



Briefing on Regulatory Research Program Activities

February 24, 2022



Opening Remarks

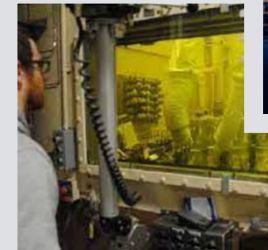
Daniel Dorman

Executive Director for Operations



Agenda

- Raymond Furstenau
 - Research Readiness
- Theresa Lalain
 - Research Innovations
- Kenneth Armstrong
 - Scientific Computer Code Investment Plan
- Nancy Hebron-Isreal
 - University Nuclear Leadership Program
- Robert Tregoning
 - Future Focused Research



RES



Research Readiness

Raymond Furstenau

Director

Office of Nuclear Regulatory Research



Research Innovation

Theresa Lalain

Deputy Director

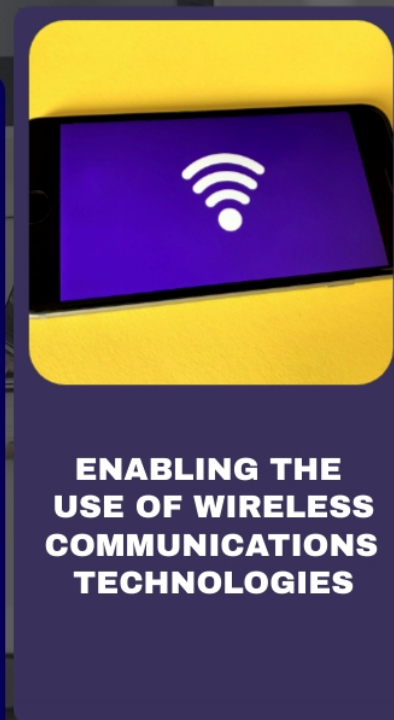
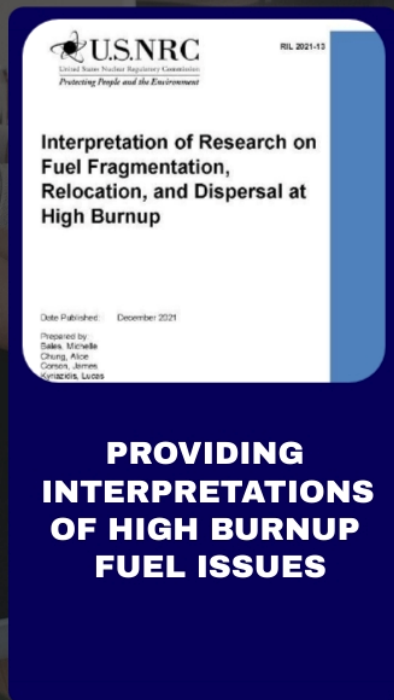
Division of Systems Analysis

Office of Nuclear Regulatory Research



Supporting Nuclear Innovations in Operating Reactors

RES



Assuring Regulatory Readiness for Advanced Nuclear Technologies

RFS



**COMPUTER
CODES**

**ENSURING CODE
READINESS**



GUIDANCE

**SCALABLE
GUIDANCE**



STANDARDS

**LEVERAGING
STANDARDS**

ACHIEVING READINESS THROUGH RESEARCH NOW AND INTO THE FUTURE



Cultivating a Proficient Workforce and Enhancing Our Technical Capabilities

RES

Retaining Core Capabilities

"Retaining core capabilities in risk and reliability and human factors is vital to maintaining a highly-skilled workforce now and in the future."



Our Experts in

RISK AND RELIABILITY AND
HUMAN FACTORS ANALYSTS

"RES's nondestructive examination program broadly supports NRC's mission and benefits from extensive collaborations with domestic and international counterparts."



Carol Nove

SENIOR MATERIALS ENGINEER

Maintaining Expertise
Recognized Across the
Nation and Worldwide

"Core competencies have a large knowledge component, and managing them is a product of our strategy working with knowledge management and innovation."



Ghani Zigh

SENIOR LEVEL ADVISOR FOR
COMPUTATIONAL FLUID
DYNAMICS

"RES is building new skills capabilities for cultivating an artificial intelligence proficient workforce through training and technical skill development."



