

Business from technology



RROG country report

Finland - the FiR 1

IIRO AUTERINEN FiR 1 reactor manager VTT Technical Research Centre of Finland

EAES RROG Meeting Institut für Kernchemie - Forschungsreaktor TRIGA Mainz (FRMZ) 14 - 17.5.2019



FiR 1 Status Report

- 1. Changing license from operation to decommission
- 2. Preparation for removal of the spent fuel
- 3. Lessons learned



FiR 1 Research Reactor TRIGA Mark II, 250 kW since March 1962



FiR 1

Finnish TRIGA Research Reactor Until 30.6.2015 International Role in Boron Neutron Capture Therapy (BNCT) and Regional Role in Isotope Production, Education and Training Baltic Research Reactor Network







FiR 1 Research Reactor (TRIGA Mark II, 250 kW)

- 1962 early 1990's:
- intensive neutron beam research, activation analysis
- 1990's to 2015
- In-core irradiations for isotope production (⁸²Br, ²⁴Na, ¹⁴⁰La etc.), activation analysis and irradiation testing
- Facility for **Neutron Capture Therapy** constructed
 - BNCT treatments (> 200 patients) in 1999–2012
- Training and education

Operating license valid until 2023

Permanent shutdown by VTT 30.6.2015 \rightarrow New license to be applied for decommissioning

Nuclear waste:

Spent fuel: 103 fuel elements Dismantling waste: Mass 75 tons (mainly concrete) Volume 40 m³ Activity 3.3 TBq

(BNCT moderator and steel > 1 TBq)



Status of decommissioning

VTT's decision to shut down FiR 1 2012 2013–15 EIA for decommissioning 2015 **End of operations** 2016 **Dismantling planning** License application for 2017 decommissioning Public hearing \rightarrow 31.3.2018 STUK's safety assessment → 31.3.2019 2021–24 Dismantling begins, subject to SNF solution



VTT submitted application for decommissioning To Finnish Government, 20 June 2017



Nuclear energy Act and Decree define the structure

STUK review was due by 10/2018 - was delayed till 4/2019

Other statements (Ministries, municipalities, companies, NGOs,...) by 3/2018

<u>http://tem.fi/en/vtt-technical-research-centre-of-finland-ltd-s-licence-application-for-decommissioning</u> (FI, SE, EN)

FiR 1 decommissioning: Road map



21/05/2019



Decommissioning: critical milestones

(i) Operating license and (ii) Agreement on SNF removal





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



TYÖ- JA ELINKEINOMINISTERIÖ / EN / RESPONSIBILITIES / ENERGY / NUCLEAR ENERGY / NUCLEAR FACILITIES AND PROJECTS / DECOMMISSIONING OF THE RESEARCH REACTOR / VTT TECHNICAL RESEARCH CENTRE OF FINLAND LTD'S LICENCE APPLICATION FOR DECOMMISSIONING /

Enterprises	>
Enterprise financing	>
Working life	>
Energy	~
Energy and climate strategy	>
Electricity market	>
Natural gas market	
Emissions trading	>
Renewable energy	>
Energy efficiency	>
Energy Efficiency Directive and Energy Efficiency Act	>
Nuclear energy	~

Nuclear energy administration

VTT Technical Research Centre of Finland Ltd's licence application for decommissioning

On 20 June, VTT Technical Research Centre of Finland Ltd submitted to the Government a licence application concerning decommissioning of the FiR 1 research reactor. Before the licence application, VTT performed environmental impact assessment (EIA) procedure during 2013 and 2015. The EIA report and coordination authority's statement on the assessment report was included in the application.

In the autumn of 2017, the Ministry of Economic Affairs and Employment launched a statutory hearing, circulating the licence application for comments. Statements were requested from ministries, authorities, municipalities and civic organisations as well as the Swedish authorities in accordance with the agreement on the construction of nuclear installations in border areas. Citizens are also asked to present their opinions or statements on the application by the end of March 2018.

