

“New Used Fuel”

For University of Maryland
Research & Training Reactor
(The MUTR)

A Joint DOE / UMD Effort.

UMD: Amber Johnson
Timothy Koeth

DOE: Doug Morrell
Kenny Osborne
Mike Worley
Won Yoon

Special Thanks:
Dale Luke & Alan Robb



MUTR History

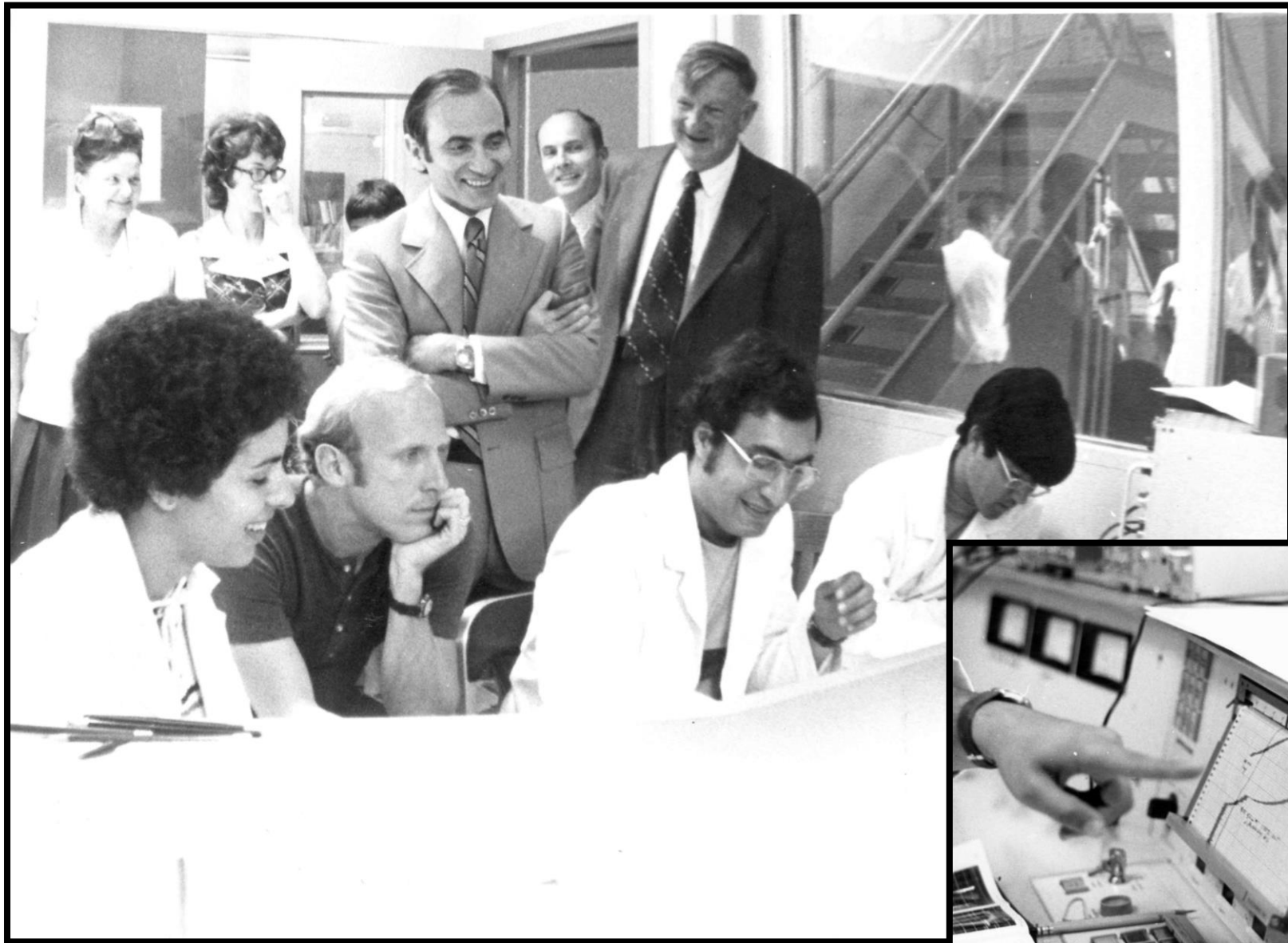
Prof. Dick Duffy & Prof. Joseph Silverman 1960



