Kairos Power

OVERVIEW OF KAIROS POWER AND THE KP-FHR LICENSING MODERNIZATION PROJECT DEMONSTRATION

REGULATORY INFORMATION CONFERENCE, MARCH 10-12, 2020

Kairos Power’s mission is to enable the world’s transition to clean energy, with the ultimate goal of dramatically improving people’s quality of life while protecting the environment.

Outline

- Overview of Kairos Power and KP-FHR
- KP-FHR LMP Demonstration
- Next Steps

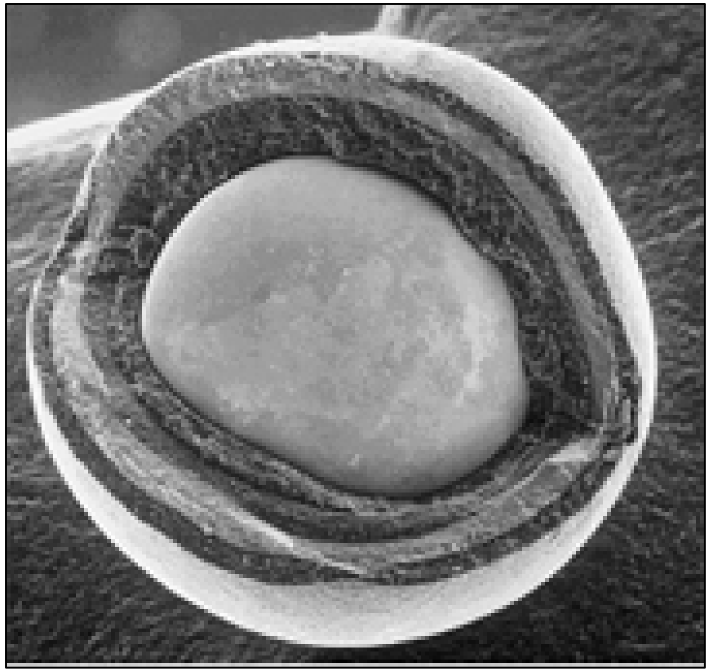
Overview of Kairos Power

- Privately funded nuclear energy engineering and design company focused on the ***commercialization*** of the fluoride salt-cooled high temperature reactor (FHR)
  - Founded in 2016
  - Based in San Francisco Bay Area
  - Builds on UC Berkeley Concept Development and R&D
  - ~120 full-time employees (***and growing***) selected from diverse industries
- Development schedule driven by US demonstration by 2030 (***or earlier***) and rapid deployment ramp in 2030s
- Leverages technology from past advanced reactor designs, coupled together to provide a competitive design

