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WNTI Back End Transport Working Group: overview of our current work and the coming challenges facing our industry

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Abstract

In 2008, the WNTI established a dedicated Working Group gathering the WNTI expertise on the transport of back end materials, including radioactive waste, spent fuel and decommissioned objects.

The aim of the WNTI Back End Transport Working Group is:

- Identifying issues with the potential to adversely affect the safety or efficiency of radioactive waste and spent fuel transports,
- Using the knowledge and experience of its members to obtain a full understanding of these issues and to develop an industry position,
- Disseminating the learning to stakeholders involved in class 7 transports.

The Back-End Transport Working Group focuses on the current following issues:

- Characterisation of Waste: techniques and methods to characterize and classify wastes
- Large Objects: slightly contaminated large objects (ex. spent steam generators) transport
- Dual Use Casks: transportable storage casks for spent nuclear fuels, including the very long term storage of spent fuel
- Fissile Exceptions: new fissile exceptions provisions of revised SSR-6

The paper will examine the way the WNTI working group supports the nuclear transport industry to manage the challenges throughout the life cycle of nuclear facilities through to final decommissioning.

Furthermore, the paper will use a worked example of cask decommissioning to illustrate the support the Working Group provides industry.

Introduction

The World Nuclear Transport Institute (WNTI) was founded in 1998 to represent the collective interests of the nuclear transport industry, and those who rely upon it in the safe, secure, efficient and reliable packaging and transport of radioactive materials. One of the WNTI roles is to give Industry Voices to Intergovernmental Organizations (IGOs) and Competent Authorities (CAs). To further this mission WNTI has working groups (WGs) to address specific issues and challenges of interest to its members..

The Back-End Transport Working Group

The WNTI Back-End Transport Working Group (BETWG) deals with issues and challenges for transporting radioactive material relating to the back-end of the nuclear fuel cycle, particularly waste and spent fuel, with the aim of:

- Identifying issues with the potential to adversely affect the safety or efficiency of radioactive waste and spent fuel transports,
- Using the knowledge and experience of its members to obtain a full understanding of these issues and to develop an industry position,
- Disseminating the learning to stakeholders involved in class 7 transports.

The WG meets twice a year, in between communicating by email, and to date, has concentrated on the following four areas that were considered to be of importance to the WNTI community.

Characterisation of Wastes

A large variety of process wastes arise in the nuclear fuel cycle industry, from mining, conversion, enrichment and fuel fabrication, reactor operations, reprocessing and more recently from decommissioning a wide variety of nuclear facilities. These wastes vary greatly in their chemical, physical and radioactive properties and the degree of homogeneity is sometimes difficult to assess.

Traditionally, waste management has been mainly focused on the need to ensure safe storage of waste, either interim or long term, in the raw or conditioned state. However, it is important to note that all these waste streams will have to be transported eventually in some form or another and the IAEA Transport Regulations SSR-6, must be able to cater for these materials without imposing unjustified constraints which could result in significant operational difficulties and economic penalties. The inventory forecasting is an important process because it determines the number of packagings, transport vehicles, personnel, etc that will be required over the coming years. It may also influence requirements for capital investment and work programmes for inter-related facilities. Nevertheless, wide discrepancies between the forecasting and actual demand of the waste transport are reported in some countries[1]. They cause inefficiency and strains for the waste transport.

Internationally, many techniques and methods are used to characterise and classify wastes and to forecast waste inventories. The BETWG has prepared a good practice guide“Waste Inventory Forecasting Principles - A Move Towards Reliable Packaging and Transport Data” .

Large Objects

Due to routine generation of clean electricity from nuclear power stations, various kinds of equipment are contaminated and activated. This equipment has to be treated, stored and discharged for disposal or recycling in a responsible and environmentally sensitive way at the end of their operational life. This equipment includes large objects (large components), such as reactor pressure vessels and steam generators (typically, over 20 metres long, 300 tons). Recently, the transport of large objects has been steadily increasing because of the decommissioning of nuclear power stations or replacing equipment for the extension of their operational life.

Such impressive and high-profile transports, however, are sometimes faced by strong opposition from the public even when the relevant Competent Authorities have approved them. For example, in Canada, Bruce Power's plan to transport 16 decommissioned steam generators from Canada to Sweden for recycling was forced to be cancelled in 2012 due to strong opposition from the public and local communities both in Canada and the U.S. even though the transport had been approved by the Canadian competent authority as being transportable under "Special Arrangement".

