

Spent Nuclear Fuel removal from Gremikha site

2002 - 2012

- **Equipment for the chemical weapon destruction (15 M€)**
 - **Low Level Radioactive Waste Incinerator (11 M€) on Zvezdochka shipyard**
 - **Securing of Spent Nuclear Fuel stored in Gremikha (46 M€)**
 - **Redirection of former military scientists (2.8 M€)**
 - **Bio-security (2 M€)**
 - **Disused Radioactive Sources securing in Russia - RTG (3.5 M€)**
 - **Disused Radioactive Sources securing in Ukraine (2.5 M€)**
 - **Nuclear Power Plant safety (2 M€)**
 - **AIDA (1 M€)**
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- **CEA was in charge of the Bilateral projects on behalf of the French government.**
 - **Rosatom has been our counterpart in Russia.**
 - **Coordination with other countries and international organizations.**
 - **Many French and Russian organizations have been involved: AREVA, RosRAO, SevRAO, Kourchatov institut, RIAR, NIKIET, IPPE, OKBM, VNIPIET, and many others.**

Gremikha - Initial state

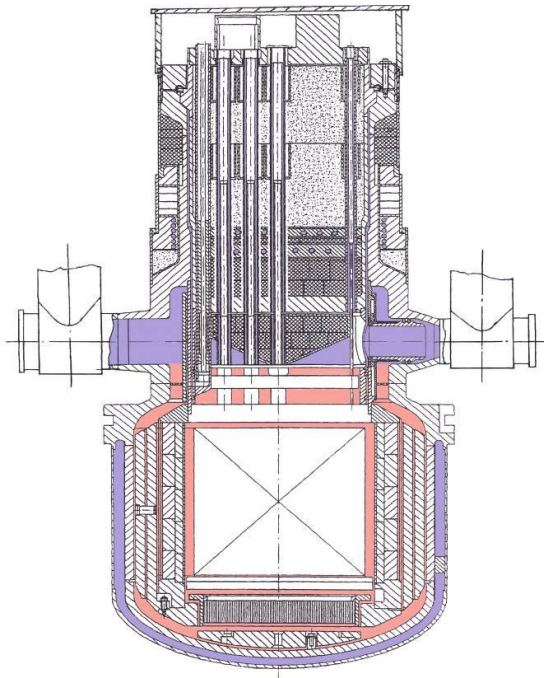
In 2004 :

- 'Alpha' & VVR SNF → to be removed
- Radiological situation on Open Pad → **harsh**
- Solid & Liquid RW → HLW, ILW, LLW
- Infrastructure → many **unacceptable** points



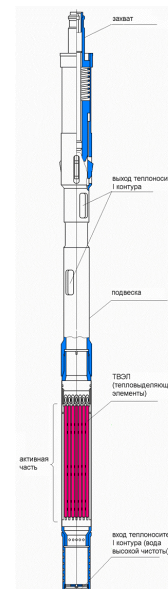
'Alpha' cores

- U-Be fuel with 90% enrichment (U⁵)
- 8 cores stored in specific storage building
- 2 'problematic' cores :
 - N°910 – high dose rate, after an accident
 - N°900 - prepared to be sunk (former final disposal method)



VVR

- SFA with 20% enrichment (U⁵)
- 898 SFA stored in poor conditions
- From those SFA :
 - 2/3 – deterioration is not very high, so accepted for reprocessing
 - 1/3 - severely deteriorated, so couldn't be accepted for reprocessing



