HTGR Technology Course for the Nuclear Regulatory Commission

May 24 – 27, 2010

Module 1 Introduction

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Course Objective

- Provide general training course on High Temperature Gas-Cooled Reactor (HTGR) technology
 - Background and applications
 - Basic safety concepts and licensing experience
 - Basics of nuclear design and thermal-hydraulic performance
 - Fuel, graphite, and other materials
 - Key design and performance features of selected major systems and components
 - Safety analyses and methods





Course Objective

- Emphasize modular HTGR design concepts being considered for Next Generation Nuclear Plant (NGNP)
 - Prismatic HTGR
 - Pebble bed HTGR
- Course is <u>not</u> an NGNP design review
- Objective is <u>not</u> to engage in detailed discussions on potential regulatory issues
 - Will be addressed through topical white papers and associated NGNP Project/NRC interactions



Course Structure

 Topics as requested by NRC – all possible topics not covered

• Organized in three parts

- Part 1: Introduction and Overview
- Part 2: Fuel, Reactor, and Plant Design
- Part 3: Safety Analysis

Schedule

- Monday 9:00 AM 6:00 PM: Part 1 and 2
- Tuesday 8:00 AM 5:00 PM: Part 2
- Wednesday 8:00 AM 5:15: Part 2
- Thursday: 8:00 AM 5:00 PM: Part 3 and wrap up
- One hour lunch break and one 20-minute break in both AM and PM each day





Course Structure (Cont.)

- Level of detail necessarily limited
- Q&A <u>after</u> completion of each presentation
- Avoid detailed discussions more appropriate for NGNP priority topic white papers and associated NRC/NGNP Project interactions
- Instructor team will follow up on NRC questions on information presented during the course if questions not adequately addressed during Q&A
- Course material provided as hard copy and CD
- List of acronyms included in course books and CD
- Each training module includes list of documents recommended for further reading



Start	Module	Торіс	Instructor
Time	#		
9:00	N/A	Introductory Remarks	NRC
		Part 1. Introduction and HTGR Overview	
9:10	1	Introduction (Course Objectives & Structure)	Saurwein (GA)
9:20	2a	Background History and Evolution of the HTGR	Shenoy (GA)
10:20	Break		
10:40	2b	HTGR Motivations and Applications	Mears (TI)
11:10	3	Modular HTGR Safety Design Approach and Safety Systems	Parme (GA)
12:20		Lunch	
1:20	4	HTGR Licensing	Wallace (PBMR)
		Part 2. HTGR Fuel, Reactor, and Plant Design	
	5	Prismatic HTGR Core Design and Thermal-Hydraulic Performance	
2:20	5a	Prismatic HTGR Core Design Description	Vollman (GA)
3:15	Break		
3:35	5b	Prismatic HTGR Nuclear Design	Baxter (GA)
4:30	5c	Prismatic HTGR Thermal-Fluid Behavior	Richards (GA)
5:30	5d	Prismatic HTGR Refueling Design	Vollman (GA)
6:00	Adjourn		



Start	Module	Торіс	Instructor
Time	#		
8:00	5e	T/F Aspects of Process Heat Coupling	Richards (GA)
	6	Pebble Bed HTGR Core Design and Thermal-Hydraulic Performance	
8:30	6a	Pebble Bed HTGR Core Design Description	Venter (PBMR)
9:30	6b	Pebble Bed HTGR Nuclear Design	Venter (PBMR)
10:30	Break		
10:50	6c	Pebble Bed HTGR Thermal-Fluid Behavior	Venter (PBMR)
11:50	6d	Pebble Bed HTGR Refueling Design	Venter (PBMR)
12:20		Lunch	
	7	TRISO Fuel Design and Fabrication	Saurwein (GA)
1:20	7a	TRISO Fuel Design, Performance Requirements, and Requirements	
2:15	7b	TRISO Fuel Manufacturing - Fabrication and Quality Control	Hunn (ORNL)
3:10	Break		
3:30	8	Fuel Performance and Modeling	McEachern (GA)
5:00	Adjourn		



Start	Module	Торіс	Instructor
Time	#		
8:00	9	Graphite	Burchell (ORNL)
	10	HTGR Component Technology - NGNP Designs	
9:30	10a	Vessel System	Lommers (AREVA)
10:00	Break		
10:20	10b	Steam Cycle Power Conversion System	Lommers (AREVA)
11:05	10c	Helium Inventory and Purification System	Hanson (GA)
11:40	10d	Reactor Cavity Cooling System	Lommers (AREVA)
12:15	Lunch		
		HTGR Component Technology - Advanced Reactor Designs	
1:15	10e	Intermediate Heat Exchanger	Lommers (AREVA)
1:40	10f	Gas Turbine Power Conversion System	Penfield (TI)
2:15	11	High Temperature Materials Performance	Shahrokhi (AREVA)
3:35	Break		
3:55	12	Instrumentation and Controls and Control Room Design	Pfremmer (GA)
5:15		Adjourn	

Start	Module	Торіс	Instructor
Time	#		
		Part 3. HTGR Safety Analysis	
8:00	13	Fission Product Behavior in HTGRs	Hanson (GA)
10:00		Break	
10:20	14	HTGR Accident Analyses	Silady (TI)
12:30		Lunch	
1:30	15	HTGR Accident Analysis Tools	Bolin (GA)
3:40		Break	
4:00		Discussion and Wrap Up	
		Additional questions/answers on covered topics	N/A
		Identification of topics requiring follow-up	
5:00		Adjourn	·

Instructor Team

Instructor affiliations

- General Atomics
- Technology Insights
- PBMR (Pty) Ltd.
- AREVA
- Oak Ridge National Laboratory
- Selected from across U.S. HTGR community to provide high-level of expertise on both prismatic and pebble bed HTGRs
- Biographical sketches included in course book





The views expressed in this HTGR technology course are those of the industry experts and do not necessarily reflect those of the NRC

