

A vertical decorative strip on the left side of the slide features a textured, abstract pattern with shades of blue, yellow, and brown, resembling a geological or artistic surface.

# Relevance for regulated sectors: **control of radioactive sources**

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**International Conference  
Control and management of  
inadvertent radioactive material  
in metal scrap.**

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# Uses of ionising radiation

**Many beneficial uses of ionizing radiation developed early after discovery.**

- Medicine
  - Cancer treatment
  - Image diagnosis
- Industry
  - Industry processes control
  - Non destructives testing
  - Material properties
- Agriculture
  - pest control
  - soil properties

Research (Biology, Medicine, Chemistry, Materials....)



**Many practices use non sealed sources or radiation generators**

**Concern of radioactive material in scrap metal derived mainly from practices using sealed radioactive sources.**

# Uses of sealed radioactive sources. Spain

USE	RADIONUCLIDE	TYPICAL ACTIVITIES		N Currently In Spain
		TeraBecquerels	Curies	
<b>Thermoelectric generators</b>	Sr-90	7.4E+02	2.0E+04	0
<b>Irradiators used in sterilization and food preservation</b>	Co-60	1.5E+05	4.0E+06	1
<b>Self-shielded irradiators</b>	Cs-137	5.6E+02	1.5E+04	1
<b>Blood/tissue irradiators</b>	Cs-137	2.6E+02	7.0E+03	19
<b>Multi-beam teletherapy (gamma knife)</b>	Co-60	2.6E+02	7.0E+03	1
<b>Teletherapy</b>	Co-60	1.5E+02	4.0E+03	42
<b>Industrial radiography</b>	Co-60	2.2E+00	6.0E+01	534
	Ir-192	3.7E+00	1.0E+02	
	Se-75	3.0E+00	8.0E+01	
<b>Brachytherapy</b>	Co-60	3.7E-01	1.0E+01	71
	Cs-137	1.1E-01	3.0E+00	
	Ir-192	2.2E-01	6.0E+00	
<b>Industrial gauges</b>	Cs-137	1.9E-01	5.0E+00	122
	Co-60	1.9E-01	5.0E+00	
	Am-241	2.2E-02	6.0E-01	



# Regulation of facilities and activities

- Early uses of ionizing radiation → harmful effects.
- Need to regulate all practices with radiations identified.
- Definition of safety + security systems based on Radiation Protection principles defined by ICRP. Derived from scientific knowledge, periodically updated.
- Regulatory infrastructure development.
- Oversight by a Regulatory Body independent from organizations involved in development/use of practices with exposure to radiations. In Spain CSN, created in 1980.



# The system for safety of radiation sources

To protect people, goods and environment from effects of radiation, allowing beneficial uses.

**Spain: established in 1972**

**• Well implemented with satisfactory results.**

**• Based on:**

- Regulatory framework development.
- Authorization of activities with R.S.
- Control of authorized activities.
- Control of radioactive sources purchasing & management when out of use.
- Personnel Training/Qualification.



# Safety of Radioactive sources. Regulatory Framework

## International

- International BSS (IAEA)
- EU Directive 1996/29/Euratom

## National

- Act 25/1964 on Nuclear Energy
- Act 15/1980 Creation of CSN
- RD 1836/1999. Nuclear and Radioactive Fac. Regulation
- RD 783/2001. Radiological Protection
- RD 1891/1991. Medical X-ray facilities
- Operation Permits of radioactive facilities.

# The system for security of radiation sources

*To protect people, goods and environment from malevolent use of nuclear and radioactive materials*

**Recent international development.**

**Spain: under development.**

➤ **Avoid access of non-authorized personnel to radioactive materials.**

- Protecting facilities, activities and materials against sabotage and robbery
- Fighting against radiological terrorism
- Preventing and prosecuting radiological crime
- Detecting and preventing illicit trafficking of rad. materials
- Detecting inadvertent movement of radioactive materials
- Accomplishing with international commitment
- Protecting assets of great economical/social value.



# Security of Radioactive sources. Regulatory framework

## International

- Code of Conduct (IAEA, 2004)
- EU Directive 2003/122/Euratom (Directive HASS)

