency: to be consistent with para. 802 (a) include „<i>fissile material</i> excepted under para. 417 (f)“ as follows:</p> <p>220. <i>Design</i> shall mean the description of <a href="#">fissile material excepted under para. 417 (f)</a>, <i>special form radioactive material, low dispersible radioactive material</i>, package or <i>packaging</i> that enables such an item to be fully identified. The description may include specifications, engineering drawings, reports demonstrating compliance with regulatory requirements, and other relevant documentation.</p>
CDN/D 24/05	<a href="#">CS-19 T20 TM-38941</a> , <a href="#">GER/0910 UK/07/08</a>	221	<p>Delete “where so required by these regulations”</p> <p><b>T22:</b></p> <p>Clarification required or deletion of word “shipment”.</p> <p><b>T22:</b></p>	<p>The words "where so required" should be deleted. Section II is definitions and definitions should not create a requirement. The wording that is proposed in Draft 2.4 creates a requirement and is inconsistent with the IAEA style used for definitions.</p> <p>What is the nature of the directions that the consignor or consignee must give in order that the “shipment” is in accordance with their directions.</p> <p>Exclusive use is related to things like stowage for heat dissipation, radiation levels etc. for health and safety reasons. An overly broad interpretation of the directions to be issued could affect things not related to the exclusive use controls required.</p>
CDN/D		222	<b>T22:</b>	It is still not clear if the revised wording allows the use of depleted

24/06			<p>Add "<a href="#">more than 0.25 g of</a>" between "with" and "fissile nuclides" in the last new sentence.</p> <p>The revised sentence is "These exclusions are only valid if there is no other material with <b>more than 0.25 g of fissile nuclides</b> in the package."</p> <p><b>T22:</b></p>	<p>uranium as shielding material for packages transporting fissile nuclides due to the last sentence of this paragraph: "These exclusions are only valid if there is no other material with fissile nuclides in the package" In the disposition table, it is stated that guidance will be developed but it has not been provided.</p> <p>If a material with fissile nuclides is not "fissile material", then it should be allowed in a package with the excluded material. This avoids nullifying the exclusion for minute quantities of fissile nuclides somewhere else in the package or shipment.</p>
F/D24 /2	<a href="#">CS-05</a>	222	<b>T22:</b>	The modifications are acceptable but it should be added in TS-G-1.1 confirmation that 0.25 g applies to total contents of a package and not to each individual fissile material in the package.
USA/d 24/1	<a href="#">CS-05</a>	222	<p><i>Fissile nuclides</i> shall mean uranium-233, uranium-235, plutonium-239 and plutonium-241. <i>Fissile material</i> shall mean a material containing any of the <i>fissile nuclides</i>. <del>in quantities exceeding a total of 0.25g per package or per consignment if shipped unpackaged.</del> Excluded from the definition of <i>fissile material</i> is any combination of the following:</p> <p>(a) <i>Natural uranium</i> or <i>depleted uranium</i> that is unirradiated;</p>	<p>The last sentence of the current para limits contents to only one material (or material type?). However, since the limit of 0.25 g is not an exclusion, the current text could be interpreted to allow multiple materials with &lt;0.25 g per "material" to be loaded in a package and all would be exempt from requirements on controls for <i>fissile material</i>. Thus, a shipper could load a package with numerous discrete pellets having &lt;0.25 g / pellet and claim each pellet as a separate material that does not meet <i>fissile material</i> definition. The proposed new text more clearly identifies the intent that only</p>

			<p>(b) <i>Natural uranium</i> or <i>depleted uranium</i> that has been irradiated in thermal reactors only.</p> <p>(c) <b>Material with fissile nuclides less than a total of 0.25 g.</b></p> <p>These exclusions are only valid if there is no other material with <i>fissile nuclides</i> in the <i>package</i> <b>or in the consignment if shipped unpackaged.</b></p> <p>T22:</p>	one material with <0.25 g is allowed per package OR the shipper has to identify the entire contents as one <i>fissile material</i> with <0.25 g.
F/D24 /3	<a href="#">CS-29</a>	223	T22:	The acceptance of those modifications is subject to checking that the new definitions for small and large freight containers are consistent with the 17 <sup>th</sup> edition of the UN model regulation which is due for release at the end of June 2011.
IAEA/ D24/0 7		223	223. ... The term " <i>freight container</i> " does not include <a href="#">the vehicle</a> .	Editorial
CDN/D 24/07	<a href="#">WNTI/120 D/04</a>	233	<p>Add "equivalent" between "corresponding" and "dose"</p> <p>"233. <i>Radiation level</i> shall mean the corresponding <b>equivalent</b> dose rate "</p>	<p>Clarification to differentiate that we mean some SI multiple of Sv/h (mSv/h, uSv/h etc.) rather than something in a SI multiple of Gy/h.</p> <p>Alternately revert to original and use units consistently throughout document. i.e. convert uSv/h to mSv/h.</p>
F/D24 /4	<a href="#">WNTI/120 D/04</a>	233	<p>233. <i>Radiation level</i> shall mean the <del>corresponding</del> <b>radiation equivalent dose rate</b></p> <p>T22:</p>	<p>If the unit of the radiation level is deleted the text should be more precise to distinguish between dose rate and equivalent dose rate.</p> <p>Remark: in the next review cycle, the wording "radiation</p>



				level” which is used only in the transport regulation could be changed for harmonization purpose with other nuclear activities (see IAEA glossary).
IND/D 24/01	<a href="#">WNTI/120 D/04</a>	233	<a href="#">T22:</a>	Removing the unit of dose rate in the definition may interpret radiation level different from the intended one. The dose rate here means the equivalent dose rate related with radiation protection. Without the specified unit the dose rate may mean in microGray per hour or milliGray per hour. To avoid this confusion, the unit may still be retained which may be in <i>“millisieverts per hour or microsieverts per hour, as appropriate”</i> .
AUS/D 24/03	<a href="#">CS-32</a>  <a href="#">IAEA Glossary</a>	247 and Table 2, footnote (b)		<p>The nomenclature throughout the document needs to be consistent. Natural uranium is defined in paragraph 247 as “uranium (which may be chemically separated) containing the naturally occurring distribution of uranium isotopes (approximately 99.28% uranium-238 and 0.72% uranium-235, by mass).”</p> <p>Table 2 on the other hand uses “U (natural)” in the table itself and “U-natural” in the footnote.</p> <p>The use of the term “U (natural)” or “U-natural” to mean uranium and all its decay products is however inconsistent and confusing. All logic would point to “U (natural)” being equivalent to “natural uranium” but this is not so. Footnote (b) shows that it is used to mean “uranium in equilibrium with</p>

				<p><u>all</u> its decay products”. Radiologically this is an entirely different material. It is an obvious potential source of confusion to have such a counter intuitive and inconsistent terminology, and a terminology such as U (equilibrium) is suggested.</p> <p>Also, footnote (b) to Table 2 is inconsistent on both U (natural) and Th (natural) – nowhere does it say that U-238 or Th-232 are included in the respective decay series.</p> <p>“U (equilibrium)” is suggested as a possible replacement for “U (natural)”.</p> <p><b>Australia recommends that reference to natural uranium be made consistent throughout the document, including nomenclature.</b></p>
CDN/D 24/08	<a href="#">CS-32</a>	247	<p>U(nat) &gt;&gt; U(natural)</p> <p><b>T22:</b></p>	During the 120 days comment period there was a comment from South Africa ( <a href="#">ZA/120D/7</a> ) on this paragraph which has not been taken into account. Also, it is not clear from the disposition table if the comment was accepted or rejected since there is no disposition for this comment.
F/D24 /5		247	247. <i>Natural uranium</i> shall mean uranium (which may be chemically separated) containing the naturally occurring	Editorial only.

			distribution of uranium isotopes (approximately 99.28% uranium-238 and 0.72% uranium-235, by mass). <i>Depleted uranium</i> shall mean uranium containing a lesser mass percentage of uranium-235 than natural uranium. <i>Enriched uranium</i> shall mean uranium containing a greater mass percentage of uranium-235 than 0.72%. In all cases, a very small mass percentage of uranium-234 is present.	
CDN/D 24/09	<a href="#">USA/120D/04, CS143</a> <a href="#">CS-19</a> <a href="#">CS 167</a> <a href="#">fissile</a> <a href="#">excepted</a>	307	<p>Add “for the purpose(s) that it has been designated or recognized” at the end of the sentence.</p> <p>“307. The <i>competent authority</i> shall assure compliance with these Regulations <b>for the purpose(s) that it has been designated or recognized.</b></p> <p><b>T22:</b></p>	Competent authority can only have responsibility for assurance of compliance for those areas that they have been designated as having authority over rather than all parts of the regulations.
D/D2 4/02	<a href="#">USA/120D/04, CS143</a> <a href="#">CS-19</a> <a href="#">CS 167</a> <a href="#">fissile</a> <a href="#">excepted</a>	307	<b>T22:</b>	The US proposal to delete the second sentence in para 307 completely has been accepted by CS-143. This second sentence which is there for many years provides important information although this list of activities may be not complete and not always applicable as it was criticized by the U.S. It is therefore proposed to maintain the second sentence but to start this sentence with the addition “ <u>If applicable</u> ”. This approach would be also consistent with the changes to paras 501 and 503 (which have been agreed by TRANSSC already) where also new text has been combined with old one to make sure that important information will not be lost on a regulatory level.

