Approaches to the release from regulatory control

Ernst Warnecke; IAEA / NSRW

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Principal Options

- Use of ‘Clearance levels’ (e.g. Germany)
  - Unconditional or conditional release of materials after final release measurement
- No use of ‘Clearance levels’ (e.g. France)
  - Disposal of materials that have been in contact with radionulides

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IAEA recommendations

- IAEA established recommended values for exclusion, exemption and clearance in Safety Guide RS-G-1.7 based on 10 µSv/a concept
  - Exclusion: Cannot be regulated (natural radiation)
  - Exemption: Not to be regulated ('trivial' risks)
  - Clearance: Released from regulation ('trivial risks')
- Recommendations for 'unconditional' clearance
- Quantitative radionuclide levels established via calculation of scenarios in a safety assessment
- 'Summation rule' applies in case of a 'mixture of radionuclides'

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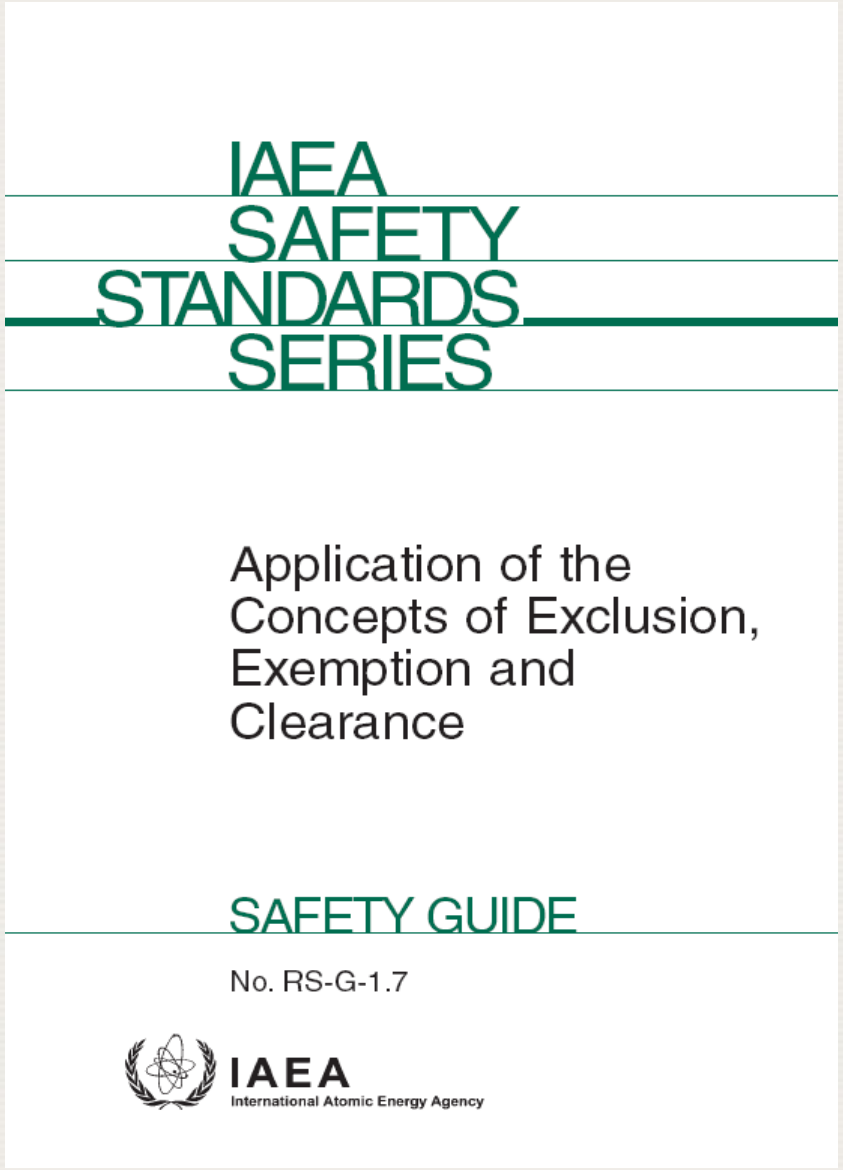
IAEA recommendations



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Clearance in Germany

Germany follows the IAEA approach and allows also conditional clearance options

German Radiation Protection Ordinance

- Paragraph 29: General clearance requirements
- Annex III: Clearance Levels for clearance options
- Annex IV: Further requirements, e.g. averaging procedures, ‘sum formula’ for a mixture of radionuclides

Clearance options

- Unconditional clearance
- Conditional clearance

Dose criterion

- Effective dose to any member of the public is at most in the range of **10 µSv/yr**