## National

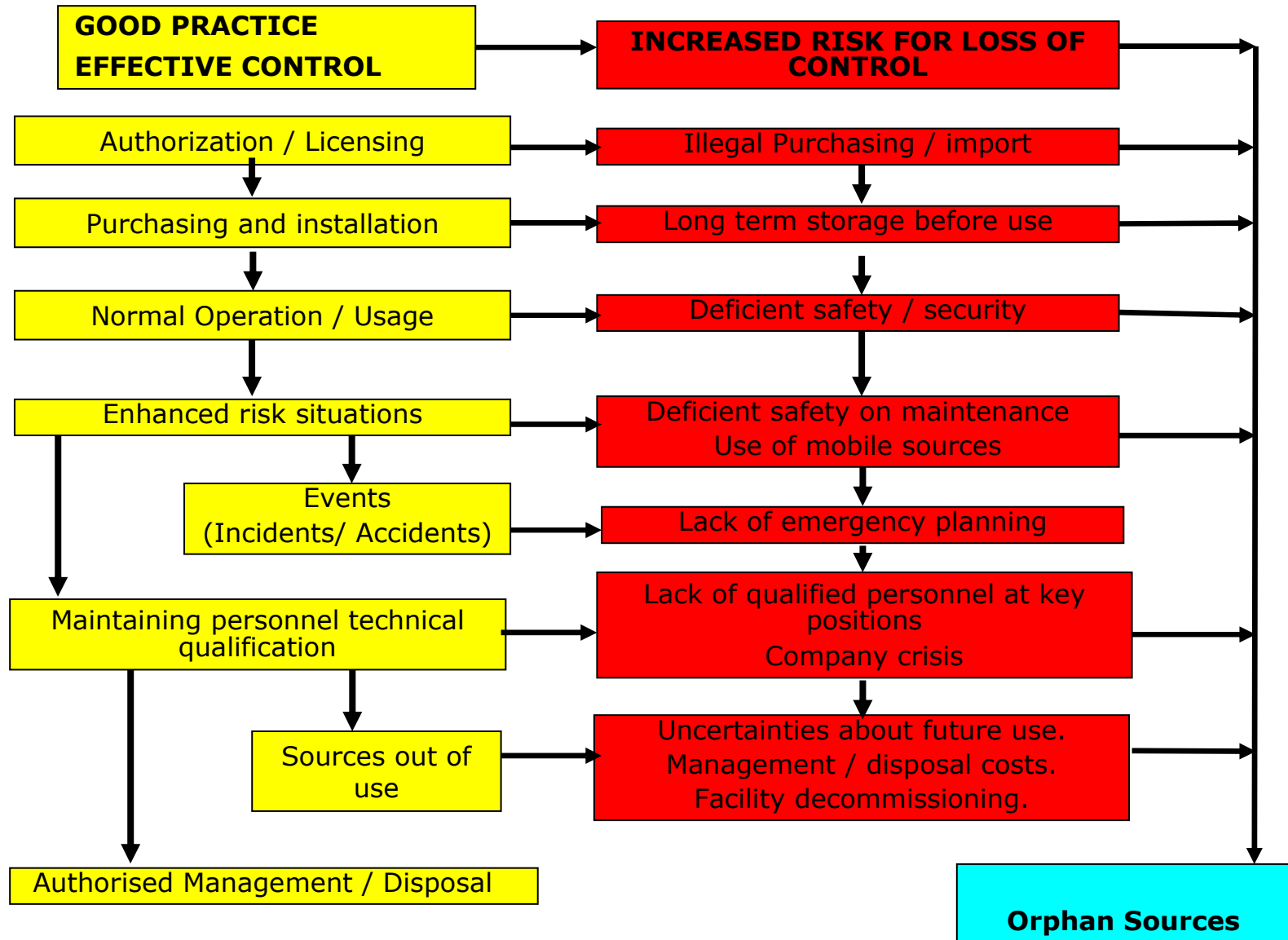
- RD 229/2006 Safety and Security of HASS

## National on Public Security

- Organic Law 2/1986 of Security Forces
- Organic Law 1/1992 of Citizen Security
- Act 23/1992 of Private Security
- RD 2364/1994. Private Security Regulation



# Control of radioactive sources. *From cradle to grave.*



# Control of sealed sources. Recent requirements.

➤ **Spain: regulation 229/2006.**

Follow up of individual sources (serial number) from manufacturing to end of life disposal in an authorized facility.



Holders:

- **Inventory sheets sending** (new source, transfer, modifications, yearly)
- **Monthly verifications** (inventory, location, good condition)
- **Financial security** for management of disused sources

Authorities:

- **Creation/maintenance of national inventories** (sources, holders)
- **Import/export/transfer control.**



Manufacturers:

- **Provide source photograph**
- **Serial number engraved or stamped when feasible**



# Security. Recent requirements.

## ➤ Regulation 229/2006.

- **Definition of security objectives: Anticipate, detect, avoid sources loss of control.**
- **Security measures to be considered during facilities licensing, control and inspection.**
- **International approach : OIEA category 1 y 2 sources.**
- **Technical** (barriers, fasteners, alarms..) **and administrative measures** (access control, keys, inventories ...)
- **CSN to develop General Criteria and reference regulations**



# Orphan sources recovery

## ➤ Before regulation 229/2006. :

- Authorization for disposal of orphan sources found.
- Free cost confiscation of medical Ra-226 needles.
- Protocol for surveillance of radioactive material in metal scrap.

