# Status Report - Aurora (United States of America)

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## 1. Overview

- ☐ **In Operation**
- ☐ **Under Construction**
- ☐ **Described in**

| | |
|---|---|
| Link to PRIS | -- |

- ☑ **New Concept**

| | |
|---|---|
| Number of Units | -- |
| Year | -- |

**Reference Plant**

| | |
|---|---|
| Name of Site | -- |
| Link to PRIS | -- |
| Net Power Output (MWe) | 15.50 |
| Gross Power Output (MWe) | -- |

### 1.1 Introduction

Oklo Inc. (NYSE: OKLO) a fast fission clean power technology and nuclear fuel recycling company developing fast fission power plants to provide clean, reliable, and affordable energy at scale.

The Oklo powerhouse is designed to provide affordable, reliable, emission-free electricity and heat. Oklo's business model is to provide power on a power purchase agreement basis. Oklo is in active discussion with companies across the following sectors: data centers, defense, industrial and manufacturing, real estate, and oil and gas.



Figure 1. Oklo concept

## 1.2 Development Milestones

| | |
|---|---|
| 2016 | Began pre-application interactions with the U.S. NRC and ongoing pre-application process for Aurora powerhouses |
| 2017 | Demonstrated prototype fuel fabrication |
| 2018 | Conducted thermal testing |
| 2019 | Safeguards Information Protection and Handling Plan approved |
| 2019 | Granted a site use permit from the U.S. Department of Energy |
| 2019 | Awarded recovered fuel material from the Idaho National Laboratory |
| 2020 | Combined license application submittal to the U.S. Nuclear Regulatory Commission and acceptance for review (currently being revised) |
| 2020 | Quality Assurance Program Document approved |
| 2021 | Began pre-application for fuel recycling |
| 2021 | Partnership with Centrus announced |
| 2021 | Awarded U.S. Department of Energy Technology Commercialization (TCF) Fund award related to fuel recycling |
| 2016-2022 | Awarded five awards from the Gateway for Accelerated Innovation in Nuclear for work on fuel data, fuel modeling, fuel fabrication, thermal hydraulic testing, licensing support, and more |
| 2022 | Awarded Advanced Research Projects Agency-Energy (ARPA-E) OPEN program award related to fuel recycling |

| | |
|---|---|
| 2022 | Awarded ARPA-E ONWARDS program award related to fuel recycling |
| 2023 | Began pre-application process for fuel fabrication |
| 2024 | Safety Design Strategy for the Aurora Fuel Fabrication Facility approved by DOE |
| 2024 | Entered into a land rights agreement with the non-profit Southern Ohio Diversification |
| 2024 | Initiative to advance the deployment of two powerhouses in Southern Ohio |
| 2024 | In partnership with Argonne National Laboratory, Oklo successfully completed the second phase of the high-fidelity testing campaign at the Thermal Hydraulic Experimental Test Article |
| 2024 | Signed non-binding letter of intent to supply 50 megawatts to Diamondback Energy, a Texas-based independent oil and natural gas company, over a 20-year power purchase agreement |
| 2024 | Began trading on the New York Stock Exchange under the new ticker symbol “OKLO" |
| 2024 | Signed non-binding memorandum of understanding with Atomic Alchemy to collaborate on isotope production |
| 2024 | Partnered with computer networking company Wyoming Hyperscale to deliver 100 megawatts to its data centers over 1 20-year power purchase agreement |
| 2024 | Completed successful end-to-end demonstration of advanced fuel recycling process, advancing commercial-scale recycling facility |
| 2024 | Established preferred supplier agreement with Siemens Energy for steam turbine generator products and services |

### 1.3 Design organization or vendor company

### 1.4 Links to designer/vendor website

### 1.5 Design Description

Main design features:

Safety is fundamentally accomplished in Oklo's design by its inherent characteristics, including:

- Low decay heat term, removed by inherent and passive means
- Inherent reactivity feedbacks ensure reactor power is controlled during overpower or overtemperature

events

- Multiple barriers to fission product release
- Ambient pressure system removes sources of pressure and minimizes driving forces for release
- Water not required for safety-related cooling
- <18 months installation
- Offsite fabrication
- Operate at atmospheric pressure
- Power output license is 40+ years

### 1.6 Licensing Application Support Documents

The design is at the detailed design stage. Oklo has completed fuel prototyping activities, heat transport testing programs, and is now developing experimental advanced fuel recycling and fabrication capabilities. Oklo was awarded a Site Use Permit by the U.S. DOE and was awarded fuel material by the Idaho National Lab and the U.S. DOE. Oklo is the only company to have had a custom combined license accepted for review by the U.S. NRC. Oklo has actively engaged the U.S. NRC from 2016 to the present in pre-application activities, as well as application review activities.

