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DOE-NE Proliferation and Terrorism Risk Assessment: FY12 Plans Update

This presentation provides background information on FY12 plans for the DOE Office of Nuclear Energy Proliferation and Terrorism Risk Assessment program. Program plans, organization, and individual project elements are described.

DOE-NE Proliferation and Terrorism Risk Assessment FY12 Plans Update

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Briefing to NNSA

June 12, 2012

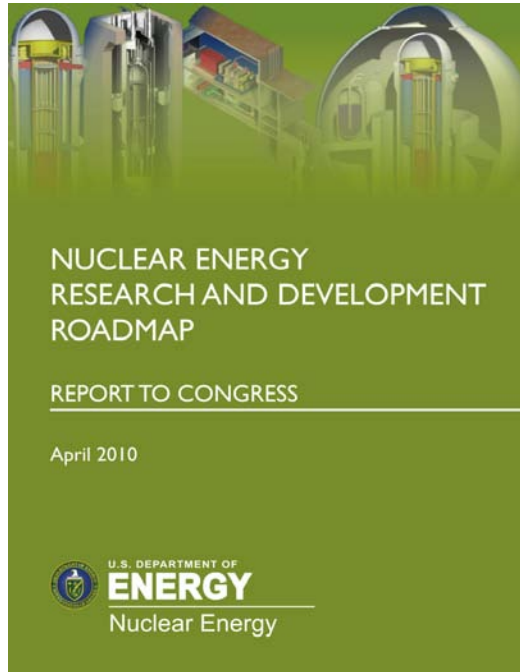
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Outline

- **Background on program**
 - DOE NE Roadmap and Research Objectives
 - Implementation plan for objective related to proliferation and terrorism risk
- **Vision and goals of the DOE-NE Proliferation and Terrorism Risk Assessment program**
- **Background**
 - Risk assessment
 - FY12 planning
- **Program Plans and Organization**
- **Project Elements**
- **Summary**

Background

NE Research Objectives



1. **Develop technologies and other solutions that can improve the reliability, sustain the safety, and extend the life of current reactors**
2. **Develop improvements in the affordability of new reactors to enable nuclear energy**
3. **Develop Sustainable Nuclear Fuel Cycles**
4. **Understand and minimize the risks of nuclear proliferation and terrorism**
Goal is to enable the use of risk information to inform NE R&D program planning

Background

Implementation Plan for Objective 4

- **Integrated program of RD&D to address the risks of nuclear proliferation and terrorism**
 - Intrinsic Design Features to Minimize Risks:
 - Drive development of reactor and fuel-cycle options with intrinsic features to minimize the risks of nuclear proliferation and terrorism
 - Next-Generation Materials Protection, Accounting, and Control:
 - Breakthroughs in effectiveness and efficiency of nuclear materials protection, accounting, and control for advanced U.S. nuclear energy systems
 - International Frameworks and Institutions:
 - Support the development, demonstration, and strengthening of frameworks and institutions that minimize proliferation risks while enabling peaceful access to nuclear energy
 - Proliferation and Terrorism Risk Assessment:
 - Significantly advance the state of the art for proliferation and terrorism risk assessments

Background

Risk Assessment – Key Issues

- **Rich pedigree for engineered-systems risk assessment**
 - Reactor Safety - WASH-1400 onward
- **Extension to non-engineered systems introduces complexities**
 - Intelligent, adaptive adversary
 - Risk is a function of adversary capabilities
 - Risk has a strong kinetics aspect
 - Social factors – behavioral characteristics
 - Sparse data – lack of empirical data
 - Uncertainties
 - Higher reliance on qualitative subject matter input
 - Risk communication
 - Multiple levels of information security

DOE-NE Proliferation and Terrorism Risk Assessment program

■ Vision

Deliver a significant enhancement in the ability to understand and analyze the risks of nuclear proliferation and terrorism, and thereby to better inform decisions and investments in advanced nuclear energy systems and technologies.

■ Goals

- Improve on current methods, and develop new methods where needed,
- Apply them to nuclear systems and technologies of interest to NE leadership, and
- Contribute to the development and sustainment of an enduring proliferation/terrorism risk assessment capability through university engagement in the work.

Background

Key Considerations in Program Planning

■ Risk Assessment Roadmap

- Drew upon discussions and comments at several meetings and workshops held in 2010
 - INMM Workshop, Texas A&M, February 2010
 - Nuclear Energy Enabling Technologies Program Workshop, Session on Proliferation Risk Assessment, July 2010
 - DOE-NE MPACT proliferation risk meeting, Sandia National Laboratories, Albuquerque, NM, April 2010

■ R&D Elements

- Conduct basic research on proliferation/terrorism risk assessment.
- Develop and demonstrate new tools.
- Apply improved risk assessment tools to high-priority issues facing NE.
- Ensure NE R&D plans and priorities are risk-informed.

Background

Key Considerations in FY12 Planning

- **National Academies project on “Improving the Assessment of Proliferation Risk of Nuclear Fuel Cycles”**
 - Identify key proliferation policy questions
 - Assess the utility of existing and historical methodologies and metrics
 - Assess the potential for adapting risk assessment methodologies developed in other contexts
 - Identify R&D and other opportunities for improving the utility of current and potential new approaches; and
 - Identify and assess options for effectively communicating proliferation risk information

This study will not address the risk associated with the physical security of the facility or materials against attack, theft, or diversion of nuclear materials.

