

December 21, 2020

U.S. Nuclear Regulatory Commission  
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Subject: Oklo Inc. Response Letter to the NRC Letter, *Oklo Power LLC Extension of Step 1 Technical Review of Key Safety and Design Aspects of the Aurora Powerhouse*, November 17, 2020

Reference: NRC Letter, *Oklo Power LLC Extension of Step 1 Technical Review of Key Safety and Design Aspects of the Aurora Powerhouse*, November 17, 2020

Dear Ms. Mazza,

Oklo Inc. (Oklo) is issuing this letter to the U.S. Nuclear Regulatory Commission (NRC) as a response to the NRC letter, "Oklo Power LLC Extension of Step 1 Technical Review of Key Safety and Design Aspects of the Aurora Powerhouse," referred to as the "NRC Step 1 extension letter," dated November 17, 2020, with regard to the Oklo Aurora combined license application (COLA). The NRC Step 1 extension letter is part of the overall Aurora COLA review, which the NRC staff decided to divide into a two-step approach, described as Step 1 and Step 2. According to the NRC Step 1 extension letter, the goal of Step 1 of the review was, "to achieve mutual understanding of four key safety and design aspects of the licensing basis: Maximum Credible Accident (MCA); Classification of Structures, Systems and Components (SSCs); Applicability of Regulations; and the Quality Assurance Program (QAP)." Also importantly, the NRC Step 1 extension letter defined the end of Step 1 in the following way, "At the end of Step 1, the NRC staff expects to have defined the scope of the full, detailed technical review so that it is possible to develop a schedule to efficiently perform the detailed review of the design in Step 2."

While the unprecedented effects of the global pandemic have certainly had a huge impact on all, there are key issues in project management for Oklo and the NRC to address in order to effectively utilize any extension to Step 1. In other words, the Step 1 extension is not a result of technical inadequacy or incompetency but is largely administrative and managerial in nature. It is of utmost importance that the Aurora COLA is reviewed efficiently, a key to which is setting an appropriate project scope and plan. Several of these issues are responded to by subject area in this letter. At this point, it has been agreed by NRC and Oklo that next steps should be proposed by Oklo. Oklo will consider these lessons learned when proposing next steps in the Aurora COLA review, both to have an efficient review and to set a positive precedent for the industry.

Ultimately, Oklo's mission is to "make reactors people want," which at a fundamental level starts with designing plants that are safe throughout their lifecycle. This inherent safety combined with the very small size of the plant design was evidenced in the efficiency of the application size and content while meeting applicable regulatory requirements for application content, and this safety and small size should also fundamentally lend to the efficiency of the regulatory review. Oklo began formal pre-application work with the NRC in 2016 on this premise and worked with the NRC to pilot a new application structure in 2018, which formed the basis for the COLA accepted for review in 2020.

## **Overview**

As stated by the NRC Step 1 extension letter, the goal of the Aurora COLA Step 1 review has two stated goals, although the metrics for reaching these goals have yet to be defined. The first goal is related to the four key areas: MCA, classification of SSCs, applicability of regulations (referred to as "non-applicabilities" by Oklo), and the QAP. The second goal is related to defining the scope of the full

technical review for Step 2. Regarding the first goal, it is important to highlight that MCA, classification of SSCs, and the QAP, are interrelated topics and cannot be fully separated or discretized.

Over four years of pre-application interactions, Oklo and the NRC staff have discussed this interrelationship, including in public meetings between the two entities. Indeed, in the course of the Step 1 review, the NRC staff both decided to consider the SSC classification topic as merged with the QAP topic, and ultimately seemed to find that the key topic they needed to come to an understanding on was actually the methodology of the MCA process. During the Step 1 review, Oklo provided a public document that describes the MCA methodology and scopes all three of these topics (MCA, classification of SSCs, QAP). This document is a summary of the full methodology used in the Aurora COLA and titled, "Oklo Inc. - Maximum Credible Accident Methodology- Summary of Methodology, Rev. 1," and herein referred to as, "the MCA methodology." During the MCA audit, as part of the Step 1 review, the NRC staff indicated that the MCA methodology should be submitted on the docket. Subsequently, Oklo chose to docket this public MCA methodology for several reasons, including all of the following:

- To explain the interrelationship between the MCA, classification of SSCs, and the QAP
- To answer requests for additional information (RAIs) submitted by the NRC staff during Step 1
- To provide the NRC staff with a referenceable document for the Step 1 review, as requested by the NRC staff during the MCA Step 1 audit

It remains unclear to Oklo if this substantive document regarding MCA methodology was reviewed during Step 1. In the NRC Step 1 extension letter, the MCA methodology is not referenced as being reviewed or as being the subject for future interactions, which was the understood purpose of its requested docketing. A key reason for Oklo to submit this document on the docket was in order to facilitate the NRC staff's closure of the Step 1 portion of the review, which was to include a reference to the MCA methodology.

