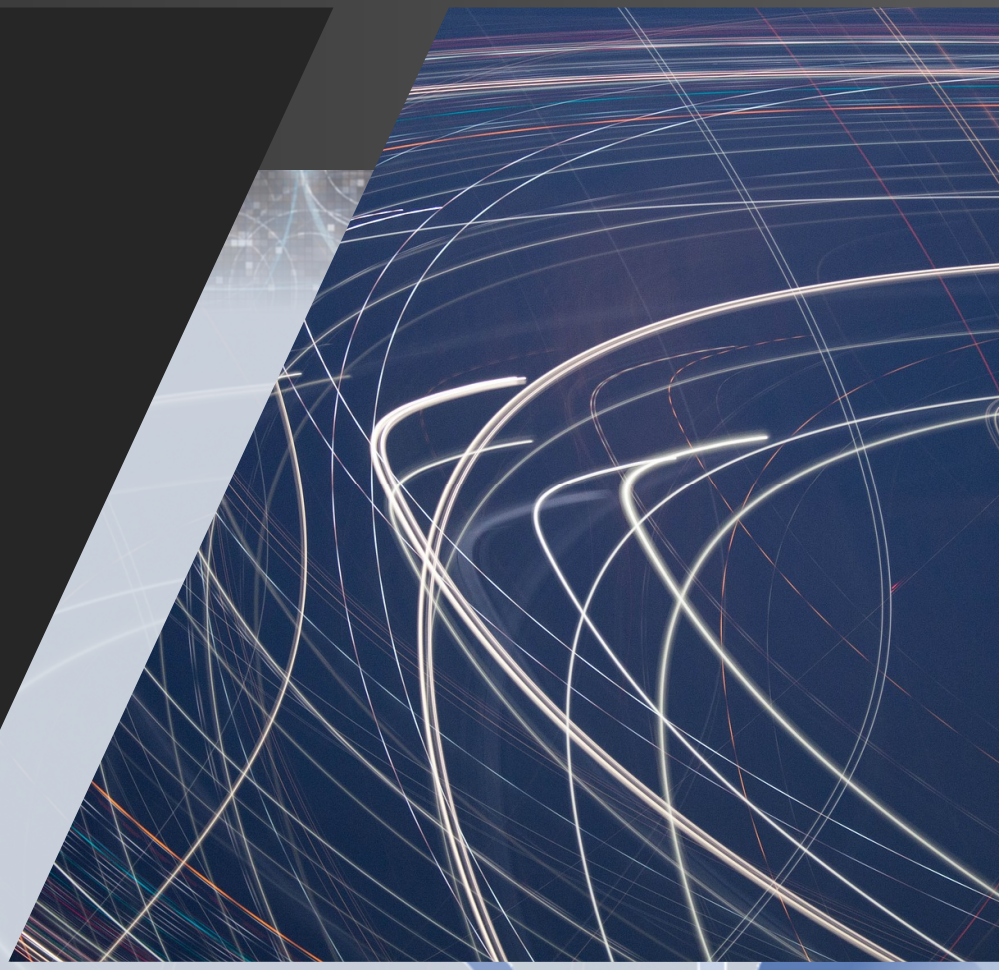
Briefing on Regulatory Research Program Activities