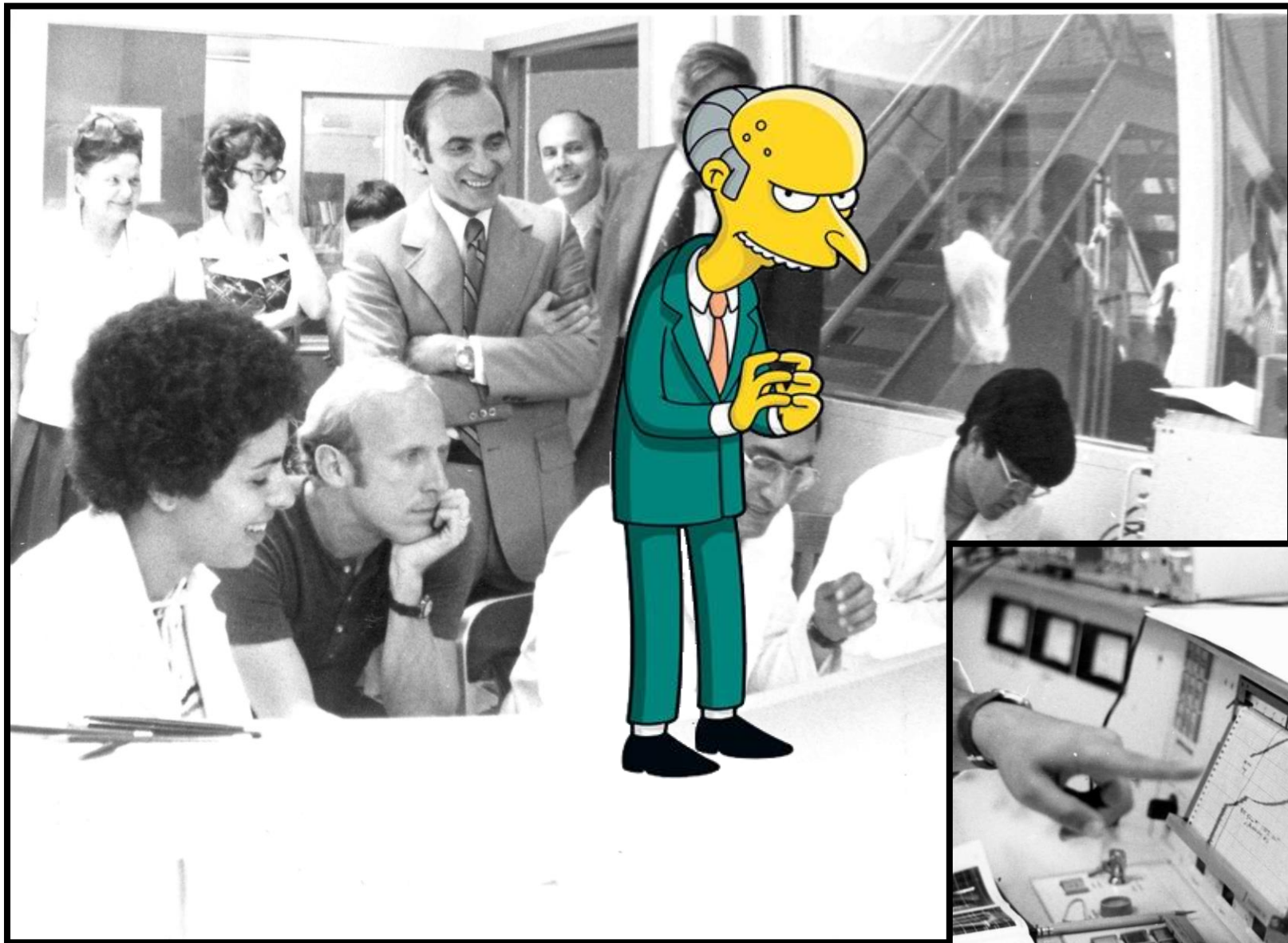
- License R-70, 1960
- 1960: MTR type HEU, 10 kW
- 1974: Replaced with “conversion” TRIGA, 250 kW
- 2017 Original TRIGA loading



