**First ATF transient prescription experiments completed in TREAT reactor**

- ATF-3 Transient Prescription Tests have started, with six runs planned to rehearse and demonstrate the repeatability of a transient clipping capability in preparation for fuelled tests later this year.

- This test series will provide data to compare measured and modelled dosimeter data and will show the effect of clipping on core-specimen power coupling and aid the design of RIA testing (e.g. ATF-SETH, SERTTA).

- The Advanced instrumentation group is supporting installation of self-powered neutron detectors for real-time flux data to be used during the upcoming fuelled tests.

- Additional new instrumentation including micro-pocket fission detectors and self-powered neutron detectors were installed into TREAT to further enhance its capabilities for the upcoming ATF-3 and other experiments.

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New ultra-high temperature thermocouples developed at INL for in-pile use perform well after first ATR irradiation cycle

- INL instrumentation engineers have developed a low-drift thermocouple system based on Mo/Nb thermoelements (called HTIR-TC), and also have tested a special Type N thermocouple design developed by researchers at Cambridge University.
- Both thermocouple types have been tested out of pile for more than 4000 hours at 1250°C, and have exhibited less than 1% drift, a substantial improvement over current instruments.

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First-of-a-kind channel gap inspection for European plate fuel

- Under the High Performance Research and Test Reactors in Europe (EUHPRR), Dr. James Smith led a team to demonstrate a first-of-a-kind inspection of channel gaps between developmental mini-fuel plates in the European MiniPlate Irradiation Experiment (EMPIrE) in ATR.

- The mini-plates are new fuel types designed to reduce the enrichment of research fuel and the risk of proliferation. The channel gap measurements had not previously been made on miniplates and provide valuable performance data.

- The Channel gap measurement system will also be used for the MP1 Experiments in ATR as part of the United States High Performance Research Reactor (USHPRR) Fuel Qualification Program for domestic reactors. Its portability allows fresh fuel to be baselined at other facilities, reducing demand on ATR resources.

For more information: james.smith@inl.gov
Completion of First Technical Report for the OECD/NEA Working Group on External Hazards

• Dr. Curtis Smith led development of the first technical report completed by the new Working Group on External Hazards (WGEV) as the DOE representative to the Organization for Economic Co-operation and Development (OECD) Nuclear Energy Agency (NEA) group
• The report, titled “Examination of Approaches for Screening External Hazards,” identifies both best practices and gaps that exist in worldwide risk screening processes based on the current state of the practice
• The report was endorsed by the Program Review Group for the Committee on the Safety of Nuclear Installations within NEA.

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INL-led project culminates with issuance of NRC’s advanced reactor design criteria guidance document

- NRC Regulatory Guide 1.232 was recently issued containing design criteria that can significantly reduce the regulatory uncertainty and risk for commercializing advanced non-light-water reactors.
- DOE and NRC entered into a joint initiative in 2013 to address the industry-identified need for this guidance. INL managed the DOE portion of the initiative, which included commercial industry interactions and directed support from ANL & ORNL.

This multi-year joint DOE-NRC initiative can help lead to accelerating commercialization of advanced reactors by providing a critical element to the needed regulatory framework.
Ron Boring leads effort to update nuclear industry guidance on human reliability analysis

- This standard is the basis for human reliability analysis (HRA) in nuclear facility risk assessments and is used across HRA methods to support plant licensing and risk determinations.

For more information: Ronald.Boring@inl.gov
INL, CEA and University of Pittsburgh collaborate on MITR test of acoustic and fiber optic instrumentation

- This partnership has completed initial tests of acoustic and optical fiber sensors that have demonstrated potential for in-pile online measurement.
  - Ultrasonic thermometers show minimal irradiation induced changes, but have lower resolution than fibers
  - Radiation induced attenuation in silica fiber appears to saturate after 50 days, but the impact of de-calibration from compaction must be further investigated
- Further tests are ongoing in ATR as part of the AGR-5/6/7 experiment and others planned at the MITR and BR2 reactor in Belgium

Optical and fiber sensors promise to drastically improve the impact of nuclear fuel and materials testing in research reactors and the performance of advanced reactor concepts, in particular for smaller core size (SMR, vSMRS).

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ART program launched a collaboration with Australian Nuclear Science and Technology Organization (ANSTO)

- ART researchers at INL are working with ANSTO to gather important information for the Advanced Graphite Creep (AGC) program.

- INL will be providing irradiated graphite specimens from AGC program to ANSTO, who will perform testing to assess the irradiation effects on graphite properties
  - ANSTO is Australia’s public research organization responsible for delivering specialized advice, scientific services and products.

