

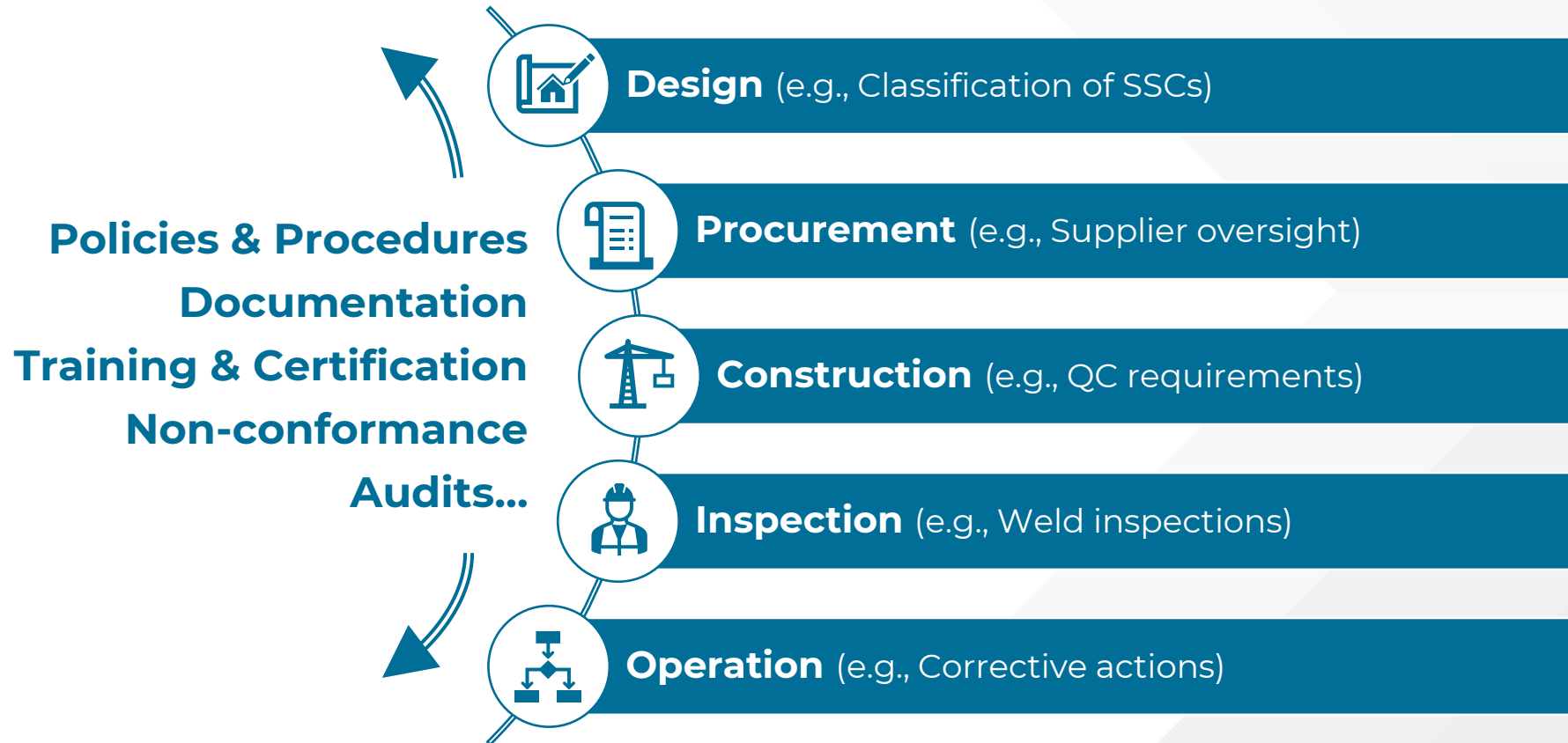
A Feasibility Study to Address Nuclear Quality Assurance Challenges

Chandu Bolisetti, Ph.D.