				307. The <i>competent authority</i> shall assure compliance with these Regulations. <u>If applicable, means to discharge this responsibility include the establishment and execution of a programme for monitoring the <i>design</i>, manufacture, testing, inspection and maintenance of <i>packaging</i>, <i>special form radioactive material</i> and <i>low dispersible radioactive material</i>, and the preparation, documentation, handling and stowage of <i>packages</i> by <i>consignors</i> and <i>carriers</i>, to provide evidence that the provisions of these Regulations are being met in practice.</u>
IND/D 24/02	<a href="#">USA/120D/04, CS143</a> <a href="#">CS-19</a> <a href="#">CS 167</a> <a href="#">fissile</a> <a href="#">excepted</a>	307	T22:	There is no harm in retaining the sentences proposed to be deleted. The sentences obviously infer that the list is not exhaustive. If the deletion is to be accepted, then para 307 will be of one sentence for sake of retaining it. Para 208 gives better and more appropriate sentence.
B/D24 /01	B/120D/0 1	309		A virgule missing between consignor and consignee: 309. In the event of non-compliance with any limit in these Regulations applicable to <i>radiation level</i> or <i>contamination</i> :  (a) The <i>consignor, consignee, carrier</i> and any organization involved during transport who may be affected, as appropriate, shall be informed of the non-compliance by:
F/D24 /6		309	309. In the event of non-compliance with any limit in these Regulations applicable to <i>radiation level</i> or <i>contamination</i> :  (a) <del>‡</del> The <i>consignor, consignee, carrier</i> and any organisation involved during transport, who may be affected, as appropriate, shall be informed of the non-	Editorial. Edit text in draft 2.4 to be consistent with the text in the table of change (missing comma is in red).

			compliance by:...	
IND/D 24/03	<a href="#">B/120</a> <a href="#">D/01</a>	309	<b>T22:</b>	The recommendation of TRANSSEC 21 is more appropriate. Deletion of the words “ <i>who may be affected</i> ” should not be done. In fact regulatory authority will come to know much later about the non-compliance and be difficult to trace who were the people got exposed to radiation unless those people come forward and report. Many affected people (public) will not do this due to ignorance. However, it will be very easy for the consignor, consignee or carrier, as appropriate, to identify and report to the competent authority of the affected people.
CDN/D 24/10		401	References should be changed to paras 408-434	Editorial
D/D2 4/03		401		Editorial: correct reference is 408-434.  401. Radioactive material shall be assigned to one of the UN numbers specified in Table 1 in accordance with paras 408– <del>435</del> <u>434</u> .
USA/d 24/2		401	<i>Radioactive material</i> shall be assigned to one of the UN numbers specified in Table 1 in accordance with paras 408– <del>433</del> <b>434</b> .	To be consistent with para renumbering.
CDN/D 24/11		403	Add “,” after “radionuclides” in the new text.  “For these radionuclides, activity concentrations for exempt material and activity limits for exempt <i>consignments</i> shall be calculated in accordance with the principles established in Ref.[2].”	Editorial

CDN/D 24/13	<a href="#">CS-32</a>	404	Use of word “daughter” and “progeny”  <b>T22:</b>	Verify that the use of these words is appropriate in the paragraph and footnote (a) of Table 2 as both are used and provide a justification for the change.
F/D24 /7		404	... and in which no daughter <b>nuclide</b> has a half-life...	Text improvement.
F/D24 /9	<a href="#">CS-32</a>	409	<p>...(a) <i>LSA-I</i>:</p> <p><b>Either:</b></p> <p>(i) <i>Uranium</i> and thorium ores and concentrates of such ores, and other ores containing naturally occurring radionuclides;</p> <p>(ii) <i>Natural uranium, depleted uranium, natural thorium</i> or their compounds or mixtures, that are unirradiated and in solid or liquid form;</p> <p>(iii) <i>Radioactive material</i> for which the <math>A_2</math> value is unlimited. <i>Fissile material</i> may be included only if excepted under para. 417; <b>or</b></p> <p>(iv) Other radioactive material in which the activity is distributed throughout and the estimated average specific activity does not exceed 30 times the values for activity concentration specified in paras 402–407. <i>Fissile material</i> may be included only if excepted under para. 417.</p> <p>(b) <i>LSA-II</i>:</p> <p><b>Either:</b></p> <p>(i) Water with a tritium concentration of up to 0.8 TBq/L; <b>or</b></p>	Editorial. In the DS437 draft 2.4 some words are needed as follow:

			(ii) Other material in which the activity is distributed throughout and the estimated average <i>specific activity</i> does not exceed $10^{-4}A_2/g$ for solids and gases, and $10^{-5}A_2/g$ for liquids....	
CDN/D 24/14		413	$4 \times 10^4$ or 10000?	Consistency throughout the document
F/D24 /10	<a href="#">CS-05</a> <a href="#">11Feb11</a>	417	417. <i>Fissile materials</i> and...  ...(ii) The total plutonium and uranium-233 content does not exceed 1% of the mass of uranium-235_per package;  ....  T22:	1/ Editorial, first line."  2/ The sub-para. 417(c)(ii) should be completed.
CH/D2 4/01	USA/120 D/06	417 (d)		Clearly accepted by CS-05, see meeting report Rev. 3 (pages 11/522 and 21/522):  2.0 g should be used instead of 0.5 g
D/D2 4/04	<a href="#">CS-05</a> <a href="#">11Feb11</a>	417 (f)	T22:	Clarification: Specify reference to 802 (a) (iii) at the end.  (f) A fissile material that meets the requirements of paras 570 (b), 606 and 802 (a) (iii).
USA/d 24/4	<a href="#">CS-05</a>	417 (f)	A <i>fissile material</i> that meets the requirements of paras 570 (b), 606 and <del>802</del> 805.	To be consistent with para renumbering. (Para 802 is not renumbered.)
E/D24	General	417 c),	T22:	In order to simplify and clarify the Regulations it is possible to

/02	Avoid the cross references <a href="#">CS-05</a> <a href="#">11Feb11</a>	d), e), 570		<p>avoid the cross references made in para. 417 c), d) and e) to para.570 c), d) and e), in relation with the consignments limits, whether these limits are directly included in 417c), d) and e) and the 570 c), d) and e) are deleted.</p> <p><b>Moreover</b>, according to Table of resolution of comments, for the comments E/120D/12; N/120D/04; RA/120D/31, CS-143 accepted to delete the paragraph 566bis 570 because it was a duplication of 417. (566bis was deleted, 570 is a new para by CS-05)</p> <p>The provisions on 570 should be merged with those in 417</p>
CDN/D 24/15	<a href="#">CS-05</a> <a href="#">120day</a> ,	418	<p>T22:</p> <p>Reference to para 816 should be changed to 834</p> <p>T22:</p>	<p>The revised paragraph does not appear to reflect the comments made during the 120-days comment period.</p> <p>Para 816 only specifies that an approval is required while para 834 provides the details on the content of this approval which appears to be more appropriate.</p>
D/D2 4/05		418	T22:	<p>a) Clarification: this para applies also to the new category of approved material according to para. 806. It must be referenced also.</p> <p>b) Editorial: change content into contents.</p> <p>418. The contents of packages containing fissile material shall be as specified for the package design either directly in</p>



