TM on the Environment to which Packages may be subject during transport and related issues concerning the regulations for the safe transport of radioactive material

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Summary

- Background
- Routine/normal conditions of transport
- Accident conditions of transport
- Very less likely accident
- Conclusion
As the transport tests were defined 50 years ago, it seems legitimate to raise again the issue of their pertinence with regards to present transport environments and changing public perception.

A review of routine, normal and accident conditions of transport is then necessary to take into account the new transport environment as the impact of climate changes, the new transport practices...

Additionally, the very less likely accident that is to say beyond the regulatory requirements have to be considered especially taking into account the Fukushima lessons.

The IAEA General conference requested a review of the environment experienced in the transport

IAEA Secretariat convened a Technical Meeting to address these issues and envisage eventual inputs for next editions of the regulation and its guidance.
Design is based on Farmer’s principle:
The higher is the probability of occurrence the lower have to be the consequences.
Plenary session: expert presentations

- Influence of package environment in the IAEA transport regulation
- Presentations concerning changes in natural environments and routine conditions of transport
- Presentations concerning normal and accident conditions of transport
- Presentations concerning severe natural events including Fukushima lessons
TM on the Environment to which Packages may be subject during transport

Working groups

- Mechanical and criticality
- Thermal and Design basis
  - Approach to take into account less likely accident

TM Report with identified problems and way to solve them for next TRANSSC
“Routine conditions of transport”

Related to general design requirements for all packaging and packages

Use of packages under every day or routine operations (no minor mishaps)
The package designer has to define ambient conditions (temperature, pressure, accelerations....)
Criterion: no deterioration in the effectiveness of closing devices or in the integrity of the package as a whole allowed
“Normal conditions of transport”

Related to minor mishaps or incidents. Packages would be relatively undamaged.

In most case involvement of the packages in the mishap is not known therefore the package will continue in transport.

The purpose of the tests (water spray test, free drop test, stacking test and penetration test) and the associated criteria is to cover these minor mishaps (bumping, rough handling, drop from a loading platform, penetration if loaded with pipes or similar articles, over stowing by other packages, climatic conditions...). For special content: liquids or gases: special additional testing conditions to prevent the complete loss of the content.
Type B(M) packages are permitted to use alternative values for ambient temperature ranges and insolation other than those prescribed in the IAEA's Regulations. A UK technical research was conducted by the UK's Met Office. The results of the research suggest that the previously accepted range of -10 to +26 °C and half of the insolation values are exceeded although they are still bound by the B(U) requirements.

It was decided during the TM that countries will provide the highest and the lowest temperature in their country relating transport routes (and if available insolation values) over the past ten years in order to compare them with the values given in the regulation.
Package stowage and retention systems

Which standards/codes incl. acceleration values and criteria are accepted? What are their technical basis?
Is there a need for measure campaign?

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<thead>
<tr>
<th>Mode</th>
<th>Longitudinal</th>
<th>Lateral</th>
<th>Vertical</th>
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<tbody>
<tr>
<td>Road</td>
<td>2g</td>
<td>1g</td>
<td>2g up, 3g down</td>
</tr>
<tr>
<td>Rail</td>
<td>5g</td>
<td>2g</td>
<td>2g up, 2g down</td>
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<td>Sea/water</td>
<td>2g</td>
<td>2g</td>
<td>2g up, 2g down</td>
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<td>Air¹</td>
<td>1.5g (9g forward)</td>
<td>1.5g</td>
<td>2g up, 6g down</td>
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"Routine and normal conditions of transport"

TS-G-1.1 should be the most important source for load case data under routine conditions of transport. A closer look, however, reveals deficiencies or at least a too wide range of standards with different values and interpretation how to apply those values. Therefore the improvement of the guidance material is recommended to have international harmonization with an up-to-date reference list on applicable design standards regarding acceleration values and criteria.

TM has recommended the formation of an expert working group to review Appendix IV of TS-G-1.1 (rev1) and air/maritime transport practices.
The IAEA Regulations control radiation doses in the vicinity of single and multiple packages through the Transport Index (TI), similarly to the way criticality is controlled in single and multiple packages through the Criticality Safety Index (CSI). Compared to this, thermal safety is controlled for single packages only, not directly accounting for multiple heat generating packages or other heat sources.

**TM has proposed to consider some modifications of the regulations concerning the accumulation of packages on the same vehicle, the impact of the conveyance on the temperatures of the packages and the consequences of the loss of mechanical cooling system. Shipments approval should be necessary for this kind of transport.**
“Accident conditions of transport”

Incident and accident with severity between normal conditions up to the severity levels imposed by the applicable test

The package will not continue in transport without detailed examination and assessment

The tests were first defined as the “maximum credible accident” and were replaced later by “tests requirement for type B packages” for public acceptance. The tests were selected to cover all modes of transport and to cover the absence of precise database of accidents. The tests are not intended to represent the worst case accident.
“Accident conditions of transport”

Immersion test: there was discussion on the conditions set for the current regulatory test condition limited to 8 hours which is not sufficient to recover an immersed package.

TM has proposed to change the time period of the water immersion test and water leakage test to 1 week instead of 8 hours.

Crush test: there is no clear justification on the condition on the density of package

TM has recommended considering in the current review/revision cycle the review of the condition on the density of package

Fire test: segregation from other dangerous goods are prescribed in the previous edition of the regulation

TM has recommended the formation of a working group on this topic
The other current regulatory tests are adequate and there is no need to change the regulations at this time.
“Very less likely accident”

Accident with severity above accident conditions of transport

Very less likely scenarios but still possible scenarios (drop of a package on another one, consequences of earthquake: burial, tornado, industrial environment on packages for example)?

An objective could be to determine the maximum radiological consequences of these very less likely scenarios and to define if necessary operational measures or emergency response actions.  
Another possible approach? Risk assessment?
"Very less likely accident"

TM has recommended as an **urgent issue** to strengthen the concept of emergency preparedness in the regulations. It is proposed to introduce in the current review/revision cycle that the regulations requires explicitly emergency plans.

In addition TM recommends the revision of TS-G-1.2 to be done in this cycle. **Concerning very less likely accident, it is agreed that some guidance on how it should be taken into account is necessary in TS-G-1.2.**
Conclusion

The TM reviewed the regulations for the transport of radioactive material including the proposals of the current revision cycle regarding the environment of the packages as given by climatic conditions as well as the transport practice.

One important outcome of the TM was the formation of a working group to review Appendix IV of TS-G-1.1 (Rev. 1) and to require explicitly emergency plan.

Another important outcome is to require explicitly emergency plan in the regulation.

The current regulatory test requirements were considered to remain appropriate in the whole, except for some issues as presented in Lecture 10.
Thank you for your attention