Senior Scientist, Idaho National Laboratory

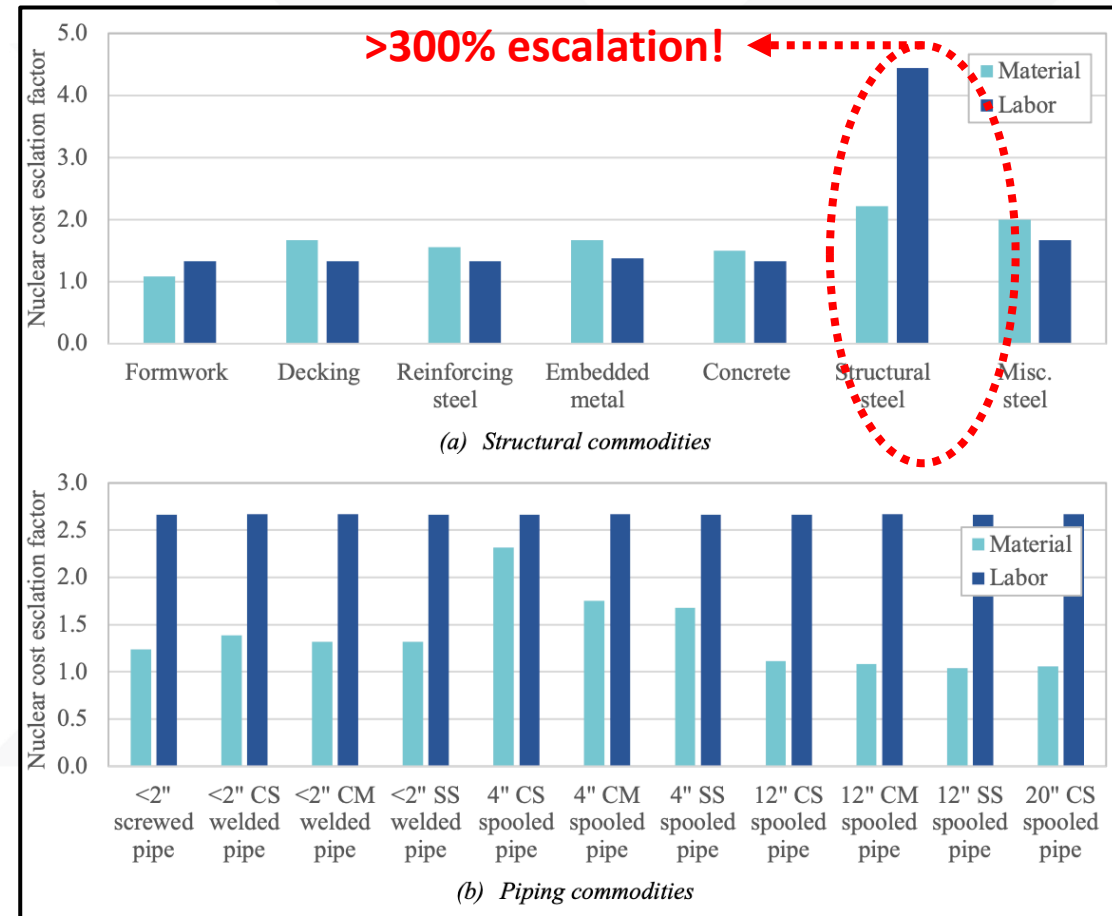
04/01/2025

Nuclear Quality Assurance (NQA) Requirements are Ubiquitous

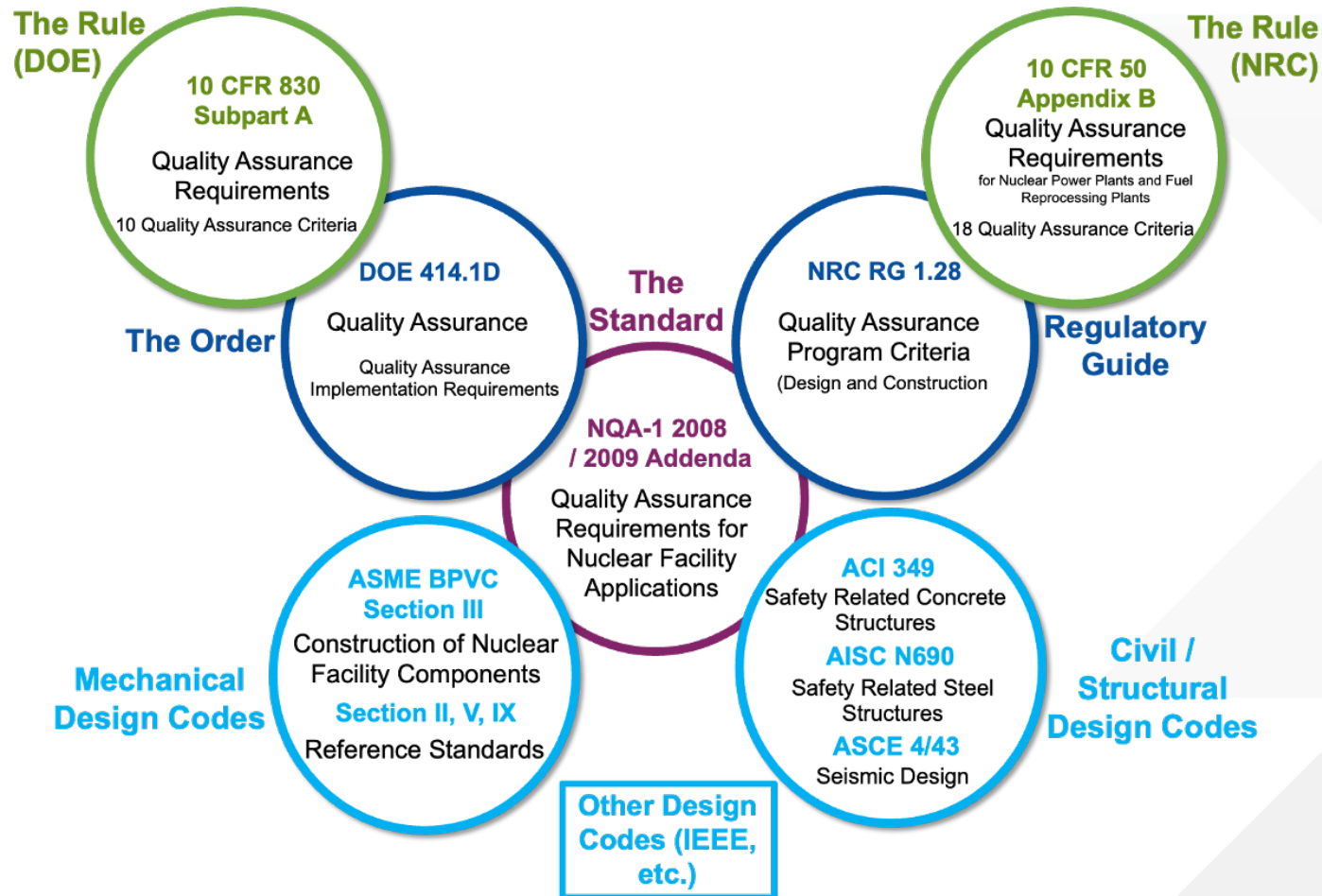


Challenges in Implementing NQA Requirements

- NQA requirements are associated with significant **cost escalation**. Conservative approaches are often employed due to lack of clarity or experience and to avoid licensing risk.
- Nuclear-certified suppliers are sparse causing **supply-chain bottlenecks** and further cost escalation.
- In many cases NQA requirements have not kept up with technological developments (e.g., in construction, manufacturing, software development) and are in need **revision or modernization**.
- Prescriptive nature of NQA requirements **hinders effectively leveraging intrinsic safety** features of advanced reactor technologies.



Flow of NQA Requirements



Regulations



NQA-1



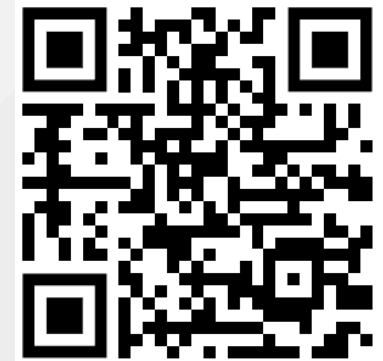
Design Codes

NRIC-NEI-EPRI Nuclear Quality Assurance Challenges Workshop

- Held on Dec 5-6, 2024, in Washington, DC.
- Attracted about **85 attendees** from **38 organizations** including **24 speakers**, including reactor developers, suppliers, code committee representatives (ASME NQA-1, mechanical and civil/structural design codes), NRC, and DOE.
- Presentations on origin and flow of NQA requirements, best practices, industry initiatives to improve their application, challenges faced by reactor developers, and opportunities for improvement.
- Stakeholder input from the workshop was used to develop a roadmap to address NQA challenges.
- Strong industry interest and **sense of urgency** in addressing these challenges with many demonstration projects on the horizon.



