UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

August 14, 2001

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FROM: John W. Craig
Assistant for Operations, OEDO

SUBJECT: 16TH INTERNATIONAL CONFERENCE ON STRUCTURAL MECHANICS IN REACTOR TECHNOLOGY (SMiRT) PRESENTATION

The subject conference is being held August 12-17, 2001, at the Key Bridge Marriott Hotel, Arlington, Virginia. This conference provides a unique forum to bring together diverse groups: academicians and researchers, analysts and designers, vendors and operators, and regulatory and non-regulatory government professionals - all interested in structural mechanics and safety of nuclear power plant buildings and components. The SMiRT 16 theme is "Challenges to Structural Mechanics: Safety and Cost." SMiRT 16 has 13 topical Divisions on a range of topics, from those related to new plants - such as siting criteria and design - to those more relevant to operating reactors.

Attached is a copy of a presentation to be given by Ashok Thadani at a morning panel session on August 15th.

Attachment: As stated

cc: W. Travers, EDO (w/o attachment)
C. Paperiello, DEDMRS (w/attachment)
W. Kane, DEDR (w/o attachment)
P. Norry, DEDM (w/attachment)
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J. Craig, AO (w/attachment)
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OCA (w/attachment)
OPA (w/attachment)
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CFO (w/o attachment)
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United States Nuclear Regulatory Commission

SMiRT 16

NEW DESIGNS AND TECHNOLOGIES ISSUES AND IMPLICATIONS

Ashok Thadani, Director
Office of Nuclear Regulatory Research

OVERVIEW

- Changing Environment
- Recent Developments
  - New Reactor Designs
  - New Technologies
- Policy and Technical Issues
- Infrastructure Needs and Requirements
- What NRC is doing to get ready
- Role of Structural Mechanics

Changing Environment

- Demand for Power
- Deregulated Industry
- Environmental Considerations
- Recent Developments

Commission Policy

- Encourages Innovative Designs
- Expects Increased Safety Margins
- Allows for Innovative Safety Criteria
- Licensability to be Supported by New Technology Demonstrations
- Less Prescriptive or Performance - Based Criteria can be Considered
- Encourages Early Interaction Between Applicant and NRC

Recent Developments

New Reactor Designs

- Light Water Reactors

  AP 1000 Design

  International Reactor Innovative and Secure (IRIS)

- Non-Light Water Reactors

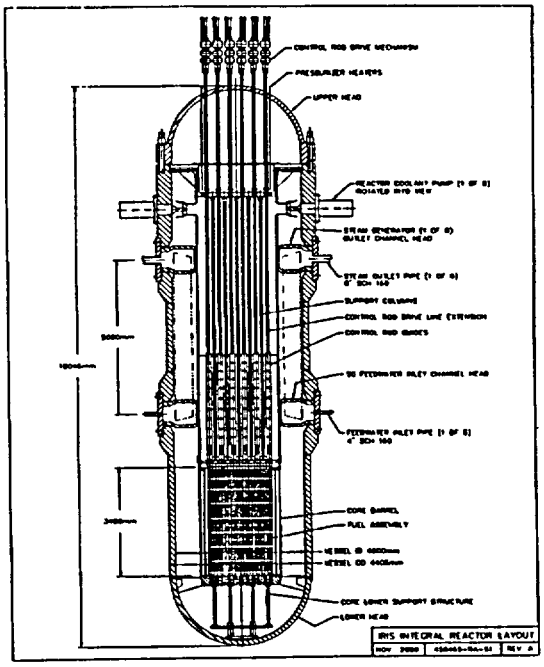
  Pebble Bed Modular Reactor (PBMR)

  Gas Turbine- Modular Helium Reactor (GT-MHR)

