

# International survey on the classification of areas

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*Study for ASN (2011) with the participation of the European ALARA Network and ISOE*

## ■ Objectives:

- Establish a **synthesis of the RP rules regarding demarcation and access to controlled and supervised areas**
  - Belgium, Spain, USA, Finland, UK, Sweden, Switzerland
- *Test the application of existing rules through ~12 case studies in the nuclear, non-nuclear (e.g. NDT) and medical sectors*



- Analysis of the regulatory frameworks
  - Laws & Decrees
  - Specific Regulatory Guidances
  - Procedures (Technical Guidances)
- Sources:
  - Web
  - European ALARA Network (EAN) survey
  - ISOE survey
  - + Interviews (RP Authorities in the UK, Switzerland, Finland)

- Unique regulatory 'cap-text', not so much detailed (i.e. establishing general principles as they are stated in the Euratom Directives), valid for all sectors,
- Complementary regulatory guidance for each sector
- The controlled area is not often sub-divided, except in the nuclear sector
  - The sub-division of the controlled areas in the nuclear installations are fixed either by RP authorities (e.g. Spain, Finland, USA) or operators (e.g. Sweden)
  - Operators can opt for stricter rules than those fixed by Law
- Usually, no subdivision of the controlled area in the medical sector (except. Spain, France)

## General objective of the classification of areas

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- Rarely explicit
- **Clear link with the dose limitation principle:** the area must be controlled if the dose limits could be exceeded (in specific circumstances)
  - Prevent or limit the probability and magnitude of radiation incidents and accidents (i.e. potential exposures)
  - Identification of areas that necessitate specific access & surveillance procedures
- **Tenuous link with the optimization principle (i.e. ALARA dose reduction in routine circumstances)**
  - UK: *'to help ensure that the measures provided are effective in preventing or restricting routine and potential exposures' (...)* *'the area design requirements and access controls should always aim to keep exposures ALARP'*
  - Switzerland: « Limit and control exposures to radiations »

# Criteria for the designation of areas (applied to all sectors)

CRITERIA	Belgium	Spain	USA	Finland	UK	Sweden	Switzerland
Potential Effective Dose	✓	✓		✓	✓	✓	✓
Potential Equivalent Dose	✓	✓	✓	✓	✓	✓	
Max. Dose rate	✓				✓		
Potential Absorbed Dose			✓				
Max. Air contamination			✓				✓
Max. Surfacic contamination							✓
Protective suits or equipment (whatever the risk level)		✓		✓	✓		

**Conservative exposure scenarios** (maximum dose rates, maximum occupancy rates of 250 d/y, 40 h/w., 8 h/d, etc)

# Dose rate criteria used in the nuclear sector (NPPs)

Belgium (Doel)	< 3 $\mu$ Sv/h (white)	3 $\mu$ Sv/h (yellow)	20 $\mu$ Sv/h (orange)	200 $\mu$ Sv/h (Purple)	1 mSv/h (red)	
Spain (Almaraz)		3 $\mu$ Sv/h (green)	25 $\mu$ Sv/h (yellow)		1 mSv/h (orange)	100 mSv/h (red)
USA (Exelon)			50 $\mu$ Sv/h at 30 cm (RA)		1 mSv/h at 30 cm (HRA)	5 Gy/h at 30 cm (VHRA)
Finland Loviisa)		3 $\mu$ Sv/h (green)	25 $\mu$ Sv/h (orange)		1 mSv/h (red)	
UK (Sizewell)		3 $\mu$ Sv/h (‘R2’)		50 $\mu$ Sv/h (‘R3’)	500 $\mu$ Sv/h (‘R4’)	
Sweden (Ringhals)		< 25 $\mu$ Sv/h (blue)	25 $\mu$ Sv/h (yellow)		1 mSv/h (red)	
Switzerland (Beznau)	‘V’		10 $\mu$ Sv/h (‘W’)	100 $\mu$ Sv/h (‘X’)	1 mSv/h (‘Y’)	10 mSv/h (‘Z’)

# Airborne activity criteria used in the nuclear sector (NPPs)

Belgium (Doel) No criteria

Spain  
(Almaraz)

AC < 0.1 DAC  
(green)

AC > 0.1 DAC  
(yellow)

AC > 1 DAC  
(orange)

AC > 10 DAC  
(red)

USA  
(Exelon)

Airborne Radioactivity Area  
AC > 0.3 DAC

Finland  
Loviisa)

AC ≤ 0,3 DAC  
(green)

AC > 0,3 DAC  
(orange)

AC ≥ 30 DAC  
(red)

UK  
(Sizewell)

Contamination controlled area C3  
(other values for specific nuclides) :

$\beta$  : AC > 10 (min) - 40 (max) Bq/m<sup>3</sup>

$\alpha$  : AC > 0,01 (min) - 0,04 (max) Bq/m<sup>3</sup>

Sweden  
(Ringhals)

AC < 1DAC  
(blue)

AC > 1 DAC  
(yellow)

AC > 10 DAC  
(red)

Switzerland  
(Beznau)

AC < 0.1 LV  
(with low probability)  
(Zone I yellow)

AC < 0.1 LV  
(Zone II yellow)

0.1 LV < AC < 10  
Zone III (red)

AC > 10 LV  
Zone IV red)



