U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

Public Meeting: Issues Paper on Revisions to Transportation Safety Requirements and Harmonization with IAEA Transportation Requirements

December 6, 2016

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Division of Spent Fuel Management

12/6/16 Morning Agenda

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

- 9:00 – 10:00am
  - Opening
  - Type C package
  - Low Specific Activity (LSA)-III leaching test
- 10:00 – 10:15am – BREAK
- 10:15 – 11:30am
  - Provisions for large solid contaminated objects (Surface Contaminated Object (SCO-III))
  - Replace radiation level with dose equivalent rate
  - UF_6 packages
- 11:30 – 12:30pm – LUNCH

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Issue 3

Type C Package Standards

Bernard White
DSFM/Spent Fuel Licensing Branch

Public Meeting

December 6, 2016

Type C Package Standards
Background

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- IAEA requirements for Type C standards are contained in SSR-6 paragraphs 669-672
- IAEA Type C Standards apply to Type B packages containing more than:
  - 3,000A_1 or 100,000A_2, whichever is least, for special form material
  - 3,000A_2 for all other radioactive material

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Type C Package Standards
Background

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- IAEA Type C tests include:
  - 9-m drop test
  - Dynamic crush test from a 500 kg mass dropped 9-m onto the package
  - Puncture–tearing test
  - 60-minute fire test and
  - 90 m/s impact test

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Type C Package Standards
Background

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- IAEA Type C acceptance criteria:
  - Dose rate of 10 mSv/hr (1000 mrem/hr)
  - Restrict loss of contents to:
    - $10A_2$ per week for ^{85}Kr and
    - A_2 per week for all other contents

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Type C Package Standards
Background

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- The NRC evaluated Type C Standards in the 2000 Proposed Rulemaking (67 FR 21390) and
  - Proposed to not adopt IAEA Type C standards
  - Asked for input on whether to adopt Type C standards

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Type C Package Standards
Background

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- In the 2004 Final Rulemaking (69 FR 3698), the NRC did not adopt Type C standards because:
  - U.S. regulations in 10 CFR 71.64 and 10 CFR 71.74 for Plutonium air transport contains more rigorous packaging standards than Type C standards
  - Lack of current or anticipated need for such packages

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Type C Package Standards

Factors for Consideration

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Is there a need to transport NRC-approved packages that contain a Type C quantity by air internationally?

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Type C Package Standards

Proposed Actions

U.S.NRC
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Evaluate adding Type C standards to Part 71

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Issue 6

Low Specific Activity III (LSA-III) Leach Test

David W. Pstrak
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Public Meeting

December 5, 2016

LSA-III Leach Test

Background

U.S.NRC
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- LSA-III (10 CFR 71.4)
  - Solids (other than powders)
  - Specific activity 2 x $10^{-3}A_2/g$
  - 10 CFR 71.77
    - Leach test
    - 7 days
    - $0.1A_2$

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LSA-III Leach Test

Issue

- IAEA proposes to remove the leach test
- SSG-26 (Para I.9)
  - Total body intake $10^{-6}A_2$
  - During use of a Type A package
- LSA-III
  - $0.1A_2$ after 7 day leach test
  - Low inhalation hazard
  - <10 mg (Para I.68 and 226.1)

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LSA-III Leach Test

Issue

- IAEA Working Group (2015)
  - Questioned need for leach test
  - Inhalation risk based on physical form and the specific activity
    - LSA-II: $10^{-4}A_2/g$
    - LSA-III: $2 \times 10^{-3}A_2/g$ solids (excluding powders)
  - Release of airborne activity from LSA-III material is highly unlikely

LSA-III Leach Test

Issue

- IAEA working group outcomes (2015)
  - Specific activity limit
  - LSA-III solids (excluding powder)
  - Ensure the effective dose criterion of the transportation regulations is maintained [50 mSv]
  - Leach test does not contribute to the effective dose criterion
  - Leach test is not necessary and should be removed

LSA-III Leach Test

Issue

- NRC assessment
  - Leach test does not decrease the inhalation pathway
  - Leach test is not needed
  - Removing the test reduces regulatory burden
  - Safety is maintained during transport

LSA-III Leach Test

Factors for Consideration

U.S.NRC
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Should the NRC remove the 7 day leach test for LSA-III material?

