Pacific Northwest
NATIONAL LABORATORY

WSU-PNNL Nuclear Science and Technology Institute

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U.S. DEPARTMENT OF ENERGY BATTELLE

PNNL is operated by Battelle for the U.S. Department of Energy

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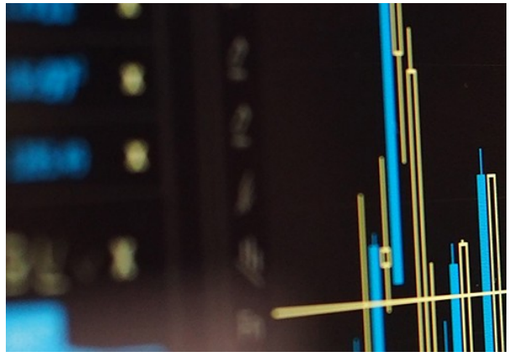
Overview

- The WSU-PNNL Institutes
- Alignment with sponsors and industry
- Leveraging our facilities
- Personnel
- Current status
- Science highlights

The WSU-PNNL Institutes

Nuclear Science and Technology (NSD)

Understand and control how materials evolve in radiation environments—to prevent the use of illicit nuclear materials, resolve issues in nuclear waste management, and advance next-generation nuclear energy.



Advanced Grid (EED)

Create and implement a national-scale simulation platform and data framework to enable advanced grid controls and operations for complex power systems of the future.

Bioproducts (EED)

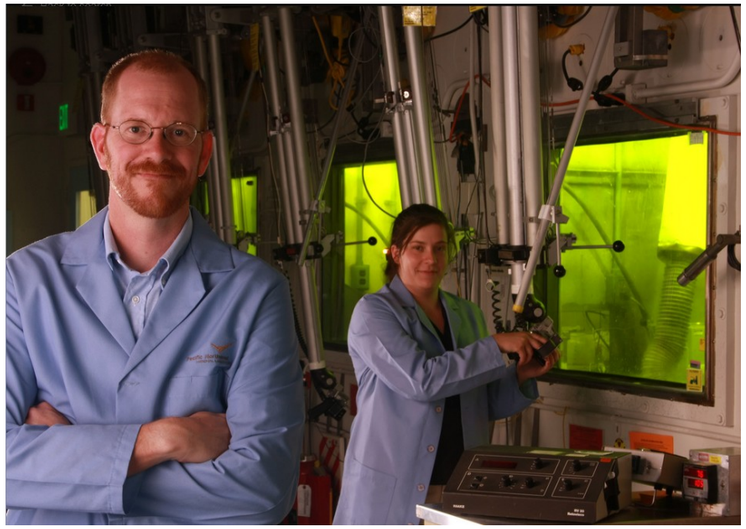
Leverage cutting edge science, engineering, and analysis to transform engineered plants and industrial, agricultural and municipal waste into valuable materials and chemicals, and develop a pipeline of talent to meet future workforce needs.

Also: NWIMPACT (De Yoreo, PCSD, UW) and PMedic (Rodland, EBSD, OHSU)

The Institutes are a Laboratory priority

- Historically strong links with Washington State University through single staff and faculty relationships
- A large number of PNNL staff members are WSU alumni
- The Institutes bring together complementary and synergistic expertise, combining the unique talents and resources of the partner institutions, to address major challenges in important mission areas that neither partner can achieve alone or easily, enabling:
  - The elevation of quality and impact of research at both institutions
  - Seamless collaboration on new multi-disciplinary projects across the partner organizations and facilities
  - The development of new programs in areas of focus for the Institute
  - The strengthening of staffing pipelines
  - Strategy development at both institutions
  - Joint funding calls and joint branding of facilities (e.g. BSEL at WSU-TC)
  - Stronger links to other WSU campuses (e.g. US-TUR at WSU-Spokane, WSU-TC)

The WSU-PNNL Nuclear Science and Technology Institute

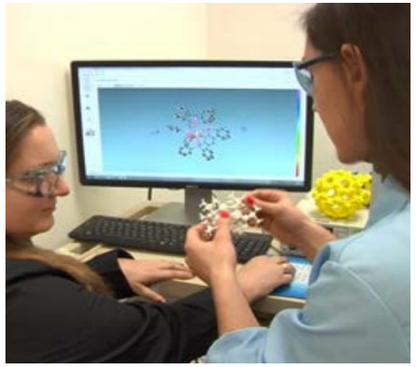


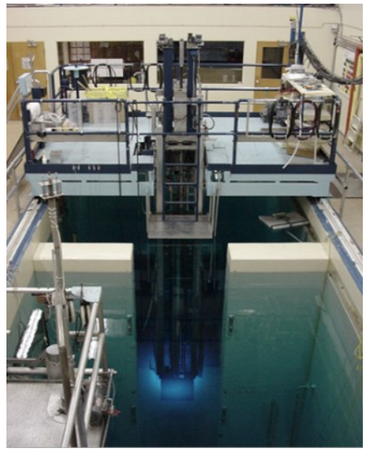
- The WSU-PNNL Nuclear Science and Technology Institute is a joint research collaboration of Washington State University and the U.S. Department of Energy's Pacific Northwest National Laboratory.
- Scientific Mission: To *understand and control how materials evolve in radiation environments* to advance knowledge in *nuclear materials management, next-generation nuclear energy, and non-proliferation of nuclear weapons.*
- Vision: To serve as a hub for education, multidisciplinary research, and innovation in nuclear science and technology

