INL USQ PROCESS
REASONABILITY DETERMINATION/POTENTIAL INADEQUACY IN THE SAFETY ANALYSIS (PISA) FORM
(DO NOT USE FOR PROPOSED CHANGES)

Facility or Activity: ATR

USQ Process No.: ~~ATR-2010~~ 2012-10-10 ATR Complex-USQ-2010-108

Subject: Adequacy of the Water Power Calculator

Describe the New Information/Discovery:

The on-going Water Power Calculator (WPC) Upgrade Project (#30013) plans a permanent replacement of the existing WPC subsystem. That effort required a revision to EDF-5465, *ATR Water Power Calculator Instrument Uncertainty Analysis*. Efforts to determine the uncertainty of the replacement WPC identified a number of issues related to the adequacy of the existing WPC design and activities related to maintaining the WPC within assumptions of the ATR Safety Analysis.

TSR-186 LCO 3.3.1.1 requires the WPC to have an "output within 3.5 MW of the Calibration Standard". These words are open to multiple interpretations. An argument can be made that the intent of the TSR is that measureable uncertainties of the WPC will be less than 3.5 MW and existing calculations demonstrate that the WPC does meet this requirement. An explicit basis for the 3.5 MW could not be identified but TRA-ATR-1211, Rev. 1, *Advanced Test Reactor Lobe Power Uncertainty* does identify an historical bias between WPC1 and WPC2 of 1.4% or 3.5 MW.

Reviews of previous uncertainty analyses identified that revision 0 of EDF-5465 and TRA-ATR-1211 did not include all applicable process measurement effects as described in ANSI/ISA-67.04.01-2000, *Setpoints for Nuclear Safety-Related Instrumentation*. When the process measurement effects (which are not measurable) are included in the instrument uncertainty the total uncertainty may exceed the 3.5 MW requirement.

TSR-186 Bases for LCO 3.3.1.1 identifies that the total core power is assumed to be not more than 250 MW for the loss of the heat sink event. Although a high temperature scram will protect the fuel elements, power must be limited to ensure PCS component temperatures remain within design values. SAR-153 Chapter 15.2.1.2.1 provides specific details of this analysis.

Identify the applicable safety basis document(s) (e. g., DSA, SAR, BIO, TSRs, etc.):
SAR-153
TSR-186

I. **REASONABILITY DETERMINATION (Reasonability determinations made as part of the ATR Design Basis Reconstitution effort may be documented per SP-10.2.4.9)**

Is it reasonable that the potential for an inadequate safety analysis exists based on the new information or discovery described above? ☐ Yes ☒ No

If "Yes," proceed to Sections II, III, and IV.
If "No," provide an explanation and basis for the reasonability determination.

The Advanced Test Reactor (ATR) Safety Analysis Report (SAR) section 4.3.2.2.8 notes that there are two water power calculators (WPC) that monitor the core power derived from the flow rate and temperature rise across the core. The water power calculators determine the total core and quadrant water (thermal) power. The WPC is important to operation of the plant in that it provides a method for plant operators to monitor thermal power.

As noted above, reviews of previous uncertainty analyses identified that revision 0 of EDF-5465

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and TRA-ATR-1211 did not include all applicable process measurement effects as described in ANSI/ISA-67.04.01-2000, *Setpoints for Nuclear Safety-Related Instrumentation,* which were not in effect at the time of ATR's initial analysis and operation. These new uncertainties include:

- Inherent process effects
- Potential changes in values of RTD uncertainty

To ensure that the core is operated within the analyzed envelope the TSR requires in section 3.3.1.1 that:

Reactor power shall:

a. Not exceed an average of 250 MW with at least one OPERABLE Water Power Calculator.

b. Have output within 3.5 MW of the calibration standard.

The LCO requirements are implemented through surveillance requirements:

4.3.1.1.1 Verify average reactor power is ≤ 250 MW

Should reactor power exceed 250 MW operators are required to reduce power below 250 in less than an hour. If power should exceed 262 MW the reactor is required to be manually SCRAMED

4.3.1.1.2 Verify CALIBRATION of Water Power Calculators Annually within LCO limits.

Surveillance Requirement 4.3.1.1.2 ensures the WPC is calibrated within the LCO limits of 3.5MW of the calibration standard. The definition of a calibration standard is not specifically provided in the TSR or SAR and the concept of a "power standard" is not realistic. ATR implements the surveillance requirement in procedures DOP 2.7.40 and 2.7.42. Combined, these two procedures apply a differential pressure to the DP flow transmitters and verify proper flow channel calibration; and apply a resistance to the temperature inputs of the WPC to verify proper temperature channel calibration. In addition a digital source is applied to the WPC and correct outputs are verified. The TSR bases also notes that the calibration of the WPC does not include the resistance temperature detectors or the flow orifices. As such the calibration of the electronic components in the WPC meets the 3.5MW requirement.

Although there may be new uncertainties in the WPC , existing analyses indicate that the Water Power Calculator performs within the 3.5 MW measurable uncertainty of TSR-186 3.3.1.1. Present reviews of existing analyses and new analyses being performed under the WPC

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Upgrade Project which factor all identified sources of uncertainty, continue to indicate that the total power uncertainty does not exceed the 3.5 MW requirement. Therefore, this PISA reasonability determination documents the discovery of additional sources of uncertainty, the evaluation of these uncertainties, and the conclusion that the total uncertainty in total water power remains within applicable limits, all in the context of preliminary additional analyses.

D McDaniel / G Matranga		2/8/10 2/8/10
USQ Evaluator Print/Type Name	USQ Evaluator Signature	Date
E. Schuebat		2/8/10
Nuclear Facility Manager Print/Type Name	Nuclear Facility Manager Signature	Date

If the answer to the question above is "No," file the completed form. Do not complete Section II, III, or IV.

If the answer to the question above is "Yes," complete Section II, III, and IV.

II. PISA DECLARATION

What is the basis for concern that the safety basis may not be bounding or may be otherwise inadequate? Provide an explanation.

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A PISA exists. Complete the following actions

- Nuclear Facility Manager document actions (below) including interim operating restrictions taken to place or maintain the facility in a safe condition.
- Nuclear Facility Manager execute reporting process for PISA per LWP-9301 and LWP-13830.
- Qualified USQ evaluator proceed to Section III.

ACTIONS TAKEN TO PLACE OR MAINTAIN FACILITY IN A SAFE CONDITION AND THE BASIS FOR THE SELECTION OF ANY INTERIM CONTROLS.

Safety Analyst Print/Type Name	Safety Analyst Signature	Date
Nuclear Facility Manager Print/Type Name	Nuclear Facility Manager Signature	Date

Is independent technical review required? Yes ☐ No ☐