February 24, 2022

Opening Remarks

Daniel Dorman

Executive Director for Operations



Agenda

RES

- 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

Research Readiness

Raymond Furstenau

Director

Office of Nuclear Regulatory Research

Maintaining and Building Capabilities

RES

People

Scientific Computer Codes and Tools

Partnerships

NEA

EPRI
ELECTRIC POWER RESEARCH INSTITUTE

Research Innovation

Theresa Lalain

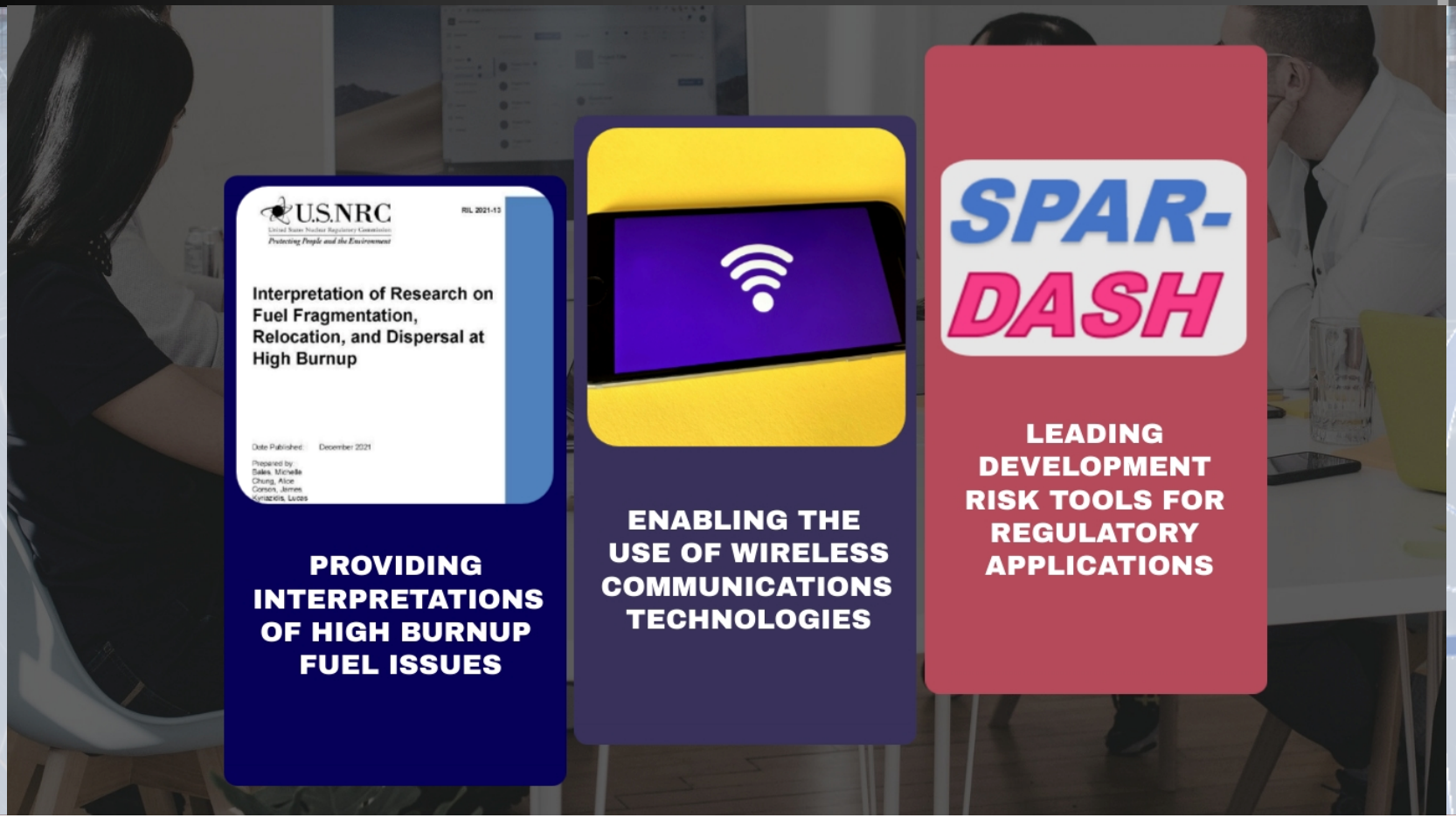
Deputy Director

Division of Systems Analysis

Office of Nuclear Regulatory Research

Supporting Nuclear Innovations in Operating Reactors

RES



Assuring Regulatory Readiness for Advanced Nuclear Technologies

RES

ENSURING CODE READINESS

SCALABLE GUIDANCE

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

"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

Maintaining Expertise Recognized Across the Nation and Worldwide

"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

Growing and Developing Skills and Capabilities

"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)