Matt Dennis

REACTOR SYSTEMS
ENGINEER (DATA SCIENTIST)

Growing and
Developing Skills and
Capabilities

RES Provides Well-Respected Leadership Across the Nation and the World
by Positively Influencing Nuclear Safety and Security Research

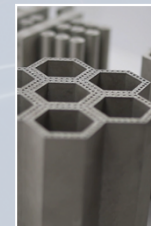
Strengthening and Expanding Partnerships Through Research

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Demonstrating Leadership in the Halden Human Technology Organization Project

*Picture courtesy by IFE



Gaining Insights on Advanced Manufacturing Technologies

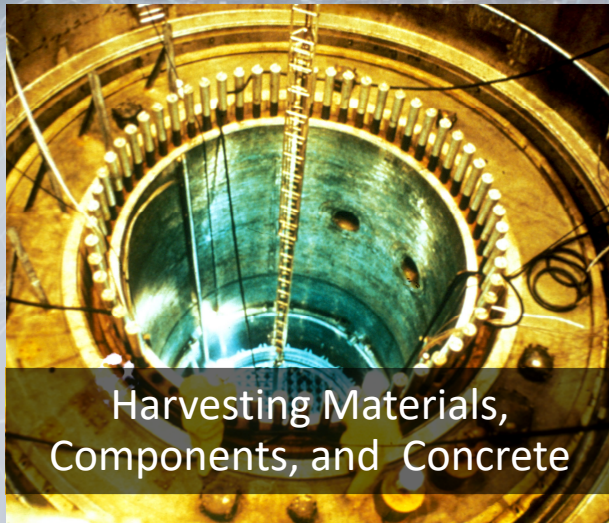
*Picture courtesy by ORNL



Leveraging Artificial Intelligence Expertise

Looking to the Future of Research and Innovation

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We Are Keeping Pace with Technological Innovations and Reducing Barriers to Enable the Safe and Secure Use of Technological Innovations in Nuclear Facilities

Scientific Computer Code Investment Plan

Kenneth Armstrong

Chief, Code and Reactor Analysis Branch II

Division of Systems Analysis

Office of Nuclear Regulatory Research



Ensuring Scientific Computer Code Capabilities

RES

Request:

“ ... work with the technical offices to review in a holistic way the existing inventory of codes that the NRC uses to develop a long-term investment plan to support future use and resource requirements.”

Success:

- Developed integrated management tool
- Stabilized annual resource
- Informed budget formulation
- Identified staff and contractor expertise requirements
- Documented process



NRC Scientific Computer Code Investment Plan Office of Nuclear Regulatory Research

Working Group
Kenneth Armstrong
Matthew Bernard
Antony Calvo
Teri Lalain

Version 1 (February 2022)

Assessing the NRC's Scientific Computer Codes

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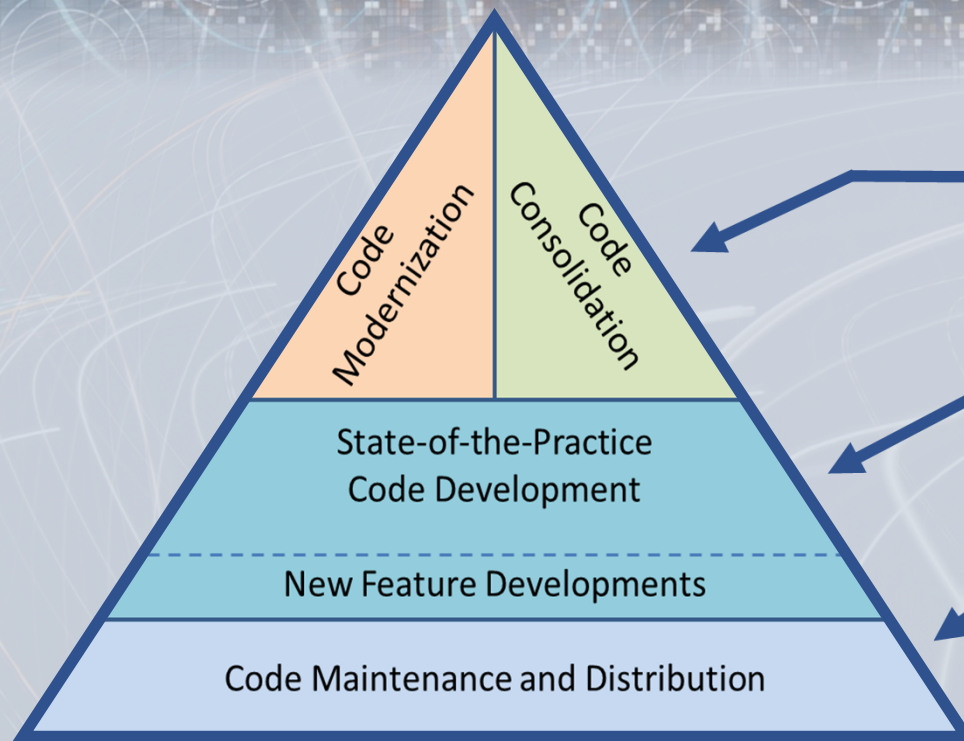
Total codes – 40

