Radioactive Waste Management

‘Protecting the Investment’: Guidance on the Interim Storage of Radioactive Waste Packages in the UK

Chris Naish, Paul Skelton and Simon Wisbey

RWM UK

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Overview

This presentation will cover:

- Introduction to the UK guidance on interim storage
- Waste stores in the UK and the Store Operations Forum
- Example Approach 1 – Operational limits and conditions
- Example Approach 2 – Monitoring the evolution of package performance
- IAEA Independent peer review

Scope of Radwaste storage in the UK

- The NDA owns and manages 16 legacy sites across the UK
- Radwaste stores are in operation at 8 of them
- There are an additional 17 non-NDA sites that hold HAW, 2 of which have operating stores
- Further stores are planned – About 40 may be required in total
- Potential to ‘share’ regional stores being explored

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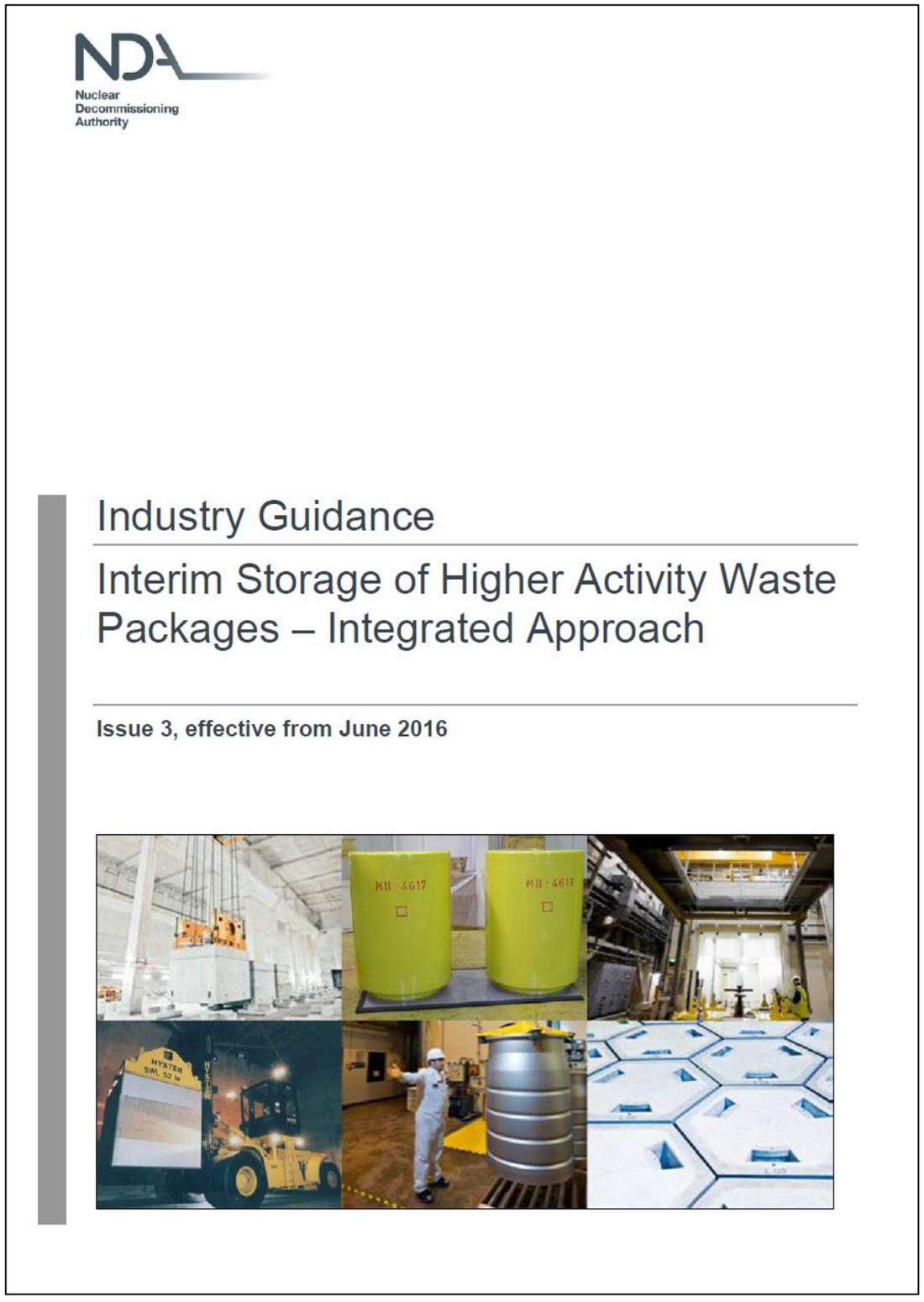
UK Industry Guidance

