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**RIC 2011
Status of Research Activities in Preparation
for Licensing of Advanced Reactors**

Status of NRC's Research on Graphite Issues Related to
Licensing High Temperature Gas Cooled Reactor

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**Graphite Key Technical Issues
Research Plan (2006)**

- Availability and applicability of national codes and standards for graphite components
- Effects of impurities, including oxygen, on component degradation
- Inspection of graphite core components
- Performance of graphite under high irradiation
- Methodology for prediction of irradiated graphite properties
- Oxidation of reflector-grade graphite, fuel pebble matrix graphite, and graphite dust

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Strategy for Graphite Research

- NRC staff expects applicant to provide technical bases for evaluation of graphite core components design
- Staff participates in codes and standards and domestic/international topical meetings
- Staff participates in domestic/international experimental programs and performs independent evaluation/interpretation of data
- Participate in Idaho National Lab (INL)/Oak Ridge National Lab (ORNL) and other DOE NGNP research to provide technical input on data needs
- Staff conducts confirmatory research in specific areas

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Challenges For Safety Evaluation of NGNP Graphite Core Components

- Develop NRC staff expertise, technical tools, and data for:
 - Materials performance analysis codes
 - Structural and component integrity analysis codes
 - Surveillance requirements and inspection codes
 - Tools to evaluate the efficacy of component degradation management programs
- Develop guidance documents for:
 - Safety review of graphite core components
 - In-service inspection and surveillance plans and techniques

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Development of Codes and Standards for Graphite Components

- Since 2002, staff has actively participated on ASME and ASTM nuclear graphite committees and provided data need input for regulatory review of:
 - Design code for graphite core components
 - Standard specification for nuclear grade graphite core components
- Staff provided perspectives on graphite properties and recommended new standards development

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Safety Significant Graphite Phenomena

- The NRC conducted, in cooperation with DOE, a PIRT exercise to identify safety-significant graphite phenomena
- Many of the high importance/low knowledge phenomena are being addressed either by DOE research or by international research
- External research is expected to provide adequate information for regulatory needs for phenomena ranked as high importance/medium knowledge
- Staff will continue to provide technical input to DOE research regarding information needs, potential uncertainty in data and material/inspection/structural integrity assessment models

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Current NRC Graphite Research

- **“Nuclear Graphite Stored Energy Release,” ORNL**
 - Determine the safety significance of the energy stored due to high temperature irradiation and released on subsequent higher temperature heating
- **“Nuclear Graphite Core Component Stress Analysis,” Argonne National Laboratory (ANL)**
 - Develop a finite element stress analysis tool to independently verify and confirm applicant’s design stresses and margins in graphite core component

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Next Steps

- Continue participation in codes and standards organizations, and monitor graphite research related to HTGRs
- Monitor DOE research and provide technical input as appropriate
- Complete research at ORNL and ANL and document findings
- Develop regulatory guides and specific standard review plan additions for review of HTGR graphite core component design

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