

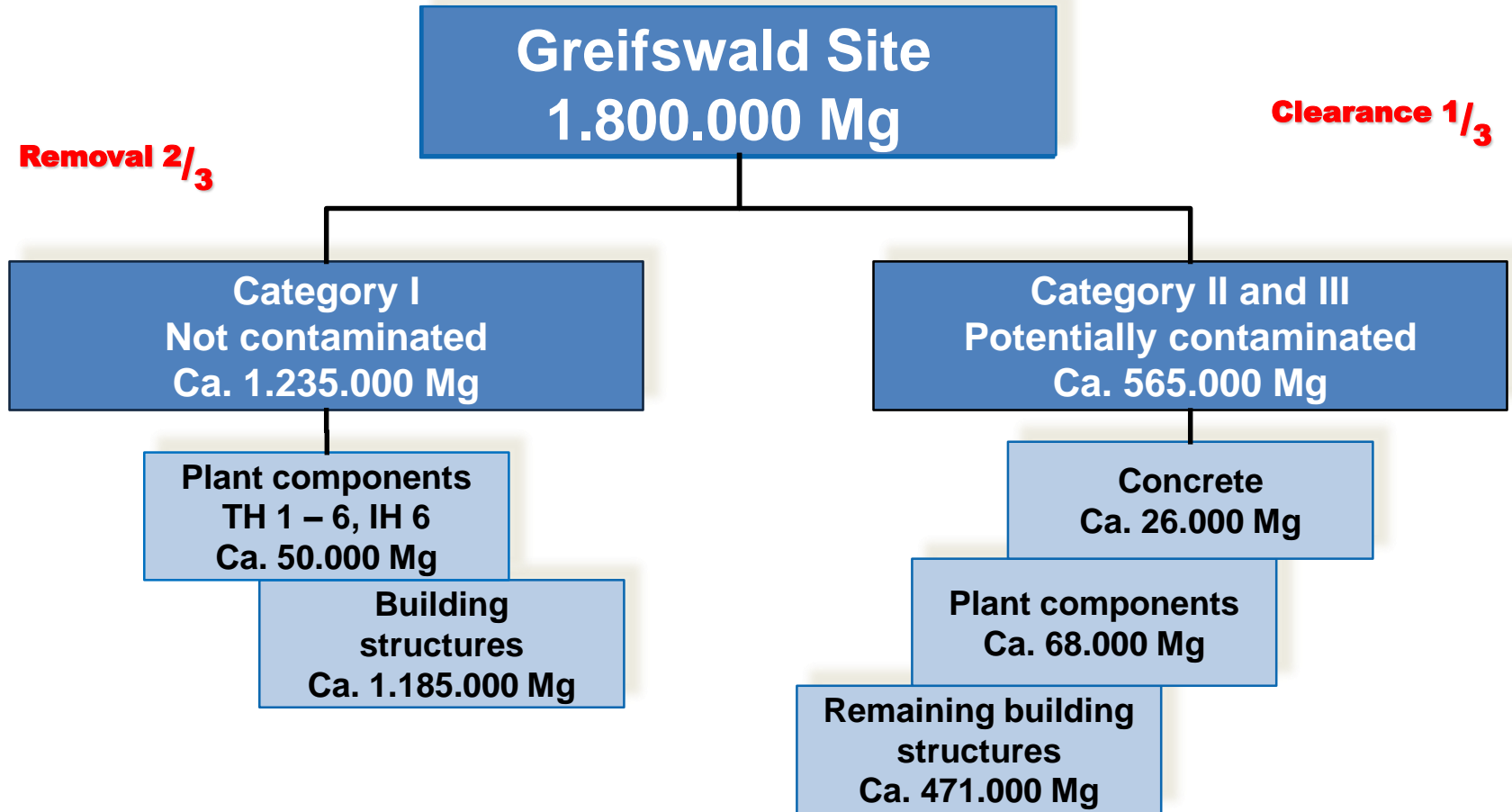
## **Clearance, Reuse, Recycle, disposal as VLLW.**

**A role for all of these options in the optimisation of rad waste management in decommissioning – more work needed on optimisation**