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LSA-III Leach Test

Proposed Actions

U.S.NRC
United States Nuclear Regulatory Commission
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- In 10 CFR 71.4:
  - Remove the reference to 71.77 in LSA-III definition
  - Remove reference to the leaching test in (3)(ii) within the LSA-III definition
- Remove 10 CFR 71.77
- In 10 CFR 71.100:
  - Remove the reference to 71.77

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LSA-III Leaching

Existing DOT requirement: 49 CFR 173.403 LSA definition:

- (3) LSA-III. Solids (*e.g.,* consolidated wastes, activated materials), excluding powders, that meet the requirements of §173.468 and in which:
  - (i) The radioactive material is distributed throughout a solid or a collection of solid objects, or is essentially uniformly distributed in a solid compact binding agent (such as concrete, bitumen, ceramic, etc.);
  - **(ii) The radioactive material is relatively insoluble, or it is intrinsically contained in a relatively insoluble material, so that, even under loss of packaging, the loss of Class 7 (radioactive) material per package by leaching when placed in water for seven days would not exceed 0.1 A_2; and**
  - (iii) The estimated average specific activity of the solid, excluding any shielding material, does not exceed 2×10^{-3} A_2/g.

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BREAK

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Issue 7

Provisions for Large Solid Contaminated Objects (Surface Contaminated Object (SCO-III))

David W. Pstrak

DSFM/Inspections and Operations Branch

Public Meeting

December 5, 2016

SCO-III
Background

U.S.NRC
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- Shipments of large radioactive objects
  - Steam generators, pumps, pressurizers
  - SCO-I or SCO-II
- "Interim Guidance on Transportation of Steam Generators" (Generic Letter 96-07)
  - NRC and DOT suggestions for transporting steam generators
- 10 CFR 71.41(d) [no change]
  - Special package authorization
  - Large non-standard package

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SCO-III

Background

- IAEA SSG-26 (Appendix VII)
  - "Guidance for transport of large components under special arrangement"
  - Guidance – not regulations
- Member States proposed SCO-III

SCO-III
Background

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SCO-III: A large object for which:

i. All openings are sealed to prevent the 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 surface does not exceed the contamination limits specified in the DOT regulations in 49 CFR 173.443;

iv. The non-fixed contamination plus the fixed contamination on the inaccessible surface averaged over 300 cm^2 does not exceed 8 x 10^5 Bq/cm^2 (20 microcuries/cm^2) for beta and gamma emitters and low toxicity alpha emitters, or 8 x 10^4 Bq/cm^2 (2 microcuries/cm^2) for all other alpha emitters, unless it can be demonstrated that, in accident conditions of transport, 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 (5000 mrem).

SCO-III

Factors for Consideration

U.S.NRC
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- Should SCO-III be added to the domestic transportation regulations?
- Is there a need for the NRC to provide guidance on the provisions for SCO-III?
- Is there a need to update NUREG-1608/RAMREG-003, “Categorizing and Transporting Low Specific Activity Materials and Surface Contaminated Objects”?

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SCO-III

Proposed Actions

U.S.NRC
United States Nuclear Regulatory Commission
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In coordination with the US DOT, make corresponding changes to 10 CFR 71.4.

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Surface Contaminated Object (SCO) - III

Jim Williams

U.S. Department of Transportation

Pipeline and Hazardous Materials Safety Administration

December 6, 2016

Draft 20xx SSR-6 SCO-III Highlights

Background

103 bis. The principal topic that justified a new edition of the IAEA Transport Regulations is the new category of Surface Contaminated Objects (SCO-III).

