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Proposed Regulations to Ship Large Objects as Surface Contaminated Objects

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ABSTRACT

It is proposed for this review cycle of the IAEA Transport Regulations (SSR-6) to incorporate regulations for the shipment of large objects as a new category of surface contaminated object (SCO). The proposal to include the transport of large objects within the regulations has been in development for many years. The progression of the discussion and the details of the final proposed changes are discussed in this paper, including how concerns raised at recent TRANSSC and working group meetings have been considered and addressed.

In many cases, large objects can be classified as SCO, but because of their size do not meet all of the packaging requirements for transport, even though they do not pose a transport risk. As a result, a set of standard provisions for transport of large objects as surface contaminated objects under a new SCO-III classification, based on the IAEA "performance package" concept, have been developed for possible incorporation into the international regulations and advisory material. The primary additions to SSR-6 are related to the SCO-III classification and requirements, as well as approval and administrative requirements for the new classification. In addition, SCO-III was added to the proper shipping name for UN 2913 and the conveyance limits have been revised for SCO-III. Advisory material was also drafted for the new requirements. The majority of this advisory material is based on the information that is currently found in Appendix VII of SSG-26 [2] for large objects. The information was moved into the body of SSG-26 to support the regulations and removed from Appendix VII.

Note that at this time the proposed provisions do not include components such as reactor vessels, due to the more limited experience and greater radioactivity levels. The SCO-III concept lays the groundwork and may be extended to low specific activity (LSA) large object provisions in the future to cover such components.

INTRODUCTION

Decommissioning or refurbishment of nuclear facilities necessitates either the storage or disposal of large radioactive components such as steam generators, pressurizers, reactor pressure vessels and heads, and coolant pumps, to list the major contributors. These components or objects are large in size and mass, measuring up to approximately 6 meters in diameter, up to 20 meters in length, and weighing over 400 000 kg. In many situations, the components are transported off-site to a storage, disposal or recycling/treatment facility. In some cases they may be transported unpackaged within the precepts of the current IAEA Transport Regulations (SSR-6) [1], such as if they can be shown to meet the requirements for a low level Surface Contaminated Object or Low Specific Activity object, as specified in paragraph 520 of the Regulations. However, as is

often the case, they cannot be transported unless they are either further decontaminated or packaged in some way.

While it is often apparent that many large components contain only surface contamination, it is not easily demonstrated that the SCO limits for inaccessible areas could be met due to non-uniform contamination deposition; nor can the interior areas be readily surveyed without dismantling the object. A steam generator, for instance, has thousands of small diameter tubes that are difficult to access. Decontamination of such large components also presents problems. Where there are issues with access, worker exposure can be increased, contrary to the As Low As Reasonably Achievable (ALARA) radiation safety principle for minimizing radiation doses and releases of radioactive materials.

Packaging of large components to meet standard packaging requirements can also be challenging or impractical due to their size and weight. Although many large objects are generally robust in design and construction due to their use as pressure vessels under other codes, the current regulations require packages that meet tests such as for stacking and free drop that pose significant engineering challenges and prohibitive costs. The physical drop test of a steam generator, for instance, would require a facility with specialized equipment (towers, lifting, drop surface), while a computer simulation of the drop test would require specialized software (finite element, dynamic analysis) and extensive analysis, both of which can be costly. Another option is to dismantle or segment the components in order to use a standard package configuration within the regulations, but this often requires specialized equipment and again can increase exposure to workers. It can be very costly to design and build such process equipment to limit the release of radioactive material from the cutting/dismantling of the component.

Decontamination, designing and fabricating an overpack, or developing segmentation operations and equipment to minimize exposures, can all be expensive options for the industry. As a result, because the IAEA regulations do not have specific provisions to deal with large components, large components are often shipped under special arrangement on a case by case basis. As the volume of these components being transported increases, and industry experience correspondingly grows, it is time to look at including provisions for them in the regulations as these shipments are no longer “special”, but increasingly “routine”.