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Options for Clearance

- **"Unconditional clearance":**
  - no requirements on the destination of materials
- Options for unrestricted clearance:
  - solids, liquids
  - building rubble and excavated soil > 1000 Mg/yr
  - land areas (release of sites)
  - buildings for reuse
- **"Conditional clearance":**
  - requirements on the destination of materials
- Options for clearance for specific purposes:
  - solids and liquids for disposal, e.g. in a conventional landfill
  - buildings for demolition only
  - Scrap metal for recycling

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Clearance Levels of the German Radiation Protection Ordinance (Excerpt)

Radionuclide	Exemption value				Clearance								
					unrestricted clearance of				Clearance of			Half-lives	
	activity in Bq	specific activity in Bq/g	HASS activity /1/100A_1 in Bq	surface conta-mination in Bq/cm^2	solid substances, liquids, except for Column 6 in Bq/g	demolition waste, excavated soil of more than 1,000 t/a in Bq/g	soil areas in Bq/g	buikdings for reuse and further use in Bq/cm^2	solid substances, liquids, except for Column 6 in Bq/g	building for demolition in Bq/cm^2	metal debris for recycling in Bq/g		
1	2	3	3a	4	5	6	7	8	9	10	10a	11	
Mn-53	1 E+9	1 E+4		1 E+2	1 E+3	1 E+3	3	1 E+3	1 E+3	2 E+4	1 E+4	3,7 E+6	a
Mn-54	1 E+6	1 E+1	1 E+10	1	4 E-1	3 E-1	9 E-2	1	1 E+1	1 E+1	2	312,2	d
Mn-56	1 E+5	1 E+1	3 E+09	1	1 E+1	1 E-1		1	1 E+1	9 E+3	1 E+1	2,6	h
Fe-52	1 E+6	1 E+1	3 E+09	1 E+2	1 E+1	7 E-2		1	1 E+1	2 E+3	1 E+1	8,3	h
Fe-55	1 E+6	1 E+4	4 E+11	1 E+2	2 E+2	2 E+2	6	1 E+3	1 E+4	2 E+4	1 E+4	2,7	a
Fe-59	1 E+6	1 E+1	9 E+09	1	1	2 E-1	6 E-2	1	7	3 E+1	1 E+1	45,1	d
Fe-60+	1 E+5	1 E+2										1,0 E+5	a
Co-55	1 E+6	1 E+1	5 E+09	1	1 E+1	1 E-1		1	1 E+1	1 E+3	1 E+1	17,5	h
Co-56	1 E+5	1 E+1		1	0,2	6 E-2	2 E-2	1	2	6	0,4	78,8	d
Co-57	1 E+6	1 E+2	1 E+11	1 E+1	2 E+1	3	8 E-1	1 E+1	1 E+2	1 E+2	2 E+1	271,3	d
Co-58	1 E+6	1 E+1	1 E+10	1	0,9	2 E-1	8 E-2	1	9	3 E+1	1	70,8	d
Co-58m	1 E+7	1 E+4	4 E+11	1 E+2	1 E+4	1 E+4		1 E+3	1 E+4	1 E+9	1 E+4	8,9	h
Co-60	1 E+5	1 E+1	4 E+09	1	0,1	9 E-2	3 E-2	4 E-1	4	3	0,6	5,3	a

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Summary: German situation

- Well established clearance levels (in Radiation Protection Ordinance)
- Various options for unconditional and conditional clearance
- Quantitative values for individual radionuclides for the various clearance options
- Long lasting experience with clearance
- Technical prerequisites are developed / in place
- Well regulated and controlled process
- Widely applied in order to recycle valuable materials and to minimise the generation of radioactive waste

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Clearance / disposal in France (I)

- Clearance
  - No ‘unconditional’ / ’universal’ clearance levels
  - Policy decision / public acceptance
- Extensive use of near surface disposal
  - La Manche repository is closed (500 000m³)
  - Aube repository in operation (1 000 000m³)
  - Aube was planned for ~30 a at ~30 000m³/a
  - Decrease to 13 000m³/a (volume reduction)
  - Disposal of 220 000m³ (end of 2008)
  - Disposal costs: about 2500 Euros/m³
  - Less incentives for volume reduction

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Closed repository (Centre de la Manche)

