Radiation protection in the management of radioactive geological material in private buildings

IRSN
INSTITUT
DE RADIOPROTECTION
ET DE SÛRETÉ NUCLÉAIRE

Enhancing nuclear safety

IRSN - French national public expert in nuclear and radiological risks

18th ALARA workshop for Decommissioning and Site Remediation Workshop

IRSN/PSE-ENV/SIRSÉ
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IRSN/PSE-ENV/SIRSE/LER-Nord :

Laboratory of **R**adiological intervention and **E**mergency preparedness of the **D**epartment of **R**adiological **I**ntervention and **E**nvironmental **M**onitoring

As Low As Reasonably Achievable

How to optimise radioprotection in an uncontrolled environment?

- No measurements prior intervention
- Few or no background checks

Hard to elaborate realistic intervention scenarios
Hard to estimate the radiation protection of intervention workers

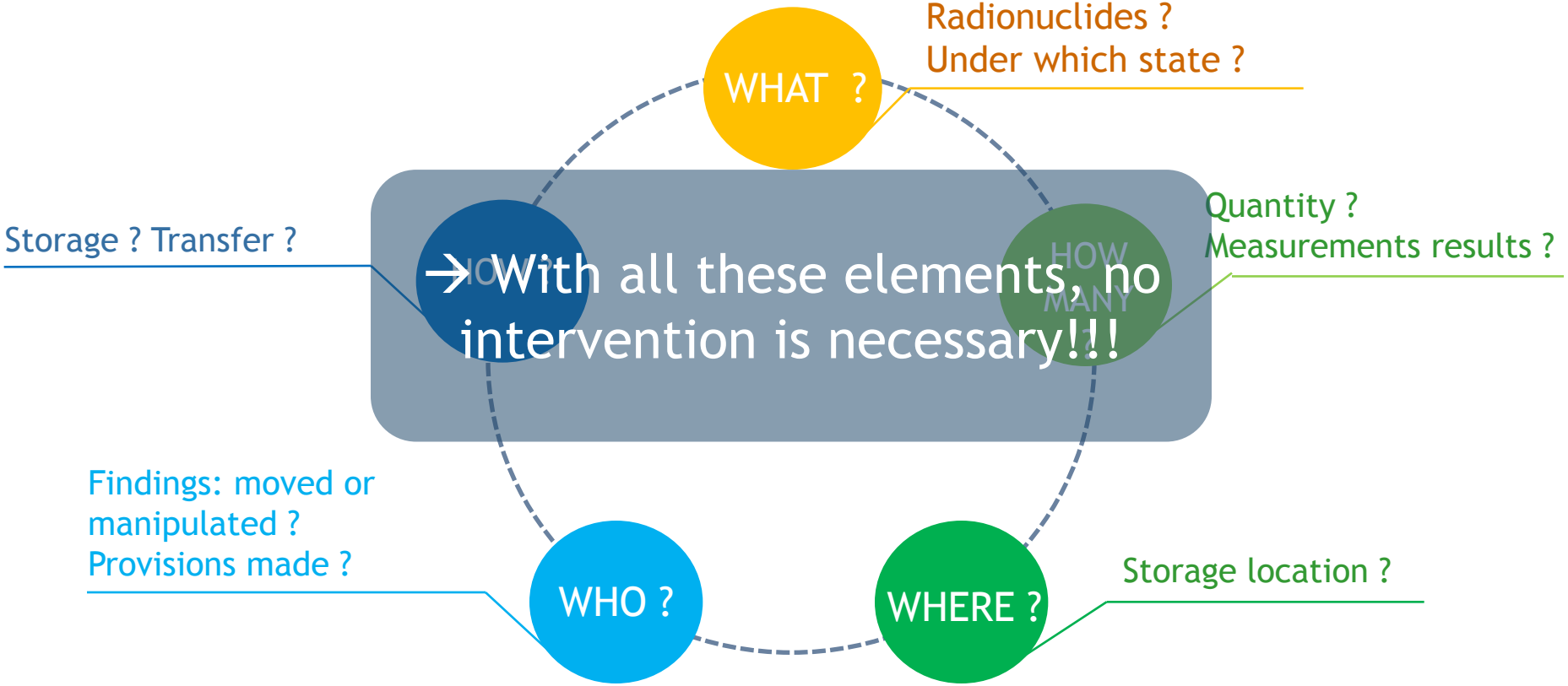
The IRSN INTERVENTION PROCESS

An expertise almost like the others

From preliminary analysis to intervention protocol

↗ Gathering of available data

« In a perfect world! »



From preliminary analysis to intervention protocol