The second goal of the Aurora COLA Step 1 review, understood by Oklo to be a plan for the full technical review of Step 2, was not discussed during Step 1. Through its interactions with the NRC over the past 4 years, Oklo anticipated that a plan for review for the Aurora COLA would be made during the acceptance review for the COLA. Oklo had this impression from pre-application interaction with the NRC staff but also because of regulatory requirements and internal NRC staff guidance. For example, LIC-109, "Acceptance Review Procedures," Revision 2, which aids the NRC staff during their acceptance review, points to 10 CFR 2.102, "Administrative Review of Application," which states the following:

In the case of docketed application for a ... combined license... under this chapter, the NRC staff shall establish a schedule for its review of the application, specifying the key intermediate steps from the time of docketing until the completion of its review.

The acceptance review time period for the Aurora COLA was allocated a mutually agreed-upon extended timeline of 90 days from the day of receipt, i.e., from March until June, and the acceptance review audit took place from April 8, 2020 through May 23, 2020. The NRC staff's acknowledgement of receipt letter stated, "If your application is found to be acceptable for docketing, the NRC staff will publish a schedule for review of the Aurora COLA within 90 days of completion of the acceptance review." At the end of this acceptance review, the NRC accepted the Aurora COLA for review but did not set a review schedule. After the issuance of the Aurora COLA acceptance letter on June 5, 2020, Oklo understood that the review schedule would be set as part of Step 1 of the review. Ultimately, a review schedule for the entirety of the Aurora COLA was not discussed during Step 1 and remains uncertain.

Although the Aurora COLA was accepted on June 5, 2020, Oklo did not receive a plan for the Step 1 review until August 27, 2020. The plan Oklo received for the Step 1 review was updated on a biweekly basis to stay up-to-date with any schedule changes, which showed flexibility by the NRC staff. However,

this Step 1 review plan was high-level and did not offer context to specific points of review or NRC staff points of confusion. With the promise of Step 1 letters by November 6, 2020 and the need to substantially complete review by late October, the timing of the release and review of the review plan in early September left about 6-8 weeks for the NRC and Oklo staff to engage on Step 1, which included issuing and responding to RAIs. This plan required such unprecedented performance by Oklo as only having 2-3 weeks to respond to RAIs, and frequently entailed situations such as the NRC requesting a meeting on a topic with just a couple business days for Oklo to prepare the remote videoconference material for the meeting. Regardless of the short timelines and the hardships encumbered by the historic global coronavirus pandemic, Oklo met all deadlines set by the NRC staff during Step 1, to include RAI responses. Although Step 1 of the review was scheduled to be completed and the Step 1 letters to be issued November 6, 2020, the NRC staff did not issue any documentation letters until November 17, 2020. Oklo did not receive any communication from the NRC staff during this extended time period clarifying the reason for this delay, besides a seemingly slow process. Presently, Oklo does not have confidence in how or on what timeline the Aurora COLA will be reviewed, and is concerned about the proposal in the response letter for an undefined extension of time for Step 1, especially with the goals for Step 1 remaining undefined.

The below sections provide more detail and response to the individual topics in the NRC Step 1 extension letter.

## **MCA**

The NRC Step 1 extension letter states the closure criteria for the MCA portion of the Step 1 review were related to the methodology used by Oklo, as stated, “on the methodology used in the analysis and evaluation of the MCA.” This closure criteria is aligned with Oklo’s expectations for the MCA portion of the Step 1 Aurora COLA review. During Step 1, Oklo provided additional information related to the methodology utilized for the MCA for the Aurora COLA. Specifically, this information was provided during MCA audit meetings, as RAI responses, and as a lengthy docketed public document describing the MCA methodology. Nearing the conclusion of the Step 1 review, the NRC staff indicated during the MCA audit meetings that they did not have remaining questions for the Oklo staff as part of Step 1.

