Advanced Gas Reactor Fuels Program Review

AGR-2 PIE Planning

Paul Demkowicz, Technical Lead for Fuels Post-Irradiation Examination

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Idaho National Laboratory

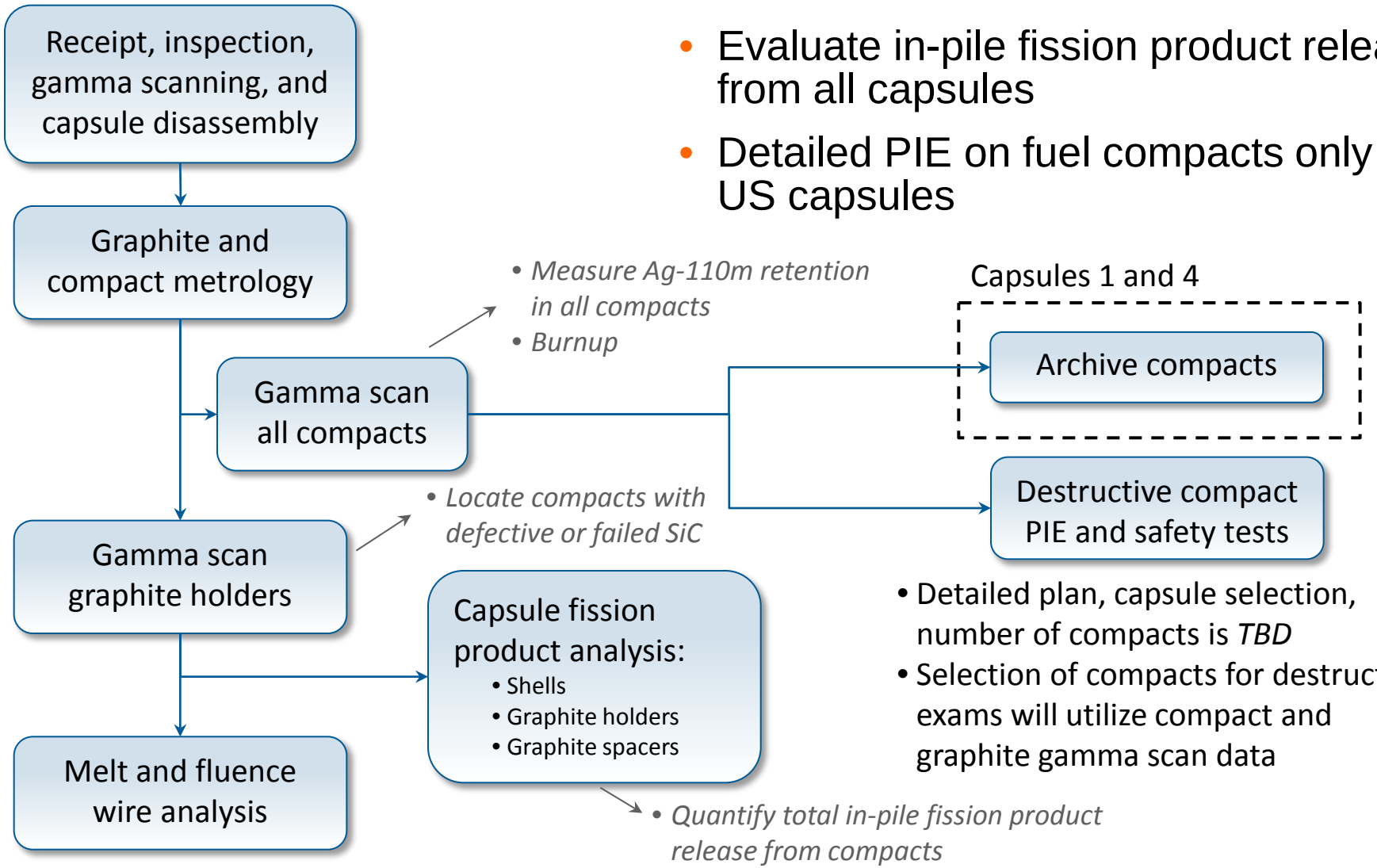
AGR-2 General Capsule Priority Considerations

