

Country presentation

SLOVENIA

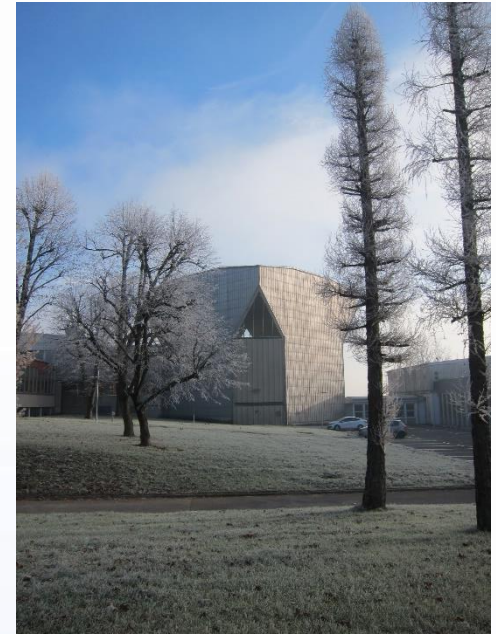
Research Reactor Operating Group 2019
14 – 17 May, Mainz, Germany

Anže Jazbec, Jožef Stefan Institute, Ljubljana



JSI TRIGA Mark II Reactor

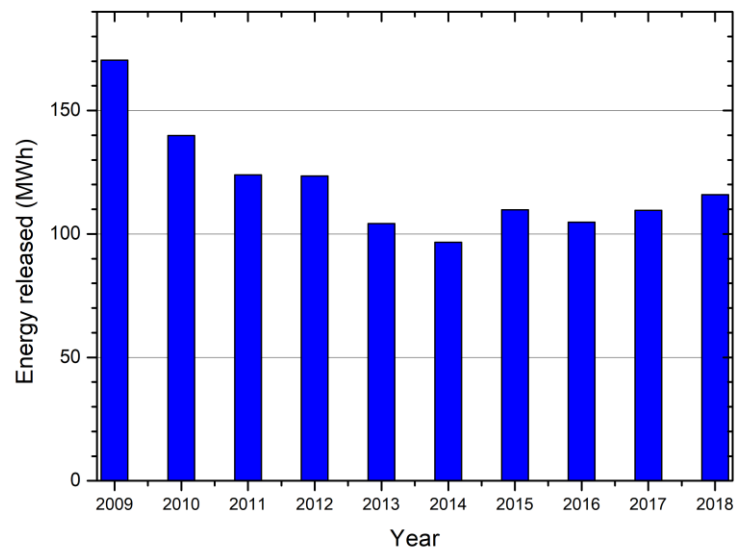
- Operator: Jožef Stefan Institute
- 1st criticality: 1966
- Power:
 - Steady state: 250 kW
 - Pulse mode: 1 GW
- Staff:
 - Head of centre
 - Head of reactor
 - 4 operators
 - 2 administrative workers



Operating Performance Indicators 2018

	2017	2018
Operation days	151	143
EFPH	438	464
Total energy	109.5 MWh	116 MWh
Pulse mode	46 pulses	27 pulses
Core changes	7	10

Energy released during reactor operation in last 10 years



Operating Performance Indicators 2018

	2018
AVALIABILITY A1 - Number of hours of scheduled operation) / (Number of hours of scheduled operation + number of hours of unscheduled shutdown)	1; since we operate on demand 0.34; if we are available 8h/working day
A2 - Annual operating time in hours	682
UNSCHEDULED SHUTDOWNS B1 - Number of unscheduled shutdowns initiated by the reactor protection system or by the operator due to external events or other reasons	3 – Due to operator mistake
B2 - Number of unscheduled shutdowns initiated by experiments or by the operator due to experiment	0

Radiation Doses

	2017	2018
<i>D1a - Collective radiation dose to reactor operating staff (mSv)</i>	0.53	1.08
<i>D1b - Number of reactor operating staff</i>	4	4
<i>D2a - Collective radiation dose to all staff at the reactor related work (mSv)</i>	1.15	2.31
<i>D2b - Number of staff involved</i>	26	32
<i>D3a - Maximum individual dose for operating staff member (mSv)</i>	0.16	0.41
<i>D3b - Maximum individual dose for any person at the reactor (mSv)</i>	0.20	0.41