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OPAL research reactor
Australia’s Open Pool Australian Lightwater (OPAL) reactor is a state-of-the-art 20 megawatt multi-purpose reactor that uses low enriched uranium (LEU) fuel to achieve a range of nuclear medicine, research, scientific, industrial and production goals.
INL researchers establish Strategic Partnership Project with BWXT for flowsheet and process development support

- BWXT Technologies, Inc. sought out the expertise of INL’s Aqueous Separations and Radiochemistry Department in an effort to improve the effectiveness and cost efficiency of their uranium recovery processes.
- INL and BWXT have entered into a Strategic Partnership Project to perform modeling and flowsheet development for a BWXT engineering study.

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$60M FOA to support nuclear innovation over next five years in addition to 1st round of GAIN FY18 NE Vouchers awarded

- On April 27, DOE Secretary Rick Perry announced selection of 13 projects to receive approximately $60 million in federal funding for cost-shared research and development for advanced nuclear technologies.

- These are the first under DOE-NE’s U.S. Industry Opportunities for Advanced Nuclear Technology Development funding opportunity announcement (FOA). INL collaboration partners X-Energy and NuScale are among the initial awardees.

- Along with the FOA, DOE announced five technical NE Voucher awards to U.S. companies selected under the GAIN initiative as part of DOE’s commitment to supporting U.S. industry through private-public technical partnerships for nuclear energy innovation.

<table>
<thead>
<tr>
<th>GAIN 2018 1st Round NE-Voucher Recipient</th>
<th>Awarded Proposal</th>
<th>NE-Voucher Amount</th>
<th>Partner Facility</th>
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<tbody>
<tr>
<td>Oklo, Inc. Sunnyvale, CA</td>
<td>Accelerate Development of Industry-Relevant Features in Modern Simulation Tools</td>
<td>$417,000</td>
<td>Argonne National Laboratory</td>
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<td>Idaho National Laboratory</td>
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First-of-a-Kind (FOAK) Nuclear Demonstration Readiness Project

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<tr>
<th>Design and License Application Development for TRISO-X</th>
<th>X-Energy Total value $9M</th>
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</thead>
<tbody>
<tr>
<td>Phase 1 NuScale Small Modular Reactor FOAK Nuclear Demonstration Readiness Project</td>
<td>NuScale Power Total value $80M</td>
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For more information: lori.braase@inl.gov  gain.inl.gov @GAINnuclear
Rita Baranwal provided NRC commissioners with a briefing on advanced reactors development activities, including an update on GAIN activities to prepare for effective and efficient reviews of advanced reactor applications.

The briefing also included stakeholder perspectives on advanced reactor development activities, projected policy and program issues that need to be resolved.
GAIN voucher recipients provide feedback to Executive Advisory Committee at first national lab visit

- GAIN’s held its Executive Advisory Committee (EAC) meeting at their first national lab visit, where members were provided:
  - GAIN initiative and VTR program updates
  - Voucher recipient presentations on their experience and improvement suggestions
  - Research highlights from INL personnel
- Industrial end user feedback and other highlights from the recent Enabling Advanced Reactors for the Market Symposium were of particular interest

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Collaborations
HOT FUEL EXAMINATION CIL

Executive Advisory Committee
Nai Wilmhurst, EPRI – Chair
Paul Kearns, ANL
Dale Klein, University of Texas
Maria Korunicz, NEI
Jeff Merrifield, USNIC
Chris Mowry, NIA
Mark Peters, INL
Ray Rothrock, Partner Emeritus Venrock
Thomas Zacharia, ORNL
INL leads kickoff of DOE-NE Center of Excellence for Thermal Fluid Applications in Nuclear Energy

• The INL-led kickoff identified key areas of interest to industry, including tailored approaches to multi-scale multi-physics thermal fluids verification & validation (V&V) and how the Center will help address growing needs in that area.

• NRC in particular was highly engaged with the approaches to V&V and licensing requirements – an area which can lead to faster deployment of new nuclear technologies.

• Many expressed the need for a data repository for validation data, a potential area of collaboration with ORNL.

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INL-led projects and researchers featured at PHYSOR 2018
International recognition of INL-Led IRPhEP & ICSBEP Efforts

• INL’s Mark DeHart and senior science advisor Massimo Salvatores and Mark DeHart provided plenary talks at the Physics of Reactors (PHYSOR) 2018 Conference
• The International Reactor Physics Experiment Evaluation Project (IRPhEP) and International Criticality Safety Benchmark Evaluation Project (ICSBEP) were highlighted in 3 of the 4 plenary talks at PHYSOR 2018. These INL-led projects are sanctioned by the OECD NEA.

INL was recognized for its leadership of the International Reactor Physics Experiment Evaluation Project (IRPhEP) and International Criticality Safety Benchmark Evaluation Project (ICSBEP) by OECD NEA’s Tatiana Ivanova

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NQA-1 certification of INL’s QA program could lead to further collaboration opportunities with nuclear developers

- BEA received notification from TerraPower that INL’s Quality Assurance Program is compliant with all requirements of ASME NQA-1- 2008, 2009a.
- This achievement made INL the first DOE National Laboratory to be added to TerraPower’s Evaluated Suppliers List (ESL).
- Addition to the ESL designates INL as an NQA-1 qualified supplier of safety-related Testing and Laboratory Services, and could lead to further collaboration opportunities with other nuclear developers.

