Interaction of U.S. Social, Technological, and Nuclear Regulatory History

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Sequence of Presentations

- History of U.S. regulatory process in the context of social and technological development
- Desirable attributes of the regulatory process as applied to research reactors
- Standard Format and Content for the Safety Analysis Report for research reactors
- Standard Review Plan for research reactors
- Inspection and Enforcement
- Selected Topics

The Changing Context of US Nuclear Regulation

- Presentation originally developed for power reactor audience
- The same social and technological factors have affected U.S. research reactors
- How both research and power reactors are regulated is affected by the dynamic of social inputs, industry initiatives, and regulatory body concerns

USNRC Mission

- Adequate protection of public health and safety
- Promote common defense and security
- Protect the environment
- (Atomic Energy Act of 1954, as amended)
- Implemented by regulations, decisions and practices

Evolution of U.S. Reactor Regulatory Oversight

- Social context has changed
  - Culture
  - Economic
- Industry has changed
- USAEC/NRC oversight has changed

Oversight - 1950s

- Industry
  - AEC power and research reactor prototypes
- Social
  - Technology optimism
  - Joint Committee on Atomic Energy Congressional Oversight
- USAEC Oversight
  - Internal to AEC
  - Little independent technical oversight
  - Effluent limits

Oversight - Early 1960s

- Industry
  - First commercial reactors
  - Heavy NSSS vendor involvement
  - Little owner expertise
  - University research reactors
- Social
  - Public neutral
  - Economic regulation by States
- USAEC Oversight
  - Separate regulatory staff within AEC
  - Regulations
    - Siting Criteria
    - Design Basis Accidents
  - Issues resolved on successive CP reviews

Oversight - Late 1960s, Early 1970s

- Industry
  - Large number of reactors ordered
  - Higher power
  - Large number of NSSS/A&E/Owner combinations
- Social
  - Distrust of Government and large business
  - Environmental concerns

- USAEC Oversight
  - Stronger technical staff
  - General Design Criteria, T.S.
  - Industry Standards
  - NRC Guides, Standard Review Plans
  - ECCS, QA rules
  - Inspections begun

Oversight - Late 1970s

- Industry
  - Electrical demand slows after oil crisis
  - Reactor orders cancelled
  - Some instances of poor quality/construction
  - 75 Power Units Operating by 1979
  - About 80 research reactors
  - TMI accident
- Social
  - Breakup of JCAE
  - Fear of nuclear
- USNRC Oversight
  - NRC separated from AEC in 1975
  - Fire Protection, Equipment Qualification regulations
  - Compliance inspections
  - Cost/Benefits considered for improvements
  - PRA studies

Oversight - Early 1980s

- Industry
  - Additional reactors, started before TMI, completed
  - More reactors cancelled
  - INPO formed
  - Industry event experience
  - Site-specific simulators
  - Decline in Research Reactors and NE programs
- Social
  - Public hearing intervention intensifies
  - Anti-nuclear globalization
- USNRC Oversight
  - TMI Orders issued
  - Emergency Preparedness rules and exercises
  - Human Factors emphasized
  - Performance based engineering inspections in response to design problems

Oversight - Late 1980s, Early 1990s

- Industry
  - More reactors under construction completed
  - 112 Power Units in 1992
  - Performance shutdowns
  - Some improve capacity factors
- Social
  - Economic deregulation starts - disincentive for large capital investment
  - Reaction to Chernobyl
- USNRC Oversight
  - Performance concept extended to all aspects of inspection program
  - U.S. industry shifted audit focus to areas NRC was inspecting
  - Safety conscious environment emphasized
  - Risk significance emphasized, some testing requirements relaxed

Oversight - Late 1990s

- Industry
  - Millstone problem
  - Improved performance in rest of industry
  - Deregulation of electricity industry results in mergers
  - Some reactors decommissioned
  - Requests to recognize better performance
- Social
  - Concerns shift to waste disposal
  - CO_2 concerns favor nuclear
  - University NE programs decline
- USNRC Oversight
  - Emphasis on FSAR accuracy and design bases
  - Effectiveness initiatives
    - Digital I&C
    - License renewal
  - Performance Indicators used in pilot plant inspections

Oversight - early 2000s

- Industry
  - Investment in security upgrades
  - Continued high performance
  - Davis Besse, grid events
  - Discussion of new plants
- Social
  - 11 September 2001 terrorist attacks
  - Nuclear power more accepted as an important energy source
- USNRC Oversight
  - Emphasis on security
  - Focus on control of materials
  - Discussion of worst-case scenarios
  - Integration of response with defense forces
  - Introduction of realism in consequence projections

Reasons for Improvement?

- Maturing industry
- No major additional NRC rules
- INPO
- Competition
- NRC and industry use of performance based inspections, audits and self-evaluations

Current USNRC Regulatory Approach

- Defense in Depth
- Licensee responsibility for safety
- Safety-conscious environment (safety culture)
- Regulatory Effectiveness
- Accountability to the public
  - Citizens
  - Congress
  - Industry
  - Interest groups

What is the Goal?

- NRC/Industry Relationship
  - Industry self-regulation
  - NRC oversight to assure that self-regulation is working
- Develop understanding of how social (culture and economic) context interacts

Summary

- Regulatory approaches used have varied with the activity regulated (design, construction, operation), with the social context, with NRC expertise, and with industry performance
- The impetus for changes of approach has come from the dynamic of social inputs, industry initiatives, and NRC concerns