

From: Zackary Stone
Sent: Tuesday, March 14, 2023 2:45 PM
To: Rusty Towell; Lester Towell; Jordan Robison; Tim Head
Cc: Edward Helvenston; Richard Rivera; Zackary Stone; Michael Wentzel; Greg Oberson (He/Him); Calvin Cheung; Joseph Ashcraft
Subject: Abilene Christian University - Audit Questions Regarding ACU CP Chapter 7
Attachments: Audit Questions Regarding Chapter 7 Instrumentation & Control Systems.pdf

Dear Dr. Towell,

Attached is a list of questions the NRC staff has prepared for Abilene Christian University (ACU) related to the ACU Preliminary Safety Analysis Report, Chapter 7, "Instrumentation and Control Systems." The NRC staff would like to discuss these questions within the scope of the ACU CP Review Audit Plan for Chapter 7 (see audit plan dated 3/2/2023, ML23065A051), and I am providing these in advance to facilitate discussion during an audit meeting. Once ACU is ready to discuss, please let us know and we can set up an audit meeting. We will add this e-mail, with questions, to public ADAMS. If you have any questions, please let Edward, Richard, or I know.

Thank you,

Zackary Stone, Project Manger
Advanced Reactor Licensing Branch 2
Division of Advanced Reactors and Non-Power
Production and Utilization Facilities
Office of Nuclear Reactor Regulation

Docket No. 50-610

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Audit Questions – Chapter 7, Instrumentation & Control Systems

Audit Plan: [ML23065A051](#)

Chapter 7, Section 7.2, “Design of Instrumentation and Control Systems”

<u>Item #</u>	<u>Reviewer(s)</u>	<u>Date Sent to ACU</u>	<u>PSAR Chapter or Topic</u>	<u>Question</u>
7.2-1	C. Cheung	3/14/2023	7.2	<p>ACU provided an overall instrumentation and control (I&C) architecture drawing (Figure 1) in response to NRC’s request for supplemental information (RSI). The NRC staff requests the following clarification/information:</p> <ol style="list-style-type: none"> Does the “DCS” envelope the entire upper box as shown? RSI Section 1.2.3, Response to RSI 1.c states, “Communication isolation between NSR and SR systems is accomplished by isolating individual subsystems on separate communication buses.” The NRC staff requests additional detail to support this statement. Specifically: <ol style="list-style-type: none"> What is the safety classification of the facility data bus? RCS non-safety data bus shows bidirectional communication to the facility data bus and without isolation. Facility data bus shows bidirectional communication to the Safety Data Bus and without isolation. Please describe what communication is occurring. Are there additional isolation devices, as there is a sole data diode depicted? The NRC staff requests details, including basic logic, for the bottom two blocks with “Reactor Trip Breakers” and “ESF Breakers,” as it is unclear to the NRC staff what these blocks represent. <ol style="list-style-type: none"> Are they headers to the items below? Do all components listed in each block initiate simultaneously? How does the manual trip/initiation interface with this? What are the initiating signals for a draining the fuel salt (i.e. SCRAM) and how are they logically connected to de-energize the equalization valves? Please describe the heater power disconnects. Please describe the gas pressure isolation. Please describe the PSAR, Section 4.2.5.3, Figure 4.2-1 and if any of the components listed in these bottom two blocks are represented.
7.2-2	C. Cheung	3/14/2023	7.2	<p>RSI Section 2.2.1, Response to RSI 2.a, states, “The initiation of the ESFAS always triggers the RPS.” The NRC staff requests additional information/details on how this happens.</p>

