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Establishing decommissioning plans and the decommissioning of the fuel facility FBFC in Belgium

BEL V
filiaal van het FANC I filiale de l'AFCN

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Summary

- The FBFC Decommissioning Project
  - History
  - Licensing procedure for decommissioning
  - Content of demand for license for decommissioning and dismantling
  - Decommissioning license
  - Decommissioning and dismantling phase
  - Waste Management Program


FBFC

History FBFC International

- Clients:
  - F: EDF
  - B: ELECTRABEL/TRACTEBEL
  - D: All producers of electricity
  - Others: Sweden, Switserland, S-Africa and Japan

  Tablets: from 14x14 to 18x18 UO2 and 10x10 tot 18x18 Gd2O3

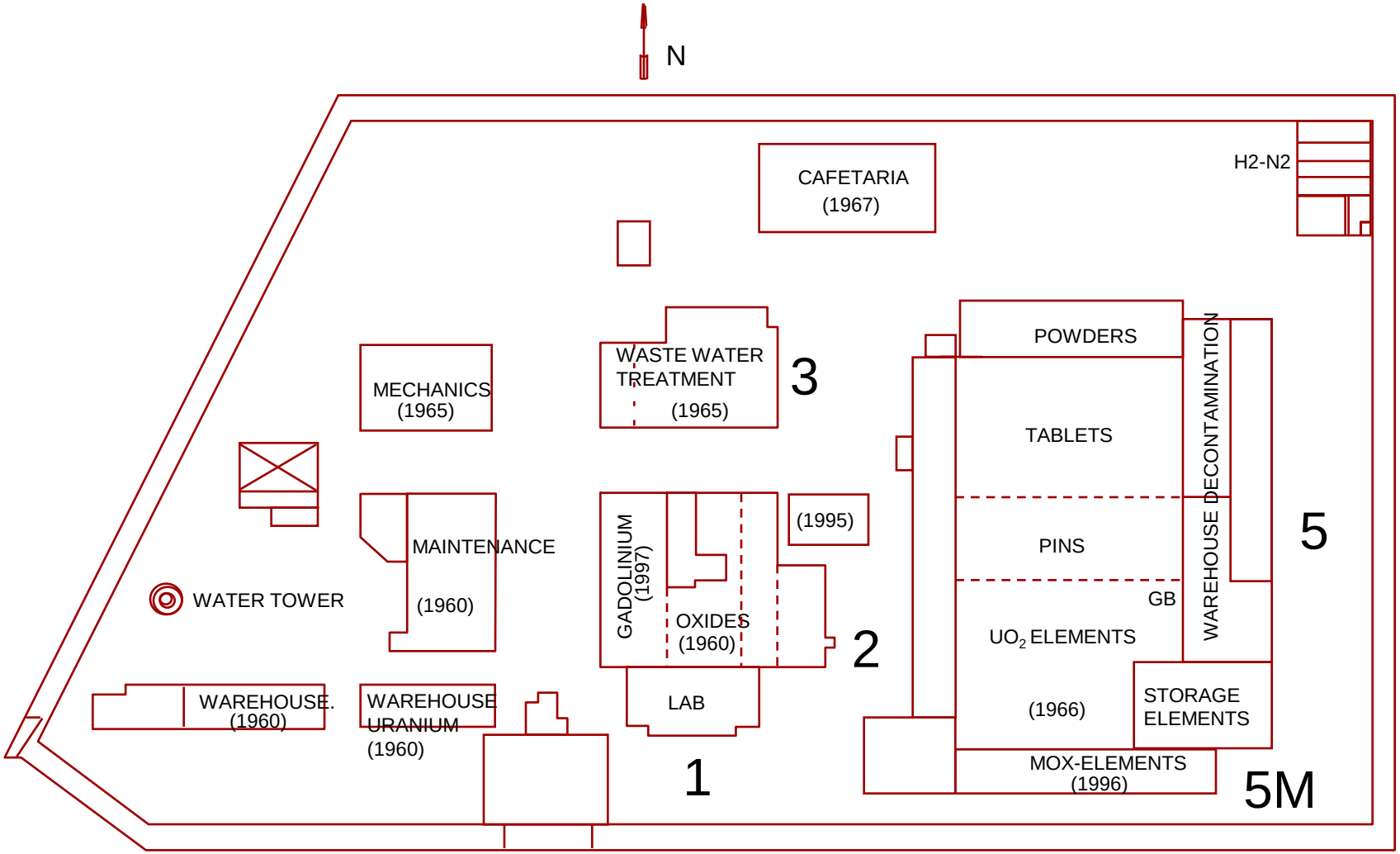
  Fuel elements: from 8x8 to 10x10 MOX and 14x14 to 18x18 MOX en UO2

- FBFC exists since 1961

Activities in the past

- UO2
  - tablets, pins, elements and frames
- Gadolinium
  - tablets and pins
- MOX
  - elements
- Small components
  - stoppers and springs for fuel pins
- R & D oxides