				these Regulations or in the certificate of approval, in accordance with the applicable paras 417(a)-(f), 674, 675 <a href="#">and 806</a> or 816.
E/D24/03	<a href="#">CS-05 J/120D/06</a>	418	<a href="#">T22:</a>	<p>The drafting of this paragraph in the Table of changes doesn't coincide with the resolution of comment J/120D/06, which was accepted by CS-143, as modified.</p> <p>The Japanese proposal modified according to CS-143 is clearer and doesn't use cross references, which complicates the use of Regulations.</p>
IND/D 24/04	<a href="#">J/120D/06</a>	418	<a href="#">T22:</a>	Suggested to delete the word "allowed" instead of "authorized" in order to maintain consistency with para 431, 432, 433 and 434. Moreover, use of 'authorized' is legalistic. 87
USA/d 24/5	<a href="#">CS-05</a>	418	<p>The content of <i>packages</i> containing <i>fissile material</i> shall be as specified for the <i>package design</i> either directly in these Regulations or in the certificate of approval, in accordance with the applicable paras 417(a) (f), 674, 675 or 816. <b>417 and 673-675</b></p> <p><a href="#">T22:</a></p>	Correctness
D/D2 4/06	<a href="#">CS-143, Nov10 USA/120D/08 TM-38941, Jan10</a>	419	<p>Uranium hexafluoride shall be assigned to one of the following UN numbers only:</p> <ul style="list-style-type: none"> <li>(a) UN 2977, RADIOACTIVE MATERIAL, URANIUM HEXAFLUORIDE, FISSILE;</li> <li>(b) UN 2978, RADIOACTIVE MATERIAL, URANIUM HEXAFLUORIDE, non-fissile or fissile-excepted;</li> <li>(c) UN 3XXX RADIOACTIVE MATERIAL, EXCEPTED PACKAGE - URANIUM HEXAFLUORIDE, less than 0.1 kg per <i>package</i>, <del>in the case of uranium hexafluoride</del></li> </ul>	Editorial: list only the proper shipping name, repetition is not necessary.

			in quantities of less than 0.1 kg in an <i>excepted package</i> .  T22:	
E/D24/04	<a href="#">USA/120D/08</a>	419	T22:	The last sentence in para. 419 c) is not necessary, since It is repetitive respect to the proper shipping name of the UN number. The item c) should be coherent with a) and b) where only the UN proper shipping name is used:  <i>419 (c) UN 3XXX RADIOACTIVE MATERIAL, EXCEPTED PACKAGE - URANIUM HEXAFLUORIDE, less than 0.1 kg per package</i>
USA/d 24/6	<a href="#">CS-143, Nov10 USA/120D/08 TM-38941, Jan10</a>	419 (c)	UN 3XXX RADIOACTIVE MATERIAL, EXCEPTED PACKAGE - URANIUM HEXAFLUORIDE, less than 0.1 kg per <i>package</i> , <b>non-fissile or fissile-excepted. in the case of uranium hexafluoride in quantities of less than 0.1 kg in an excepted package.</b>	To correct editing error.
IAEA/D24/09	<a href="#">CS-32 TRANSSC 21, TSU CS-143, WNTI/120D/10 TM-38941,</a>	422	422. Packages may <u>only</u> be classified as <i>excepted packages</i> <del>if the condition of para. 515 is met</del> and if: (a) They are empty packages having contained radioactive material; (b) They contain instruments or articles in limited quantities as specified in Table 5; (c) They contain articles manufactured of natural uranium, depleted uranium or natural thorium; (d) They contain radioactive material in limited quantities as specified in Table 5; or (e) They are designed to contain less than 0.1 kg of uranium hexafluoride not exceeding the activity limits specified in column 4 of Table 4.  T22	This para is not requirement but just lists the possible materials that may be classified as excepted package. The requirements or conditions are described in the following paras. (Paras.423, 424, 425, 426, 427).  For materials transported by IPs, Type A or Type B packages, there is no such list.  For consistency with other packages this para or just simplify it as suggested in the resolution of 120-day comments.

	<a href="#">Jan10</a>			
E/D24/05	<a href="#">E/120D/07,CS-143</a> <a href="#">T20, Jun10</a> <a href="#">CS-19, Feb10</a>	423	<a href="#">T22:</a>	<p>The drafting of this paragraph in the Table of changes doesn't coincide with the resolution of the comment E/120D/07, which was accepted by CS-143, as modified.</p> <p>It is not necessary to include 'do not require markings' in points i), ii) and iii), since the exception of marking is clearly stated on the heading sentence of b)</p>
D/D24/07	E/120D/07	423 (b)	<a href="#">T22:</a>	<p>Editorial: delete „do not require marking“.</p> <p>(b) Each instrument or article bears the marking “RADIOACTIVE” on its external surface except for the following:</p> <p>(i) Radioluminescent time-pieces or devices <del>do not require markings</del>.</p> <p>(ii) Consumer products that have either received regulatory <i>approval</i> in accordance with para. 107(e) or do not individually exceed the activity limit for an exempt <i>consignment</i> in Table 2 (column 5) <del>do not require markings</del>, provided that such products are transported in a <i>package</i> that bears the marking “RADIOACTIVE” on its internal surface in such a manner that a warning of the presence of <i>radioactive material</i> is visible on opening the <i>package</i>.</p> <p>(iii) Other instruments or articles too small to bear the marking “RADIOACTIVE” <del>do not require markings</del>, provided that they are transported in a <i>package</i> that bears the marking “RADIOACTIVE” on its internal surface in such a manner that a warning of the presence of</p>

				<i>radioactive material</i> is visible on opening the <i>package</i> .
USA/d 24/7	<a href="#">CS-32</a>	423 (e)	<p><del>For transport by post, the total activity in each excepted package shall not exceed one tenth of the relevant limits specified in column 3 of Table 4.</del></p> <p>(e) For transport by post, the total activity in each <i>excepted package</i> shall not exceed one tenth of the relevant limits specified in column 3 of Table 4.</p>	No reference to why this format change was necessary and approved.
CDN/D 24/16		423(b)	<p>(b) Each instrument or article bears, <del>where practical,</del> the marking "RADIOACTIVE" <del>where marking the instrument or article is not practical then the packaging shall bear the marking "RADIOACTIVE" on an internal surface in such a manner that a warning of the presence of radioactive material is visible on opening the package.</del> Excepted from any such marking are:</p> <p>(i) Radioluminescent time pieces or devices.</p> <p>(ii) Consumer products that have either received regulatory approval according to para. 107(d) <b><u>provided that such products are transported in a package that bears the marking "RADIOACTIVE" on an internal surface in such a manner that warning of the presence of radioactive material is visible on opening the package.</u></b></p> <p><b><u>(iii) Consumer products that do not individually exceed the activity limit for an exempt consignment in Table 2 (column 5).</u></b></p> <p>(iii) Other instruments.....</p>	The RADIOACTIVE package marking should be kept for consumer products that have received regulatory approval according to para. 107(e) but is not required for consumer products that do not individually exceed the activity limit for an exempt consignment.

			T22:	
USA/d 24/8	<a href="#">CS-32</a>	424	<p><del>For transport by post, the total activity in each <i>excepted package</i> shall not exceed one tenth of the relevant limits specified in column 4 of Table 4.</del></p> <p>(c) For transport by post, the total activity in each <i>excepted package</i> shall not exceed one tenth of the relevant limits specified in column 4 of Table 4.</p> <p>T22:</p>	No reference to why this format change was necessary and approved
D/D2 4/08	J/120D/0 7	425	T22:	<p>Clarification:</p> <p>Uranium hexafluoride not exceeding the limits specified in column 4 of Table 4 may be classified under UN 3XXX RADIOACTIVE MATERIAL, EXCEPTED PACKAGE - URANIUM HEXAFLUORIDE, less than 0.1 kg per <i>package</i>, provided that:</p> <p>(a) The mass <a href="#">of uranium hexafluoride</a> in the <i>package</i> is less than 0.1 kg.</p> <p>(b) The conditions of paras 420 and 424 (a), (b) are met.</p> <p>For transport by post, the mass <a href="#">of uranium hexafluoride</a> in the <i>package</i> shall be less than 10 g.</p>
E/D24 /06	CAN/120 D/11	431, 432, 434 (merged)		<p>Editorial:</p> <p>Change content into contents:</p> <p>432. The contents of a <i>Type B(U)</i>, <i>Type B (M)</i> or <i>Type C package</i> shall be as specified in the certificate of approval.</p>
D/D2	F/120D/1	432		Editorial: change content into contents.

