

# **FiR 1 TRIGA Reactor Decommissioning Licensing**

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Lillehammer 6.12.2018**



# FiR 1 in the Finnish nuclear energy program



30 May 1960: TRIGA order was signed  
by Frederic de Hoffman (General Atomics) and  
Minister Pauli Lehtosalo

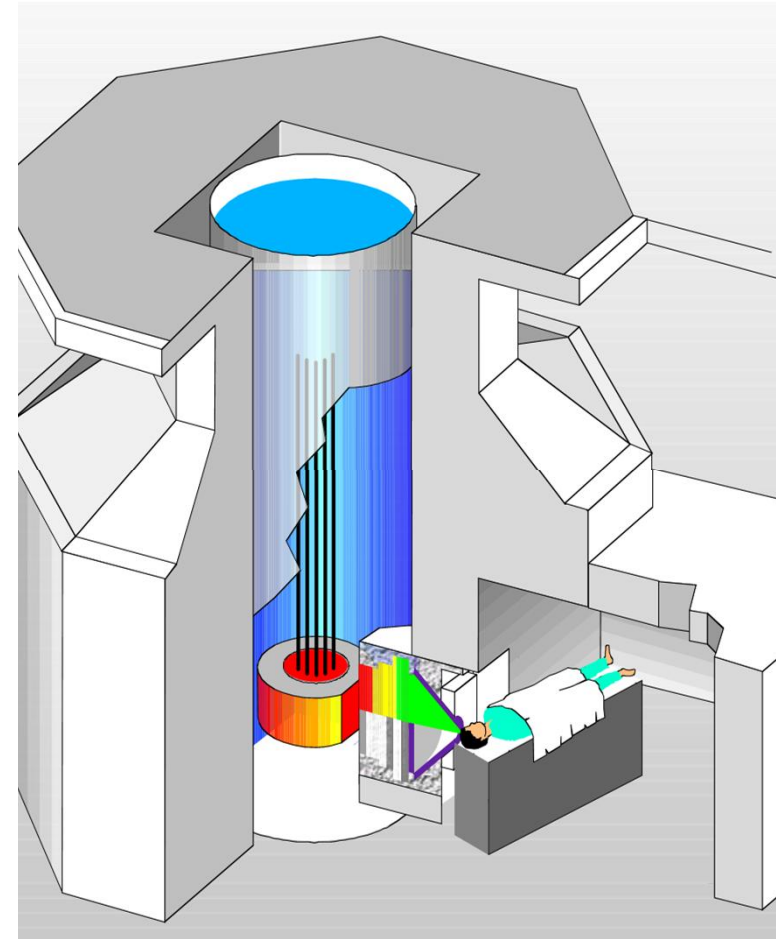
31 August 1962: FiR 1 inauguration  
President of the Republic Urho Kekkonen  
and Director of General Atomics  
Dr. Frederic de Hoffman with high level  
state and industry representatives



# History of FiR 1 in brief

## TRIGA Mark II, 250 kW

- Neutron beam research, activation analysis
- Isotope production ( $^{82}\text{Br}$ ,  $^{24}\text{Na}$ ,  $^{140}\text{La}$  etc.), irradiation testing
- Facility for Boron Neutron Capture Therapy
  - BNCT treatments (> 200 patients) in 1997–2012
  - Special materials to be managed in decommissioning
- Operating license until 2023, shutdown 2015
- New “operating license” for decom 2019
- Inventory estimates (excluding fuel):
  - Mass 75 tons, volume 40 m<sup>3</sup> (mainly concrete)
  - Activity 3.3 TBq (BNCT moderator and steel > 1 TBq)



