

# PUBLIC SUBMISSION

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**Comment On:** NRC-2021-0193-0003

Notice of Intent To Conduct Scoping Process and Prepare Environmental Impact Statement; Kairos Energy, LLC, Kairos Test Reactor

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## General Comment

See attached file(s)

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## Attachments

Kairos Hermes Reactor Environmental Scoping Comments

## Kairos Hermes Reactor Environmental Scoping Comments: April 19, 2022

The Environmental Report (ER) and Preliminary Safety Analysis Report (PSAR) for the proposed Kairos Hermes reactor project in Oak Ridge, Tennessee fail miserably to accomplish the Nuclear Regulatory Commission's (NRC) mission and stated purpose of protecting the public and the environment from potential harm caused by nuclear energy projects.

The reports blindly and prematurely validate safety claims being made by Kairos about the inherent safety of the design. The use of the term "postulated events" instead of "accidents" (Section 3.1.1) is suspect as an attempted semantic neutralization of perceived risks. In fact, the Hermes reactor is a one quarter size experimental test reactor being built solely to validate many theoretical claims.

The reliance of "functional containment" instead of robust, leak-resistant physical containment is a major concern and should be rejected by the NRC. The proposed functional containment relies on the fuel balls themselves to contain the radiation created by fission. Stretching the point, further containment credit is given to the liquid fluoride coolant while the fuel is covered with it in the reactor vessel.

The PSAR is riddled with unchallenged and unproven assumptions like this one in Section 3.1.1: "failure of the reactor vessel is a beyond design basis event as the vessel is designed against such failure." And: "The TRISO fuel layers of fuel in the reactor core and the Flibe are credited with the radionuclide retention properties described in Reference 1. For the Flibe to maintain the retention properties described in Reference 1, the integrity of the portion of the reactor vessel that ensures the pebbles in the reactor core remain covered by Flibe is credited with maintaining integrity under MHA conditions." (13.1.1.2)

The PSAR and the ER do not address the possibility of failure of the reactor vessel which would likely result in release of dangerous amounts of radiation. The “functional containment” would disappear in the blink of an eye and all the radiation within the TRISO fuel would be released if their maximum temperature of 1600 degrees Celsius is exceeded. Since the irradiated fuel is set to be stored in the reactor building a serious fire might compromise the integrity of that storage, each canister is set to have 2100 fuel balls. Storage capacity is 192 canisters. Burnup levels will be quite high so there will be an enormous amount of radiation stored and possibly at risk. This would likely cause the release of much other radiation in the reactor area.

A disaster like the devastating accidents at Three Mile Island, Chernobyl and Fukushima is not considered by the ER and PSAR. It is a fundamental failure to continue to ignore true worst-case scenarios when licensing new nuclear reactors. The bureaucratic slight of hand that manages to avoid having to consider the worst possible effects on the public and the environment puts Tennesseans at unacceptable risk.

The Hermes design is a new combination of HALEU (high assay low enriched uranium) TRISO fuel pellets enriched to almost 20 percent with liquid fluoride salt cooling (Flibe). There will be around 36,000 fuel balls floating in the cooling liquid. Operating temperatures are designed to be quite high, 600 to 700 degrees centigrade at the coolant outlet. The Flibe coolant contains poisonous beryllium and will present many engineering challenges at those temperatures. This novel design creates many issues, known and unknown. The PSAR (Section 1.3.9) list of areas of research for this design include: fuel pebble behavior, high temperature testing on reactor vessel and internals, graphite oxidation, develop and validate computer codes for core design, develop reactor coolant chemical monitoring instrumentation.

There are also concerns about maintaining the Flibe coolant's liquidity during shutdown or in a scram since it will freeze at 450 degrees C.

The Nuclear Regulatory Commission needs to verify any assumptions of "inherent safety" very carefully and require robust containment surrounding this experimental reactor.

Don Safer