GAIN
Gateway for Accelerated Innovation in Nuclear

Dr. Rita Baranwal
Director, GAIN

Advanced Reactor Briefing to NRC Commissioners
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GAIN Gateway for Accelerated Innovation in Nuclear

Idaho National Laboratory · Oak Ridge National Laboratory · Argonne National Laboratory

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What is GAIN?

Mission:
Provide the nuclear energy industry with access to technical, regulatory and financial support necessary to move innovative nuclear energy technologies toward *commercialization* in an accelerated and cost-effective fashion

GAIN is:
A private-public partnership framework aimed at rapid and cost-effective development of innovative nuclear energy technologies towards market readiness.

TRISO Fuel Particle

GAIN Initiative: Simultaneous Achievement of Three Strategic Goals

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GAIN: Connecting nuclear innovators to DOE laboratory capabilities and RD&D programs

Modeling & Simulation	Crosscutting Design Support	NRC Interface	Base Reactor and Fuel Cycle R&D Programs	Experimentation
HPC Infrastructure	Nuclear Hybrid Energy	Licensing Framework	Advanced Fuel Cycles	Nuclear Fuels
Verification and Validation	Nuclear Cyber Security	Gradual Risk Reduction	Advanced Reactors	Instrumentation and Sensors
M&S Expertise	Digital I&C Human Factors	Licensing Support Expertise	LW-based Reactors	Materials Science
Reactor physics				Test Reactors

Modeling and Simulation | **Expertise** | **Unique Facilities**

Knowledge Management & Integration

– GAIN –

Industry and investor access to DOE capabilities and expertise

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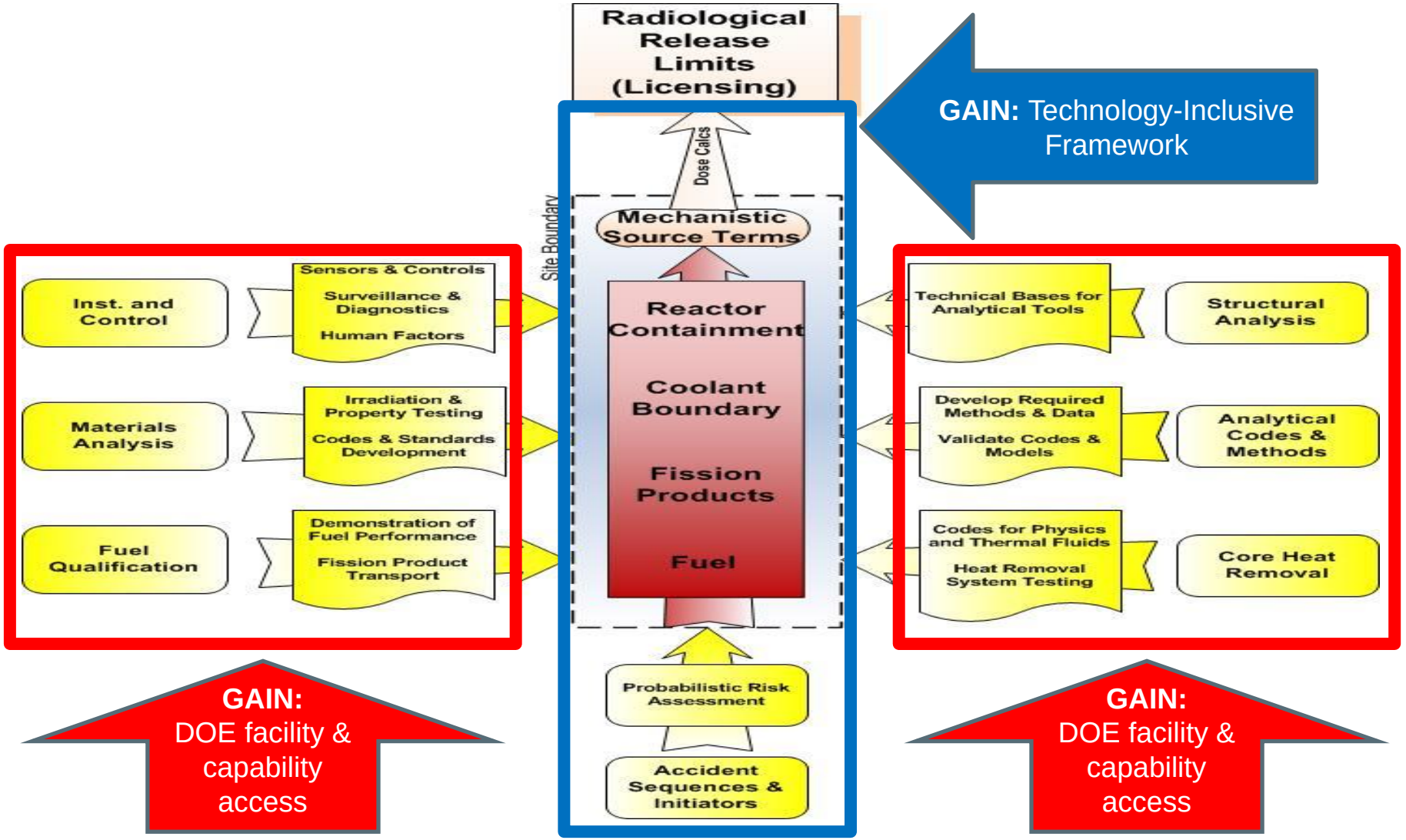
Development & Regulatory Framework Support



