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DOE AGR Program Review:
Concluding Remarks

ART Advanced Reactor Technologies
GAS-COOLED REACTORS

AGR Program Timeline

Early test of lab-scale UCO fuel performance; shakedown of test train design.

Engineering-scale particles in lab-scale compacts. Includes UCO and UO_2 fuel.

"Designed-to-fail" (DTF) fuel to assess fission product retention and transport in reactor graphite and fuel matrix.

Fuel qualification test. Engineering-scale UCO particles and compacts.

Program participants:
INL
ORNL
BWXT

Fuel Fabrication

AGR-1 | AGR-2 | AGR-3/4* | AGR-5/6/7

Irradiation (in ATR)

Future schedule is notional

AGR-3/4
AGR-1
AGR-2
AGR-5/6/7

2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025 2026 2027 2028 2029

PIE

AGR-1
AGR-5/6/7
AGR-2
AGR-3/4

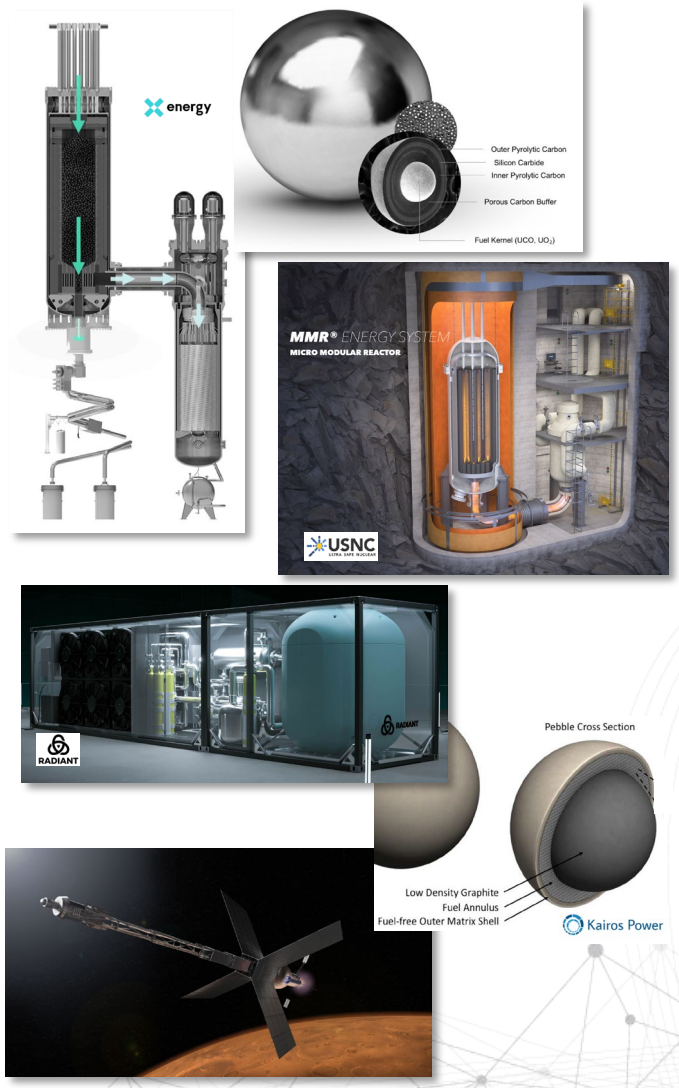
**Includes fabrication of DTF particles; driver fuel taken from AGR-1 fabrication campaign*

Major Program Activities – FY23 and Beyond

- **Complete AGR-3/4 PIE and data analysis**
  - Determine key takeaways in terms of fission product transport
- **Continue/complete AGR-5/6/7 PIE and safety testing**
  - Confirm cause of Capsule 1 particle failures
  - Confirm performance of pilot-scale fuel, including performance at extreme high and low temperature regimes
- **Fuel oxidation tests**
  - Determine fuel performance under oxidizing conditions
- **Reporting**
- **Compile AGR datasets for use by reactor designers, e.g.:**
  - Fission product retention characteristics of the fuel
  - Fuel failure analyses under all tested conditions
  - Oxidation kinetics and impact on fission product retention
- **Support vendors' interaction with the regulator during licensing activities**

Coated-Particle-Fueled Reactor Concepts and Fuel Designs

Developer	Description	Fuel design
X-energy	Xe-100 (200 MWt PB HTGR) Xe-Mobile (1 – 5 MWe microreactor)	UCO TRISO pebbles, graphitic matrix UCO TRISO
Framatome	SC-HTGR (625 MWt)	UCO TRISO compacts, graphitic matrix
Ultrasafe Nuclear	MMR (15 MWt microreactor)	UCO TRISO in SiC matrix (“FCM”)
BWXT	BANR	UN TRISO in SiC matrix
Kairos Power	KP-FHR (140 MWe salt-cooled SMR) HERMES (35 MWt test reactor)	UCO TRISO pebbles, graphitic matrix UCO TRISO pebbles, graphitic matrix
U-Battery	U-Battery 10 MWt microreactor	UO_2 TRISO fuel compacts
Westinghouse	eVinci 7-12 MWt microreactor	UCO TRISO compacts, graphitic matrix
Radiant Nuclear	>1 MWe microreactor	UCO TRISO compacts, graphitic matrix
StarCore Power	20 MWe HTGR	TRISO
HolosGen	22 MWt scalable microreactor	TRISO fuel compacts
ORNL	Transformational Challenge Reactor	UN TRISO in SiC matrix
NASA	Nuclear thermal propulsion (NTP), nuclear electric propulsion (NEP)	Various