**Claudio Pescatore, OECD NEA**

## Decommissioning

- **Produces large amounts of**
  - materials and
  - radioactive waste
    - Radioactive waste is a relatively small fraction of the total, but it absorbs most of the budget for materials management
    - Most of the radioactive waste is only slightly contaminated
- **What is then radioactive waste?**
  - how many categories?
  - which are disposal routes?
  - what is the tolerance for other practices than concentration and final disposal?
    - Clearance, conditional release, conditional disposal in landfills, reuse



**(outside of controlled zone, no clearance procedure)**

## National policies and strategies regarding WM of slightly contaminated materials vary across countries

- **Some countries implement both clearance and surface disposal of VLLW, plus they implement recycle/reuse for waste minimization (even if they also have a LLW facility), e.g.,**
  - Spain, United Kingdom, Sweden
- **Germany implements clearance and recycling, does not have a VLLW categories but has conditional disposal in landfills.**
  - Germany, also has a deep disposal repository for non-heat emitting waste
- **France follows the path of no clearance, but has VLLW category.**

## Disposal and WM Strategy in France

**Short-lived**

**Long-lived**

<p><b>Very low level</b></p>	<p><b>Surface disposal; not a nuclear facility; no clearance (Centre de Morvilliers)</b></p>	
<p><b>Low level</b></p>	<p><b>Surface disposal (Centre Aube + Centre MANCHE)</b></p>	<p><b>Being defined, but at some depth</b></p>
<p><b>Intermediate level</b></p>	<p><b>Disposal planned at 500 m; Area identified and studied; construction to be requested in 2015; possible operations in 2025</b></p>	
<p><b>High level – No SF</b></p>	<p><b>Disposal planned at 500 m; Area identified and studied; construction to be requested in 2015; possible operations in 2025</b></p>	

## Disposal and WM Strategy in Germany

Short-lived

Long-lived

<b>NO Very low level</b>	Clearance or disposal in landfills under “clearance”. Recycling/reuse are also used.
<b>Low level</b>	<b>Deep disposal</b> (Konrad, mine at 1000 metres, <b>Morsleben</b> )
<b>Intermediate level</b>	
<b>High level + SF</b>	<b>Deep disposal</b> (Gorleben ?)

## Disposal and WM strategy in Sweden

Short-lived

Long-lived

Very low level	Municipal landfills (after “clearance”) On site disposal at nuclear power plants	
Low level	Disposal at about 80 m (SFR, Forsmark)	Being defined (but at great depth)
Intermediate level		
Spent Fuel –	Disposal at 500 metres; <b>application for authorization on 16 March 2011.</b> (SFK, Forsmark)	

**No HLW**

## Waste amounts depend on the management strategy



## France, 2050 Percentage by volume and activity (Total volume : 3.328.000 m<sup>3</sup> ; VLLW : 1.768.000 m<sup>3</sup>)

