REVIEW OF TECHNICAL STUDIES IN THE UNITED STATES IN SUPPORT OF BURNUP CREDIT REGULATORY GUIDANCE

John C. Wagner, Cecil V. Parks, Don E. Mueller, Ian Gauld

Oak Ridge National Laboratory[*]
Nuclear Science and Technology Division
P.O. Box 2008, Bldg. 5700
Oak Ridge, Tennessee 37831-6170, USA
E-mail: wagnerjc@ornl.gov

Abstract - Taking credit for the reduction in reactivity associated with fuel depletion can enable more cost-effective, higher-density storage, transport, disposal and reprocessing of spent nuclear fuel (SNF) while maintaining a sufficient subcritical margin to establish an adequate safety basis. Consequently, there continues to be considerable interest in the United States, as well as internationally, in the increased use of burnup credit in SNF operations, particularly related to storage, transport and disposal of commercial SNF. This interest has motivated numerous technical studies related to the application of burnup credit, both domestically and internationally, as well as the design of SNF storage, transport and disposal systems that rely on burnup credit for maintaining subcriticality. Responding to industry requests and needs, the U.S. Nuclear Regulatory Commission (NRC) initiated a burnup credit research program in 1999, with support from the Oak Ridge National Laboratory (ORNL), to develop regulatory guidance and the supporting technical bases for allowing and expanding the use of burnup credit in pressurized-water reactor SNF storage and transport applications. Although this NRC research program has not been continuous during the past ten years, considerable progress has been achieved in many key areas in terms of increased understanding of relevant phenomena and issues, availability of relevant information and data, and subsequently updated regulatory guidance. This paper will review the technical studies performed by ORNL for the U.S. NRC burnup credit research program. Examples of topics that will be addressed include: reactivity effects associated with reactor operating characteristics, fuel assembly characteristics, burnable absorbers, control rods, spatial burnup distributions, cooling time and assembly misloading; methods and data for validation of isotopic composition predictions; methods and data for validation of criticality calculations; and operational issues and data related to assembly burnup confirmation. The objective of this paper is to provide a summary of the work and significant accomplishments, with references to the technical reports and publications for complete details, that will be a useful resource to others in the burnup credit community.

[*] Managed by UT-Battelle, LLC, for the U.S. Department of Energy under contract No. DE-AC05-00OR22725.