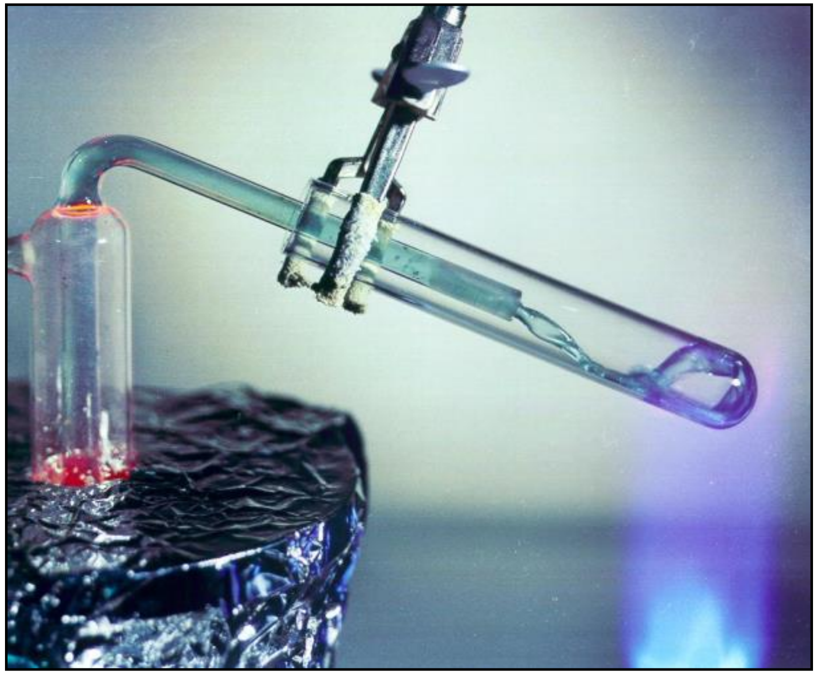
Kairos Power Headquarters
Alameda, CA

Fluoride Salt-Cooled High-Temperature Reactor (FHR) Technology Basis

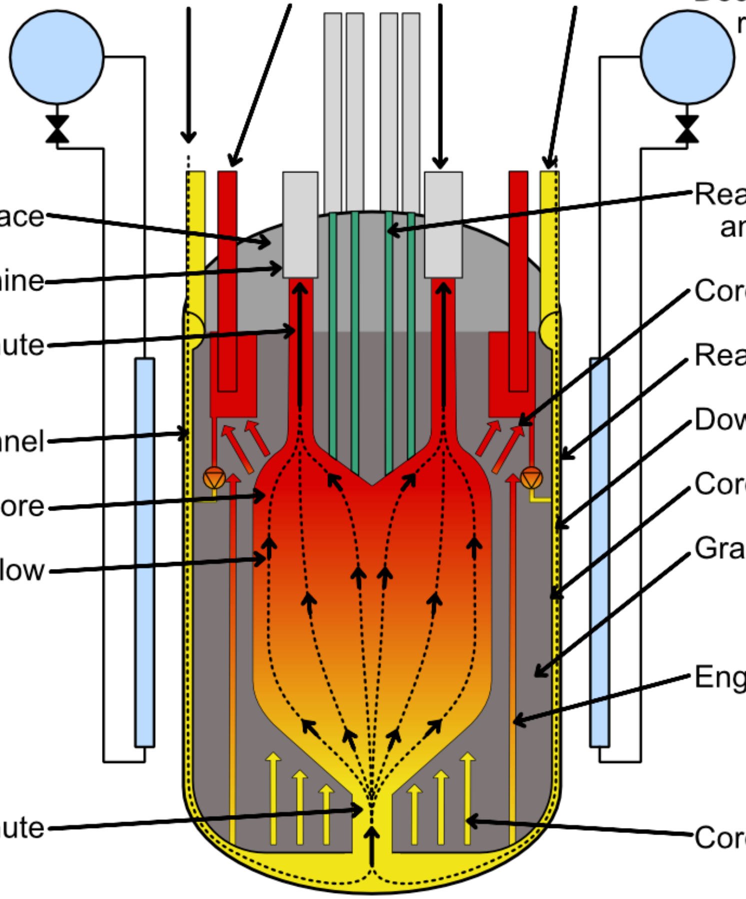
Coated Particle Fuel
TRISO



Liquid Fluoride Salt Coolant
Flibe ($2LiF\text{-}BeF_2$)



Reactor Systems - Core Configuration & Reactor Vessel



Highlights

- Pebble bed fuel, salt coolant, and graphite structures provide large thermal inertia, slow transient response, and ensure that design limits are not exceeded
- Graphite reflector designed to match the vessel service lifetime

