



A Regulatory Perspective on Advanced Technology

Risk, Reliability, and Human Factors in Healthcare and Nuclear Power
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Objective

- Support effective break-out discussions by providing a perspective on the nature and scope of NRC's mission and activities as they pertain to human performance and human reliability
- Facilitate identification and understanding of potential areas of sharing and collaboration



Overview



NRC's

- Mission and Activities
- Regulatory Framework and Philosophy
- Structure and Resources
- Human and Organizational Factors Initiatives



Agency Mission

To *license and regulate* the Nation's civilian use of byproduct, source, and special nuclear materials in order to *protect public health and safety*, promote the common defense and security, and protect the environment.



Regulated Activities and Entities

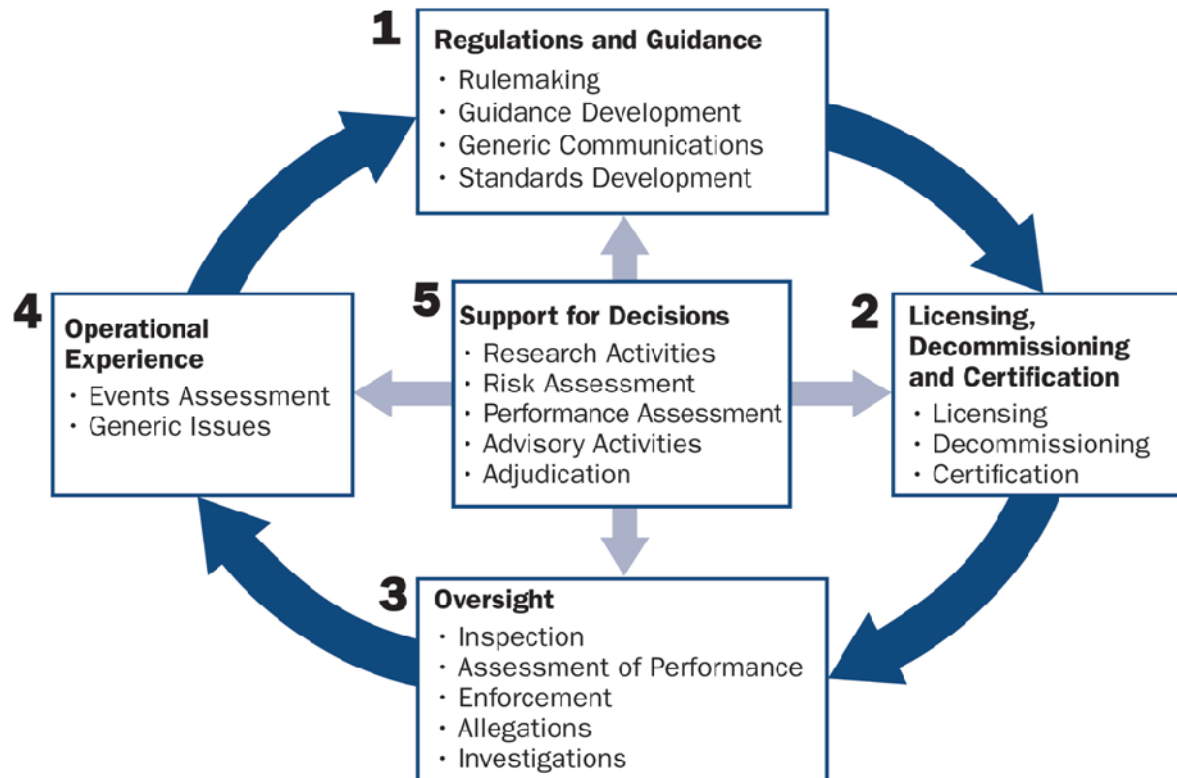


Include:

- Commercial reactor operations
- Test and research reactors
- Uranium enrichment and fuel fabrication facilities
- Transportation, storage & disposal of nuclear materials and wastes
- Medical, Industrial, & Academic Uses of Nuclear Materials (in conjunction with agreement states)



How We Regulate



Source: U.S. Nuclear Regulatory Commission

We don't . . .

- Promote
- Design
- Build
- Operate



Regulatory Philosophy



- Risk-informed decision making
- Performance-based regulation



Agency Structure

Key Stakeholders:

- Office of Nuclear Reactor Regulation
- Office of New Reactors
- Federal and State Materials and Environmental Management Programs
- Office of Nuclear Regulatory Research



Resources

Areas of Relevant Expertise include:

- Human Factors Engineering/Psychology
- Organizational Factors/Safety Culture
- Human Reliability Analysis
- Probabilistic Risk Assessment
- Digital Instrumentation and Controls
- Operator Licensing
- Training



Risk, Reliability & Human Performance



Areas of Emphasis:

- Digital Instrumentation and Controls
 - PRA for digital systems
 - Degraded I&C
 - Use/design of computer-based procedures
 - Use of manual actions as a diverse back-up
- Fitness for Duty
 - including fatigue management



