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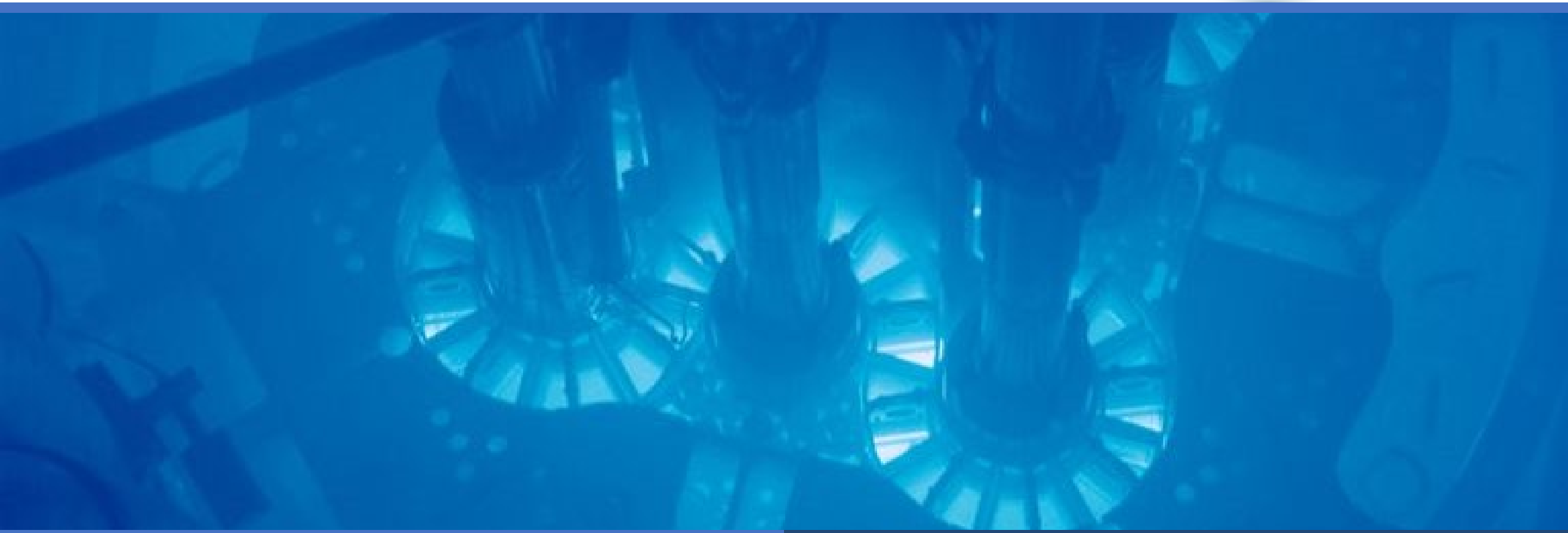

ADVANCED REACTOR SAFEGUARDS

Program Overview, Workshop Goals

Stakeholder Workshop, April 2021

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Federal Program Manager: Alison Hahn