Further information: linda.kumpula(at)tem.fi

Decommissioning of VTTs FiR 1 research reactor licence application PDF



VTT FiR 1 lupahakemuksen täydennys 2019 PDF

Lausuntopyynnöt 2019

Laaja PDF <u>Säteilyturvakeskus</u> PDF <u>Natur och Miljö rf</u> PDF <u>Strålsäkerhetsmyndigheten</u> PDF Ålands Landskapsregering PDF

Lausunnot 2019

Museoviraston kansilehti PDF Museoviraston lausunto PDF Liikenne- ja viestintäministeriön lausunto PDF Maa- ja metsätalousministeriön lausunto PDF Akavan lausunto PDF Ilmatieteen laitoksen lausunto PDF Senaattikiinteistön lausunto PDF TUKESin lausunto PDF Nakkilan kunnanhallituksen lausunto PDF Fennovoiman lausunto PDF Sosiaali- ja terveysministeriön lausunto PDF STTK:n lausunto PDF Ympäristöministeriön lausunto PDF Sisäministeriön lausunto PDF Fortum Power and Heat Oy:n lausunto PDF Länsi-Uudenmaan pelastuslaitoksen lausunto PDF Euraioen kunnan lausunto PDF Porvoon kaupungin lausunto PDF STUKin lausunto PDF STUKin lausunnon Liite 1 Turvallisuusarvio PDF STUKin lausunnon Liite 2 YTN lausunto PDF

Opinions to VTT supplement application 1.2.2019

Stuk

Lausunto

2.4.2019

2/F48401/2017

1(9)

Työ- ja elinkeinoministeriö PL 32 00023 Valtioneuvosto

TEM/1311/08.05.01/2017, 29.8.2017 ja TEM/1311/08.05.01/2017, 4.2.2019

Säteilyturvakeskuksen lausunto FiR 1 -tutkimusreaktorin käytöstäpoistoa koskevasta lupahakemuksesta

Johdanto

Työ- ja elinkeinoministeriö on viitekirjeissään pyytänyt Säteilyturvakeskukselta (STUK) ydinenergialain (YEL) 23 §:n tarkoittamaa lausuntoa Teknologian Tutkimuskeskus VTT Oy:n (VTT) FiR 1 –tutkimusreaktorin käytöstäpoistoa koskevasta lupahakemuksesta. VTT hakee ydinenergialain 20 §:ssä tarkoitettua lupaa

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

VTT hakee vuoden 2038 loppuun voimassa olevaa käyttölupaa. VTT pyytää samalla reaktorin nykyisen, vuoden 2023 loppuun voimassa olevan käyttöluvan raukeamista.

VTT täydensi käyttölupahakemustaan 1.2.2019. Täydennys koski käytetyn ydinpolttoaineen palauttamista Yhdysvaltoihin, ydinjätehuollon sopimusten tilannetta, hankkeen aikataulua sekä hallussa pidettävän ydinmateriaalin määriä.

VTT on toimittanut työ- ja elinkeinoministeriölle ydinenergia-asetuksen (YEA) 33 §:n tarkoittaman käyttölupahakemuksen ja ydinenergiaasetuksen 34 §:n edellyttämät käyttölupahakemukseen liitettävät asiakirjat. VTT on toimittanut STUK:lle ydinenergia-asetuksen 36 §:n mukaiset asiakirjat.

STUK on laatinut tämän lausunnon liitteenä 1 olevan turvallisuusarvion VTT:n toimittamien asiakirjojen sekä FiR 1 -tutkimusreaktorin

STUK SÄTEILYTURVAKESKUS STRALSÄKERHETSCENTRALEN RADIATION AND NUCLEAR SAFETY AUTHORITY

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LAUSUNTO	1
7.3.2019	
	LAUSUNTO 7.3.2019

SÄTEILYTURVAKESKUS Kirjaamo Laippatie 4, 00880 Helsinki PL 14 00881 Helsinki

Stuk

Viite: STUKin lausuntopyyntö; 2/F48401/2017, ratkaistu 12.2.2019

Ydinturvallisuusneuvottelukunnan lausunto FiR 1 -reaktorin käytöstäpoistoa koskevasta VTT:n hakemuksesta Säteilyturvakeskuksen lausunnon ja turvallisuusarvion perusteella

> Espon Otaniemessä äjäätesva FIR. 1–tutkimuseaktoti, Triga-tyypinen teholaan 250 kWn allassenkoito, on otettu käyttön vuona 1902. TRI 1316 on voimassa normain käytön katuva käyttölupa vuoteen 2023. Luvanhaltija, Feknologian Tutkimuseksuk VTT 07 (VTT), on vuona 2012 päättänyk josta reaktorin käytön, sukenut reaktorin lopallisesti vuonna 2015 ja hakenut vuonna 2017 uutta käytöh an, jossa käyttölupa jaritääsiin kosekamaa reaktorin käytön, siktöittösen jä jättävä 16 pyysiä susmälla nykyisen käytöluosa runkemäistä.