Table 1

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

Draft 20xx SSR-6 SCO-III Highlights

Classification of Material

413(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;

Draft 20xx SSR-6 SCO-III Highlights

413(c)(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.

Draft 20xx SSR-6 SCO-III Highlights

Requirements and controls for transport of LSA material and SCO in industrial packages or unpackaged

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

(e) For *SCO-III*;

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

(ii) Stacking shall not be permitted;

Draft 20xx SSR-6 SCO-III Highlights

520(e)(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*.

Draft 20xx SSR-6 SCO-III Highlights

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.

Draft 20xx SSR-6 SCO-III Highlights

Approval of shipments

825. *Multilateral approval* shall be required for:

(e) The *shipment* of *SCO-III*.

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*.

Draft 20xx SSR-6 SCO-III Highlights

827(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.

Draft 20xx SSR-6 SCO-III Highlights

827(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;

Draft 20xx SSR-6 SCO-III Highlights

827(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.

U.S. Background

- 1985 IAEA Transport Regulations Adopted Domestically in U.S. in 1996
- Retirement/Dismantling of Several Nuclear Power Stations and Test Facilities
- Degraded Component Replacement at Several Nuclear Power Stations
- 1990s - 2000s - 2010s

U.S. Large Objects/Components

- Reactor Vessels
- Reactor Heads with and without CRDMs
- Pressurizers
- Reactor Coolant Pumps
- PWR Steam Generators with and without Steam Domes
- BWR Steam Dryer
- Up to 20 feet diameter and 70 feet length
- Weigh 50 to 600 tons

U.S. Initial Issues Identified

- Surface Contaminated Object Classification
  - Contamination Limit Compliance
  - Inaccessible Areas
  - Non-Uniform Distribution
- Packaging Requirements
  - Stacking Test
  - Free Drop Test
- Challenges
  - On-Site Dismantlement
  - Packaging
  - Technical Feasibility
  - Logistics

Path Forward

- NRC Generic Letter 96-07, Interim Guidance on Transportation of Steam Generators
  - Components to be Considered as SCO
  - SCO Compliance and Relief
  - Three Meter Dose Rate
  - U.S. DOT Packaging Relief Required
  - Compensatory Measures
  - DOT Exemptions and Special Permits

DOT Applications

- Relief Requested
  - SCO Classification
  - IP-2 Free Drop without Securement Systems
  - IP-2 Stacking Test
  - No Loss Dispersal/ Radiation Level Increase
  - Credit for Pressure Vessels under Other Codes
- Compensatory Measures
  - Case-by-Case
  - Transportation Plans
  - Emergency Plans
  - Administrative Controls
  - Exclusive Use
  - Health Physics Escort
- Equivalent Level of Safety

Contamination Control

- Component External Contamination
  - Decontamination
  - Fixatives
  - Coverings
- Irregular Surfaces
  - Caulking Compounds
  - Coating Polymers

Current Status

- Multiple Origination, Intermediate and Destinations - 500 to 2,000 Mile Transports
- Advisory Material for the IAEA Regulations for the Safe Transport of Radioactive Material (2012 Edition)
  - Appendix VII Guidance for Transport of Large Components under Special Arrangement
- Draft 20xx SSR-6
- 10 CFR 71.41(d) Authorization
- 49 CFR 173.416 and 173.417 Cross References


BIGGE
BIGGE
400 TON CAPACITY
BJ-400-6


LIFTING
TECHNOLOGIE

Summary

Issue 5

U.S.NRC
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Radiation Level or Dose Equivalent Rate?