Created by NDA Integrated Project Team (2009 – 2011):

- Issue 1 – Trial use (2011)
- Issue 2 – Formal publication (2012)
- Management passed to Store Operations Forum (2013)
- Issue 3 – Expanded range of materials, decay storage, asset care (2016)



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Structure of the Industry Guidance

Waste packages:

- Package design, performance, evolution and management, lifetime care

Store structure:

- Design, longevity, environmental control, operational limits and conditions

Operations:

- Package movement, emplacement, safety functions, life-limiting features

Assurance:

- Baselining, monitoring and inspection, samples, knowledge management

Guidance provided throughout:

- Good practice – 30 headline recommendations to Store Operators
- Approaches – 28 specific ‘how-to’ descriptions
- Toolkits – 23 techniques derived from operational experience and R&D

Store Operations Forum

- All UK store operators are members
- Annual meetings to exchange information and good practice – key issues:
  - Store environment – preserve packages / manage evolution
  - Baselining of package condition – on entry to store
  - Monitoring – evolution of package condition with time
  - Records – need to be comprehensive and complete
  - Asset Management – long term maintenance and life extension of store
- Dedicated ‘Knowledge Hub’ for access to shared information
- Bilateral meetings, audit support and encourages visits to UK waste stores to share observations

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Example Approach 1 – Operational Limits and Conditions (OLCs)

OLCs are set for the key environmental control parameters:

- relative humidity (RH)
- temperature (T)
- surface concentration of potentially corrosive contaminants (e.g. Cl^-)

General principles relevant to all package and store types:

- avoid extremes of temperature, contrasting air and waste package surface temperatures, leading to condensation/deliquescence
- avoid major fluctuations in relative humidity, as transient conditions increase the risk of condensation/deliquescence
- prevent ingress of corrosive contaminants into the store, including salt particles and aerosols from external sources

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Operational Limits and Conditions for stainless steel waste packages

		Temperature [T/°C]			
		-10 to 10(b)	10 to 30	30 to 50	> 50(c)
		Chloride deposition density [Cl/µg cm^{-2}](a)			
Relative Humidity [RH/ %]	<40(d)	<[100]	<[10]	<[1]	<[0.1]
		>[100]	[10-25]	[1-10]	[0.1-1]
			>[25]	>[10]	>[1]
	40 to 60(d)	<[100]	<[10]	<[10]	<[1]
		>[100]	[10-100]	[10-25]	[1-10]
			>[100]	>[25]	>[10]
	60 to 90(d)	<[100]	<[10]	<[10]	<[1]
		>[100]	[10-100]	[10-25]	[110]
			>[100]	>[25]	>[10]
	>90(d)				

De-minimis - ideal conditions to avoid localised corrosion

Tolerable - moderate risk of pitting corrosion

High - risk of relatively penetrating damage, mainly due to SCC or MIC; only potentially tolerable as a transient condition

Notes:

(a) Based on the amount of chloride alone, assumed to be present in a soluble form in mixtures of NaCl, $CaCl_2$ and $MgCl_2$.

(b) At temperatures below 10 °C (the 'CPT' for 316L in $FeCl_3$), corrosion is severely inhibited.

(c) Limited data above 50 ºC, hence the maximum recommended temperature.

(d) Desiccation of waste packages and particular store features may define a lower OLC for RH, but no data are presently available to quantify a minimum level. Values below 40%, between 40-60%, and above 60% are expected to produce different levels of dilution of $MgCl_2$ and $CaCl_2$. Above 60% RH, wetting of NaCl is expected, but SCC is unlikely. An upper limit of 90% is recommended to reduce the risk of MIC.