Radioactivity Released Annually

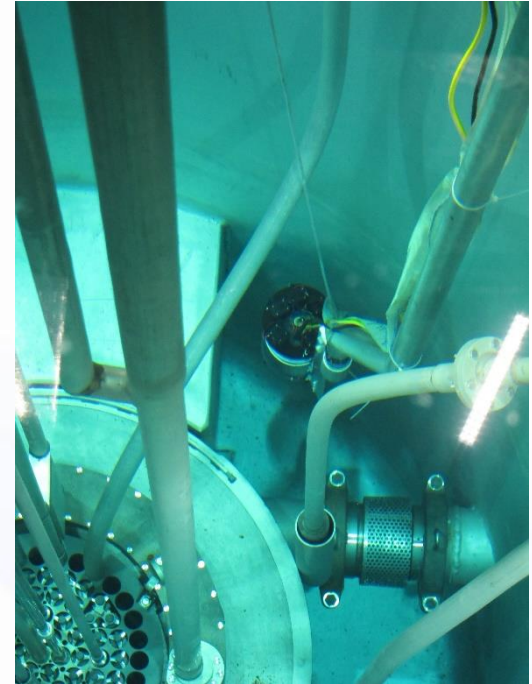
	2017	2018
<i>E1 - Noble gas released to the atmosphere (GBq) Ar-41</i>	1200	1260
<i>E2 - Iodine released to the atmosphere (MBq)</i>	0	0
<i>E3 - Liquid effluents released from reactor (m3)</i>	15	20
<i>E3* - Liquid effluents released from laboratories (m3)</i>	258	268
<i>E3** - Liquid effluents released from laboratories (MBq)</i>	< MDA	< MDA
<i>E4 - Solid radioactive waste generated (m3)</i>	0.20	0.20

Operating Performance Indicators 2018

	2018
Emergency preparedness	<ul style="list-style-type: none">• 1 exercise for operating staff – contamination in air
Unplanned maintenance of safety systems	<ul style="list-style-type: none">• Announcement system failure• failed probe on contamination monitor• fingerprint sensor failure• pneumatic transfer system failure - vacuum pump replaced
Work permits issued	7 (+4 in Hot cell facility)
Regulatory inspections	1
QA audits	1

2018 Highlights

- Submersible ROV test
 - Designed at University of Lancaster
 - It will investigate damaged Fukushima reactors
 - Low cost
 - Can carry
 - Gamma probe
 - Neutron probe
 - Gamma spectrometer
 - Camera
 - Sonar



2018 Highlights

- Practical exercises course for MIT students



2018 Special topic – Ageing Management

- Based on SSC classification and qualification
 - There are 103 SSC that we recognized as safety relevant
 - Each one is visually checked and if possible, tested
 - One page report
 - Possible corrective actions
 - Some are done during inspection and noted
 - For others, action plan
 - Visual check also for ageing mechanisms

RIC-QA-960-SMJG-ORGE
SISTEM ZA MENJAVO JEDRSKEGA GORIVA: ORODJE ZA ROKOVANJE Z GORIVNIMI ELEMENTI

Oznaka po planu nadzora:	9.1	Datum pregleda:	Datum nasi. pregleda:
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Tip pregleda: Preizkus grabilcev
Pogostost pregleda: Pred vsako uporabo ali vsaj 1 x L
Zadotžen: IJS-RIC
Pregledal:

Po postopku: Pregledati delovanje grablica gorivnih elementov.

Ugotovljene pomanjkljivosti. Izdelati je potrebno analizo učinkov odpovedi in vpliv na kvalifikacijo.

Predlagani ukrepi:

Analiza korektivnih akcij:

Podpis pregledovalca: Dne:

