

Used TRIGA Fuel Burns Again



Photo courtesy: INTEC

A packaging and transport story

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Abstract

Used TRIGA Fuel Elements were mined out of dry storage at Idaho National Laboratory, INTEC facility and transported to Atominstitut Vienna to provide a reload LEU core to permit the long term continued operation of the research and test reactor in Vienna, Austria.

After the delivery of the replacement core, the used fuel, including some HEU was packaged and shipped to Idaho National Laboratory.

This story is interesting due to the mining of what was presumed to be waste material for reuse, the round trip transport of the cask, INF vessel, and the logistics of twice transiting a third country with no inherent interest in the project.

We even picked up a hitch hiker from Italy along the way back.

Outline

Topics

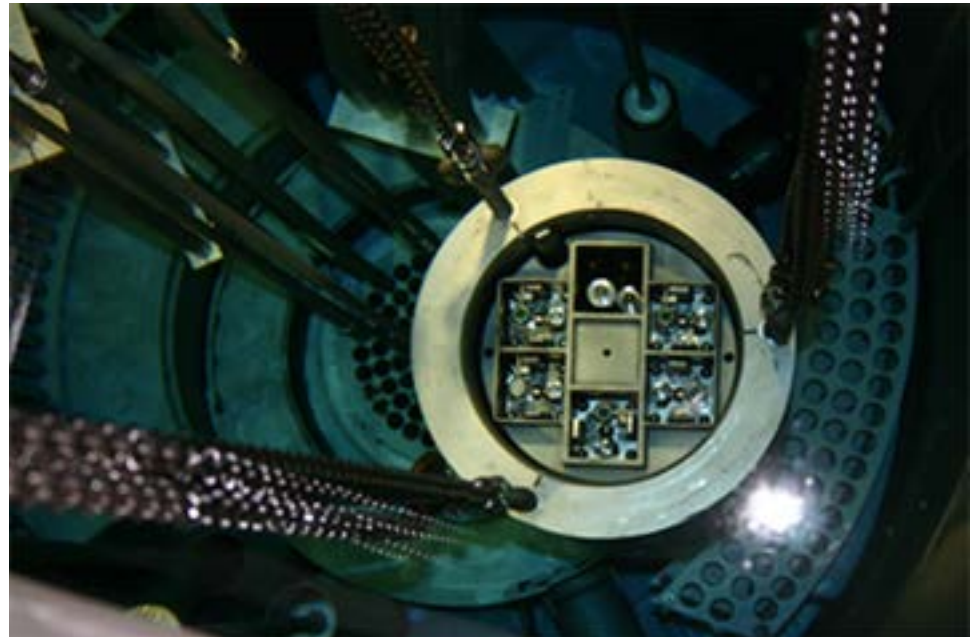
- Vienna Institute of Technology, Atomistitut (ATI) - Burned core
 - HEU inventory & Damaged fuel
- FRR Program return deadline
 - Shut down 5/2016 & Return by 5/2019
- TRIGA fuel supply
 - TRIGA International & Alternatives
- Mining used fuel from INL storage
 - Retrieval & Inspection
- Packaging & Transporting new core in
 - Package, Loading, Road, Export, Marine, Transit, Unloading
- Packaging & Transporting of old core out
 - Damaged fuel, Press, Hitch hiker

Vienna Institute of Technology, Atominstitut (ATI) Vienna, Austria

50 years of operation

Burned core of 91 Fuel Elements consisting of:

- 9 HEU
- 82 LEU
- 11 Damaged



FRR Program

Under the terms of the FRR Return Program the reactor wishing to participate must stop irradiating the qualified US origin fuel by May 2016 and ship the fuel back to the USA by May 2019.

ATI was successful in negotiating with the DOE a special agreement to allow return of fuel significantly after that deadline for continued operations of the reactor's usefulness to support IAEA personnel safeguards training.