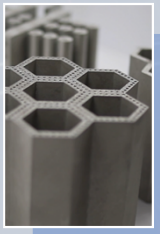
RES Provides Well-Respected Leadership Across the Nation and the World by Positively Influencing Nuclear Safety and Security Research

Strengthening and Expanding Partnerships Through Research

RES

Demonstrating Leadership in the Halden Human Technology Organization Project

*Picture courtesy by IFE



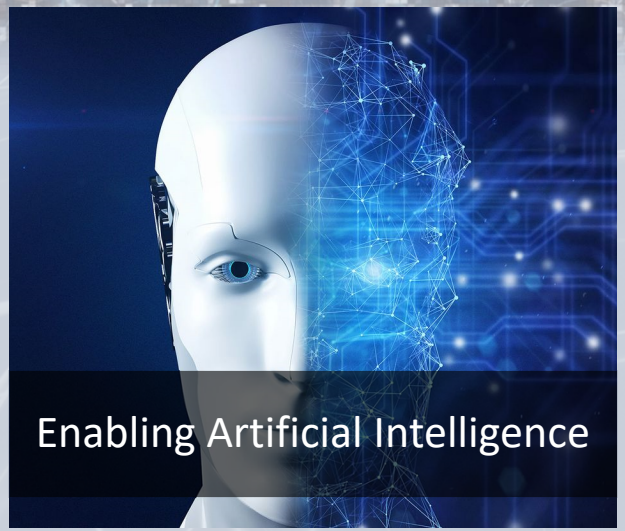
Gaining Insights on Advanced Manufacturing Technologies