# Status of decommissioning

2012 VTT's decision to shut down FiR 1

2013–15 EIA for decommissioning

2015 End of operations

2016 Dismantling planning

2017 License application for  
decommissioning

Public hearing → 31.3.2018

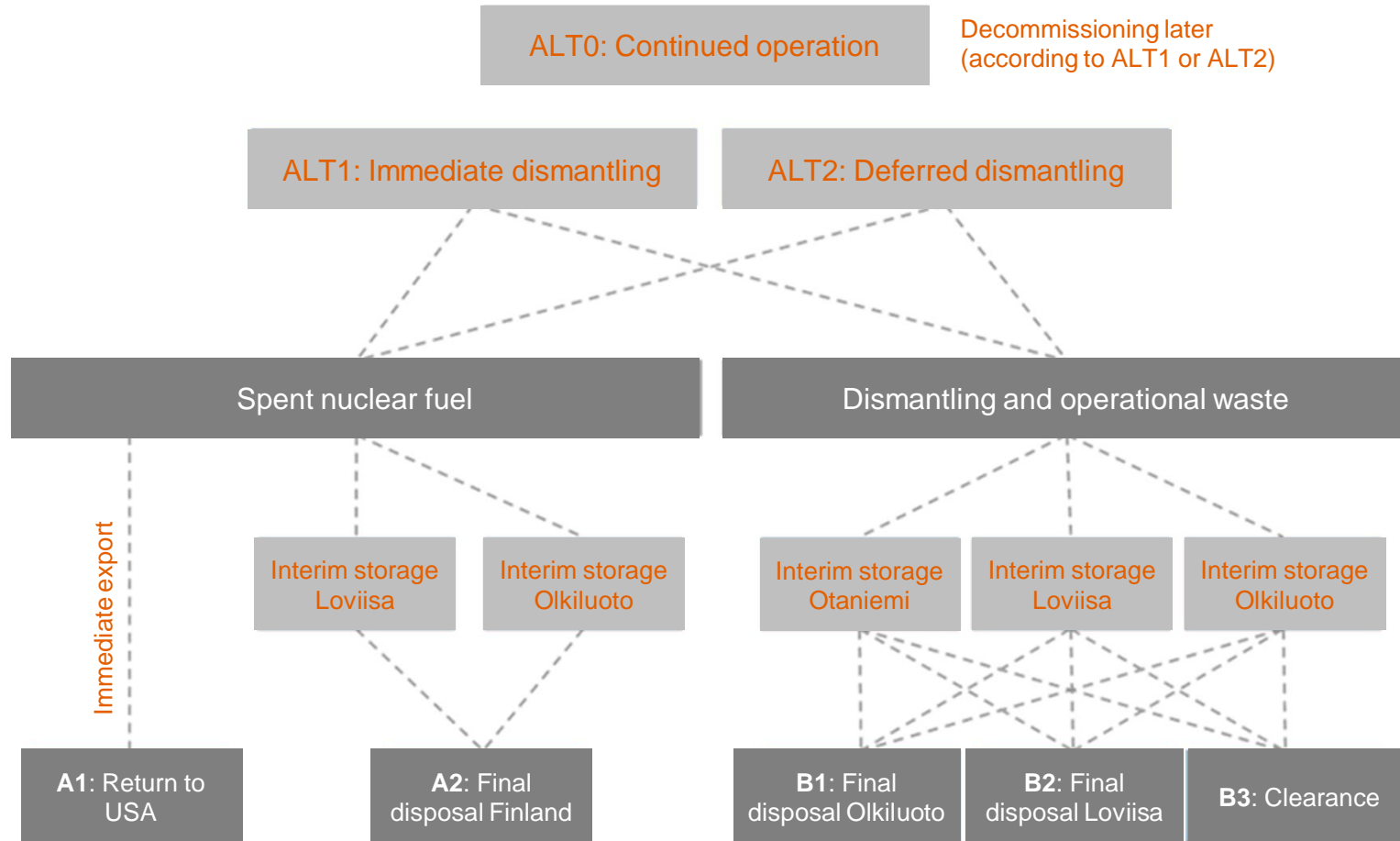
STUK's safety assessment → 31.3.2019

2021–24 Dismantling begins, subject to SNF solution



# Options for nuclear waste management

## FiR 1 Environmental Impact Assessment 2013–15



# Dismantling planning 2016–17

## Example: cutting of the biological concrete shield

### Competitive tender for planning

Relatively high interest, good tenders

Selected contractor: Babcock Noell GmbH & Fortum

### Work completed by BNG and reviewed by VTT

Practically in schedule (+ 1 month)