4/09	5			432. The contents of a <i>Type B(U)</i> , <i>Type B (M)</i> or <i>Type C package</i> shall be as specified in the certificate of approval.
CDN/D 24/17		433	100 000 or 10 <sup>5</sup> .	Consistency
D/D2 4/10		502	<p>502 Before each <i>shipment</i> of any <i>package</i>, it shall be ensured that the <i>package</i> contains neither:</p> <p>(a) Radionuclides different from those <del>assessed</del> <u>specified</u> for the <i>package design</i>; nor</p> <p>(b) Contents in a form, or physical or chemical state different from those <del>assessed</del> <u>specified</u> for the <i>package design</i>.</p> <p>T22:</p>	Editorial: replace „assessed“ by „specified“ as more appropriate term.
CH/ D 24/02	<a href="#">WNTI/120 D/14 CS-143</a>	504		WNTI/120D/14 Should be accepted because clarification is provided for contamination level of conveyances instead of indirect provision by para 214
D/D2 4/11	RA/120D /23	505	<p><i>Freight containers, IBCs, <del>overpacks and</del> tanks</i>, as well as other <i>packagings and overpacks</i> used for the transport of <i>radioactive material</i> shall not be used for the storage or transport of other goods unless decontaminated below the level of 0.4 Bq/cm<sup>2</sup> for beta and gamma emitters and <i>low toxicity alpha emitters</i> and 0.04 Bq/cm<sup>2</sup> for all other alpha emitters.</p> <p>T22:</p>	Clarification: an overpack is not a packaging.

D/D2 4/12	<a href="#">B/120D/08</a> ; <a href="#">CS-05</a>	515 (a)	(a) The requirements specified in paras 503 504, 505, 507– 513, 516, 530- 533, 545, 546 introductory sentence, 546 (a), <del>(j) and</del> (k) <a href="#">and (l)</a> , 550- 553, 555, 556, 561, 564, 582 and 583;  <b>T22:</b>	Clarification: para 546 (j) doesn't apply for excepted packages, but 546 (l) does apply.
D/D2 4/13		515 (c)	(c) If the <i>excepted package</i> contains <i>fissile material</i> , one of the fissile exceptions provided by para. 417 shall apply. This implies that also paras <del>s-</del> <a href="#">570 and</a> 636 shall be complied with;  <b>T22:</b>	Clarification: the reference to para 570 should be added.
USA/d 24/9		515 (c)	If the <i>excepted package</i> contains <i>fissile material</i> , one of the fissile exceptions provided by para. 417 shall apply; <del>This implies that also para. 636 shall be complied with;</del>  <b>T22:</b>	Para 417 allows unpackaged to be approved so 636 would then not apply.
CDN/D 24/18		515(c)	If the <i>excepted package</i> contains <i>fissile material</i> , one of the fissile exceptions provided by para. 417 shall apply <u>and the requirement of</u> <del>this implies that also</del> para. 636 shall be met.  <b>T22:</b>	Consistent with comments made by Member State during the 120-days comment period. In addition, the use of the word “imply” is not appropriate for regulatory text.
F/D24 /11	<a href="#">WNTI/120D/16</a> , <a href="#">CS-143</a>	519	<del>517bis</del> 519. For <i>LSA material</i> and <i>SCO</i> that are or contain <i>fissile material</i> , <del>that is not excepted under para. 417, and for that do not meet the requirements of paras 674 and 675,</del> the applicable requirements of para. 673 shall be met.	1/ Editorial: delete reference to 517bis.  2/ Fissile exceptions 417, 674 and 675 are already stated in para. 673. To prevent redundancy, change the para. as proposed.

			T22:	
CDN/D 24/19	<a href="#">WNTI/120 D/17, CS- 143</a>	520 (a)	T22:	Has the intent of paragraph 520(a) been clarified in TS-G-1.1 as per the comment from WNTI (WNTI/120D/17)?
CDN/D 24/20	<a href="#">E/120D/09 , CS-143</a>	520(d)	(d) Unpackaged <i>fissile material</i> shall meet the requirements of paras 417(e) <b>and 570 (e)</b>  T22:	Suggest adding reference to para 570(e) as per comments received in the 120-days comment period.
E/D24 /07	IND/120 D/14	529 e)	Change 'which that' into 'that':  <i>e) An overpack or freight container <u>that</u> contains packages transported under special arrangement shall be assigned to</i>	Editorial:
E/D24 /16	<a href="#">WNTI/12 0D/20,CS 143; CS-19 amended</a>	541	541. <u>Each label conforming to the model in Fig. 5 shall be completed with the CSI as stated in the certificate of approval applicable in the countries through or into which the consignment is transported and issued by the competent authority or as specified in paras 674 or 675.</u>  T22:	A provision should be established for the case that different countries of transit define different CSI for the packages. In that case what CSI should be indicated in the label?
B/D24 /03	<a href="#">TM- 38941</a>	543	[...] where appropriate, as shown in Figs 2–4 5, except having the minimum size shown in Fig. 6  T22:	The reference to figure 5 is needed:
E/D24 /08	<a href="#">D/120D/3 2</a>	546 (old 544)	546  (e) <del>The UN class number "7" in accordance with the UN</del>	In (c) it is not necessary to refer to the reference UN Model Regulations [10], since similar reference may be used



			Model Regulations [10]; <b>T22:</b>	in many other parts of the TS-R-1
D/D2 4/14	<a href="#">CS-19</a>  <a href="#">CS-167</a> ;	546 (j)	<p>(j) For <i>fissile material</i>:</p> <p>(i) <del>Shipped under one exception of sub- paras 417(a) (f), reference to that para;</del></p> <p>(ii) <del>Shipped under para. 417(c) (e), the total mass of fissile nuclides;</del></p> <p>(iii) <del>Contained in a package for which one of paras 674(a) (e) or 675 is applied, reference to that para;</del></p> <p>(iv) The <i>CSI</i>, where applicable.</p> <p>Current text:</p> <p>(j) <u>For consignments including fissile material other than consignments excepted under para. 417, the <i>CSI</i>.</u></p> <p><b>T22:</b></p>	The required information under (i), (ii) and (iii) doesn't provide any useful information to the carrier and complicates the list of information unnecessarily. It's proposed to delete them and go back to the current wording of TS-R-1 (2009).
CDN/D 24/21	IATA	555	<b>T22:</b>	Suggest moving to TS-G-1.1. since it only provides guidance. This was recommended by TRANSSC 21..
J/D24/ 01	IATA	555(55 2bis)	<b>T22:</b>	It was accepted by TRANSSC 21 that Para 555 was moved to TS-G-1,1.But this para is still existed in TS-R-1.
IAEA/ D24/0 3	New	562(b)	562(b). " <i>Packages, overpacks and freight containers containing radioactive material and unpackaged radioactive material shall be segregated during transport and during storage in transit: (b) From members of the <del>critical group of the public</del></i>	ICRP and the BSS now use the concept of the representative person. There is an explanatory note to the definition of representative person in the BSS to state that the concept of critical group remains valid. Has TRANSSC considered using ""

			<p><u>representative person</u>, in areas where the public has regular access, by distances calculated using a dose criterion of 1 mSv in a year and conservative model parameters</p> <p>T22:</p>	in para 562(b)?
E/D24 /09	<a href="#">CS-05;</a> <a href="#">T21</a> <a href="#">E/120D/12</a>	570 (old 566bis)	T22:	To keep the paragraph 570 is not agree with the resolution of comments E/120D/12; N/120D/04; RA/120D/31, by CS-143 that accepted to delete the paragraph because it was a duplication of 417. The provisions on 570 should be merged with those in 417.
USA/d 24/11	<a href="#">CS-05;</a> <a href="#">T21</a>	570	<p>570. <del>Fissile material meeting one of the provisions (a)–(f) of para. 417 is excepted from the requirement to be transported in packages that are classified as FISSILE if the following consignment conditions are met:</del></p> <p>(a) <del>Only one of the provisions (a)–(f) is allowed per consignment;</del></p> <p>(b) <del>Only one approved fissile material in packages classified in accordance with para. 417(f) is allowed per consignment unless multiple materials are authorized in the certificate of approval;</del></p> <p>(c) <del>Fissile material in packages classified in accordance with para. 417(c) shall be transported in a consignment with no more than 45 g of fissile nuclides;</del></p> <p>(d) <del>Fissile material in packages classified in accordance with para. 417(d) shall be transported in a consignment with no more</del></p>	

			<p>than 15 g of fissile nuclides;</p> <p>(e) — Unpackaged or packaged fissile material classified in accordance with para. 417(e) shall be transported under <i>exclusive use</i> on a conveyance with no more than 45 g of fissile nuclides.</p> <p><b>Paragraph and all cross references should be deleted.</b></p> <p>T22:</p>	
USA/d 24/12		570(a)	<p>Only one of the provisions (a)-(f) of para. 417 is allowed per <i>consignment</i>;</p> <p>T22:</p>	To improve clarity.
CDN/D 24/23	IATA/120 D/02	579bis	T22:	Move to TS-G-1.1 as discussed at TRANSSEC 21.
E/D24 /10	IATA/120 D/02; IATA/120 D/03; IATA/120 D/04; IATA/120 D/05; IATA/120 D/06	579bis 580bis 581 bis 582bis 583bis		<p><b>Remark:</b> These changes are included in the document <i>Table of changes draft 2.4. TS-R-1</i> but they are not included in the document <i>DS437Draft2.4TSR120XXclear8April11</i> (¿?)</p> <p>For all of them the 120 days comments resolution states:  <b>TRANSSEC 21: Don't add text to TS-R-1, but consider for TS-G-1.1. TSU: retain text for further comments</b></p> <p>Further comment from Spain:</p> <p>In several of those new paragraphs the term 'dangerous goods transport document' is used. However, that term belongs to modal regulations, as the ICAO Technical Instructions. The</p>

