

## International survey on the classification of areas

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*C. Schieber*

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

CEPN



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



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

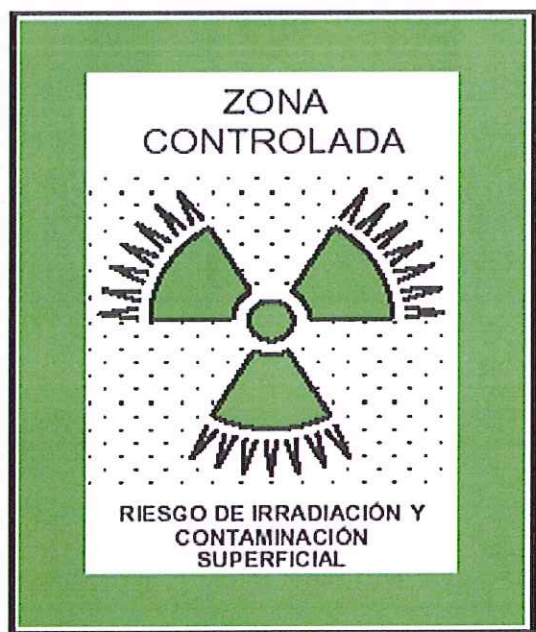
Belgium (Doel)	No criteria			
Spain (Almaraz)	AC < 0.1 DAC (green)	AC > 0.1 DAC (yellow)	AC > 1 DAC (orange)	AC > 10 DAC (red)
USA (Excelon)	Airborne Radioactivity Area AC > 0.3 DAC			
Finland (Loovisa)	AC ≤ 0,3 DAC (green)	AC > 0,3 DAC (orange)	AC ≥ 30 DAC (red)	
UK (Sizewell)	Contamination controlled area C3 (other values for specific nuclides) :		β : AC > 10 (min) - 40 (max) Bq/m <sup>3</sup> α : 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 (Excelon)	Contaminated Area		$\beta/\gamma > 1000 \text{ dpm/100 cm}^2$ $\alpha > 20 \text{ dpm/100cm}^2 \text{ alpha}$	
Finland (Loovisa)	$\beta/\gamma \leq 4 \text{ Bq/cm}^2$ $\alpha \leq 0.4 \text{ Bq/cm}^2$ (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)	SC < 1 LV (with low probability) (Zone I yellow)	AC < 10 LV (Zone II yellow)	SC < 100 LV Zone III (red)	SC > 100 LV Zone IV red)

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



A rectangular sign with a yellow border. The background is white. At the top, it says "ZONA DE PERMANENCIA LIMITADA". In the center is a trefoil symbol with a yellow background. At the bottom, it says "RIESGO DE IRRADIACIÓN".

Below the sign is a document titled "SERVICIO DE PROTECCIÓN RADIOLÓGICA" and "INFORMACIÓN RADIOLÓGICA DEL CUBÍCULO H3-02 (ANTESALA DE CALENTADORES 3 A/B)".

FECHA DE LAS MEDIDAS : 14/10/09

TASA DE DOSIS EN PUNTOS CALIENTES (mSv/h)

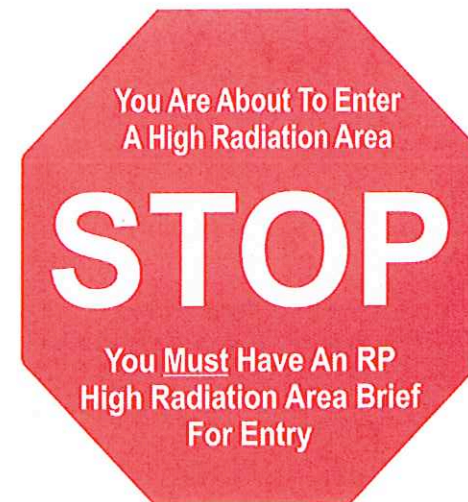
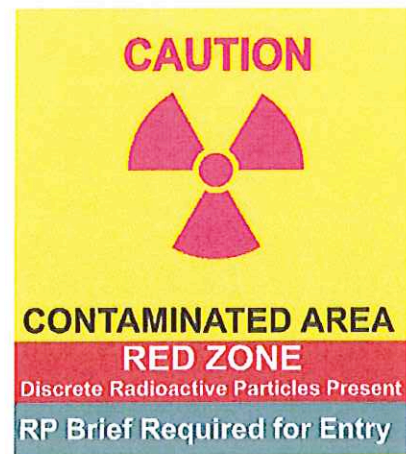
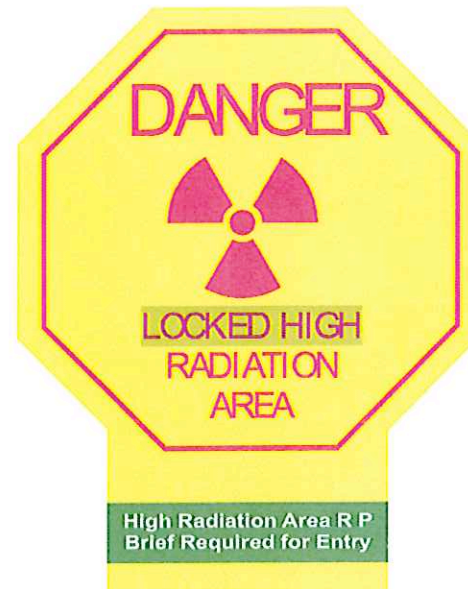
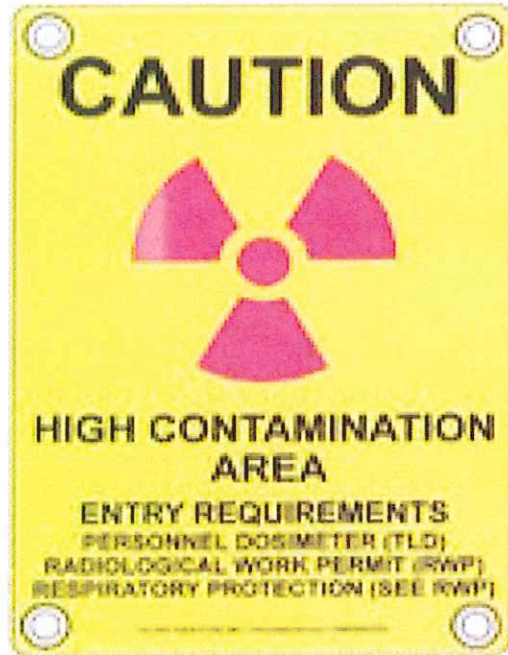
Número	Coordenadas	Valor	Observaciones
1	1.25	0.05	112% de per. al. H <sup>3</sup> a 1.0 ppm's
2	1.32	0.08	

Observaciones: - Visto y utilizado en el área (presencia de riesgo de contaminación) - Visto por inspección, para trabajo o en caso de emergencia de ardo.

- Nº de teléfono de contacto del SPP: 978 300 000



# Signs in the USA





## Pääsy kielletty

LUOKITUS:

**PUNAINEN**

Annosnopeus:  
yli 1 mSv/h

## Oleskelua rajoitettava

LUOKITUS:

**ORANSSI**

Säteilyn yleistaso:  
0,025 - 1 mSv/h

## Ei oleskelurajoituksia

LUOKITUS:

**VIHREÄ**

Säteilyn yleistaso:  
alle 0,025 mSv/h




## 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 ( $\neq$  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)