MUTR TRIGA 1st Critical in 1974



MUTR TRIGA 1st Critical in 1974



2017 Have New Programs But Can Not Achieve Full Licensed Power

Undergrad Reactor Operator Program



Neutron Imaging

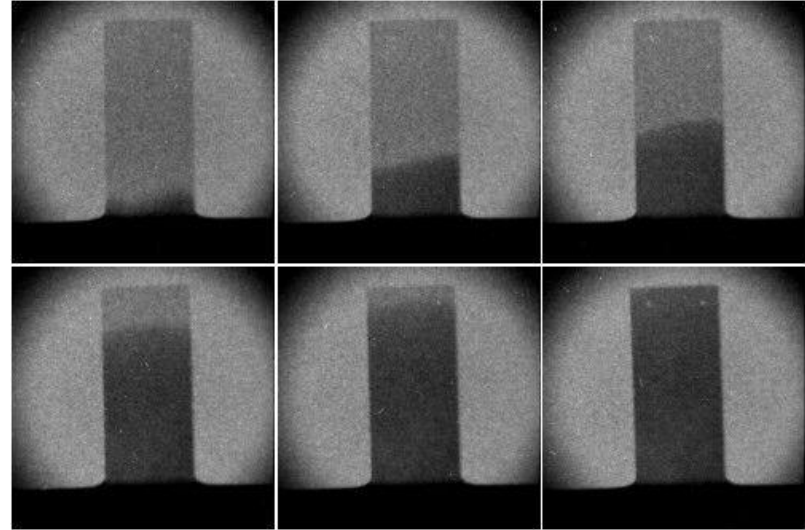


Table 1 Parameters for TRIGA fuels

Type of fuel*	Weight percent		Uranium-235	Uranium	$\alpha \times 10^5$	Core	Uranium
	Uranium	Erbium	(g/element)	enrichment	($\Delta k/k^\circ C$)	lifetime	volume
				(%)		(MWd)	percent
Original	8.5	0.0	39	20	9.5	100	2.6
FLIP	8.5	1.6	137	70	10.5	3500	2.6
LEU	20	0.5	99	20	10.5	1200	6.8
LEU	30	0.9	162	20	8	3000	11.2
LEU	45	1.8	282	20	5	4000	19.5

*FLIP = Fuel Life Improvement Program conducted at GA;
LEU = low-enriched uranium.

The use of erbium burnable poison in conjunction with the higher U-235 loadings permits longer core lifetimes than would be obtainable with the original TRIGA fuel. It also permits maintaining a large prompt negative temperature coefficient of reactivity, α , that is changed little from that of the original fuel through at least the 30-w% LEU fuel. As shown in Table 1, the volume percent (v%) of uranium increases with the increasing uranium loading but remains a small value, increasing from 2.6 v% in the original fuel to 11.2 v% for the 30-w% LEU fuel, and to 19.5 v% for the 45-w% fuel.

A collection of numerous colorful hot air balloons of various patterns and colors (including stripes, globes, and abstract designs) are suspended from the ceiling against a light blue background. The balloons are scattered across the frame, creating a festive and celebratory atmosphere.

TRTR2016 (T-7 Months)

- Side meeting with DOE, NRC, OSU, UMD
- Suggestion of taking fuel out of storage INL
- Doug's suggested list of fuel

November 3rd Kick Off & Planning Meeting (T-5 Months)



A Few Insurmountable Tasks Lay Ahead

We needed our License Renewal
(T-2 months)



We needed the “cage” to be removed
(T-1 month)



We needed a certified fork lift operator
(T-2 weeks)



The Crane ! T-3 Weeks

Operational on Valentines Days: “Nothing can tug at the heart like a 3-ton crane.”



Fuel Selection at INL – February (T-3 weeks)

Other business in Sydney Australia



48 hours later...