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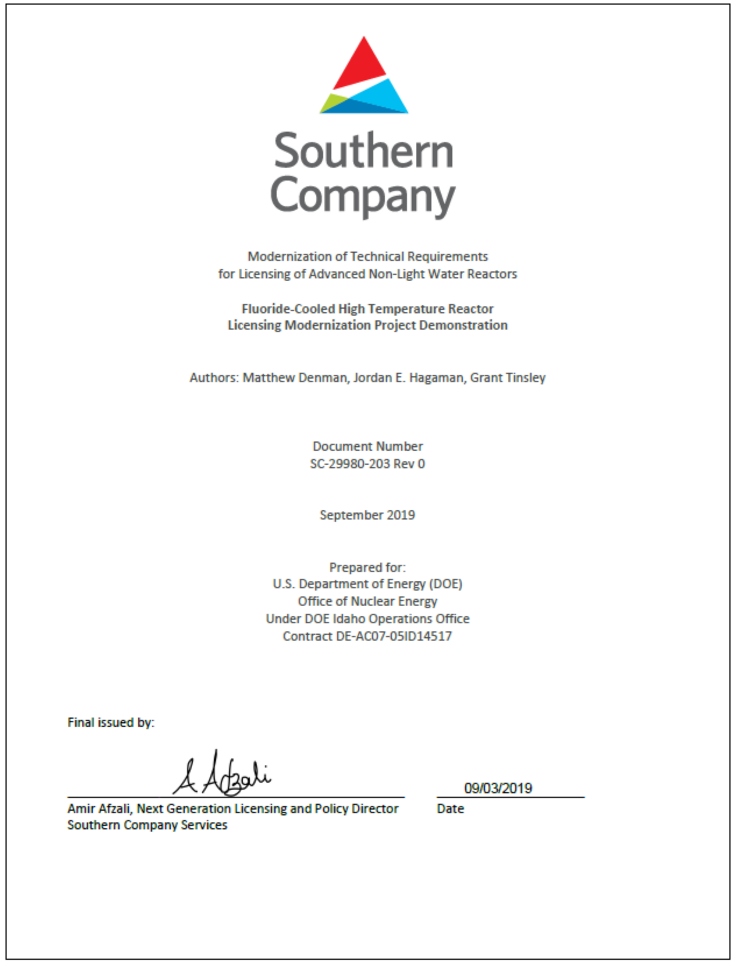
KP-FHR Demonstration of LMP



Southern Company

Modernization of Technical Requirements
for Licensing of Advanced Non-Light Water Reactors

Fluoride-Cooled High Temperature Reactor
Licensing Modernization Project Demonstration

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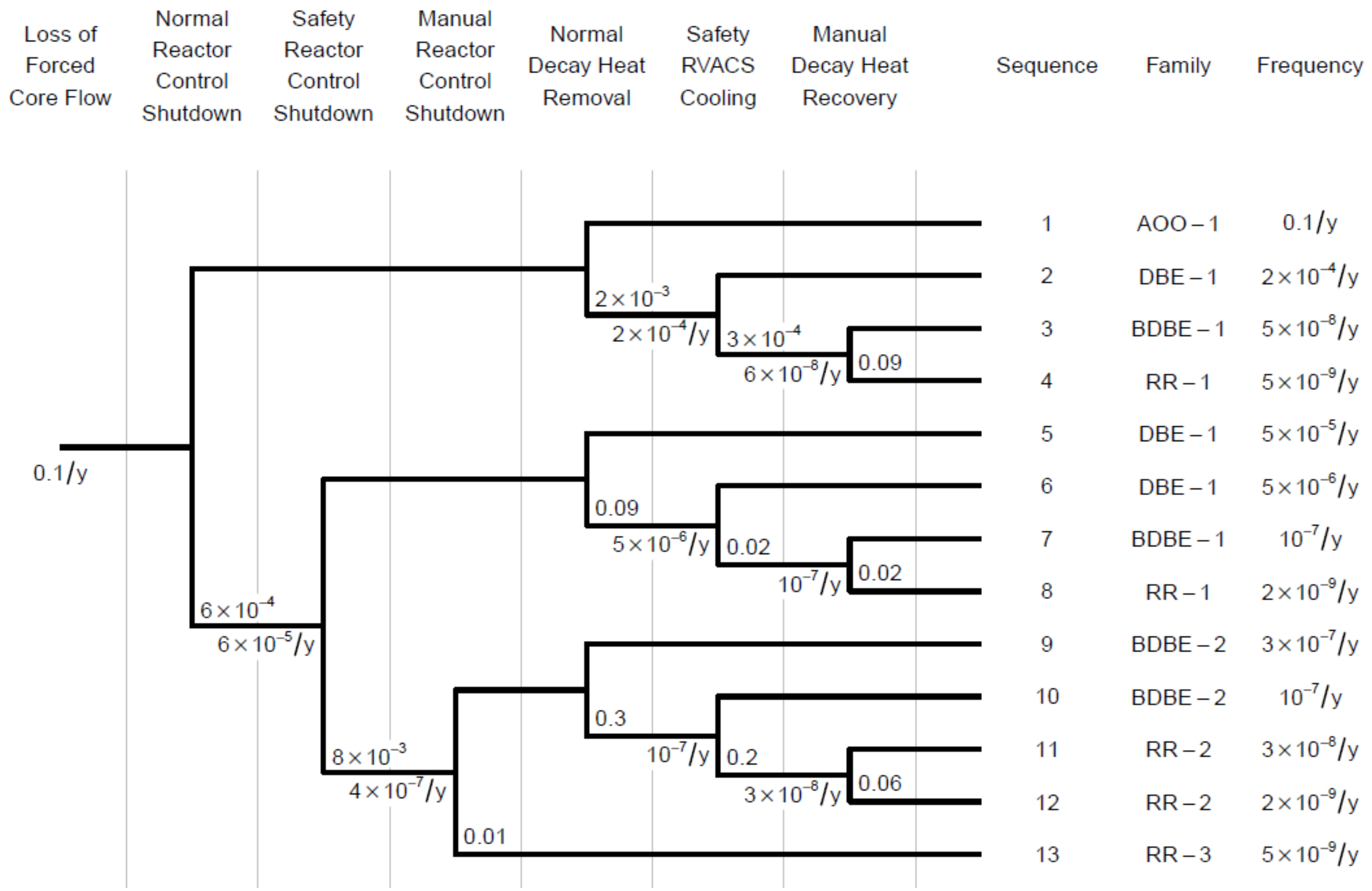
Amir Afzali, Next Generation Licensing and Policy Director
Southern Company Services

