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Background and Purpose for the NRC Delegation Visit to Japan on the Safety Aspects of HTGR Technology

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The NRC Delegation

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Mission Purpose:

- Meet Leading HTGR Design, Technology, Operations and Safety Experts in Japan and Learn of Their Areas of Special Expertise and Experiences

- Discuss and Obtain Information in the Many HTGR Design and Technology Areas That Are Important to the PBMR and GT-MHR Safety Review

  Fuel Design, Manufacture, Performance, Qualification, etc.
  Heat Transfer and Fluid Flow Analysis, Methods, Testing, etc.
  Core Physics and Nuclear Design Analysis, Methods, Testing, etc.
  High Temperature Steel Properties, Fracture Mechanics, Behavior, Monitoring, etc
  Nuclear Graphite, Properties, Behavior, etc.
  Accident Passive Decay Heat Removal Experiments, Analysis, etc.
  HTTR Testing, Operating Experiences and Safety Lessons Learned
  Ex-Reactor Fuel Cycle Safety, Storage, Transportation, etc.
  Regulatory & Safety Assessments of HTTR, Regulations, Codes, etc.

- Obtain Japanese Expert's Views and Information on the Key HTGR Design and Technology Safety Issues Which Should be Closely Examined in the PBMR and GT-MHR Safety Reviews

- Explore Areas and Opportunities for Cooperative HTGR Safety Research

Mission Background: Recent HTGR Initiatives in the U.S.

- Exelon Requested Pre-License Application Technical Review of the PBMR HTGR:

  - Technical Review Began Jun 2001
  - Review Covers Significant Design and Technology Areas
  - NRC Will Provide Guidance on Significant PBMR Design, Technology, Safety and Policy-Level Issues
  -Technical Review to be Completed Nov 2002

- General Atomics Expected to Request Pre-License Application Technical Review of the GT-MHR HTGR

  - Technical Review Expected to Begin In the Fall 2001

- Exelon May Apply for an Early Site Permit and a License for a PBMR Plant Module in the U.S. in CY 2002

- Exelon May Apply for Design Certification of the PBMR Design in Early 2003

Mission Background: HTGR Pre-Application Review Objectives

- To provide guidance on the regulatory process, regulatory framework and the technology-basis expectations for licensing an HTGR, including identifying significant technology, design, safety, licensing and policy issues that would need to be addressed in licensing an HTGR.

- To develop a core infrastructure of analytical tools, contractor support, staff training and NRC staff expertise needed for NRC to fully achieve the capacity and the capability to review an HTGR license application.

Mission Background:
HTGR NRC Regulatory Infrastructure Development Needs

- Staff Training Course for HTGR Technology
- Analytical Codes and Methods for Modular HTGR Licensing Reviews
- Regulatory Framework for Modular HTGR Licensing Reviews
- Core Staff Capabilities for HTGR Technology and Licensing Reviews
- Contractor Technical Support Capabilities
- Possible RES Confirmatory Testing and Experiments
- Possible Codes and Standards for HTGR Design and Technology

Mission Background: NRC Staff Review Strategy and Resources

- NRC HTGR Technical Expertise and Regulatory Experience
- Contractor Support From National Labs and Design/Technology Experts
- NRC's Prior Modular HTGR Pre-Application Review Experience
- Design, Operation and Safety Review Experience for Fort St. Vrain HTGR
- **International HTGR Experience:** Germany, **Japan,** China, UK, IAEA
- Exelon, GA and DOE HTGR Design, Technology and Safety Assessments
- Obtain Input and Comments From Stakeholders at Public Meetings
- Obtain Advice and Insights from the NRC's Advisory Committee on Reactor Safeguards and Advisory Committee on Nuclear Waste

Mission Background: Exelon PBMR Pre-Application Technical Review Scope

Selected Design, Technology and Regulatory Review Areas:

- Fuel Design, Performance and Qualification Testing
- Nuclear, Thermal-Fluid Design and Safety Analysis Codes
- Nuclear Graphite Performance
- Hi-Temp Materials Performance
- Source Term
- Containment Design
- PBMR Licensing approach
- Human Performance and Digital I&C
- Prototype Testing Program
- Codes and Standards
- Postulated Licensing-Basis Events
- Fuel Handling and Waste
- Emergency Planning
- Reactor Shutdown/Shutdown Cooling

Mission Background: HTGR Safety Significant Review Issues

- Fuel Performance and Fuel Qualification
- Passive Design and Safety Characteristics
- Accident Source Term Determination and Basis
- Postulated Licensing Basis Events
- Scope and Regulatory Credit for Planned Prototype Testing
- Functional Requirements for Containment Design Basis.
- Emergency Planning Zone and Requirements
- Risk-Informed Licensing Approach
- Probabilistic Risk Assessment

Exelon-Proposed Top-Level Risk Criteria
fir the PBMR