This paper describes objective technical results and analysis. Any subjective views or opinions that might be expressed in the paper do not necessarily represent the views of the U.S. Department of Energy or the United States Government.

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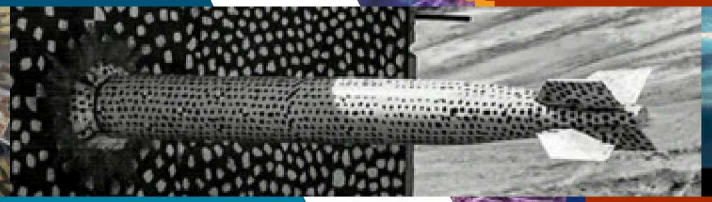
Exceptional service in the national interest








National Labs & EPRI Support Session

NEI's National Security and Emergency Preparedness Summit
Scottsdale, AZ - August 20, 2019

UPDATED JUNE 2019

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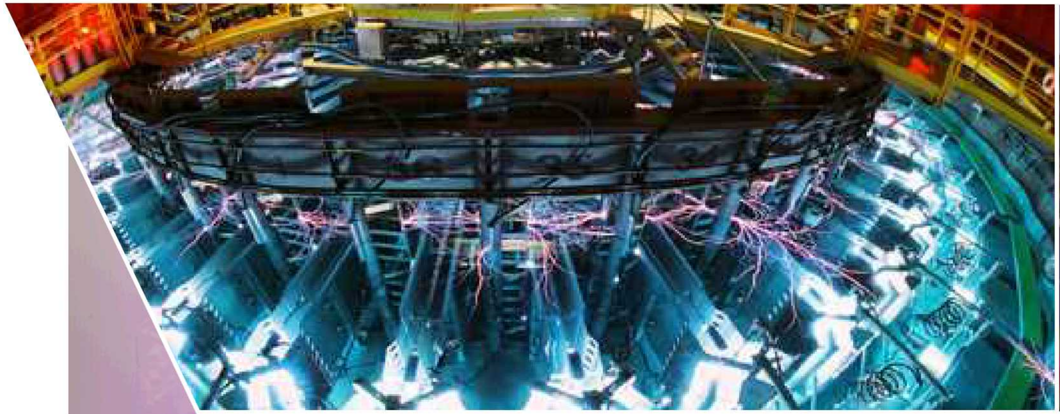
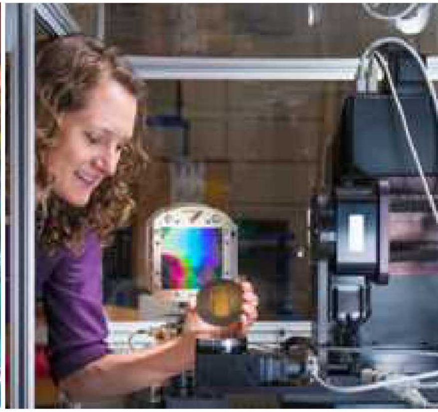
ADVANCED SCIENCE & TECHNOLOGY

Resear ral role in mission delivery

Nanodevices & Microsystems

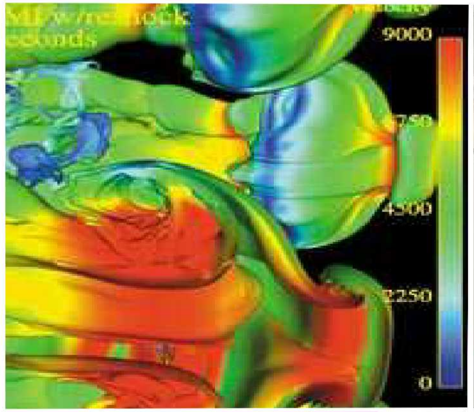


Radiation Effects & High Energy Density Science



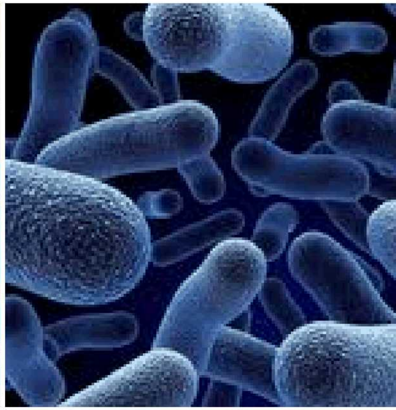
Materials Science

Computing & Informa



Engineering Science

Geoscienc
e



Bioscience

Foundational Goal of Safety

The importance and responsibility of nuclear safety became paramount in the same moment in which the power of the atom was unlocked.