Audit Questions – Chapter 7, Instrumentation & Control Systems

7.2-3	C. Cheung	3/14/2023	7.2	RSI Section 2.2.1, Response to RSI 2.a states, “A loss of SR RMS detectors will trigger a SCRAM, potentially after a time delay.” The NRC staff requests the following clarifications: I. What RMS detectors are safety related? II. What is the purpose of the time delay and what factors are considered that would necessitate a time delay?
7.2-4	C. Cheung	3/14/2023	7.2	RSI Section 2.2.1, Response to RSI 2.a states, “As the ESFAS can potentially initiate based on readings from the RMS....” The NRC staff notes that based on PSAR Section 7.5, “ESFAS activates upon detection of fission products...by sensors from the RMS.” No other information indicates other initiating inputs besides from the RMS. The NRC staff requests clarification on what else initiates ESFAS and when would it not initiate based on RMS.
7.2-5	C. Cheung	3/14/2023	7.2	RSI Section 2.2.1, Response to RSI 2.a states that the “Triggering Value” on Table 1 for “Loss of RMS or Components” is TBD. The NRC staff requests clarification on what is still being determined.

Chapter 7, Section 7.4, “Reactor Protection System”

<u>Item #</u>	<u>Reviewer(s)</u>	<u>Date Sent to ACU</u>	<u>PSAR Chapter or Topic</u>	<u>Question</u>
7.4-1	C. Cheung	3/14/2023	7.4	PSAR Section 7.4.1 identified the design bases and design criteria for the reactor protection function. Please clarify if the intent is to have PDC 13 applicable to Section 7.4. If not, provide justification as to why PDC 13 is not applicable for the RPS to address safety-related sensors and range requirements.
7.4-2	C. Cheung	3/14/2023	7.4	In PSAR Section 7.4, no logic, schematic, and circuit diagrams are provided, and the descriptions provided are not sufficient for the NRC staff to understand how the signals provide safety trips. The NRC staff requests that ACU provide additional information to explain how the signals provide safety trips.
7.4-3	C. Cheung	3/14/2023	7.4	As stated in Response to RSI 1.c, and in consideration of criteria found in IEEE Standard 603-2018 and IEEE 7-4.3.2-2003, the DCS shall be such that communication between NSR and SR systems is regulated appropriately. The NRC staff requests that ACU describes the communication and how it is regulated as shown on RSI Figure 1, for the communication between the facility data bus and safety data bus.
7.4-4	C. Cheung	3/14/2023	7.4	The NRC staff requests that ACU identifies valves and lines shown in the PSAR, Section 4.2.5.3, Figure 4.2-1 as it relates to PSAR Section 7.4
7.4-5	C. Cheung	3/14/2023	7.4	It is unclear to the NRC staff on how loss of power is detected for drain valves and louvers in PSAR Section 7.5. Please provide an explanation and a description on what is actually detected (loss of voltage, loss of frequency, or both, time delay). Additionally, explain if loss of power is detected at the same place for RPS and ESFAS.

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Chapter 7, Section 7.5, “Engineered Safety Features Actuation System”

<u>Item #</u>	<u>Reviewer(s)</u>	<u>Date Sent to ACU</u>	<u>PSAR Chapter or Topic</u>	<u>Question</u>
7.5-1	C. Cheung	3/14/2023	7.5	<p>PSAR Section 7.5.1 identified the design bases and design criteria applicable to ESFAS. ESFAS should be designed to assume a safe state on loss of electrical power. Based on RSI Section 2.2.3, Response to RSI 2.c, the louvers and valves seal on loss of power.</p> <p>Please clarify if the intent to have PDC 23 applicable to Section 7.5. If not, provide justification as to why PDC 23 is not applicable.</p>
7.5-2	C. Cheung	3/14/2023	7.5	<p>As stated in PSAR Section 7.5.2, the ESFAS triggers the reactor enclosure isolation system to place the enclosure in its passively safe, low-leakage configuration. The NRC staff requests the following clarification/information:</p> <ol style="list-style-type: none"> a. Details on what components make up the reactor enclosure isolation system. Are the following items part of this system, and are these different components? If the same, consistent language should be used. <ol style="list-style-type: none"> I. reactor enclosure penetrating gas valves II. gas penetrating line valves - from Figure 1 from the response to RSI III. gas management system reactor enclosure penetration isolation valves – from PSAR 7.5.4 b. RSI Section 2.2.3, Response to RSI 2.c states “[t]he ESFAS brings the MSRR into a configuration to meet the designed leak rate...by sealing valves on all gas penetrations through the reactor enclosure.” How many gas penetrations and valves are there and how are they configured?
7.5-3	C. Cheung	3/14/2023	7.5	<p>As stated in PSAR Section 7.5.3, the ESFAS actuation closes the auxiliary heat removal system intake and exhaust louvers. The NRC staff requests the following clarification/information:</p> <p>Details on what components make up the reactor cell air louvers. Are the following items part of this system, and are these different components? If the same, consistent language should be used.</p> <ol style="list-style-type: none"> I. cell air louvers II. AHRD intake and exhaust louvers III. Cell louver mechanism - from Figure 1 from the response to RSI IV. air louvers in the auxiliary heat removal system – from PSAR Section 7.5.4
7.5-4	C. Cheung	3/14/2023	7.5	<p>As stated in PSAR Section 7.5.4, ESFAS isolates based on inputs from RMS. Please clarify if there anything else that provides input and provide additional information on what actuates ESF (inputs, basic logic) and what happens upon actuation.</p>