				<p>term generally used by the TS-R-1 is ‘transport documents’ (current paras. 544 and 552). To use ‘dangerous goods document’ and other particular references to general dangerous goods requirements is very confused for users of TS-R-1. Each international modal regulation shall adapt the general terminology used by the TS-R-1 to each particular case. It is not adequate to try to adapt the TS-R-1 to each particular case of international modal regulations. That may make very confuse the TS-R-1.</p> <p>So, if this new paragraphs are finally accepted the terminology should be adapted to that used in TS-R-1</p>
B/D24/04	IATA//120 D/02 => IATA/120 D/06	579bis => 583bis		Keep the decision of TRANSS21: Don’t add text to TS-R-1, but consider for TS-G-1.1
F/D24/13	IATA//120 D/02	579bis, 580bis, 581bis, 582bis, 583bis.	See comment.	In DS437 draft 2.4 do not insert para 579bis, 580bis, 581bis, 582bis, 583bis since the relevant requirements are not related to any specificity of radioactive materials.
CDN/D 24/22		580 and 581	None	Modifications to paras 580 and 581 were pending discussion with the UPU and this information has not been provided therefore it is not possible to determine if the proposed changes are needed or no
CDN/D 24/24		580bis	None	Move to TS-G-1.1 as discussed at TRANSSC 21.
CDN/D		581bis	None	Move to TS-G-1.1 as discussed at TRANSSC 21.

24/25				
CDN/D 24/26		582bis	None	Move to TS-G-1.1 as discussed at TRANSSEC 21.
CDN/D 24/27		583bis	None	Move to TS-G-1.1 as discussed at TRANSSEC 21.
CDN/D 24/28	<a href="#">CS-32</a> <a href="#">CS-05</a> <a href="#">CS-19</a> <a href="#">amended.</a> <a href="#">TM</a> <a href="#">38941.</a>  T20: France will provide more informati on during 120-day comment ,	606	T22:	How will this be implemented? Is there sufficient guidance developed to assist applicant and competent authority in ensuring that these requirements are met?

D/D2 4/15	E/120D/1 4	617	<p>617. A <i>package</i> shall be so designed that it provides sufficient shielding to ensure that, under routine conditions of transport and with the maximum <i>radioactive contents</i> that the <i>package</i> is designed to contain, the <i>radiation level</i> at any point on the external surface of the <i>package</i> would not exceed the values specified in paras <a href="#">516</a>, 527 and 528, as applicable, with account taken of paras 566(b) and 573.</p> <p><b>T22:</b></p>	Para. <a href="#">516</a> must be added for completeness (reference to 5 µSv/h for excepted packages).
E/D24 /11	WNTI/12 0D/24	617 (old 615 bis)	<p><i>617. A package shall be so designed that it provides sufficient shielding to ensure that, under routine conditions of transport and with the maximum radioactive contents that the package is designed to contain, the radiation level at any point on the external surface of the package would not exceed the values specified in paras <a href="#">516</a>, 527 and 528, as applicable, with account taken of paras 566(b) and 573</i></p> <p><b>T22:</b></p>	<p>The 120 days comments resolution states: <b>TRANSSC 21: reject to delete 615bis. 615bis is retained as draft 1.1.</b></p> <p>The TRANSSC 21 conclusion is considered adequate, but it is necessary to add a cross reference to the para. <a href="#">516</a> for completeness (reference to 5 µSv/h for excepted packages)</p> <p>So, it is proposed that the para. 617 says:</p>
USA/d 24/13	<a href="#">WNTI/12 0D/24, T21</a>	617	<p><del>617. A package shall be so designed that it provides sufficient shielding to ensure that, under routine conditions of transport and with the maximum radioactive contents that the package is designed to contain, the radiation level at any point on the external surface of the package would not exceed the values specified in paras 527 and 528, as applicable, with account taken of paras 566(b) and 573.</del></p> <p><b>T22:</b></p>	Personal notes from TRANSSC 21 approved the deletion proposed by WNTI and accepted by CSM 143.

F/D24 /14		634	<p>634. Subject to <i>multilateral approval</i>, packages designed to contain 0.1 kg or more of uranium hexafluoride may be transported <del>d</del> if the <i>packages</i> are designed:</p> <p>[...]</p> <p>In all other respects, the requirements specified in paras <del>629–631</del><del>631–633</del> shall be satisfied.</p>	Editorial.
CDN/D 24/29		673	<p><del>674</del> <u>673</u>. Fissile material shall be transported so as to:</p> <p>(a) Maintain subcriticality during <del>routine</del> <del>routine</del>, normal and accident conditions of transport; in particular, the following contingencies shall be considered:</p> <ul style="list-style-type: none"> <li>(i) Leakage of water into or out of <i>packages</i>; <del>and</del></li> <li>(ii) Loss of efficiency of built-in neutron absorbers or moderators; <del>and</del></li> <li>(iii) Rearrangement of the contents either within the <i>package</i> or as a result of loss from the <i>package</i>; <del>and</del></li> <li>(iv) Reduction of spaces within or between <i>packages</i>; <del>and</del></li> <li>(v) <i>Packages</i> becoming immersed in water or buried in snow; <del>and</del></li> <li>(vi) Temperature changes.</li> </ul> <p>(b) Meet the requirements:</p> <ul style="list-style-type: none"> <li>(i) Of para. <del>634</del> 636 <del>for packages containing fissile material; and</del></li> <li>(ii) Prescribed elsewhere in these Regulations <del>which that</del> <u>pertain to the radioactive properties of the material; and</u></li> <li>(iii) <del>Specified in</del> <u>Of</u> paras. <del>635 637 and 673–683</del> <u>635 637 and 673–683</u> unless excepted by para. 417; <del>and</del></li> <li>(iv) <u>Of paras <del>673–683</del> 676–686, unless excepted by paras 417, <del>672 or 672bis</del> 674 or 675.</u></li> </ul>	<p>Editorial:</p> <p>(a) Replace “routine” with “routine” (Typo)</p> <p>(b) (i) Delete “634”</p>
F/D24	<a href="#">CS-167 Meeting</a>	673	...(b)...	1/ In sub-para. (b) (i), the reference to para. 634 should be deleted and an exception of application of the para. 636 have

/15	<a href="#">Report page 18.</a> <a href="#">CS-19 amended</a>		<p>... (i) Of para. 634 636 except for unpackaged material when specifically allowed by para. 417 (e);</p> <p>... (iii) Of para. 637 <del>unless material is excepted by para. 417</del>;...</p> <p><b>T22:</b></p>	<p>to be made for unpackaged fissile material.</p> <p>2/ Editorial, the sub-para (b) (iii) should be improved as proposed.</p>
	F/D24/16	674	<p><del>672</del> 674. <i>Packages</i> containing <i>fissile material</i> that meet one of the provisions of subparas (a)–(c) of this paragraph are excepted from the requirements of paras 675<del>6</del>–686.</p>	Editorial:
D/D24/16	<a href="#">CS-167 TM-38941</a> <a href="#">CS-19 amended.</a>	674	<p>674. <i>Packages</i> containing <i>fissile material</i> that meet one of the provisions of subparas (a)–(c) <a href="#">and the following sentence</a> of this paragraph are excepted from the requirements of paras 676– 686.</p> <p>The total mass of beryllium, hydrogenous material enriched in deuterium, graphite and other allotropic forms of carbon in an individual <i>package</i> shall not be greater than the mass of <i>fissile nuclides</i> in the <i>package</i> except where their total concentration does not exceed 1 g in any 1000 g of material. Beryllium incorporated in copper alloys up to 4% in weight of the alloy does not need to be considered.</p> <p>(a) <i>Packages</i> containing <i>fissile material</i> in any form provided that:</p> <p>.....</p> <p><b>T22:</b></p>	Editorial: add: „and the following sentence“ to make clear that also the sentence before the subparas must be met.
IAEA/D24/08	<a href="#">CS-167 TM-38941</a> <a href="#">CS-19 amended.</a>	674 (c) (iii)	<p>The <i>CSI</i> of the <i>package</i> is calculated using the following formula:</p> $CSI = 50 \times 2 \times \{ [\text{mass of U-235 in package (g)}] / \text{Z}450 + [\text{mass of other fissile nuclides in package (g)}] / \text{Y}280 \}$ <p><del>where the values of Z and Y are taken from Table 13.</del></p> <p><del>The value of Z shall be that for 100% enriched</del></p>	<p>If one column in Table 13 is accepted by TRANSSC. The numbers for “X” and “Y” for 100% enrichment have no choice.</p> <p>And also the value for “Y” in all formulas in this para should be changed to 280.</p>