<https://nric.inl.gov/event/2024-nqa-workshop/>



Panelists



Mike Fish

MFC Quality and
Procurement Engineering
Manager
INL

Cultivate efficient
application of NQA



Sanj Malushte

Sr. Director of Technology,
Division of Infrastructure
Research and Innovative
Solutions
PARI

Optimize and modernize
civil/construction QA
requirements



Jon Facemire

Senior Project
Manager, New Nuclear
NEI

Leverage risk-
informed
performance-based
(RIPB) approaches



Ross Hays

Digital Engineering
Researcher
INL

Modernize SQA
practices to enable use
of digital tools



Mark Richter

Technical Advisor
NEI

Increase flexibility in
meeting regulations

Pathways to Address NQA Challenges



1. Cultivate efficient application of requirements.

Benchmark with developers; Collect CGD best practices; Develop NQA-1 guidance and training.



2. Review, optimize, and modernize requirements.

Identify and revise outdated or unnecessarily onerous requirements.



3. Deploy new methodologies to minimize or manage requirements.

Deploy risk-informed performance-based (RIPB) approaches, digital engineering (DE), and digital twins (DT).



4. Increase flexibility in meeting regulations.

Develop pathways for using commercial quality standards (e.g., ISO 9001), and non-nuclear codes and standards for design.



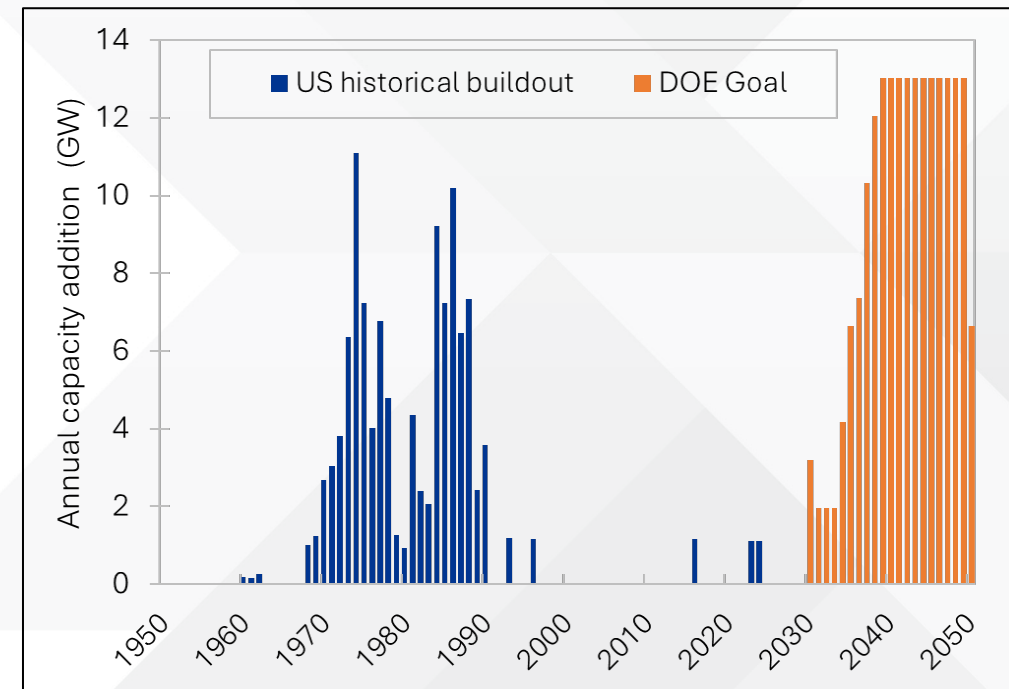
5. Demonstrate execution of best practices.

Employ best practices in demonstration projects and document lessons learned.



