Project Title: Aalo-X Critical Assembly Facility

Project Description and Purpose:

Proposed Action:

Aalo Atomics Inc. (hereinafter "Sponsor" or Aalo") proposes the Aalo-X Critical Assembly project at Idaho National Laboratory (INL) involving the installation, configuration, and operation of a graphite-moderated, zero-power critical assembly within the existing Critical Assembly Facility (CAF). Reactor activities are limited to controlled approach-to-critical testing and zero-power reactor physics experiments at nominal steady-state power levels not exceeding 10 watts thermal. Operations include core loading and configuration within the Critical Assembly Vessel (CAV), reactivity control system testing, instrumentation validation, and neutron physics measurements necessary to support advanced microreactor development. The assembly is a dry configuration and does not utilize liquid coolant systems, sodium systems, or process water systems. No electrical generation, thermal energy production, or power conversion systems are involved.

Fuel-related activities include receipt, radiological survey, nuclear material control and accountability (NMC&A) processing, criticality safety evaluation, interim storage, handling, core assembly, and subsequent shipment of Sponsor-owned low-enriched uranium dioxide (UO2) fuel pins. These fuel pins will be stored at the TREAT facility until DOE approves the Aalo CAF as a HAZCAT 2 facility. Once this approval is final, the fuel pins will be stored in a secured conex at the Aalo location at INL. This conex will also be a part of a larger structure consisting of two conexes shown in figure 6. The fuel inventory consists of approximately 1,500 fuel pins, each containing 1.449 kg of UO2, shipped to INL in U.S. Nuclear Regulatory Commission (NRC)-certified RAJ-II transportation containers (50 pins per container), for a storage duration not to exceed six months. Fuel will remain in approved shipping containers during interim storage and will not be repackaged as part of this scope. Activities include coordination with safeguards and security, radiological controls, criticality safety program implementation, and compliant transportation back to the Sponsor's permitted facility once authorized. INL assumes no ownership of the fuel and no fuel fabrication, reprocessing, or disposal activities are included in this scope.

Upon completion of zero-power testing activities, reactor operations will cease and the fuel assemblies will be removed from the CAV and returned to approved storage configuration within the NRC-certified RAJ-II transportation containers. Because operations are limited to a maximum of 10 watts thermal, fission product accumulation and decay heat generation are minimal; therefore, no extended onsite cooling period is required prior to fuel handling. Some of the fuel may remain in the CAF or may be moved for reuse in the future Aalo-X reactor. Following completion of testing and any required radiological surveys and material accountability reconciliation, the sponsor-owned fuel will be prepared for shipment in accordance with applicable U.S. Department of Transportation (DOT), NRC, and DOE requirements. Fuel will be transported to the sponsor's permitted facility once authorization to receive fuel has been obtained. No used fuel reprocessing, repackaging, long-term storage, or disposal activities are included in this scope. Any future decommissioning of the critical assembly structure or facility modifications would require separate DOE authorization and additional review under the National Environmental Policy Act (NEPA), as applicable.

Secondary Power Source (Generator):

As a secondary source of power, a temporary diesel-powered mobile generator rated at 300 kVA, 480V will be installed within the existing CAF site footprint to provide backup electrical power in the event of loss of normal utility service. The generator will operate intermittently for emergency backup and periodic testing and will not exceed a three-month period. The unit will utilize diesel fuel stored in an integral or adjacent manufacturer-approved fuel tank and will remain within the previously analyzed 2.2-acre CAF site boundary. Operation of the generator may result in minor air emissions typical of diesel combustion engines, including nitrogen oxides (NOx), carbon monoxide (CO), particulate matter (PM), and greenhouse gases. No additional permanent ground disturbance, process water use, liquid effluent discharge, or modification of reactor systems is included in this scope. While used intermittently, the generator will be available to provide power 24/7.

Operational Parameters:

This section provides a summary of the anticipated components and activities associated with the implementation of the Aalo-X Critical Assembly project. The project is expected to include a range of design and operational elements that support its technical, safety, and environmental objectives. These elements are described to offer a clear understanding of the project's scope, including expected emissions, waste streams, and other relevant considerations.

Operational Timeline:

Phase One - Construction and Installation: 0-2 Months
Phase Two - Initial Startup and Commissioning: 2-12 Months
Phase Three - Operational Phase: 12-60 Months
Phase Four - End of Life and Defueling: 60-72 Months

The table below summarizes the key parameters and characteristics of the anticipated project. These parameters reflect the expected operational envelope for the Aalo-X CAF and serve as a reference for understanding the scale and nature of project activities. Should project activities evolve

beyond these expectations, additional review under the NEPA may be required to ensure continued compliance with applicable environmental regulations.