> Säteilyturvakeskus on pyytänyt ydinturvallisuusneuvottelukunnalta lausuntoa VTT:n hakomuksesta lausuntopyynnön liitteenä olleen lausuntoluonnoksen ja turvallisuusarvion (luonnos 6.2.2019) perusteella.

Ydinturvallisuusneuvottelukunta (YTN) on käsitellyt STUKin lausuntoa FiR 1 – tutkimusreaktorin käyttölupahakemuksesta ja STUKin lautimaa, hakemusta koskevaa turvallisuusarvion luonnosta. Arviointinsa perusteella YTN kiinnittää huomiota seuraaviin seikkoihin:

- STUK toteaa, että FiR 1 –tutkimusreaktori täyttää pysyvässä sammutustilassa sille asetetut ydin- ja säteilyturvallisuutta koskevat vaatimukset. YTN yhtyy fahän käsitykseen ja toteaa, että turvallista tilaa on mahdollista ylläpittä niin kauan kuin VTT ylläpittä tarvittavaa organisastilota, turva- ja valmiusjärjestelyjä
- sekä reaktoria ympäröivää infrastruktuuria. 2. Turva- ja valmiusjärjestelyjä ja ydinmateriaalivalvontaa on STUKin lausunnossa ja turvallisuusarviossa arvioitu riittävän kattavasti ja riittävää asiantuntemusta
- sa ja turvalisuusarviossa arvioitu riittävän kattavasti ja riittävää asiantuntemusta käyttäen. 3. Ydin- ja säteilyturvallisuutta on STUKin lausunnossa ja turvallisuusarviossa ar-
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Finnish regulation for decommissioning of nuclear installations

IAEA Safety Standards for protecting people and the environment

P STUK

GUIDE YVL D.4 / 15 NOVEMBER 2013

Decommissioning of Facilities

General Safety Requirements Part 6 No. GSR Part 6



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PREDISPOSAL MANAGEMENT OF LOW AND INTERMEDIATE LEVEL NUCLEAR

WASTE AND DECOMMISSIONING OF

A NUCLEAR FACILITY

With regard to new nuclear facilities, this Guide shall apply as of 1 December 2013 until further notice. With regard to operating nuclear facilities and those under construction, this Guide shall be enforced through a separate decision to be taken by STUK. This Guide replaces Guides YVL 8.2 and YVL 8.3.

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The Nuclear Energy Act and the STUK's regulations and YVL Guides (Guide YVL D.4) cover the decommissioning requirements of the IAEA standard as well as WENRA's decommissioning reference levels

STRÅLSÄKERHETSCENTRALEN

STUK • SÄTEILYTURVAKESKUS Osoite/Address • Laippatie 4, 00880 Helsinki Postiosoite / Postal address • PL / P.O. Box 14, FIN-00881 Helsinki, FINLAND RADIATION AND NUCLEAR SAFETY AUTHORITY Puh./Tel. (09) 759 881, +358 9 759 881 • Fax (09) 759 88 500, +358 9 759 88 500 • www.stuk.fi







NAC-LWT cask system for transport of irradiated TRIGA fuel to INTEC facility for storage





Pu-2 (gram 0,0005 0,0005 0,0005 0,0005 0,0005 0,0005 0,0015

0,0014

Preparation of the DOE/INTEC documents

434.28 02/25/16 Rev. 05 Use with MCP-2861

FUEL AND PACKAGING REQUIRED SHIPPER'S DATA FORM

Page 1 of 15

Revision Number:

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DOE/EIS-0218-SA-8

SUPPLEMENT ANALYSIS FOR THE FOREIGN RESEARCH REACTOR SPENT NUCLEAR FUEL ACCEPTANCE PROGRAM

APRIL 2019



U.S. Department of Energy National Nuclear Security Administration Washington, DC

MAY 6, 2019 EIS-0218-SA-08: Supplement Analysis

NNSA proposes to extend the Foreign Research Reactor Spent Nuclear Fuel Acceptance Program through May 12, 2029 and implement the Policy on Exemptions

Foreign Research Reactor Spent Nuclear Fuel Acceptance Program

This Supplement Analysis (SA) evaluates extension of the Foreign Research Reactor (FRR) Spent Nuclear Fuel (SNF) Acceptance Program through May 12, 2029 and implemention of the Policy on Exemptions to the FRR SNF Acceptance Program.

