IAEA TRANSSC MEETING 32
Agenda item 4.4

NEED FOR AN EXPERT WORKING GROUP ABOUT PRESSURE DIFFERENTIAL REQUIREMENT (SSR-6 – Para 621)

World Nuclear Transport Institute
310-312 Regent Street, London, U.K.

Vienna – 15th of June 2016
The IAEA Safety Standards - Regulations for the Safe Transport of Radioactive Material No. SSR-6-2012 Edition, in its paragraph 621 require that all packages of radioactive material (excepted packages, industrial packages IP-1, IP-2 and IP-3, type A, type B(U), type B(M) and type C packages) be designed to meet the following requirement:

“Packages containing radioactive material to be transported by air shall be capable of withstanding, without loss or dispersal of radioactive contents from the containment system, an internal pressure that produces a pressure differential of not less than the maximum normal operating pressure plus 95 kPa.”

The requirement stated above may be difficult to achieve, especially in the case of packagings of large dimensions, such as ISO freight containers which are commonly used as type IP-2 packages for air carriage of tools and components as surface contaminated objects (SCO-I or SCO-II), and it may seem excessively severe for low activity materials with little risk even in case of dispersion, such as excepted packages loaded with solid radioactive materials for example.
The proposal made by WNTI to solve the possible issue
- First proposal submitted by WNTI in the 2013 review cycle
- Submitted for comments to the ICAO DGP in November 2013
- Redrafted proposal submitted in the 2015 review cycle.

The decision taken by IAEA TRANSSC 31 in November 2015
“No action taken. Decision on the proposal is deferred to the IAG (Inter Agencies Group) and other appropriate aviation organizations for further discussion and development.”

Additional information and analysis compared to what was provided in support of the WNTI proposal:
WNTI agrees that this should primarily be discussed with experts before any conclusion can be drawn.

The WNTI suggestion to TRANSSC 32
- Creation of a dedicated WG of experts from aviation organizations, IAEA, interested competent authorities and the industry
The purpose of the experts WG

- To share views on the implementation of para. 621
- To reach a consensus on the interpretation of para. 621
  - If no consensus on the interpretation of para. 621, and/or
  - If the interpretation of para. 621 appears to be difficult to implement,
  To reach an agreement on the optimization of the pressure differential safety requirement which is needed.
- To review SSG-26 & SSR-6 to assure that the wording accurately reflects the consensus on the interpretation of para. 621 and/or the optimization of the pressure differential safety requirement; to propose revision of SSR-6, if needed and revision of SSG-26 and/or additional guidance if needed
- To draft a working plan for further actions, if needed*

The pace of the experts WG

A two days meeting should be enough to provide the adequate recommendations to TRANSSC

*Actions, if needed shall be implemented during the next review and revision cycle
Pressure differential in air carriage
Pressure differential in air carriage

Current requirement:

• 621. Packages containing radioactive material to be transported by air shall be capable of withstanding, without loss or dispersal of radioactive contents from the containment system, an internal pressure that produces a pressure differential of not less than maximum normal operating pressure plus 95kPa.

1. How this requirement should be understood (engineer point of view)?

2. Current practices: three examples to illustrate the issue
   – Uranium ore samples.
   – Large contaminated equipment in ISO container as excepted package, IP-1 or IP-2
   – Solid UF6 samples in excepted packages

3. Suggested list of items to be discussed by the WG
How the requirement in para.621 should be understood?

• Example of a package containing a solid object, solid radioactive material or radioactive material in a capsule (no thermal power, no expected radiolysis phenomena)

• What is required:

  - Containment system shall be able to withstand a differential pressure of 110 kPa. Are there other ways to demonstrate compliance?

At loading: inner pressure = atmospheric pressure at 15°C ≈ 100 kPa

MNOP: increase of inner pressure between 15°C and 55°C = 14.1 kPa

MNOP + 95 kPa

MNOP + 95 kPa = 14.1 + 95

= 109.1 kPa

≈ 110 kPa
Current practices
Solid uranium ore samples: What they look like?