The transport of radioactive material is regulated by national and international modal regulations based on the IAEA Transport Safety Regulations (SSR-6). Generally, radioactive material is packed inside a packaging (e.g. drum, freight container or cask) which satisfy the requirements of the SSR-6 according to their radioactivity and chemical/physical properties. Previously, used radioactive large objects were usually treated and their size reduced into smaller pieces, packed into a number of packagings onsite (at the nuclear power plants or the fuel cycle facilities), then transported off site to disposal or recycling facilities. However, this size reduction and packing may increase exposure of workers and risk of radioactivity release. Therefore, some large objects have been transported directly to disposal or recycling facilities without onsite dismantling or size reduction.

Intensive discussion on such transport had been conducted in the last review cycle of the IAEA Transport Regulations and a new guidance for the transport of large objects was included in the advisory material SSG-26.

Transporting Large Object countries hoped new categorisation of Large Object, had continued discussion, and one of the country submitted comment on a new category SCO-III for transporting Large Object in the 2015 SSR-6 revision cycle. This comments have discussed and would be accept in this cycle.

The BETWG will have contributed to draft the new edition of SSG-26 on this topic and will collect industry's experience to contribute to improve these regulation and guidance.

Dual Use Casks

With the shortage of reprocessing plant capacity or the lack of repository site, large amounts of spent fuels are accumulated in nuclear power plants. An option for the management of spent fuel is to use dual purpose casks which are designed to meet the requirements for both transport and storage (interim and/or long term). Some interim storage facilities have already been installed or planned in some countries. And governments, intergovernmental organisations and industries considered and discussed past several years.

The IAEA established the "Joint Working Group on Guidance for an Integrated Transport and Storage Safety Case for Dual Purpose Casks for Spent Nuclear Fuel" in 2011 and started the discussions internationally to provide guidance to Member States for integrating the safety cases for storage and transport in a holistic manner. Some BETWG members have participated in the activities and the draft TECDOC “Dual purpose cask safety case for transport/storage casks 6 containing spent fuel” was finalized, now have been published. And the joint WG recommended TRANSSC to incorporate DPC concept to Transport Regulations.

In the 2013 review cycle, two proposals related to DPC were raised which TRANSSC decided to resolve in next review cycle. Consequently, a consultancy meeting (CM) was organized to discuss the issues invoked by proposed new provisions in SSR-6 and SSG-26. In the CM, WNTI proposed a gap analysis to review the technical issues around applicants maintaining package approval, ageing mechanisms and ageing management programs. The BETWG discussed the new requirements and has continued to join discussions and proposed comments to the TRANSSC.

The BETWG will collect facts in industry and will have contributed to improve these regulation and guidance, especially in the areas of Gap Analysis and Ageing Management Programs.

Fissile Exception

Criticality is one of the most serious potential risks of nuclear fissile material; as such special considerations should be taken into account for the transport of such material. A “fissile package” which contains a certain amount of fissile material is specially categorised and requires additional tests together with the approval from related Competent Authorities (CAs) to ensure the critical safety under the IAEA Transport Regulations. Some transporters and airlines, however, refuse to transport fissile packages even if the packages contain very limited fissile material with no risk of criticality due to the potential risk and additional burdens for the transport of fissile material. It is very important for carriers or consigners, therefore, to understand whether the packages are categorised as a fissile package or not. In particular, the provisions for fissile exception are important because a package containing fissile material which can satisfy all the requirements of one of the provisions for fissile-excepted does not then need to be treated as a fissile package, which means it can be transported more smoothly. Some industry members, however, thought that some requirements for fissile-exceptions in the previous IAEA Safety Transport Regulations (TS-R-1(2009)) were too strict from a reasonable practicability point of view. However, the contrary view was held by some CAs who were concerned about the possibility of the accumulation of fissile-excepted packages containing fissile material on a conveyance and thought the regulations were too permissive in some cases. The previous fissile exception provisions in the TS-R-1 (2009) had been challenged from both sides.

The provisions of fissile exception have been in the IAEA Transport Regulations since the first edition in 1961. As these provisions are important for the industry and CAs, some major changes had been conducted from the first edition and another major change has been made in the latest edition of the IAEA transport regulations (SSR-6) . Although the latest changes had been discussed for over ten years, only minor changes had been incorporated to the regulations before the SSR-6, mainly because a wide range of issues had been raised during the discussions and it was very difficult to reach consensus among all stakeholders. The main issues were; (a) concerns about accumulation of fissile excepted packages on a conveyance from CAs, (b) the validity of the fissile mass limits from criticality experts, and (c) expansion of fissile exception for low concentration of fissile material which has no risk of criticality from industries. Intensive discussions on all of these have been held with the criticality experts, CAs and industries for many years and finally, the consensus was obtained with safety, practicality and flexibility. Ultimately there are winners and losers for the new provisions.

