



Project Title

Pre-Application Licensing Report on the Development of a Mechanistic Source Term Methodology for the Kairos Power Fluoride Cooled High Temperature Reactor (KP-FHR)

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Collaborators: None

Program: Advanced Reactor Technologies

ABSTRACT:

Project Objectives: Develop and document a methodology for establishing the mechanistic radiological source terms of the Kairos Power fluoride cooled, high temperature reactor (KP-FHR) in preparation for obtaining NRC review and evaluation during the pre-application licensing phase of the KP-FHR development.

Description of the Project: Kairos Power is developing a generation IV advanced reactor technology for deployment in the US. The technology is based, in part, on University of California, Berkeley, and DOE-sponsored university Integrated Research Projects (IRPs) for fluoride cooled, high temperature reactors. The design uses a form of the high-temperature graphite matrix coated TRISO particle fuel developed for gas reactors along with a low-pressure, chemically stable, molten fluoride salt mixture for the primary coolant. A key measure of safety for advanced reactor designs is the magnitude of the potential radiological source term, which refers to the types and amounts of radioactive material postulated to be released to the environment, resulting in dose to a member of the public following a credible event. Work performed by the Idaho National Laboratory in support of the Next Generation Nuclear Program (NGNP) indicated the source term for TRISO based fuels is significantly less than traditional fuels. Source terms are directly used in calculations of potential radiological consequences for licensing basis events.

To take advantage of the inherent safety benefits provided by TRISO based fuels and ongoing DOE sponsored development work for advanced reactors (such as the licensing modernization project [LMP] and safety analysis modeling/simulation code development activities), Kairos Power intends to develop a mechanistic approach to determining the source term for the KP-FHR design for ultimate use in future licensing basis analyses that implement the LMP process. The source term methodology development will include considerations of the radionuclides generated and transported in the fuel particle and the barriers to release to be credited in related licensing basis event analyses. The methodology will also consider the evaluation models and analytical codes which simulate source term calculations. However, development, verification, and validation of analytical models and analysis tools, and their use in licensing basis event analyses, are companion activities outside the scope of this proposed project. The mechanistic source term methodology approach will be documented in a licensing report for NRC review and evaluation as part of pre-application licensing activities associated with KP-FHR deployment.

A significant uncertainty in advanced reactor licensing is the acceptability of the methodology and required data for consequence analysis. The desired outcome of this development activity is the submittal of a report that ultimately leads to an NRC-approved source term methodology that may be used, along with companion licensing reports, by applicants for licensing a KP-FHR. The documentation of the NRC evaluation should identify any limitations or considerations on the use of the methodology for future license applications and reduce uncertainty in future licensing activities. The NRC review is not within the scope of this activity. The duration of this activity is anticipated to be 8 months.