- These are solid natural mineral samples (rock, sand, soil,...) presenting no significant hazard except that their specific activity exceeds the exemption level for natural uranium (1 Bq/g ≈ 80 mg U/kg of material)

Soil samples (few tens of grams per plastic bag)

Geologic carrots (rocks, 8 cm in diameter, up to 1 m long, up to 15 kg each) in plastic tubes closed by adhesive tape, or in plastic sleeves, placed in a rack, made of plywood or natural wood
Current practices
Solid uranium ore samples: How they are carried?

Plastic bags are gathered in fibreboard boxes (from few kg to few tens of kg each), placed in a plywood outer box. The whole package is UN2910

Several racks closed, placed in an outer steel box. The whole package is UN2910
Current practices
Solid uranium ore samples: Why these samples are shipped primarily by air?

• The transport of these samples are needed for uranium exploration activities, often from geographical areas difficult to access (from everywhere in the world to few laboratories).
• It is necessary for the teams of geologists to know as soon as possible the results of analysis of their samples to continue their activities.
• Land transport combined with sea-carriage is not really adapted to meet these constraints.
• Carriage by air offers much more commodities for those shipments.
Current practices

**Large contaminated equipment in ISO container**

- Computer Numerical Controlled lathe used in NPPs for maintenance and/or repairing of control rod drive mechanism: in a 20-foot ISO container as excepted package, IP-1 or IP2 (SCO)
Current practices

Large contaminated equipment in ISO container

- Other equipment used in NPPs for maintenance and/or repairing of control rod drive mechanism: in a 20-foot ISO container as excepted package, IP-1 or IP-2 (SCO)
Current practices

*Large contaminated equipment in ISO container*

- ISO containers have holes fitted with high efficiency filters to allow the equalization of the pressure during the climb and descent phases (9 kPa/min)
Current practices
Why these equipment are shipped primarily by air?

- Equipment used during maintenance or repair operations on NPPs are sometimes cumbersome, often expensive and very specific and usually belong to companies specializing in this type of intervention.
- The distances involved to bring this material in the different NPPs served can be large, and the required delay for intervention may be incompatible with a land and maritime transport.
Solid UF6 samples in excepted packages

Old configuration

- Up to 99 g of UF6 in 13 P10 tubes (not able to withstand 95 kPa gauge pressure)
- P10 tubes in 1 intermediate packaging qualified for 95 kPa (MNOP considered as being nil …)
- One intermediate packaging in an outer packaging

- Closing at 15°C, heating at 55°C, pressure increase = 14kPa
- Max depressurization = 75kPa (ICAO-TI); 75+14 = 89 kPa < 95 kPa
Solid UF6 samples in excepted packages

Current configuration

- Up to 49 g of UF6 in 6 P10 tubes (not able to withstand 95 kPa gauge pressure)
- 2 P10 tubes in 1 intermediate packaging qualified for 150 kPa
- 3 intermediate packagings in an outer packaging

- Closing at 15°C, eating at 55°C, MNOP = 14 kPa
- 14 kPa + 95 kPa = 109 kPa; 109 kPa < 150 kPa
- Strictly compliant with the rules, but more expensive than before
Non exhaustive list of items which could be discussed by the WG

• Minimum ambient pressure inside cargo holds of a commercial aircraft: 25 kPa as stated in ICAO-TI ? or other value?
• Maximum pressure rate variation in cargo holds of a commercial aircraft in phases of climb and descent: 9 kPa per minute (2500 feet / minute) ? or other value?
• Shall depressurization incident be considered as part of normal conditions of transport ?
• Maximum ambient pressure decrease in case of depressurization incident? 50 kPa? 75 kPa? or other value?
• Which are the recommendations against the risk of over pressure for large packages or containers not able to withstand the pressure differential resulting of a depressurization incident ?
• Could/should the requirement and/or the guidance be amended ?