

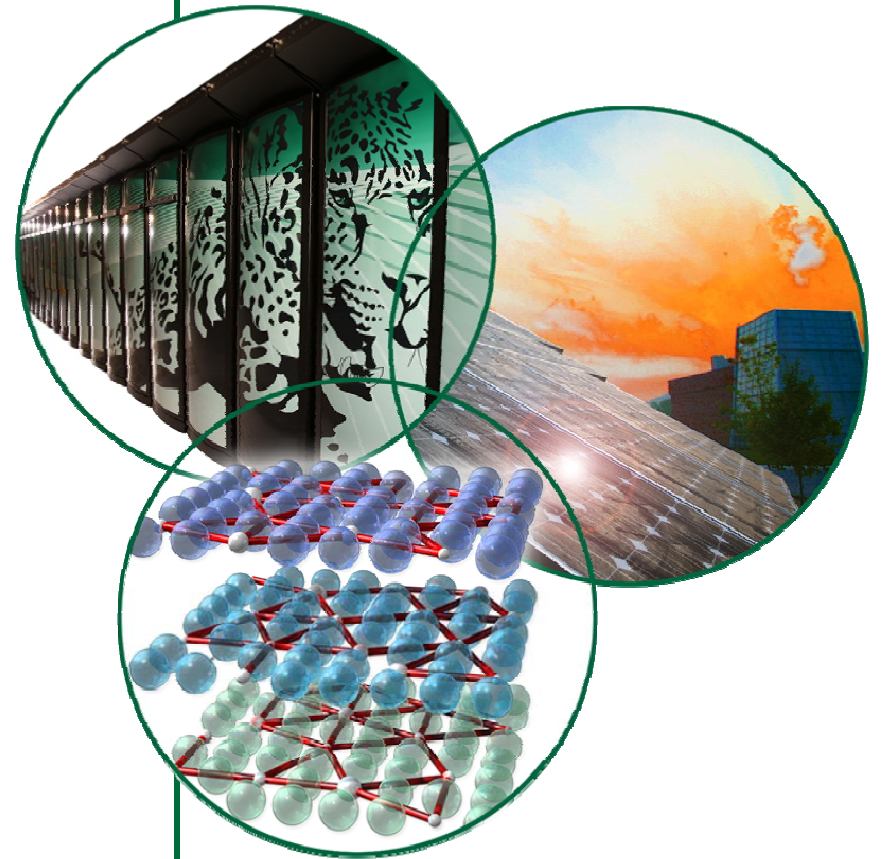
Workshop Overview and Goals

Nidia Gallego
Carbon Materials Group
Oak Ridge National Laboratory

Presented at the NRC Workshop on
Graphite Research

Rockville, MD

March 16-18, 2009



Workshop on Nuclear Graphite Research

Organized by ORNL – Sponsored by NRC

- **Objectives:**

- To provide NRC with an independent assessment of worldwide progress of graphite research, specifically related to NGNP HTGR, and regulatory challenges and expectations.
- To identify additional research activities related to graphite, beyond those planned by DOE and other organizations, needed to evaluate safety margins, failure points, and quantify uncertainties.

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- **Impact of this Workshop:**

- The outcome of this workshop and the assessment are expected to identify those technical areas for future NRC research, which could augment DOE and other international research to enable the acquisition of data and knowledge with high quality and sufficiency.

Documents Provided for Reference

- NUREG/CR-6944, "Next Generation Nuclear Plant Phenomena Identification and Ranking Tables (PIRT), Volume 5: Graphite PIRTs".
- INL/EXT-07-13165, "Graphite Technology Development Plan".
- ORNL/TM-2007/153, "NGNP Graphite Selection and Acquisition Strategy".
- ORNL-GEN4/LTR-06-019, "Experimental Plan and final Design Report for HFIR High Temperature Graphite Irradiation Capsules HTV-1 and -2".
- ORNL/TM-2008/129, "Generation IV Reactors Integrated Materials Technology Program Plan: Focus on Very High Temperature Reactor Materials".