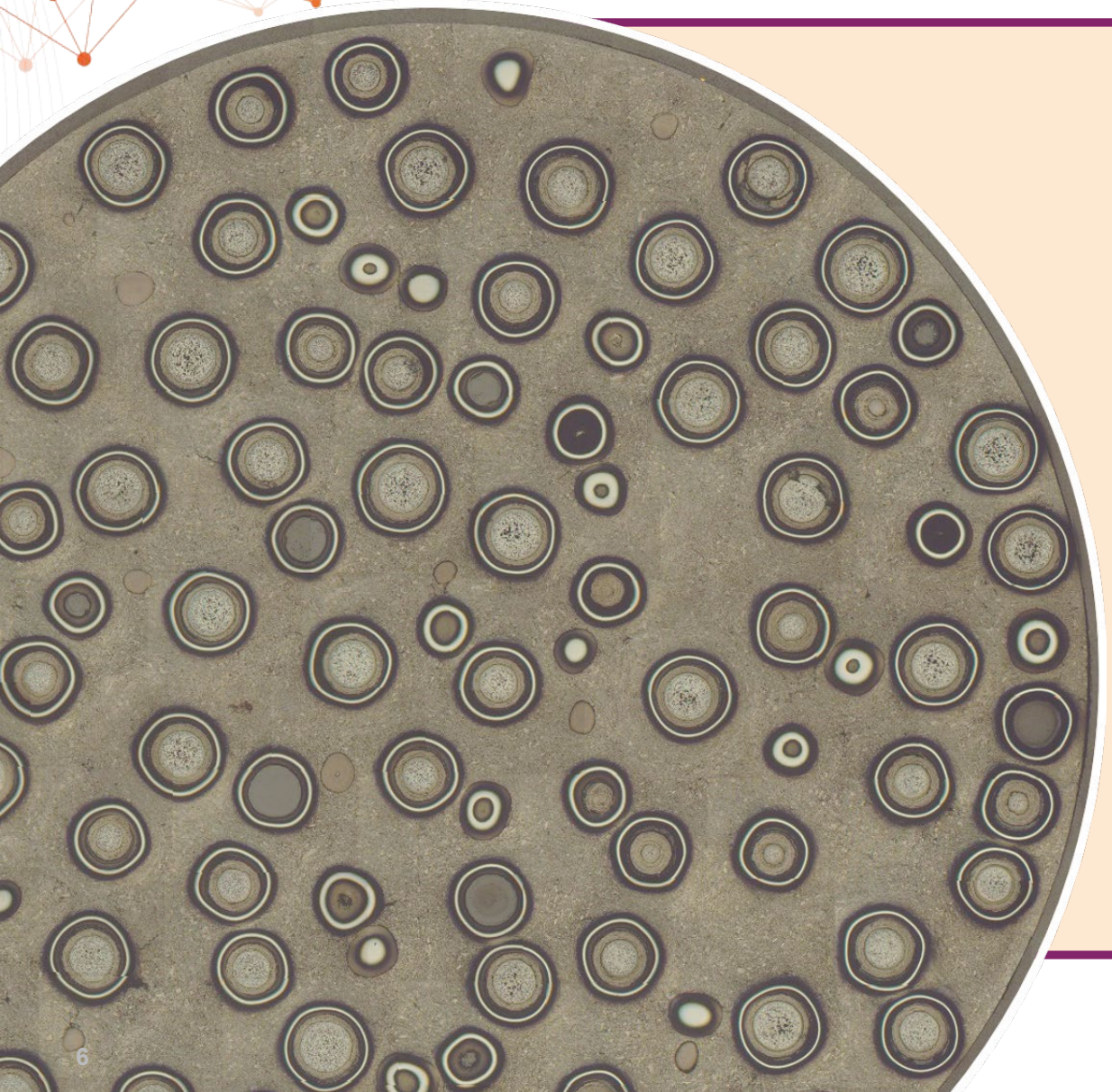


Useful references:

- Advances in Small Modular Reactor Technology Developments. A Supplement to: IAEA Advanced Reactors Information System (ARIS), 2020 Edition, IAEA (https://aris.iaea.org/Publications/SMR_Book_2020.pdf)
- https://www.world-nuclear.org/information-library/nuclear-fuel-cycle/nuclear-power-reactors/small-nuclear-power-reactors.aspx

AGR Program Support for Industry Efforts to Commercialize TRISO-Fueled Reactor Technology

- Developers would like to leverage as much fuel qualification experience from the AGR database as possible
  - Program staff supports industry in interpretation and application of AGR data
- Varied fuel designs and operating conditions will require additional fuel performance data
  - Various DOE funding opportunities available (iFOA, ARDP, GAIN, ARC15, etc.)
  - National labs are supporting industry by applying expertise obtained from the AGR program experience to these fuel qualification efforts
- Topical report preparation:
  - Meeting with the High-Temperature Reactor Technology Working Group (HTR-TWG) in February 2022 to discuss prospective scope for future topical reports based on AGR program results (Summary report: INL/RPT-22-66553)



Thank you for your attention

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