Based on the analysis in the SA, DOE/NNSA finds that the impacts of the proposed action would be within the range of impacts analyzed in the FRR SNF EIS.

Extending the Acceptance Program end date consistent with the Policy on Exemptions would not constitute a substantial change in the proposed action evaluated in the FRR SNF EIS. DOE/NNSA determined that neither a supplement to the FRR SNF EIS nor a new EIS is required.

For more information, see

Foreign Research Reactor Spent Nuclear Fuel Acceptance Program.

supplement-analysis-eis-0218-sa-08-foreign-research-reactor-snf-2019-05.pdf





Department of Energy National Nuclear Security Administration Washington, DC 20585



May 7, 2019

Mr. Riku Huttunen Director General Energy Department Ministry of Employment and the Economy P.O. Box 32 FI-00023 Helsinki, Finland

Dear Mr. Huttunen:

The Department of Energy's National Nuclear Security Administration (DOE/NNSA) implements the Foreign Research Reactor Spent Nuclear Fuel Acceptance Program (Acceptance Program), which permits other countries to send U.S.-origin spent fuel to the United States for storage and disposition. This program is set to expire on May 12, 2019.

DOE/NNSA completed a review of the Acceptance Program and concluded there may be circumstances that warrant an exemption to the May 2019 program expiration. A Policy on Exemptions was established to allow DOE/NNSA to provide an exemption to the Acceptance Program end date on a case-by-case basis if there is a national security or non-proliferation reason to do so. For example, a limited exemption may be granted if an HEU research reactor is shutdown or converted; if a significant amount of HEU and/or separated plutonium will be removed from a nuclear facility; or if the facility meets the criteria of the program prior to the deadline in 2019 but is unable to complete the shipping campaign for reasons outside of its control.

After careful analysis, we have determined that the FIR-1 research reactor operated by VTT Technical Research Centre (VTT) has met the criteria established in the Policy on Exemptions. Therefore, VTT is granted permission to return the LEU spent fuel until May 12, 2029.

If you have any questions regarding this matter, please contact Peter Hanlon, Assistant Deputy Administrator for Material Management and Minimization, at peter.hanlon@nnsa.doc.gov.

After careful analysis, we have determined that the FIR-1 research reactor operated by VTT Technical Research Centre (VTT) has met the criteria established in the Policy on Exemptions. Therefore, VTT is granted permission to return the LEU spent fuel until May 12, 2029.