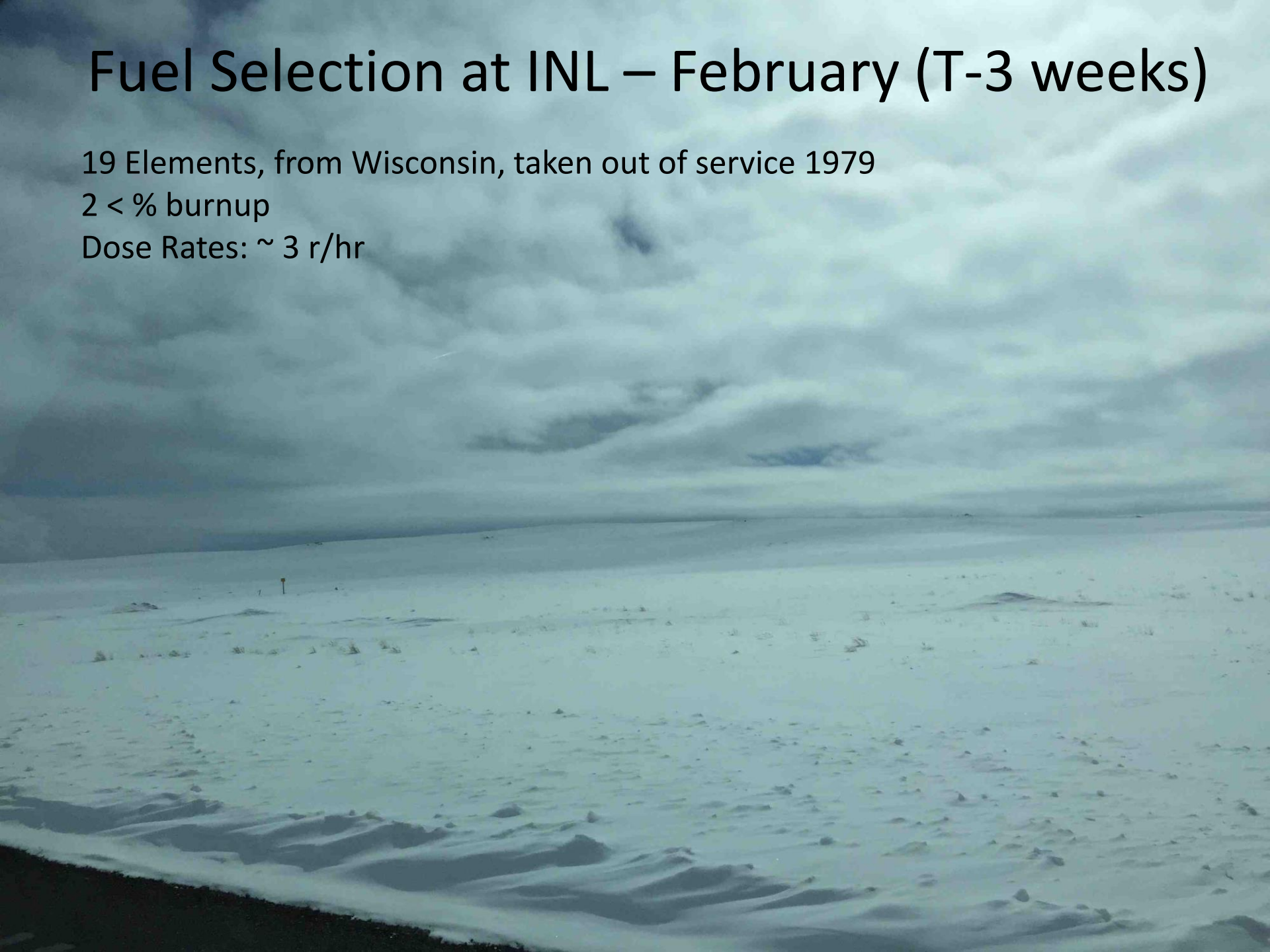


Fuel Selection at INL – February (T-3 weeks)

