

# IRP Scope of Work Overview

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# Project Objectives and Outcomes

- **Objective 1 –**

- A comprehensive evaluation of existing TREAT Facility neutronics data using the next generation reactor core neutronics codes. This will be performed in accordance with established guidelines per the International Handbook of Evaluated Reactor Physics Benchmark Experiments (IRPhEP).
- Yield a fully characterized reactor core with dynamic input and feedback from the U.S. Nuclear Regulatory Commission (NRC) (via advisory board member participation) which may be utilized to support the safety case for the TREAT Facility restart.

# Project Objectives and Outcomes

- **Objective 2 –**

- A complete thermal hydraulic characterization of existing sodium loop experimental data will be performed and documented using American institute of Aerospace and Astronautics Association (AIAA) validation hierarchy paradigm.
- Result in a documented basis for developing future sodium flow loops to be utilized within the TREAT Facility; these bases will be created by the industry user that is planning on employing such flow loops within the TREAT Facility in the near future (TerraPower, LLC).

# Project Objectives and Outcomes

- **Objective 3 –**

- The collection of and benchmarking against new, NQA-1 (2008, 2009a) compliant experimental thermal hydraulic data of a representative TREAT Facility water flow loop using the six guiding principles of good validation experiments identified by Oberkampf.
- Produce a documented water flow loop design and demonstration that is representative of a prototypic configuration for the TREAT Facility to provide operational information and benchmarking data; and a fully benchmarked thermal hydraulic model of the water flow loop that may be utilized for future TREAT Facility water flow loop safety analyses.

# Project Objectives and Outcomes

- **Objective 4 –**

- A comprehensive instrumentation plan for the TREAT Facility that objectively aligns with the technical and functional requirements resulting from accomplishing Objective 1 and supplemented by Objectives 2 and 3.
- A documented and demonstrated basis for the selection and arrangement of in-pile instruments within the TREAT Facility that satisfy the needs for both steady state and transient test conditions.

# Project Task Outline

- **Neutronics Benchmarks –**

- A comprehensive neutronics benchmarking analysis will be conducted using PROTEUS (DoE NEAMS code), PARCS/AGREE (U.S. NRC code) and Open MC (Monte Carlo code). An IRPhEP will result from this comprehensive benchmarking analysis.

[Led by the University of Michigan]

- **Steady-State** – Two steady state condition benchmarking tests will be selected and studied.
- **Transient** – Two transient condition benchmarking problems will be selected and studied.

# Project Task Outline

- **Loop Thermal-Hydraulics –**

- A complete thermal hydraulic study will be conducted that focuses on the experimental loops placed within the TREAT Facility. These include a comprehensive evaluation of historical data collected from previous sodium experiments as well as expansion of existing data through design, development, and utilization of a new experimental loop that is representative of a proposed TREAT water flow loop.

[Led by Oregon State University]

- **Sodium Loop –** Data from historically collected sodium loop calibration experiments will be used in a benchmark study against Nek5000 (DoE NEAMS code) and Star CCM+ (Industry code).
- **Water Loop –** Empirical data resulting from the new experimental flow loop will be benchmarked against RELAP5-3D (Industry code) and TRACE (U.S. NRC code). The experimental loop will also be used to support operational shake-down efforts for a TREAT Facility prototype.

# Project Task Outline

- **Core Instrumentation –**

- The result of Task 1 and 2, along with the conduct of ongoing experimental efforts underway by the FY14 IRP-NE team, will provide a clear basis for the design and development of a comprehensive TREAT Facility instrumentation plan.

[Led by Massachusetts Institute of Technology]

- **Instrumentation Plan** – A comprehensive instrumentation plan (location and instrument selection) will be conducted.
- **Initial Benchmark Evaluation** – Testing of instruments that are required for implementation within the TREAT Facility and that have not already been tested will be conducted at the Massachusetts Institute of Technology Reactor II (steady state tests) and the Oregon State TRIGA<sup>®</sup> Reactor (transient tests).



# Project Timeline (Refer to Project Website)

- **Neutronics Benchmarks**

- Steady-State: IRPhEP (Year 1)
- Transient: IRPhEP (Year 2 and 3)

- **Loop Thermal-Hydraulics**

- Sodium Loop: Benchmark (Year 1, 2 and 3)
- Water Loop: Experiment (Year 1, 2 and 3)

- **Core Instrumentation**

- Instrumentation Plan: Plan Draft (Year 1)
- Initial Benchmark Evaluation: Evaluation (Year 2 and 3)

# Project Deliverables (General)

- **Monthly Updates**

- 1 to 2 sentence update on each primary subtask End of each month  
Submit to PI

- **Quarterly Reports**

- Detailed task-by-task update End of each quarter  
Submit to PI

- **Final Report**

- Compilation of all Project scope and outcomes 12/29/2018

# Project Deliverables (Task Specific)

- **Neutronics Benchmark**

- Submit SS Benchmark for Peer Review 09/30/2016
- Submit TR Benchmark for Peer Review 09/30/2018

- **Loop Thermal-Hydraulics**

- Submit TH Sodium Loop Benchmark for Peer Review 09/30/2018
- Submit TH Water Loop Benchmark for Peer Review 09/30/2018

- **Core Instrumentation**

- Submit TREAT Core Instrumentation Plan Draft 09/30/2016
- Submit Detailed Final Instrumentation Report 09/30/2018

Thank You