Alignment with sponsors and industry

- Washington State has a *considerable investment* in nuclear science and technology businesses
  - Columbia Generating Station (only commercial reactor in the Northwest, 1100 employees)
  - Hanford Site (world's largest radiological clean-up project, $2B/yr, 8000 employees)
  - Framatome operational center of excellence (nuclear fuel products, 5% of energy generated in nation)
  - TerraPower (Bellevue, WA; next-generation reactor design)
- These enterprises need a *strong fundamental scientific basis* to be successful, both in terms of technology development and the next-generation workforce
- Washington State has a *considerable investment* in radiological research and development
  - PNNL: world-leading scientific capabilities in nuclear fuels, nuclear clean-up and nuclear security
  - WSU: nationally recognized training and education in radiochemistry and applications in forensics, nuclear materials, interfacial phenomena. Combining education and research in Chemistry, Chemical Engineering, and Materials Science and Engineering

Combining our unique nuclear facilities





- PNNL
  - Radiochemical Processing Laboratory (RPL)
  - Radiological Exposure and Metrology (REM) Laboratory
  - Ultra-trace laboratory
  - Environmental Molecular Sciences Laboratory (EMSL)
- WSU
  - TRIGA research reactor at the Nuclear Science Center
  - Xradia X-ray tomography instrument

Personnel

Co-Director (WSU) Prof. Aurora Clark

Co-Director (PNNL) Neil Henson

- A permanent director has been selected and will begin their role in August 2019 as a faculty member at WSU and a Joint Appointment at PNNL; a co-director will reside at PNNL
- Participating WSU faculty drawn from the existing WSU Institute of Nuclear Science and Technology spanning several departments and centers (Chemistry, NRC, MME, Chem. & Bio. Engr., Environment, Crop and Soil Science, Political Science)
- Participating PNNL staff to be drawn from three Directorates (National Security Directorate, Energy and Environment Directorate and Physical and Computational Sciences Directorate)
- The Institute promotes the formation of multi-disciplinary teams, and Joint Appointments between the two organizations to promote common research activities as well as facilitating graduate students to perform research at PNNL facilities

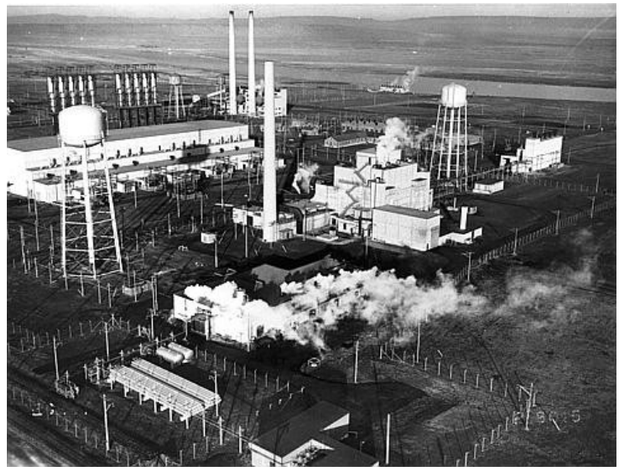
NSTI Progress: scientific output and personnel

- People
  - Joint Appointments: current: 5 (S. Clark, A. Clark, McCloy, Clowers, Schenter)
  - WSU graduate students working in PNNL facilities: Meadows, Louis, Krzysko (Clark), Athon (McCloy), Reiser (Wall)
  - PNNL staff working in WSU facilities: irradiation of samples at WSU TRIGA Reactor (Morrison)
  - PNNL staff pursuing graduate degrees at WSU: Beck (NSD, radiochemistry), Beiswenger (NSD, environmental science)
- Publications (5): 1 publication from PNNL/WSU Internal Investment project (Nuclear Processing Science Initiative), 4 publications from PNNL/WSU DOE-SC EFRC IDREAM (Interfacial Dynamics in Radioactive Environments and Materials)

NSTI Progress: engagement and outreach

- Development of teams and collaborations
  - Site visits to WSU and PNNL facilities promoting discussion, creating collaborations
  - WSU-PNNL NSTI Seminar Series started in Spring 2019, alternating on-site visits between WSU and PNNL, Zoom video streaming to all Institute participants (let me know if you'd like to be added to the distribution list)
  - Curricula development discussions: Hanford contractors, WSU and Columbia Basin College in health physics, WSU-TC
- Successful NSTI proposals in 2019
  - NNSA Defense Nuclear Non-Proliferation consortium proposal (GA Tech lead) "Consortium for Enabling Technologies and Innovation (ETI)" $4M/yr for five years, several students associated with PNNL projects and staff