*Picture courtesy by ORNL

Leveraging Artificial Intelligence Expertise

Looking to the Future of Research and Innovation

RES



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

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


U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

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

RES

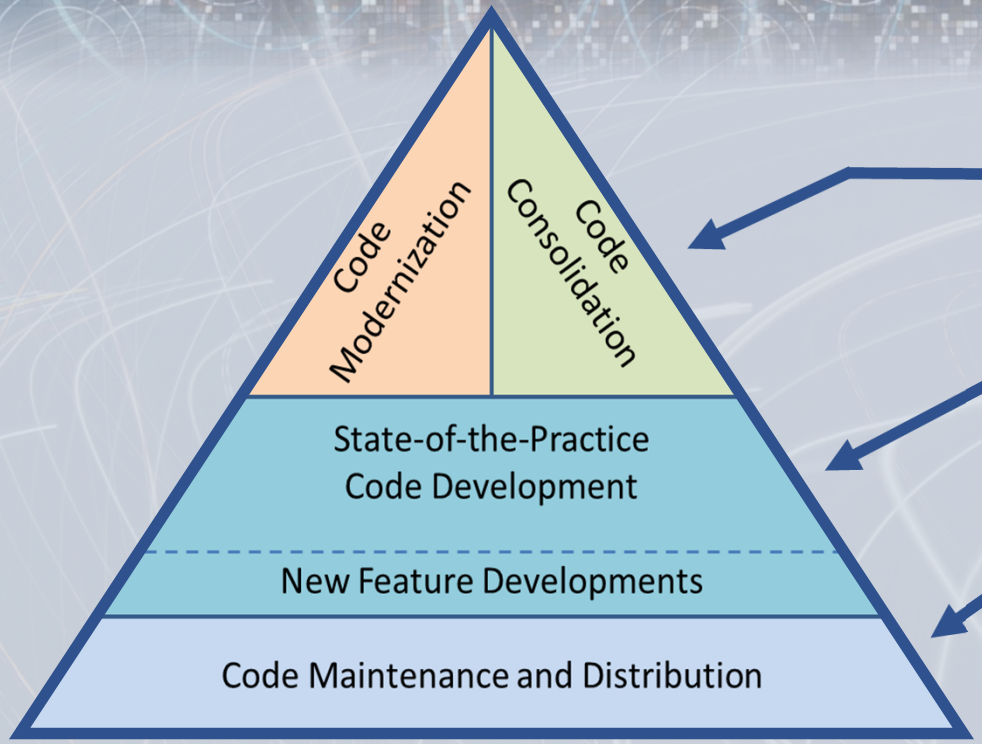
Total codes – 40

- 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
Accident Progression and Source Term	MELCOR
	RTT
Atmospheric Dispersion	ARCON
	PAVAN
	TEPHRA
Chemical Dispersion	HABIT
Consequence	MACCS
Decommissioning	DandD
	GENII
	MILDOS
	RESRAD
	VSP
Dose Assessment	GALE
	NRCDose
	RADTRAD
	RADTRAN
	RASCAL
	VARSKIN
External Hazards	PVHM-YM
Fuels	FAST

Area of Analysis	Scientific Computer Code
Geographic	OLYMPUS DISS
Graphical User Interface	PiMAL
	SNAP
Human Reliability	IDHEAS-ECA
	SACADA
Hydrology	BREATH
	MULTIFLO
	TPA
	xFlo
Materials	3D STRESS
	FAVOR
	FES
	LEAPOR
Neutronics	SCALE
	PARCS
Probabilistic Risk Assessment	xLPR
	SAPHIRE
Record Database	Radiological Toolbox
Thermal-Hydraulics	RELAP5
	TRACE

Applying Resources Strategically



- 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

- **Justify** — Justify Need for a Code
- **Survey** — Survey Options
- **Identify** — Identify Maintenance and Distribution Needs
- **Identify** — Identify Development Needs
- **Planning** — Resource Planning

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


Auburn University


University of Illinois

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

Western Carolina University – NRC scholarship graduates

Purdue University

Leveraging Opportunities and Relationships

- 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)

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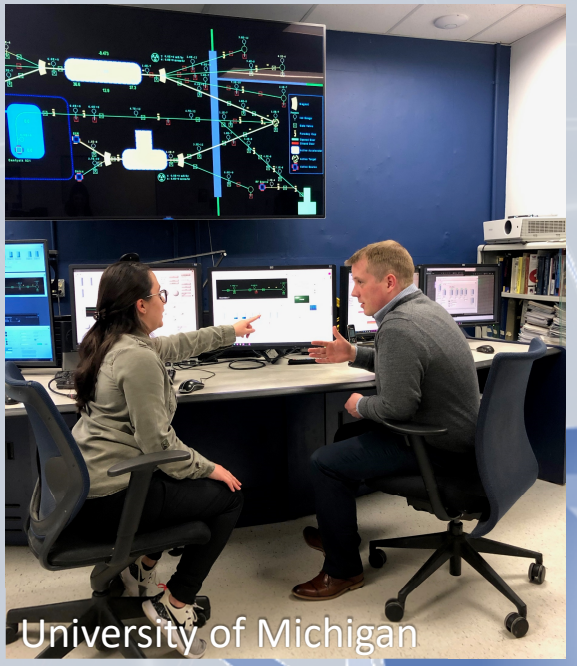
FIND. APPLY. SUCCEED.℠



