IRSN
INSTITUT
DE RADIOPROTECTION
ET DE SÛRETÉ NUCLÉAIRE

Eurados intercomparison 2009

Extremity dosemeters (wrist, ring)
Beta irradiations

IRSN – *France*

Système de management
de la qualité IRSN certifié

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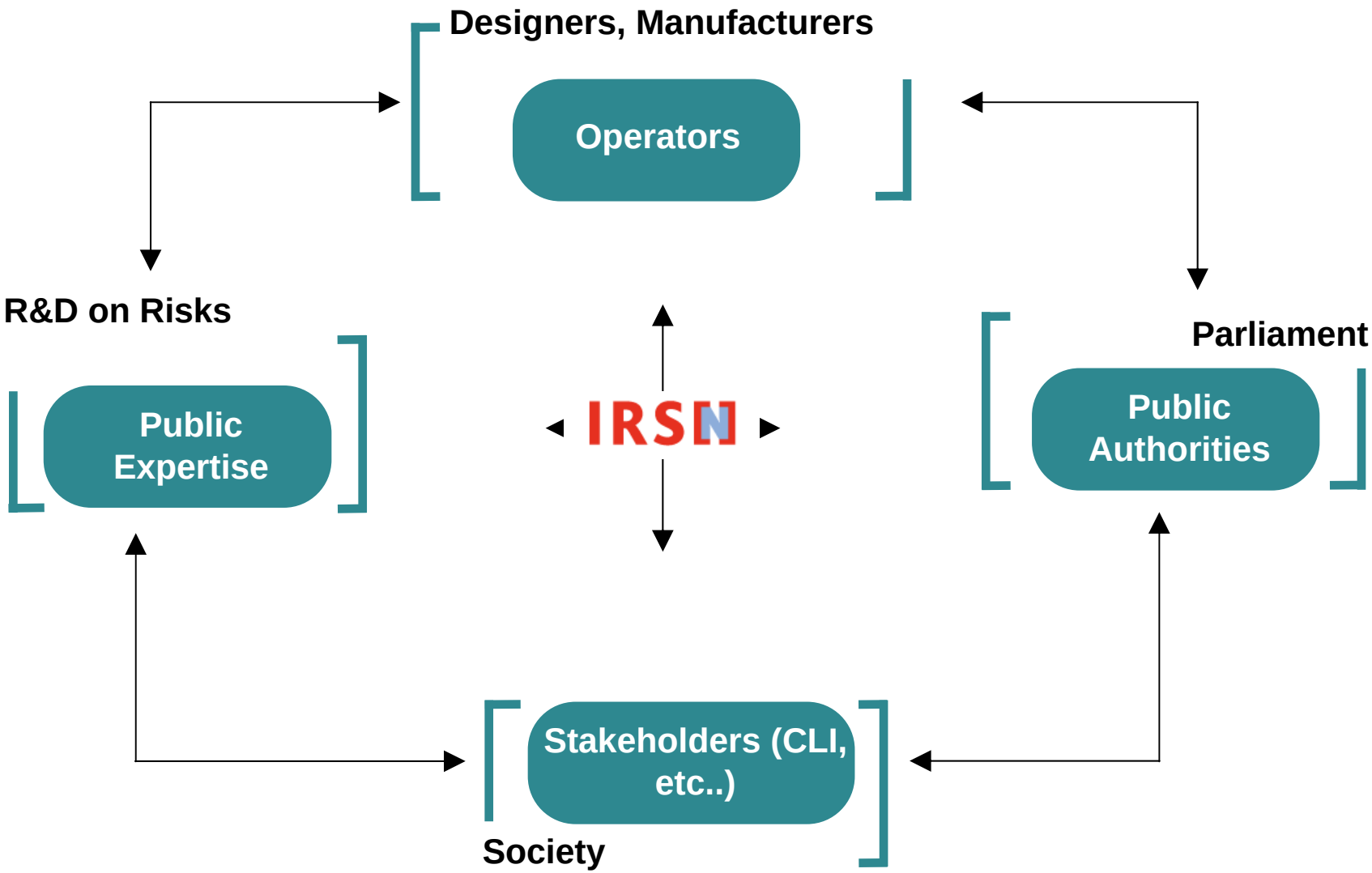
Institute for Radiological Protection and Nuclear Safety (IRSN)
in short

Key features of IRSN

IRSN is a French public body which performs research in nuclear safety and radiation protection, and provides expertise to evaluating nuclear and radiological risk in normal and accidental situations

