NRC Advanced Non-LWR Licensing Experience

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NRC Licensing Experience

- The NRC has undertaken licensing activities for non-light water reactors in the past
- This presentation covers the period beginning in the late 1980's to the present

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- Post Clinch River Breeder Reactor period included several advanced reactor designs
  - Sodium Advanced Fast Reactor LMR (3600 MWt)
  - GE-Hitachi PRISM Liquid Metal Reactor (LMR) (350 MWt)
  - Modular High Temperature Gas Reactor (HTGR) (471 MWt)
  - Process Inherent Ultimate Safety (PIUS) Pressurized Water Reactor (2000 MWt)
  - CANDU 3 Heavy Water Reactor (1378 MWt)

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- NRC staff conducted pre-application activities and provided feedback in the form of Pre-Application Safety Evaluation Reports structured to follow RG 1.70, Standard Format and Content of Safety Analysis Report for:
  - SAFR (NUREG-1369)
  - PRISM (NUREG-1368)
  - MHTGR (NUREG-1338)
- Generally no obvious impediments to licensing were identified.
- Areas where additional design, analysis, testing, and research and development was needed were noted in the Pre-Application Safety Evaluation Reports.
- NRC staff conducted pre-application activities and provided less formal feedback for CANDU 3, and PIUS.

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- Reviews Conducted As for Licensing
  - Hardware design and development
  - Experience data base
  - Experimental development activities
  - Design base testing data base
  - Independent analytical assessments
  - Identification of policy issues

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- In April 1993, NRC staff issued SECY-93-092, "Issues Pertaining to the Advanced Reactor (PRISM, MHTGR, and PIUS) and CANDU 3 Designs and Their Relationship to Current Regulatory Requirements."
- Major Policy Issues Addressed
  - Accident Evaluation
  - Source Term
  - Containment Performance
  - Emergency Planning
  - Operator Staffing & Function
  - Residual Heat Removal
  - Positive Void Reactivity Coefficient

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- Containment Performance
  - Proposed use of a standard based on containment functional performance rather than prescriptive design criteria.
  - For 24 hours no greater than the limiting containment leak rate used to evaluate event categories and acceptable limits.

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- Operator Staffing and Function
  - Operator staffing may be design dependent and smaller crew size may be justifiable.
  - Adequacy shall be tested and demonstrated.

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- Positive Void Reactivity Coefficient
  - A positive void coefficient should not necessarily disqualify a reactor design.
  - Overall risk perspective should be taken into account.
  - Consider estimated probability of the accidents as well as severity of consequences.

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- Earlier pre-application efforts aided the NRC in more recent pre-application reviews:
  - Advanced CANDU Reactor 700 (700 MWe)
    - Designed out positive void coefficient
  - Pebble Bed Modular Reactor (HTGR) (120 MWe)
    - Closed cycle HTGR
  - Toshiba 4S LMR (10 MWe)
    - Similarities/differences with PRISM
  - Next Generation Nuclear Plant (NGNP)

NRC Licensing Experience

- Activities following the CRBR review have positioned NRC to move forward
  - Carryover of policy issues
  - Adaptability allowing NRC staff to consider changes in fundamental regulatory areas
    - Accident/event definition and determination
    - General Design Criteria