Decisions by the criticality working group
10-11 July 2017
Fissile exception code, F/2015/10, SSR-6, § 546(j)(i) / 417 / 674 / 675

SSR-6 (2018 Draft)
548. The consignor shall include in the transport documents with each consignment the identification of the consignor and consignee, including their names and addresses, and the following information, as applicable, in the order given:
(j) For fissile material:
   (i) Shipped under one exception of subparagraphs 417(a)–(f), reference to that para.;
   (ii) Shipped under para. 417(c)–(e), the total mass of fissile nuclides;
   (iii) Contained in a package for which one of para. 674(a)–(c) or 675 is applied, reference to that para.;
   (iv) The CSI, where applicable.

Mostly France and WNTI support having the subparas (in form of the proposed code) and masses of fissile nuclides in the transport document for reasons of enhanced authority control and emergency response. Most other participants support only having reference to 417 if shipped under one exception of 417 or reference to 674/675 if shipped applying one of these paras. (the CSI of cause is always necessary, if there is one)

Has not been resolved. Needs attention at further meetings.
Large number of unknown parameters, UK/2015/02, SSG-26, § 676.2

SSR-6 (2018 Draft)

676. Where the chemical or physical form, isotopic composition, mass or concentration, moderation ratio or density, or geometric configuration is not known, the assessments of paras 680–685 shall be performed assuming that each parameter that is not known has the value that gives the maximum neutron multiplication consistent with the known conditions and parameters in these assessments.

New text proposed by UK for SSG-26

676.2 Where the number of possible parameters is very large the probability of them all achieving their most reactive value during normal or accident conditions of transport may be vanishingly small. In such cases it may not be necessary for a criticality safety assessment to assess all possible permutations provided the Competent Authority is satisfied that criticality safety has been adequately demonstrated.

Agreed by the group. Proposed for immediate introduction into SSG-26.
Criticality safety for air transport, RUS/2015/06, SSR-6, § 683

SSR-6 (2018 Draft)

683. For packages to be transported by air:

(a) The package shall be subcritical under conditions consistent with the Type C package tests specified in para. 734, assuming reflection by at least 20 cm of water but no water in-leakage.

(b) In the assessment of para. 682, use of special features as specified in para. 680 is allowed provided that leakage of water into or out of the void spaces is prevented when the package is submitted to the Type C package tests specified in para. 734 followed by the water leakage test specified in para. 733.

The text is not easy to read. But if taken carefully it is clear how to apply. The interpretation of the regulations e.g. in Russia differs from the use in other countries. In Russia consideration of water in-leakage is required for the assessment of 683(a) and (b), which exceeds the IAEA requirements. Other countries do not take into account water in-leakage after the Type C tests of 683 (a). No technical basis can be identified additionally to the wording in SSG-26. This definitely needs improvement.
Definition of the confinement system

SSR-6 (2018 Draft)

209. Confinement system shall mean the assembly of fissile material and packaging components specified by the designer and agreed to by the competent authority as intended to preserve criticality safety.

An individual package should be subcritical independent of the definition of a confinement system.

Does confinement system mean some removable part of the package, including the fissile material, that should be subcritical on its own (‘reflection by 20cm of water’) or the complete package? Subcriticality of removable parts could be important during loading or in emergency response. Does this fit with the aim of the transport regulations? Or is it at least useful as a technical requirement to support package design, emergency response?

Confinement system also means an assembly (a list?) of criticality related package components. See para 501 (b), (c). Do we want to keep this? Do we want to reduce the meaning to this? Do we need a special term for this list?

How do competent authorities apply confinement system? Which meaning should be kept for future? Proposed questionnaire and then discussion.
Experience on approval of material excepted from fissile classification, Para 417(f) / 606 of SSR-6

SSR-6 (2018 Draft)

605. A fissile material excepted from classification as “FISSILE” under para. 417(f) shall be subcritical without the need for accumulation control under the following conditions:

(a) The conditions of para. 673(a);

(b) The conditions consistent with the assessment provisions stated in paras 684(b) and 685(b) for packages;

(c) The conditions specified in para. 683(a), if transported by air.

The only application known to the group is from the UK. It is based on a ratio of fissile nuclides to certain non-fissile material. It is similar to the US domestic rules and to the discussion at IAEA before introduction of para 417(f). The application has not been approved yet.

Exchange of experience should continue. Additionally, wording of 606 and 802 is not clean and needs correction.
Criticality at low temperatures

See UK Office for Nuclear Regulation Guide (http://www.onr.org.uk/transport/index.htm)

For low (and also high temperatures) three influences on neutron multiplication may exist:
1. The material properties of the packaging or content may change leading to changes in the assumptions made for the criticality safety demonstration. This is usually taken into account.
2. The density of moderating material may change (e.g. formation of ice)
3. The neutron cross sections vary with temperature. The current versions of cross section databases do not contain data for low temperatures.

The influences 2 and 3 are often not taken into account. 3 is difficult because of missing cross sections. There have been reported extreme cases where $k_{eff}$ changes by up to 2% due to temperature changes. It is considered that the uncertainty due to not accounting for 2 and 3 is covered by conservatism and margins in the criticality safety assessment. But the situation should be improved by taking into account all influences. To this aim cross sections for low temperatures will be introduced in the ENDF/B-VIII.0 cross-section library.

Countries investigating the influence of low temperatures are strongly encouraged to present results in meetings and conferences (next PATRAM).
CSI limits for seagoing vessels

Table 11 of SSR-6

<table>
<thead>
<tr>
<th>Type of freight container or conveyance</th>
<th>Limit on sum of CSIs in a freight container or aboard a conveyance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Not under exclusive use</td>
</tr>
<tr>
<td>(ii) Total vessel:</td>
<td></td>
</tr>
<tr>
<td>Packages, overpacks,</td>
<td></td>
</tr>
<tr>
<td>small freight containers</td>
<td>200^b</td>
</tr>
<tr>
<td>Large freight containers</td>
<td>No limit^b</td>
</tr>
</tbody>
</table>

The reason for the CSI limits for total seagoing vessels are not clear. There is no clear benefit for criticality safety of using containers, independently of being closed or not closed containers. The question from IMO about the need to have a closed character of container for applying higher CSI limits cannot be answered.

There should be initiated investigation for analyzing these limits. It would be useful if WNTI could lead this investigation, collecting some results and discussing them with the group.
Thank you for your attention!