

## **RFA-17-14597, Methodology for Meeting Containment System Principal Design Criteria to Maximize the Passive Safety Value in Advanced Nuclear Energy Economic Competitiveness**

Advanced (non-light water) reactors are being designed with passive safety as an essential and integral feature. To help streamline the licensing of advanced reactors, DOE-NE funded a proposed adaptation of the Nuclear Regulatory Commission's (NRC's) General Design Requirements (10 CFR 50, Appendix A) documented as Guidance for Developing Principal Design Requirements for Advanced (Non-Light Water) Reactors (INL/EXT-14-31179). The NRC subsequently drafted principal design criteria (PDCs) for advanced reactors as a draft regulatory guide (DG-1330) leveraging NE's proposed PDCs. A remaining question is how meeting the advanced reactor PDCs can take credit for passive safety features inherent in certain advanced reactor concepts. Because passive safety partially drives the economic advantages of Generation IV reactors relative to the existing fleet, it is crucial that PDCs and their interpretation effectively leverage passive safety features to ensure the economic viability and marketplace competitiveness of advanced nuclear energy. Because containment systems can be a significant cost driver, the focus of this project is on the PDCs related to containment requirements.

The 2011 University of Chicago SMR cost study estimated the cost of containment at 55% of the plant structures cost. Accurately defining the design criteria for a lead-bismuth primary coolant containment structure is expected to substantially reduce the design requirements for the containment, reducing plant construction costs and inspection costs during operations.

This work by Columbia Basin Consulting Group with Pacific Northwest National Laboratory will allow the passive and inherent safety features of an advanced reactor core and primary system to be effectively accounted for in meeting containment system PDCs. While this project will be for a lead bismuth-cooled fast reactor, the principles developed for meeting containment system PDCs are expected to have value for other advanced reactor concepts. Ultimately, this analysis will contribute substantially to the development of cost-competitive nuclear energy systems through cost reduction in the design and construction of containment systems.