In FY12, the DOE-NE PTRAs program will focus on terrorism risk – physical security aspects of nuclear fuel cycles and facilities

Program Plans

■ FY12 Milestones

- Initiate a portfolio of innovative, risk assessment projects, including prototype risk assessments focused on terrorism risk for once-through, modified-open, and full-recycle options

■ FY 13 Milestones

- Upon completion of the National Academy of Sciences review, identify additional proliferation risk assessment projects for initiation in FY 2013
- Deliver an updated proliferation and terrorism risk assessment RD&D roadmap and program plan, incorporating the findings and recommendations from the National Academy of Sciences study
- Initiate an expanded set of RD&D activities based on the NAS review, roadmap, and updated program plan
- Complete prototype risk assessments for once-through, modified-open, and closed-cycle options

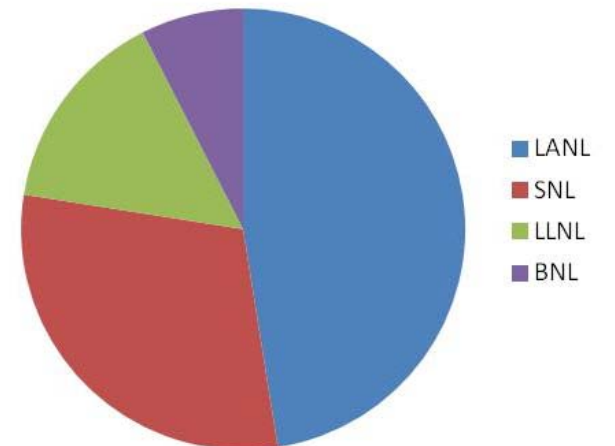
Project Organization

■ Program Management and Execution Structure:

- Responsibility transferred to NE-52 on April 9
- HQ Program Manager: Dan Vega
- Technical Lead: Pratap Sadasivan, LANL (transitioned from Mark Mullen)

■ Project Organization

- Program definition
 - Several workshops
 - White paper solicitations from Labs (Fall 2010)
 - Selections based on likely results in Y1
- Directed Research:
 - Labs: LANL, SNL, LLNL, BNL
 - University partnerships (lab subcontracts):
 - LANL: Naval Postgraduate School, TAMU
 - SNL: UT Austin
 - LLNL : UT Austin



Project Elements

■ Innovative methods

- Adversary decision models
- Adversary risk analysis
- Expert elicitation
- Treatment of uncertainties

■ Advanced Applications

- Prototypic Risk Assessments focusing on a range of nuclear systems of interest to NE,
- Demonstrate best practices, compare methods, identify gaps

■ University Research

- NEUP projects
- Collaborative partnerships with NLs

■ National Academies Study

- External advisory body

Lessons Learned from Nuclear Regulatory Commission Experience

■ Objective

- To provide insights and lessons learned to DOE-NE for risk-informing security and safeguards of future US nuclear energy facilities based on related experience from NRC

■ Approach

- Review how information on risk is used by the NRC to make decisions on licensing and regulation of nuclear facilities
- Develop analogs and counterparts for safeguards and security of future US nuclear energy facilities

■ Project Participants

- BNL

Decision Analysis Methods for Analysis of Nuclear Terrorism Threats with Imperfect Information

■ Objective

- Extend current methods to incorporate uncertainty in our knowledge of the adversary's capabilities and behavior as well as uncertainty about performance of countermeasures.

■ Project Participants

- LLNL, University of Texas at Austin

Risk-Informed Security Analysis Methodology with Applications to Small Modular Reactors

■ Objective

- Risk-informed security analysis methodology will assess the relative level of appeal for the opportunities for sabotage or theft of material in nuclear facilities.

■ Approach

- Develop the metrics to analyze security risks in terms of level of difficulty.
- Use this data to develop the “rules” for game theory.
- Use a generic SMR design as an example application.

■ Project Participants

- SNL, University of Texas at Austin

Analytical Framework for Terrorism Risk

■ Objective

- Develop a systems representation for terrorism risk

■ Approach

- Develop metrics to represent operator's ability to prevent theft or sabotage.
- Develop models for insider threats for domestic facilities and transportation scenarios
- Systems model for fuel cycle terrorism risk for domestic facilities and transportation
- Apply to prototypic systems

■ Project Participants

- LANL, NPS

Fundamental Studies

■ Objective

- Fundamental studies to improve aspects of proliferation and terrorism risk assessment

■ Approach

- Best practices for expert elicitation in the domain of proliferation and terrorism risk assessment, including analysis of potential biases and errors that have been shown to arise in other fields from failure to properly address the inherent limitations of expert judgment
- Treatment of uncertainties
- Risk communication, including display and presentation of results

■ Project Participants

- LANL, TAMU

Closing Comments

- **The PTRA program supports DOE-NE's goal of using risk information to inform R&D program planning**
- **The FY12 PTRA program is focused on terrorism risk**
- **The program includes a mix of innovative methods that support the general practice of risk assessments, and selected prototypic applications.**