FBFC International - Dessel



Licensing procedure for decommissioning

- Based on requirements of FANC
- Based on:
  - IAEA Safety Requirements: Predisposal Management of Radioactive Waste, including Decommissioning (WS-R-2)
  - IAEA Safety Guides:
    - Decommissioning of Nuclear Power Plants and Research Reactors (WS-G-2.1)
    - Decommissioning of Medical, Industrial and Research Facilities (WS-G-2.2)
    - Decommissioning of Nuclear Fuel Cycle Facilities (WS-G-2.4)

Content of demand for license for decommissioning and dismantling

- Introduction
- Description of the installation
- Radiological and toxic inventory
- Dismantling strategy
- Purpose, dismantling alternatives, safety principals and criteria, destination of the site, …
- Project Management
- Personnel, Documentation, Financing
- Quality System

Content of demand for decommissioning and dismantling

- Dismantling activities
  - Planning, decontamination and dismantling techniques, release, re-use of materials,…
  - Safety Analysis
  - ALARA study
  - Safety systems, Incident Analysis, Criticality, Industrial Safety, Emergency Planning, Security,…
  - Environmental Report

Decommissioning license

- License conditions
  - Specific procedures needed (release of waste, dismantling techniques, …)
  - Safety evaluation report / Decommissioning plan /Technical report
  - QS system
  - Procedures and instructions / ALARA study
  - Inventory of radioactive waste
  - Inspection program
  - Risk analysis (for new dismantling techniques)
  - Dose registration
  - Operational experience feedback system
  - Methodology and results of final characterisation

Decommissioning license

- License received for decommissioning of buildings 1 (lab), 2 (Gado), 3 (ARIEL) and 5M (MOX) on Dec 8, 2010
- License for decommissioning of building 5 (Uranium) received end of 2013

Since 2012

- Stop Uranium / gadolinium production in 2012;
- Assembly of MOX fuel elements stopped in 2015
- Production of stoppers and springs for fuel pins (stopped end of 2012)
- From April 2012 ~ 30 FBFC staff members on site (for safety, security, MOX production and dismantling activities) + subcontractors

Dismantling activities (status October 2016)

- Buildings 1, 2, 3 and 5 will be demolished
  - Buildings 1 & 2 (decommissioning started end of 2012 and will be completed beginning of 2017)
  - Building 3 (demolished in December 2015, decontamination of foundations between December 2015 and April 2016)
  - Building 5 (decommissioning started end of 2013 and will be finished in 2017)
  - Building 5M will probably be reused, but MOX installations will be dismantled in 2017
- Decommissioning of ARIEL Water Treatment installation in 2017
- UO_2 powder and last 25 spare MOX rods evacuated in 2016
- FBFC site will probably be reused after release in 2018

Dismantling

- Is done by subcontractors
- Monthly follow-up visits by Bel V
- No real anomalies during decommissioning activities, except:
  - one fire incident in August 2015 in a filterinstallation,
  - overflow of a watertank with slightly uranium contaminated water in October 2016,
- Some sand contaminations found in building 3 and in canals on and around the FBFC site + contaminations of surfaces in buildings 1, 2, 3 and 5

Data and information during decommissioning on the FBFC site

- 920 tons of equipment to evacuate
  - of which 655 tons contaminated equipment
- 35000 m2 of surfaces to be released
  - of which 25000 m2 to decontaminate
- 3400 m3 of waste to treat
  - 3050 m3 of ground and sand
  - 100 m3 of peeled products (crust)
  - 250 m3 of bricks and pipings

Contaminated areas: Equipments

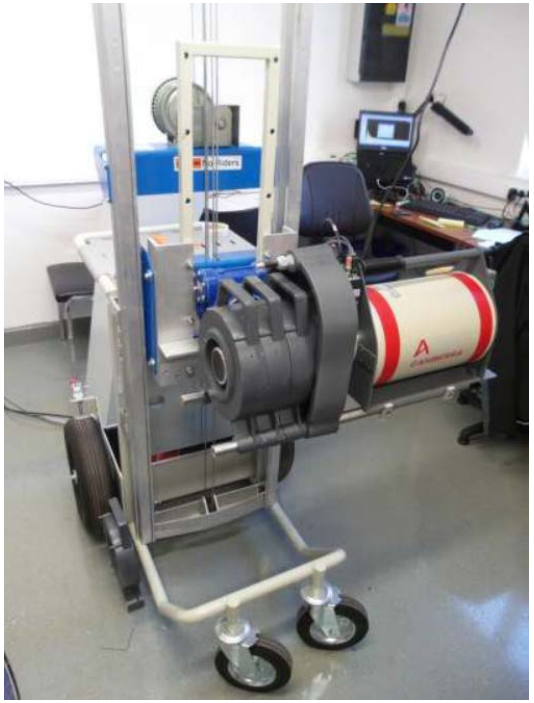
- Metals
  - For melting at Studsvik (till 2015) and Energy Solutions
  - Non accepted alloys to NIRAS/ONDRAF (Belgian Agency for Radioactive Waste and Enriched Fissile Materials)
- Verification of the contaminations of the equipments
  - Surface
    - > 0,04 Bq/cm^2 α → to NIRAS
  - Mass
    - > 1 Bq/g α → to NIRAS