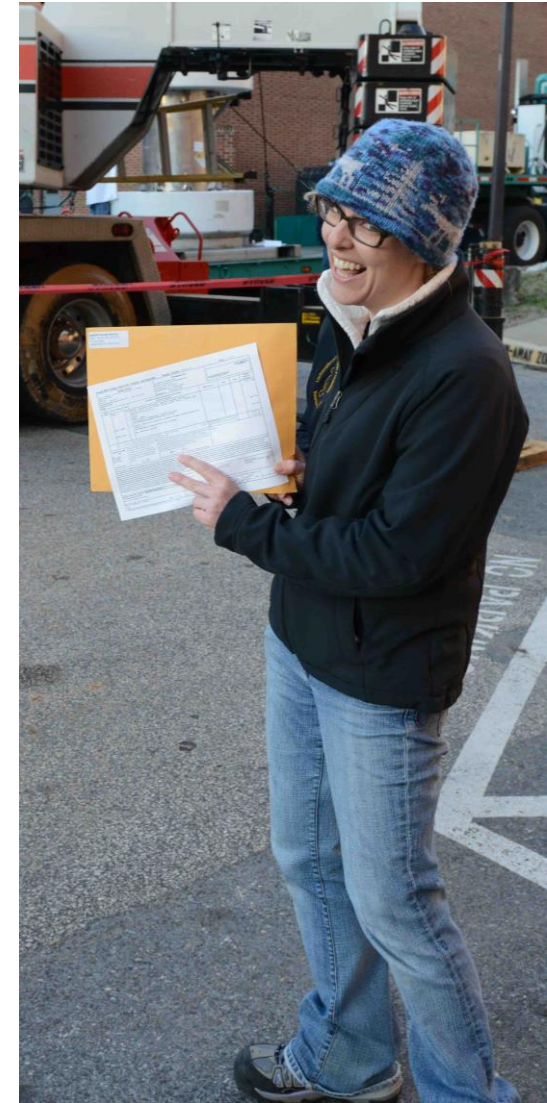
19 Elements, from Wisconsin, taken out of service 1979