Sincerely,

Brent K. Park Deputy Administrator for Defense Nuclear Nonproliferation



Contracts under preparation

CONTRACT NO.		
BETWEEN THE	EDLOW	
UNITED STATES DEPARTMENT OF ENERGY IDAHO OPERATIONS OFFICE	COMPANY 155	5,2019 Services - 203965-2019 - TED Tenders Electronic Daily
		Services - 203965-2019
AND	AGREEMENT	02/05/2019 S85 Services - Contract notice - Competitive procedure with negotiation I. III. III. IV. VI.
VTT TECHNICAL RESEARCH CENTRE OF FINLAND		Finland–Espoo: Radioactive–, toxic–, medical– and hazardous waste services 2019/S 085–203965
HELSINKI, FINLAND	for	Contract notice
TERMS AND CONDITIONS FOR	101	Services
TERMS AND CONDITIONS FOR THE ACCEPTANCE OF		Legal Basis:
FOREIGN RESEARCH REACTOR SPENT NUCLEAR FUEL	Finnish Reactor 1 (FiR1) TRIGA Spent Nuclear Fuel Shipment	Section I: Contracting authority
AT UNITED STATES DEPARTMENT OF ENERGY SITE	and all Transportation Sources from Espage (Finland) to	I.1) Name and addresses Teknologian tutkimuskeskus VTT Ov
	and an Transportation Services from Espoo (rimand) to	2647375- PL 1000, VTT
	Idaho National Laboratory (INL - U.S.A.)	Espoo 02044
	Between	Finland Contact person: Markus Airila E-mail: Kipalutus®vtt.fi NUTS code: Fi181 Internet address(es): Main address.ite(). /www.vtt.fi
		I.2) Information about joint procurement
Note: This contract contains clauses that are common to many contracts that	VTT Technical Research Centre of Finland, Ltd.	(i.s) Communication The procurement documents are available for unrestricted and full direct access, free of charge, at: https://tajouspalvelu.fl/haki Additional information can be obtained from the abovementioned address Tenders or requests to participate must be submitted electronically via: https://tarjouspalvelu.fl/hanki? id=2387336tp-50 laad=a-71d=41b=3-36a=a47d78888ac
have been entered into by the Department of Energy and foreign research	Kemistintie 3	I.4) Type of the contracting authority Body governed by public law
reactor operators in countries with high income economies. However, the	FI-02150 Espoo	I.5) Main activity Other activity tutkimus ia kehitys
terms and conditions of any contract between the Department and individual	Finland	Section II: Object
operators will be negotiated on a case-by-case basis.		II.1) Scope of the procurement
	and	II.1.1) Title: II.1.1 Title: II.1.1 Lutkimusreaktorin ja Otakaari 3:n materiaalitutkimuslaboratorion käytöstäpoiston palvelut, mukaan lukien ydinjäteiden ja muiden radioaktiivisten jätteiden vastaanotto Reference number: Ref. no. 261 (2016) 2019
	Edlow International Company	II.1.2) Main CPV code 90520000 III.3) Type of contract Services
	1666 Connecticut Avenue, NW, Suite 201	II.1.4) Short description: Takaologian Tutkimuskaskus VIT. Ov (išliamošoš VIT. tilagia tai bankintavksikkā) poztāš abdokkaita
	Washington, DC 20009	lähettämään osallistumishakenuksen neuvottelumenettelyyn Hilma-ilmoituskanavassa julkaistun osallistumisilmoituksen sekä sen liitteiden 01–06 ia näiden alaliitteiden mukaisesti.
	U.S.A.	II.1.5) Estimated total value
		II.1.6) Information about lots This contract is divided into lots: no
		II.2) Description II.2.1) Title:
		II.2.2) Additional CPV code(s)
		II.2.3) Place of performance NUTS code: FI1B1
	http	s://ied.europa.eu/udl?uri=TED:NOTICE:203965-2019:TEXT:EN:HTML&tabId=0



Finnish licensing for the FiR 1 SNF transfer to US

• Export license by STUK

EU Directive 2006/117/Euratom NSG guidelines (INFCIRC 254 / Part1)

• Transport license & responsible manager

- Transport Plan
- Transport security plan
- Nuclear liability insurance
- Safeguards notification and reporting
- Approval of the VTT-DOE contract by the Euratom Supply Agency (ESA)



Lessons learned about decommissioning planning and reality



Evolution of detail in planning

2007: Consultation on potent decommissioning strategies Various options to execute the proje	tial (Platom) ect		
Review of VT 2 2013: Prelimina Suggestions f 2013: Prelimina Experiences f (Platom)	ry dismantling	olan	
Available dismantli Experiences and d foreign research re	2016: Detaile All specific back Documentation	d dismantling planning (BNG) ground information from FiR 1 suitable for the procurement of the	
	dismantling wo Technical repc p.)	2017 → Refine the detailed dismantli plan (Fortum)	nç
	VII prepared decommission	 Include all practical considerations: Site logistics Waste acceptance criteria Integrate dismantling, waste managemen 	nt,







Cost estimate evolution 1988–2018





Summary of lessons learned First nuclear facility to be decommissioned in Finland

Impact on national regulation and practices

- → Interpretations of specific requirements (safety goals and practice)
- → MEAE and STUK used FiR 1 experiences in development of legislation
- → NPPs will have license to receive nuclear waste from other facilities

Experience gained in the project organization

- → Active owner in dismantling planning projects
- \rightarrow In-house experience in inventory modelling and measurements

Adapting the organization to decommissioning

- → Retained all operating personnel + key recruitments
- → Safety culture assessment 2018 recommendations being implemented

Main challenge: uncertainty over waste solutions at shutdown

- \rightarrow Licensing: long preparation and review times
- → Planning: slow convergence of plans (lack of fixed boundary conditions)



See also

VTT's info pages on the decommissioning project

http://www.vttresearch.com/services/low-carbon-energy/nuclearenergy/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-applicationfor-decommissioning



Drilling samples from the biological shield











BROCHURE

TRIGA FUEL 19.11.2015



Unused TRIGA fuel at FiR 1



VTT TECHNICAL RESEARCH CENTRE OF FINLAND LTD

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FiR 1 in Otaniemi, Espoo, Finland January 20th 2010