

# Belgian acceptance criteria for NORM residues: theory and practice

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## Current NORM regulations

### Directive 96/29/EURATOM

Transposed into Royal Decree of July, 20 2001

⇒ Restricted list of « *work activities* »:

- Phosphate industry;
- Zircon industry;
- Extraction of rare earths;
- Tin foundries;
- Production of thoriated welding electrodes.

Industries of these sectors compelled to make **dose-assessment** of workers + population: assessment must address residues management

Impact must **< 1 mSv/y** – if not, corrective measures or licensing



## FANC proposals for operational criteria



Up to now, treatment of residues considered on a **case-by-case** basis

⇒ No *generic* criteria

⇒ No regulatory framework for NORM residues *outside* the list of work activities

- ⇒ NORM waste in regulatory “*no man’s land*” between industrial waste and radioactive waste;

FANC project of regulatory development:

⇒ Translate dosis criteria into operational acceptation criteria (activity concentration) for each type of residue treatment (landfill, use in cement industry,...)



## Duties of residues producers



For NORM residues **producers**:

⇒ Use of clearance/exemption levels of EC document “Radiation Protection 122 II”

Derived from a dose criterion of **0.3 mSv/y**

Exposure scenario's RP122 II (population):

- 
- *Person living in a house near a heap/landfill*
  - *NORM additives in building materials for public spaces/sport ground*
  - *Person living in a house with building materials containing NORM*
  - *Person living a house built with undiluted NORM as unshielded surface cover*

⇒ NORM residues producers (belonging to “positive” list) must characterize their residues:

**If levels < RP 122 II:** no additional constraints for residue management (**exception:** mono-landfill):  
clearance from further surveillance

**If levels > RP 122 II:** follow-up necessary (at least *administrative* follow up – record-keeping)



## Acceptation criteria for NORM residues treatment facilities

Processing of (not exempted) NORM residues = **work activity** in the sense of Royal Decree

⇒ NORM-residues treatment facilities must notify the radiation protection authority

⇒ **Acceptation criteria** in function of type of treatment

- Landfill (hazardous, non hazardous or inert waste)
- Mono-landfill
- Incineration / co-incineration
- Processing into building materials
- ...

## Acceptation criteria

Treatment	Activity concentration		
		Input (residue producer)	Output (after residue processing)
Landfill for hazardous waste	$C_{\text{exemption}}$	RP 122 II	$C_{\text{average}} < 0.2 \text{ Bq/g}$
	$C_{\text{max}}$	50 Bq/g	
Landfill for non hazardous or inert waste	$C_{\text{exemption}}$	RP 122 II	$C_{\text{average}} < 0.2 \text{ Bq/g}$
	$C_{\text{max}}$	10 Bq/g	
Mono-landfill		$< 0.2 \text{ Bq/g}$ : no restrictions	
		$> 0.2 \text{ Bq/g}$ : site-specific dose assessment	

## Acceptation criteria

Treatment	Activity concentration		
		Input (residue producer)	Output (after residue processing)
(Co-)incineration	$C_{\text{exemption}}$	RP 122 II	- Activity index (building) - RP 122 II (road construction)
	$C_{\text{max}}$	10 Bq/g	
Building materials	$C_{\text{exemption}}$	RP 122 II	- Activity index (buildings) - RP 122 II (road construction)
	$C_{\text{max}}$	1 Bq/g	
Other uses	Case by case (dose assessment < 0.3 mSv/y)		



## Case-studies



### Flow of NORM residues in residues treatment facilities

#### Objectives:

- View on **current quantities** and **nature** of NORM residues in treatment facilities;
- Check relevance of **European waste codes** to track NORM residues;
- Check whether application of acceptance criteria would imply a change in **current practices**.