- **Reporting to 5 ministries: Environment, Industry, Health, Defense, Research**
- **1,700 employees: 70% researchers and engineers**
- **A budget of ~280 M€, financed up to 80% by public funding**
- **11 locations in France, including 3 major sites: Fontenay-aux-Roses, Cadarache and Le Vésinet**

Institutional environment of IRSN



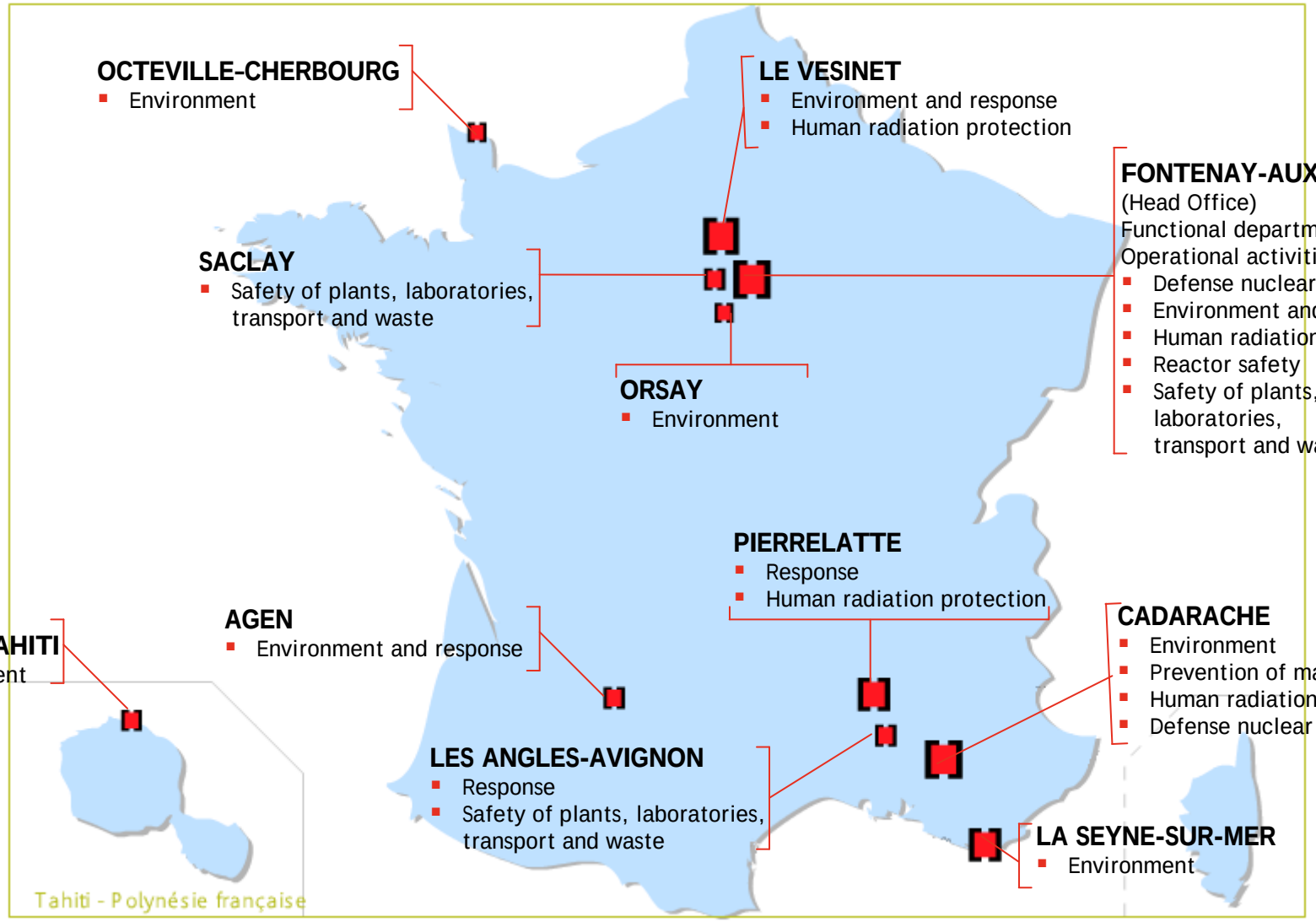
Five fields of expertise at IRSN

- **Safety of nuclear installations**
- **Safety of radioactive and fissile material transport**
- **Protection of workers, population and environment against ionizing radiation**
- **Protection and control of nuclear and sensitive materials**
- **Protection of nuclear facilities and radioactive and fissile material transport against malicious acts**