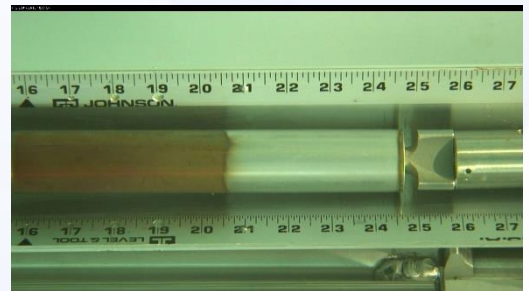
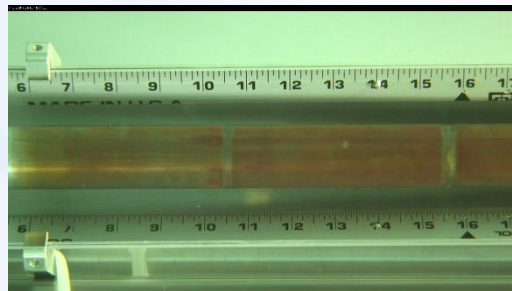
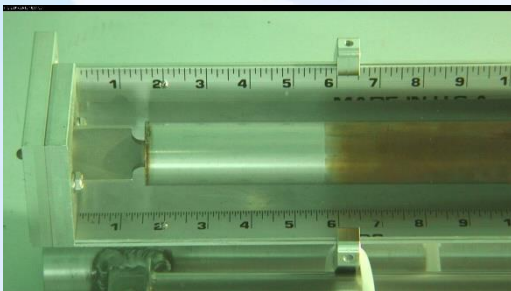
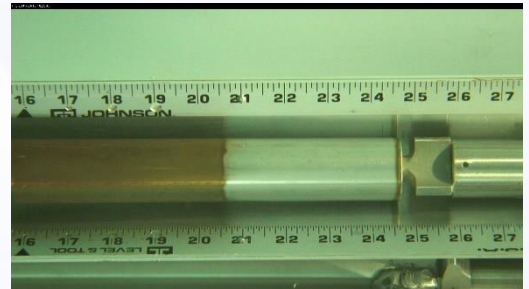
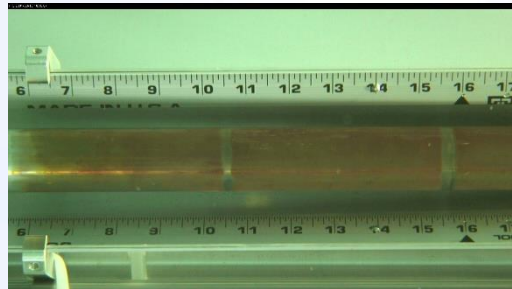
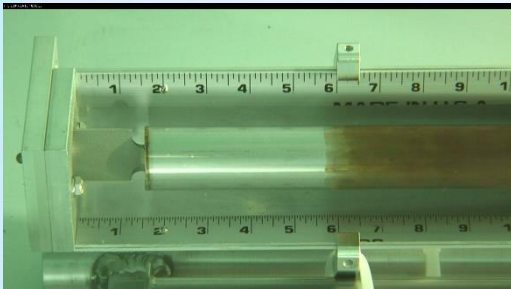
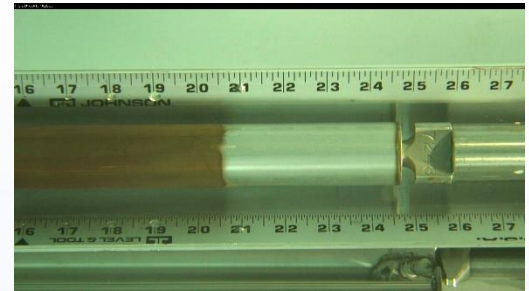
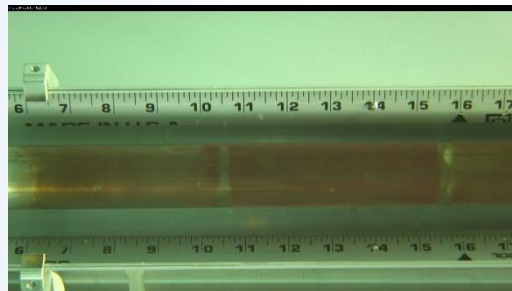
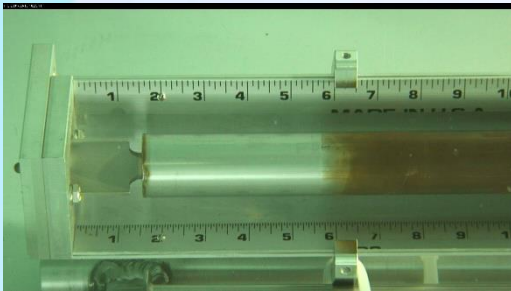
Naročeno za popravilo: Dne:

Izvajalec popravila:

Opis popravila:

Podpis naročnika popravila:

Annual fuel elements inspection

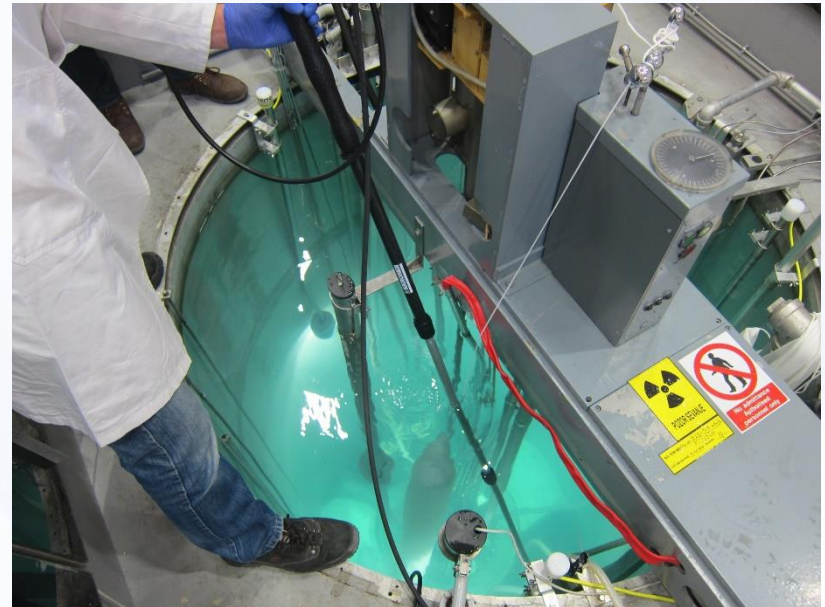


Preventive maintenance

- Performed by operators:
 - Nuclear instrumentation calibration
 - All 5 nuclear channels (steady state operation and pulse mode operation)
 - Fuel temperature sensors
 - Coolant temperature sensors
 - Coolant level sensors
 - Control rod drop time
 - Radiation instrumentation calibration
 - All detector inside reactor hall, reactor basement, reactor stack, hot cell facility and environment.

Preventive maintenance

- Performed by operators:
 - Reactor tank cleaning



Preventive maintenance

- Performed by operators:
 - Ion exchange resin replacement
 - Regular filter replacement



Preventive maintenance

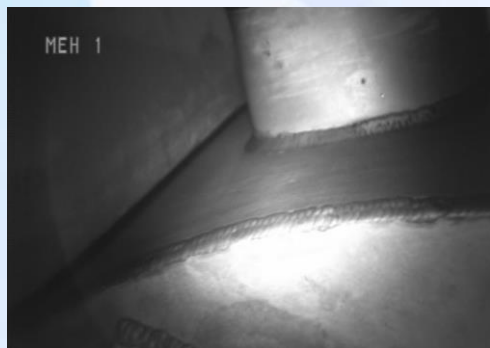
- Maintenance planned every few years
 - Reactor tank inspection (VT + UT)



Beam tube



Wall of the tank



Welds



Thermalizing column

Preventive maintenance

- Maintenance planned every few years
 - Beam tube inspection



Preventive maintenance

- External companies
 - Reactor ventilation system
 - Crane
 - Compressed air supply
 - UPS
 - Fire protection system
 - Physical protection system

2018 Special topic - Decommissioning

- Preliminary decommissioning programme in 2007, revised in 2016
 - Complete inventory including mass and activity after shutdown
 - Concrete activity study performed by JSI in cooperation with TUW
- DACCORD project conducted by IAEA
 - Systematic approach to decommissioning – International Structure for Decommissioning Costing (ISDC) of Nuclear Installations
 - Identified steps for our decommissioning case (costing model)
 - Cost Estimation for Research Reactor Decommissioning (CERREX - D2 code)
 - Probabilistic and deterministic calculation of contingency estimation, time line of investment, waste partitioning, risk assessment etc.

2018 Special topic - Decommissioning

ISDC No.:	ISDC Actions	Austrian TRIGA	Brazilian TRIGA	Indonesian TRIGA	Korean TRIGA	Malaysian Puspati TRIGA	Philippines TRIGA	Slovenian TRIGA
1	Pre-decommissioning actions	15%	9%	13%	17%	9%	0%	12%
2	Facility shutdown activities	17%	13%	17%	0%	13%	0%	16%
3	Additional activities for safe enclosure or entombment	0%	13%	0%	0%	0%	0%	0%
4	Dismantling activities within the controlled area	22%	15%	20%	17%	28%	3%	18%
5	Waste processing, storage and disposal	17%	14%	18%	9%	15%	16%	15%
6	Site infrastructure and operation	11%	9%	13%	0%	9%	0%	9%
7	Conventional dismantling and demolition and site restoration	0%	10%	13%	0%	13%	0%	0%
8	Project management, engineering and support	9%	9%	13%	17%	9%	0%	9%
9	Research and development	0%	9%	13%	17%	9%	0%	9%
10	Fuel and nuclear material	0%	13%	13%	0%	13%	0%	0%
11	Miscellaneous expenditure	5%	0%	0%	0%	0%	1%	9%

Thank you for your attention.