Contaminated areas: Buildings

- Floors, walls, ceilings, beams
  - Cleaning by aspiration of the dust
  - Removal of one layer ~ 3 mm

    (for example by peeling)
  - Verification of the contamination

    (double measurement)
    - ≤ 0,04 Bq/cm^2 (alpha)
    - ≤ 0,4 Bq/cm^2 (beta)
  - Verification of the waste drums using gamma spectrometry
    - < 1 Bq/g (total activity = U-234 + U-235 + U-238)
    - Determination of the U-235 activity with gamma spectrometry (ISOCS - In Situ Object Counting System) and calculation of the U-234 and U-238 activities taking into account the mean isotopic vector



ISOCS

Excavation and decontamination of the pipes

Used decontamination techniques

Decontamination of the floor

Measurement of contaminated bricks

Removal of pipes and contaminated ground

Site

- Methodology for the release of the site
  - < 1 Bq/g (total activity = U-234 + U-235 + U-238)
  - Maximum dose impact for the most exposed person: 10 µSv per year
  - Sampling: if Activity > 1 Bq/g → excavation
  - Measurement of the samples: determination of the U-235 activity with gamma spectrometry and calculation of the U-234 and U-238 activities taking into account the mean isotopic vector

Canals

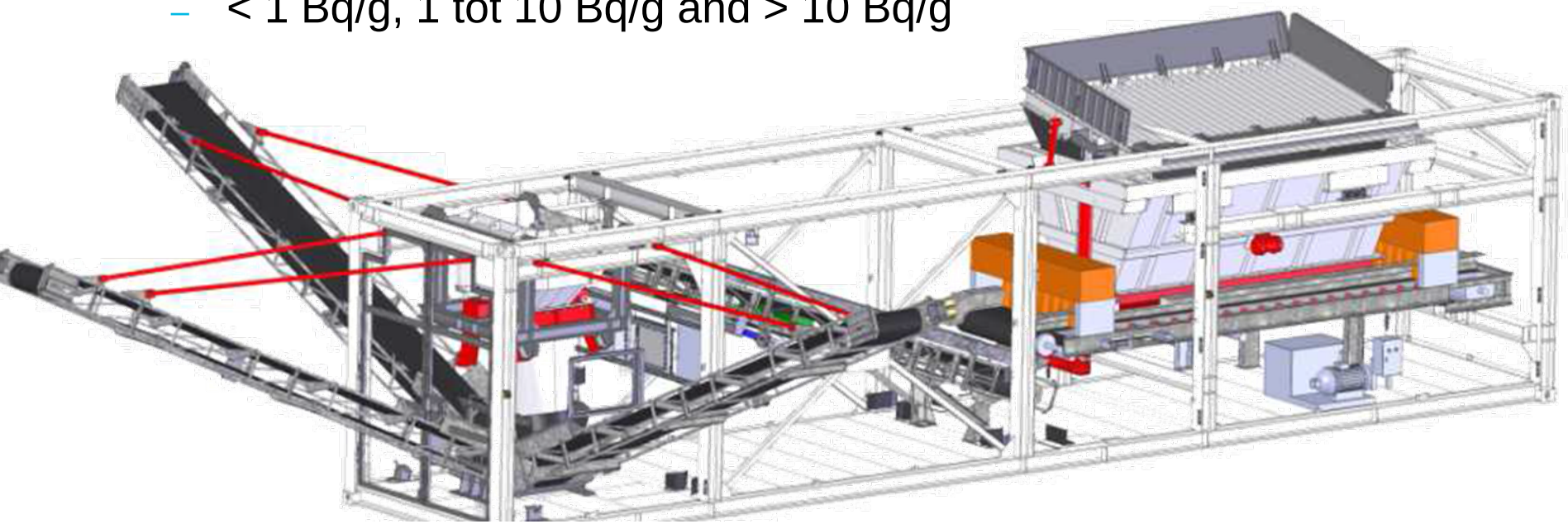
- Same methodology for the canals

Waste Management Program

- All materials are selectively collected in waste categories
- Specific waste drums are used to collect the waste
- All drums are radiologically characterised
- The results of the characterisation determine the removal paths of the material
- All information of each drum is saved in a data management system

Contaminated soil

- Contaminated soil sorting unit
  - Plastic scintillator
  - 10 tons per hour
  - < 1 Bq/g, 1 tot 10 Bq/g and > 10 Bq/g



THANK YOU FOR YOUR ATTENTION