University of Michigan

Nuclear Leadership through Workforce Development

- 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

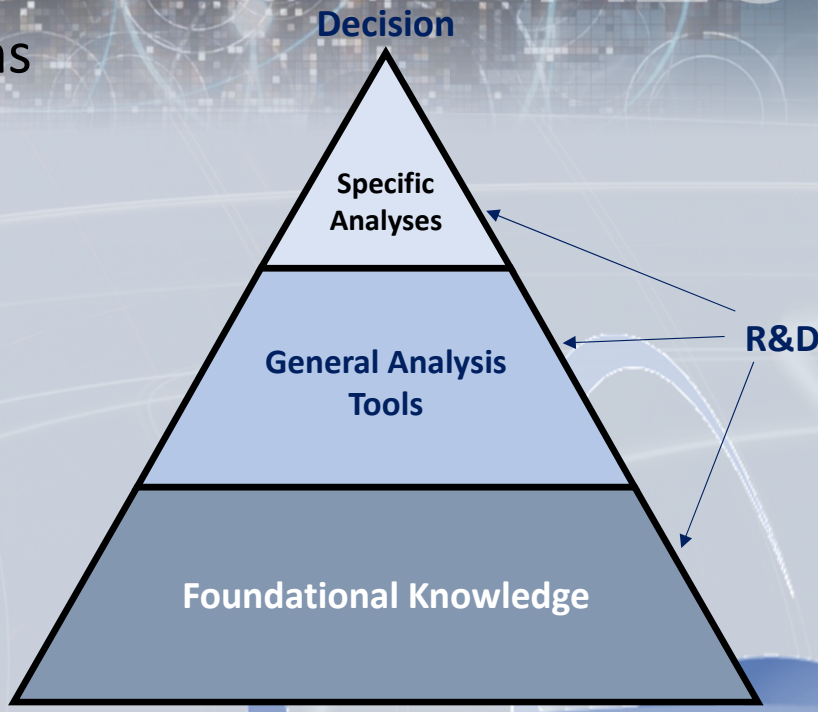
"It's tough to make predictions, especially about the future."
- Yogi Berra

Building Foundational Knowledge

RES

- Provides strong basis for regulatory decisions
- Supports agile capability development
- Payoff may not be readily apparent

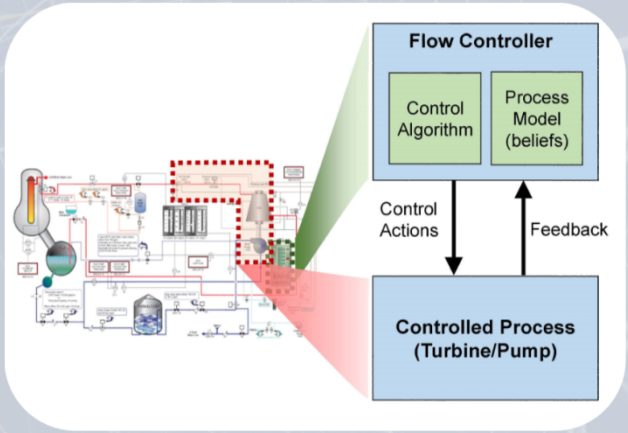
re•search, n. diligent and systematic inquiry or investigation in order to discover or revise facts, theories, applications, etc.



Successes Have Enhanced Readiness

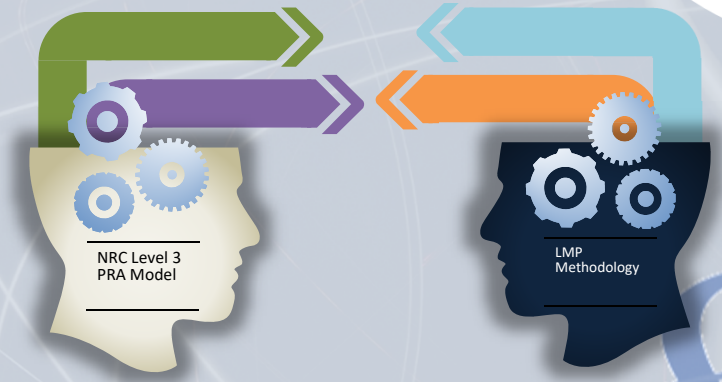
RES

- 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)

Digital Twins



Licensing Modernization Project

Grow into an Agency-wide Resource

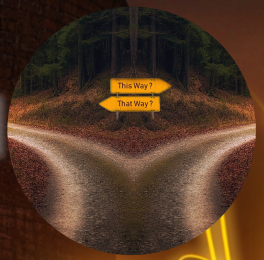
- Serve as an incubator for research ideas
- Become part of agency's culture and consciousness
- Effectively leverage resources
- Partner with related internal (e.g., UNLP) and external (e.g., DOE) programs

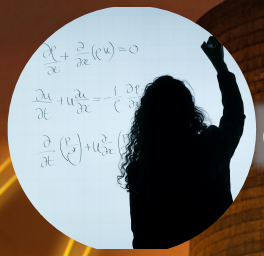
"The road to success is always under construction."