			<del>uranium.</del>	
E/D24 /12	Several <a href="#">CS-167</a> <a href="#">TM-38941</a> <a href="#">CS-19</a> <a href="#">amended.</a>	674 (old 672)	<p>674. Packages containing <i>fissile material</i> that meet one of the provisions of subparas (a)–(c) <a href="#">and the following sentence</a> of this paragraph are excepted from the requirements of paras 676– 686.</p> <p>The total mass of beryllium, hydrogenous material enriched in deuterium, graphite and other allotropic forms of carbon in an individual <i>package</i> shall not be greater than the mass of <i>fissile nuclides</i> in the <i>package</i> except where their total concentration does not exceed 1 g in any 1000 g of material. Beryllium incorporated in copper alloys up to 4% in weight of the alloy does not need to be considered.</p> <p>(a) Packages containing <i>fissile material</i> in any form provided that:.....</p> <p>T22:</p>	It is proposed to add: “ <a href="#">and the following sentence</a> “ to make clear that also the sentence before the subparas must be met:
CDN/D 24/30		675	<p><del>675. Packages containing not more than <math>10^{-3}</math> 1000 g of plutonium are excepted from the application of paras <del>673–683</del> <a href="#">673–683</a> <del>676–686</del> provided that:</del></p>	<p>Editorial (references)</p> <p>Replace 673-683 with 676-686.</p>
D/D2 4/17	<a href="#">CS-19</a> <a href="#">amended.</a> <a href="#">CS-167</a> <a href="#">Meeting Report</a> <a href="#">page 18.</a>	675	<p>To make this more clear add the following sentence:</p> <p><a href="#">If uranium is present with the plutonium, the mass of uranium shall be no more than 1% of the mass of the plutonium.</a></p> <p>T22:</p>	According to the discussion amongst criticality specialists, the possible presence of fissile uranium has to be limited for use of this paragraph (the intention of this paragraph has always been the shipment of nearly pure plutonium).

UA/D2 4/02	New	685 (a)	Modify the text «Hydrogenous moderation between the packages...» as follows: “ <a href="#">Optimum</a> hydrogenous moderation between <a href="#">and inside</a> the packages...”	<p>Para. 680 provides for criticality assessment of a package in case of water ingress or egress (for hydrogenous packages). It is not clear why para. 685 assumes that water may appear only between packages but not inside them in case of emergencies related to water ingress (flooding, rain, etc.).</p> <p>The addition «<a href="#">Optimum</a> hydrogenous moderation ...» determines what state of hydrogenous moderation should be considered in package criticality analysis.</p>
F/D24 /17		802	<a href="#">T22:</a>	Concerning calculation of the alternative activity limits for an exempt consignment of instruments and articles (see subpara. (f)), the requirements regarding the approval procedure itself have to be defined. Those requirements should be defined on the basis of the <a href="#">German proposal</a> of 29 <sup>th</sup> March 2011 (F Nitsche).
USA/d 24/14	See <a href="#">D/D24/01</a>	802	<p><del>(a)(iii) Fissile material excepted under 417(f) (see paras 805 and 806)</del></p> <p><b>(g) Fissile material excepted under 417(f) (see paras 805 and 806)</b></p> <p><a href="#">T22:</a></p>	Approval will not require a certificate of competent authority but will be approved in the same manner as alternative A values. Accordingly, the citation should stand alone.
CDN/D 24/31		805	<p><del>804bis</del> 805. A fissile material <del>to be</del> <a href="#">excepted from the FISSILE classification</a> <del>fissile</del> <a href="#">FISSILE, according to in accordance with</a> <del>with</del> <a href="#">Table 1</a>, under para. 417(f) shall require <a href="#">multilateral approval</a>.</p> <p><a href="#">An application for approval shall include: ...</a></p>	<p>Editorial</p> <p>Add “the” before FISSILE</p>

			T22:	
D/D2 4/18	See <a href="#">USA/24D/14</a>	805	<p><b>APPROVAL OF <del>OTHER</del> MATERIAL FOR EXCEPTION FROM CLASSIFICATION AS FISSILE</b></p> <p>805. <a href="#">The design of a</a><del>A</del> <i>fissile material</i> excepted from classification as FISSILE in accordance with Table 1, under para. 417(f) shall require <i>multilateral approval</i>. An application for approval shall include:</p> <ul style="list-style-type: none"> <li>(a) A detailed description of the material; particular reference shall be made to both physical and chemical states.</li> <li>(b) A statement of the tests that have been done and their results, or evidence based on calculation methods to show that the material is capable of meeting the requirements specified in para. 606;</li> <li>(c) A specification of the applicable <i>management system</i> as required in para. 306;</li> <li>(d) A statement of specific actions to be taken prior to <i>shipment</i>.</li> </ul> <p>T22:</p>	Editorial:
USA/d 24/15		805  Headin g before para 805	<p><b>APPROVAL OF <del>OTHER-ADDITIONAL</del> MATERIAL FOR EXCEPTION FROM CLASSIFICATION AS FISSILE</b></p> <p>T22:</p>	For consistency with the heading before para 606 (REQUIREMENTS FOR ADDITIONAL MATERIAL FOR EXCEPTION FROM CLASSIFICATION AS FISSILE)
	F/D24/18	817	<p>(b) ...</p> <p>v) The packaging was not manufactured or modified after 31 December 2003</p>	Editorial probably. The last sentence should be the point v).

B/D24/05		817		A package prepared for transport prior to 31 December 2003 is not ready to be transported but in storage. Date or possibility need to be reconsidered seeing this kind of package prepared 10 years ago could not still been considered as "prepared for transport"
F/D24/19	<a href="#">CS-11, TM-38941 T20: amended CS-19 re-organize d.</a>	818	<del>...(h) The package design has not been modified after the date of enforcement of the edition of gthe Regulations that followed the one under which the package was approved, unless to improve safety.</del> <b>T22:</b>	The sub-para. (h) should be simplified as proposed.
CDN/D24/32		818 (h)	<del>(gh) The package design has not been modified during transitional period after the date of enforcement of the edition of gthe Regulations that followed the one under which the package was approved, unless to improve safety.</del> <b>T22:</b>	Delete this sub-paragraph. It appears to be in contradiction with the footnote introduced at the beginning of section VIII. This sub-parapgrah would be acceptable if it only applied to the 1973 and 1985 Editions of the regulations.
D/D24/19	F/120D/26	818 (h)	<del>(h) The package design has not been modified after the date of enforcement of the edition of the Regulations that followed the one under which the package was approved, unless to improve safety.</del> <b>T22:</b>	Due to the fact that any design modification was and is always under control of the competent authority and because this requirement seems not to be implementable or at least very complicated to be applied in practice ("...after the date of enforcement of the edition..."?) it is proposed to delete it (consistent with TRANSSEC 20 recommendation).
E/D24/13	<a href="#">F/120D/26</a>	818 (h) (old 816 (g))	The proposal of F/120D/26 is better than current text:  <u><b>h) the package design has not been modified during transitional period unless to improve safety.</b></u>	The drafting of this paragraph in the Table of changes doesn't coincide with the resolution of comment F/120D/26, which was accepted by CS-143.  The French proposal that the current proposal (TS-R-1. rev