- Generation IV

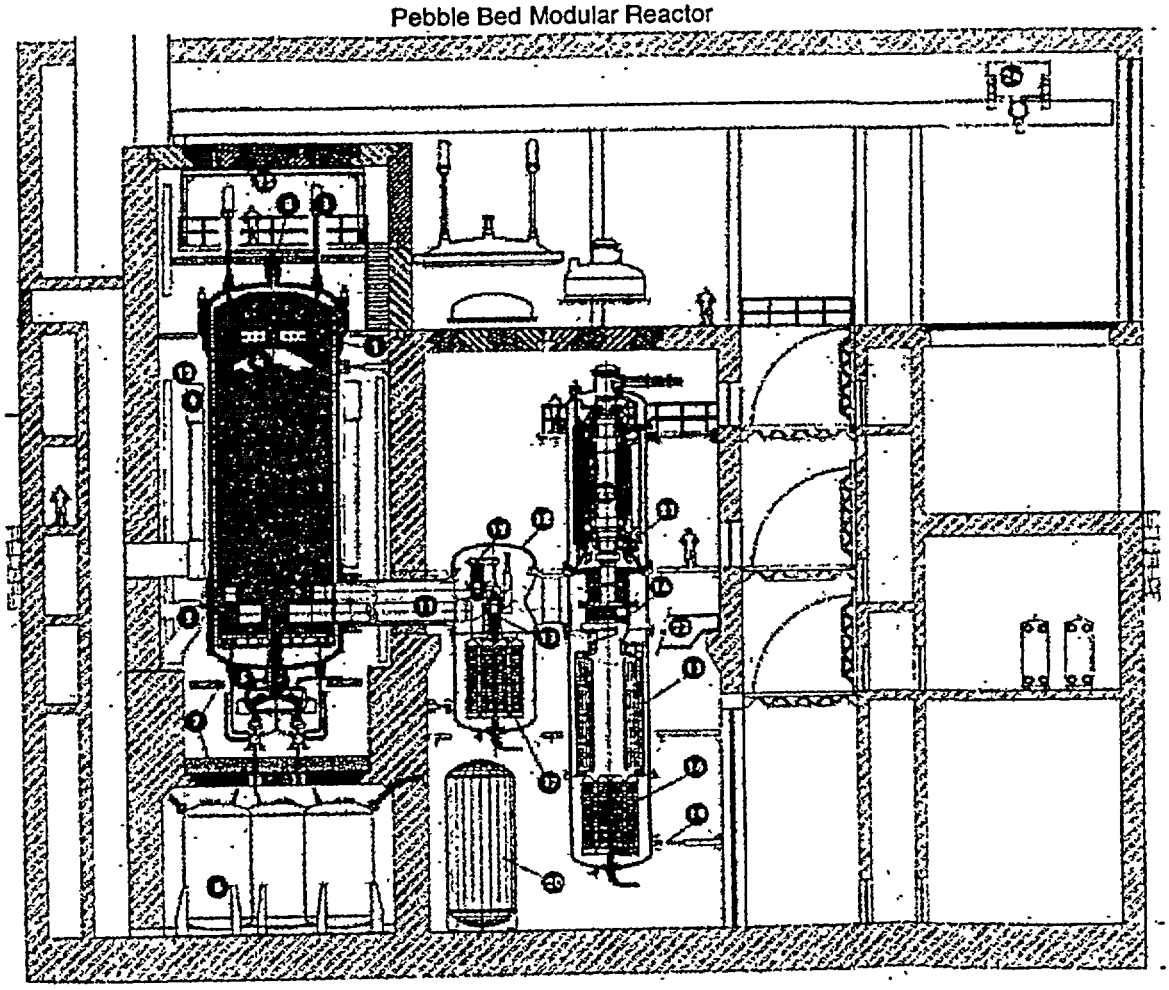
IRIS is a Modular LWR, with Emphasis on Proliferation Resistance and Enhanced Safety

- Small-to-medium (100-300 MWe) power module
- Integral primary system
- 5- and 8-year straight burn core
- Utilizes LWR technology, newly engineered for improved performance
- Most accident initiators are prevented by design
- Potential to be cost competitive with other options
- Development, construction and deployment by international team
- First module projected deployment in 2010-2015