- Lily Tomlin

Providing Integral Mission Support

Preparing for the Future





Conducting Relevant Research

Fostering Partnerships

Focusing on Safety

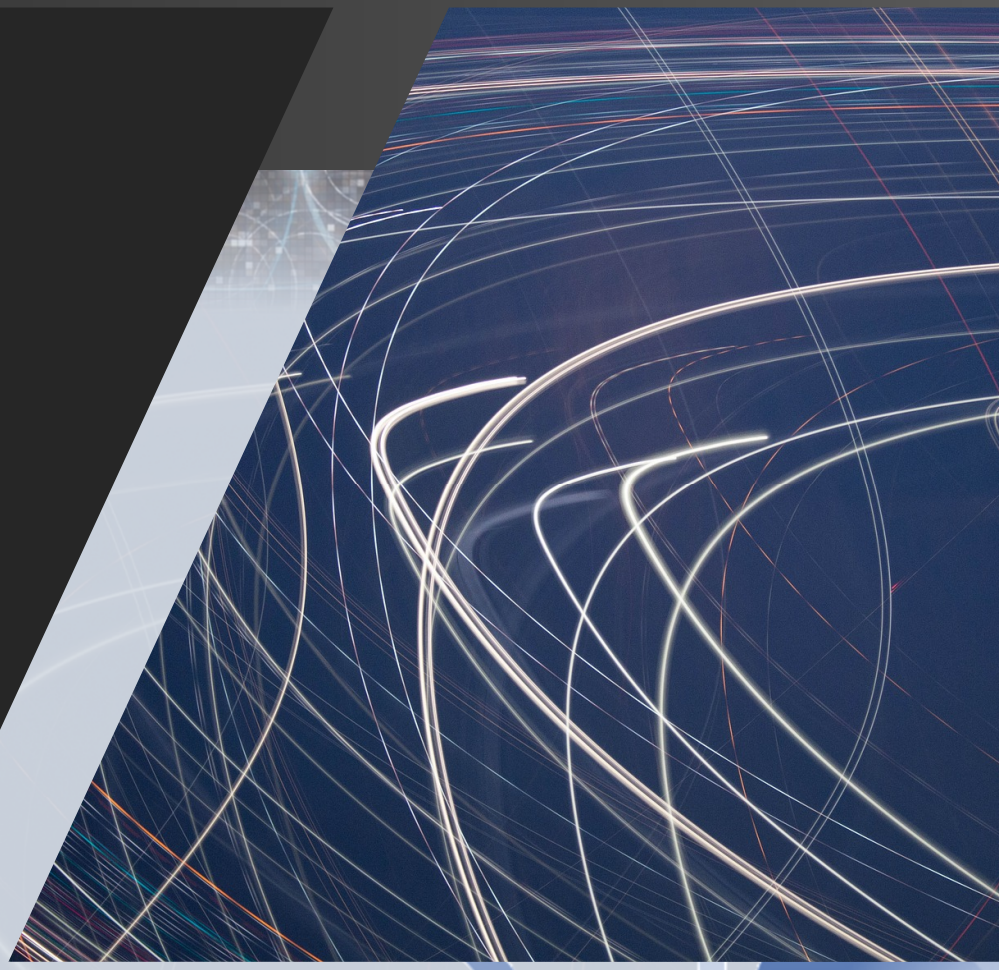
Building our Capabilities

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