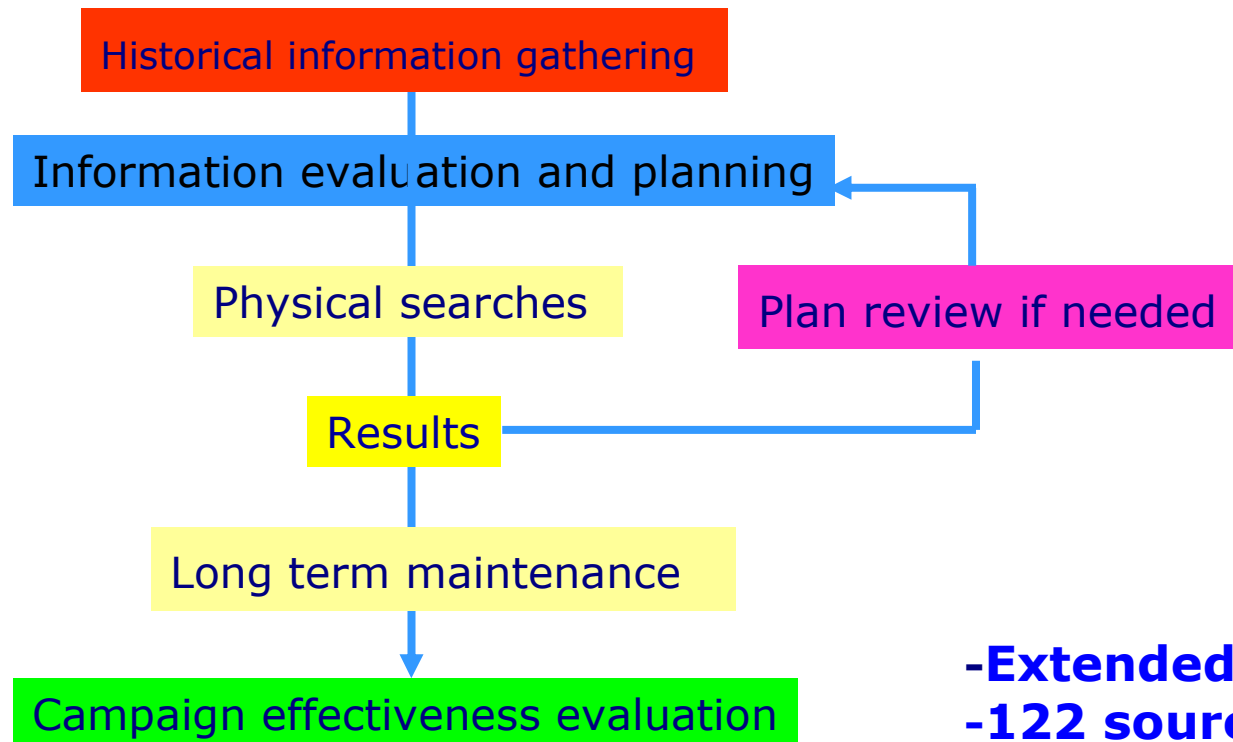


## ➤ Additional requirements

- Surveillance of all places where orphan sources may be encountered.
- CSN technical advisory/assistance to anyone suspecting the presence of an orphan source.
- Industry Ministry to organize campaigns to recover orphan sources from past practices. (Co-operation Enresa & CSN).
- Costs produced by orphan sources to be paid by: 1° last holder, 2° licensee of the facility where found (except scrap protocol).

# Orphan Sources National Recovery Campaign.

- **Effective control in force** → **concern: practices from the past.**
- **Financing provision. Nat. Budget 07 – 08 (MITYC => ENRESA)**
- **Plan development ENRESA. Approval MITyC & CSN.**
- **Approach similar to proposed in IAEA TECDOC-1388.**



**-Extended to 2009.**  
**-122 sources recovered**  
**so far the end of 2008**  
**(1 kBq –76,2 GBq)**

# NATURAL ORIGIN RAD. MATERIALS (NORM). OIL AND GAS EXPLORATION

- **Radioactive isotopes (Ra-226, Ra-228, Ra-224) contained in formation water at oil and gas reservoirs.**
- **Changes in temperature and pressure conditions during the extraction process, promote the co-precipitation of Ra as sulphate and carbonate compounds on the inner surface of tubes and other production equipment.**



- **A gamma radiation field is found coming mainly from Ra-226 decay products (Bi-214, Pb-214) contained in the scales.**
- **Since the implementation of the Scrap Protocol, about 500 notifications have been made concerning NORM (50% of notifications)**

# Conclusions

- **Wide use of radioactive sources (Medicine, Industry Research...)**
- **Likelihood of sources to become orphan and end up as metal scrap.**
- **Systems for Safety + Security should be implemented.**
  - Based in Classical Radiation Protection approach.
  - Reinforced with recent developments.
- **Elements for effective control of radioactive sources included.**
  - Special attention: transfers & end of life disposal.
- **Oversight by Regulatory Body + Co-operation from other Authorities and affected sectors needed.**
- **Concern about orphan sources from past practices.**
  - National recovery campaigns to be launched.
- **Scrap from Gas and petroleum industries produce a lot of alarms on surveillance systems due to presence of NORM.**
- **Key element : international co-operation.**
  - All countries to develop similar approach.
  - Avoid orphan sources inadvertent transfer through scrap trade.