2 < % burnup

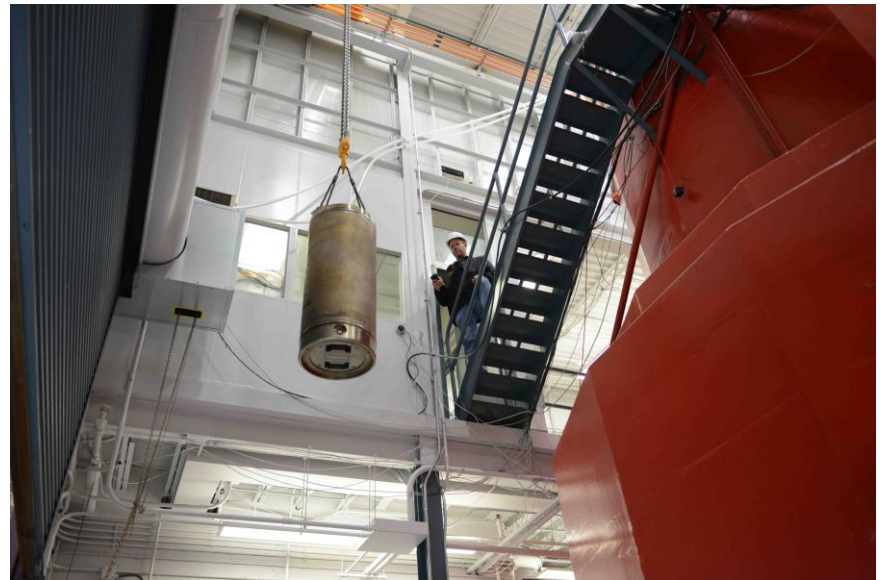
Dose Rates: ~ 3 r/hr



About Week Later... T=0



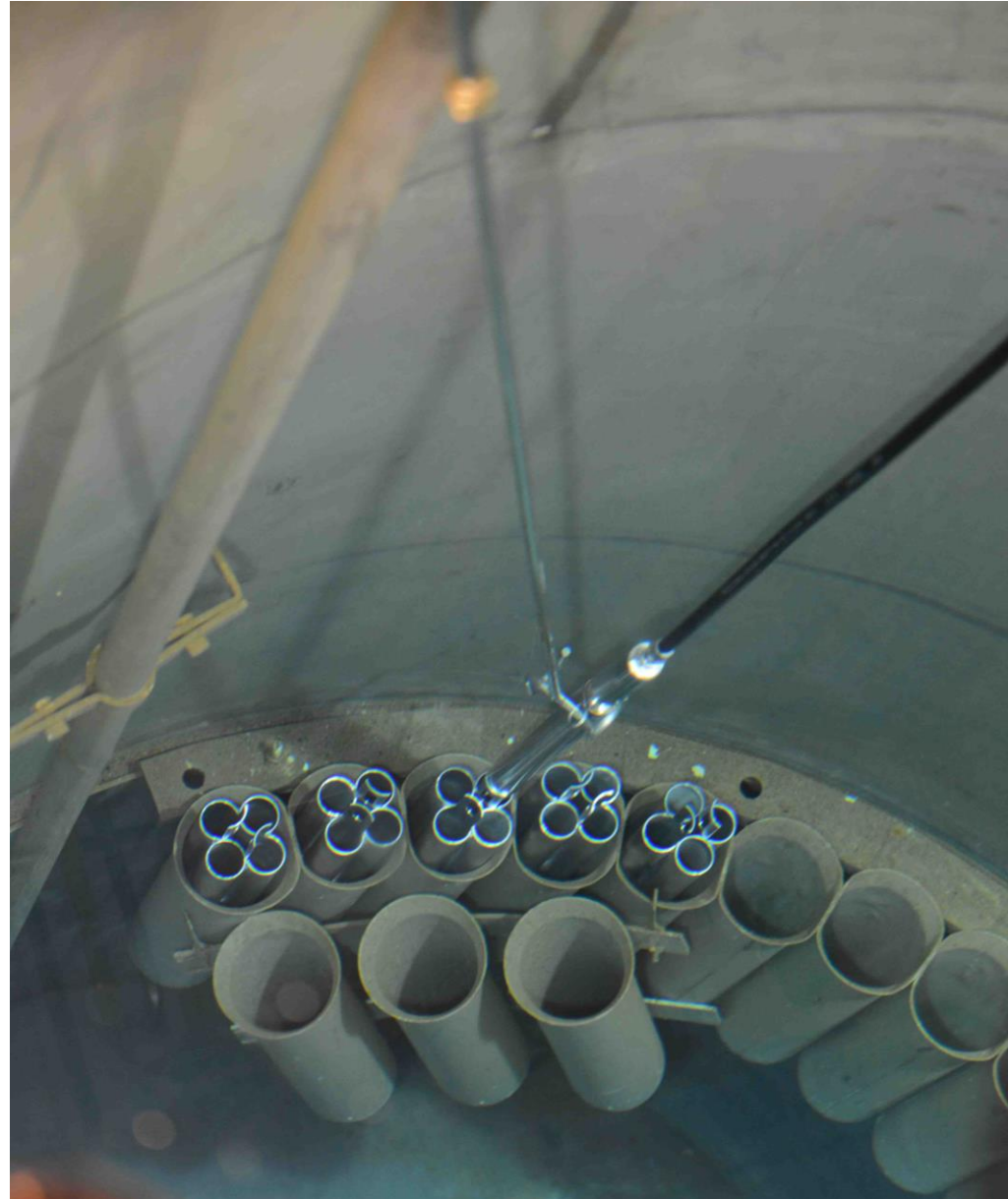
The Transfer Process, 1 Element at a Time