From the NRC Step 1 extension letter, the exact NRC staff goals for the Step 1 MCA review portion are unclear. The NRC staff notes that, “staff has gained an understanding of Oklo’s definition of credible as used in the application, the methodology for and implementation of the MCA selection process,” which seems to be directly related to the stated goal for the Step 1 MCA portion, “on the methodology used in the analysis and evaluation of the MCA.” Nevertheless, the NRC staff provided aspects that they feel need more clarification; Oklo will be considering these aspects and proposing a plan forward for the NRC staff to further their understanding of the MCA methodology utilized by Oklo for the Aurora COLA.

The NRC staff highlighted that Oklo committed to amending the COLA to add several programmatic controls, which Oklo views as a constructive step forward and in line with how a thorough technical review should be performed, as well as how a novel review can reach conclusions based on agreements for modified programmatic controls as identified as important or helpful by NRC staff. Additionally, the NRC staff recently brought additional fuel data to Oklo that could potentially challenge some of the previous assumptions made in the Aurora COLA. Oklo has seen some of this data and is evaluating any possible impacts internally but also in regard to the NRC review. Oklo is committed to resolving outstanding technical questions such as these, with an increased importance on those questions which might pertain to the safety case of Oklo’s reactors. Items such as these are expected by Oklo, are taken seriously, and will be responded to through the course and at the appropriate stages of the COLA review. It is Oklo’s expectation that the licensing bases of its plants will be modified, as needed, when design information changes or other information is brought forward that might warrant additional safety considerations.

A key point to clarify is the misunderstanding that the requested exemptions for the Aurora COLA rely on a “zero dose MCA,” which is stated in the NRC Step 1 extension letter:

Reasonable assurance of the adequacy of the MCA is essential because it establishes the basis for Oklo’s licensing basis assumption of zero radioactivity release. Exemption requests for emergency planning, postulated fission product release, and portions of the environmental review are dependent on the MCA.

This point was brought up during the MCA audit and MCA RAIs, as part of the Step 1 review. In contrast to the NRC Step 1 extension letter, the majority of the Aurora COLA requested exemptions do not rely on an “assumption of zero radioactivity release”; the majority of the Aurora COLA requested exemptions do not invoke this assumption and this is an interpretation of the NRC staff. Further, this point of confusion was highlighted during the MCA RAIs (ADAMS Accession No. ML20265A123), as part of Step 1, to which Oklo responded with a commitment to update the Aurora COLA in order to reconcile this confusion. For the requested exemptions related to licensed operators and emergency preparedness, Oklo provided a redline and a commitment to update the Aurora COLA to remove any language that might lead to this continued confusion (ADAMS Accession No. ML20305A584). In fact, it seems that it may be the case that the staff make this assumption based on inadequate discussion and inadequate technical understandings of nonsafety portions of regulations and applicability of these regulations (for more information on the inadequate effort on the applicability topic, please see the Oklo response letter “Oklo Inc. Response Letter to the NRC Letter, *Oklo Step 1 Technical Review of Key Safety and Design Aspect Activities Related to the Applicability of Regulations*, November 17, 2020). In summary, an “assumption of zero radioactivity release” is largely not germane to the Aurora safety case or to the basis for the majority of the requested exemptions; however, this misinterpretation continues to present itself by the NRC staff as a key item requiring clarification.

Oklo is reviewing the specific items outlined by the NRC staff in the NRC Step 1 extension letter, reconciling those items with the closure criteria for the MCA topic, and proposing next steps for the Step 1 review.

### **Classification of SSCs**

Similar to the MCA Step 1 review topic, the NRC Step 1 extension letter states that the closure criteria for the classification of SSCs topic were related to the process used by Oklo. As expected by Oklo, the closure for this topic for the Step 1 review is similar to the MCA topic, in the sense that it is, or at least should be treated as, a methodological question. As already noted by this response letter, Oklo submitted a public document on the docket that describes the MCA methodology, which includes a summary of how SSCs are classified.

As noted previously by Oklo, for example during the August 5, 2020 public meeting, “Meeting with Oklo to Discuss Classification of SSCs for the Aurora Reactor,” there is no regulatory requirement to submit a list of how SSCs are classified – this point from Oklo still has not received either acknowledgement or a response from the NRC staff. In contrast, Oklo’s MCA methodology aligns better with more recent approaches to reactor licensing, and those specifically encouraged to be risk-informed and performance-based as outlined in the NRC staff’s policy paper to the NRC Commission, SECY-03-0047, “Policy Issues Related to Licensing Non-Light Water Reactor Designs.” Specifically, the MCA methodology focuses on functions and inherent features that are important to the overall safety of the facility and, from that determination, a connection is made to the appropriate level of quality that should be applied. This fundamental aspect to the MCA methodology is clearly needed to be discussed with the NRC staff further and is a key piece to the Step 1 review.