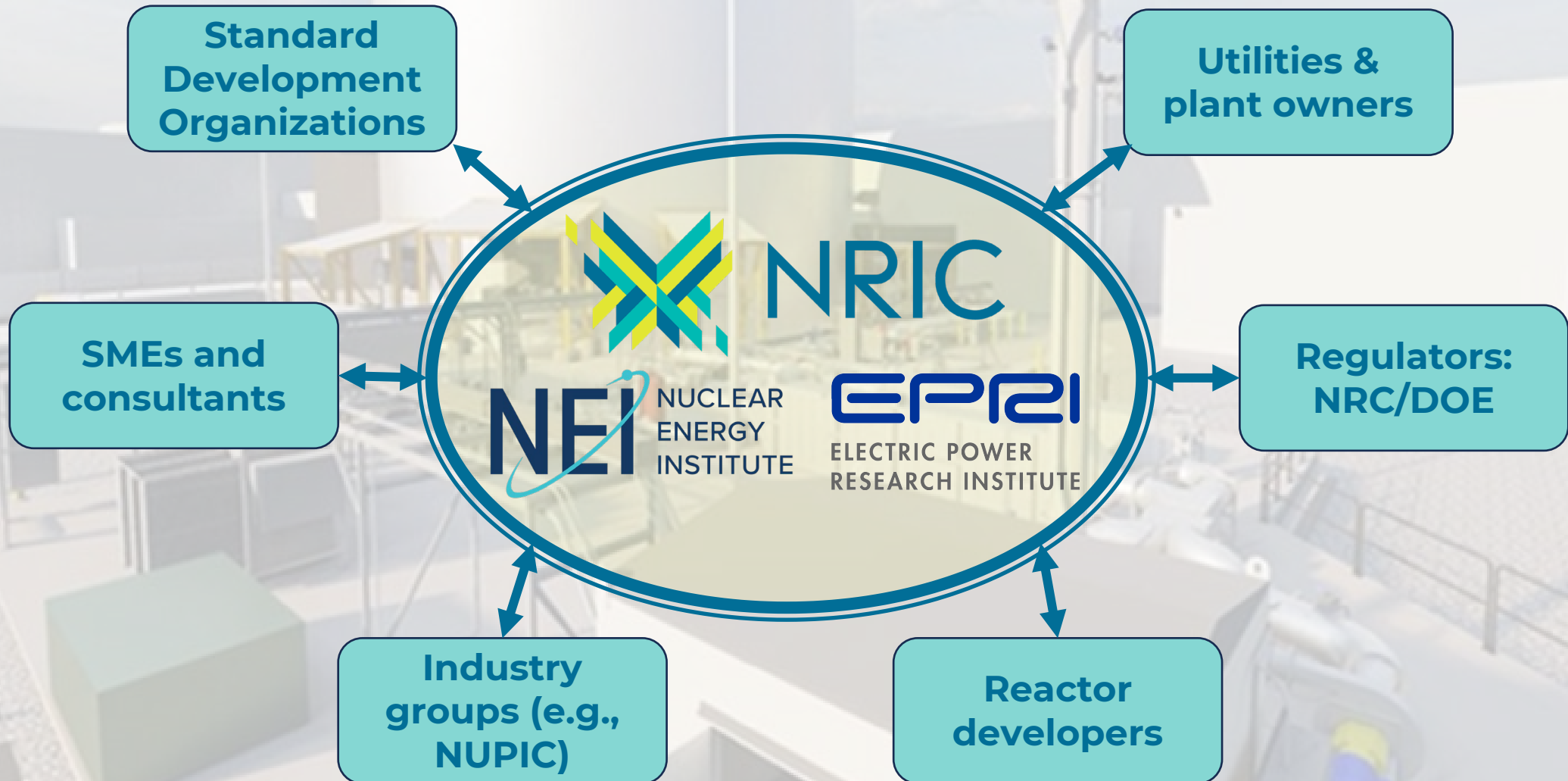
Impact

- **Cost Reduction:** Lower cost of QA program; improved constructability and less rework; lower prices for SR systems due to expanded supply chain; leverage benefits of advanced reactor safety.
- **Schedule Reduction:** Shorter lead times due to expanded supply chain; faster construction and less rework; mitigation of delays from non-compliance.
- **Reduced Licensing Risk:** Better guidance for using RIPB and digital tools including DE/DT and AI.
- **Faster Innovation:** Lower barrier-to-entry for “new” and non-nuclear commercial technologies.



W. Robb Stewart (Alva) and DOE Liftoff Report

A “Whole-of-Industry” Effort



Questions?



NRIC National Reactor
Innovation Center