Capsule	Remarks
Capsule 2	High temperature, burnup, and fluence; UCO
Capsule 5	Much lower temperature, slightly lower burnup and fluence relative to Capsule 2
Capsule 3	Only US UO_2
Capsule 6	Similar temperature as Capsule 5 but lower burnup and fluence. Can be considered backup to Capsule 5 and to explore independent effect of burnup/fluence

- Exploring causes for abnormal behavior would be relatively high priority regardless of capsule
  - Large fission product releases
  - Large number of failures
  - Compacts with suspected leakers

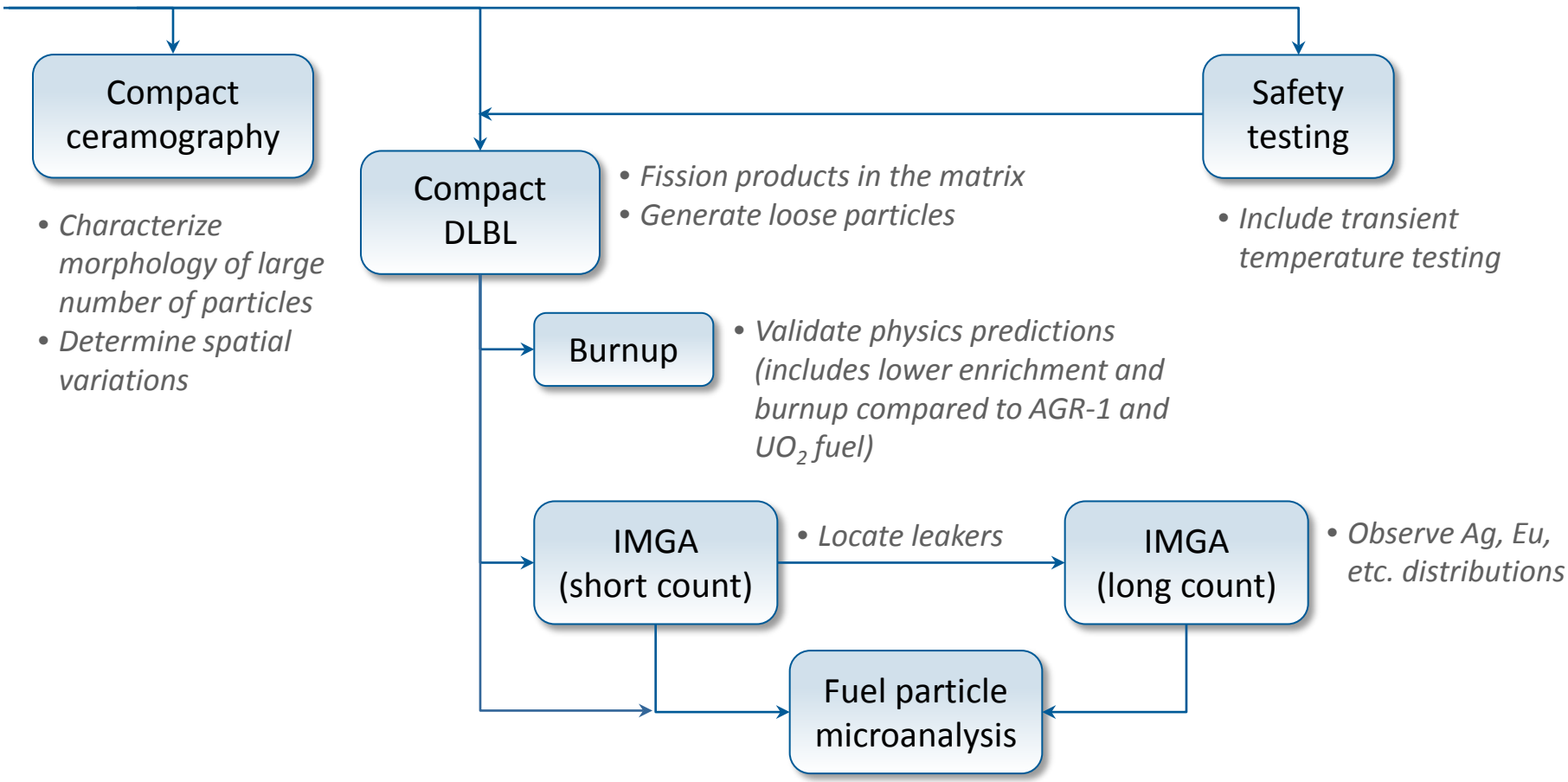
AGR-2 PIE Approach

- Evaluate in-pile fission product release from all capsules
- Detailed PIE on fuel compacts only for US capsules