UPDATES TO CANADIAN REGULATIONS

The Canadian *Packaging and Transport of Nuclear Substances Regulations 2015* (PTNSR 2015) [3], which are based on the IAEA SSR-6 Regulations [1], were recently updated primarily to make reference to the current edition of the IAEA Regulations, which was a recommendation from the IAEA Integrated Regulatory Review Service (IRRS) mission to Canada in 2011. This was accomplished by using ambulatory references, which automatically adopt the latest edition of the IAEA Regulations. At the same time, the opportunity was taken to make a number of improvements to the PTNSR 2015, based on Canadian experience over the years, including adding provisions for the shipment of large objects and removing reference to “special arrangements”. These changes were made recognizing that shipments of large objects have become routine and do not need a special arrangement.

The PTNSR 2015 defines a large object as an object that has been decommissioned from a nuclear facility, that is internally contaminated with nuclear substances meeting the requirements

applicable to an SCO-I or SCO-II as set out in the IAEA Regulations and that cannot be transported in a type of package described in the PTNSR/IAEA Regulations due to its dimensions. The PTNSR 2015 requires anyone wishing to transport large objects to apply for a transport licence from the Canadian Nuclear Safety Commission (CNSC), the competent authority for radioactive material transport in Canada. The information to be included in the application for a transport licence are largely the same as those proposed for an application for approval of SCO-III shipments in the international regulations in the following section.

PROPOSED INTERNATIONAL REGULATIONS

Led by Canada, a set of standard provisions for transport of large components or objects as surface contaminated objects (new SCO-III category), based on the IAEA "performance package" concept, have been developed and submitted for incorporation into the SSR-6 Regulations [1] and advisory material, SSG-26 [2]. Many member state and industry representatives were involved in the development of these requirements for large objects and for their submission to the IAEA for inclusion into the Regulations. The contributions of the following individuals are greatly acknowledged and appreciated:

Mr. Sylvain Faille	Canada
Mr. Jeff Ramsay	Canada
Ms. Karine Glenn	Canada
Mr. Frank Nitsche	Germany
Ms. Nancy Capadona	IAEA
Mr. Jim Stewart	IAEA
Mr. Makato Hirose	Japan
Mr. Iain Davidson	United Kingdom
Mr. Michael Conroy	United States
Mr. Jim Williams	United States
Ms. Betty Bonnardel-Azzarelli	WNTI
Mr. Yoshiyuki Fujita	WNTI

The SCO category was chosen as the most logical place to insert requirements for large components or objects. The term "large object" was therefore selected to be more general in the definition and to align with the SCO terminology.

The key proposed changes to the regulations are described below. New or reviewed text proposed to be added to the regulations is shown in blue. Note that these proposed provisions do not include components such as reactor vessels at this time, due to the more limited experience and greater radioactivity levels with these components. The SCO-III concept lays the groundwork and may be extended to low specific activity (LSA) large object provisions in the future to cover reactor vessels and other similar objects once more international experience is gained in transporting such items.

CHANGES TO SSR-6 REGULATIONS

SSR-6 Section 4

Table 1

Surface contaminated objects

UN 2913	RADIOACTIVE MATERIAL, SURFACE CONTAMINATED OBJECTS (SCO-I or SCO-II or SCO-III), non fissile or fissile-excepted[b]

Para 413:

413. *SCO* shall be in one of ~~two~~ three groups:

(a) *SCO-I*… (as is)

(b) *SCO-II*…(as is)

(c) *SCO-III*: A large solid object which because of its size cannot be transported in a type of package described in these Regulations and for which:

(i) All openings are sealed to prevent release of *radioactive material* during routine conditions of transport;

(ii) The inside of the object is as dry as practicable;

(iii) The *non-fixed contamination* on the external surfaces does not exceed the limits specified in para. 508;

(iv) The *non-fixed contamination* plus the *fixed contamination* on the inaccessible surface averaged over 300 cm^2 does not exceed 8×10^5 Bq/cm^2 for beta and gamma emitters and *low toxicity alpha emitters*, or 8×10^4 Bq/cm^2 for all other alpha emitters, unless it can be demonstrated that, following a transport accident, the activity intake by a person in the vicinity of the accident does not exceed $10^{-6}A_2$ or a corresponding inhalation dose of 50 mSv.

SSR-6 Section 5

Para 517:

517. The quantity of *LSA material* or SCO in a single *Type IP-1*, *Type IP-2*, *Type IP-3 package*, *SCO-III*, object or collection of objects, whichever is appropriate, shall be so restricted that the external *radiation level* at 3 m from the unshielded material or object or collection of objects does not exceed 10 mSv/h.