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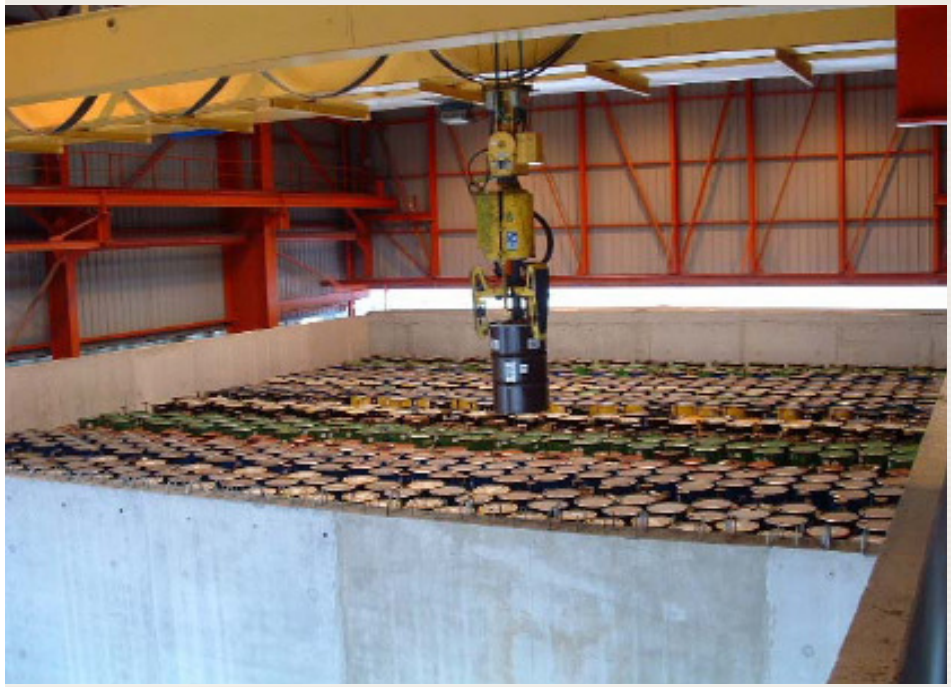
Centre de l'Aube: Site and disposal cells

Aube: Loading / grouting a disposal cell



Clearance / Disposal in France (II)

- Very low level waste (VLLW) disposal
  - Materials used for a nuclear activity are at least VLLW if in contact with radionuclides
  - Two routes for waste:
    recycling in nuclear the industry or disposal
  - Dedicated VLLW repository (Morvilliers) is in operation since 2003
  - Similar to a repository for industrial waste
  - VLLW amounts are expected to increase with increasing dismantling operations
  - VLLW disposal costs: ~ 500 Euro/t

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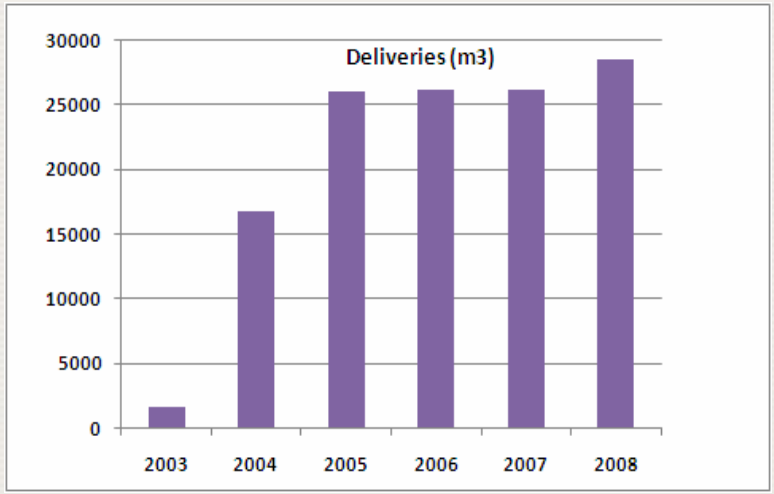
VLLW repository (Morvilliers)

(and Centre de l'Aube in the back)

Capacity : 650,000 m3
Start up : October 2003

Disposed volume (end 2008) :~115,700 m3



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Morvilliers: Construction of a disposal cell

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Morvilliers: Operation of a disposal cell

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Morvilliers: Closing of a disposal cell

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Clearance / Disposal in France (III)

- Methodology / Approach
  - ‘Zoning’ concept
  - Distinction between nuclear and conventional areas
- Conventional area: release from regulatory control, if necessary after decontamination
  - No universal clearance levels
  - Decisions taken on a case-by-case basis
- Nuclear area: no release from regulatory control
  - nuclear recycling or disposal