- Archived codes – 9
- Active codes – 31
 - Modernizing – 4
 - Consolidating – 7 into 2
- Most developed by RES and financially leveraged

Area of Analysis	Scientific Computer Code	Area of Analysis	Scientific Computer Code
Accident Progression and Source Term	MELCOR	Geographic	OLYMPUS DISS
	RTT	Graphical User Interface	PI-MAL
Atmospheric Dispersion	ARCON		SNAP
	PAVAN	Human Reliability	IDHEAS-ECA
	TEPHRA		SACADA
Chemical Dispersion	HABIT	Hydrology	BREATH
Consequence	MACCS		MULTIFLO
Decommissioning	DandD		TPA
	GENII		xFlo
	MILDOS	Materials	3D STRESS
	RESRAD		FAVOR
	VSP		FES
Dose Assessment	GALE		LEAPOR
	NRCDose	Neutronics	SCALE
	RADTRAD		PARCS
	RADTRAN	Probabilistic Risk Assessment	xLPR
	RASCAL		SAPHIRE
	VARSKIN	Record Database	Radiological Toolbox
External Hazards	PVHM-YM	Thermal-Hydraulics	RELAP5
Fuels	FAST		TRACE

Applying Resources Strategically

RES



- Significant efforts, span multiple fiscal years
- Resources planned for the full scope of the project to ensure success of investment

- Updates to incorporate advancements made by industry
- Minor code changes that enhance the code usability or improve confidence in the model

- Recurring maintenance cost to fix bugs, ensure stability/operability with current operating systems
- Ensure IT security compliance

Investment Process



Intake Process

Type of Development: Code(s)

DESCRIPTION OF CURRENT STATE		IMPACT IF NOT RESOURCED													
NEED / REQUIREMENT		DELIVERABLE(S)													
		Major Deliverables (Code/Feature Releases)	Date (MM/DD/YYYY)												
ACTIVITIES THE CODE SUPPORTS															
RESOURCE REQUIREMENTS, \$ K															
Resource Requirements		FY21	FY22	FY23	FY24	FY25	FY26	FY27							
Activity	Business Line/Product	\$K	FTE	\$K	FTE	\$K	FTE	\$K	FTE	\$K	FTE	\$K	FTE	\$K	FTE
Maintenance															

Lead :
UNR/RAR:

University Nuclear Leadership Program

Nancy Hebron-Isreal

Senior Grants Specialist

University Nuclear Leadership Program



UNLP - Goals and Objectives

- Program initially supported traditional educational grants
- Broadened in FY20 to support research projects relevant to agency mission
- University led R&D projects to complement current and future research needs

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Leveraging Opportunities and Relationships

RES

- Overwhelming response to R&D announcement
 - Received and reviewed over 200 proposals for FY20 and FY21
 - Technical areas are focusing on all parts of R&D portfolio
- Coordination with NNSA and DOE engagement
- Grant recipient presentations
 - *Oregon State University (Dynamic Risk Assessment for Nuclear Cybersecurity)*
 - University of Michigan (Safety Analysis Models Heat Pipe Microreactors)
 - Rensselaer Polytechnic Institute (Modular Data Tool for NRC Comprehensive Reactor Analysis Bundle (CRAB))
 - University of Southern California (Risk-informed Condition Assessment of Spent Nuclear Fuel Canisters)
- Encourage Minority Serving Institutions (MSI)



Nuclear Leadership through Workforce Development

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- UNLP student recipients are required to obtain nuclear related employment.
 - Nuclear industry
 - NRC/federal agencies
 - National Laboratories
 - Academia
- UNLP serves as pipeline to fill Agency entry level positions - since 2020
 - 35 NRAN hires
 - 2 Resident Inspector Development Program trainees; and 1 Resident Inspector hire
 - Streamlined noncompetitively hiring for grant recipients



Future Focused Research Program

Robert Tregoning

Senior Level Advisor

Division of Engineering

Office of Nuclear Regulatory Research



Preparing the Agency for Future Challenges

RES

- Promote robust research supporting longer-term readiness
- Kickstart work on important topics
- Develop cognizance of cutting-edge research
- Create synergy with relevant partners and programs
- Energize staff while building essential capabilities

“It’s tough to make predictions, especially about the future.”