Institute Science Theme Areas

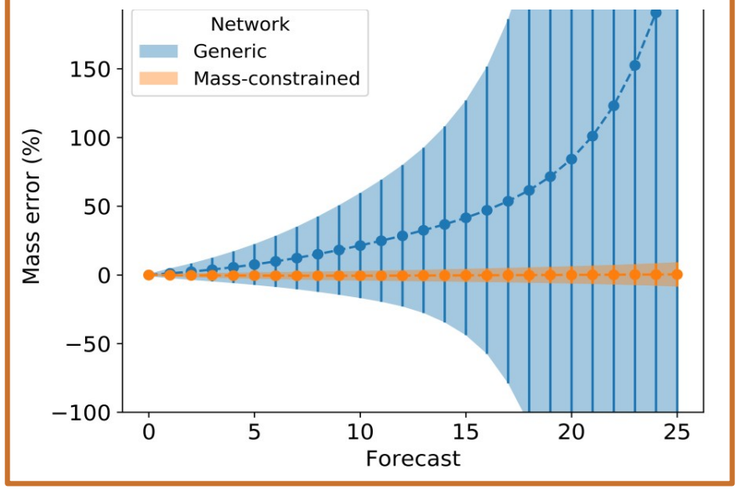


PRODUCTION

Fundamental chemistry and materials science relating to the production processes of nuclear materials, including separations science, radiochemistry and nuclear fuels

DISPOSAL

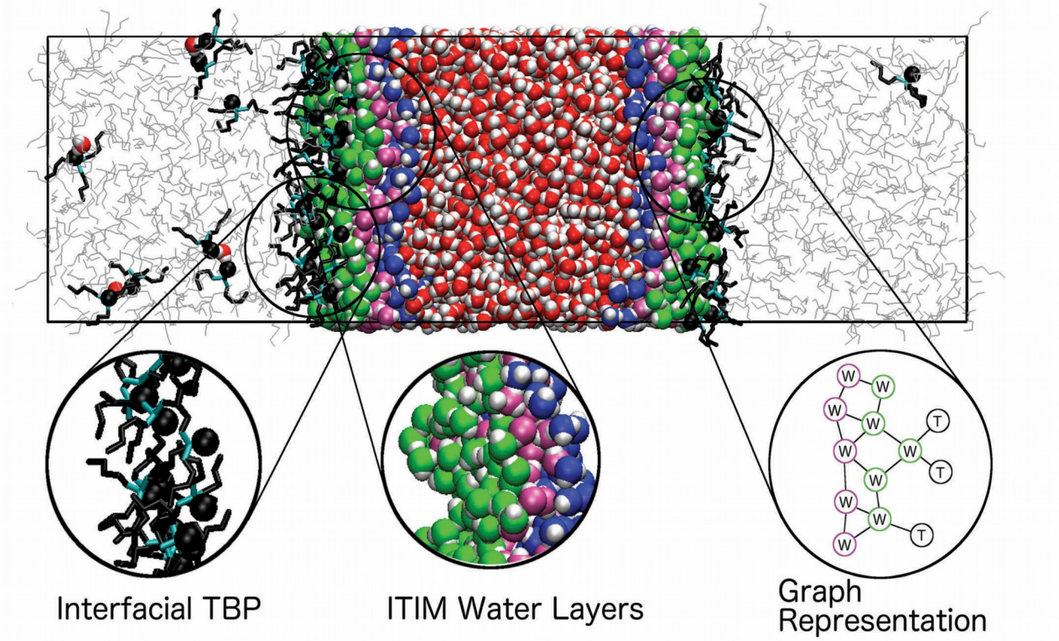
The behaviour of nuclear materials in radiation fields focused on issues of disposal of nuclear waste and mitigation of environmental effects

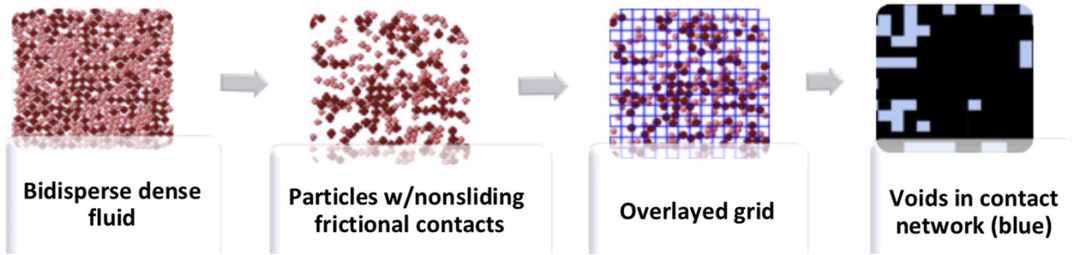


PREDICTION

The application of data science tools to enable predictive chemical modelling of nuclear systems

Institute Science Highlights





- Institute collaborations have helped elucidate fundamental mechanisms of solute transport across oil water interfaces relevant to waste processing technologies

  Phys. Chem. Chem. Phys., **2019**, *21*, 2866 – 2874

- New data science methods have revealed changes to intermolecular forces in the shear thickening fluids of Hanford tank waste slurries

  Phys. Rev. E, **2019**, DOI: 10.1103/PhysRevE.99.012607

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Thanks for listening!

https://thewsu-pnnlinstitutes.labworks.org/