SNF removal



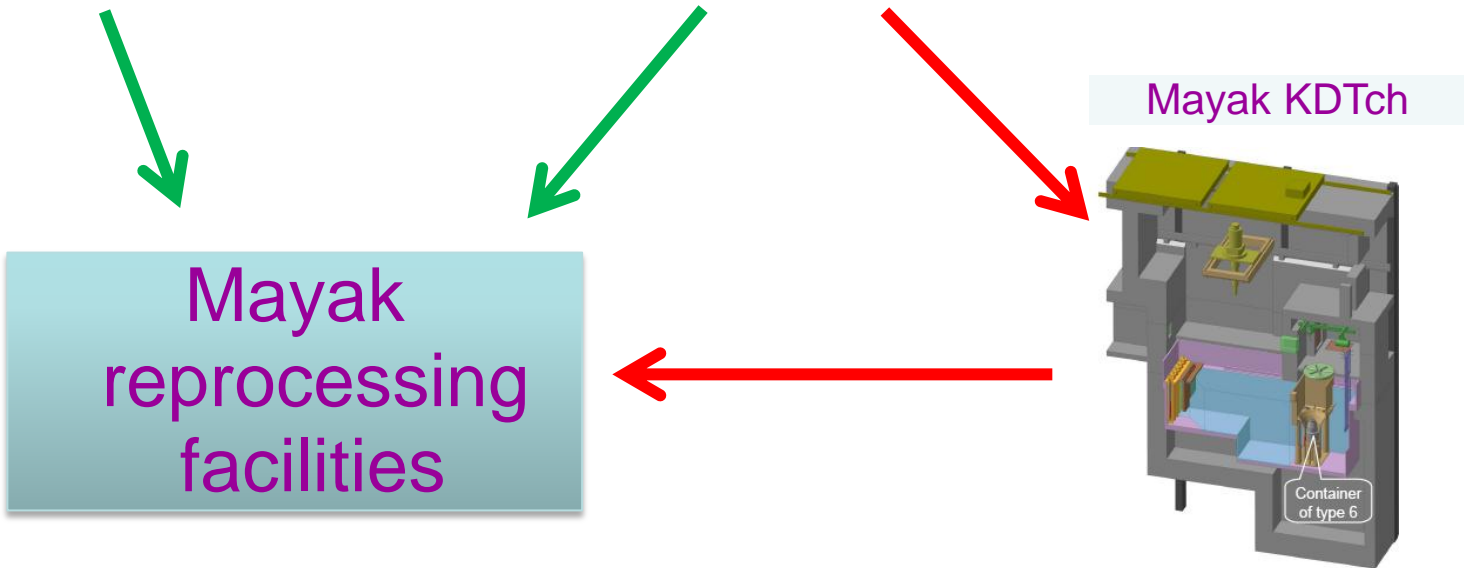
SNF removal



'Alpha'

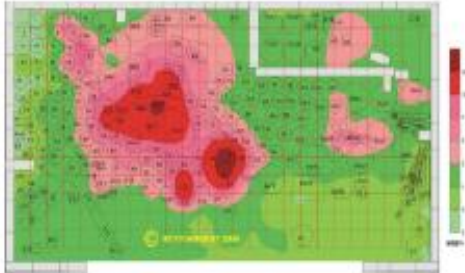


VVR

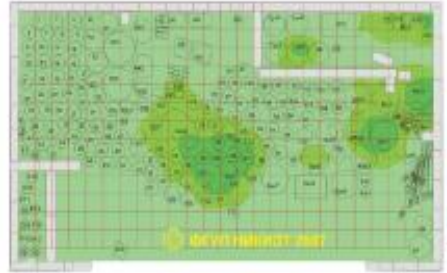


Radiation protection & equipment

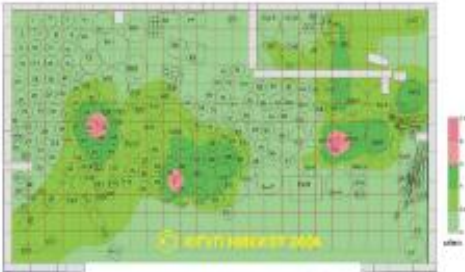
Improvement of the radiation situation at the Open Pad in 2006-2008



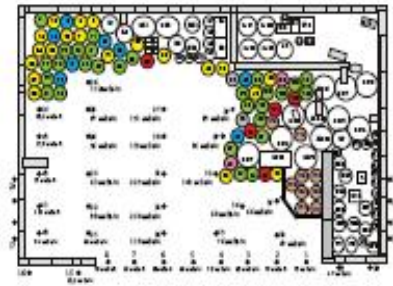
Before localization of sources, spring 2006,
 $\bar{P}_1 = 3.21 \text{ mSv/h}$



After stage 2 of localization of sources, autumn 2007,
 $\bar{P}_2 = 0.34 \text{ mSv/h}$



After stage 1 of localization of sources, autumn 2006,
 $\bar{P}_2 = 0.50 \text{ mSv/h}$