### 1.7 Reactor Unit in PRIS

## 2. Category Fields

Table 1: ARIS Category Fields

| ARIS Category | Value | Units of Examples |
|---|---|---|
| Current/Intended Purpose | | e.g. Commercial – Electric/Non-electric, Prototype/FOAK, Demonstration, Experimental |
| Main Intended Application (once commercial) | Baseload | e.g. Baseload, Dispatchable, Off-grid/Remote, Mobile/Propulsion, Non-electric (specify) |
| Reference Location | Inland | e.g. On Coast, Inland, Below-Ground, Floating-Fixed, Marine-Mobile, Submerged-Fixed (Other-specify) |
| Reference Site Design (reactor units per site) | | e.g. Single Unit, Dual Unit, Multiple Unit (# units) |
| Core Coolant | liquid metal | H2O, D2O, He, CO2, Na, Pb, PbBi, Molten Salts, (Other-specify) |

| | | |
|---|---|---|
| Reactor Core Size (1 core) | 30 MWth <= Thermal power < 1000 MWth | e.g. Thermal Power < 30 MWth, 30 MWth ≤ Thermal power < 1000 MWth, 1000 MWth ≤ Thermal power ≤ 3000 MWth, Thermal power > 3000 MWth |
| Reactor Type | Others | e.g. PWR, BWR, HWR, SCWR, GCR, GFR, SFR, LFR, MSR, ADS |
| Reactor Size | Microreactor | e.g. PWR, SMR |
| Neutron Moderator | None | e.g. H2O, D2O, He, CO2, Na, Pb, PbBi, Molten Salts, (Other-specify) |
| NSSS Layout | | e.g. Loop-type (# loops), Direct-cycle, Semi-integral, Integral, Pool-type |
| Primary Circulation | | e.g. Forced (# pumps), Natural |
| Thermodynamic Cycle | | e.g. Rankine, Brayton, Combined-Cycle (direct/indirect) |
| Secondary Side Fluid | | e.g. H2O, He, CO2, Na, Pb, PbBi, Molten Salts, (Other-specify) |
| Fuel Form | | e.g. Fuel Assembly/Bundle, Coated Sphere, Plate, Prismatic, Contained Liquid, Liquid Fuel/Coolant |
| Fuel Lattice Shape | | e.g. Square, Hexagonal, Triangular, Cylindrical, Spherical, Other, n/a |
| Rods/Pins per Fuel Assembly/Bundle | | e.g. #, n/a |
| Fuel Material Type | Metal | e.g. Oxide, Nitride, Carbide, Metal, Molten Salt, (Other-specify) |
| Design Status | Detailed Design | e.g. Conceptual, Detailed, Final (with secure suppliers) |
| Licensing Status | | e.g. DCR, GDR, PSAR, FSAR, Design Licensed (in Country), Under Construction (# units), In Operation (# units) |
| Neutron Spectrum | Fast | e.g. Fast, Thermal |

# 3. Parameter Fields

Table 2: ARIS Parameter Fields

| ARIS Parameter | Value | Units of Examples |
|---|---|---|
| **Plant Infrastructure** | | |
| Design Life | 40 | Years |
| Lifetime Capacity Factor | | %, defined as Lifetime MWe-yrs delivered / (MWe capacity * Design Life), incl. outages |
| Major Planned Outages | | # days every # months (specify purpose, including refuelling) |
| Operation / Maintenance Human Resources | | # Staff in Operation / Maintenance Crew during Normal Operation |
| Reference Site Design | | n Units/Modules |
| Capacity to Electric Grid | 15.50 | MWe (net to grid) |
| Non-electric Capacity | | e.g. MW(th) heat at x °C, m3/day desalinated water, kg/day hydrogen, etc. |
| In-House Plant Consumption | | MWe |
| Plant Footprint | 8094 | m2 (rectangular building envelope) |
| Site Footprint | | m2 (fenced area) |
| Emergency Planning Zone | | km (radius) |
| Releases during Normal Operation | | TBq/yr (Noble Gases / Tritium Gas / Liquids) |
| Load Following Range and Speed | | x – 100%, % per minute |
| Seismic Design (SSE) | | g (Safe-Shutdown Earthquake) |
| NSSS Operating Pressure (primary side) | 0.101325 | MPa(abs), i.e. MPa(g)+0.1, at core outlet |
| NSSS Operating Pressure (secondary side) | 0.10325 | MPa(abs), i.e. MPa(g)+0.1, at secondary side outlet |
| Primary Coolant Inventory (incl. pressurizer) | | kg |