# Surface contamination criteria used in the nuclear sector (NPPs)

Belgium (Doel)	$\beta/\gamma \leq 0.4 \text{ Bq/cm}^2$ (green)	$\beta/\gamma > 0.4 \text{ Bq/cm}^2$ 3 sub areas : 0.4 - 4 / 4 – 40 / 40 – 400 (yellow)		$\beta/\gamma \geq 400 \text{ Bq/cm}^2$ (red)
Spain (Almaraz)	$\beta/\gamma < 4 \text{ Bq/cm}^2$ $\alpha < 0.4 \text{ Bq/cm}^2$ (green)	$\beta/\gamma < 40 \text{ Bq/cm}^2$ $\alpha < 4 \text{ Bq/cm}^2$ (yellow)	$\beta/\gamma < 400 \text{ Bq/cm}^2$ $\alpha < 40 \text{ Bq/cm}^2$ (orange)	$\beta/\gamma > 400 \text{ Bq/cm}^2$ $\alpha > 40 \text{ Bq/cm}^2$ (red)
USA (Exelon)	Contaminated Area		$\beta/\gamma > 1000 \text{ dpm/100 cm}^2$ $\alpha > 20 \text{ dpm/100cm}^2 \text{ alpha}$	
Finland (Loviisa)	$\beta/\gamma \leq 4 \text{ Bq/cm}^2$ $\alpha \leq 0.4 \text{ Bq/cm}^2$ (green)	$\beta/\gamma < 40 \text{ Bq/cm}^2$ $\alpha < 4 \text{ Bq/cm}^2$ (orange)		$\beta/\gamma > 40 \text{ Bq/cm}^2$ $\alpha > 4 \text{ Bq/cm}^2$ (red)
UK (Sizewell)	Contamination controlled area C2 (other values for specific nuclides) :		$\beta/\gamma > 4 \text{ Bq/cm}^2$ $\alpha > 0.4 \text{ Bq/cm}^2$	
Sweden (Ringhals)	$\beta/\gamma < 40 \text{ kBq/m}^2$ $\alpha < 4 \text{ kBq/m}^2$ (blue)	$\beta/\gamma < 1000 \text{ kBq/m}^2$ $\alpha < 100 \text{ kBq/m}^2$ (yellow)		$\beta/\gamma > 1000 \text{ kBq/m}^2$ $\alpha > 100 \text{ kBq/m}^2$ (red)
Switzerland (Beznau)	$\text{SC} < 1 \text{ LV}$ (with low probability) (Zone I yellow)	$\text{AC} < 10 \text{ LV}$ (Zone II yellow)	$\text{SC} < 100 \text{ LV}$ Zone III (red)	$\text{SC} > 100 \text{ LV}$ Zone IV red)

- Trefoils (4 colours)
- Risk of irradiation indicated with a 'shining' symbol
- Contamination indicated with a dotted background



**ZONA DE PERMANENCIA LIMITADA**

**RIESGO DE IRRADIACIÓN**

This sign features a yellow trefoil symbol on a white background with a solid yellow border. The text is in Spanish, indicating a limited stay zone with a risk of irradiation.

**SERVICIO DE PROTECCIÓN RADOLÓGICA**

**IBERDROLA**

**INFORMACIÓN RADOLÓGICA DEL CUBÍCULO**

**H2-02**

**(ANTESALA DE CALENTADORES 3 AB)**

■ TASA DE DOSIS EN ÁREA : 0.10s mSv/h

■ CONT. SUPERFICIAL EN ÁREA : 0.2 Bq/cm²

■ CONT. AMBIENTAL EN ÁREA : 0.00s LOCA

**FECHA DE LAS MEDIDAS : 16/03/2009**

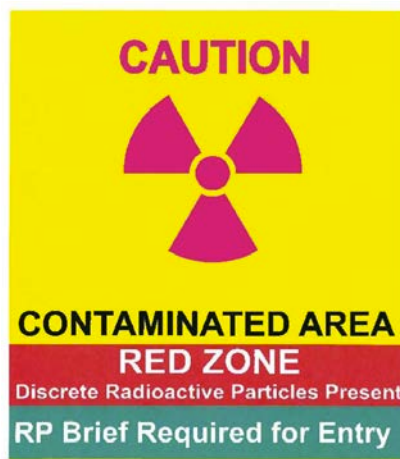
**TASA DE DOSIS EN PUNTOS CALIENTES (mSv/h)**

Número	Contacto	1 metro	Observaciones
1.1	1.25	0.05	112% de pot. el. H <sup>2</sup> a 1.0 ppm/s
1.2	1.32	0.08	

**OBSERVACIONES** : - Ventarita a utilizar en el área (en presencia de riesgo de contaminación). Instrucciones para inspecciones, para trabajos o en caso de emergencia.

- Nº de Teléfono de contacto del SPR : 878.


# Signs in the USA



# Signs in Finland



Radiological Safety Rules



**Radiation**  
**Hotspot!**

**Do not Linger in this Area!**

Contact doserate	
Doserate @ 0.5m	
Hotspot Number	
Monitor Name / Date	/

Radiological Safety Rules



**Contamination  
Controlled  
Area C**



- Regulatory framework valid for all sectors
  - Main criterion is, most of the time, the potential effective dose (using a conservative approach)
  - Real dose assessment (ALARA procedure) at workplace is generally disconnected of the principles that steer the classification of area (≠ in France)
  - Other domain-specific criteria
- Non harmonization between countries, in terms of
  - Criteria (type, levels)
  - Designation of areas (colours, VWXYZ, R1/2/3...)
  - Signs, etc.
- This can be problematic for transient workers.
  - Training of new workers is particularly needed
  - It calls for harmonization (at least at the European level)