IRSN
INSTITUT
DE RADIOPROTECTION
ET DE SÛRETÉ NUCLÉAIRE

Faire avancer la sûreté nucléaire

Industrial radiography incident in France IRSN Feurs (42) site

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Summary

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IRSN presentation

- Three main missions of the French institute for radiological protection and nuclear safety
  - Research and services of public interest, including public transparency
  - Support and technical assistance to the public authorities for civil or defense-related activities
  - Contractual assessment, study and measurement services for public and private organizations, both French and foreign

Incident origin

- CASTMETAL in FEURS is a steel foundry, uses an industrial radiography device for non destructive testing : GR 50 manufactured by CEGELEC (F)

- In 2010, the cobalt source (1,25 TBq) was blocked outside the radiological protection, into the ejection tube

- With CASTMETAL, CEGELEC and IRSN decided to cut off both the ejection tube and the control wire of the source

- Unfortunately, the source was damaged

➔ The industrial site was contaminated by cobalt 60 particles

- In 2012, IRSN became the owner of the 6 000 m² contaminated site of which 3 000 m² contaminated buildings

IRSN Feurs site

Localization :
inside the city

Radiological aspect :
zoning and waste

Feurs town

IRSN site

CASTMETAL site

Buildings : very low activity waste

Bunker 3 : damaged source

Bunker 2 : low and medium activity waste

Clean-up strategy approved by ASN (the French nuclear safety authority) authorization

Phase 1 : ended in 2013

- Secure the site (fence, video camera, guarding, radiological zoning, ventilation, insulation of buildings),
- Inventory of waste

Phase 2 : in progress

- Package and evacuate very low activity waste (1500 m3) : 75% of waste has been evacuated since 2012
- Bunker 3 preliminary clean-up : performed in 2015

Phase 3 : start in 2016

- Clean-up the buildings and evacuate the waste products
- Make a radiological cartography

Phase 4 : expected in 2017

- Check the final radiological state and liberate the site for an industrial activity without any constraint due to radioactive pollution

Site illustrations during phase 2

Before work

After work

Hall gamma

Building A

Building YZ

Removing of very low activity waste during phase 2

- Key figures

Type of waste	Volume (m3)	Weight (ton)	Activity (MBq)
Wood (mold of casting)	730	212	286
Inert (ceramic, concrete)	49	22	21
Plastic (vinyl)	98	7	65
Total	877	241	372

Bunker 3 cartography and preliminary clean-up scenario (1/2)

- Scenario : make simultaneously the radiological and physical cartography and the preliminary clean-up of bunker 3
- Safety file : assessed by Federal Office of Public Health in Berne and approved by ASN in Lyon
- In March 2015 : source activity estimated at 0,7 TBq
- Use of teleoperated tools : equipped Brokk robot, manufactured in Sweden
- Use of video camera, high flux gamma measuring apparatus and vacuum cleaner to collect source particles

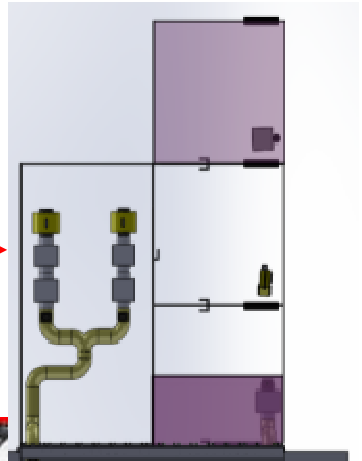
Bunker 3 cartography and preliminary clean-up scenario (2/2)

- Package the collected source particles into a type B(U) container : SO-05 manufactured by UJP in Prague (Czech Republic)
- Low and medium activity waste must respect ANDRA (French radiological waste agency) 7A agreement : use of type IP2 5 m3 container
- Objective : reach the radiological yellow zone criteria (dose rate < 2 mSv/h and volumetric contamination < 1 Bq/m3 without work) to allow final clean-up of bunker 3, expected in the second half of 2016