The missions in the field of radiation protection for persons

- **Research and studies**
  - Measurement systems and reference facilities for IR, modeling…
  - Biological and medical effects from irradiation and contamination
  - Health effects of ionizing radiation
- **Assistance to the medical and public health management in case of accident**
- **Expertise in radiation protection for the competent authorities, workplace studies…**
- **Monitoring of exposed workers**
- **In charge of the national inventory of radioactive sources and the national register of exposed workers**

IRSN sites: a national deployment



A worldwide network of partners

- **In France**
  - CEA, CNRS, INSERM, INERIS, universities, engineering schools, BRGM, IFREMER, INRA, INVS, research hospital structures, etc.
  - Health Agencies: AFSSA, AFSSAP, AFSSET, InVS…
  - EDF, AREVA
- **In Europe and beyond**
  - European Commission; GRS, BfS, PTB, Helmotz Z. (Germany); HPA, NPL, HSE (England); AVN (Belgium); NRC (United States); NUPEC, JAERI (Japan), Kurtchatov Institute, MMRC (Russia)…
- **Contribution to the development of technical standards with international commissions and organizations**
  - CIPR, ICRU, IEC, AIEA, UNSCEAR, ISO, OCDE/AEN…

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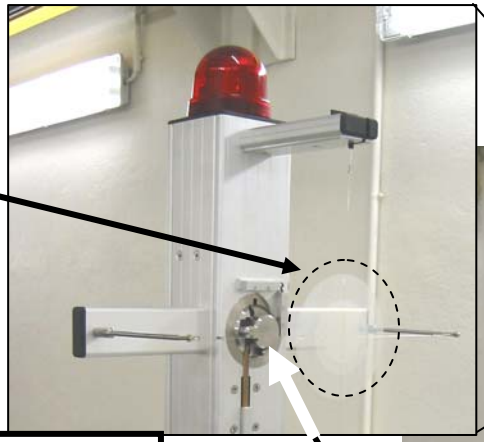
Protocol used for irradiation

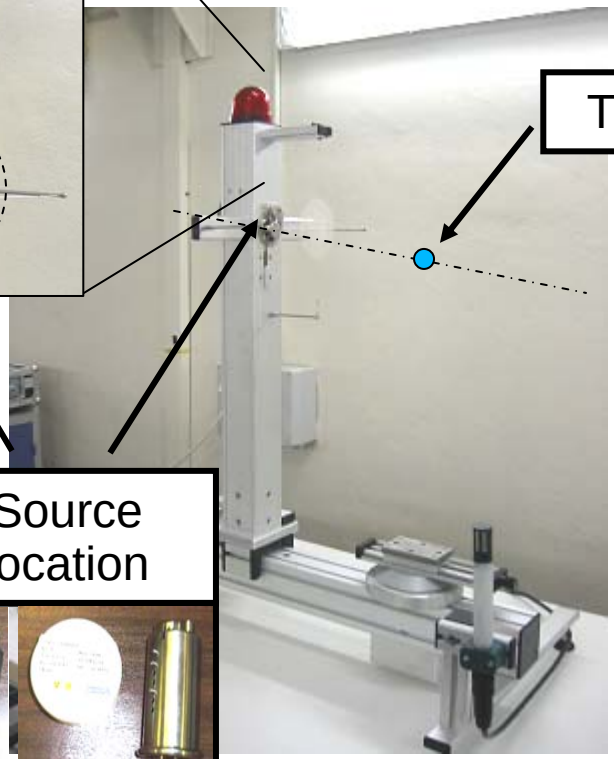
- **The irradiations were realized in terms of personal dose equivalent, Hp(0.07), according to the international Standard ISO 6980.**
- **The calibration equipment is a "beta Secondary Standard 2" manufactured by ISOTRAK/PTB. The radioactive sources used during this comparison exercise were 90Sr+90Y and 85Kr.** *The traceability of this standard is defined in calibration certificates delivered by the national standard laboratory, PTB (Physikalisch-Technische Bundesanstalt), respectively:*
  - *PTB-6.31-SR-KB436-10.2001 for 90Sr+90Y source*
  - *PTB-6-31-KR-KB396-10.2001 for 85Kr source*
- **The reference quantity is established in terms of personal dose equivalent, Hp(0.07), calculated by the BSS2 program including the irradiation condition.**

