

# **Ageing Management of Spent Fuel Dry Storage Systems An International Perspective**

Session T3: Independent Spent Fuel Storage Installation and  
Certificate of Compliance Renewals - Update on the Latest  
Guidance Documents, Paul Standing, NEFW, IAEA, Vienna



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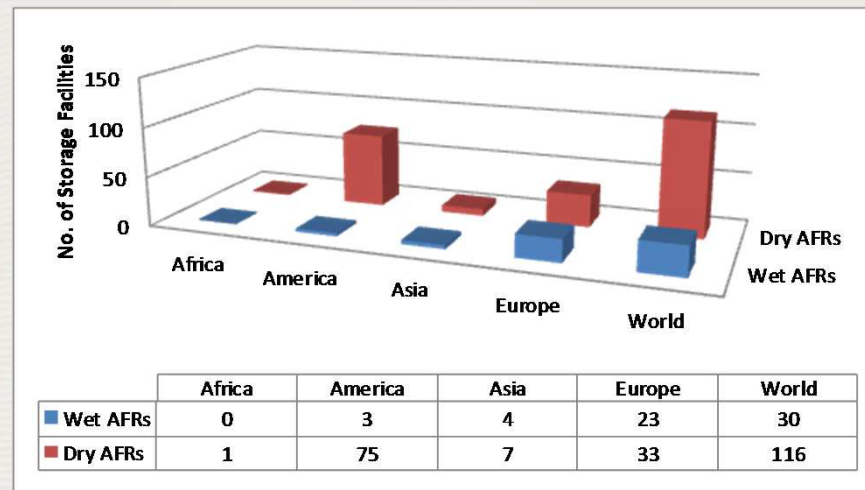
# Content

- Global context – ISFSIs
- Ageing management – International guidance
- Integrated safety case for transport and storage – draft guidance document
- Current international efforts



# ISFSI – Global Context

- Globally there are around 146 independent spent fuel storage installations (ISFSI) for power reactor fuels
  - 80% are dry; the majority being deployed over the last 20 years



- Are there any trends in adopted dry storage technologies?
  - No, Country specific
  - Choice appears to be influenced by a number of factors for example regulatory approval, fuel specific, site specific, cost availability, political.....

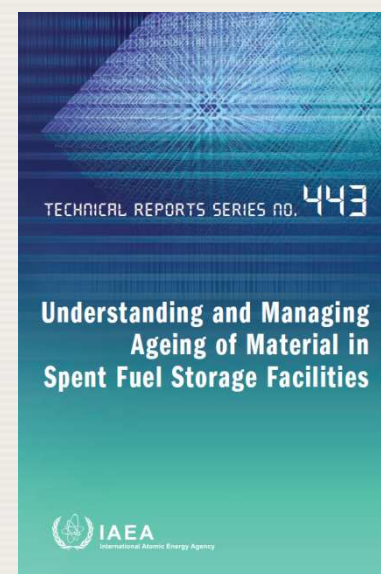
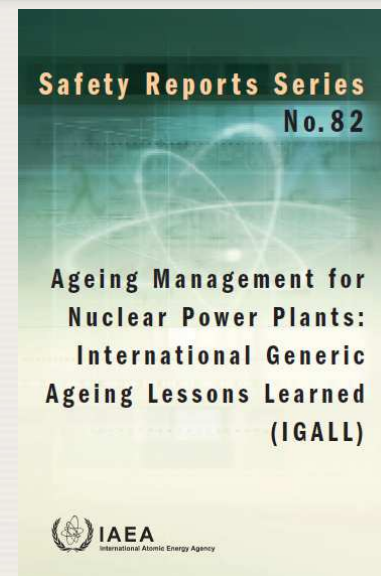
# Dry Storage - Global Context

- United States of America
  - >95% of dry storage systems are based on welded canisters stored on pads (Yellow)
- In a global context the largest ISFSI is vault type (Green)