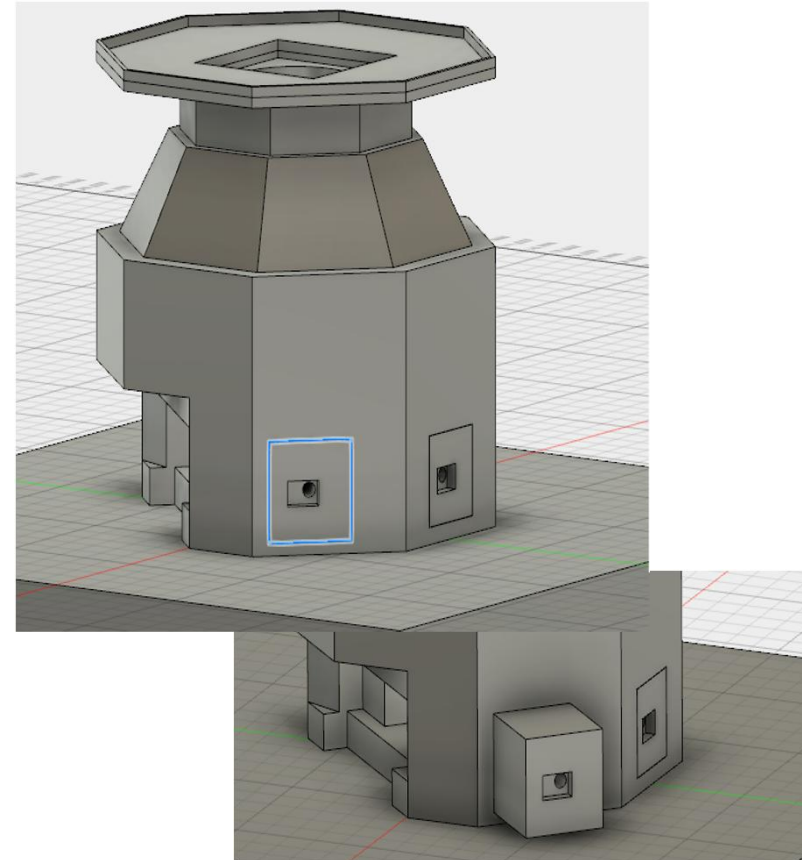
One small additional work order

Domestic regulation, packaging plan and safety classification scheme by Fortum

### The plan forms the basis for...

Technical part of the licensing documentation

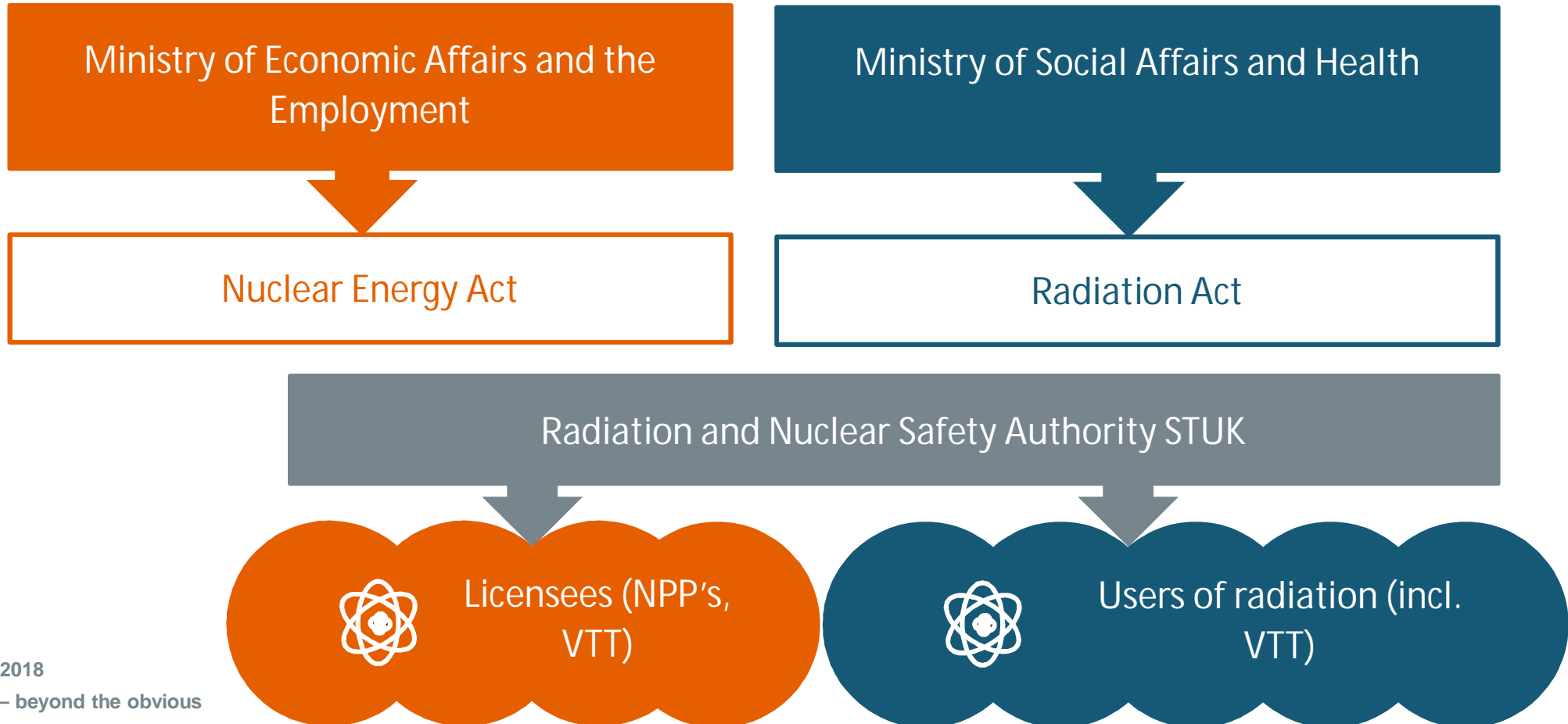
Also supports costing calculations



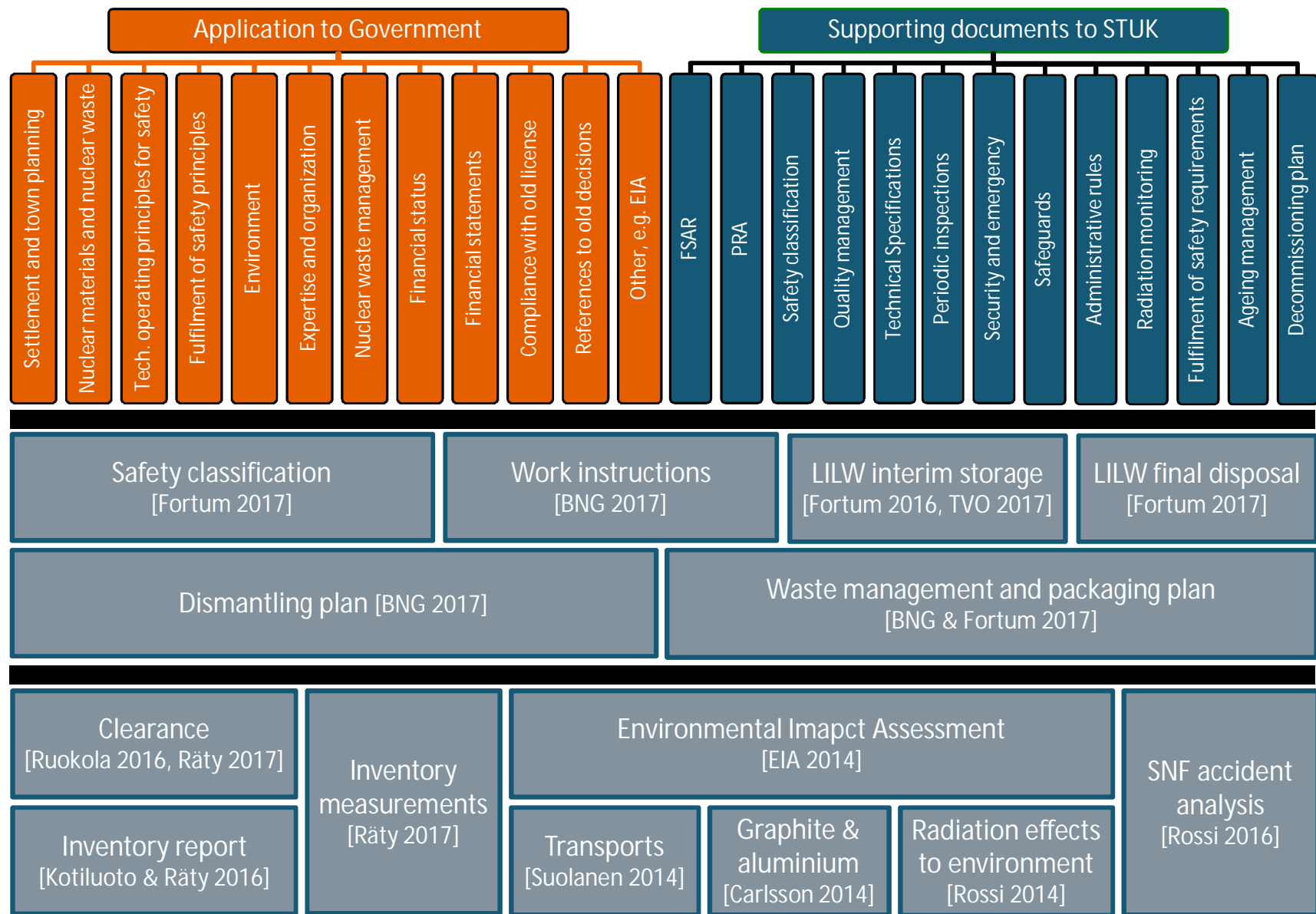
# Licensing for decommissioning

# Division of duties between ministries

According to the Finnish Radiation Act







# Steps during review of application

- Submission of application (Ministry / Government)
- Submission of technical documentation
  - Several batches
- Public hearing + invited statements (7 months)
- VTT supplements the application + additional hearing
  - Status of waste management plans (contracts)
  - Schedule update
  - Any other updates
- STUK prepares safety assessment
  - Statement by Advisory Committee on Nuclear Safety
  - Statement by the Ministry of the Interior
- Hearing of the applicant before final decision

**Total time almost 2 years (insufficient information originally)**



Työ- ja elinkeinoministeriö  
Arbets- och näringsministeriet

## Ilmoitus

### Teknologian tutkimuskeskus VTT Oy:n tutkimusreaktorin käytöstäpoistoa koskevan lupahakemuksen vireilläolosta

Työ- ja elinkeinoministeriö ilmoittaa hallintolain 41 §:n nojalla, että Teknologian tutkimuskeskus VTT Oy (jäljempänä VTT) on jättänyt 20.6.2017 valtioneuvostolle hakemuksen (TEM/1311/08.05.01/2017), jolla se hakee ydinenergilain (990/1987) 20 §:ssä tarkoitettua lupaa:

1. poistaa FiR1 -tutkimusreaktori käytöstä siten, että laitosalueella jäljellä olevien radioaktiivisten aineiden määrä on ydinenergilain nojalla asetettujen vaatimusten mukainen;
2. pitää hallussa, käsitellä ja varastoida reaktorin käytettyä ydinpolttoainetta sekä muita käytön ja purkamisen yhteydessä syntyneitä ydinjätteitä;
3. pitää hallussa, käyttää, käsitellä ja varastoida VTT:n hallinnoimalla materiaalitalasealueella jo olevia muita ydinmateriaaleja, jota Säteilyturvakeskus, Euratom ja IAEA valvovat.

VTT pyytää samalla reaktorin nykyisen, vuoden 2023 loppuun voimassa olevan käyttöluvan raukeamista.

Jäljennös lupahakemuksesta on nähtävissä virka-aikana 29.8.2017–31.3.2018 seuraavissa paikoissa:

- Espoon kaupungin kirjaamo, Siltakatu 11 (Kauppa-keskus Entresse, 3. kerros), Espoo
- Kauniaisten kaupungintalo, Kauniaistentie 10,

# Delivery of VTT's license application



License application delivered to the ministry on 20 June 2017. From left: Jorma Aurela and Linda Kumpula (MEAE); Satu Helynen and Markus Airila (VTT).



Project manager Markus Airila delivering the first set of documents for STUK's review on 30 June 2017.



Antti Rätty delivering the last set of documents for STUK's review on 29 March 2018.

27.11.2018

VTT – beyond the obvious



# Primary option for SNF is repatriation to US Idaho National Laboratory

FiR 1 fuel is US origin and is covered by the Foreign Research Reactor Spent Nuclear Fuel Acceptance Program of US DOE.

Several shipments from other TRIGA type reactors in the past

SNF export (repatriation) is allowed by the Finnish Nuclear Energy Act as an exception only for the research reactor

The return program is currently halted – delayed processing of historical waste

VTT negotiates on extension beyond May 2019

DOE is executing an Environmental Assessment for the extension



# VTT and Fortum have signed a letter of intent on the decommissioning of a research reactor and laboratory

03/12/2018

VTT and Fortum have signed a letter of intent on cooperation in the decommissioning of the FIR research reactor and the nuclear power plant structural materials research laboratory. In addition to cooperation over dismantling and waste handling, the companies investigate possibilities for interim storage and final disposal of the decommissioning waste at the Loviisa nuclear power plant site.

The cooperation will make Fortum's long experience in nuclear power plant operation and nuclear waste management available to VTT.

VTT applied to the Government in 2017 for permission to decommission the reactor. The spent nuclear fuel must be removed from the facility before the reactor is dismantled. VTT primarily intends to repatriate the fuel to its country of origin, the United States. The secondary alternative is deep geological disposal in Olkiluoto, Eurajoki, after interim storage. The actual demolition phase will begin in 2021 at the earliest. Preparations have been made for the decommissioning of the laboratory, which will begin in 2019.