- Yogi Berra



RES

- [illegible]

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Decision

Specific Analyses

General Analysis Tools

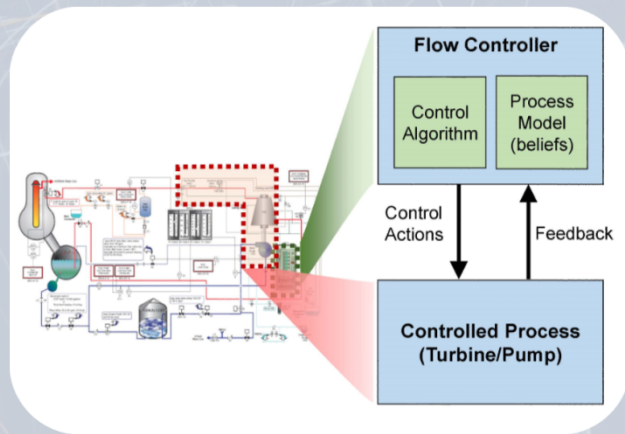
Foundational Knowledge

R&D

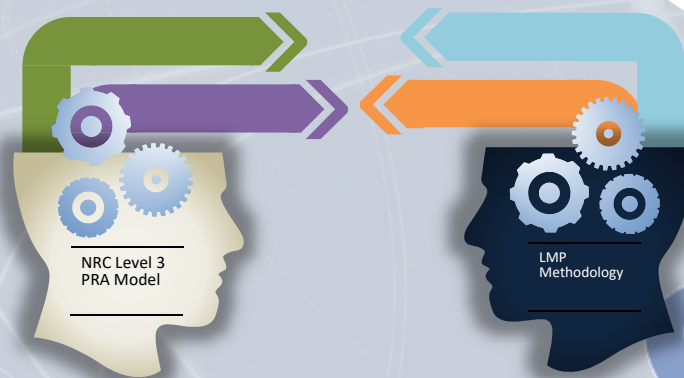
Regulatory Decision Support

Successes Have Enhanced Readiness

- Initiated in spring of 2020
- Initial results from several FFR programs have enhanced agency's readiness in those areas
- Optimistic about program's future



System-Theoretic Accident Model and Processes (STAMP)



Licensing Modernization Project



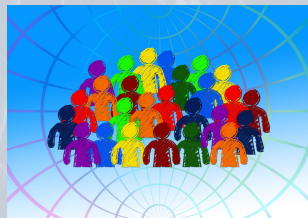
Grow into an Agency-wide Resource

RES

- Serve as an incubator for research ideas
- Become part of agency's culture and consciousness
- Effectively leverage resources
- Partner with related internal (e.g., UNLP) and external (e.g., DOE) programs



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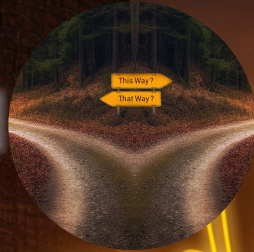


"The road to success is always under construction."

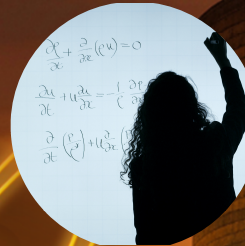
- Lily Tomlin

Providing Integral Mission Support

Preparing for the Future



Conducting Relevant Research



Fostering Partnerships



Focusing on Safety



Building our Capabilities



Fueling Innovation





Closing Remarks

Daniel Dorman

Executive Director for Operations



Acronyms

RES

- ACRS – Office of the Advisory Committee on Reactor Safeguards
- CRAB - Comprehensive Reactor Analysis Bundle
- DOE – Department of Energy
- EPRI – Electric Power Research Institute
- FFR – Future Focused Research Program
- IFE - Institut for Energiteknikk (Operator of the Halden HTO Project)
- MSI - Minority Serving Institutions
- NEA - Nuclear Energy Agency
- NNSA – National Nuclear Security Administration
- NRAN – Nuclear Regulator Apprenticeship Network
- ORNL – Oak Ridge National Laboratory
- R&D – Research and Development
- RES – Office of Nuclear Regulatory Research
- SPAR DASH - Standardized Plant Analysis Risk Models (SPAR) Dashboard (DASH)
- UNLP – University Nuclear Leadership Program