The definition from 10 CFR 50.2 for safety-related is not used by the MCA methodology or for the Aurora. The NRC Step 1 extension letter focuses on the difference of classifying components versus functions and inherent features, but this is only one portion of the reasoning behind not utilizing the 10 CFR 50.2 definition of safety-related; other portions include historical context, non-applicability to nonlight water reactors, and technical inadequacy in a piecemeal application. The MCA methodology document explains this position:

Of specific note is that this definition uses “safety-related” in the context of SSCs. This 10 CFR 50.2 definition is not applied to Oklo designs because it is in the context of a component-based analysis and in the context of the currently operating fleet of large light water reactors.

The NRC included this definition in its regulations after the first large light water reactors had already been operating for a number of years.<sup>1</sup> The concept of “safety-related structures, systems, and components” was first incorporated into the Commission’s regulations in 10 CFR Part 100, Appendix A, “Seismic and Geologic Siting Criteria for Nuclear Power Plants,” in November 1973. The first regulation in 10 CFR Part 50, “Domestic Licensing of Production and Utilization Facilities,” to include a definition of “safety-related structures, systems, and components” was 10 CFR 50.49, “Environmental Qualification of Electric Equipment Important to Safety for Nuclear Power Plants,” in January 1983. When the NRC amended its regulations to update the criteria used in decisions regarding power reactor siting, including geologic, seismic, and earthquake engineering considerations for future nuclear power plants in December 1996 it added the definition of safety-related SSCs to 10 CFR 50.2. The NRC likely based the definition of “safety-related” on the technology that had been operating in the U.S., large light water reactors.

Although Oklo’s reactor designs might have systems that are similar in nature to the systems described by 10 CFR 50.2, the intent of the safety-related definition of 10 CFR 50.2 is to be taken as a whole, not piecemeal. In other words, the combination of systems described in 10 CFR 50.2 are needed to meet the safety-related definition, not any piece on its own merit, to achieve the philosophy of defense-in-depth for light water reactors. As such, a piecemeal application of a regulatory definition is not only unprecedented but is also technically inadequate for nonlight water reactors. Further, the methodology presented here describes “safety-related” in the context of functions and inherent features, not in the context of a component-based approach; this is a significant difference in interpretation of the language and another reason why the 10 CFR 50.2 definition is not applied to the Oklo designs. Lastly, definitions included in 10 CFR are not regulatory requirements and were not included by the NRC with the intention of evoking further regulatory requirements.

The Aurora COLA is performance-based and, as noted by the NRC Step 1 extension letter, utilizes design bases, design commitments to support the design bases, and specific programmatic controls to ensure those commitments, and other criteria, which are summarized by the design bases summaries throughout the Aurora COLA, are met throughout the lifecycle of the facility. This aspect of the Oklo approach is critical, as it provides the flexibility required to construct a first-of-a-kind reactor. The use of programmatic controls puts specific requirements in place to ensure that the design bases are upheld through a comprehensive initial test program. This allows flexibility in how components are fabricated and erected, while ensuring that a reactor that does not meet the design commitments cannot start up or

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<sup>1</sup> See “Definition of Safety-Related Structures, Systems, and Components; Technical Amendment,” 62 Fed. Reg. 47268 (Sept. 8, 1997).

operate. The design commitments described in the design bases summaries are held to a higher level of quality, because they are related to the assumptions the design and safety analysis are based on. It is key to underline the distinction between design bases summaries and functions or inherent features that might be classified as safety-related – the MCA methodology also outlines this different treatment. Oklo is not confident that this approach is clearly understood and this should be a key area of focus during the Aurora COLA review.

There is a clear interrelation between the topic of “classification of SSCs” and the QAP. As described in the MCA methodology, the different portions of the NRC-approved Quality Assurance Program Description (QAPD)<sup>2</sup> are applied to the Aurora depending on the safety analysis. The QAPD has commitments to multiple standards, so the NRC Step 1 extension letter assertion that there are no standards being committed to by Oklo is not an entirely appropriate observation. However, since the Aurora COLA is a performance-based application, the demonstration of key metrics is assured multiple times, physically, in the as-built configuration. This may be a business risk for Oklo, but in cooperation with the NRC-approved QAPD, this approach presents a more fulsome demonstration of the characteristics of safety concern than rote application of a standard. Quality assurance, combined with pre-operational testing, startup testing, and the utilization of technical specifications throughout the life of the plant, are all go/no-go gates for safety assurance in the as-built plant. Ultimately, this level of detail does not seem reasonable when the Aurora COLA review is in the Step 1, while it simultaneously does not seem like the NRC staff are anticipating the holistic review and agreement of all of these performance-based controls in Step 2, as Oklo has been anticipating.