Audit Questions – Chapter 7, Instrumentation & Control Systems

Chapter 7, Section 7.6, “Control Console and Display Instruments”

<u>Item #</u>	<u>Reviewer(s)</u>	<u>Date Sent to ACU</u>	<u>PSAR Chapter or Topic</u>	<u>Question</u>
7.6-1	C. Cheung	3/14/2023	7.6	<p>PSAR Section 7.6.1 identified the design bases and design criteria applicable to the Control Console and Display Instruments.</p> <ul style="list-style-type: none"> I. It is unclear to the NRC staff if the intent for the control console, display instruments, and equipment is to be readily testable and capable of being accurately calibrated. Please provide more information or explain where this is discussed in the PSAR. If this is not intended, please provide justification as to why testability and calibration is not necessary. II. The NRC staff notes that the designed range of operation of each device should be sufficient for the expected range of variation of monitored variables under all normal and transient conditions of operation. Please clarify if the intent is to have PDC 13 applicable to Section 7.6. If not, please provide justification as to why PDC 13 is not applicable. III. It is unclear to the NRC staff if the intent for the control console instruments and equipment is to be designed to assume a safe state on loss of electrical power or to have a reliable source of emergency power sufficient to sustain operation of specific devices. Please provide more information or explain where this is discussed in the PSAR. If this is not intended, please provide justification as to why these power requirements are not necessary.
7.6-2	C. Cheung	3/14/2023	7.6	Does ACU intend to have a TS for control console and display instruments?
7.6-3	C. Cheung	3/14/2023	7.6	RSI Section 3.2.1, Response to RSI 3.a stated “PDC19 will be deleted.” The NRC staff notes that the 3 bullet portions shown in PSAR Section 7.6.1 on PDC 19 still seem to be applicable. Please clarify if PSAR Section 3.1.2.2 listing for PDC 19, 2 nd half of 2 nd paragraph on “locations outside the control room,” are the only items intended to be deleted.
7.6-4	C. Cheung	3/14/2023	7.6	PSAR Section 7.6.3 states “secondary and analog systems sufficient to maintain control in the event of a total failure of the DCS also are present.” Please clarify if the portions of the control console and display are safety-related and if the secondary and analog backups are safety-related.

Chapter 7, Section 7.7, “Radiation Monitoring System”

<u>Item #</u>	<u>Reviewer(s)</u>	<u>Date Sent to ACU</u>	<u>PSAR Chapter or Topic</u>	<u>Question</u>
7.7-1	C. Cheung	3/14/2023	7.7	The NRC staff notes that no preliminary PDC have been selected to be applicable to the PSAR Section 7.7. Please clarify if there are any applicable PDCs that are intended to be met.
7.7-2	C. Cheung	3/14/2023	7.7	The NRC staff requests additional details on quantity, location, type, basic logic, etc. for monitors in safety-critical areas, specifically details on sensors that feed into RPS and ESFAS.