IRSN facility for beta irradiation

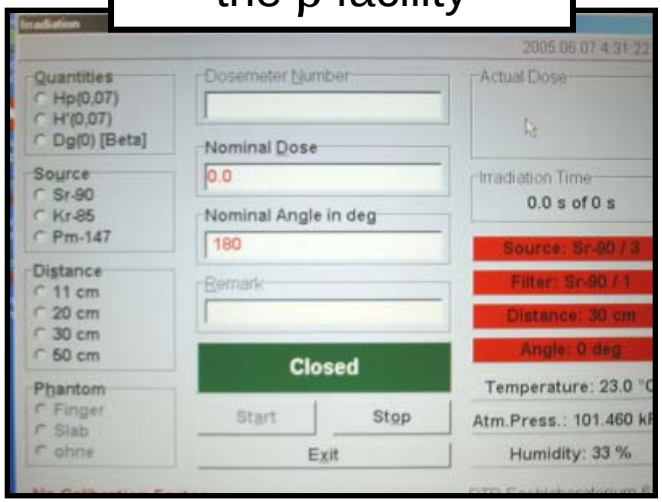
Beam flattening filter



Test point



Control screen of the β facility



Source location

^{85}Kr $^{90}Sr/^{90}Y$

Irradiation configurations

- Distance source - test point of the dosemeter: 30 cm. The reference point of the dosemeter defined by the participant was placed on the test point.
- Diameter of the fields and homogeneity: 15 cm in diameter with a factor of homogeneity of 1.
- Dosemeters on the phantom: within ± 50 mm from the centre of the axis of the radiation field.
- Rotation axis: rotation axis parallel to the axis of the phantom and goes through the reference point of the dosemeters.
- Phantom for wrist dosemeters: ISO pillar phantom is a water-filled hollow cylinder with PMMA walls and an outer diameter of 73 mm and a length of 300 mm.
- Phantom for ring dosemeters: ISO rod phantom: cylindrical PMMA phantom with a diameter of 19 mm and a length of 300 mm.

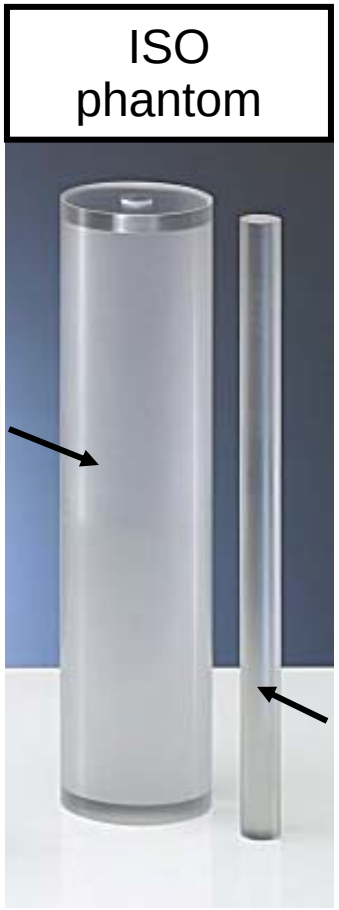
Irradiation configurations

Reference quantity

$^{90}Sr/^{90}Y$ → $H_p(0,07;0°)$

$^{90}Sr/^{90}Y$ → $H_p(0,07;60°)$

^{85}Kr → $H_p(0,07;0°)$



Traceability of the reference quantity to the primary reference of PTB

Irradiation according to the 6980 ISO Standard

Irradiation plan

Source	Reference quantity	Personal dose equivalent rate	Personal dose equivalent	Relative expand uncertainty
		$mSv.h^{-1}$	mSv	%
$^{90}Sr+^{90}Y$	$H_p(0.07;\alpha=0°)$	30	8 - 12	4.6
$^{90}Sr+^{90}Y$				
$^{90}Sr+^{90}Y$	$H_p(0.07;\alpha=60°)$	35	8 - 12	5
$^{90}Sr+^{90}Y$				
^{85}Kr	$H_p(0.07;\alpha=0°)$	95	20 - 30	4.6
^{85}Kr				

- **Uncertainty:**

The budget uncertainty is calculated as the combination of each measurement uncertainty with the uncertainty due to the determination of the reference. The expanded uncertainties for personal dose equivalent are calculated with a coverage factor of two.

- **183 (61 x 3) dosemeters irradiated**

Thank you for your attention

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