GAIN NE Voucher Recipient	Title	Partner Facility
AMS Corp. Knoxville, TN	Radiation Aging of Nuclear Power Plant Components	ORNL
Columbia Basin Consulting Group LLC Kennewick, WA	Methodology for Meeting Containment System Principal Design Criteria for Heavy Metal Fast Reactor Systems	PNNL
DYNAC Systems LLC Del Mar, CA	Dynamic Natural Convection System	INL
Elysium Industries Clifton Park, NY	Synthesis of Molten Chloride Salt Fast Reactor Fuel Salt from Spent Nuclear Fuel	INL / ANL
Fauske & Associates LLC Burr Ridge, IL	Development of an Integrated Mechanistic Source Term Assessment Capability for Lead- and Sodium-Cooled Fast Reactors	ANL
GSE Systems Inc. Sykesville, MD	Human Factors Engineering for the Move to Digital Control Systems – Improved Strategies for Operations	INL
Kairos Power LLC Oakland, CA	NEAMS [Nuclear Energy Advanced Modeling and Simulation] Thermal-Fluids Test Stand for Fluoride-Salt-Cooled, High-Temperature Reactor Development	ANL / INL
MicroNuclear LLC Franklin, TN	Development of the Microscale Nuclear Battery Reactor System	INL
Muons Inc. Batavia, IL	Conversion of Light Water Reactor Spent Nuclear fuel to Fluoride Salt Fuel	ORNL
NuVision Engineering, Inc. Pittsburgh, PA	Evaluation of Power Fluidic Pumping Technology for Molten Salt Reactor Applications	ORNL
Oklo Inc. Sunnyvale, CA	Risk-Informed Mechanistic Source Term Calculations for a Compact Fast Reactor	SNL/ANL
SMR Inventec LLC Camden, NJ	Small Modular Reactor-160 Primary Flow Stability	ORNL
Terrestrial Energy USA Ltd. New York, NY	IMSR® [Integral Molten Salt Reactor] Fuel Salt Property Confirmation: Thermal conductivity and Viscosity	ANL
Transatomic Power Corporation Cambridge, MA	Fuel Salt Characterization	ANL

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FY 2017 GAIN Vouchers:

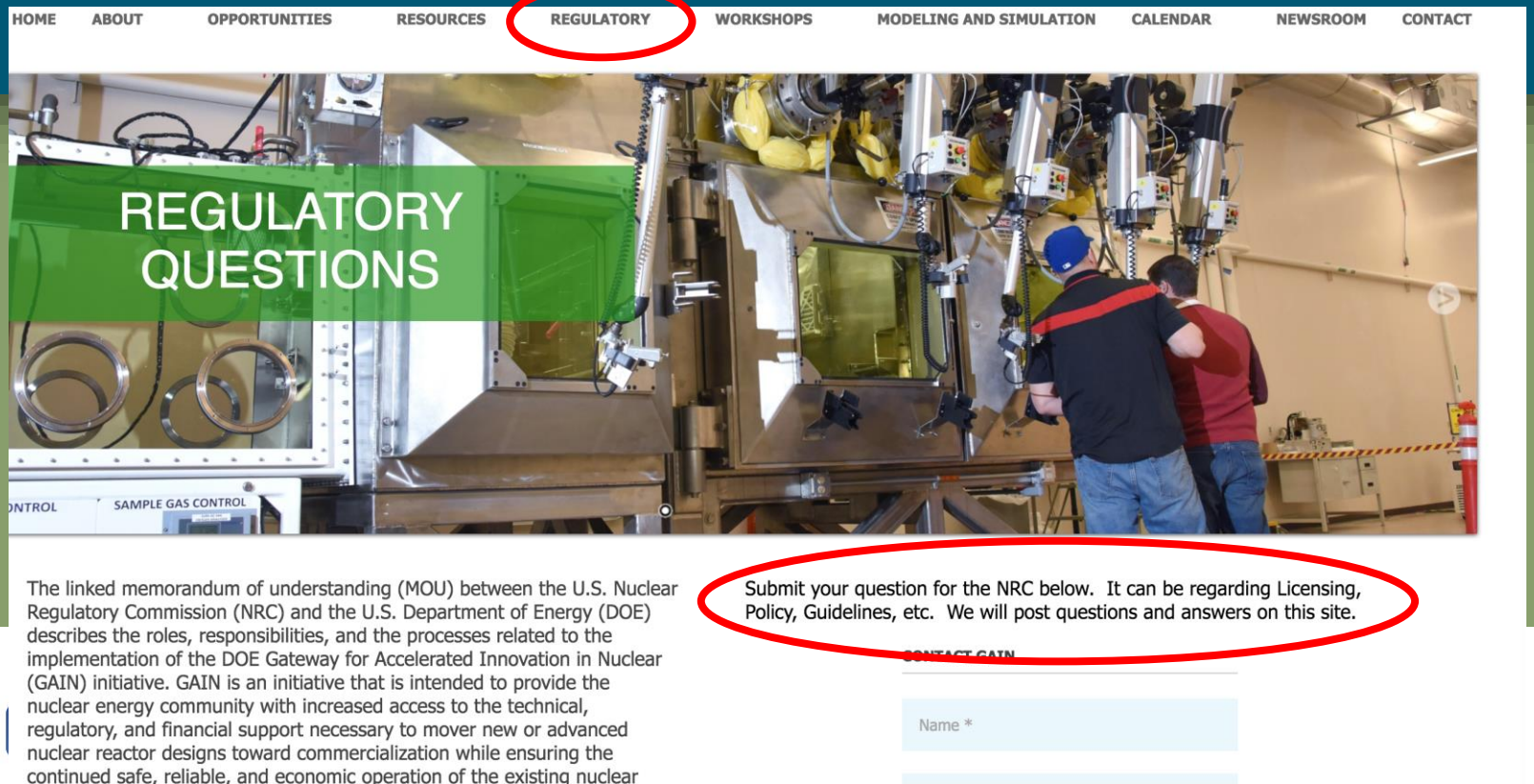
- 41 Letters of Intent
- 32 Voucher requests submitted
- 25 separate small businesses
- 9 “returnees”
- 16 new businesses compared to the 2016 pilot
- ~$4.2M awarded to 14 small businesses

Innovator Access to DOE Facilities and Expertise

- **Accident-Tolerant Fuels** (ATF)
  - New ATF cladding conceived, developed, manufactured and tested at ORNL has been manufactured by Global Nuclear Fuels (GNF) into lead test assemblies, and shipped to Southern Nuclear Operating Company for trials in Edwin I Hatch plant.
  - FeCrAl cladding (IronClad) will be the first developed through US Department of Energy's (DOE) Enhanced Accident-tolerant Fuel program to be installed in a commercial nuclear reactor
- **Molten Salt Reactor (MSR) development**
  - Training on MSR technology and MSRE experience has been provided to NRC via series of training courses
  - Continue to support the ARC-15 FOA with TerraPower on MSR technology development, including material development, corrosion expertise, salt properties, modeling & simulation, safeguards
  - Legacy reports from MSRE and MSBR have been released for developer community
- **Database development**
  - Legacy fast reactor information, including EBR-II reactor physics and fuel performance data, and TREAT data on fuel transient testing and post-test examination. GAIN supported completion and activation of TREAT database (TREXR) for benefit of industry users.

GAIN Interface with NRC

- MOU between NRC and DOE on GAIN, November 10, 2016
  - NRC provides DOE and GAIN community with current, accurate information on NRC licensing processes and regulations
- GAIN website:



Future Activities 2018

Workshops:

- Gap Analysis on Standards and Codes for Advanced Reactors at NRC Offices: May 2, 2018
- Digital Instrumentation & Controls at Argonne National Lab: June 5-6, 2018

Database/catalog:

- Develop a list of historical advanced-reactor documents to support knowledge transfer; facilitate access to key documents through OSTI
- Develop and initiate the process to appropriately remove AT designation on high priority documents requested by industry

Funding Opportunities:

- Industry-focused FOA and Vouchers awarded quarterly for 5 years

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