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**Increased funding and rapid scope shift illustrate priority of Versatile Test Reactor (VTR) Program**

- The VTR Program received a significant increase in funding ($35M) in FY 2018 Appropriations necessitating a rapid ramp up of the Program and delivery of CD-0 in January 2019. The priority of the program within DOE is evident.

- Expressions of Interest (EOIs) are being issued to gauge the level of interest with industry to join the multi-laboratory team to develop the reactor and experiment capabilities and leverage existing fast reactor designs. To this end, subcontracts with universities are also in the works. The VTR team will be a broad multi-laboratory, industry, and university team.

For more information: john.bumgardner@inl.gov
ATF experiment database provides valuable tool to aid in evaluation of data by developers and NRC

- The ATF Nuclear Data Management and Analysis System (NDMAS) database provides a framework for managing scientific and technical information generated from irradiation experiments conducted as part of the Accident Tolerant Fuels program.

- The limited access SharePoint Site captures and maintains the QA pedigree associated with the various data streams, and is expected to be instrumental in license applications for these fuel concepts in the future.

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April Novak receives 2018 Innovations in Nuclear Technology R&D award for full-core FHR simulator using Pronghorn code

- INL modeling & simulation intern April Novak was named a 2018 Innovations in Nuclear Technology Award winner for her work on a full-core fluoride salt-cooled high temperature reactor (FHR) simulator using the MOOSE-based Pronghorn code.
- Funded by NEUP, April Novak worked as an INL intern with research focused on the full-core FHR simulator.

MOOSE-based Pronghorn is designed to provide engineering solutions for reactor full core thermal-fluids simulations on small clusters or large workstations.
- Pronghorn is designed to be coupled to Rattlesnake (radiation transport), BISON (TRISO fuels performance), and RELAP-7 and SAM (balance of plant).
- Pronghorn was jointly developed by INL (Drs. Ling Zou and John Peterson), NRC (Joe Kelly), and by April Novak of the University of California at Berkeley (UCB).
- Funded by NEAMS and the NRC for VHTR work conducted at INL and NRC.

For more information:
richard.martineau@inl.gov
Bruce Mincher

Mincher was recognized by EU GENIORS (Generation IV Oxide Fuels Recycling Strategies) at their annual meeting in Wurzburg, Germany, in recognition of his outstanding contributions in the fields of radiation chemistry and separation science.

Brent Dixon

Brent Dixon was named the Techno-Economic Analysis (TEA) sub-team lead for ARPA-E’s MEITNER Resource Team. MEITNER is the Modeling-Enhanced Innovations Trailblazing Nuclear Energy Reinvigoration Program, with an objective to achieve drastic cost reduction for advanced nuclear concepts.
Dr. Ron Boring has been elected to serve a 3 year term on the Executive Committee of the Human Factors, Instrumentation and Controls Division of the American Nuclear Society.

Dr. John Wagner was inducted into the Mines and Metallurgy Academy of the Missouri University of Science and Technology. This ambassadorship position recognizes university alumni who rise to leadership positions in fields related to mines and metallurgy.

Dr. Shannon Bragg-Sitton serves as the Technical Area Lead for the new DOE-NE Special Purpose Applications (SPA) research area under the Advanced Reactor Technologies Program that aims to support near-term deployment of a MW-class reactor.
INL’s Data Science Community of Practice was formed in 2017 to create a community for the often-isolated work of data scientists at INL. The Community of Practice elected new officers who will be inaugurated in May.

Dr. Shannon Bragg-Sitton and Dr. John Wagner completed the Oppenheimer Science and Energy Leadership Program (OSELP) in a capstone event held at INL on April 4, 2018.
New Hires—April 2018

Jess Gehin
Nuclear Science and Technology (C000)
Chief Scientist

Kevan Weaver
Fuel Design and Development (C620)
Research Area: Technical Lead, Transient Safety Testing & VTR Validation Experiments

Ryan Fronk
Fusion, Hydrogen and Measurement Sciences (C640)
Research Area: Development and deployment of flux sensors for irradiation testing with a focus on characterization and resolution of detector noise.

Sudipta Biswas
Fuel Modeling and Simulation (C650)
Research Area: Computational Microstructure Science
Post-Doc
New leaders in NS&T

Jim Cole
Nuclear Fuels and Materials (C600)
US High Performance Research Reactor Fuel Qualification (HPRR-FQ) National Technical Lead

Irina Glagolenko
Nuclear Fuels and Materials (C600)
US High Performance Research Reactor Fuel Qualification (HPRR-FQ) Deputy National Technical Lead
April Publications