July 2008



Canberra solution



CARTOGAM



ISOCS system



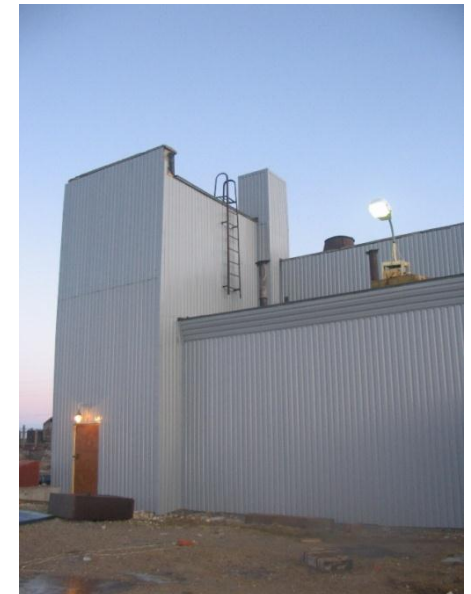
CZT detector



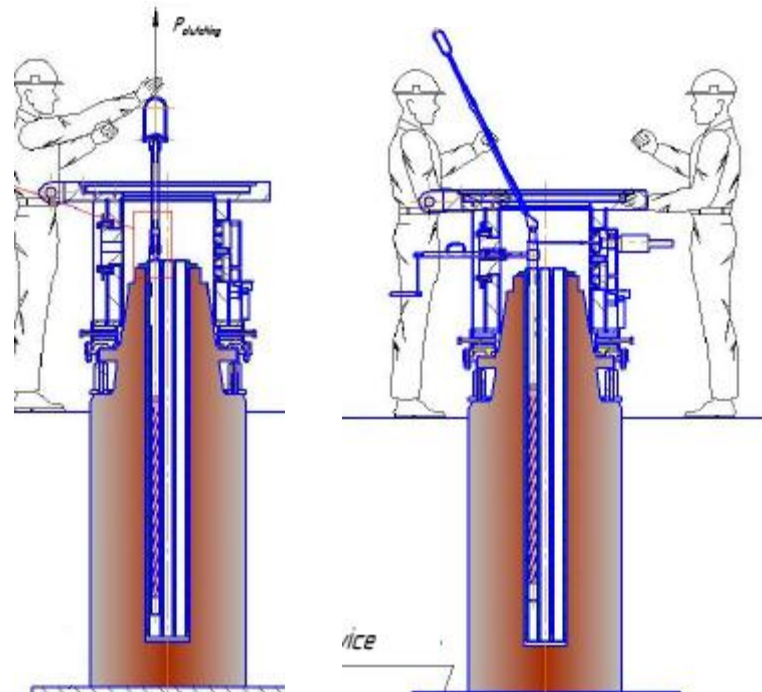
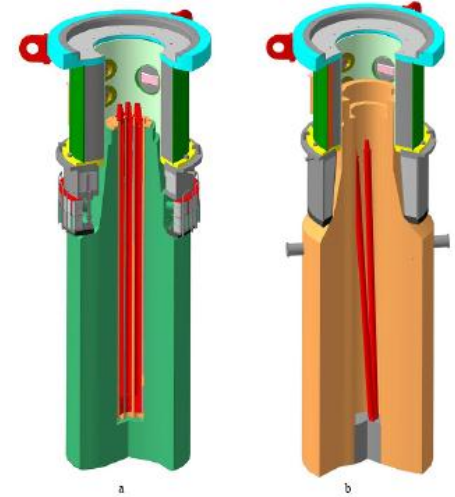
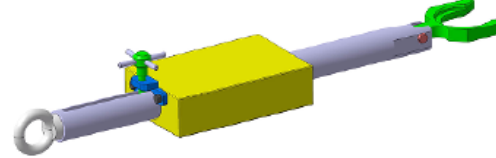
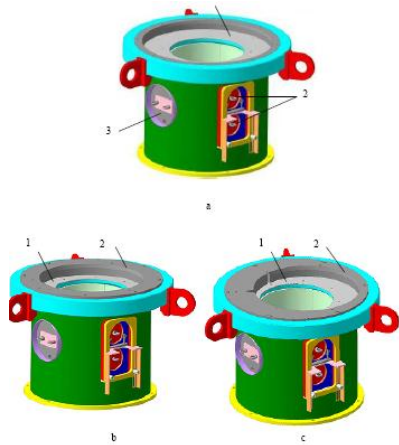
Refitting of infrastructure



- Electricity supply (normal and back-up)
- Cranes, buildings, roads, DOC – 10, fire fighting,
- Radioactive waste building



Specific equipment



Analysis of postulated events in order to check the risk related to:

- Criticality
- Radioactivity release
- Irradiation of workers
- Impact on environment

Exercises:

- Fire on the cask with SFA
- Cask drop

Robot operation



Main achievements in 2013



Dose rate reduced / Infrastructure refurbished

Feasibility studies realised (KIRO, DON & OBIN)

Staff equipped correctly

- 898 SFA VVR → removed
- “Alpha” n°910 → Decontaminated – Unloaded
- “Alpha” n°900 → reactor – removed from the hull and prepared for the SNF unloading



In progress :

- Refitting of hot cell at Mayak
- SNF unloading from “Alpha” n°900

Budget 2004-2012

- ROSATOM ≈ 55 M€
- Donors ≈ 53 M€ (including CEA = 45 M€, EBRD = 6.4 M€ and EC = 1.2 M€)

partnership
≠
assistance