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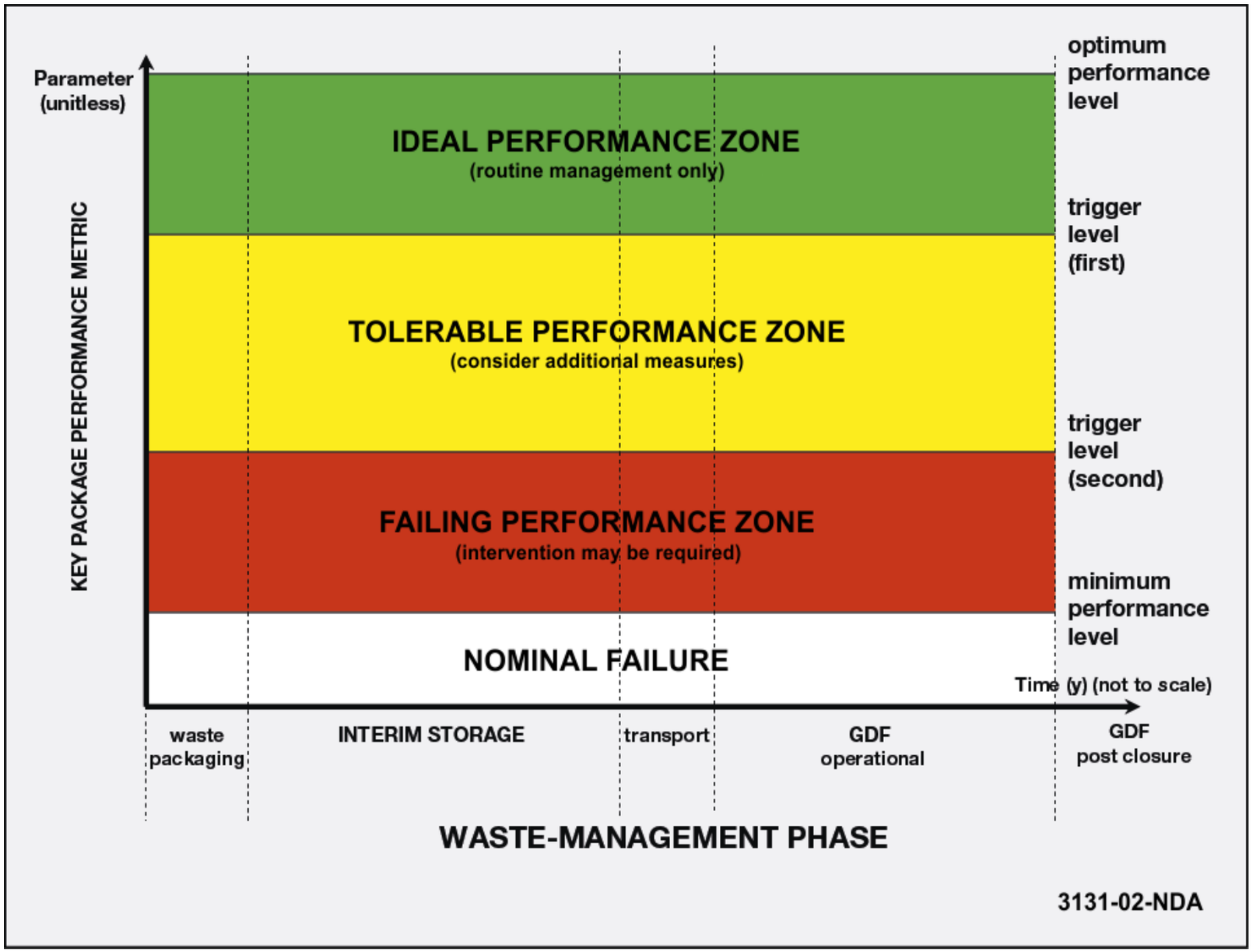
Example Approach 2 – monitoring the evolution of package performance



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Performance zones

Three bands defined:

- *Ideal*, where evolution has no negative bearing on safety performance
- *Tolerable*, where evolution has led to detectable change, while retaining acceptable performance
- *Failing*, where evolution has led to a significant loss in performance, but a ‘margin of safety’ is retained

Threshold values for any parameter:

- *‘Optimum performance’*, which defines the target specification
- *‘1st trigger level’*, which defines the transition from ideal to tolerable performance
- *‘2nd trigger level’*, which defines the transition from tolerable to failing performance
- *‘Minimum performance’*, which defines the lowest performance at which the safety function is still provided