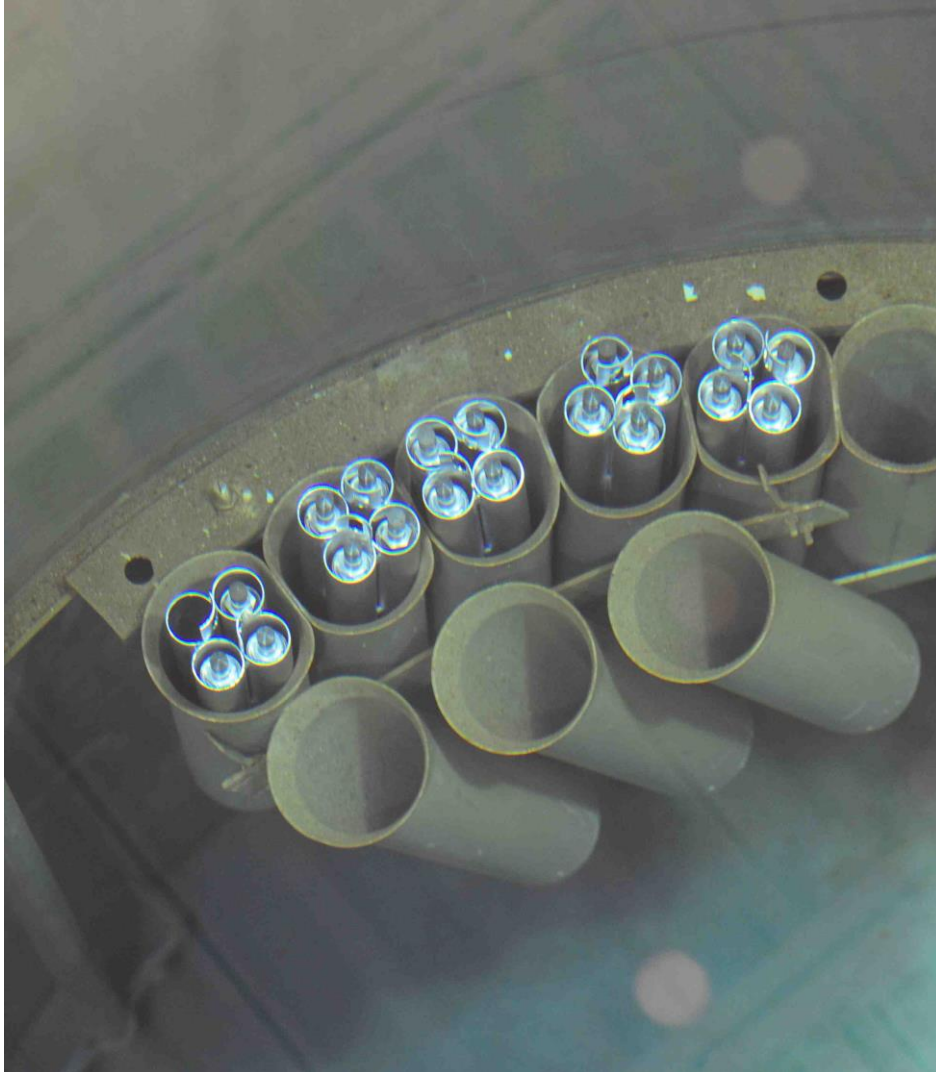
The Transfer Process, 1 Element at a Time



The Transfer Process, 1 Element at a Time



“All 20, I Mean 19 Loaded”



Total Dose of Operations



Highest dose: T. Koeth
WB: 20 mrem
Extremity: 23 mrem

2nd Highest: A. Johnson
WB: 10 mrem
Extremity: 13

All other participants < min. reportable

Instadose badges all reported 0 mrem

15 Area Monitor badges: all 0, every day

(except 1 area: courtyard 7 mrem day#1)