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## Fortum and VTT signed a letter of intent on the decommissioning of a research reactor and laboratory

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The cooperation will make Fortum's long experience in nuclear power plant operation and nuclear waste management available to VTT. In addition to cooperation over dismantling and waste handling, the companies investigate possibilities for interim storage and final disposal of the decommissioning waste at the Loviisa nuclear power plant site.

### More information:

Jari Tuomppa, Head of Nuclear Waste, Fortum Generation, +358 50 342 3331

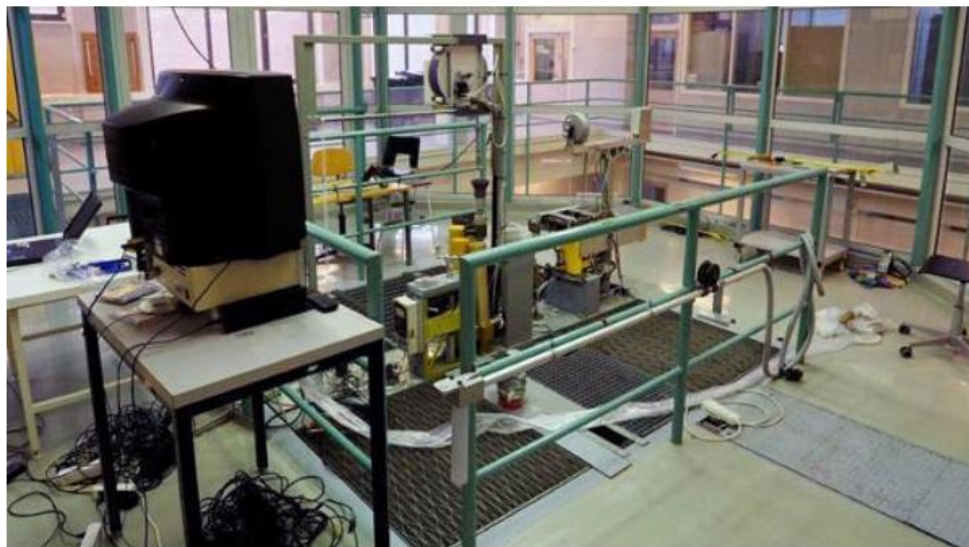
## Fortum to assist in decommissioning research reactor

04 December 2018



Share

**Finnish utility Fortum has signed a letter of intent to cooperate with VTT Technical Research Centre of Finland in the decommissioning of the Finnish Reactor 1 (FiR 1) research reactor and the nuclear power plant structural materials research laboratory.**



*The Finland Reactor 1 (Image: Stuk)*

The FiR 1 water-cooled, pool-type TRIGA Mark II research reactor at Otaniemi, Espoo, was commissioned by the Helsinki University of Technology in 1962. The reactor was originally built for research and education and later also for isotope production and radiotherapy. Operational responsibility for the reactor was transferred to VTT in





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Dear Madam/Sir,

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The FiR 1 research reactor, which has served as a key nuclear energy and educational research facility for 50 years, was shut down permanently on 30 June 2015.

## **FIR 1 timeline**

**2015:** The reactor is run for the last time on 30 June 2015.

**2019:** The spent nuclear fuel is transported to the US or interim storage.

**2021:** The reactor is dismantled, and the resulting waste placed in interim storage.

**2022:** The empty reactor building is decontaminated and released.

**2030's:** The waste is transported from the interim storage facility to a final repository.

Fortunately, Fortum has confirmed to attend [5th Central & Eastern Europe Nuclear Industry \(New Build/Life Extension/Decommissioning/WM\) Congress 2019, January 28-29, Prague, Czech Republic.](#)

If you wanna know the decommissioning program in Finland, their progress in dismantling and waste

# Summary and outlook

## First nuclear facility to be decommissioned in Finland

### License application for decommissioning June 2017

- STUK's statement expected Q1/2019 → followed by new license by the Government

### Uncertainties remain in waste management

- Relatively small activity and amount of waste
- Spent fuel: primary option US return, delayed
- Dismantling waste management with Finnish NPP operators

## See also

### **VTT's info pages on the decommissioning project**

<http://www.vttresearch.com/services/low-carbon-energy/nuclear-energy/decommissioning-of-finlands-first-nuclear-reactor>

### **Decommissioning license application (Website of the Ministry)**

<http://tem.fi/en/vtt-technical-research-centre-of-finland-ltd-s-licence-application-for-decommissioning>