| | | |
|---|---|---|
| Nominal Coolant Flow Rate (primary) | | kg/s |
| Nominal Coolant Flow Rate (secondary) | | kg/s |
| Core Inlet Coolant Temperature | | ºC |
| Core Outlet Coolant Temperature | | ºC |
| Available Tempeature as Process Heat Source | | ºC |
| NSSS Largest Component | | e.g. RPV (empty), SG, Core Module (empty/fuelled), etc. |
| - NSSS Largest Component Length | | mm |
| - NSSS Largest Component Diameter | | mm |
| - NSSS Largest Component Thickness | | mm |
| - NSSS Largest Component Weight | | tonne |
| Reactor Vessel Material | | e.g. SS304, SS316, SA508, 800H, Hastelloy N |
| Steam Generator Design | | e.g. Vertical/Horizontal, U-Tube/ Straight/Helical, cross/counter flow |
| Secondary Coolant Inventory | | kg |
| Pressurizer Design | | e.g. separate vessel, integral, steam or gas pressurised, etc. |
| Pressurizer Volume | | m3 / m3 (total / liquid) |
| Containment Type | | Dry (single/double), Dry/Wet Well, Inerted, etc. |
| Containment Volume | | m3 |
| Spent Fuel Pool Capacity and Total Volume | | Years of full-power operation / m3 |
| Non Electric Application | | - |
| Core Delta Temperature | | ºC |
| **Fuel/Core** | | |
| Single Core Thermal Power | 50 | MW(th) |

| | | |
|---|---|---|
| Refuelling Cycle | 120-240 | months or “continuous” |
| Fuel Material | | e.g. UO2, MOX, UF4, UCO |
| Enrichment (avg./max.) | | % |
| Average Neutron Energy | | eV |
| Fuel Cladding Material | | e.g. Zr-4, SS, TRISO, E-110, none |
| Number of Fuel “Units” | | Specify as Assembly, Bundle, Plate, Sphere, or n/a |
| Weight of one Fuel Unit | | kg |
| Total Fissile Loading (initial) | | kg fissile material (specify isotopic and chemical composition) |
| % of fuel outside core during normal operation | | Applicable to online refuelling and molten salt reactors |
| Fraction of fresh-fuel fissile material used up at discharge | | % |
| Core Discharge Burnup | | MWd/kgHM (heavy metal, eg U, Pu, Th) |
| Pin Burnup (max.) | | MWd/kgHM |
| Breeding/Conversion Ratio | | Fraction of fissile material bred in-situ over one fuel cycle or at equilibrium core |
| Reprocessing | | e.g. None, Batch, Continuous (FP polishing/actinide removal), etc. |
| Main Reactivity Control | | e.g. Rods, Boron Solution, Fuel Load, Temperature, Flow Rate, Reflectors |
| Solid Burnable Absorber | | e.g. Gd2O3 |
| Core Volume (active) | | m3 (used to calculate power density) |
| Fast Neutron Flux at Core Pressure Boundary | | n/(cm²*s) |
| Max. Fast Neutron Flux | | n/(cm²*s) |
| Core Control Rod Absorber | | - |
| Core Soluble Neutron Absorber | | - |
| **Safety Systems** | | |

| | | |
|---|---|---|
| Number of Safety Trains | Active / Passive | % capacity of each train to fulfil safety function |
| - reactor shutdown | Active/Passive | - / - / - |
| - core injection | Active/Passive | - / - / - |
| - decay heat removal | Active/Passive | - /- / - |
| - containment isolation and cooling | Active/Passive | - / - / - |
| - emergency AC supply (e.g. diesels) | Active/Passive | - / - / - |
| DC Power Capacity (e.g. batteries) | | Hours |
| Events in which Immediate Operator Action is required | | e.g. any internal/external initiating events, none |
| Limiting (shortest) Subsequent Operator Action Time | | Hours (that are assumed when following EOPs) |
| Severe Accident Core Provisions | | e.g. no core melt, IVMR, Core Catcher, Core Dump Tank, MCCI |
| Core Damage Frequency (CDF) | | x/reactor-year (based on reference site and location) |
| Severe Accident Containment Provisions | | e.g., H2 ignitors, PARs, filtered venting etc. |
| Large Release Frequency (LRF) | | x/reactor-year (based on reference site and location) |
| **Overall Build Project Costs Estimate or Range (excluding Licensing, based on the Reference Design Site and Location)** | | |
| Construction Time (nth of a kind) | | Months from first concrete to criticality |
| Design, Project Mgmt. and Procurement Effort | | Person-years (PY) [DP&P] |
| Construction and Commissioning Effort | | PY [C&C] |
| Material and Equipment Overnight Capital Cost | | Million US$(2015) [M&E], if built in USA |
| Cost Breakdown | %[C&C]/%[M&E] | |
| - Site Development before first concrete | | |

