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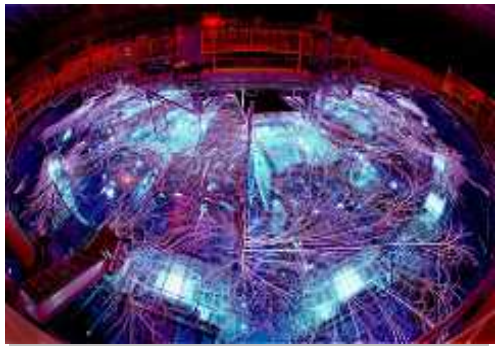


Risk Management in R&D

A Systems Approach

U.S. DEPARTMENT OF ENERGY
NNSA National Nuclear Security Administration

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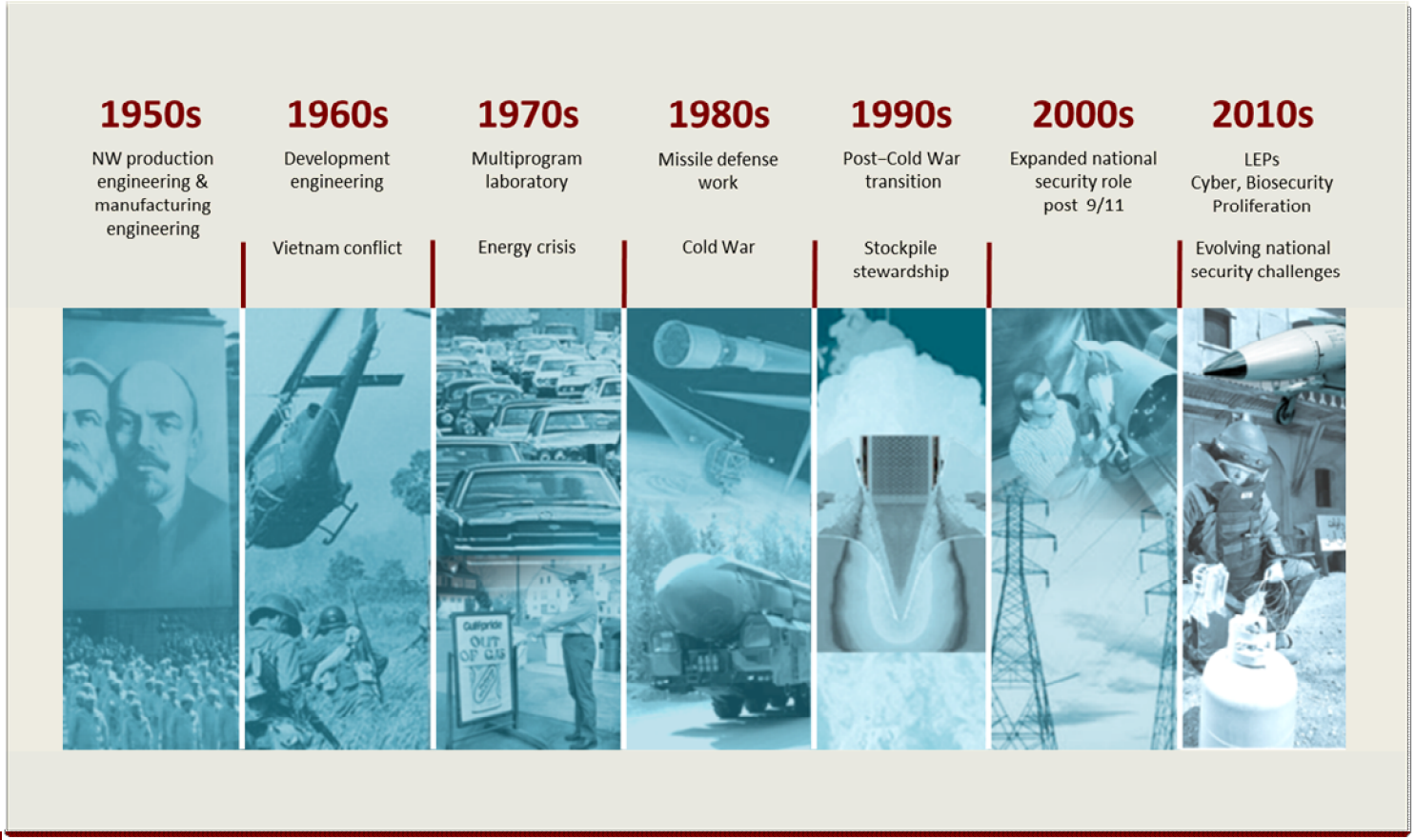
Sandia National Laboratories

- A federally funded research and development center, we anticipate and solve the most challenging problems that threaten security in the 21st century