Short-lived

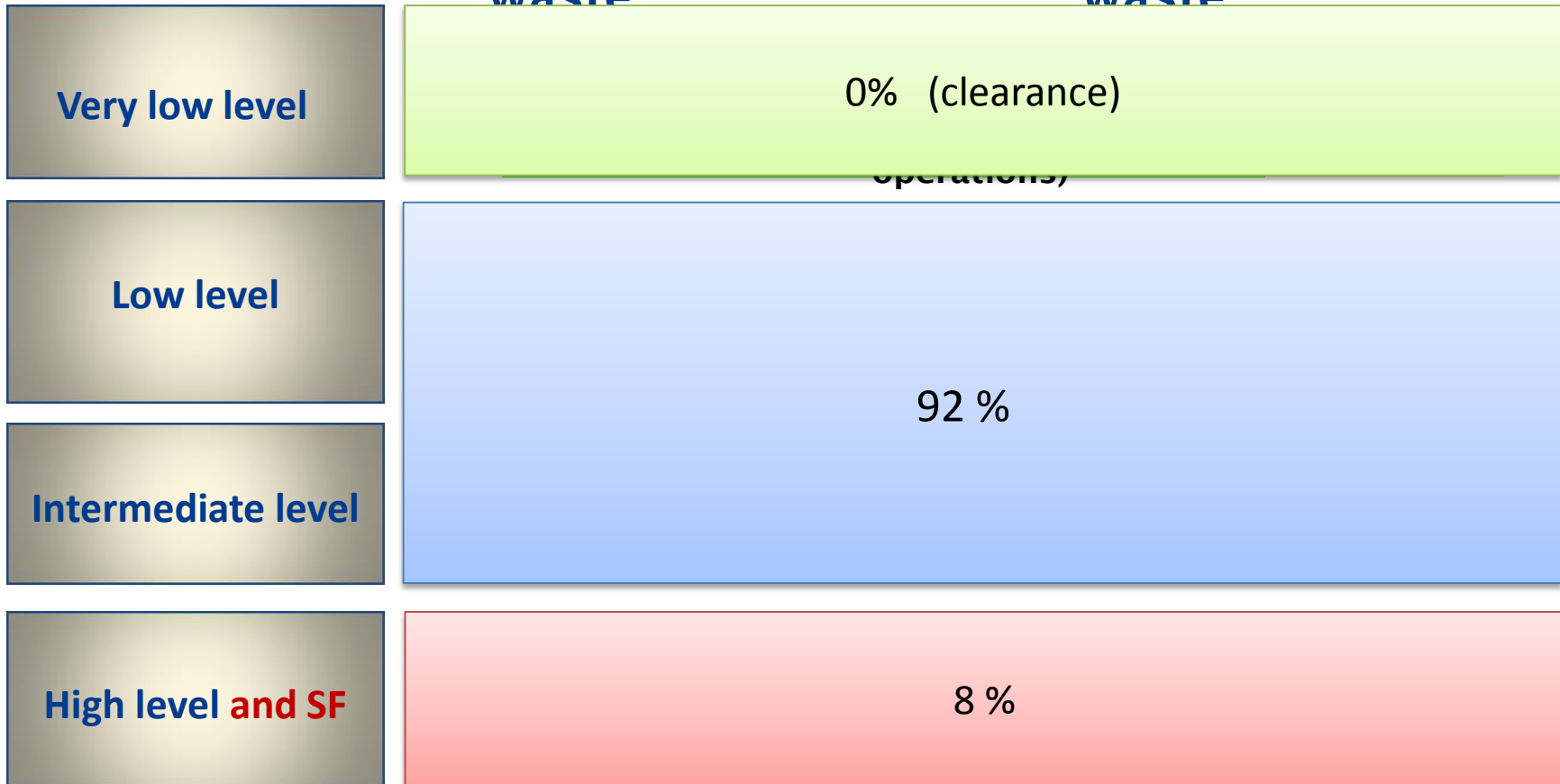
Long-lived

	Short-lived	Long-lived
Very low level	<p>Volume : 46,8%</p> <p>Activity : 0,000 006 %</p>	
Low level	<p>Volume : 46 %</p> <p>Activity : &lt; 0,017%</p> <p>(86.5%)</p>	<p>Volume : 4,95 %</p> <p>Activity : 0,005%</p> <p>(9.3%)</p>
Intermediate level		<p>Volume : 1,96 %</p> <p>Activity : 2,3%</p> <p>(3.7%)</p>
High level – No SF	<p>Volume : 0,24 %</p> <p>Activity : 97,65%</p> <p>(0.44%)</p>	

## Germany, 2080 Percentages by volume (Total volume : 304.000 m<sup>3</sup>)

Short-lived  
waste

Long-lived  
waste



## Sweden: over lifetime of nuclear park (Total volume : 408.000 m<sup>3</sup>; VLLW: 198.000 m<sup>3</sup>)

Short-lived

Long-lived

Very low level	< 48,5%	
Low level	< 49,01% (95%)	< 2,4% (5%)
Intermediate level		
SF – No High level	12000 tonnes - U	

- **In practice:**
  - the more volume minimization is practiced, the less waste will need to be dealt with
  - Germany < Sweden < France
- Recently it has been found, in France (no clearance), that decommissioning will generate larger VLLW volumes than forecast: either a new VLLW facility or additional waste minimization approaches are needed (or both), but waste minimization is preferred.

