Pre-Application Activities

TRISO-X Fuel Fabrication Facility

NRC Docket No. 70-7027

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Overview and History of X-energy

X-energy is reimagining nuclear's role in solving tomorrow's energy challenges

- X-energy founded in 2009 by Kam Ghaffarian to address the world's most serious energy challenges and make a lasting contribution to clean energy technology
- Dr. Ghaffarian has committed ~$38.5M since X-energy inception to date
- Secured two Department of Energy (DOE), Office of Nuclear Energy Cooperative Agreements
  - Advanced Reactor Concept (ARC)15: Xe-100 Pebble Bed Small Modular Reactor: Solving Critical Challenges to Enable the Xe-100 Pebble Bed Advanced Reactor Concept ($53M total project)
  - Industry Funding Opportunity Announcement (iFOA)18: Design and License Application Development for TRISO-X: A Cross-Cutting, High Assay Low Enriched Uranium (HALEU) Fuel Fabrication Facility ($38M total project)

Dr. Kam Ghaffarian
Founder/CEO

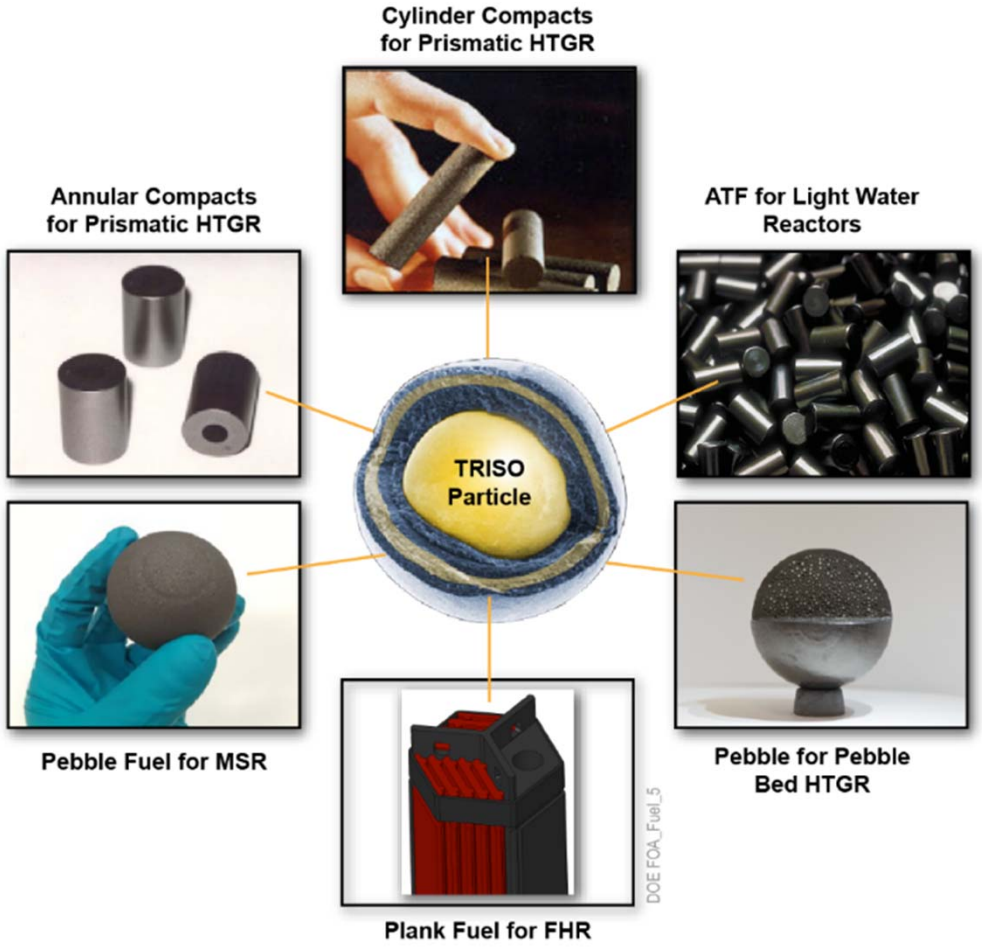
TRISO-X Fuel Fabrication Facility

Mission

- Process high-assay low-enriched uranium (HALEU) enriched to ≤ 19.8 wt% in a newly constructed commercial-scale fuel fabrication facility by 2025