Oklo is reviewing the specific items outlined by the NRC staff in the NRC Step 1 extension letter, reconciling those items with the closure criteria for the classification of SSCs topic, and proposing next steps for the Step 1 review.

## **QAP**

The NRC Step 1 extension letter outlines the closure criteria to the QAP Step 1 review topic as, “understanding of the scope and application of the Quality Assurance Program to the Aurora.” Oklo agrees with the NRC staff that implementation of the QAPD is closely related to the classification of functions and inherent features (i.e., “classification of SSCs” Step 1 review topic). However, at a plain read of this closure criteria, the MCA methodology, which was already docketed as part of the Step 1 review, describes the scope and application of the QAPD; the MCA methodology specifically includes an appendix that outlines the scope and application of the QAPD to the Aurora. As no outstanding questions are listed in the NRC Step 1 extension letter, it is unclear what outstanding questions exist, as part of the Step 1 review, at this time. Oklo expects that more detail will be needed by the NRC staff for Step 2 of the review.

## **Applicability of Regulations (i.e., non-applicabilities)**

The NRC staff issued a separate Step 1 review letter on this subject, “Oklo Step 1 Technical Review of Key Safety and Design Aspect Activities Related to the Applicability of Regulations,” referred to as the “NRC Step 1 non-applicabilities letter.” Oklo has provided a separate response to the NRC Step 1 non-applicabilities letter. In summary, the NRC Step 1 non-applicabilities letter does not evaluate the proposed non-applicabilities description by Oklo. Further, the NRC Step 1 non-applicabilities letter barely references the Aurora COLA and largely disregards the approach proposed by Oklo.

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<sup>2</sup> Oklo’s topical report, “Quality Assurance Program Description (QAPD) Design and Construction,” Revision 1 was accepted by the NRC staff on August 11, 2020 (ADAMS Accession No. ML20205L415)

The NRC staff proposed a determination of applicability based on the plain language of the regulations, which was neither the methodology proposed by Oklo nor based on a thorough regulatory and technical review of the information provided by Oklo. Further, there is a generally recognized exception to the utilization of a plain language interpretation: specifically, it is rejected if it would produce an “odd” or “unintended” result. While the interpretation of the whole of the regulations would benefit from a thorough regulatory and technical review considering intent instead of a plain language interpretation, at a minimum, in these cases of where a plain language interpretation produces an odd or unintended result, the NRC still has discretion to look at the structure and context of the regulatory framework to interpret the regulations and the respective scope. Specifically in the context of the NRC Step 1 review letter, the conclusion that the subject regulations apply to the Aurora design on a “plain language” read yields an odd and unintended result because the purpose of those regulations relates to design features that are not present in the Aurora design. In contrast, there are many other available tools available to the NRC such as underlying intent, precedent, context, and so on. When reviewed from proficient technical and regulatory standpoints, it is apparent that these subject regulations are not technically relevant, are not intended to apply to the Aurora design, and therefore are not germane to the statutorily-required safety findings to be made by the NRC. Ultimately, a “plain language” read of the regulations is less legally defensible and aligns less with the Atomic Energy Act than a thorough comprehensive analysis.

### Conclusion and Next Steps

Oklo is pioneering a fundamentally new approach to nuclear technology for the betterment of the nation and, ultimately, the planet. A key part of this approach was pioneering with the NRC a new way of thinking for reactor licensing, which Oklo saw as a viable path forward because of the years of positive experience with the NRC staff in pre-application space. The NRC was able to accept an innovative approach to reactor licensing by the acceptance of the Aurora COLA, and creating a novel plan for review. Oklo is confident that with management alignment on key areas to review, adequate prioritization, and an outlined review plan, licensing success is possible both for Oklo and the NRC, as well as for the entire new advanced reactor industry.

If you have any questions or need any additional information, please contact us at [regulatory@oklo.com](mailto:regulatory@oklo.com).

Sincerely,



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