SAND2021-2690PE

Program Overview

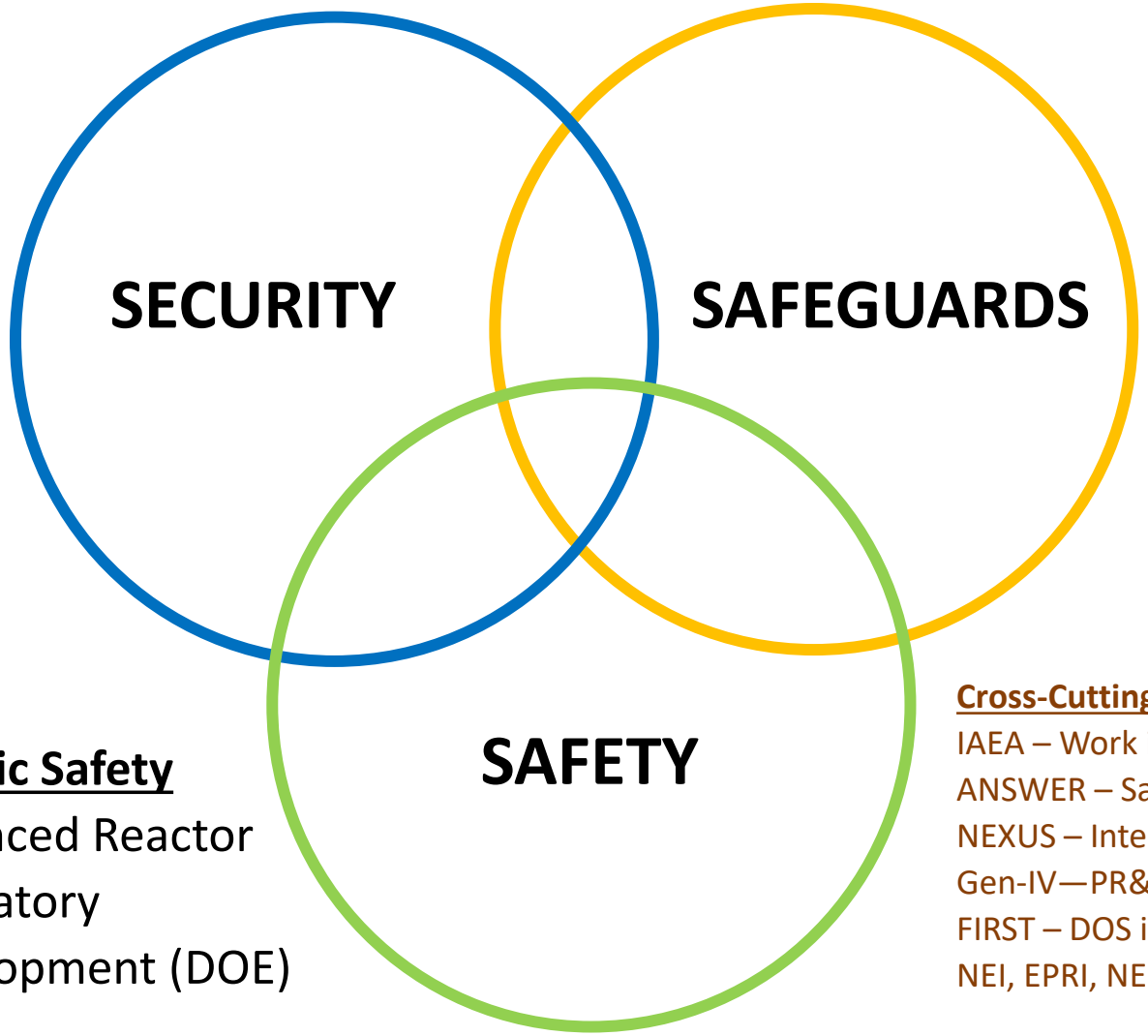
- The Advanced Reactor Safeguards (ARS) program was established in 2020 as part of appropriations for the Advanced Reactor Demonstration Program (ARDP) within the Office of Nuclear Energy in DOE.
- The ARS program applies laboratory R&D to address near term challenges that advanced reactor vendors face in meeting domestic materials accountancy and physical protection requirements for U.S. builds.
- Our vision is to help reduce roadblocks in the deployment of new and advanced reactors by solving regulatory challenges, reducing safeguards and security costs, and utilizing the latest technologies and approaches for plant monitoring and protection.

Workshop Goal: Receive stakeholder feedback on the technical work in the ARS program and inform future R&D

Related Program Areas

Domestic Security
- Advanced Reactor Safeguards (DOE)
- Cyber (DOE)
- Light Water Reactor Sustainability (DOE)
- NRC

International Security
- International Nuclear Security (NNSA)



Domestic Safeguards (MC&A)
- Advanced Reactor Safeguards (DOE)
- Material Protection Accounting and Control Technologies (DOE)
- NRC

International Safeguards & Nonproliferation
- NNSA

Domestic Safety
- Advanced Reactor Regulatory Development (DOE)
- NRC

Cross-Cutting Initiatives/Organizations

IAEA – Work in all three areas
ANSWER – Safeguards and Security Coordination in the U.S.
NEXUS – International Security & Non-proliferation
Gen-IV—PR&PPWG and RSWG
FIRST – DOS initiative for newcomer countries
NEI, EPRI, NEUP, GAIN, SBIR, NTI, Third Way

Connections to other R&D programs, NRC, Industry

- Many of the individual work packages are engaging with NRC to help determine regulatory gaps.
- Vendor interactions are helping to inform the direction of the work and will help re-shape the portfolio over time.
- Engagements with NEI and EPRI serve as interfaces with industry.
- Maintain close coordination with the ARDP, GAIN, NEUP, and SBIR programs.
- Continuing to coordinate work with other NE program areas:
  - Gas Cooled Reactors, Fast Reactors, Molten Salt Reactors, Microreactor Technologies, Advanced Sensors and Instrumentation, Nuclear Cyber Security, Advanced Reactor Regulatory Development, National Reactor Innovation Center, Material Protection Accounting and Control Technologies, and others.
- Coordinating with related NNSA programs (International Safeguards and Security)

FY20-21 Objectives and Priorities

- New projects started in June, 2020, and most were written as 2-year proposals. We are emphasizing near-term results in order to provide useful R&D to vendors in time to influence their designs.
- Several of the projects recently completed interim reports and are on schedule to produce a final report at the end of FY21.
- The ARS program is funded at $5 million/year to support R&D at national laboratories and 2-4 university and small business projects.
  - Currently have two NEUPs related to molten salt reactor safeguards
  - Hope to have more NEUPs and SBIRs going into next year
- The ARS program is developing a roadmap that describes six key research areas—the roadmap will be influenced by this workshop.