↗ Gathering of available data: Real life case (SIRSE, 2017)

In November 2017, ANDRA (*the French Radioactive Waste Management National Agency*) get a call from an individual asking to evacuate vast amounts of radioactive minerals in three dwellings. Some of these minerals were stored in an apartment located in a building downtown Orleans city

On November 6, 2017

ANDRA informs ASN (*the French Nuclear Safety Authority*) & IRSN (*French national public expert in nuclear and radiological risks*)

On November 13, 2017

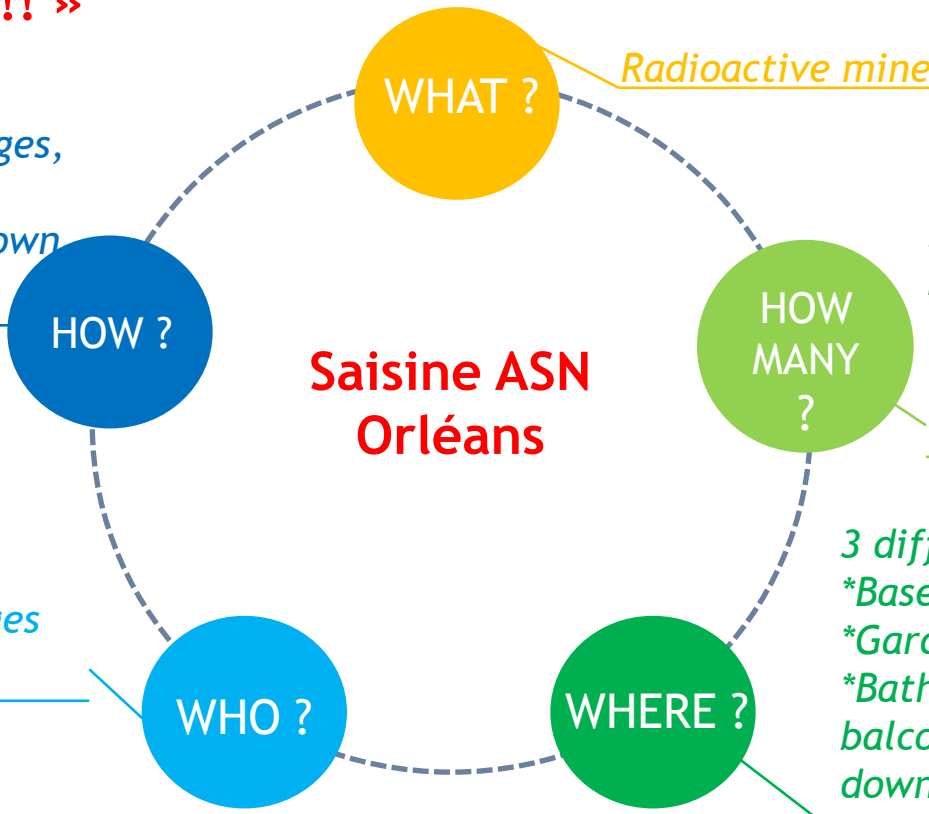
ASN addresses IRSN for assessing radiological risks, releasing doubts regarding radiological hazard and deploying a « render safe procedure (RSP) » regarding wastes and the building

IRSN intervention planned on November 15 and 16, 2017

From preliminary analysis to intervention protocol

↗ Gathering of available information

« In real life!!! »



Radioactive minerals

Minerals stored in packages, transfered from a single house to a flat in downtown Orleans city

« a few minerals »
Saturation of mesurement tool
→ Type of measurement device ?
→ Saturation of all parcels ?