Appendix E to10 CFR Part 50 followed by NUREG-0654/FEMA-REP-1 provided those in the nuclear power industry a standard to provide safety and preparedness to the public in the case of an emergency.

In the years and decades since, Sandia National Laboratories and other DOE/NNSA labs have partnered with the Nuclear Regulatory Commission (NRC) and Nuclear Industry to advance and better understand the science behind emergency preparedness.

DOE-NE's Light Water Reactor Sustainability Program (LWRS) Physical Security Initiative (PSI) includes that may impact Emergency Preparedness and Planning

New DOE-NE LWRS Physical Security Initiative (PSI) includes efforts in the following areas:

- R&D of **risk-informed techniques** for physical security to account for a dynamic adversary.
- R&D of **advanced modeling and simulation tools** to better inform physical security scenarios.
- **Assess benefits** from proposed enhancements, novel mitigation strategies, and potential changes to best practices, guides, or regulation.
- Enhance and **provide a technical basis** for stakeholders to employ new methods, tools, and technologies to achieve optimized physical security.

Sandia's Contributions to EP Regulation, Guidance, and Review

Sandia partnered with the NRC on Protective Actions Recommendation Strategies for NUREG-0654 Supplement 3, Rev 3, Evacuation Time Estimate (ETE) guidance/regulation, and guidance on how to evaluate the importance of site specific EP

- NUREG/CR-6953, 'Criteria for Protective Action Recommendations for Severe Accidents Volumes 1, 2, and 3
- NUREG/CR-7002, "Criteria for Development of Evacuation Time Estimate Studies"
- NUREG/CR-7160, "Emergency Preparedness Significance Quantification Process: Proof of Concept"

Sandia provided Emergency Plan and Evacuation Time Estimate (ETE) formal reviews for license extensions and site updates.

Fermi	Bell Bend	Turkey Point	Calvert Cliffs
Comanche Peak	Lee	North Anna	PSEG
Victoria	Watts Bar	Bellefonte	Callaway
Grand Gulf	South Texas	VC Summer	Levy

- Quantify protection of emergency preparedness:
  - Credible scenarios define release and timing
  - Calculation allows health consequence estimate
  - Estimate allows calculation of benefit of EP program
  - Significance of individual elements estimated, e.g., notification systems
- In Sandia led studies such as SOARCA and NRC's Level 3 PRA work, variations for EP actions were studied and quantified in detail.
  - Keyhole versus circular evacuation
  - Sheltering instead of evacuating
  - Notification limitations
  - etc

Understanding the Human Factors to EP

- Evacuations like the one shown are an OROs worse nightmare.
  - How could an non- NPP evacuation compare to an event at a NPP?
- Sandia conducted intense research studying large-scale evacuations around the U.S.
- Performed a telephone survey of populations living within EPZs gathering information on their EP knowledge.

Informing the Future of EP

In recent years there has been significant progress in nuclear plant accident analysis

It is possible to inform regulatory structure with risk and consequence information

- Quantify protection provided by EP
- Develop analytical techniques for EP regulatory oversight
- Site-specific basis

Informing the Future of EP

Together with the NRC, Sandia developed and maintains the MELCOR Accident Consequence Code System (MACCS)

This code allows the analyst to model site specific emergency preparedness actions and quantify risks, costs, and contamination to the population and land area surrounding the plant.

The MACCS team strives to create a model that provides realistic modeling scenarios with high fidelity.

Informing the Future of EP

The following Emergency Preparedness considerations can be modeled in MACCS:

- Evacuation/sheltering
- Define various cohort types and allow for specific EP actions or behaviors per cohort
- Network evacuation
- Plume Animation
- Weather sampling
- Variations in notification times of the public
- Shielding from specific housing types
- KI ingestion
- MUCH MORE

Informing the Future of EP

The NRC and Sandia are currently working to determine a process to distribute MACCS to private companies and institutions.

Visit maccs.sandia.gov for more information and notification of upcoming MACCS training.

Questions

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