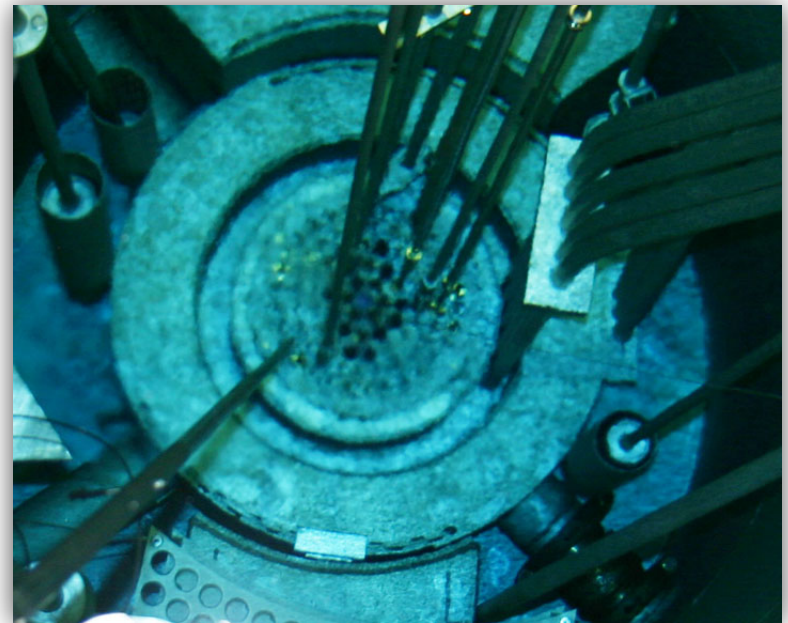
Replacement TRIGA fuel supply

TRIGA International

- Fuel fabrication line disruption
- Fuel element cost increases

Alternatives

- Shut down reactors
- Idaho National Lab used TRIGA storage facility (INTEC)



Need a replacement core of 77 fuel elements

Mining used fuel from INL

Unprecedented

Retrieval & Inspection



Photo courtesy: INTEC

Several used inventories from which to pick

Chose fuel from Musashi Institute of Technology –
TRIGA Mark II Reactor, 1% burned fuel

Package: NAC-LWT

NAC International

Dimensions	inch	mm
Overall length	199.80	5075
Overall diameter	44.20	1120
Cavity length	180.90	4600
Cavity diameter	13.37	340
Weighs	Tons	Metric Tons
Loaded inside ISO	33.0	30.0
Empty cask	24	22.4
Package ID#s		
USA/9225/B(U)F-96	US NRC	Rev 58
USA/9225/B(U)F-96	US DOT	Rev 49
USA/9225/B(U)F-96 (DOE)	US DOE	Rev 6



INL-INTEC

Fuel Inspection and selection performed September 2012



Photo courtesy: INTEC

As each fuel element was agreed upon it was placed into NAC TRIGA fuel basket for packaging

Package loading performed early October 2012

Package unloading performed December 2012

Road Transport

Two new NRC approved US road routes

#242 - Eastbound, INL – SRS

#243 - Northbound, SRS – Charleston



Photo by: Blake Williams, STS

Marine Transport

- Round Trip
- 10 days ship demurrage between sailings
- One port needed for drop-off
- Two ports needed for pick-up (Hitchhiker)
- Bunkering in between raised questions



Photo by: Blake Williams, STS

Port & Transit

Round trip

– LEU in; HEU out

Austria is land locked

Project needed a port

Others denied port
access & ground transit

Port of Koper



Thank You SLOVENIA !

Unloading/Loading at Vienna

One week activity

Set up equipment

Unload 77 elements

Reload 91 elements

(including 5 sealed cans)

Prepare for transport

Test

Issue: Tiny bubbles



Photo courtesy: ATI

Emergent Fuel Leaker

- Additional fuel leaker found during loading of final fuel basket
- Needed additional sealed can to transport
- Needed cask receipt configuration change approval
- 1st available flight from INL with can hand-carried
 - Arrived by next morning (Sunday)