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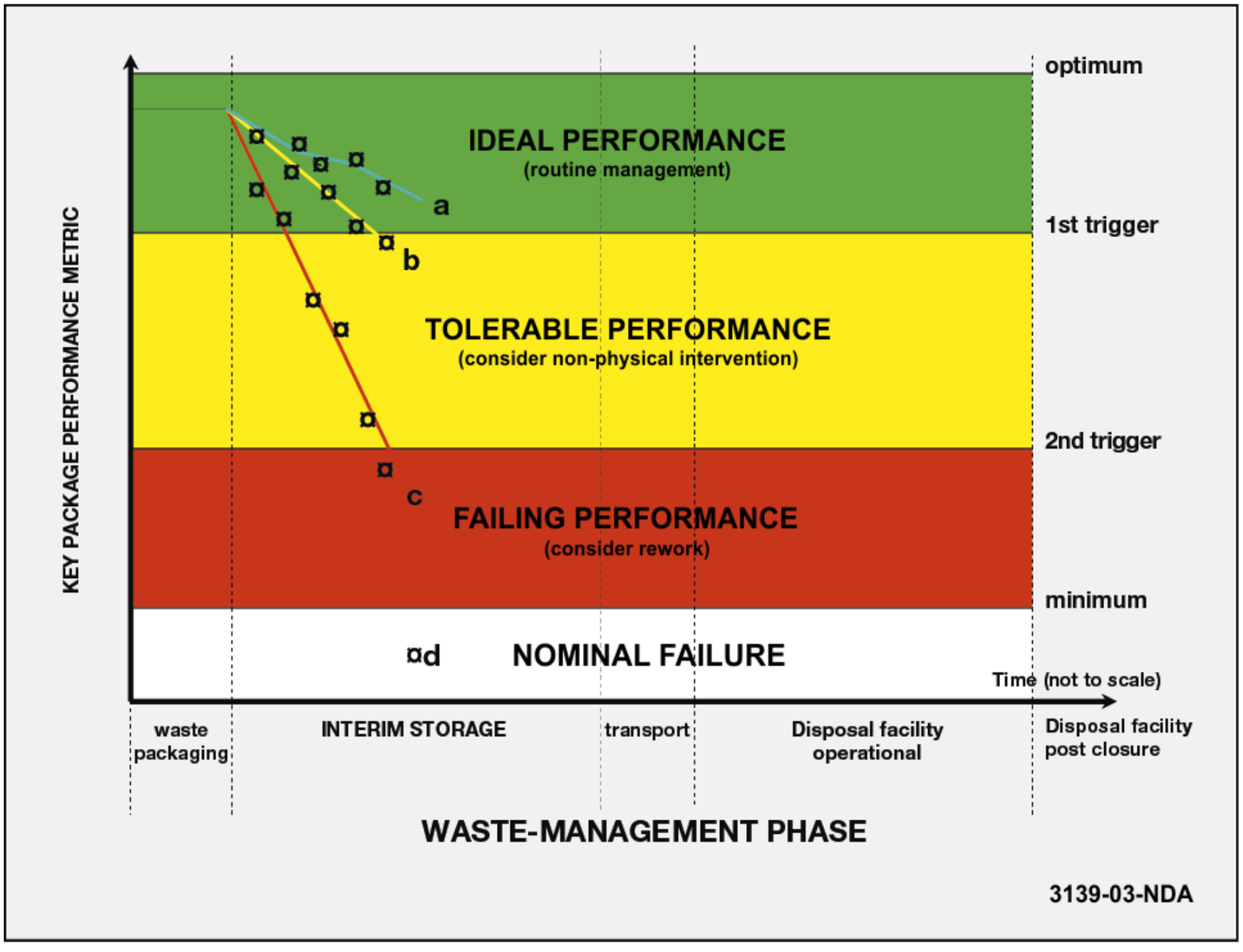
Hypothetical Patterns of Package Evolution



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IAEA independent peer review of the UK Industry Guidance on Interim Storage

Objectives:

- To review and assess the integrated approach to the storage of higher activity waste packages, based on IAEA Safety Standards and proven international practice and experiences
- Provide conclusions and comments on the approach, including recommendations for improvements / gaps to be addressed

Timetable:

- Team visit (Sellafield & Trawsfynydd) – Dec 2012
- Final Report issued – July 2013 (with 20 recommendations)