## IMPORTANCE OF HAVING CHOICE...

- **More waste categories**, including VLLW
- More waste minimization paths, such as recycling and re-use, clearance, conditional release, conditional disposal
- **More types of disposal facilities**: from nuclear-licensed to special but not nuclear-licensed, to municipal landfills

## The cost equation?

- VLLW is much less costly to manage than LLW.
  - Some countries have recently introduced or are introducing this category. Try this in the first place.
  - Getting additional disposal sites can be a public acceptance issue
  - Conditional disposal in landfills is akin to VLLW disposal, possibly with less of an acceptance issue. Try this as well.
- Clearance reduces waste even more.
  - There is a large industrial experience in clearance procedures.
  - In some cases, however, clearance may be complicated/expensive, to the point that LLW disposal is sometimes preferred
  - Public acceptance may become an issue
- Recycle and reuse are also useful to reduce waste
  - There may be limitations of scale, acceptance by other industries, public

**A lot has been done and is known on clearance**

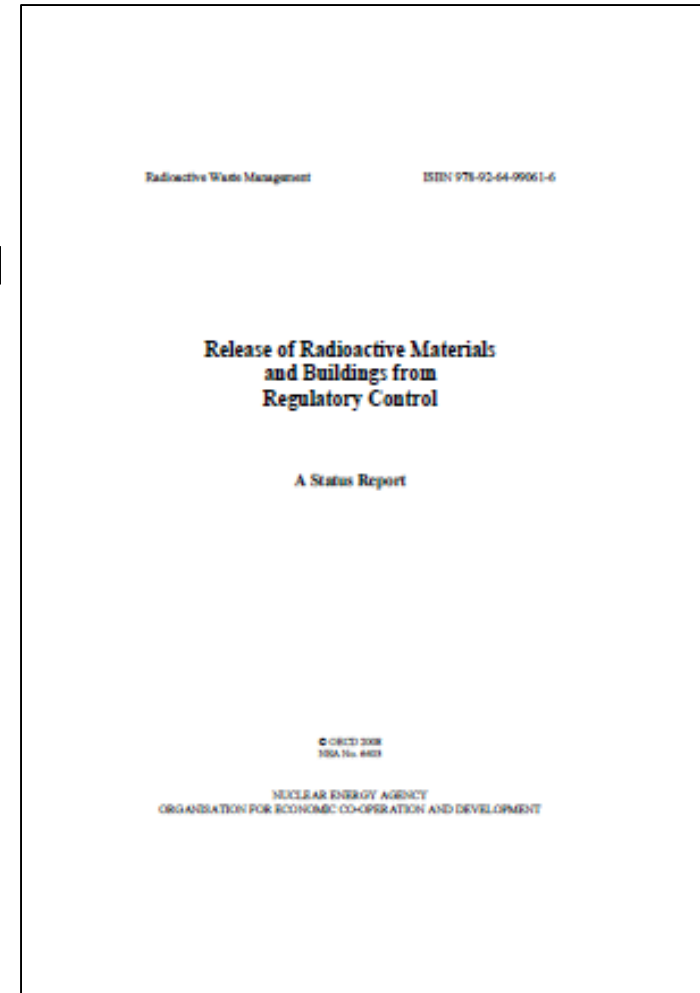
## NEA\WPDD report of 2008 : Release of Radioactive Materials and Buildings from Regulatory Control

- Information collected from nine countries on the legal context for **clearance**, including
  - clearance levels; facility-specific assessments; the extent of clearance at a particular site; radionuclide vector/radiological fingerprints; averaging criteria; and clearance/release procedures.
- The report provides comprehensive information on **an array of approaches to clearance**.



## NEA\WPDD report of 2008 : Release of Radioactive Materials and Buildings from Regulatory Control

- The report has only few pages on recycling, disposal as VLLW, interim storage
- The treatment is only qualitative and not based on the countries questionnaire. The most accurate statement is likely this: “*there are economically viable alternatives to clearance, but they have to be judged in the context of the existing nuclear programme and of the general waste management strategy*”.



## ROOM FOR MORE IN DEPTH ANALYSIS

- At the NEA to start work on optimisation
- Topical session at WPDD Meeting in November 2014
  
- PHASE-1: WORK WITH THE COUNTRIES WHO HAVE THE COMPLEMENTARY APPROACHES TO UNDERSTAND HOW THEY CAME ABOUT
  
- PHASE-2 IDENTIFY THE GOOD QUESTIONS AND GOOD PRACTICES FOR DEFINING OPTIMIZATION
  
- Some of the very issues that will be discussed in this study are also important in view of the implementation of a national WM plan required in the EU countries by the Directive of 2011 .