#### 3 facilities investigated:

- 1) *landfill for hazardous waste*
- 2) *Incinerator of household and assimilated waste*
- 3) *Pretreatment facility for cement industry*



## Case-study 1: landfill for hazardous waste (1)



*Equiped with portal monitor  $\Rightarrow$  all NORM detections registered*

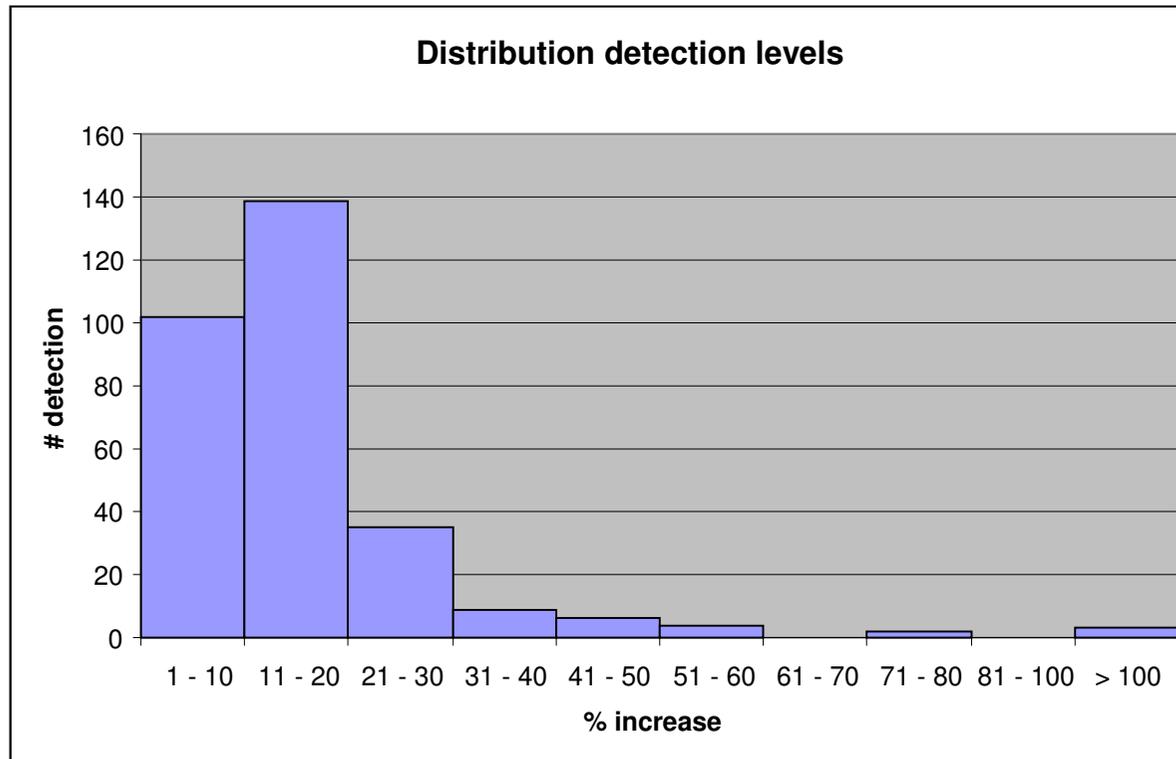
*NB: Detection level very low: a few % compared to background;*

	<b>2010</b>	<b>2009</b>	<b>2008</b>
# NORM detections	92	97	111
# NORM detections > 2 X BGD	1	0	2
Quantity disposed NORM waste (tons)	2012	1877	2396
Quantity disposed waste (tons)	158 930	171 096	130 975
% NORM	1.2	1.1	1.8

## Case-study 1: landfill for hazardous waste (2)

*Distribution of detections as a function of radiation level (% increase on portal monitor with respect to background)*