Westinghouse Science & Technology

Pebble Bed Modular Reactor



1 = reactor vessel
2 = reactor vessel support
3 = control rod drive mechanisms
4 = fuel
5 = defuelling devise
6 = spent fuel storage vessels(7)
7 = radiation shield
8 = seismic support
9 = heat removal skirt
10 = reactor pit cooling
11 = main connection manifold
12 = turbine comp. No 1
13 = turbo comp. no 2
14 = power turbine
15 = recuperator
16 = precooler enclosures
17 = intercooler
18 = power conversion unit
19 = snubbers
20 = helium storage tanks (9)
21 = generator coupling
22 = generator
23 = main carrier beam
24 = main overhead crane

Recent Developments

New Technological Changes (Impacting Operating Reactor & New Designs)

- Risk-Informed Approaches
- Materials and Structures - Aging Management, Longer Life, High Temp.
- Power Uprates/High Burnup/Longer Cycle
- New Fuel Designs (e.g. New Cladding Materials, MOX, Pebble Bed)
- Use of Digital Systems
- Application of Advances in Technology and Analytical Tools

Policy and Technical Issues

- Is a New Design Independent Safety Framework Needed?

  Role of the Safety Goals (Limited Surrogate, Modular Plants)

  Defense - In - Depth

  Development of General Design Criteria (GDCs) for Each Design?

  Risk Informed, Performance - Based Approach for:
  - Design Basis Accident Selection
  - Safety Classification

  Role of PRA (e.g. Replace Single Failure Criterion?) and Deterministic Approach

Policy and Technical Issues (continued)

- **Legal and Financial**
  - **Anti-trust**
  - **Price Anderson**
  - **Decommissioning Trust Fund**

Policy and Technical Issues

- Fuel Performance and Qualifications (e.g., Ability to Retain Fission Products at High Temperatures)
- High-Temperature Application of Materials (Creep Behavior, Failure Modes, Long-Term Performance)
- Different Approaches to Safety Assurance

  Increased Emphasis on Accident Prevention
  Containment Robustness
  Source Term and Emergency Planning

- Passive Systems - Performance and Reliability

Policy and Technical Issues

- Demonstration Testing
- Use of New Analytical Tools and International Data
- Greater Use of Digital Systems
- Human Performance Associated with Multi-Modular Designs
- Fuel Cycle Safety and Safeguards
- PRA Methodology and Data

Infrastructure Needs and Requirements

- NRC

  Framework (e.g. Guidance, Review Plans)

  Resources (Staff and Funds)

  Expertise and Experience (e.g. Natural Hazard, Designs, Construction Inspection)

  Scope of Independent Testing

  - Probe Fringes (Severe Accident Knowledge)
  - Critical Areas (e.g., Fuel)

  Experimental Programs and Facilities

  Analytical Capabilities for Independent Assessment

Infrastructure Needs and Requirements

- **Industry**

  Adequate R&D by the Industry

  Expertise and Experience

  Codes and Standards

  Construction/Fabrication

What NRC is doing to get Ready?

- Created Advanced Reactor Groups in Both Licensing and Research Offices
- Engage Early in Process - Pre-Application Reviews
- Advance RES/Agency's Expertise in Evolving Technology
- Advance International Collaboration
  - Sharing of Information and Experiences
  - Joint Research Programs
  - Optimize Use of Resources and Facilities
  - Applicability of Codes and Standards
- Work with DOE and Industry
- Work with Codes and Standards Organizations

Roles of Structural Mechanics

- Critical Role for Aging Management of Existing Plants and New Designs
- At the Forefront in Building New Plants - Siting, Design and Construction
- Implementation of Advanced Technologies

  Materials - High Temperature Applications
  Design/Analysis - Improved Modeling and Calculational Capability
  Construction/Fabrication - Modular Construction
  Inspection/Maintenance - On-Line Monitoring

- Codes and Standards for above and Consideration of Risk Informed Applications

Roles of Structural Mechanics (continued)

- **Advances Required for Integration in Risk Assessment Methodology**

  Probabilistic Methods
  Realistic vs. Conservative
  Failure Modes and Margins
  Characterization of Uncertainties

- **International Forums, Like SMiRT, Important for Sharing Information, Establishing Needs, and Establishing Programs**