Potential Customers

- Xe-100
- Department of Defense
- NASA
- Other Advanced Reactor designs
- Accident Tolerant Fuel



NRC License Requirements

- 10 CFR 70, “Domestic Licensing of Special Nuclear Material”
- Special nuclear material of moderate strategic significance (10 CFR 70.4)
  - 10,000 grams or more of uranium-235
  - Enrichment > 10% but < 20%
  - Category II quantity of material

License Application Development

- Regulatory framework – primary drivers
  - 10 CFR 70, “Domestic Licensing of Special Nuclear Material”
  - 10 CFR 51, “Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions”
  - 10 CFR 73, “Physical Protection of Plants and Materials”
  - 10 CFR 74, “Material Control and Accounting of Special Nuclear Material”
- Preparation of the license application follows the guidance in NUREG-1520, “Standard Review Plan for Fuel Cycle Facilities License Application” and other applicable NRC guidance documents for specific topics

License Application – Major Elements

License Chapters 1 - 11	Integrated Safety Analysis Summary	Environmental Report
Emergency Plan	Security Plan	Fundamental Nuclear Material Control Plan
Decommissioning Funding Plan	Safety Programs and Procedures	Staff Technical Qualifications

Commercial Facility Design Status

- TRISO-X Pilot Facility established in 2016 at Oak Ridge National Lab
  - Research, Development, Characterization, Optimization
  - Commercial scale equipment for each process step
- Conceptual Design completed August 2018
  - Lean manufacturing layout, full-size mock up assembled to aid design
  - Modular design that replicates Pilot Facility equipment
  - Multiple production lines to achieve fuel demands from reactors
  - Adaptable to multiple fuel forms
- Preliminary Design complete / nearly complete, Detailed Design started
  - Initial Process Hazards Analysis planned for 2020 to support Integrated Safety Analysis process

Pre-Application Activities

8/9/2018	Submitted initial Regulatory Engagement Plan (REP)
8/24/2018	Pre-application meeting to introduce project and discuss REP [1]
12/12/2018	Pre-application meeting on Nuclear Criticality Safety (NCS) approach [1]
1/23/2019	Informal Drop-In meeting with NRC Project Manager (PM) [1]
2/11 – 12/2019	NRC safety review team visited X-energy facilities in Oak Ridge, TN [2] ▪ PM, NCS, Quality Assurance, Management Measures, Integrated Safety Analysis
3/14/2019	Informal Drop-In meeting with NRC PM and Environmental Review Branch Chief to discuss environmental review process [1]
6/27/2019	NRC security reviewers visited X-energy facilities in Oak Ridge, TN [2]

[1] NRC Headquarters, Rockville MD

[2] TRISO-X Pilot Facility at ORNL and TRISO-X FFF mock-up area at Centrus site

Pre-Application Activities

9/11/2019	Pre-application meeting on Integrated Safety Analysis methods/process [1]
9/18/2019	NRC security reviewers visited X-energy facilities in Oak Ridge, TN [2]
11/21/2019	NRC managers visited X-energy facilities in Oak Ridge, TN [2] ▪ Nuclear Material Safety & Safeguards, Nuclear Security and Incident Response, International Programs, General Counsel, Region II
2/12/2020	NRC managers, Material Control & Accountability reviewers, and inspectors visited X-energy facilities in Oak Ridge, TN [2] ▪ Division of Fuel Management, Nuclear Security and Incident Response, Region II

[1] NRC Headquarters, Rockville MD

[2] TRISO-X Pilot Facility at ORNL and TRISO-X FFF mock-up area at Centrus site

Pre-Application Activities

Additional pre-application meetings will include:

- Site selection results / Plans for Environmental Report preparation
- Material control and accounting considerations for HALEU
- Security Plan considerations
- Emergency Preparedness
- Other topics as necessary to gain common understanding

Q3 Calendar Year 2021: target submittal of license application