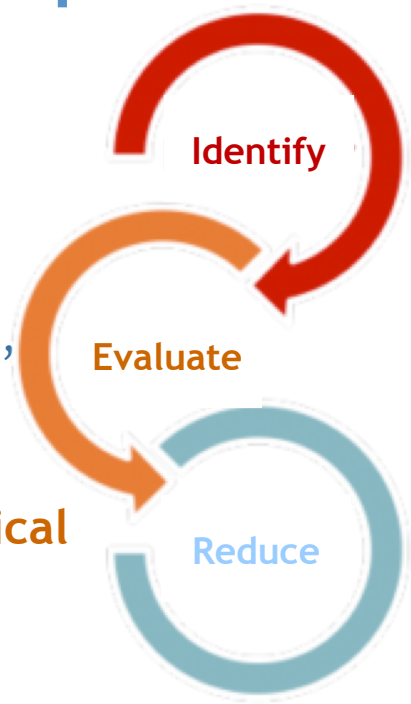
Family owner in contact with contaminated packages

3 different sites :
**Basement (single house 1)*
**Garden shed (single house 2)*
**Bathroom, living room and balcony & cellar (the flat in downtown Orleans city)*

↗Scarce technical data to prepare intervention

From preliminary analysis to intervention protocol

↗ Why establish a protocol ?



Risk management

- Radiological risk for intervention workers,
- Other technological/usual risks for intervention workers,
- Societal and mediatic impact.

→ Risk analysis: Study of different scenarios and technical solutions

Intervention methodology

- Standard technical operations according to the type of intervention,
- Evolution of methodology thanks to the feedback of past interventions (REX)

↗ Protocol is the common thread throughout intervention

From preliminary analysis to intervention protocol

↗ Protocol : the intervention step by step

Step 1 : Appraisal of the situation outside storage rooms

Step 2 : Definition of intervention conditions

Step 3 : Assessment of the initial state in the storage rooms

Step 4 : Adapted « Render Safe Procedure » (RSP)

Step 5 : Assessment of the final state of the storage rooms

↗ Adaptation of the different steps according to the risk
- Regular catch points throughout the intervention
- Adjustment of technical solutions:
  - individual protection choice,
  - Division of tasks between workers

Step 1 : Appraisal of the situation outside storage rooms

Objective : Identify the radiological risk

- For flats below and above: rise of the dose rate located on the balcony and in the bathroom
  [170 à 210 nSv/h – Bdf 80 nSv/h]
- Landing door of the contaminated flat: rise of the dose rate
  [150 nSv/h – Bdf 80 nSv/h]

- **Checking the absence of radiological risk outside storage rooms**

Step 2 : Definition of intervention condition

Objective : Risk evaluation for intervention workers before going in (external and internal dose rate exposure, radon)

- Measurement of radon volumic activity
  - Appartment [60 à 170 Bq/m^3]
  - Cellar [400 à 900 Bq/m^3]

- Catch points: choice of individual protection
- Division of tasks between workers:
  - Prospection in the room
  - Handling
  - RP controls

Step 3 : Assessment of the initial state in the storage rooms

Objective : Evaluate the radiological state of the storage rooms

Step 4 : Adapted « Render Safe Procedure »

Objective : Limit radiological risk and reduce dose rate exposure before removal of the source term