09/03/2019
Date

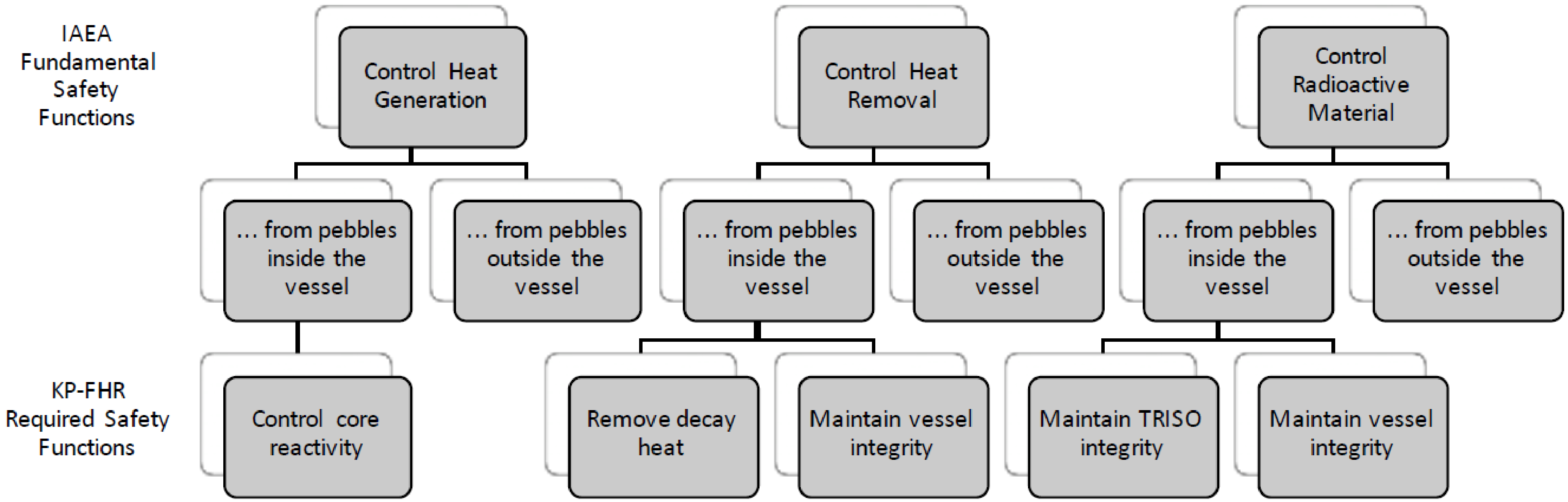
- Purpose - Exercise key tasks from NEI 18-04 to demonstrate the applicability of the LMP methodology to the KP-FHR.
- KP-FHR pre-conceptual design inputs and early PRA
- Scope limited to a loss of flow event
- Insights expected to be useful to future users of the guidance in NEI 18-04.