Workshop Format

- **Background on International HTGR Nuclear Graphite Research and Regulatory Perspective:**
 - Presentations from USA, UK, RSA, Japan (*China unable to attend due to visa issue)
- **Identification of Technology Gaps and Future Nuclear Graphite Research Activities:**
 - Group discussion sessions on proposed themes
- **Panel Documentation of Recommendation for NRC's Nuclear Graphite Research**

A G E N D A

Day 1 Topic: Background on International HTGR Nuclear Graphite Research and Regulatory Perspective

8:25 AM	Welcome by Dr. Brian Sheron, Director of Research, Office of Nuclear Regulatory Research, NRC.
8:30 AM	A Short History of NRC Nuclear Graphite Research – Dr. Makuteswara Srinivasan, Senior Materials Engineer, Office of Nuclear Regulatory Research, NRC
8:45 AM	Workshop Overview and Goals – Dr. Nidia Gallego, Research Scientist, Carbon Materials Technology Group Oak Ridge National Laboratory (ORNL)
9:00 AM	Overview of Graphite PIRT Findings – Dr. Timothy Burchell, Group Leader, Carbon Materials Technology Group, ORNL
9:30 AM	Overview of US DOE NGNP Research Plan – Dr. William Windes, Leader Graphite Group, Idaho National Laboratory (INL)
10:10 AM	Break
10:30 AM	UK and European Research Activities – Professor Barry Marsden, School of Mechanical, Aerospace and Civil Engineering, The University of Manchester – UK
11:10 AM	PBMR Research Activities – Mr. Mark Mitchell, Leader Materials Group, Pebble Bed Modular Reactor (Pty) Ltd – Republic of South Africa (RSA)
12:00 Noon	Lunch Break

1:00 PM	Chinese Research Activities – Professor Suyan Yu, Institute of Nuclear and New Energy Technology, Tsinghua University – China
1:40 PM	Japanese Research Activities – Dr. Motokuni Eto, Technical Consultant, Toyo Tanso Co. Ltd – Japan
2:20 PM	U.K. Regulatory Perspective – Mr. Graham Heys, HM Principal Inspector (Nuclear Installations), HM Nuclear Installations Inspectorate, Health and Safety Executive – United Kingdom
3:00 PM	Break
3:15 PM	RSA Regulatory Perspective – Mr. Schalk Doms, Senior Regulatory Officer, PBMR Programme, National Nuclear Regulator – RSA
3:55 PM	Chinese Regulatory Perspective – Professor Suyan Yu, Institute of Nuclear and New Energy Technology, Tsinghua University – China
4:20 PM	Japan Regulatory Perspective – Dr. Motokuni Eto, Technical Consultant, Toyo Tanso Co. Ltd – Japan
4:35 PM	NRC Regulatory Research Perspectives Related to NGNP V/HTGR Licensing – Dr. Stuart Rubin, Senior Technical Advisor, Dr. Sudhamay Basu, Senior Nuclear Engineer and Dr. Makuteswara Srinivasan, Senior Materials Engineer, U.S. NRC
5:00 PM	ADJUORN

Day 2 Topic: Identification of Technology Gaps and Future Nuclear Graphite Research Activities

- 8:00 AM Some of the Challenges in NGNP HTGR Graphite Component Safety Evaluation – Makuteswara Srinivasan, Senior Materials Engineer, NRC
- 8:30 AM Comparison of Graphite PIRT Results with DOE Research Plan – Dr. Timothy Burchell, Group Leader, Carbon Materials Technology Group and Dr. Nidia Gallego, Research Scientist, Carbon Materials Technology Group, ORNL
- 9:00 AM Panel Discussion to Identify Gaps

Purpose: NGNP H(VH)TGR Research Needs Identified For:

- Design Certification Review and Approval (near term)
- Operation Review (near term)
- Inspection (ISI) (mid term)
- Operating License Extension Beyond The existing NGNP Graphite Irradiation Database (long term)
- Decommissioning Graphite Core Components (long term)

Day 2 Topic: Identification of Technology Gaps and Future Nuclear Graphite Research Activities

Suggested Panel Discussion Themes:

- Graphite qualification
 - INL plans, and vendors plan
 - Comments on plans
 - Adequacy of properties and database
 - Quality assurance requirements
- Requirements for core behavioral models
 - Irradiation properties
 - Models for fundamental understanding for structural integrity analysis
 - Handling of data and model uncertainties
- Oxidation of graphite by coolant impurities
- Status of codes and standard development / future challenges
 - Design and construction code (Section III)
 - Stress analysis
 - Adequacy of margins
 - In-service inspection (Section XI)
- Tribology and oxidation leading to graphite dust
- Air ingress and water ingress (accident)
 - Safe shutdown and safe cool down
- Defining end of core-component life (criteria and safety margins)
- Decommissioning and disposal

Other themes as suggested by panel members

Day 3 Topic: Expert Panel Documentation of Recommendation for NRC's Nuclear Graphite Research

- Continuation of discussion
- Summary and wrap up
- Document any changes necessary to Graphite PIRT
- Review proposed NRC research topics