

An overview of Electricité de France Research and Development projects in the field of Occupational Radiological Protection

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ISOE 2012



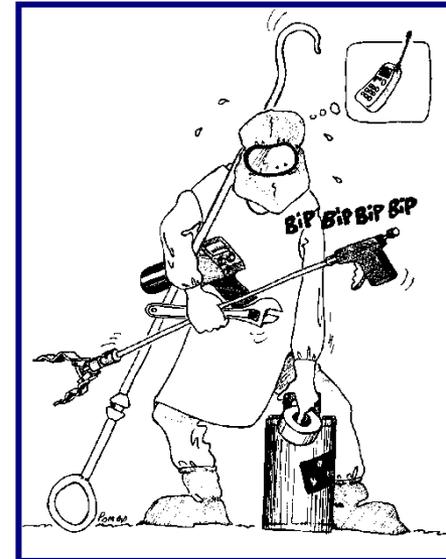
Framework

➤ Major RP concerns at EDF:

- Reduction of the largest doses ($> 10 \text{ mSv/y}$ - $< 1\%$ of the work force \supset outside workers)
- Reduction of the number of personal contamination events
- Improvement of the radiological cleanliness
- Limit the increase of the collective dose that could be observed (increase of maintenance operations)
- Enhance the security for likely high dose activities

➤ Justification for a R&D RP project

- Evolution of techniques and of scientific knowledge \rightarrow improved means available for the radiation protection of workers
- Evolution of the risk management and the regulation \rightarrow Potential additional risk to monitor
- Improve staff competencies, rules comprehension and organizational reliability \rightarrow progress in eradication of RP events



EPURE project at a glance

▶ Project data

- Long-term initiative with a 3-years project
- EPURE: 2012-2014
- 2.4 M€/year

▶ Topics addressed

- Nuclear measurement and process optimization
- Surface and atmospheric contamination
- RMS and 3D dose map
- Risk management and human factor
- Training, expertise and partnership

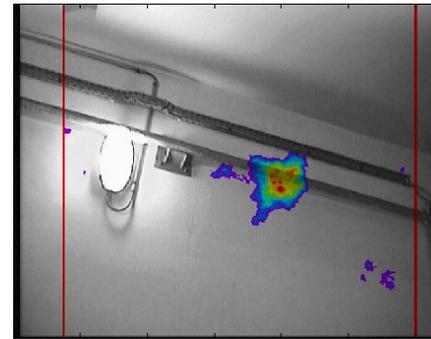
EDF skills involved

Human factor
Robotics
Decontamination
Measurement techniques
Signal / data processing
Numerical simulation (particle physics and fluid dynamics)
Knowledge management
Information technology...

RP

Advanced instrumentation – portable gamma camera

- ▶ **EDF objective:** reduce individual and collective doses
- ▶ **Technical issue:** identify radioactive hot spots (^{60}Co) with a routine instrument
- ▶ **Principle:** superimpose visible and gamma images
 - Partnership with CEA
 - Technology jump : SC vs scintillator → 30 kg to < 3 kg
 - Camcorder mode available



Remote monitoring systems

- ▶ **EDF objective:** reduce individual and collective doses
- ▶ **Specific issue:** to be able to anticipate a change in the radiological situation
- ▶ **Principle:** to integrate teledosimetry, air and radiation monitoring, audio and video liaison to a centralized supervisor



Individual dosimeters



Rad. monitors



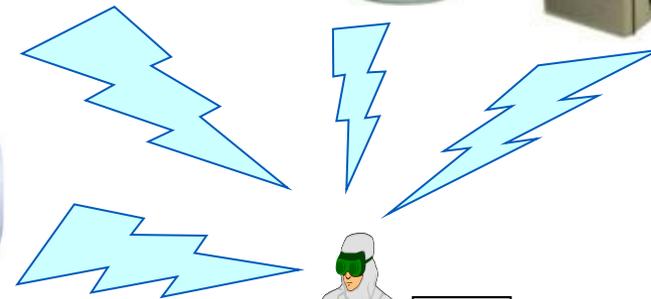
CAMs



Video



Audio



supervisor



Improvement of NDE safety using gammagraphy

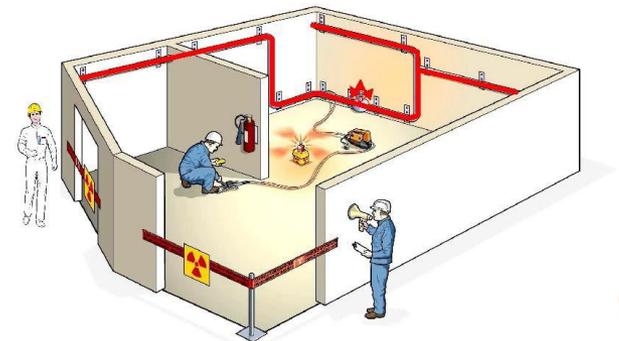
- ▶ **EDF Objective:** Enhance the security for likely high dose activities

- ▶ **Specific issue:** Improvement of gammagraphic non destructive examinations safety through the analysis of human behavior and organizational reliability

- ▶ **Work in progress since 2008:** Enhanced organization around gammagraphy
 - Specific organization which integrates NPP Management, Outage Management, gammagraphy coordinator and supervisor (effective control of the operation)
 - Ability in adapting to specific circumstances together with keeping position when facing some disruptions.

- ▶ **Roadmap 2012**
 - Focus on identifying practices from the different NDE contractors and various working conditions
 - In order to enhance both security and performance

- ▶ **Model to measure risk of gammagraphic inspections**



Development of a realistic practical RP training

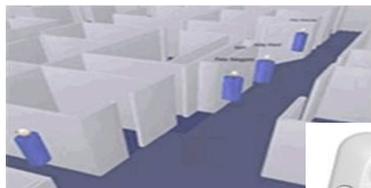
▶ Technical issues (all EDF objectives addressed):

- To develop an advanced method for a realistic training, providing the trainees with high-quality dose readings, and avoiding the use of radioactive sources
- To include this method in dedicated training programs including risk assessment basis and technical issues.

▶ **Principle:** To calculate a realistic and dynamic dose map combined to real-time display of the dose for the trainee.

50% of the workforce will be replaced within 5 years

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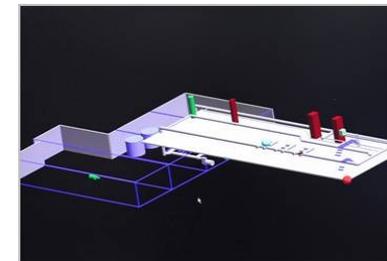
Indoor location tracking system



Trainer MMI



Local display for trainees



3D Transport code 

Conclusion and perspectives

► Major RP concerns at EDF:

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► To support these goals, EDF R&D:

- Pays attention to being connected to the needs of the operator
- Provides the operator with an integrated research project (aiming at a better characterization of the risk along with an enhanced comprehension for the workers as well as improvements of related processes)
- Develops efficient partnership with research laboratories
- Participates in ISO standardization as well as in other expert groups to develop its RP expertise
- Tries to develop a three-levels view, combining short-, medium-, and long-term studies.

Thank for
your attention