Bernard White
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Public Meeting

December 6, 2016

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Radiation Level
Background

U.S.NRC
United States Nuclear Regulatory Commission
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IAEA proposed to change from “radiation level” to “dose equivalent rate” in DS495

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Radiation Level

Background

- 10 CFR 20.1003: “Dose equivalent means the product of the absorbed dose in tissue, quality factor, and all other necessary modifying factors at the location of interest. The units of dose equivalent are the rem and Sievert (Sv).”
- IAEA, DS495, Paragraph. 220 bis. “Dose equivalent rate shall mean the ambient dose equivalent or the directional dose equivalent, as appropriate, per unit time, measured at the point of interest and expressed in millisieverts per hour or microsieverts per hour.”

Radiation Level

Issue

U.S.NRC
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Should NRC change “radiation level” in 10 CFR Part 71 to “dose equivalent rate”?

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Radiation Level

Factors for Consideration

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- Are there conflicts with existing radiation protection programs if the NRC uses dose equivalent rate?
- Are there other issues or concerns to NRC licensees and certificate holders?
- Are there other definitions that could be recommended for incorporation in 10 CFR Part 71?

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Radiation Level

Proposed Actions

- Evaluate changing from “radiation level” to “dose equivalent rate” in Part 71
- Determine whether a definition of “dose equivalent rate” is needed in Part 71

Definitions

- 49 CFR 173.403
- *Radiation level* means the radiation dose-equivalent rate expressed in millisieverts per hour or mSv/h (millirems per hour or mrem/h). It consists of the sum of the dose-equivalent rates from all types of ionizing radiation present including alpha, beta, gamma, and neutron radiation. Neutron flux densities may be used to determine neutron radiation levels according to Table 1:

Issue 8

UF_6 Cylinder Plugs

Bernard White
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Public Meeting

December 6, 2016

UF_6 Cylinder Plugs
Background

U.S.NRC
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- 10 CFR 71.55(g)(1) states following HAC:

  "there is no physical contact between the valve body and any other component of the packaging, other than at its original point of attachment, and the valve remains leaktight."

- IAEA proposes to include plugs in DS495

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UF_6 Cylinder Plugs
Issue

U.S.NRC
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IAEA DS495, following the tests for HAC:

> "*there is no physical contact between the valve or the plug and any other component of the packaging other than at its original point of attachment and where, in addition, following the test prescribed in para. 728, the valves and the plug remain leaktight*"

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UF_6 Cylinder Plugs
Factors for Consideration

U.S.NRC
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- Impact of adding the “plug” to 10 CFR 71.55(g)(1)?
- Impact on current package designs if the NRC adds “the plug” into 71.55(g)(1) based on previous evaluations of HAC?

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UF_6 Cylinder Plugs
Proposed Actions

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Revise § 71.55(g)(1) to read:

> "Following the tests specified in § 71.73 ("Hypothetical accident conditions"), there is no physical contact between the valve body or the plug and any other component of the packaging, other than at its original point of attachment, and the valve and plug both remain leak tight;

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Public Comment Period

- Issues paper (ML16299A298)
- FRN (81 FR 83171): 60 day period
  - November 21, 2016 through January 20, 2017
- Electronically on Federal Rulemaking Website: http://www.regulations.gov, **Docket ID NRC-2016-0179**
- Mail comments to: Cindy Bladey, Chief, Rules, Announcements, and Directives Branch (RADB), Division of Administrative Services, Office of Administration, Mail Stop: OWFN-12-H08, U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001

Abbreviations

- CFR – *Code of Federal Regulations*
- CSI – Criticality Safety Index
- DOT – U.S. Department of Transportation
- DSFM – Division of Spent Fuel Management
- HAC – Hypothetical Accident Conditions
- IAEA – International Atomic Energy Agency
- IP – Industrial Package
- LSA – Low Specific Activity
- MOU – Memorandum of Understanding
- NRC – Nuclear Regulatory Commission
- ORNL – Oak Ridge National Lab
- QAP – Quality Assurance Program
- RADB – Rules, Announcements and Directives Branch
- RG – Regulatory Guide
- SCO – Surface Contaminated Object
- SOC – Statement of Consideration
- SRM – Staff Requirements Memorandum
- TI – Transport Index