- Detailed plan, capsule selection, number of compacts is *TBD*
- Selection of compacts for destructive exams will utilize compact and graphite gamma scan data

Destructive Compact Examination and Safety Testing



AGR-2 PIE Status Summary

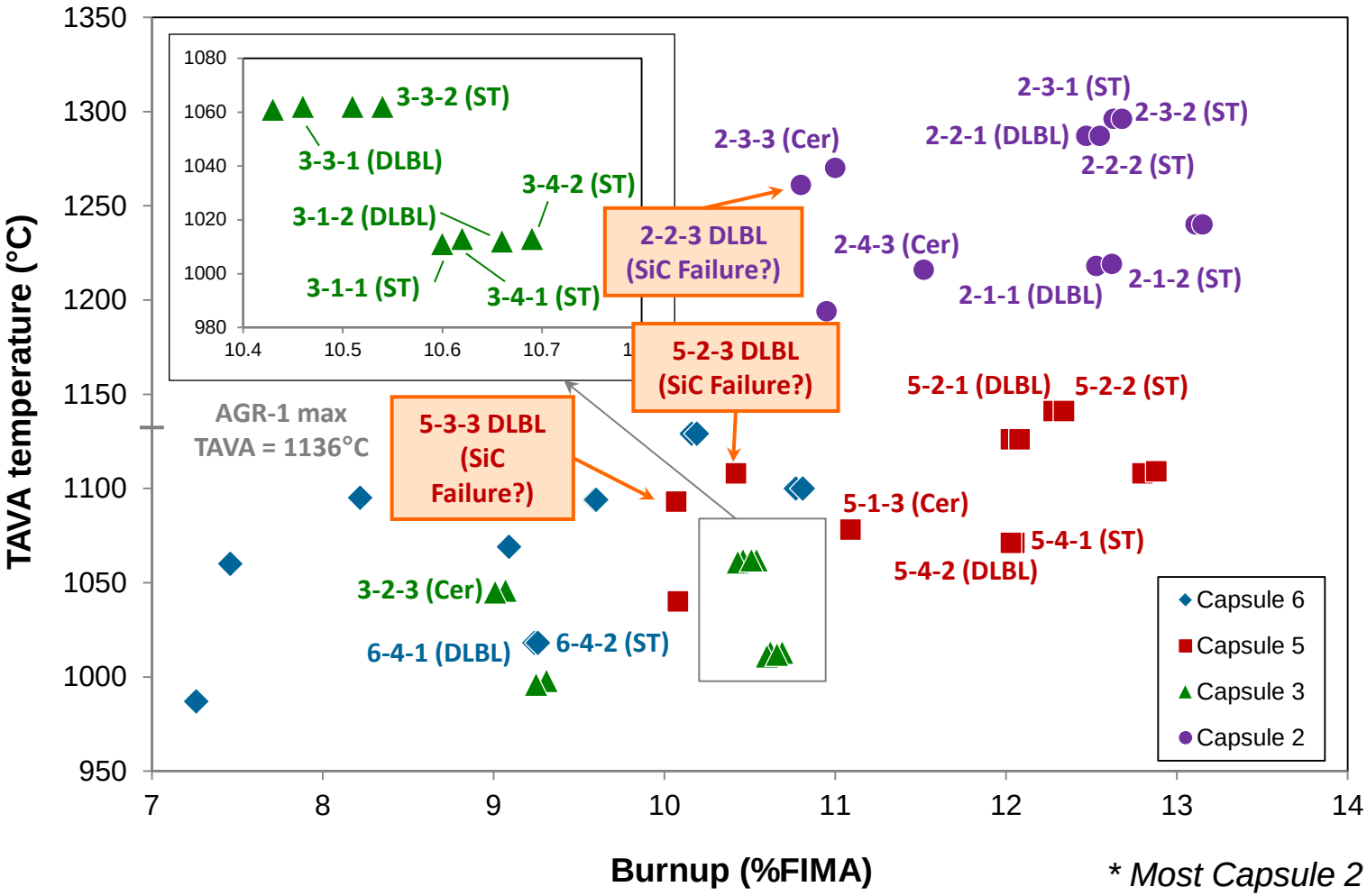
Activity	Status
Capsule inspection, disassembly, and metrology	Complete
Capsule component analysis:	
Capsule shells	Leaching and analysis (gamma spectrometry, mass spectrometry, Sr-90) complete
Graphite spacers	Gamma analysis in progress
Graphite holders	• Gamma scanning Capsules 2, 3, 5, and 6 complete • Destructive analysis (gamma spec, mass spec, Sr-90) to follow removal of flux and melt wires
Compact gamma scanning	• Capsules 2, 3, 5, and 6 complete