Risk, Reliability & Human Performance



Areas of Emphasis:

- Safety Analyses
 - Identifying risk-important human actions
- Safety Culture and Safety Conscious Work Environment
 - Policy
 - Assessments



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Areas of Emphasis:

- Event Assessment and Analysis
 - Significance Determination
 - Accident Sequence Precursor Analysis
 - Operating experience review
 - Nuclear Materials Events Database



Risk, Reliability & Human Performance



Areas of Emphasis:

- Main Control Room Design and Operations
 - Human-System Interfaces
 - Procedures
 - Training
 - Conduct of Operations



Risk, Reliability & Human Performance

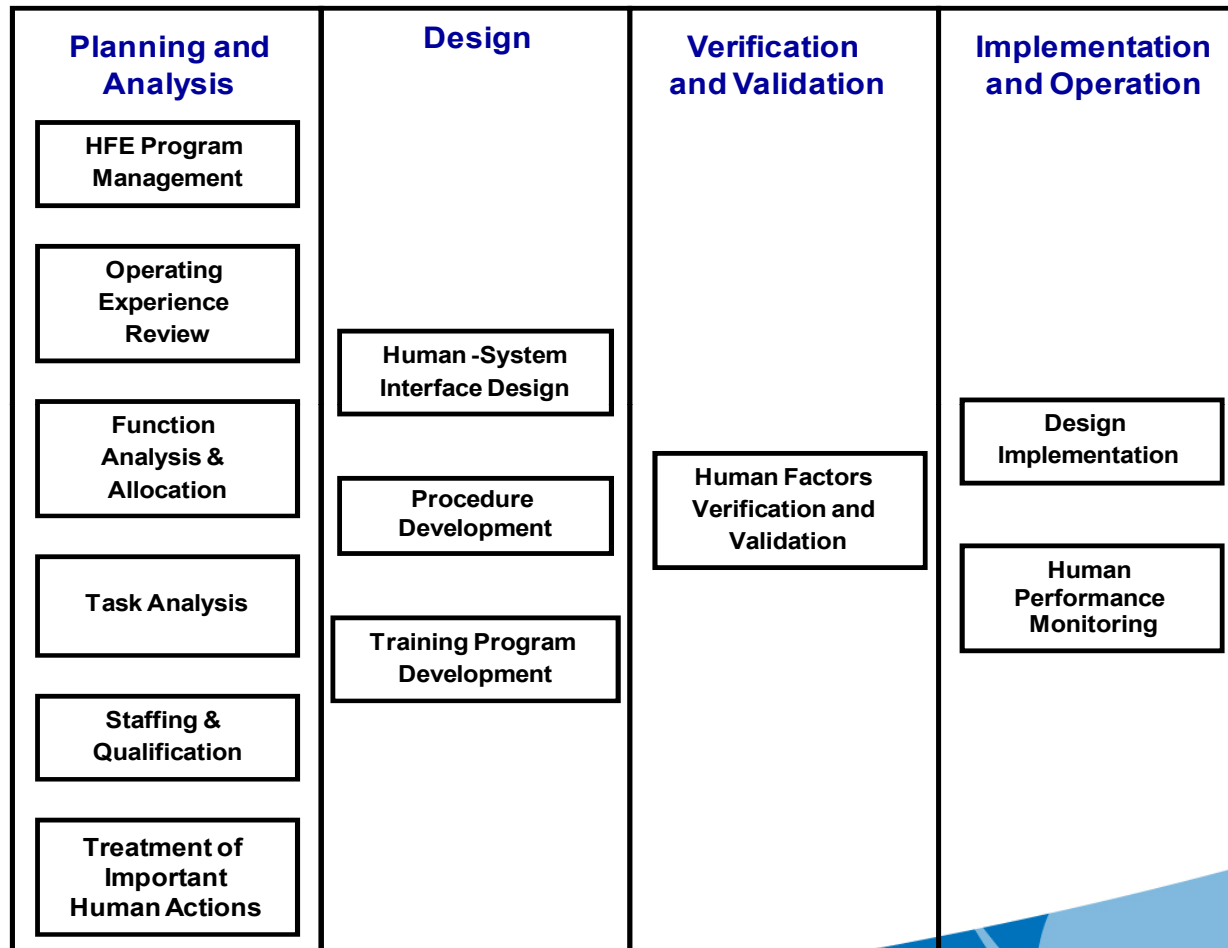


Recent Areas of Interest and Research:

- Control room modernization and hybrid control rooms
- Impact of automation on control room design and operations
- Methods for measuring workload, teamwork, and situation awareness



HFE Program Review Model (NUREG-0700)



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Current/Planned Initiatives:

NUREG-0711 Guidance Updates:

- Task Analysis
- Verification and Validation, including Integrated System Validation



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Current/Planned Initiatives:

NUREG-0700, Human System Interface Design Review Guidelines (Rev. 2)

- Computer-based procedures
- Computerized operator support
- Communication systems
- Alarm coding
- Input devices
- Automation