⇒ Majority of detections at **lower end** of distribution



## Case-study 1: landfill for hazardous waste (3)

*European waste code (EWC) of detected NORM*

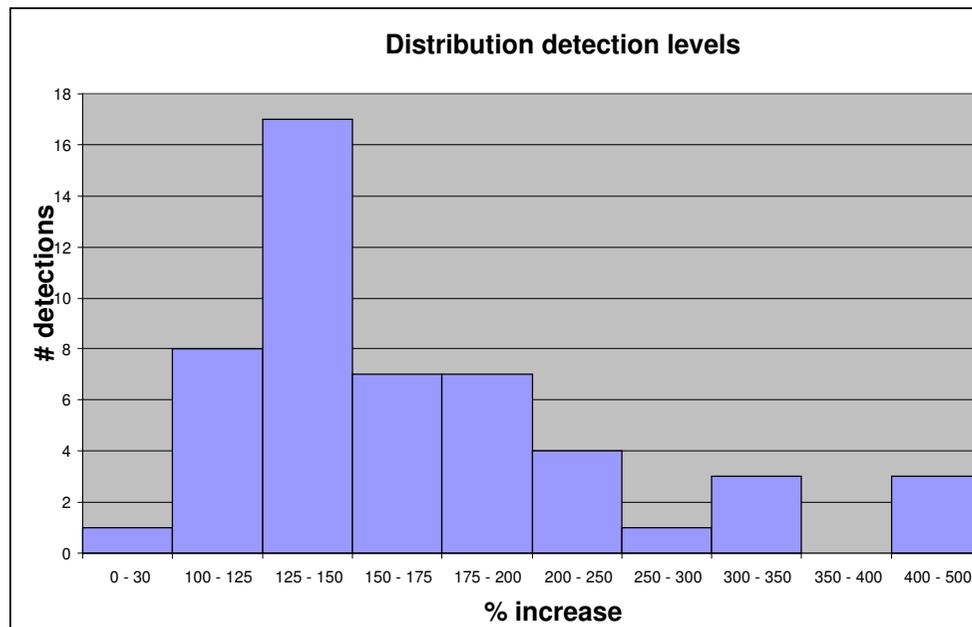
*⇒ Majority of detections not linked to “positive list”*

EWC	# detections 2008 - 2010
06 03 11 “solid salts and solutions containing cyanides”	22
06 06 02 “wastes containing dangerous sulphides”	8
07 07 07 “halogenated still bottoms and reaction residues”	65
10 03 99 “wastes from aluminium thermal metallurgy - wastes not otherwise specified”	9
16 08 07 “spent catalysts contaminated with dangerous substances”	5
17 05 03 “soil and stones containing dangerous substances”	35
19 01 13 “wastes from incineration or pyrolysis of waste - fly ash containing dangerous substances”	67
19 01 19 “wastes from incineration or pyrolysis of waste - sands from fluidised beds”	48
19 01 99 “wastes from incineration or pyrolysis of waste - wastes not otherwise specified”	8

## Case-study 2: incinerator household and assimilated waste

	2010	2009	2008
# detections	15	14	20

Total amount of waste (2009): 170,000 tons (NORM = 0.2 %)



## Case-study 2: incinerator household and assimilated waste (2)

	# detection 2008 - 2010
commercial waste	8
Bottom ash	6
Bulky waste	4
Household waste	6
Deliveries	20
Residues dust filter	3

~ 2/3 detections caused by **deliveries** (refractories) and own (outgoing) **incineration waste**.

+ scaling on washing tower

## Case-study 3: pre-treatment facility for cement industry

Pasty waste (e.g. oil tank sludges, paint) converted into solid fuel to be used in cement production plant  
⇒ **Mineral part goes to clinker**

*Oil tank sludges* may be enriched in NORM  
Values (measured in other companies) up to 7 Bq/g Ra-226  
(but very inhomogeneous)

According to mass balance, ~**20%** of activity may go to clinker

## Case-study 3: pre-treatment facility for cement industry (2)

$\gamma$ -spectroscopic analysis of some samples of processed waste

Only one sample with increased value:

Refractory coating ~ 270 Bq/kg Ra-226 & 340 Bq/kg Ra-228

Oil sludges ~ background values (~ 20 Bq/kg Ra-226 & Ra-228)

*⇒ single type of residue may display large range of activity concentration;*



## Conclusions

### Lessons from stakeholders involvement (consultation of professional federations of waste treatment sector):

- Need for **juridical clarity** ⇒ transparent regulatory approach to avoid ambiguities between “NORM” waste and radioactive waste;
- Results of **case-studies** indicate that processing of NORM residues seems to be *limited in quantities* (exception of mono-landfills)
- Link between **EWC and NORM** waste not necessarily obvious in practical cases;
- **Traceability** may be an issue (intermediate steps – e.g. waste transfer station - between waste producer and final treatment);
- import from **foreign** NORM waste ?
- Need for **pragmatical ways of checking acceptance criteria**  
⇒ clear definition of acceptable measurements procedure and methodology (definition of a batch, criteria on homogeneity, use of external radiation measurements as screening criteria,...)