Compact Destructive Exams: Estimated Number of Analyses

Activity	Capsule	# of compacts	Remarks
Compact ceramography	Capsule 2	2	
	Capsule 5	1	
	Capsule 3	1	
As-irradiated DLBL, IMGA, particle microanalysis	Capsule 2	3	2 normal, 1 suspected leaker
	Capsule 5	4	2 normal, 2 suspected leakers
	Capsule 6	1	Low burnup data
	Capsule 3	2	
Safety tests + DLBL, IMGA, particle microanalysis	Capsule 2	4	
	Capsule 5	2	
	Capsule 6	1	Low burnup data
	Capsule 3	4	

Safety test matrix does not include special tests, including: transient temperature tests, loose particle tests, or other varying temperature tests to explore specific phenomena.

AGR-2 Compact Selection



ST = safety test

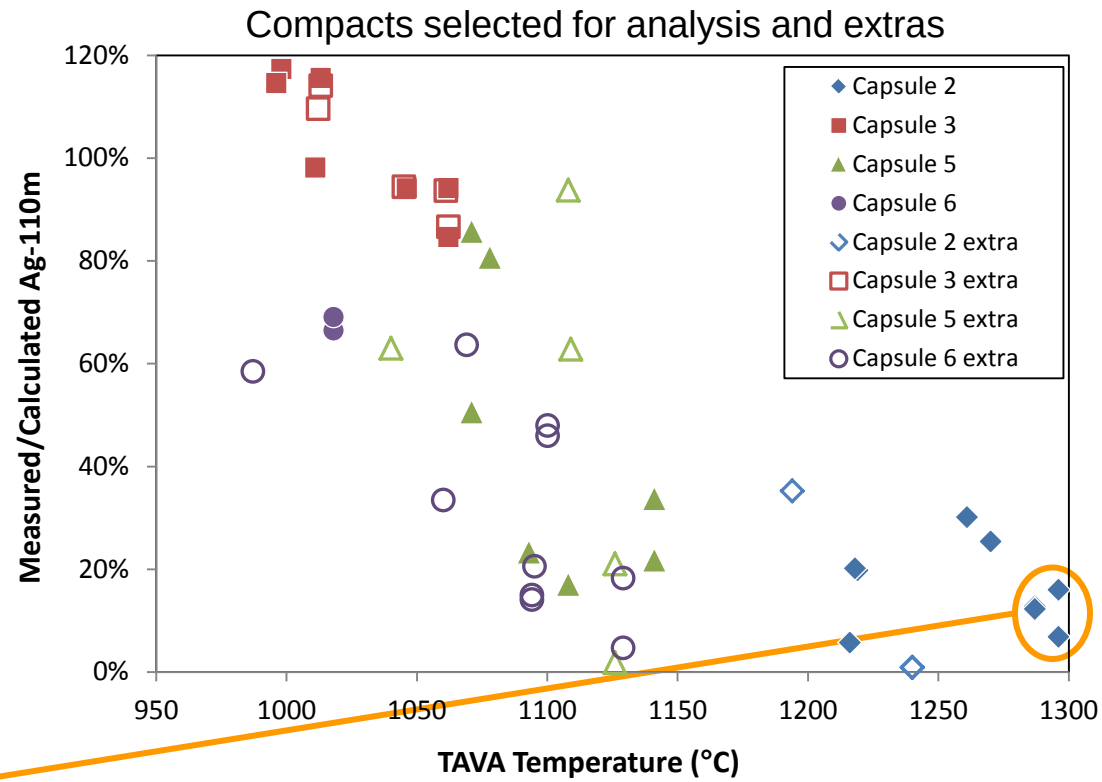
DLBL = DLBL, IMGA, and microanalysis

Cer = Compact Ceramography

** Most Capsule 2 compacts and some Capsule 5 compacts have very low retained Ag-110m*

Additional considerations

- Ag retention in compacts
  - Capsule 5 compacts span broadest range
  - (Note that Ag-110m M/C results reflect a negative bias in the predicted Ag-110m inventory)



- Eu release from Capsule 2 Level 2 and 3 compacts appears to be especially high

