Multi Universities Small Modular Reactor Simulators: NuScale

PI: Richard Christensen,
University of Idaho
Program; Scientific
Infrastructure Support

Collaborators: Derick Botha, NuScale
Qaio Wu, Oregon State University
Yassin Hassan, Texas A&M University

ABSTRACT:

The objectives of this project are to provide three absolutely unique NuScale reactor plant simulator facilities at the following U.S. Department of Energy (DOE) designated institutions: The Center for Advanced Energy Studies (CAES) in Idaho Falls, Idaho, at Texas A&M University (TAMU) in College Station Texas, and at Oregon State University (OSU) in Corvallis, Oregon that accomplish the following.

The simulator will provide the CAES Universities and National Laboratory system an open location to conduct research related to the use of modular reactors for flexible operation, process heat, inclusion in hybrid energy systems, cybersecurity analysis, and electricity generation. Additional areas of research that can be explored with the remote simulator include human factors engineering, human-system interface design, advanced diagnostics, and plant control room automation, and serve as an NSUF site wherein students and professors from the intermountain region and the rest of the country can perform research.

It will also provide undergraduate students of TAMU, OSU, and the associated CAES universities (University of Idaho (UI), Idaho State University (ISU), Boise State University (BSU) and University of Wyoming (UWy)) an opportunity to amplify their understanding of basic nuclear engineering principles by observing the reactor response to simulated transients, giving them a deeper understanding of the design simplicity and safety of small modular reactors.

Additionally, it will provide outreach to the intermountain region through demonstrations, tours, and education to community leaders, K-12 students, junior college students, and interested citizens. It will allow high school students to gain insight into career opportunities in the nuclear industry, serve as a preliminary training site for reactor operators for future NuScale reactor facilities, and serve as a test bed for the development of a mobile NuScale simulator.

The remote simulator, based on NuScale's simulator technology, will deploy a simulator interface that accepts input from operators in a virtual control room and reflects parameters simulating the plant response with the use of computer models. NuScale proprietary computer models used in the simulator include thermal-hydraulic systems models of the NuScale power module in NRELAP5, power train and shared systems thermal-hydraulics models in GSE, core physics models in S3K (Studsvik) along with models representing protection- and control systems for a 12 module NuScale power plant.

NuScale simulator use will shape future learning objective outcomes by providing a platform for innovative thinking and transformative educational opportunities. This simulator will the enhance scientific assets of UI by providing unprecedented capabilities in nuclear science and engineering singular in the Mountain West that will offer our student bodies the technical expertise needed to solve the complex issue of domestic energy security and independence. Housing the simulator at CAES in Idaho Falls, Idaho will facilitate collaboration with four university research institutions and experts in these fields at INL. This simulator acquisition for these efforts is consistent with the UI's land grant mission to strengthen teaching, scholarly, and creative capacities statewide through new research pathways. The simulator will be installed and brought operational in the CAES facility (adjacent to INL) within a year from the award date.