ARS Program Goals

Physical Protection Systems

- Reduce number of on-site responders
- Reduce upfront costs
- Evaluate enhanced safety systems
- Evaluate unique sabotage targets

HALEU Regulatory Gaps

- Implications to MC&A and the PPS
- Evaluate cross-over into the fuel cycle

Pebble Bed Reactor MC&A

- Evaluate regulatory gaps and issues
- Determine driving requirements
- Evaluate new monitoring technologies

Microreactor PPS and MC&A

- Develop a licensing framework based on gaps and issues
- Develop approaches appropriate to the very small scale
- Evaluate new monitoring technologies

Liquid Fueled MC&A

- Evaluate regulatory gaps and issues
- Develop baseline accountancy approaches
- Evaluate new measurement and monitoring technologies

International Considerations

- Consider international safeguards requirements
- Interface with international safeguards and security programs
- Support the Gen-IV PR&PP working group

Key Goal:

Develop Robust and Cost Appropriate Physical Protection Systems

Large numbers of on-site responders would be a significant economical roadblock
(Evaluate PPS approaches that increase delay and rely on local law enforcement)
Reduce upfront costs through new technology and Security by Design
(Develop PPS designs and provide performance results)
Evaluate how enhanced safety systems may be utilized
(Link to new NRC rulemaking)
Evaluate unique sabotage targets and stay ahead of emerging threats
(Ensure robustness for new coolants and fuels)

Key Goal:

Examine HALEU Regulatory Gaps

The use of HALEU places reactors in a different Category
(Most advanced reactor vendors plan to use HALEU)
The implications to MC&A and the PPS are being examined
(Implications may vary depending on reactor class)

Key Goal:

Develop MC&A Approaches for Pebble Bed Reactors

Evaluate regulatory gaps/issues for pebble bed reactors
(Focus on pebble handling systems and storage)
Determine driving requirements
(Accountability vs. rad. sabotage vs. process control)
Evaluate new monitoring technologies
(Pebble identification, burnup measurements, C/S approaches)

Key Goal:

Develop MC&A and PPS Requirements for Microreactors

Evaluate regulatory gaps/issues for microreactors
(Develop a licensing framework based on design choices)
Develop approaches appropriate to the very small scale
(Need to consider new theft/sabotage pathways)
Evaluate new monitoring technologies
(Process monitoring, sealed core measurements)

Key Goal:

Develop MC&A Approaches for Liquid-Fueled Reactors

Evaluate regulatory gaps/issues for molten salt reactors
(How much of 10 CFR 74 applies here)
Develop baseline accountancy approaches and determine performance
(Tie in measurement technology work)
Evaluate new measurement/monitoring technologies
(On-line, NDA measurements)

Key Goal:

Consider International Requirements

Take into account international safeguards requirements
(Part of a Safeguards by Design approach)
Interface with other programs supporting international safeguards and security
(Where is there overlap between domestic and international needs)
Support the Gen-IV PR&PP working group
(Many lessons learned can be applied)

Feedback

- The six program goals will evolve based on industry needs, and we welcome feedback on the direction of the program.
- The research portfolio is expected to rotate depending on vendor needs.
- During the presentations, please enter any questions or comments into the chat box and we will try to address them all during the discussion periods. We also have additional time at the end of each day for more detailed conversations.
- Also feel free to contact me at any time during or after the workshop with additional feedback or comments:

Ben Cipiti

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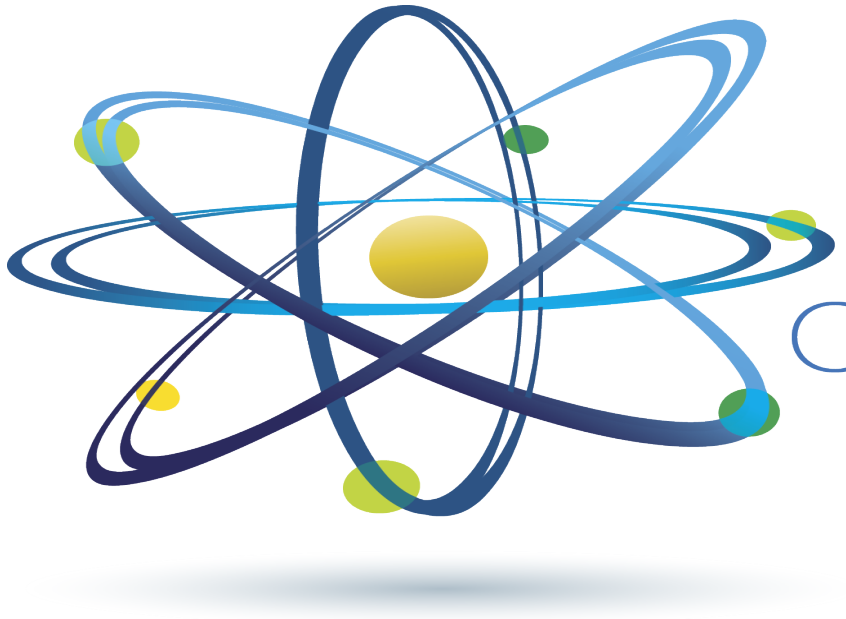
Questions?



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