

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

- 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 (Exelon)			50 $\mu\text{Sv/h}$ at 30 cm (RA)		1 mSv/h at 30 cm (HRA)	5 Gy/h at 30 cm (VHRA)
Finland Loviisa)		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 (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 (<i>other values for specific nuclides</i>):		β : AC > 10 (min) - 40 (max) Bq/m ³ α : AC > 0,01 (min) - 0,04 (max) Bq/m ³	
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		$\beta/\gamma > 1000 \text{ dpm/100 cm}^2$ $\alpha > 20 \text{ dpm/100cm}^2$ 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 (<i>other values for specific nuclides</i>) :	$\beta/\gamma > 4 \text{ Bq/cm}^2$ $\alpha > 0.4 \text{ Bq/cm}^2$		
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



ZONA DE PERMANENCIA LIMITADA

RIESGO DE IRRADIACIÓN

IBERDROLA SERVICIO DE PROTECCIÓN RADOLÓGICA

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 LDCA

FECHA DE LAS MEDIDAS : 10/03/2009

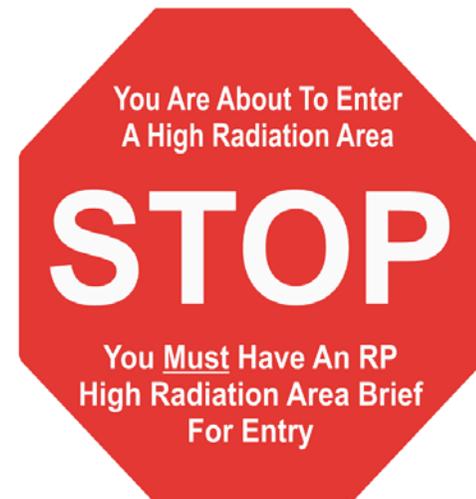
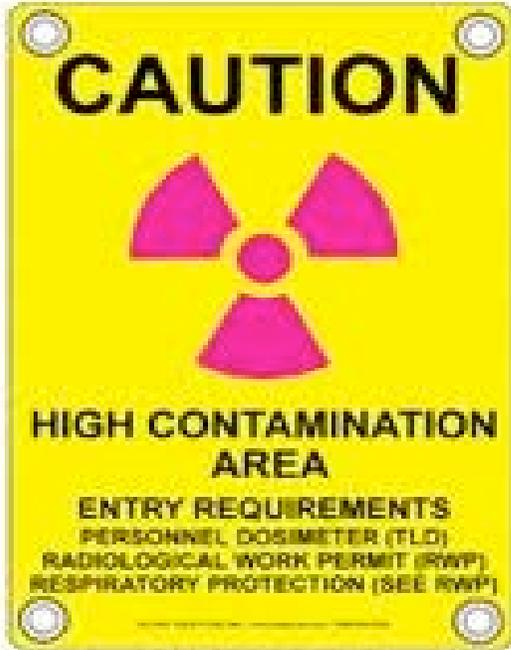
TASA DE DOSIS EN PUNTOS CALIENTES (mSv/h)

Número	Contacto	1 metro	Observaciones
1	1.25	0.05	112% de pot. el. H ²¹⁸ a 1.0 ppm/s
2	1.32	0.08	

OBSERVACIONES: - Vestuario o utilizar en el área (en presencia de riesgo de contaminación). Vestuario para inspecciones, para trabajos o en consecuencia de ambos).

- Nº de Teléfono de contacto del SPR : 87C

Signs in the USA



Ei oleskelurajoituksia



LUOKITUS:
VIHREÄ

Säteilyn yleistaso:
alle 0,025 mSv/h

Oleskelua rajoitettava



LUOKITUS:
ORANSSI

Säteilyn yleistaso:
0,025 - 1 mSv/h

Pääsy kielletty



LUOKITUS:
PUNAINEN

Annosnopeus:
yli 1 mSv/h



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)