Enclosure 1

Presentation Materials for Kairos Power Pre-Submittal Meeting on Setpoint Methodology Topical Report

(Note that the enclosed information is preliminary and pre-decisional and is subject to change during detailed planning and project execution. It is provided for planning and familiarization purposes in support of pre-application discussions with the NRC Staff.)

Kairos Power

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KAIROS POWER INSTRUMENT SETPOINT METHODOLOGY TOPICAL REPORT

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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.

In order to achieve this mission, we must prioritize our efforts to focus on a clean energy technology that is *affordable* and *safe*.

Kairos Power Instrument Setpoint Methodology

The Kairos Power FHR (KP-FHR) Instrument Setpoint Methodology Topical Report

- Follows guidance in ANSI/ISA-67.04.01-2018, “Setpoints for Nuclear Safety-Related Instrumentation,” as endorsed by Regulatory Guide 1.105, Revision 4
- Considers recommended practices described in ISA RP67.04.02-2010, “Methodologies for the Determination of Setpoints for Nuclear Safety-Related Instrumentation”
- Applies to Safety-Related Instrument Setpoints for Non-Power Test and Commercial Power KP-FHRs licensed under 10 CFR 50 or 10 CFR 52
- Kairos Power is requesting NRC review and approval of the instrument setpoint methodology to the support meeting requirements of 10 CFR 50.34(b)(2) or similar requirements of 10 CFR 52, 10 CFR 50.36(c)(1)(ii)(A), and 10 CFR 50.36(c)(3)

Kairos Power Instrument Setpoint Methodology

The Kairos Power FHR (KP-FHR) Instrument Setpoint Methodology Topical Report contains the following major sections:

- Introduction including KP-FHR design features, regulatory requirements and guidance, and industry standards and guidance
- Uncertainties including characterizing and combining uncertainties, sources of uncertainties, and calculating instrument uncertainties
- Establishment of Setpoints including determining relationships between limits and setpoints, determining instrument channel setpoints, calculating trip setpoints, and calculating performance testing acceptance criteria

Instrument Setpoint Methodology Guidance (1/3)

The KP-FHR Instrument Setpoint Methodology includes guidance to:

- Characterize types of uncertainties
  - Random
  - Bias
  - Abnormally distributed
- Identify sources of uncertainties
  - Process Measurement Effects - process temperature effects, fluid density effects, system configuration effects, line pressure loss/head pressure effects
  - Instrument Uncertainties - primary element accuracy, reference accuracy, temperature effects, pressure effects, drift, power supply variations, digital signal processing, accident environmental effects, calibration uncertainty
  - Other Uncertainty Effects - insulation resistance effects
- Calculate Instrument Uncertainties
  - Square-Root-Sum-of-the-Squares used to combine random, independent uncertainties
  - Arithmetic summation used to combine uncertainties that are dependent, not random, or not normally distributed

Instrument Setpoint Methodology Guidance (2/3)

The KP-FHR Instrument Setpoint Methodology includes guidance to:

- Describe the relationship between:
  - Safety Limit
  - Analytical Limit
  - Limiting Trip Setpoint (Limiting Safety System Settings)
  - Nominal Trip Setpoint
- Perform Instrument Loop Analysis
  - Identify major portions of the instrument loop
  - Identify the functional requirements, actuation functions, operating times, and postulated environments
  - Identify uncertainties that are present in each portion of the loop
- Calculate Total Loop Uncertainty
  - Maximum positive and negative Total Loop Uncertainties are calculated

Instrument Setpoint Methodology Guidance (3/3)

The KP-FHR Instrument Setpoint Methodology includes guidance to:

- Calculate Trip Setpoints
  - The Total Loop Uncertainty represents an allowance between the Limiting Trip Setpoint and the Analytical Limit to accommodate expected performance of the instrumentation under applicable process and environmental conditions
  - The Nominal Trip Setpoint may incorporate additional discretionary margin to the Limiting Trip Setpoint but should not result in spurious trips or actuations due to transients that may occur during normal operations
- Establish Performance Testing Acceptance Criteria
  - Performance Testing Acceptance Criteria are established to verify setpoint performance based on expected instrument performance under test conditions
    - The acceptance criteria are calculated by applying as-found tolerances to the Nominal Trip Setpoints
  - Performance Testing also require equipment being tested be left within an as-left tolerance at the conclusion of calibration or testing
    - The as-left tolerance is applied around the Nominal Trip Setpoint

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