Parameter	Definition	Bounding Condition
Thermal Output	Maximum thermal power generated by the critical assembly	= 10 watts thermal (zero-power operation)
Electrical Output	Estimate of maximum electric generator output from the reactor	Not applicable — the assembly does not generate electricity
Fuel Type	Reactor fuel type	Low-enriched uranium dioxide (UO2) fuel pins
Fuel Enrichment	Extent to which fuel has been enriched	< 20% U-235
Fuel Form	Physical configuration of fuel	Solid UO2 fuel pins arranged in graphite-moderated lattice
Fuel Inventory	Total fuel quantity authorized under this scope	Approximately 1,500 fuel pins; 1.449 kg UO2 per pin
Shipping Configuration	Fuel transportation and storage configuration	NRC-certified RAJ-II containers (50 pins per container; up to 30 containers)
Commissioning Time	Maximum time to complete installation and readiness testing	Consistent with programmatic schedule; limited to zero-power testing configuration
Operational Time	Maximum duration of reactor operation	Expected duration of operations 12-60 months.

Heat Transfer Medium	Mechanism for removal of reactor heat	Not applicable — negligible heat generation at =10 watts
Heat Sink	Medium used to dissipate reactor heat	Not applicable — no active heat removal system required
Water Consumption	Process or operational water use	No process water use; minimal potable water for sanitary purposes only
Liquid Effluent	Routine discharge of liquid waste streams	None anticipated
Radiological Air Emissions	Projected airborne radionuclide releases	Conservatively bounded to result in = 0.001 mrem/year to the maximally exposed individual
Waste Generation	Anticipated operational waste streams	Small quantities of low-level radioactive waste; minor industrial and hazardous waste consistent with maintenance activities

Location:

The Aalo-X critical assembly will be installed within the existing CAF located immediately south of the Materials and Fuels Complex (MFC) at the INL. The CAF is located inside the already analyzed footprint of approximately 2.2 acres and consists of a single-story pre-engineered metal building nominally 60 feet by 60 feet by 60 feet, including foundations, utilities, and life-safety systems. The facility was constructed to provide a code-compliant building shell and site infrastructure to support installation and operation of the Aalo-X critical assembly and associated systems. Aalo will also erect a 10ft x 10ft structure to house PPE equipment for visitors. The PPE stored at this structure will be hard hats, reflective vests, safety glasses, hearing protection, first aid kits, and safety related items.

Utilities:

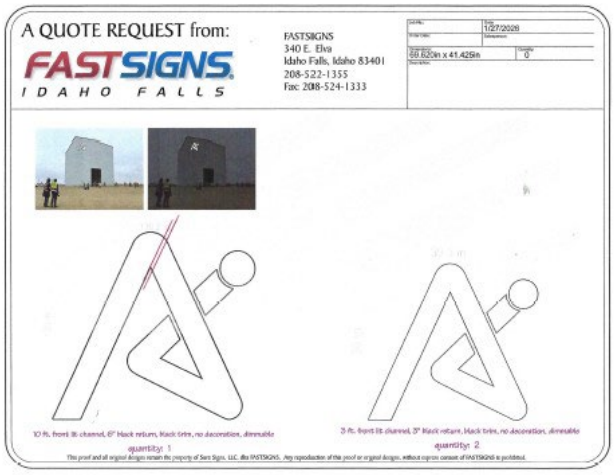
Potable/fire water lines, sanitary sewer lines and industrial wastewater lines will be installed and will be tied into the existing MFC utilities to support the Aalo-X facility. Industrial wastewater effluent will not exceed a maximum peak of 40 gpm and the normal occupancy for the Aalo-X facility will be 20 personnel.

Waste:

Solid and industrial waste generated during construction and operation of the CAF will produce an approximate maximum volume of 0.50-1.0 tons annually. Minor quantities of universal/hazardous waste (e.g., maintenance materials) – less than 500 pounds per year of hazardous waste is anticipated during construction and operation of the CAF. During total operation of the CAF, less than 100 pounds of low-level radioactive waste is anticipated being generated from any of the following possible waste.