			T22:	<p>2.4.):</p> <p>(h) <i>The package design has not been modified after the date of enforcement of the edition of the Regulations that followed the one under which the package was approved, unless to improve safety.</i></p> <p>This provision include in the 2.4 draft is very confuse and it seems very complicated to be applied in practice.</p>
D/D2 4/20	<a href="#">F/120D/2</a> <a href="#">Z</a>	819 and 820	<p>817bis <a href="#">No new manufacture of packages designed to meet the provisions of the 1973, 1973 (As Amended), 1985, and 1985 (As Amended 1990) Editions of these Regulations shall be permitted to commence.</a></p> <p>T22:</p>	<p>Due to the continuous revision of the transitional arrangement provisions by all previous editions of the Regulations since 1985 and its implementation in practice it is clear that there is no new manufacture of 73-designs since 1/1/1996 ( para. 714, 1985 Edition) and no new manufacture of 85-designs since 1/1/2007 (para. 817, 1996 Edition). Based on this both paras 819 and 820 can be combined in one para without any reference to former dates as follows (as proposed by TRANSSC 20, WG 2 and the proposed change under b) is equivalent to the wording of para. 822, last sentence):</p> <p>a) delete 819 and 820</p> <p>b) new para. 817bis:</p>
B/D24 /06		821	<p>[...] before xxdatexx may continue in transport and may continue to be classified as non-fissile or fissile-excepted under <a href="#">para. 560 (a), (b) or (d) of the 1985 or 1985 (As Amended 1990) Edition or under para. 672 (a)(i) or (iii) of the 1996 or 2005 Edition or</a> under para. 417(a)(i) or (iii) of the 2009 Edition of these Regulations, except that the <i>consignment</i> limits in Table 4 of the 2009 Edition of these Regulations shall apply to the <i>conveyance</i>. The <i>consignment</i> shall be transported under <i>exclusive use</i> and subject to <i>multilateral approval of shipment</i>.</p>	<p>The para 560 of the 1985 Edition, para 672 and para 417 are not exactly the same.</p>

CDN/D 24/33	<a href="#">CS-05</a>	821	<p><b>T22:</b></p> <p>...</p> <p><u>before <b>xxdatexx</b> may continue in transport and may continue to be classified as non-fissile<del>or fissile-excepted</del> under para. 417(a)(i) or (iii) of <del>TS-R-1</del> the 2009 Edition of these Regulations except that the <i>consignment limits</i> in Table 4 of <del>TS-R-1</del> the 2009 Edition of these Regulations shall apply to the conveyance. The <i>consignment</i> shall be transported under <i>exclusive use</i> and subject to <i>multilateral approval of shipment approval</i>.</u></p> <p><b>T22:</b></p>	<p>No new text is being proposed but the text needs to be finalized as a date is required.</p> <p>In addition, it is unclear as to which edition of the regulations it is referring to.(2009 or 20XX). Do you use the exceptions from the 2009 Edition but Table 4 from the 20XX Edition? If the intent is to make reference to the 2009 Edition then it is suggested to state TS-R-1 2009 Edition. If it is to this new edition, suggest referring to 20XX Edition of TS-R-1.</p>
D/D2 4/21	E/120D/0 1	821	<p>..... The <i>consignment</i> shall be transported under <i>exclusive use</i> <del>and subject to multilateral approval of shipment.</del></p> <p><b>T22:</b></p>	<p>The last sentence requires multilateral approval. There is no approval procedure established for this kind of material and it is unnecessary for this transitional provision. Reference to multilateral approval in the last sentence of para. 821 must be deleted as follows:</p>
E/D24 /14	No specific comments . The proposal comes from CS-05	821	<p>A simpler alternative may be:</p> <p><u>Packages excepted from the requirements for fissile materials under the 2009 and earlier Editions of these Regulations that were prepared for transport before <b>xxdatexx</b> may continue in transport classified as non-fissile<del>or fissile-excepted</del> provided that:</u></p>	<p><b>First comment:</b></p> <p>The reference to paragraphs of specific editions of the TS-R-1 will complicate very much to express the same provision in the Modal Regulations, since the TS-R-1 editions doesn't have a <i>one to one</i> correspondence with the Modal editions (i.e.: the 1996 TS-R-1 edition was the base for several UN editions).</p>

			T22:	<p><b>Second comment:</b></p> <p>To limit the total mass of fissile nuclides to the conveyance and to require the transport be carried out under exclusive use is considered adequate; however, to require a multilateral approval for the shipments means excessive, taking into account the limitation of the mass per conveyance and the control of the shipment by an unique consignor, which implies an important control of the risk. It is proposed to substitute the multilateral approval requirement by a requirement of previous notification to the competent authorities. This notification would be enough to the competent authority carries out the necessary control on the transport operation.</p>
F/D24/20	CS-05	821	<p><u>...before <del>xxdatesxx</del> enforcement of this Edition of this Regulations may continue in transport and may continue to be classified as non-fissile or fissile-excepted under para. 417(a)(i) or (iii) of the 2009 Edition of these Regulations except that the <i>consignment limits</i> in Table 4 of the 2009 Edition of these Regulations shall apply to the conveyance. The <i>consignment</i> shall be transported under exclusive use and subject to multilateral approval of shipment.</u></p> <p>T22:</p>	The aim of this proposal is to solve the date problem.
GB/D24/01	GB/120D/25	821		There is no obligation on operators to make an effort to transport already loaded packages under the new arrangements if possible.
J/D24/02		821	T22:	The current draft described that packages that were prepared for transport either by the items (a) or (b) before xxdatesxx may

				continue to be.....  The time limit shall be specified in the TRANSSC.
CDN/D 24/34		824	<del>820</del> 824. Multilateral approval shall be required for: <del>a-3000</del>  T22:	Editorial
USA/D 24/16	CS-32 <a href="#">CS-05</a> <a href="#">T20:</a> <a href="#">amended</a> <a href="#">CS17</a>	831 (c)	FE <i>Fissile material that requires multilateral approval to be excepted from classification as FISSILE, in accordance with Table 1</i> <b><u>complying with the requirements of para 606</u></b>  T22:	To correct editing error.
D/D2 4/25		ANNE X I	T22:	Consistency: If the proposal for multilateral approval for alternative activity limits for an exempt consignment of instruments or articles is accepted it must also be included in ANNEX I.
USA/D 24/17	CS-32 <a href="#">CS-05</a> <a href="#">T20:</a> <a href="#">amended</a> <a href="#">CS167</a> see USA/d24/ 16	Annex I (Part 4) Page 112,	Fissile excepted material from classification as FISSILE, in accordance with <b>para 606 in accordance with Table 1</b>  T22:	To correct editing error.
D/D2 4/24		ANNE X I (Part 4), para 805	Fissile <del>excepted</del> material <b>excepted</b> from classification as FISSILE, in accordance with <del>in accordance with</del> Table 1	Editorial:



B/D24/07		Annex III	<a href="#">[...] (k) Packages excepted from the requirements for fissile materials under earlier Editions of these Regulations in accordance with the provisions of para 821.</a> T22:	Add:
D/D24/26		ANNE X III	<a href="#">(k) Packages containing fissile material classified as non-fissile or fissile excepted under para. 417(a)(i) or (iii) of the 2009 Edition of these Regulations (see para. 821).</a> T22:	Consistency: results from new para. 821.  Fissile <del>excepted</del> material <u>excepted</u> from classification as FISSILE, <del>in accordance with</del> in accordance with Table 1  The following <i>consignments</i> are required to be shipped under <i>exclusive use</i> : ...
F/D24/1		ANNEX VI and Summary	No proposal.	Contents of ANNEX VI are unknown.  When available, this annex should be submitted to Member States 120 day comments. The numbering should be changed to ANNEX IV?
USA/d 24/3		Table 1	UN 3XXX RADIOACTIVE MATERIAL, EXCEPTED PACKAGE - URANIUM HEXAFLUORIDE, less than 0.1 kg per <i>package</i> , <b>non-fissile or fissile-excepted.</b> <b>(Change should be carried throughout TS-R-1)</b> T22:	Correctness
B/D24/02	USA/120D/12	Table 2		For Kr-85 the reference to the footnote (h) has not the same format as for the other concerned radionuclides: T(H)-3, Th-228 and Th-232
CDN/D 24/12		Table 2	T22:	The requirements for footnote (h) have not been specified.  The principles to be used in allowing an alternate activity limit for an exempt consignment is not clear, but needs to be. Should this be in

				accordance with the principles in the BSS?
IND/D 24/05	<a href="#">USA/120 D/12</a>	Table 2	T22:	<p>The proposed footnote (h) will dilute the essence of exemptions which are derived from the system of protection and safety complying with Basic Safety Standards. The referred report has not yet been endorsed by the agency. There are other radioisotopes like Am-241, Po-210, Pm-147, Ni-63, H-3, C-14, Ba-133 etc., which are abundantly used in many other consumer products. Keeping only exemption values for Kr-85, H-3 and Th-232(used in lighting consumer products) open ended and leaving to the concerned competent authority of the country is not appropriate. There should be a rational approach for all the radioisotopes used in the consumer products.</p>
E/D24 /01	USA/120 D/12	Table 2 foot note h	T22:	<p>It is not acceptable to establish a specific procedure to define a different exemption value for a particular case.</p> <p>The activity exemption values have to be established clearly by the Regulations for each radionuclide based on a risk/dose analysis that assures that below those values the radioactive material may be transported freely without risk in any scenario, independently if the radionuclide is content in an article or not.</p> <p>Otherwise, if this system based on a multilateral procedure is finally established the decision on this problem is being transferred case by case to each competent authority, which may produce a dangerous un-harmonization on this important subject.</p> <p>This procedure, which is really being introduced for solving the particular case of lamps incorporating radioactive material,</p>