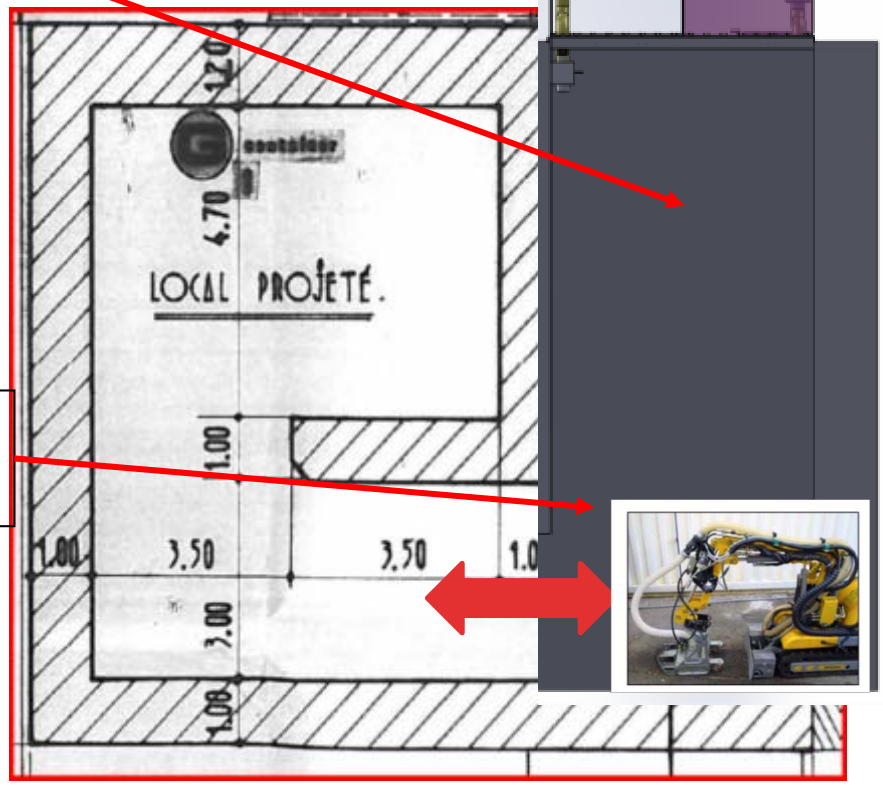
Bunker 3 operating (subcontract to ONET Technologies)

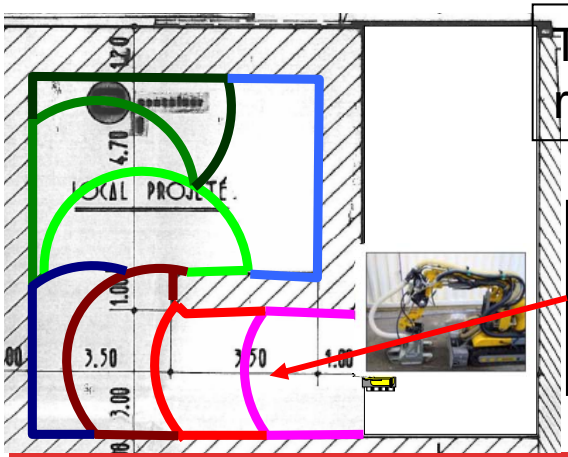
Internal containment (after corridor clean-up)
Operations with air supply

External containment and ventilation



In each working zone of robot : use of video camera and measuring apparatus (cartography) and vacuum cleaner (decontamination)





Teleoperated robot (Brokk)

Robot progressive move

Bunker 3 configuration illustrations

External containment

Ventilation with 2 lines of very high efficiency filters

Internal containment

Partition door between internal containment and central part of the bunker

Equipments and tools illustrations

Brokk robot

Brokk complementary tools

SO-05 Type B(U) container

SO-05 radiological protection with special equipment to move its lid

SO-05 nest with the vacuum pot

Bunker 3 operating illustrations

Brokk with measuring probe

GR 50 with its cut ejection tube

Small robot with its video camera used in 2010

Robot with its circular saw used in 2010

Packaging and transporting radioactive cobalt 60 source particles

Vacuum pot

SO-05 Shielding

Radioactive transport regulations → SO-05 Type B(U) container

ANDRA 7A agreement → 5 m3 metallic container with internal concrete pads

ANDRA waste storage

Bunker 3 cartography and preliminary clean-up results (1/2)

- 42 days of teleoperated works were needed
- Before cleaning :
  - a lot of mesure points with dose rate about 2 Sv/h at 5 cm
  - All source particles were removed from the cladding tube to the bunker
  - The contamination was heterogeneous on the floor and materials
- After cleaning :
  - The contamination of the Brokk is low, except the robot gripper (dose rate about 2 mSv/h)
  - 5 points could not be treated with the robot and are radiologically protected

Bunker 3 cartography and preliminary clean-up results (2/2)

- Total collective dosimetry = 2 mSv (4 operators)
- Maximum personal dosimetry = 0,85 mSv
- Vacuum pot dose rate measured at 4,5 m = 7 mSv/h
- Evacuated activity = 461 GBq
- Inside the bunker 3 :
  - volumetric contamination < 1 Bq/m3 without work
  - dose rate < 2 mSv/h
  - the radiological yellow zone criteria are reached
  - About 170 GBq are still present

➔The bunker 3 final clean-up can start

Conclusion (1/2)

- A particular project : site localization and its industrial configuration
- IRSN atypical role : context, operating of a contaminated site
- Incident origin : loss of containment of the cobalt source
- High radiation risk before preliminary clean-up of bunker 3 with teleoperated tools
- The bunker 3 final clean-up represents a significant radiological challenge

Conclusion (2/2)

- Concerning ALARA in industrial radiography :

➔A good operating of non destructive testing is fundamental

➔With attention and safety culture, incident can be avoided

➔Equipment maintenance and user training should be monitored more regularly

➔Dosimetric cost of incident treatment is very high, in comparaison with a normal operating of industrial radiography apparatus

Thanks for your attention

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