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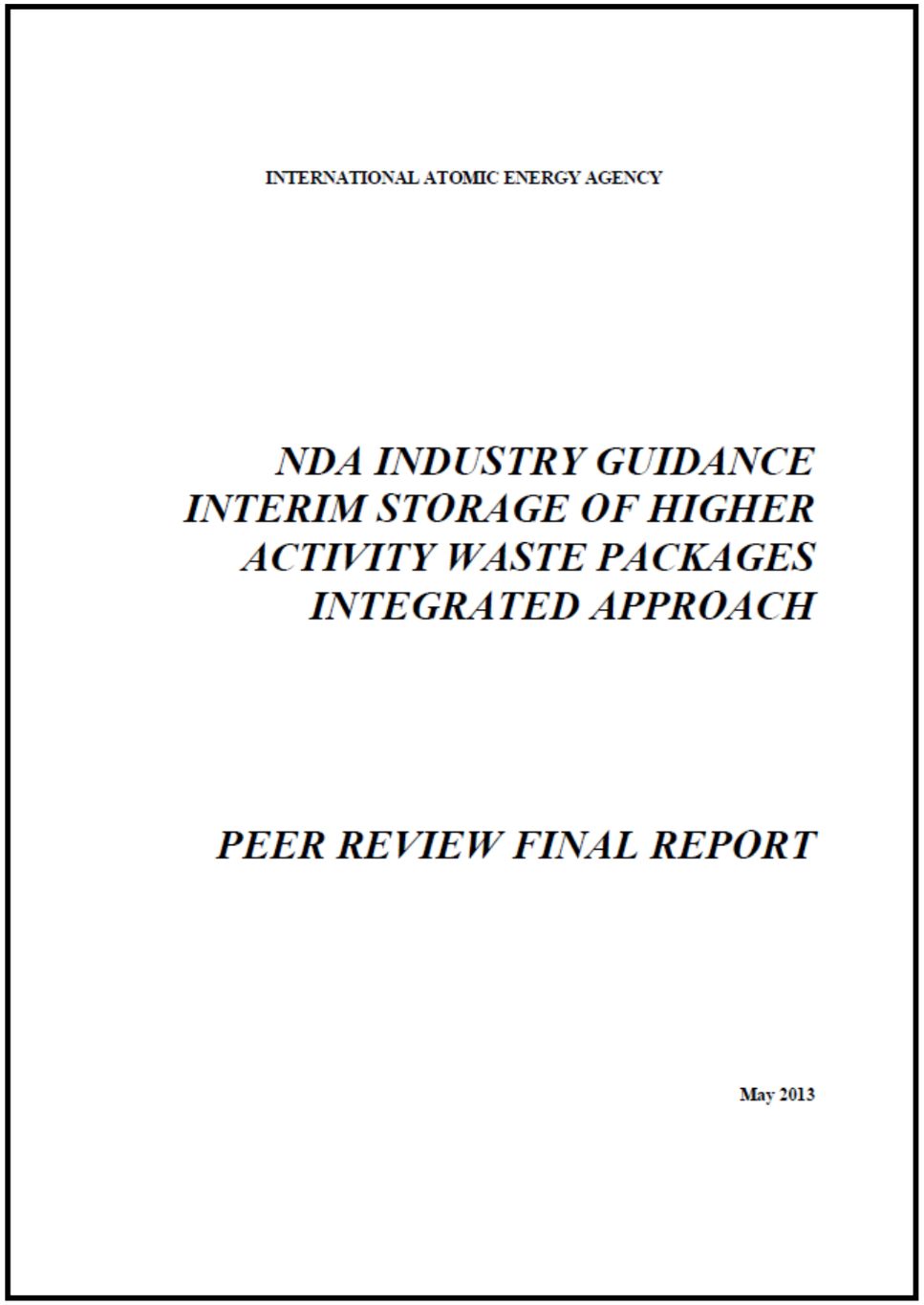
Outcomes

- The IAEA Peer Review Team were supportive of the Industry Guidance:
  - *"The NDA is to be commended for its initiative … addressing the challenges of 100 years of storage of HAW."*
  - *"… the Operators' Forum and Industry Guidance can be seen to play a timely role in collection and dissemination of experience and knowledge."*
  - *"The standardization of design for HAW facilities … is a commendable example of good practice."*
- All 20 recommendations were addressed prior to the recent update


INTERNATIONAL ATOMIC ENERGY AGENCY

NDA INDUSTRY GUIDANCE INTERIM STORAGE OF HIGHER ACTIVITY WASTE PACKAGES INTEGRATED APPROACH

PEER REVIEW FINAL REPORT

May 2013

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Overall summary

Industry Guidance:

- Developed to provide long-lasting stores with benign storage environments
- Highlights the importance of baselining, package monitoring facilities / strategy, and subsequent interventions
- Practical application growing – valued by all parties to ‘protect their investment’

Store Operations:

- Multiple stores in operation – many more to come
- Active ‘Forum’ which encourages and facilitates sharing of experience

External peer review:

- Very positive – findings have informed development of operations and guidance

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- Thank you for your attention,

- Please feel free to ask any questions either now or on a one to one basis
- Alternatively you can contact me at paul.skelton@nda.gov.uk
- The guidance can be accessed via our website at: www.gov.uk/rwm
- For regular updates please subscribe to our e-bulletin news alerts at: https://public.govdelivery.com/accounts/UKRWM/subscriber/new

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