Balcony – Apt. 6th floor

- Rock: 800 µSv/h (contact)
- 10 000 times the background in irradiation

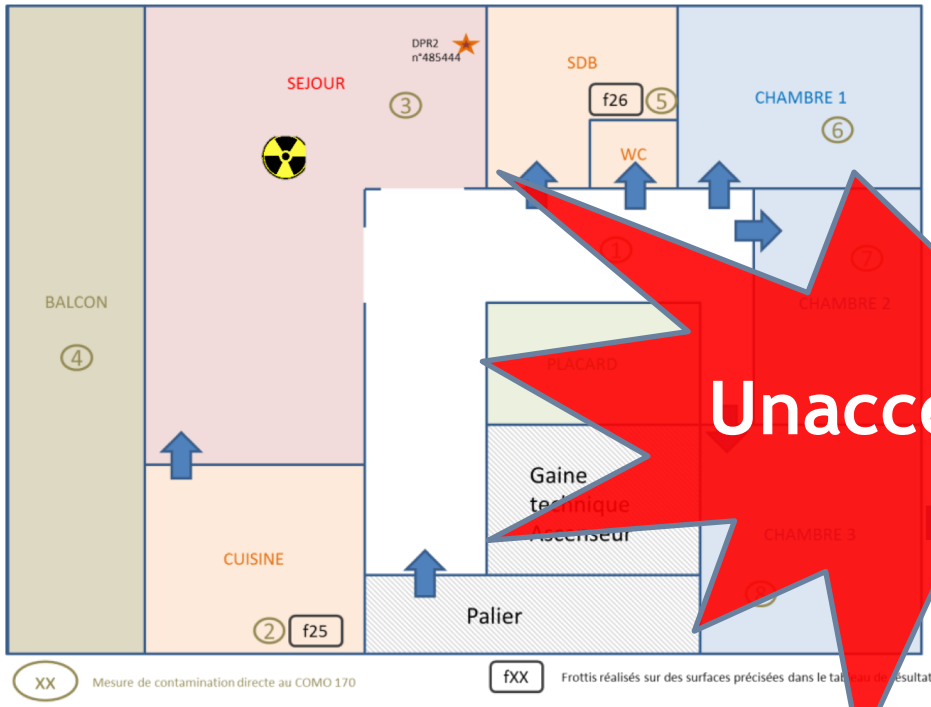
Step 4 : Adapted « Render Safe Procedure »

The most irradiating minerals were found on the balcony Apt. 6th floor

↗ « a RSP » in the living-room under biological protections

Step 5 : Assessment of the final state of the storage rooms

Objectif : Checking the efficiency of « aRSP »



Unacceptable!

Dose Rate control in the adjacent rooms
↗ 1,4 µSv/h in the living-room of the below flat (at 1,90 m high)

→ Back to step 4 to reduce neighbourhood dose rate exposure
→ Proposition to ASN: store the most irradiating minerals in the cellar

Step 5 : Assessment of the final state of the storage rooms

- Storage of the most irradiating minerals in the basement before their removal

- Dose rate control in the common areas of the basement
  - prior aRSP: 2 µSv/h
  - after aRSP: 2,5 µSv/h

→ Recommendation to ASN: restrict basement access

Radiological risk managed

Feedback (REX)

Elements of REX for the Orleans case:

- **The gathering of data required for intervention preparation was difficult → multiple parties**

- **Request of CMIR45 & CMIR41 support**
  → Technical support
  → Logistical support
  → Communication aid for public address

- **Sizing IRSN team**
  → Adapted during intervention:
  - 3 intervention workers
  - 1 coordinator in charge of the interface with authorities

- **Communication means** (clean area/work site)
  →not very relevant with breathing masks

Conclusion

→ A structured expertise process

- Analysis of available data
- Consider degraded situations
- Development of intervention protocol

→ Use of the feedbacks (REX) acquired throughout SIRSE multiple interventions:

- Organizational issues
- Technical issues

↗ Management of radiological risk

↗ Optimisation of intervention workers radiation protection

THANKS FOR YOUR ATTENTION