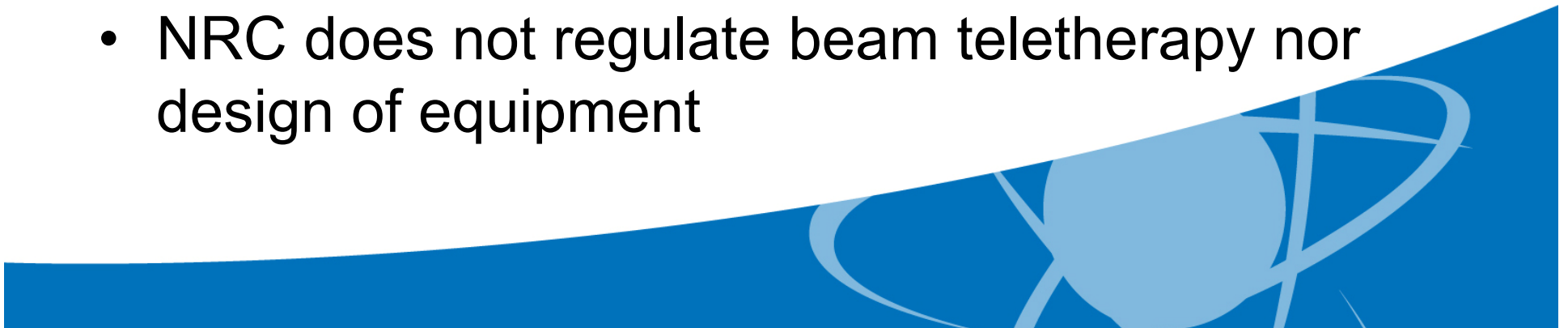


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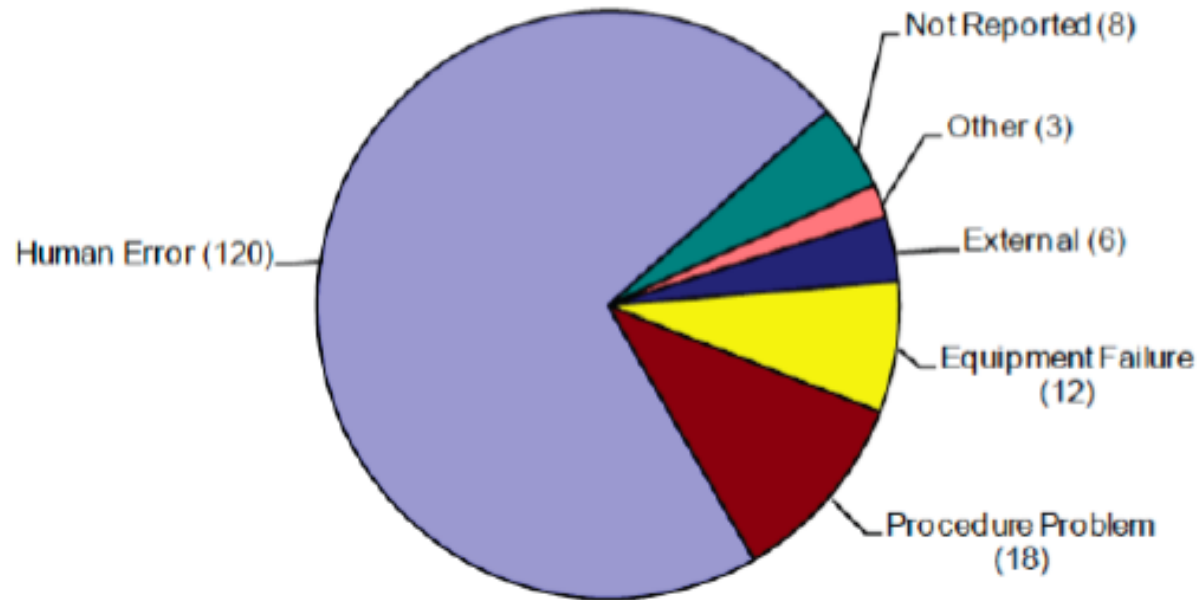
Medical Applications

- NRC regulates the medical uses of radioactive byproduct materials. Examples include:
 - High dose-rate (HDR) brachytherapy
 - Stereotactic radiosurgery (Gamma knife)
 - ^{125}I seeds
 - Microspheres
- NRC does not regulate beam teletherapy nor design of equipment



Risk, Reliability & Human Performance

Medical Applications Reportable Events



Wreathall, Miletello, Cooper, Brown, Marble & Lopez, PSAM, June 2012

Risk, Reliability & Human Performance



Medical Applications Events Review

Underlying causes

- “Black box” aspects of automation
- Repetition and automaticity
- Computer interfaces and mode errors
- Computer interfaces and data entry errors
- Cross checking and independent verification
- Prospective memory challenges



Summary



- NRC staff engage in a wide range of activities focused on understanding the interactions of people and technology and their implications for protecting public health and safety
- The agency promotes a continuous learning environment and values the opportunity to learn from other industries

