Industry Perspective on NRC Guidance for Dry Storage Confinement Boundary (ISG-25)

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Summary of Industry Perspective

- ISG-25 represents a change in NRC's established regulatory position
- Industry does not understand the problem that the NRC seeks to solve with ISG-25, and is unable to propose alternatives to the guidance because:
  - NRC has not articulated a basis for its change in position on He leak testing (*e.g.*, a safety concern or enhancement benefit)
  - Specific language used in the guidance implies that the new position is a requirement
  - NRC practice has been to impose the new position as requirement
  - Industry's data does not indicate change in position is necessary
- Revision to guidance is necessary to assure effective regulation
- Industry is prepared to respond to NRC's questions on our position (8/4/11 letter)

ISG-25 established new NRC positions

- **Previous NRC position**
  - Many cask licensing bases do not leak test lids and some do not test shells (other testing, e.g. ASME used to satisfy 72.236 (j) and (l))
  - NRC's did not express concern for leakage through base materials (neither in guidance, SER's nor RAI's)
  - Storage confinement boundary not treated the same as transportation containment boundary
- **New NRC position**
  - Helium leak test is necessary to demonstrate base materials are leak tight (Shell, base plate, lid)
  - Applying a standard for transportation containment to storage confinement
  - NRC states that ANSI N14.5 includes base materials, but this is not explicitly stated and industry believes this was not the intent

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1) ANSI N14.5 Leakage Tests on Packages for Shipment

Specific ISG-25 language implies guidance is a requirement

- **Introductory statement is important…**
  - **"This ISG provides guidance to the staff and is not a regulatory requirement."**
- **…but is not consistent with specific language**
  - **"A shop helium leakage test, using ANSI N14.5 [sic], must be performed…"**
  - **"…requirements for the helium leakage test should be specified in the CoC…"**
- **NEI commented on this language in the draft ISG**
- **Similar concern with NUREG-1536**
  - **"The canister shell has been helium leak tested prior to its loading as required by 10 CFR 72.236"(l)**
  - **There is no requirement in 10 CFR 72 for this test**
- **Multiple RAIs indicate ISG is being enforced as requirement**
  1) RAI on HI-STORM 100, May 28, 2010, ML101480829
  2) RAI on HI-STORM 100, June 11, 2011, ML111662010
  3) RAI on MAGNASTOR, July 1, 2011, ML111890351

NRC has not articulated a basis for the new position

- "Basis" articulates the rational connection between the facts found and the choice made.
- Is there a safety concern with existing practices or is this an enhancement?
  - If NRC is addressing a safety concern, what is the NRC's technical basis for concluding that the concern exists? How would the proposed testing resolve the concern?
  - If NRC is proposing an enhancement, how would the proposed testing enhance safety?
  - How does NRC intend to reconcile new positions for casks fabricated/loaded under previous NRC positions?

Required Ingredients for Effective Regulation

- **NRC must articulate a well-reasoned basis for regulatory actions that demonstrates a rational connection between the facts found and the choice made.**
  - ***See, e.g., Shieldalloy v. NRC*; *Honeywell v. NRC*.**
- **This foundational principal of administrative law is appropriately infused throughout NRC's Principals of Good Regulation.**
  - **Clarity: "Agency positions should be readily understood and easily applied."**
  - **Reliability: "Regulations should be based on the best available knowledge from research and operational experience."**
  - **Efficiency: "Regulatory activities should be consistent with the degree of risk reduction they achieve. Where several effective alternatives are available, the option which minimizes the use of resources should be adopted."**
  - **Independence: "Final decisions must be based on objective, unbiased assessments of all information, and must be documented with reasons explicitly stated."**

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Industry testing experience does not reveal concern with base materials

- **Industry experience with helium leakage testing of base materials**
  - **Over 1,000 canisters and casks tested**
    - **Typically include shell, sometimes include baseplate or lid**
  - **100% passed (i.e., met leak tight criterion)[1]**
  - **Range of thickness (1/2 in. to 7 in.)**
  - **Location of testing (Fab. Shop or field depending on component)**
  - **Lids: either forged, made from plate or rolled**
  - **Shell : typically rolled with material working direction parallel to boundary**
  - **Baseplate: either made from plate, or forged with material working direction perpendicular to boundary**

1) Some differences in leak-tight leakage criteria ranging from 10^{-7} to 10^{-4} depending on cask design

Demonstration testing shows no concern

- Investigation of whether helium leakage through stainless steel base material can occur[1]
  - Stainless steel tubes (austenitic, pearlite and nickel-base alloy)
  - Seamless tubing, and sleeves made of cast metal
  - Temperatures up to 800 C
  - He Pressures up to 100 atm
  - Thickness from 0.02in. to 0.14in. (0.5mm to 3.5mm)
- Concluded no helium leakage up to 800 C and 60 atm
  - Determined by leak detectors and indirect methods
  - Leakage in 3 cases determined to be caused by sub-microscopic defects (caused by high temperature and pressure)
  - No helium diffusion observed

1) "Investigation of the Penetration of Metal Tube Walls", I. Lupakov and Y. Kuz'michev", Translated from Atomnaya Energiya, Vol 17, No. 1, 1964.

Anecdotal evidence of leakage through base material is condition specific

- Savannah River bulk tritium shipping packages[1]
  - CV Protective cap (bar stock, machined to 1/8 in. thick)
  - Material working direction perpendicular to containment boundary
  - Microscopic defects
  - Savannah River's recommended solutions in this case
    - Helium leak testing of bar stock, or
    - Use forging instead of bar stock, or
    - Bar stock with cold working (e.g. flow forming)
- This experience is not directly applicable to industry canisters
  - Industry can not identify any relevant experience elsewhere
- This unique case is an insufficient basis for requiring base metal tests

1) *Evaluation of material flaws identified during fabrication leak testing of 304L containment*, Blanton, et.al., Packaging, Transport, Storage & Security of Radioactive Material, 2011 Vol. 22 No. 1

Blanket application of ANSI N 14.5 to storage is problematic

- ANSI N14.5 addresses transportation containments
- Guidance should recognize that individual sections of standards may be used in specific circumstances
  - E.g. cask designer choice to use selected criteria from ANSI N14.5 for storage design does not imply that entire standard applies to storage
- Accordingly, ANSI N14.5 should not be invoked in its entirety to storage confinement because there are:
  - Differences between “confinement” and “containment” boundaries
  - Differences in service conditions
  - Differences in scope of Part 71 and Part 72 (e.g. Part 71 includes materials other than spent fuel, e.g. gaseous materials)
- Current ISG-25 position both interprets and extends the applicability of ANSI N 14.5

Industry's recommended path forward

- **Re-evaluate need for guidance on helium leak testing**
  - Address whether safety concern or enhancement benefit exists
  - Consider ***relevant*** experience (e.g. 1000 industry casks vs. Savannah River example)
- **If guidance is necessary, publish as a Regulatory Guide (the appropriate vehicle for guidance intended for industry)**
  - Articulate basis (i.e. explain the phenomenon of leakage through base materials)
  - Incorporate all aspects of confinement boundary leakage (e.g. ISG-18, SRP excerpts)
  - Base materials: Identify conditions under which NRC considers leak testing unnecessary (e.g. range of material properties, manufacturing processes, and thickness threshold)
  - Type of test: address the use of alternative tests to establish a maximum leakage rate (used when leak-tight is not part of the licensing basis)
  - ANSI N14.5: Avoid blanket use of standard, identify applicable sections/criteria
- **These actions will enable industry to understand and address the problem/NRC concern**

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