				<p>would open the door to multiple future applications of approvals to increase the exemption values of other radionuclides regularly used in other articles or instruments as many consumer products.</p> <p>Additionally, it is not adequate to speak about ‘articles and instruments’ in a general way, since any equipment or system containing radioactive material (industrial gauges, for example) may be considered affected by this foot note.</p>
D/D2 4/22	<a href="#">TIC/120 D/01</a>	Table 2,	<a href="#">T22:</a>	<p>Change of activity concentration for exempt material for Ra-226 and 228, Th-nat and U-nat:</p> <p>These changes in Table 2 are not justified and additionally any change to such values should be done only in connection and harmony with BSS review/revision. The current limits must be maintained. The problem for NORM has been solved by revising para 107 (f).</p>
F/D24 /8	<a href="#">TIC/120 D/01</a>	TABLE 2,	<p>new activity concentration limits for exempt material for Ra-226 Ra-228 U(NAT) and Th(NAT°</p> <p><a href="#">T22:</a></p>	<p>Comment 1: The proposed change is subject to harmonization with revised BSS.</p> <p>Comment 2: France supports BFS proposal to complete requirements relative to these issues.</p>
D/D2 4/23	USA/120 D/12	Table 2, footnot e (h)	<a href="#">T22:</a>	<p>Footnote (h) applicable to T(H-3), Kr-85, Th-228 and Th-232 (lamp industry):</p> <p><a href="#">See Attachment 1</a> to this document</p>

F/D24 /12		TABLE 8	See comment.  T22:	Delete footnote reference “d” in the title of table 8 in DS437 draft 2.4.
USA/d 24/10	New	Table 11, footno te b and c	The <i>consignment</i> shall be so handled and stowed that the sum of <i>CSIs</i> in any group does not exceed 50, and that each group is handled and stowed so <b>as to maintain a spacing of at least 6 m from all other groups.</b> <del>that the groups are separated from each other. by at least 6 m.</del>  T22:	The text of the footnote should be consistent with the text of para 569 where there is an emphasis on <b>maintaining</b> the 6m spacing.



**Attachment 1 (for Table 2, footnote h) D/D24/23**

**Comments and proposal regarding USA/120D/12 (alternative activity limits for an exempt consignment of instruments or articles for T(H-3), Kr-85, Th-228 and Th-232)**

**Comments:**

The US proposal is using a footnote to the above mentioned nuclides in Table 2 of TS-R-1 to provide a specific exemption option to the lamp industry. It is not justified why such an option within the regulatory framework of TS-R-1 is restricted to only these radionuclides and should not also be applicable to others.

In addition there are no requirements proposed regarding the approval procedure itself (e.g. application, assessment, certificate,...) which makes it rather complicated to achieve a harmonised implementation in practice and which is not consistent with other approval procedures in TS-R-1.

If such a new exemption option is basically acceptable then another way of its implementation into TS-R-1 is proposed as described in the following.

**Proposal to introduce alternative activity limits for an exempt consignment of instruments or articles**

1) Insert a new para. 403bis following para. 403:

403bis. For radioactive material in instruments or articles in which the radioactive material is enclosed in or is included as a component part of the instrument or other manufactured article and which meet para. 423 (c) alternative basic radionuclide values to those in Table 2 for the activity limit for an exempt consignment are permitted subject to multilateral approval. Such alternative activity limits for an exempt consignment shall be calculated in accordance with the principles set out in the BSS.

2) Extend para. 802 by adding the following:

(f) Calculation of alternative activity limits for an exempt consignment of instruments or articles (see para. 403bis).

3) Insert a new heading and new paras 802bis and 802bis1 in Section VIII following para. 802:

APPROVAL OF ALTERNATIVE ACTIVITY LIMITS FOR AN EXEMPT CONSIGNMENT OF INSTRUMENTS OR ARTICLES

802bis. Alternative activity limits for an exempt consignment of instruments or articles according to para. 403bis shall require multilateral approval. An application for approval shall include: *(remark: the following list is a slightly revised version of the list proposed by IAEA- CS-05 for TS-G-1.1)*

(a) A detailed description of the item, its intended uses and the radionuclide(s) incorporated.

- (b) The maximum activity of the radionuclide(s) in the item.
- (c) The chemical and physical forms of the radionuclide(s) contained in the item.
- (d) Details of the construction and design of the item, particularly as related to the containment and shielding of the radionuclide in routine, normal and accident conditions of transport.
- (e) The applicable management system, including the quality testing and verification procedures to be applied to radioactive sources, components and finished products to ensure that the maximum specified quantities of radioactive material (see (b)) or the maximum radiation levels specified for the item (see (g)) are not exceeded, and that the items are constructed according to the design specifications.
- (f) A description of the prototype tests for demonstrating the integrity of the product in normal use, and the results of these tests of possible misuse and damage.
- (g) Maximum external radiation levels arising from the item and the measures taken for compliance assurance.
- (h) The maximum number of items expected to be shipped per consignment and annually.
- (i) Dose assessments in accordance with the principles and methodologies set out in the BSS, including individual doses to transport workers and members of the public and, if appropriate, collective doses arising from routine, normal and accident conditions of transport, based on representative transport scenarios the consignments are subject to.

802bis1. The competent authority shall establish an approval certificate stating that the approved alternative activity limit for an exempt consignment of instruments or articles meets para. 403bis and shall attribute to that certificate an identification mark.

4) Insert a new type code for approval for alternative activity limits for an exempt consignment of instruments or articles under para. 831 (c):

831 (c)

AL      Alternative activity limits for an exempt consignment of instruments or articles



5) Insert a new heading and a new para. 833bis following para. 833:

**Certificates for alternative activity limits for an exempt consignment of instruments or articles**

833bis. Each certificate issued by a competent authority for alternative activity limits for an exempt consignment of instruments or articles according to para. 802bis1 shall include the following information:

- (a) The competent authority identification mark.
- (b) The issue date and expiry date.
- (c) List of applicable national and international regulations, including the edition of the IAEA Regulations for the Safe Transport of Radioactive Material under which the exemption is approved.
- (d) Specifications of the radionuclide(s), the approved alternative activity limit(s) for the exempt consignment(s) and the instrument(s) or article(s).
- (e) Any restrictions or limitations for the instrument(s) or article(s) or the consignment(s), if applicable.
- (f) Specification of the applicable management system.
- (g) If necessary, any administrative or operational requirements for the consignment before and during transport.
- (h) If deemed appropriate by the competent authority, reference to the identity of the applicant.
- (i) Signature and identification of the certifying official.
- (j) Reference to documentation that demonstrates compliance with para. 403bis.

## IAEA glossary:

### radiation level

[The corresponding *dose rate* expressed in millisieverts per hour.] (From Ref. [2].)

! This usage is specific to the Transport Regulations, and should otherwise be Avoided

***equivalent dose,  $H_T$*** . The quantity  $H_{T,R}$ , defined as:

where  $D_{T,R}$  is the *absorbed dose* delivered by *radiation* type R averaged over a tissue or organ T and  $w_R$  is the *radiation weighting factor* for *radiation* type R. When the *radiation* field is composed of different *radiation* types with different values of  $w_R$  the *equivalent dose* is:

Formula

- The unit of *equivalent dose* is the *sievert* (Sv), equal to 1 J/kg. The *rem*, equal to 0.01 Sv, is sometimes used as a unit of *equivalent dose* and *effective dose*.
- This should not be used in *IAEA publications*, except when quoting directly from other publications, in which case the value in *sieverts* should be added in parentheses.
- *Equivalent dose* is a measure of the *dose* to a tissue or organ designed to reflect the amount of harm caused.
- Values of *equivalent dose* to a specified tissue from any type(s) of *radiation*

- can be compared directly.  
***natural uranium.*** Uranium (which may be chemically separated) ([AUS/D24/03](#))

containing the naturally occurring distribution of uranium isotopes

(approximately 99.28% uranium-238 and 0.72% uranium-235 by mass).

(From Ref. [2].)

■ In all cases, a very small mass percentage of uranium-234 is present.

■ The naturally occurring distribution of uranium isotopes including uranium-234 (approximately 99.285% uranium-238, 0.710% uranium-235 and 0.005% uranium-234 by mass) corresponds to approximately 48.9% uranium-234, 2.2% uranium-235 and 48.9% uranium-238 by *activity*.