From:	Mazza, Jan
Sent:	Monday, September 21, 2020 2:55 PM
To:	C Cochran
Cc:	Lupold, Timothy; Beasley, Benjamin; Alex Renner; Hayes, Michelle; Drzewiecki, Timothy
Subject:	REQUEST FOR ADDITIONAL INFORMATION REGARDING THE OKLO MCA HEAT TRANSFER IN THE REACTOR SYSTEM
Attachments:	Oklo_Final_RAI_9772_Heat_Trans_9-21-2020.docx

Dear Ms. Cochran:
By letter dated March 11, 2020 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML20075A000), Oklo Power LLC (Oklo), submitted a combined license (COL) application for one micro-reactor to be located at the Idaho National Laboratory. This proposed plant is to be designated as the Aurora. By letter dated June 5, 2020 (ADAMS Accession No. ML20149K616), the U.S. Nuclear Regulatory Commission (NRC) informed Oklo of its decision to accept the application for docketing and that a two-step approach will be used in order to gain a fulsome understanding of four key safety and design aspects of the licensing basis prior to establishing a schedule for the licensing review. One of those key safety and design aspects is an understanding of the process used for determining the maximum credible accident (MCA). As part of the step-one review, the NRC staff has identified additional information needed to support its review of the MCA in the area of the inputs to and the structure of the ANSYS Mechanical model described in the FSAR, Section 5.6, as well as the assumptions and conditions used to calculate those inputs pertaining to heat transfer. The NRC conducted a focused audit of the Oklo ANSYS Mechanical model (ADAMS Accession No. ML20246G616). The staff is issuing this RAI as a follow up to the audit.

A draft of this request for additional information (RAI) was transmitted to Oklo on September 15, 2020. After reviewing the draft RAI Oklo determined that a clarification call was not needed. The NRC staff requests that Oklo provide a response to the RAI or a written request for additional time to respond, including the proposed response date and a brief explanation of the reason, by October 21, 2020.

The response to the RAI must be submitted in accordance with Title 10 of the Code of Federal Regulations (10 CFR) 50.4, “Written communications,” and be executed in a signed original document under oath or affirmation per 10 CFR 50.30(b), “Oath or affirmation,”. Information included in the response that you consider sensitive or proprietary, and seek to have withheld from public disclosure, must be marked in accordance with 10 CFR 2.390, “Public inspections, exemptions, requests for withholding.” Any information related to safeguards should be submitted in accordance with 10 CFR 73.21, “Protection of Safeguards Information: Performance Requirements.”

In the case that the NRC staff requires additional information beyond that provided in the response to this RAI, the NRC staff will request that information by separate correspondence. If you have any questions regarding the NRC staff’s review or if you intend to request additional time to respond, please contact Jan Mazza at 301-415-0498 or by electronic mail at Jan.Mazza@nrc.gov.

Jan Mazza
Project Manager, Advanced Reactor Licensing Branch
Division of Advanced Reactors and
Non-Power Production and Utilization Facilities

NRC Office of Nuclear Reactor Regulation
301-415-0498
Jan.Mazza@nrc.gov

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Subject: REQUEST FOR ADDITIONAL INFORMATION REGARDING THE OKLO MCA HEAT TRANSFER IN THE REACTOR SYSTEM
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From: Mazza, Jan

Created By: Jan.Mazza@nrc.gov

Recipients:
"Lupold, Timothy" <Timothy.Lupold@nrc.gov>
Tracking Status: None
"Beasley, Benjamin" <Benjamin.Beasley@nrc.gov>
Tracking Status: None
"Alex Renner" <alex@oklo.com>
Tracking Status: None
"Hayes, Michelle" <Michelle.Hayes@nrc.gov>
Tracking Status: None
"Drzewiecki, Timothy" <Timothy.Drzewiecki@nrc.gov>
Tracking Status: None
"C Cochran" <c@oklo.com>
Tracking Status: None

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Options
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Reply Requested: No
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Request for Additional Information 3

Issue Date: 09/21/2020
Application Title: Oklo Aurora COL - Docket 52-049
Operating Company: Oklo Power LLC
Docket No. 52-049
Review Section: Aurora Step 1 – MCA
Application Section: FSAR Section 2.2

Aurora Step 1 – MCA - 5 - Heat Transfer in the Reactor System

Regulatory Basis

10 CFR Part 52.79(a)(5) requires in part that an applicant provide an analysis and evaluation of the design and performance of structures, systems, and components with the objective of assessing the risk to public health and safety resulting from operation of the facility and including determination of the margins of safety during normal operations and transient conditions anticipated during the life of the facility, and the adequacy of structures, systems, and components provided for the prevention of accidents and the mitigation of the consequences of accidents.