Licensing Basis Event Identification



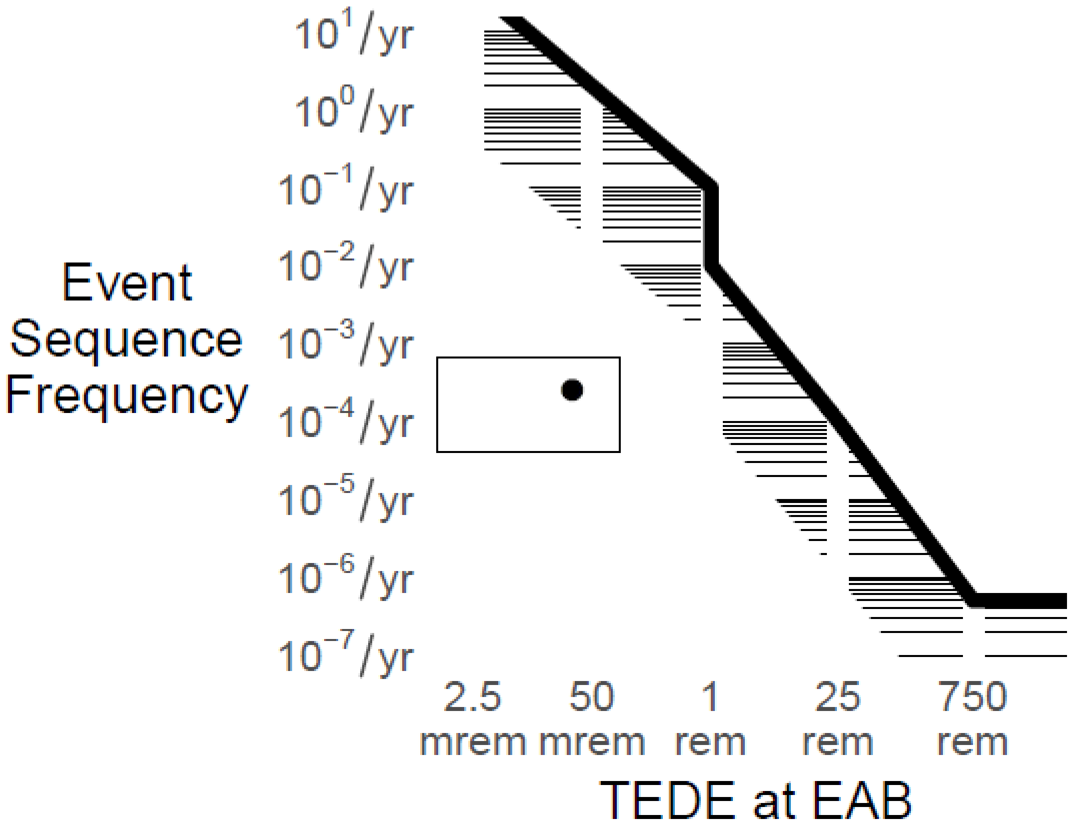
Note that the frequencies and event progressions used in table top, and shown here, are for illustration and do not reflect final design or analysis of the KP-FHR.