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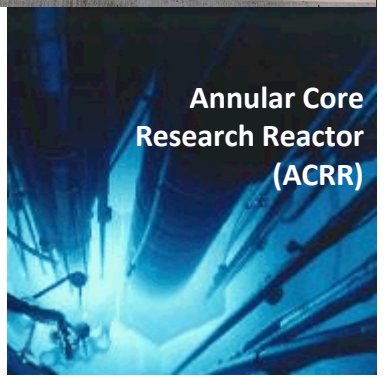
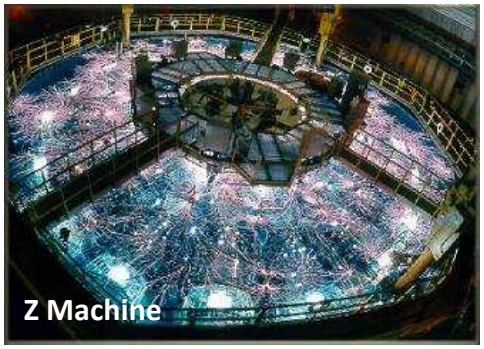
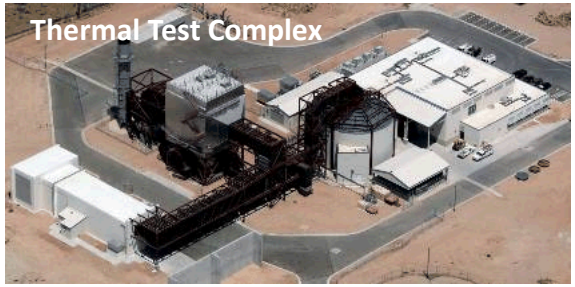
- **Operations span research, design, development, prototype, qualification and production activities**
- **Breadth of work encompasses micro- to macro-scale efforts**
- **Varying levels of complexity**
- **Typically involves multiple hazards in combination**







SNL ES&H: The Past

- Historically focused on weapons systems
  - Focus on system risk vice enterprise risk
- Less regulation and oversight
- Hazard based, not risk based

- Series of events identified need for broader, systems view of ES&H and a risk based approach

Key Elements of Sandia "culture"

- Competency-based culture prefers the "what" to the "how"
- To successfully effect change, the workforce must perceive the challenge to be intellectually stimulating
  - Application of these safety principles demands critical thinking and the application of sound, engineering-based judgment
- This culture is both a strength and a challenge to change

SNL ES&H: The Present

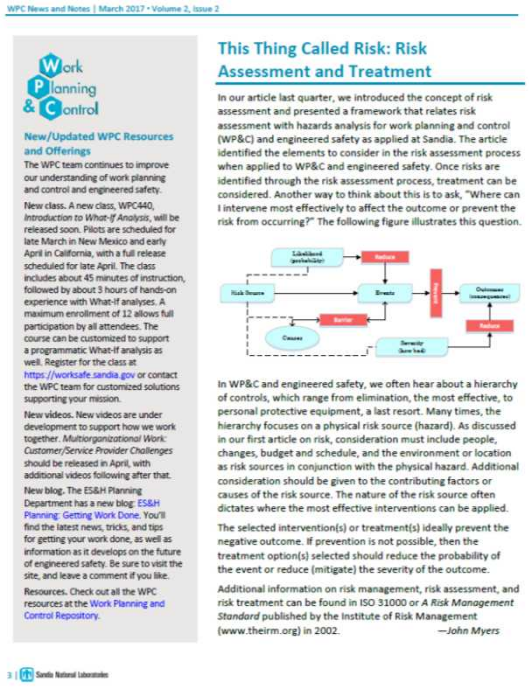
Sandia National Laboratories

Implemented a new work planning process

- Broadened context of a system
  - Hardware and software
  - People
  - Environment; location plus budget or financial, political, schedule, etc
- Introduced risk and de-emphasized probability
- Four basic questions
  - What could go wrong
  - How bad could it be
  - How do I prevent it
  - What if it goes wrong anyway

SNL ES&H: The Present

- Retain traditional ES&H SMEs
- Communications campaign
  - Short videos
  - Newsletters
  - Community of practice sessions



WPC News and Notes | March 2017 • Volume 2, Issue 2

Work Planning & Control

New/Updated WPC Resources and Offerings

The WPC team continues to improve our understanding of work planning and control and engineered safety.

New class. A new class, WPC440, *Introduction to What-If Analysis*, will be released soon. Pilots are scheduled for late March in New Mexico and early April in California, with a full release scheduled for late April. The class includes about 45 minutes of instruction, followed by about 3 hours of hands-on experience with What-If analyses. A maximum enrollment of 12 allows full participation by all attendees. The course can be customized to support a programmatic What-If analysis as well. Register for the class at https://worksafe.sandia.gov or contact the WPC team for customized solutions supporting your mission.