AGR-2 Compact Destructive Exam Matrix

Compact ID	Burnup (%FIMA)	TAVA (°C)	Ag retained fraction	Examination Plan
243	11.52	1216	0.057	Ceramography
233	11.00	1270	0.254	Ceramography
232	12.68	1296	0.068	Safety test (1800°C)
231	12.63	1296	0.160	Safety test (1600°C)
223*	10.80	1261	0.301	DLBL, IMGA
222	12.55	1287	0.127	Safety test (1600°C)
221	12.47	1287	0.122	DLBL, IMGA
212	12.62	1219	0.198	Safety test (1700 or 1800°C)
211	12.53	1218	0.201	DLBL, IMGA
342*	10.69	1013	1.156	Safety test (1600°C)
341	10.62	1013	1.174	Safety test (1800°C)
332*	10.54	1062	0.942	Safety test (1600°C)
331*	10.46	1062	0.941	DLBL, IMGA
323	9.01	1045	0.847	Ceramography
312	10.66	1012	0.982	DLBL, IMGA
311	10.60	1011	1.146	Safety test (1700 or 1800°C)
542	12.03	1071	0.506	DLBL, IMGA
541	12.05	1071	0.857	Safety test (1600 or 1800°C)
533	10.07	1093	0.233	DLBL, IMGA
523	10.42	1108	0.170	DLBL, IMGA
522	12.34	1141	0.218	Safety test (1600 or 1800°C)
521	12.28	1141	0.337	DLBL, IMGA
513	11.09	1078	0.807	Ceramography
642	9.26	1018	0.665	Safety test 1600C
641	9.24	1018	0.691	DLBL, IMGA

Shipped to ORNL

Questions?

Paul Demkowicz
paul.demkowicz@inl.gov

Idaho National Laboratory
(208) 526-3846