IAEA Training Course on NATURAL CIRCULATION PHENOMENA AND PASSIVE SAFETY SYSTEMS IN ADVANCED WATER-COOLED REACTORS

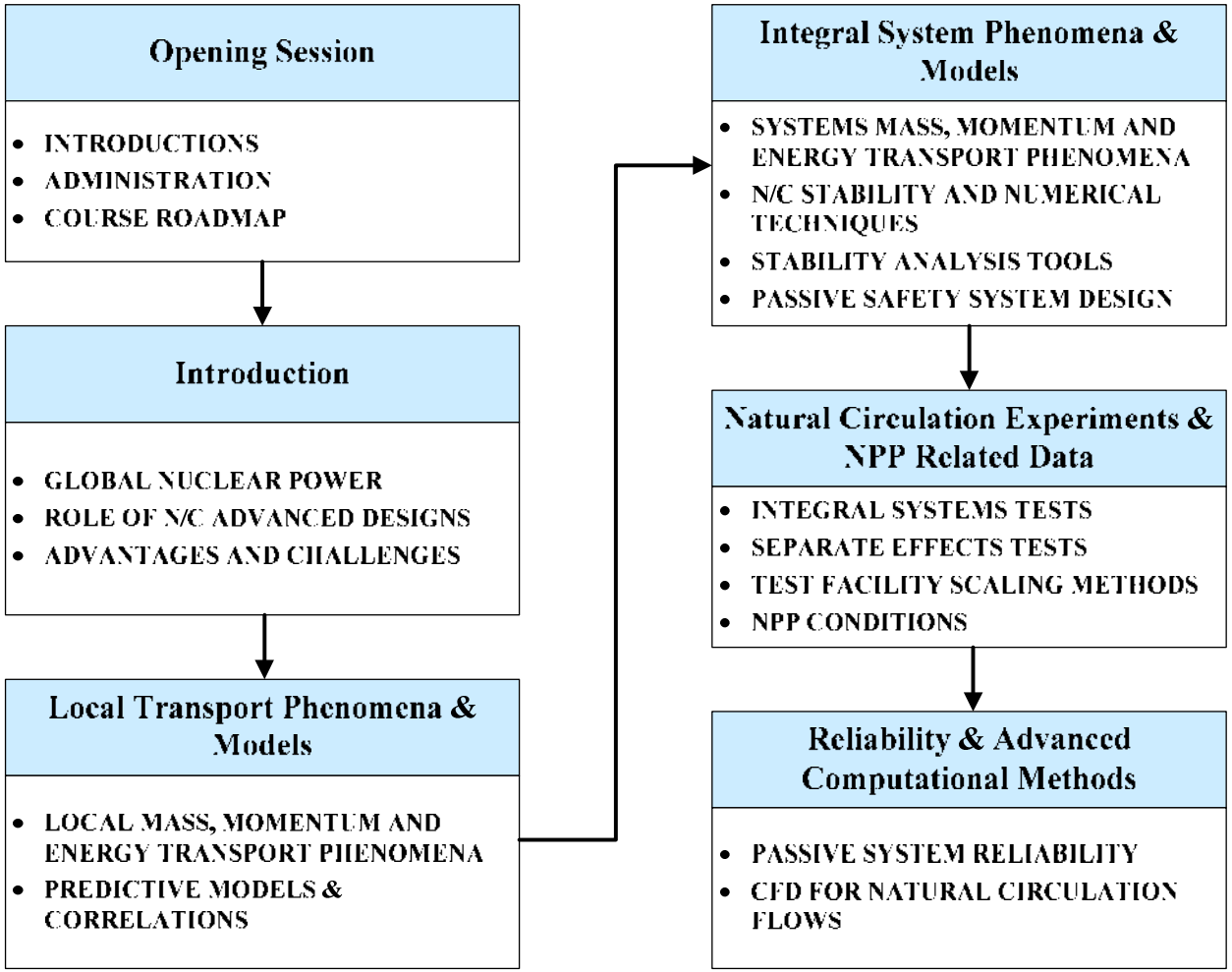
Course Objectives and Schedule

International Centre for Theoretical Physics,
Trieste, Italy, 17 to 21 May 2010

Course Objective

- **The Objective of the Course is to Provide Participants with Instruction on:**
  - **Natural circulation during reactor start-up and operation, including:**
    - **Methods of analyses and governing equations**
    - **Passive system initiation and operation**
    - **Flow stability**
    - **Scaling laws for experiments;**
  - **Natural circulation phenomena that influence the reliability of passive systems that utilize natural circulation, including:**
    - **Effect of non-condensable gases on heat transfer**
    - **Thermal stratification and mass stratification**
    - **Pool heat transfer, moisture carryover, and others.**
  - **Experimental databases for these phenomena;**
  - **A Methodology for determining the reliability of passive systems that utilize natural circulation.**

Course Roadmap



Final Agenda for the IAEA Training Course on
NATURAL CIRCULATION PHENOMENA AND PASSIVE SAFETY SYSTEMS IN ADVANCED WATER-COOLED REACTORS
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Course Director: Jong-Ho Choi (J.H.Choi@iaea.org)

