

Harmonised criticality assessment

The transport of fissile nuclear fuel cycle materials, i.e. materials such as enriched uranium hexafluoride and new fuel assemblies which are capable of sustaining a nuclear chain reaction, is an international business. For international shipments the regulations require a package to be certified and validated not only by the competent authority of the country of origin but also to be approved by each country through or into which the consignment is to be transported, i.e. it requires multilateral approval in respect of criticality safety to ensure that a critical excursion (an unwanted nuclear chain reaction) cannot occur. This raises a number of harmonisation issues which have an important bearing on transport activities.

Criticality safety assessments demand much time and high level effort. Major contributing factors are inconsistencies in the method of assessment by industrial organisations and challenges from competent authorities. This can result in high costs for all concerned and can also cause delays in obtaining approvals.

A major initiative has been launched within WNTI with the setting up of an Industry Task Force to explore the possibility of developing an Industry Knowledge Base on Criticality Assessment. This could form a basis for a more harmonised approach to criticality safety assessment by industry.

Currently, when considering hypothetical accident conditions, the underlying assumptions can differ widely from application to application. One stage of a harmonisation process could be the identification and justification of realistic and achievable configurations of nuclear fuel cycle materials following an impact accident.

A challenge for Industry is to see if it can agree on realistic worst cases, i.e. those which would have most effect on the approach to criticality, based on sound engineering principles and analysis, coupled with experimental evidence following the IAEA tests relevant to accident conditions of transport.

Various options may be considered for the preparation of an acceptable safety case for the transport of nuclear materials. While the objective of a WNTI Industry Knowledge Base would be to assist applicants, they would decide which course of action to adopt on the basis of their own cost/benefit considerations. It is not intended to offer advice on the optimum strategy or on design solutions to meet particular regulatory requirements. These matters will depend on the circumstances relating to a particular application but the document would point out major generic factors to be addressed.

The Task Force has concentrated mainly on new and spent fuel assemblies.

Sub-Groups were set up to further study the scope for rationalisation in the three priority areas, (i) enrichment mapping/burn-up, (ii) fuel break-up/lattice expansion and (iii) water ingress. Good progress has already been made in addressing some of these major issues with work carried forward to a fourth workshop in December 2006.

Discussion on possible future Task Force work has identified the following stages for further consideration:

- preparing the concept, format and content of the Knowledge Base;
- developing more explanatory material and detail;
- commercial/implementation issues.

While the initial focus of work within WNTI has been on fuel assemblies it is intended to initiate work on other fissile fuel cycle materials.