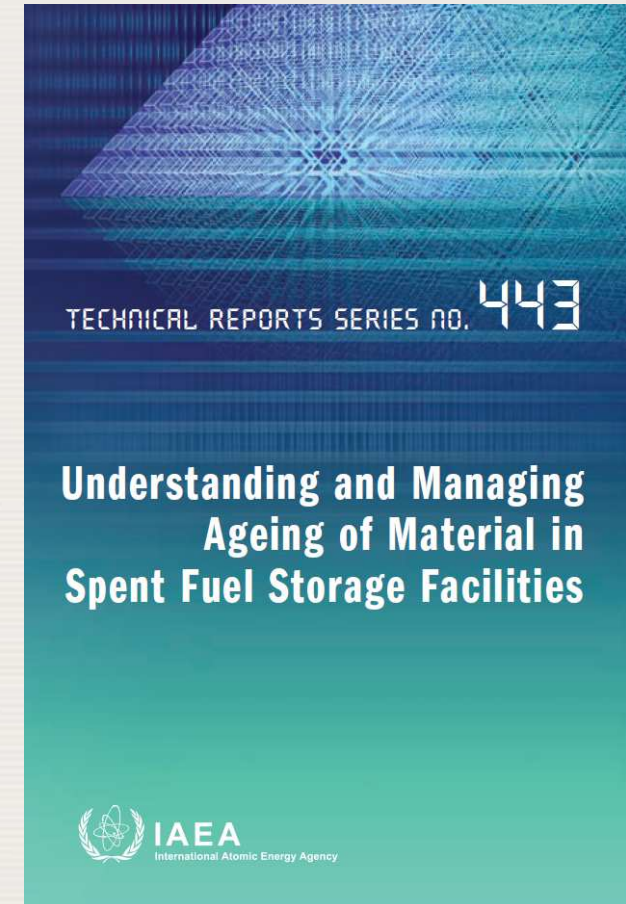
# Ageing Management – International Guidance

- IAEA efforts on ageing management, similar to the USA, were initially focused on nuclear power plants
  - IAEA published some guidance in 1990 (latest guidance is 2015)
- Ageing management in spent fuel storage
  - IAEA CRP on ageing of materials in spent fuel storage facilities (1999-2003)
  - Final report published in 2006 (TRS-443)



# IAEA-TRS-443

- Reports
  - Summaries material behaviour of spent fuel and materials used in ISFSI
  - Examples of:
    - Ageing management guidance
    - Experience
  - Limited survey of ISFSI operators
  - Recommendations (10)
    - For example...All ISFSIs should have effective AMPs that address the durability of their SSCs



# IAEA-TRS-443 – Example Guidance

## Ageing Management German Safety Guidance Requirements (2001)

- Inspection
  - Observation programme on long term ageing effects during the storage period
- Design
  - Components developed for the entire period of use (storage system and the storage facility)
- Retrieveability
  - Safety related systems and components must be guaranteed for the entire service period, to enable cask handling inside the facility at any time
- Review



Periodicity of observation programme  
IAEA  
Learning from experience

# Technical Underpinning

- The IAEA has been reporting on both spent fuel and storage systems performance since 1981 through its coordinated research projects (CRPs)
  - BEhaviour of spent Fuel Assemblies in Storage (BEFAST), 1981-1996
  - Spent fuel Performance Assessment and Research (SPAR), 1997-
  - DEMOnstrating Performance of Spent Fuel and Related Storage System Components during Very Long Term Storage (Demo), 2012 -

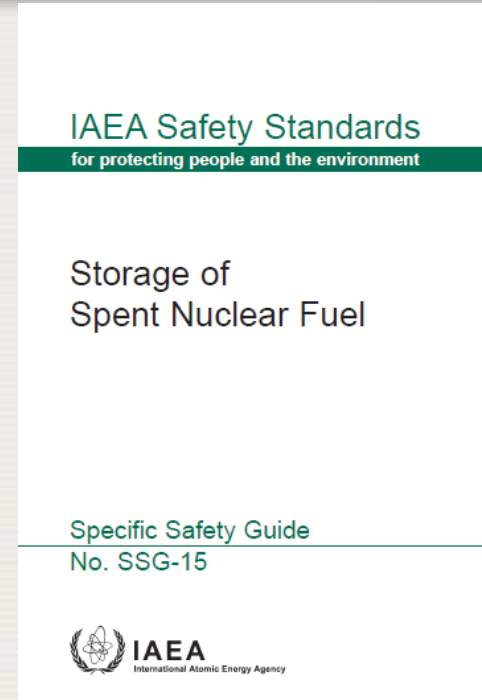


NEW - IAEA-TECDOC-1771



# International - Safety Guidance

- Specific safety guidance for the storage of spent nuclear fuel was published in 2012 (IAEA-SSG-15)
- Guidance related to ageing management:
  - Maintenance, inspection and testing
  - Storage beyond the original design lifetime
  - Retrieval of Spent Fuel
  - Transport after storage (Para 6.137)



# Draft Guidance Document

- 2010
  - Side meeting at the International Conference on Management of Spent Fuel from Nuclear Power Reactors (2010)
    - Discussions on the requirement for an integrated safety case (Transport and Storage) for dual purpose casks
- 2011
  - Joint working group was set-up to address the issue (WASCC/TRANSCC)

# Draft Guidance Document

## Objective

1. To provide an IAEA document containing recommendations and guidance for the structure and contents of an Integrated Safety Case for a dual purpose storage and transport cask.
2. Recommendation for changes to be made to existing IAEA documents

## WG activities (2011 – 2013)

- Three Technical meetings held to develop technical report and information exchange
- Base document:
  - Technical Guide – Package Design Safety Reports for the Transport of Radioactive Material (PDSAR) by European Association of Competent Authorities



