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Computational Capability to Substantiate DOE-HDBK-3010 Data

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Safety basis analysts throughout the U.S. Department of Energy (DOE) complex rely heavily on the information provided in the DOE Handbook, DOE-HDBK-3010, Airborne Release Fractions/Rates and Respirable Fractions for Nonreactor Nuclear Facilities, to aide in determining radionuclide source terms from postulated accident scenarios. In calculating source terms, analysts tend to use the DOE Handbook's bounding values on airborne release fractions (ARFs) and respirable fractions (RFs) for various categories of insults (representing potential accident release categories). The reliance on these bounding values is typically due to both time constraints and the avoidance of regulatory critique. Unfortunately, these bounding ARFs/RFs may represent extremely conservative values. Moreover, they were derived from very limited small-scale bench/laboratory experiments conducted decades ago and/or from engineered judgment. Thus, the basis for the data may not be representative of the actual unique accident conditions and configurations being evaluated.

The goal of this multiyear research is to develop a more accurate and defensible method to determine bounding values for the DOE Handbook using state-of-art multi-physics-based computer codes from Sandia National Laboratories. This enables us to better understand the fundamental physics and phenomena associated with the types of accidents in the Handbook. With support from the Nuclear Safety Research and Development Program (NSR&D) from the U.S. Department of Energy's Office of Nuclear Safety (AU-30), this research project is currently in its fourth year of efforts. In this paper, we summarize our accomplishment throughout the past three years of the research, and the current progress in our fourth year.

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