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17 May **Monday**	18 May **Tuesday**	19 May **Wednesday**	20 May **Thursday**	21 May **Friday**
9:00 – 9:30 Registration 9:30 – 10:00 Welcome Opening Remarks Introduction of Lecturers, *J.-H. Choi* Self-Introduction of Participants Objectives/Schedule, *J. Reyes* 10:00 - 10:45 (T1) Overview of Global Developments of Advanced Nuclear Power Plants, *J.-H. Choi* 10:45 – 11:30 (T3) Applications of Natural Circulation Systems, *N. Aksan* 11:30 – 12:15(T2) Natural Circulation Systems: Advantages & Challenges-I, P.K. Vijayan	8:30 - 9:20 (T6) Introduction to Instabilities in Natural Circulation Systems, P.K. Vijayan 9:20 - 10:10 (T7) Insights into Natural Circulation Stability, *F. D'Auria* 10:10 – 10:40 Coffee Break 10:40 - 11:30 (T8) Stability Analysis of NC Based Systems: Pressure Tube Type BWR and Steam Generators, P.K. Vijayan 11:30 - 12:20 (T26) Numerical Techniques and Stability in Natural Circulation, *J.C. Ferreri*	8:30 – 9:20 (T11) Coupled 3D Neutron Kinetics and Thermal-Hydraulics Techniques and Relevance for the Design of Natural Circulation Systems, *F. D'Auria* 9:20 – 10:10 (T16) The CSNI Separate Effects Test and Integral Test Facility Matrices for Validation of Best-Estimate Thermal Hydraulic Computer Codes, *N. Aksan* 10:10 – 10:40 Coffee Break 10:40 – 11:30 (T20) Use of Natural Circulation Flow Map, *F. D'Auria* 11:30 - 12:00 (T21a) Examples of Natural Circulation in PHWR, P.K. Vijayan	8:30 – 9:20 (T15) Experimental Validation and Data Base of Simple Loop Facilities, P.K. Vijayan 9:20 – 10:10 (T14) Integral System Experiment Scaling Methodology, *J. Reyes* 10:10 – 10:40 Coffee Break 10:40 - 11:30 (T29) Natural Circulation Situations Relevant to Nuclear Power Plants, *F. D'Auria* 11:30 - 12:15 (T30) Reliability of TH Passive Safety Systems: Background, *F. D'Auria*	8:30 - 8:45– Completed Exams Due 8:45 – 9:30 (T24) Pre-processing and Post-processing of RMPS data, *M. Marques* 9:30 – 10:15 Exam Presentations 10:15 – 10:45 Coffee Break 10:45 – 12:00 Exam Presentations
Lunch Break (12:15-14:30)	Lunch Break (12:20-14:00)	Lunch Break (12:00-13:30)	Lunch Break (12:15-14:00)	Lunch Break (12:00-13:30)

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14:30 - 15:15 (T4) Local Phenomena Associated with Natural Circulation, P.K. Vijayan 15:15 - 16:00 (T5) Local Phenomena Associated with Natural Circulation, P.K. Vijayan 16:00 – 16:30 Coffee Break 16:30 - 17:20 (T10) Governing Equations in Two-Phase Natural Circulation Flows, *J. Reyes* 17:20 – 18:10 (T25) Numerical Techniques of Natural Circulation: History and Background, *J.C. Ferreri* 18:10 – 18:30 Discussion 18:30 - Reception	14:00 - 14:50 (T12) The Boiling Water Reactor Stability, *F. D'Auria* 14:50 - 15:40 (T13) The Boiling Water Reactor Stability, *F. D'Auria* 15:40 – 16:10 Coffee Break 16:10 – 17:00 (T22) Overview on Some Aspects of Safety Requirements and Considerations for Future Nuclear Reactors, *N. Aksan* 17:00 – 17:50 (T9) AP600 and AP1000 Passive Safety System Design & Testing in APEX, *J. Reyes* 17:50 – 18:20 Discussion	13:30 - 14:20 (T18) Overview on PANDA test Facility and ISP-42 PANDA Tests Data Base, *N. Aksan* 14:20 - 14:50 (T21b) Selected Examples of Natural Circulation for Small Break LOCA and Some Severe Accident Conditions, *N. Aksan* 14:50 – 15:40 (T17) Flow Stagnation and Thermal Stratification in Single and Two-Phase Natural Circulation Loops, *J. Reyes* 15:40 – 16:10 Coffee Break 16:10 – 17:00 (T27) Computational Fluid Dynamics for Natural Circulations – Needs and V&V, *Y. Hassan* 17:00 – 17:50 (T28) Computational Fluid Dynamics for Natural Circulations – Needs and V&V, *Y. Hassan* 17:50 – 18:20 Discussion 18:30 – Official Dinner	14:00 – 14:45 (T23) Statistical Basis for RMPS, *M. Marques* 14:45 - 15:00 Discussion and assignment of tasks for exam. 15:00 – 22:00 Group Discussion and Preparation of Exam Presentation (*Completed exams are due at 8:30 am on Friday)*	13:30 –15:00 Exam Presentations 15:00 – 15:30 Coffee Break/Exam Evaluation 15:30 – 16:00 Presentation of course certificates 16:00 – 16:10 Closure Remarks 16:10 – 16:25 Completion of course evaluation feedback form 16:25 Adjourn Course