# Working Group Discussions

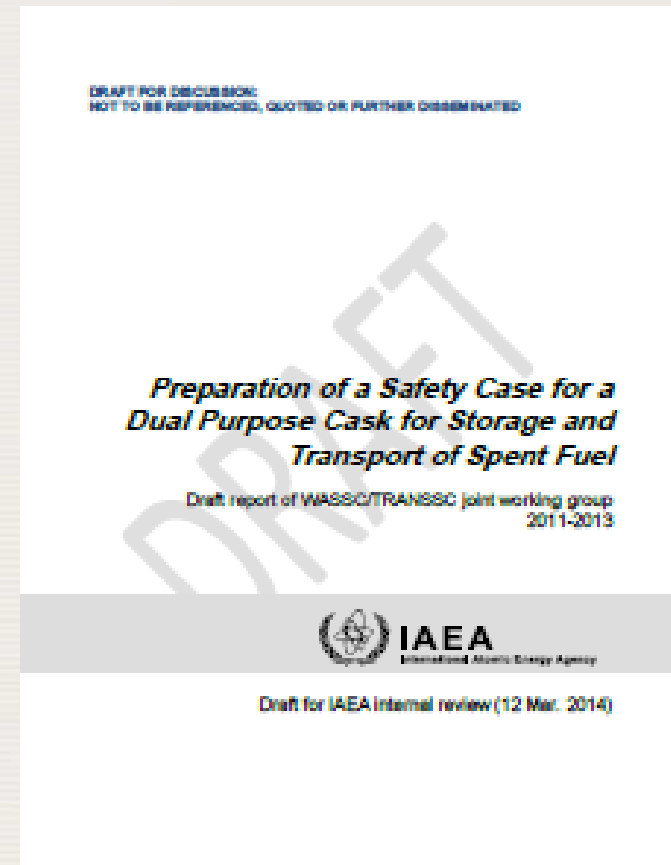
- How to define acceptance criteria
- Ageing consideration for long-term storage and transport after storage
  - Design / Fabrication
  - Operation
  - Retrievability
  - Ageing management programme
- Licensing consideration
  - Licensing for both storage / transport
  - Licensing renewal (esp. for transport)
  - Change of transport regulations / new technology development



- *And...*
  - *Inspections before transport*
  - *Records during fabrication/operation*

# Draft Guidance Document

- Ageing Management (section 1.7)
- Mainly for metallic casks, consideration for canisters being added later
- Publication process in progress (to be published as a TECDOC)
  - <http://www-ns.iaea.org/downloads/rw/waste-safety/disp/dual-purpose-spent-fuel-cask-draft-tecdoc-2014.pdf>



# Current Efforts on Providing Guidance

- 2014
  - International Workshop on ‘Development and Application of a Safety Case for Dual Purpose Casks for Spent Nuclear Fuel’
  - Recommendation – To produce A document providing guidance for developing an AMP specifically for DPCs should be developed:
    - Experience compendium;
    - Lessons learned, design changes towards inspection for ageing management;
    - AMP for records management and ageing management for regulatory changes and technological advances;
    - Maintenance of the Safety Case during the storage period;
    - Examples of safety-related components requiring reference within an AMP.



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within an AMP.

# Current Efforts on Providing Guidance

- 2015
  - Approach being taken to address the recommendation is to initiate a CRP to collect information on ageing management programmes in use or to be developed
  - CRP was approved 2015
- 2016
  - Looking to initiate CRP T21028 on 'Ageing Management Programmes for Dry Storage Systems'

# IAEA CRP T21028

- Research proposals are solicited which address one or more of the following topics:
  - Ageing management plans in use - for the dry storage system(s) in operation;
  - Plans for development of an AMP - for operators that will need an AMP for dry storage;
  - Criteria for identifying the systems, structures and components (SSCs) to ensure spent fuel dry storage systems are safe, and that spent fuel is transportable;
  - Methodology for selection and examples of SSCs that are identified for inspection;



# IAEA CRP T21028

- Examples of maintenance and inspection on:
  - Dry storage systems;
  - Transport casks (for on-site transport or off-site transport);
  - A loaded cask system to qualify it for transportation (for on-site transport or off-site transport).
- Further Information is provided at the following link:

<http://cra.iaea.org/crp/project/ProjectDetail?projectId=2103&lastActionName=OpenedCRPList>

# THANK YOU FOR YOUR ATTENTION



# Abbreviations

- ISFSI – Independent spent fuel storage installation
- AMP – Ageing management programme
- CRP – Coordinated research project
- SSCs – Systems, Structures and Components
- TRS – Technical report series
- TECDOC – Technical document
- WASSC – Waste safety standards committee
- TRANSCC – Transport safety standards committee