INL-INTEC support

Immediate

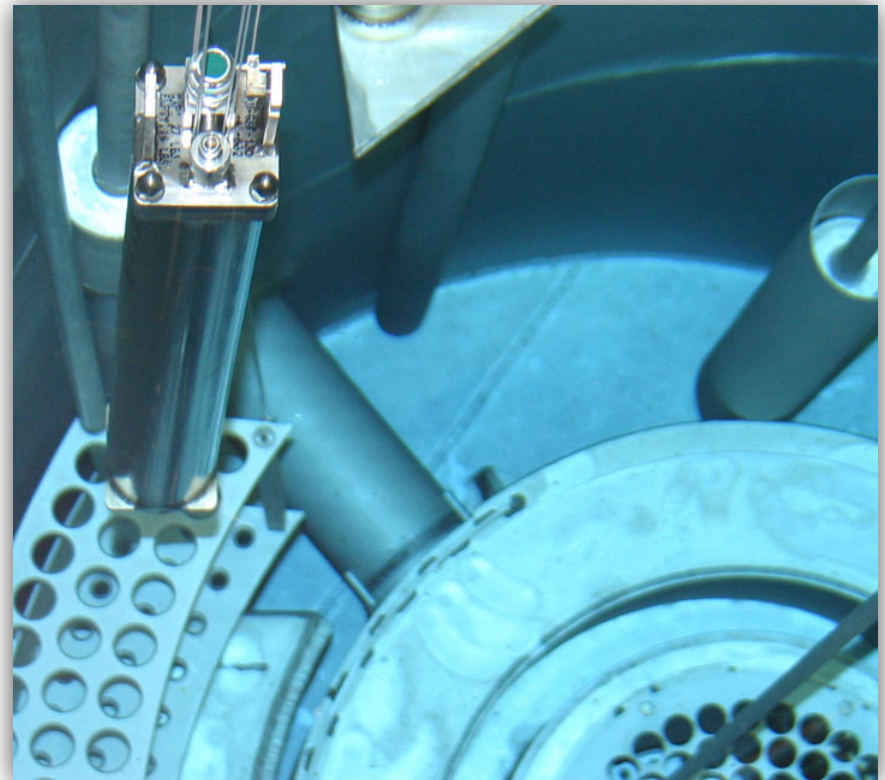
Swift

Positive

Critical to success

Thanks INL!

Eric Woolstenhulme



Participants

- NAC International
- Edlow International Co.
- Secured Transportation Services
- Columbiana High-Tech
- Tri-State Motor Transit
- Atlantic Container Lines
- Nuclear Cargo + Service
- Dusan Jovic
- Port of Koper
- Prangle
- J. Poulsen Shipping
- TU Wien – Atominstitut
- Austrian Government
- DOE-NNSA
- DOE-EM
- DOE-ID
- INTEC
- DOE-SR
- NRC
- Slovenia Government
- Joint Base Charleston

Hitchhiker

Italy – Sogin Avogadro facility

10 HEU MTR fuel loose plates

Horizontal loading of the NAC-LWT

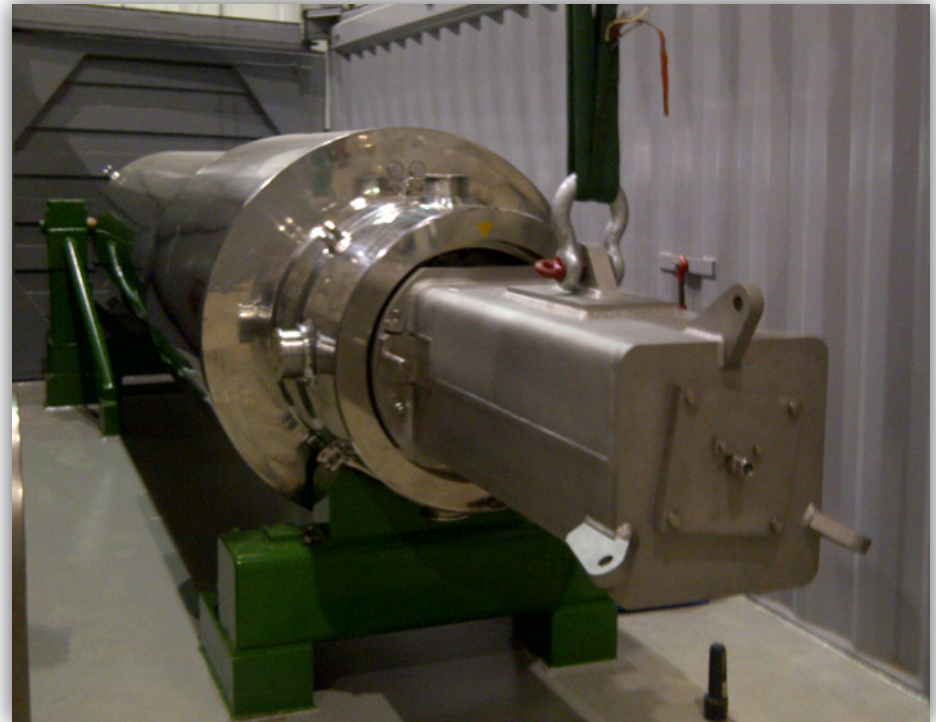
New designed tooling

Last minute approvals

Met the ship at Trieste

Unwanted press

Transport uneventful



Thank you!