Issue

NRC staff conducted a regulatory audit to clarify their understanding of the heat transfer analyses presented in FSAR Section 2.2, "Reactor system," and FSAR Section 5.6, "Safety analysis," (ML20225A227). During this audit, NRC staff observed design information that is important to the safety case of the Aurora design. Specifically, Oklo presented information to clarify NRC staff's understanding of the thermal bonds between the reactor cell can and heat pipe, and between the heat pipe and heat exchanger. This information on thermal bonds affects the margin to the fuel safety limits during (1) normal operations and transient conditions anticipated during the life of the facility, and (2) the heat redistribution phase of the maximum credible accident. Specifically, these thermal bonds affect the fundamental safety function of heat removal because they are significant points of thermal resistance along the heat transfer pathway between the fuel and passive heat structures. Accordingly, NRC staff is requesting that Oklo incorporate this information in its licensing documentation on the docket to support the NRC staff's safety review.

Request

NRC staff requests that the FSAR be updated to describe the thermal bonds between (1) the reactor cell can and heat pipe, and (2) the heat pipe and heat exchanger. Specifically, NRC staff requests updates to the following sections of the FSAR:

- FSAR Section 2.1,3,1, "Key dimensions," to clarify the reactor conditions that correspond to the dimensions provided in FSAR Table 2-1 (i.e., hot or cold).
- FSAR Section 2.2.2, "Reactor core system," to describe the thermal bond between the reactor cell can and heat pipe and to provide, as necessary, design commitments and programmatic controls associated with the thermal bond design in order to support DB.RXS.04, "The reactor core system provides a pathway to conduct heat from the fuel to the surrounding systems and ultimately to reject it to the environment."

- FSAR Section 2.6, "Heat exchanger system," to describe the thermal bond between the heat pipe and heat exchanger and to provide, as necessary, design commitments and programmatic controls associated with the thermal bond design in order to support DB.HXS.01, "The heat exchanger system provides a pathway to conduct heat from the heat pipes of the reactor core system to the surrounding systems and ultimately to reject it to the environment."
- FSAR Table 5-7, "Summary of assumptions in safety analysis and reason for conservatism," to include the assumptions imposed on the thermal bonds between (1) the reactor cell cans and heat pipes, and (2) the heat pipes and heat exchanger.

Aurora Step 1 – MCA - 6 - Heat Transfer in the Reactor System

Regulatory Basis

10 CFR 52.79(a)(24) and 10 CFR 50.43(e) require that for an application for a nuclear power reactor design that uses innovative means to accomplish their safety function, that (1) the performance of each safety feature of the design be demonstrated through either analysis, appropriate test programs, experience, or a combination thereof, and (2) that sufficient data exist on the safety features of the design to assess the analytical tools used for safety analyses.

Issue

NRC staff conducted a regulatory audit to clarify their understanding of the heat transfer analyses presented in FSAR Section 2.2, "Reactor system," and FSAR Section 5.6, "Safety analysis," (ML20225A227). During this audit, NRC staff observed design information that is important to the safety case of the Aurora design. Specifically, Oklo presented additional information to clarify NRC staff's understanding of the current FSAR description of the thermal bonds between the reactor cell can and heat pipe, and between the heat pipe and heat exchanger. These thermal bonds affect the margin to the fuel safety limits during (1) normal operations and transient conditions anticipated during the life of the facility, and (2) the heat redistribution phase of the maximum credible accident. Specifically, these thermal bonds affect the fundamental safety function of heat removal because they are significant points of thermal resistance along the heat transfer pathway between the fuel and passive heat structures. The methods to thermally bond these heat transfer surfaces appear to be an innovative means that support the safety function of heat removal. Accordingly, NRC staff is seeking evidence to demonstrate the adequacy of the thermal bond design and to support the modeling used in the safety analyses.

Request

NRC staff requests that Oklo incorporate into the FSAR, either directly or by reference, information to (1) provide evidence of analysis, appropriate test programs, experience, or combination thereof to support the efficacy of the design features used to thermally bond the heat pipes in the Aurora to the reactor cell cans and heat exchanger, and (2) explain how this evidence supports the modeling parameters used in the safety analyses.