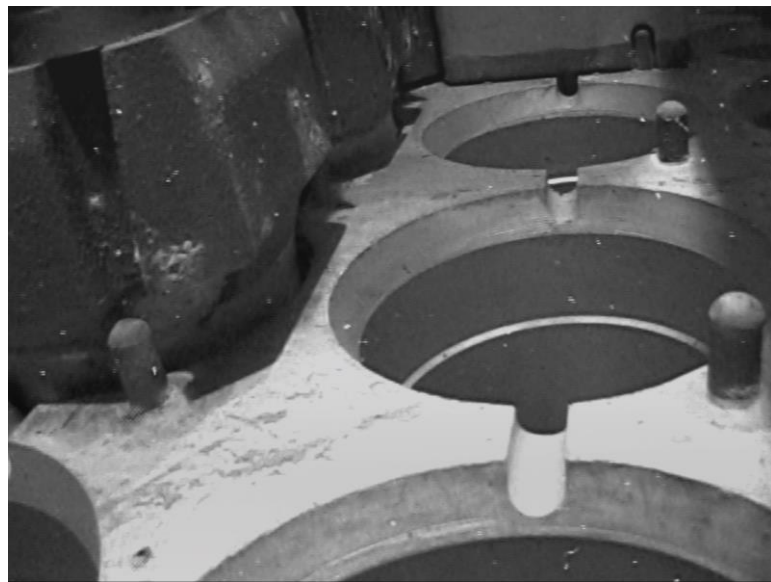
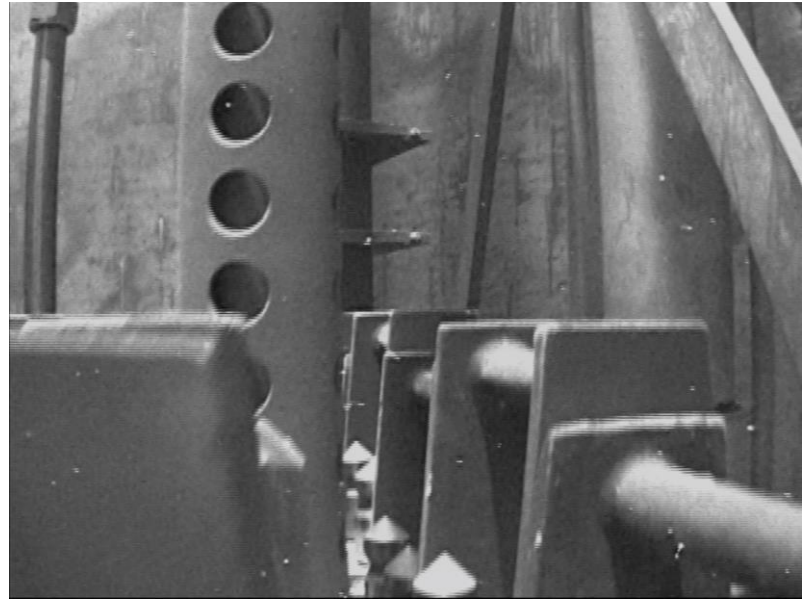
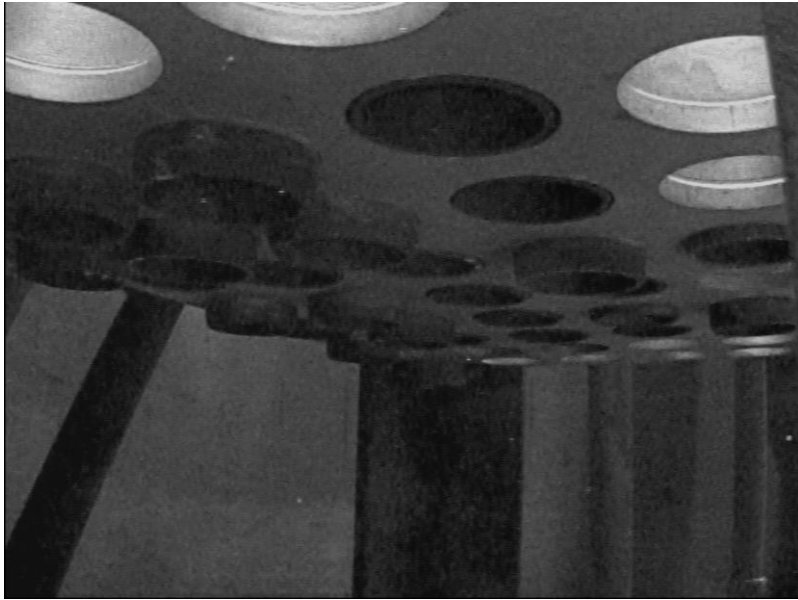
Time Lapse Video

Next Steps...

- LAR Submission next month.
- MCNP Calculation of best use of new fuel.

	8		7		6		5		4		3	
F	7390	7391	7378	7379	7354	7355	7395	7393	7168	7169	7333	7335
	7389	7392	7377	7380	7353	7356	7397	7396	7167	7166	7334	7336
E	7161	7026	7398	259	7368	7365	7374	7375	304	7406	7342	7343
	7028	7027	7399	7400	7367	7366	7373	7376	7404	7405	7341	7344
D	7408	7409	7345	7346	7382	7383	7371	7372	7290	7330	7164	7165
	7407	7160	7348	7347	7381	7384	7370	7369	7332	7331	7163	7162
C	7360	7357	7352	7349	7401	260	7388	7385	Rabbit		7362	7363
	7359	7358	7351	7350	7403	7402	7387	7386			7361	7364
B	6286	6284	5861	6281	PuBe Source		6287	6289	7338	7337	6282	6277
	6283	6285	5862	5864			6279	6290	7339	7340	6288	6268

“Don't Ask Questions You Don't Want Answer Too”



Thank You !