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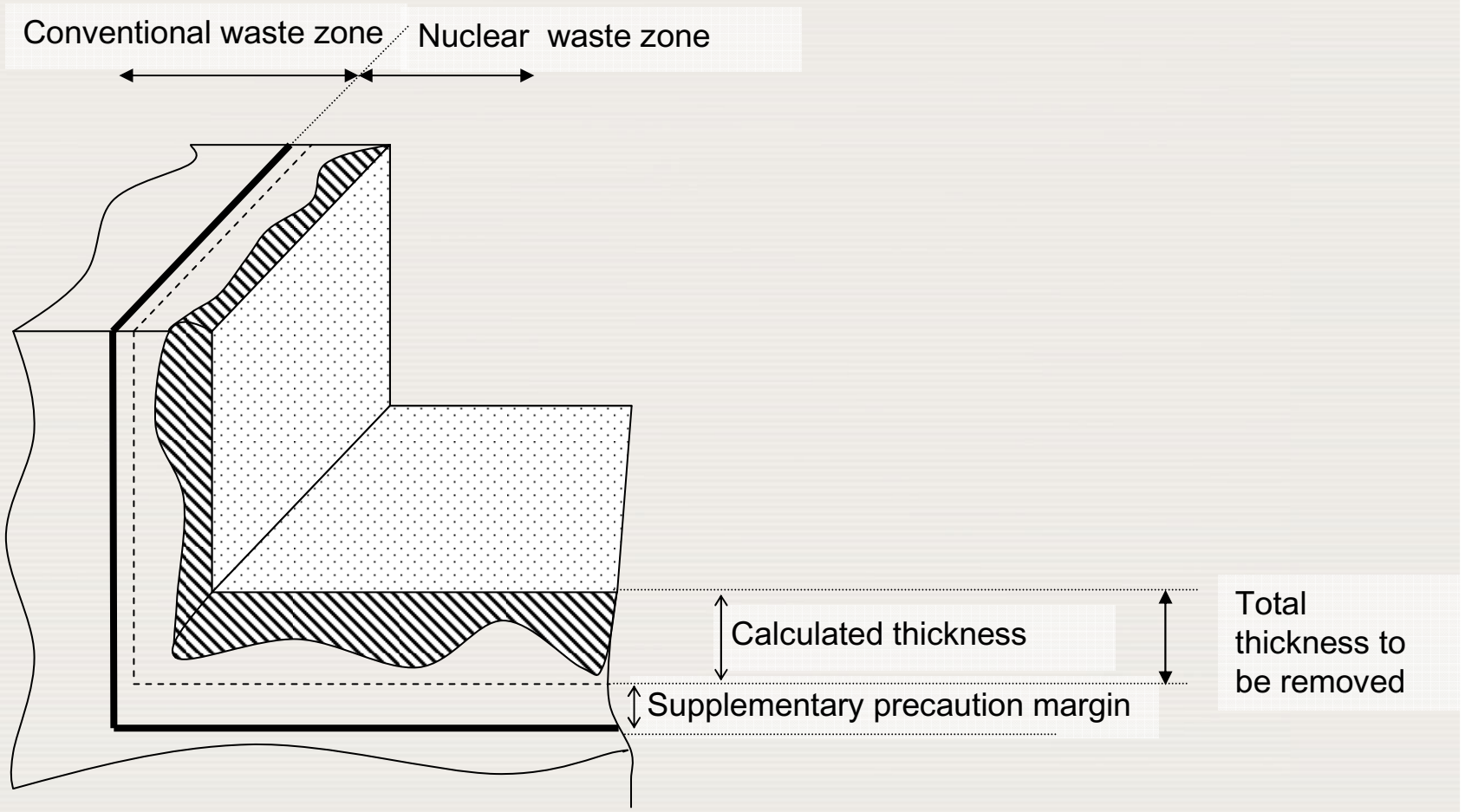
Zoning / Safe termination of practices



French radioactive waste classification

<table>
<tr><th>Half-life
Activity</th><th>Very short half-life
(< 100 days)</th><th>Short half-life
(≤ 31 years)</th><th>Long half-life
(> 31 years)</th></tr>
<tr><td>Very Low Level (VLL)</td><td rowspan="4">Management by radioactive decay</td><td colspan="2">Surface disposal (CSTFA)
Recycling systems</td></tr>
<tr><td>Low Level (LL)</td><td rowspan="2">Surface disposal
(CSFMA)
except some tritiated waste and some sealed sources</td><td>Dedicated sub-surface facility under study</td></tr>
<tr><td>Intermediate Level (IL)</td><td rowspan="2"></td></tr>
<tr><td>High Level (HL)</td><td></td></tr>
</table>

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Summary / Conclusions

- Different options: ‘clearance’ versus ‘disposal’
- Participating countries should be clear on how to proceed
- Important decision for decommissioning AND radioactive waste management / disposal
- Note!: Managing small waste amounts is much more expensive than managing large amounts
- Minimisation of radioactive waste
  - Precautionary act: avoid facing huge disposal costs
  - Disposal costs were always higher than expected

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Summary / Conclusions

- This workshop will focus on the German clearance approach and the associated technology

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THANK YOU