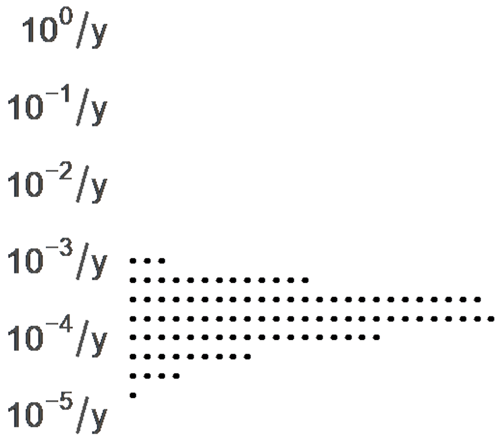
Identifying Required Safety Functions



Note that the required safety functions identified in table top, and shown here, are for illustration and should not be considered final.

Evaluate LBE Against F-C Target – DBE Example





Note that the frequency and consequence values used in table top, and shown here, are for illustration and do not reflect final design or analysis of the KP-FHR.

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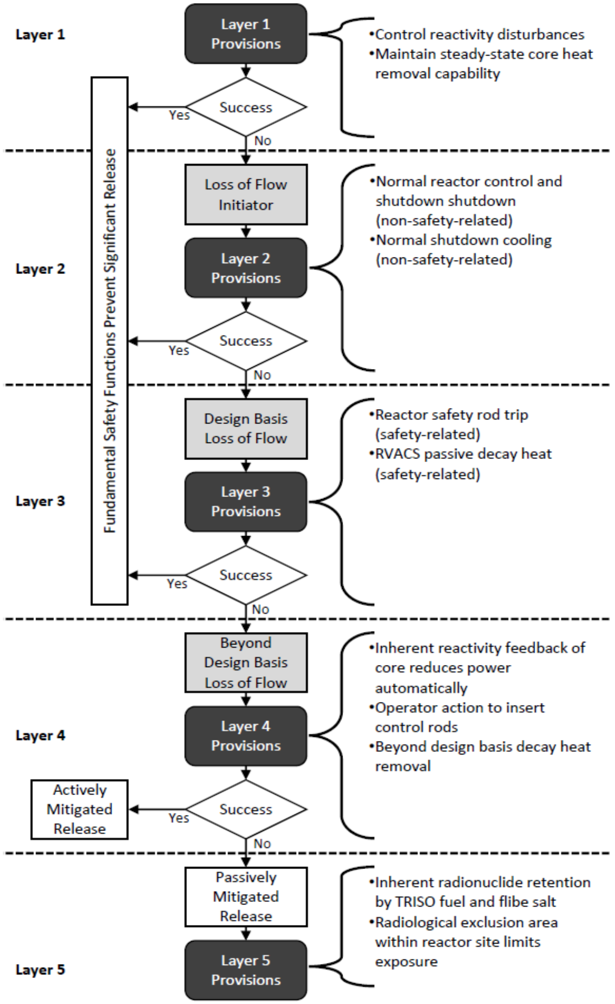
Defense In Depth



Layer	Quantitative	Qualitative
1) Prevent off-normal operation and anticipated events	Maintain frequency of plant transients within design cycles	Meet owner requirements for plant availability
2) Control anticipated events and prevent design basis events	Maintain frequency of design basis events below 10^{-2}/yr	Minimize frequency of challenges to safety-related equipment
3) Control design basis events and prevent beyond design basis events	Maintain frequency of beyond design basis events below 10^{-4}/yr	No single design or operational feature relied upon to meet quantitative objective for all design basis events
4) and 5) Control beyond design basis conditions and prevent adverse impact on public health and safety	Maintain plant risks below health targets with sufficient margins	No single barrier or plant feature relied upon to limit releases for beyond design basis events

Note that the SSCs and layers of defense identified in table top, and shown here, are for illustration and do not reflect final design or analysis of the KP-FHR.

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Next Steps

- KP-TR-009-NP, KP-FHR Risk-Informed, Performance-Based Licensing Basis Methodology Topical Report – Submitted to NRC April 2019
- Non-LWR PRA Standard – Targeting Standard Ballot Later This Year
- Expect More Mature Exercise of the LMP Process to be Demonstrated in Preliminary Safety Information Document Which is Targeted for Submittal at End of 2020

Questions