Para 520:

520. *LSA material* and *SCO* in groups *LSA-I*, ~~and~~ *SCO-I* and *SCO-III* may be transported, unpackaged, under the following conditions:

(a) through (d) as is; …

(e) For *SCO-III*;

(i) Transport shall be under *exclusive use* by road, rail or vessel;

(ii) Stacking shall not be permitted;

(iii) The requirements of para. 624 for a *Type IP-2 package* shall be satisfied, except that the maximum damage referred to in para. 722 may be determined based on provisions in the transport plan (para. 827 bis.(f)), and the requirements of para. 723 are not applicable.

(iv) The object and any shielding are secured to the *conveyance* in accordance with para. 607.

(v) The transport shall be subject to *multilateral approval*.

Para 522:

522. The total activity in a single hold or compartment of an inland waterway craft, or in another *conveyance*, for carriage of *LSA material* or *SCO* in a *Type IP-1*, *Type IP-2*, *Type IP- 3 package* or unpackaged, shall not exceed the limits shown in Table 6. For *SCO-III*, the limits in Table 6 may be exceeded provided it can be demonstrated that, following a transport accident, the activity intake by a person in the vicinity of the accident does not exceed $10^{-6}A_2$ or a corresponding inhalation dose of 50 mSv.

Note added to Table 6 to see paragraph 522 for SCO-III.

SSR-6 Section 8

Para 827 bis.:

827 bis. An application for *approval* of *SCO-III shipments* shall include:

(a) A statement of the respects in which, and of the reasons why, the consignment is considered a *SCO-III*.

(b) Justification for choosing *SCO-III* by demonstrating that:

i. no suitable packaging currently exists;

ii. designing and/or constructing a packaging or segmenting the object is not practically, technically or economically feasible;

iii. no other viable alternative exists;

iv. the advantages and level of overall level of safety and security to conducting the

transport as *SCO-III* exceed any possible disadvantages or risks, respectively.

(c) A detailed description of the proposed *radioactive contents* with reference to their physical and chemical states and the nature of the radiation emitted;

(d) A detailed statement of the *design* of the *SCO-III*, including complete engineering drawings and schedules of materials and methods of manufacture;

(e) All information necessary to satisfy the *competent authority* that the requirements of para. 520(e) and the requirements of paras. 413(c)(iv) and 522, if applicable, are satisfied;

(f) A transport plan covering all activities associated with the shipment, including radiation protection, emergency response, and any special precautions or special administrative or operational controls which are to be employed during transit;

(g) A specification of the applicable *management system* as required in para. 306.

CHANGES TO SSG-26 ADVISORY MATERIAL

Much of the guidance from Appendix VII of SSG-26 was moved into the new proposed regulations or into the corresponding guidance paragraphs for the new proposed regulations. The only information left in Appendix VII is the guidance for the calculation of activity intake for transport of SCO-III based on the Q method. Guidance was added to SSG-6 in the appropriate paragraphs to describe the large object concept, the sealing of openings, determination of surface contamination and dryness. Paragraph 310.5 guidance was also moved to paragraph 413.7 bis., removing any references to special arrangement.

CONCLUSION

There has been an increasing demand in many countries for transportation of large radioactive objects. Many large objects must currently be transported under special arrangement. However, as experience with this type of transport has grown and is becoming more routine, specific regulatory requirements are needed to allow the movement of large radioactive objects without the need for special arrangement. A set of standard provisions for transport of large objects have been developed for incorporation into the international regulations. These have been submitted as part of the current review cycle for the 2012 Edition of the IAEA Transport Regulations.

REFERENCES

1. International Atomic Energy Agency (IAEA) Safety Standard, “Regulations for the Safe Transport of Radioactive Material, Specific Safety Requirements”, 2012 Edition, No. SSR-6, Vienna, Austria, 2012.
2. International Atomic Energy Agency (IAEA) Specific Safety Guide, “Advisory Material for the IAEA Regulations for the Safe Transport of Radioactive Material (2012 Edition)”, No. SSG-26, Vienna, Austria, 2014.
3. Canadian Nuclear Safety Commission (CNSC) Regulation, “Packaging and Transport of Nuclear Substances Regulations, 2015”, SOR/2015-145, Ottawa, Canada, 2015.