New videos. New videos are under development to support how we work together. *Multiorganizational Work: Customer/Service Provider Challenges* should be released in April, with additional videos following after that.

New blog. The ES&H Planning Department has a new blog: ES&H Planning: Getting Work Done. You'll find the latest news, tricks, and tips for getting your work done, as well as information as it develops on the future of engineered safety. Be sure to visit the site, and leave a comment if you like.

Resources. Check out all the WPC resources at the Work Planning and Control Repository.

This Thing Called Risk: Risk Assessment and Treatment

In our article last quarter, we introduced the concept of risk assessment and presented a framework that relates risk assessment with hazards analysis for work planning and control (WP&C) and engineered safety as applied at Sandia. The article identified the elements to consider in the risk assessment process when applied to WP&C and engineered safety. Once risks are identified through the risk assessment process, treatment can be considered. Another way to think about this is to ask, "Where can I intervene most effectively to affect the outcome or prevent the risk from occurring?" The following figure illustrates this question.

In WP&C and engineered safety, we often hear about a hierarchy of controls, which range from elimination, the most effective, to personal protective equipment, a last resort. Many times, the hierarchy focuses on a physical risk source (hazard). As discussed in our first article on risk, consideration must include people, changes, budget and schedule, and the environment or location as risk sources in conjunction with the physical hazard. Additional consideration should be given to the contributing factors or causes of the risk source. The nature of the risk source often dictates where the most effective interventions can be applied.

The selected intervention(s) or treatment(s) ideally prevent the negative outcome. If prevention is not possible, then the treatment option(s) selected should reduce the probability of the event or reduce (mitigate) the severity of the outcome.

Additional information on risk management, risk assessment, and risk treatment can be found in ISO 31000 or *A Risk Management Standard* published by the Institute of Risk Management (www.theirm.org) in 2002. —*John Myers*

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Best Practice:
Incorporating a broader view of risk and a systems approach to managing our work

Successes

- Flame spray operations
- Aerial Cable test facility
- Radioactive material testing at Z Machine
- Manager and staff recognizing and addressing risks in a broader sense than purely ES&H

SNL ES&H: The Future

- New contract affords SNL the opportunity to address risk management in a new way
  - NTESS LLC, a wholly owned subsidiary of Honeywell International, Inc replaces Sandia Corporation, a Lockheed Martin subsidiary
- Bring systems engineering into ES&H
  - Issue: Lack of system safety and system engineering expertise in ES&H SMEs
- Build on the concept of enterprise risk
  - Issue: Risk implicitly managed; focus primarily on project cost, scope, schedule; Lack of understanding of risk at all levels
  - Issue: Work planning process and risk management is decentralized

SNL ES&H: The Future

- Break down barriers that deter integration of all enterprise disciplines
  - Issue: Mission execution vs mission support as well as stovepipes in the mission support areas cause increasingly complex and often conflicting requirements (related to enterprise risk concept)
- Improve ES&H support to the lifecycle of programs and projects
  - Issue: Programs and projects accepted without understanding ES&H requirements leading to delays and cost overruns
- Reconcile R&D culture of mastery and autonomy with need for training and control
  - Issue: Culture of the laboratory affects behaviors and attitudes and is a barrier to successful understanding of risk and ES&H integration

Mission Integration

Mission Execution	**Plan**			**Do**	**Check**	**Act**
ISMS	**Define Scope**	**Analyze Hazards**	**Control Hazards**	**Perform Work**	**Feedback**	**Improve**
Goverance	**Plan Work**	**Manage Risk**		**Assure Performance**		
Scientific Method	**Theory/Hypothesis**	**Prediction**		**Experiment**	**Observation/Feedback**	
Project Management	**Initiate/Plan**		**Execute**	**Monitor and Control**		**Close**
Key Points	• Are all elements of the work defined and understood? • Are all assumptions identified and validated? • Who is the decision maker? • What are my key measures of success?	• What can go wrong? • How can it go wrong? • Do I understand my risk(s)? • Are my assumptions still valid?	• How do I manage my risk(s)? • Do I have a plan if something unexpected occurs? • Have I taken all reasonable steps to address my risk(s)?	• How do I know I'm ready to execute work? • Do I have everything I need to execute the work? • Do I have all the necessary resources and associated timing factored into the work execution?	• How do I know how I'm doing? • How do I know how I did? • How did I do against my measures of success?	• What do I do with what I've learned? • How do I make what I've learned available? • How do I know if the improvements I am or have implemented are working?

Management of Change

Critical Thinking/Questioning Attitude