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PATRAM 2010

IAEA Self Assessment Package Types Methods for Leak Testing

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Introduction

- This subject arose during the preparation for TRANSCC 18 in 2009
- Industrial & Type A leak test methods and pass criteria were discussed at length
- The regulations specify no loss during testing
- There is guidance in TS-G-1.1 but it did not address the practicalities sufficiently
- Changes had been proposed but were not considered to be immediately acceptable without more in depth consideration by UK industry

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We must however consider the effect of changes on;

- **Public perception of safety**
- **Standards used throughout our industry**
- **Existing, commonly used designs**

whilst recognising that better criteria are perhaps overdue.

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Key general phrases from TS-G-1.1 2008

- 646.1 ‘Type A..intrinsically limit.. radiological hazard’
- 646.2 ‘allowable leakage rate for Type As has never been defined quantitatively’
- 646.3 ‘under normal...radioactive contents cannot escape in quantities that create a radiological hazard’

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More specific guidance from TS-G-1.1 2008;

- 646.4 ‘monitor the package (containing non active material) on completion of a vacuum test ... or other test

- 646.4 ‘an absorbent material may be used as test indicator ...visual inspection’

- 646.5 ‘another detection method would be a simple bubble test’

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So current practice is to use qualitative simple proven methods ;

- **soap/immersion bubble test pre and post impact**
- **tracer simulants – powders/dyed liquids**
- **The first only shows how the package behaved before and after test**
- **The second shows transient leaks**

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The UK Transport Container Standardisation Committee Code of Practice TCSC 1068 goes further, giving guidance on leak detection sensitivity ;

- **Qualitative**
  - **bubble testing -10^{-4} Pa m^3 s^{-1}**
  - **helium sniff testing -10^{-7} Pa m^3 s^{-1}**

- **Quantitative**
  - **gas pressure drops in seal spaces or package cavities 10^{-7} Pa m^3 s^{-1}**

  - **Neither tests will detect transient leaks during an impact.**

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IP-2 Industrial Package

- Immersion tests not practical
- Pressure differential not easy to apply
- Liquid or powder simulants only

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Type A Package

- **Wide variation**
  - **Lead/steel composite flasks**
  - **Glass vials in light packaging**
- **Generally easy to leak test**
  - **Fit leak test points to steel flasks/containment systems**
  - **Vacuum test vials**

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Costs (most expensive first)

- Helium gas - spectrometer
- Pressure fall air pumps and digital manometers
- Soap bubble soap solutions/pumps
- Powder/liquid simulants
- All require skilled/experienced operators

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Accuracy of current practice using simulants

- LSA-II SOLID material contaminated with any isotope.
- Excepted limit for a release package then 10g of material could escape.
- Powder density of 1.8g/cm^3 then some 5 cm^3 of simulant would escape if 10g were released

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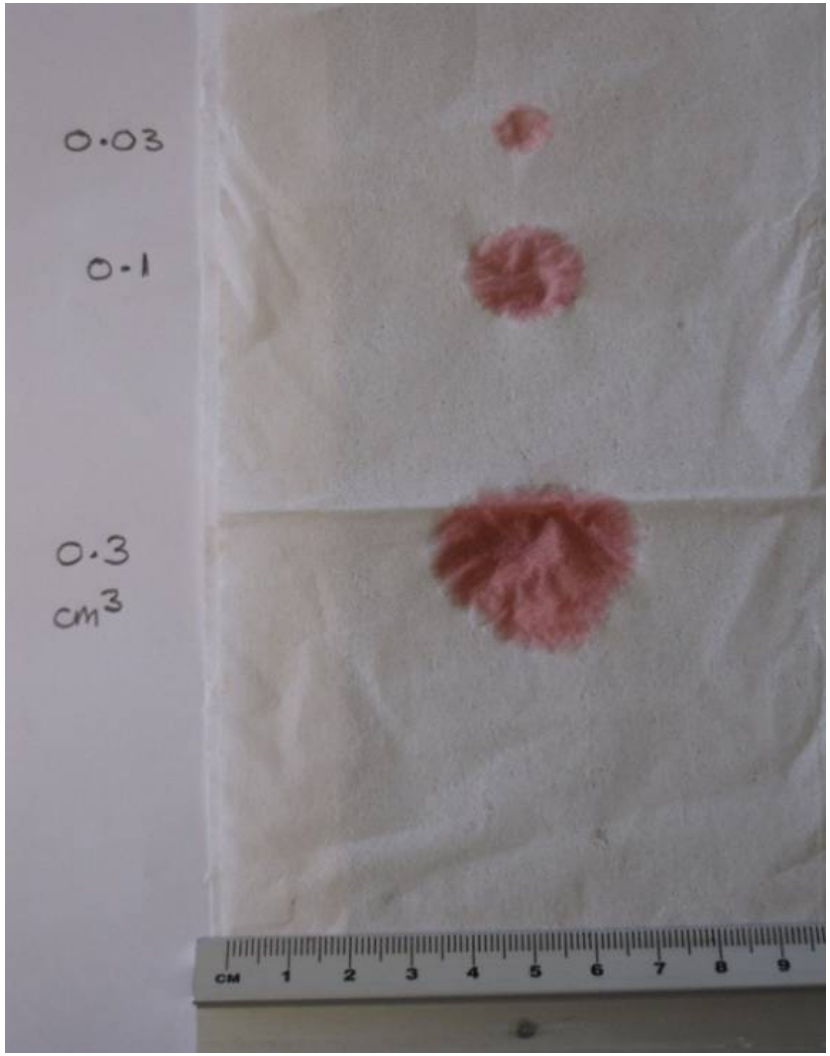

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Case studies

205 litre drum

- maximum permissible differential pressure 30kPa
- Distortion of lid could affect seal integrity at 20kPa
- Experience shows powder simulant best used

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Cuboid package

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Type A

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Type A

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ISO Container

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Conclusions

- Simulants visually observed detect releases of the excepted limit and less
- Bubble testing is meaningful but limited in use to Type A
- Both methods practically demonstrate that no loss occurs
- Powder/liquid simulants are best to detect transient leaks

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