| | | |
|---|---|---|
| - Nuclear Island (NSSS) | | (e.g. 25/10 )<br>( 30/40 )<br>( 20/25 )<br>( 20/10 )<br>( 5/15 )<br>( ----------)<br>(to add up to 100/100) |
| - Conventional Island (Turbine and Cooling) | | |
| - Balance of Plant (BOP) | | |
| - Commissioning and First Fuel Loading | | |
| Factory / On-Site split in [C&C] effort | | %/% of total [C&C] effort in PY<br>(e.g., 60/40 ) |
| **Nuclear System** | | |
| System Steam Flow Rate | | kg/s |
| System Steam Pressure | | MPa |
| System Steam Temperature | | ºC |
| System Feedwater Flow Rate | | kg/s |
| System Feedwater Temperature | | ºC |
| **Reactor Core** | | |
| Active Core Height | | m |
| Equivalent Core Diameter | | m |
| Average Linear Heat Rate | | kW/m |
| Average Fuel Power Density | | kW/kgU |
| Average Core Power Density | | MW/m3 |
| Outer Diameter Of Fuel Rods | | mm |

# 4. Plant Layout, Site Environment and Grid Integration

# SUMMARY FOR BOOKLET

**Plant Layout Arrangement**

The Aurora site has a primary building with some supporting structures. The Aurora powerhouse has two floors. The radiators are located external to the Aurora powerhouse. The radiators exchange heat with ambient air as the ultimate heat sink for the power cycle. There is a parking lot for the site as well as landscaping surrounding the site. Due to the inherent safety characteristics, an evacuation zone outside of the site boundary is not generally required.

**4.1 Site Requirements during Construction**
**4.2 Site Considerations during Operation**
**4.3 Grid Integration**

# 5. Technical NSSS/Power Conversion System Designn

# SUMMARY FOR BOOKLET

**5.1 Primary Circuit**
**5.2 Reactor Core and Fuel**
**5.3 Fuel Handling**
**5.4 Reactor Protection**
**5.5 Secondary Side**
**5.6 Containment/Confinement**
**5.7 Electrical, I&C and Human Interface**
**5.8 Unique Technical Design Features (if any)**

# 6. Technology Readiness

# SUMMARY FOR BOOKLET

**Initial Proposed Site**

Oklo is working with a range of customers related to the initial sites. It is anticipated that the first powerhouse will be sited at the Idaho National Laboratory (INL) Site in southeast Idaho, referred to as the "Aurora INL site." The Oklo Inc. site use permit request was evaluated by the Department of Energy Office of Nuclear Energy (DOE-NE), a field office of the DOE, through the site use permit process and received a permit on September 26, 2019. Additionally, the DOE provisionally approved a specific site within the INL Site for the location of the powerhouse in late 2021.

**Design and Licensing Status**

The design is at the detailed design stage. Oklo has completed fuel prototyping activities, heat transport testing programs, and is now developing experimental advanced fuel recycling and fabrication capabilities. Oklo was awarded a Site Use Permit by the U.S. DOE and was awarded fuel material by the Idaho National Lab and the U.S. DOE. Oklo is the only company to have had a custom combined license accepted for review by the U.S. NRC. Oklo has actively engaged the U.S. NRC from 2016 to the present in pre-application activities, as well as application review activities.

**6.1 Deployed Reactors**
**6.2 Reactors under Licensing Review**

6.3 Reactors in the Design Stage

## 7. Safety Concepts

## SUMMARY FOR BOOKLET

7.1 Safety Philosophy and Implementation
7.2 Transient/Accident Behaviour

## 8. Fuel and Fuel Cycle

## SUMMARY FOR BOOKLET

8.1 Fuel Cycle Options
8.2 Resource Use Optimization
8.3 Unique Fuel/Fuel Cycle Design Features

## 9. Safeguard & Physical Security

## SUMMARY FOR BOOKLET

9.1 Safeguards
9.2 Security
9.3 Unique Safeguards and/or Security Features

## 10. Project Delivery & Economics

## SUMMARY FOR BOOKLET

10.1 Project Preparation and Negotiation
10.2 Construction and Commissioning
10.3 Operation and Maintenance