The concept of the new provisions is shown in Fig.1. The fissile exception in the previous regulations (TS-R-1) is categorised into three concepts, “Non-fissile”, “Fissile excepted” and “Approval-excepted fissile material” in the new regulations (SSR-6). The comparison of the related provisions between the previous regulations and SSR-6 is shown in WNTI Good Practice Guide “New Fissile Exception Provisions in the IAEA Transport Regulations (SSR-6)[1]” in detail.

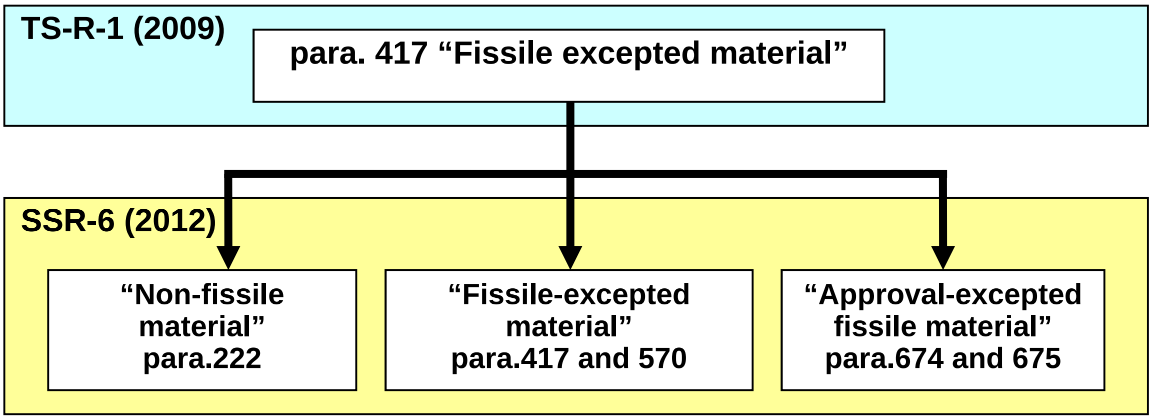

Fig.1 Concept of the latest modification on fissile excepted

The provisions on the fissile exception have changed widely and fundamentally after long discussions between experts, CAs and industries including the WNTI. The new provisions are safer, more rational and flexible than previous ones. It is necessary to understand the new provisions and applicants should be careful to comply with them, including the transitional arrangements. Furthermore, Industry is encouraged and recommended to share our experience among all the stakeholders, especially CA’s approval based on para. 417(f). Also such feedback is crucial for improving safe and rational regulations in the next review cycle.

Cask Decommissioning

A current area of specific interest to some members of the BETWG is the challenge and opportunities presented by transport casks that have reached end of serviceable life. In the UK alone there are some 85 casks that were previously used to ship spent oxide fuel that need to be responsibly managed and have no further duty expectations. This position is not unique to the UK and viable end-of-life processes are being developed throughout the world’s nuclear industry to deal with such assets. The BETWG has recognized this position and is currently developing a workstream to understand the options that have been deployed to date, or are currently being developed, in order to take a view on what constitutes best industry practice. The BETWG is to initiate the workstream at the December 2016 Semi-Annual Members Meeting in London with the intent of exploring the options available for decommissioning casks. The output from this work is expected to be the production and subsequent publication of a WNTI industry good practice guide with supporting factsheets. In taking the lead on coordinating the industry thinking on this difficult and diverse challenge the WNTI has taken another mission step in facilitating industry cooperation to the mutual benefit of the members who will help shape and steer the future of cask decommissioning practice.

Conclusions

The WNTI established a working group in 2008 to promote the developments in the safe, efficient and reliable transport of waste radioactive and spent fuel. The BETWG has focused on four fields, Characterisation of Waste, Large Objects, Dual Use Casks and A1/A2 value. The activities contributed to the revision of the regulations SSR-6 and advisory material TS-G-1.1, and discussions in the IAEA through the members' expertise and practical experiences.

The importance of the transport of radioactive wastes and spent fuels will be increasing all over the world because of the expansion of the usage of nuclear energy and the decommissioning of the old facilities. The BETWG continues to tackle various issues flexibly with members' expertise and experience. Through these activities, the WNTI provides a channel for the industry to facilitate the safe, efficient and reliable transport of radioactive waste materials.

References

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2. WNTI Good Practice Guide “New Fissile Exception Provisions in the IAEA Transport Regulations (SSR-6)” , World Nuclear Transport Institute, 2013 http://www.wnti.co.uk/media/60110/IP10_EN_NOV13_V1.pdf