Signage:

Three signs will be installed at the Aalo facility. A large 8' will be installed on the south exterior wall of the CAF building in the upper left corner. The other two smaller signs will be interior install in the offices and factory. White LEDs will be used for the sign and it will have an off/on switch and be visible over 2500' away. The sign will be illuminated when the reactor goes critical. This should be done during normal operating hours. At this point there is no intention to have the sign be illuminated at night, as Aalo is not a business that is open to the public. If the sign is required on at night, it will be illuminated at its lowest setting. A rendering of the sign is shown below.



Aalo-X System Integration Figures:

Figure 1: Site

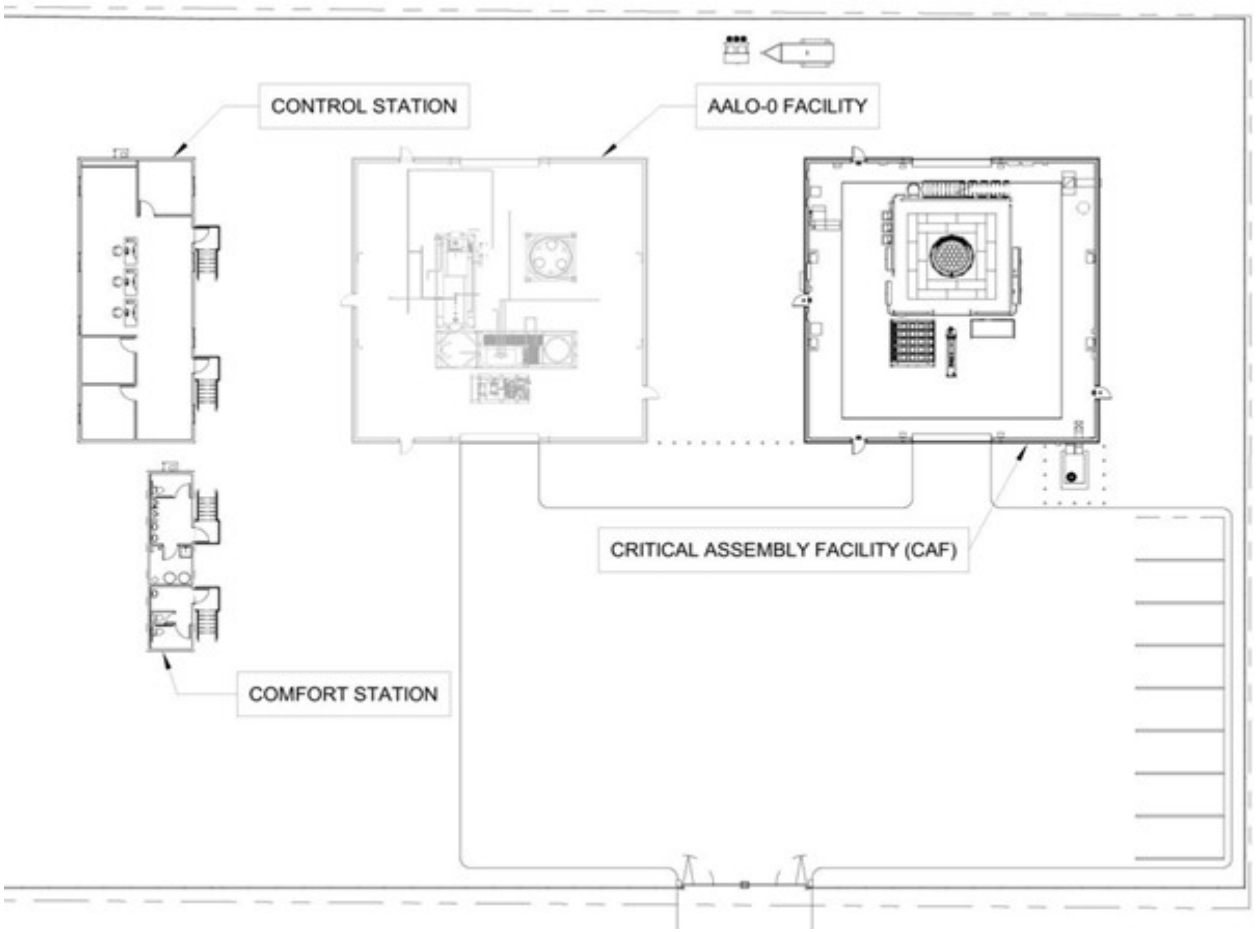


Figure 2: Plan view of the CAF showing reactor components

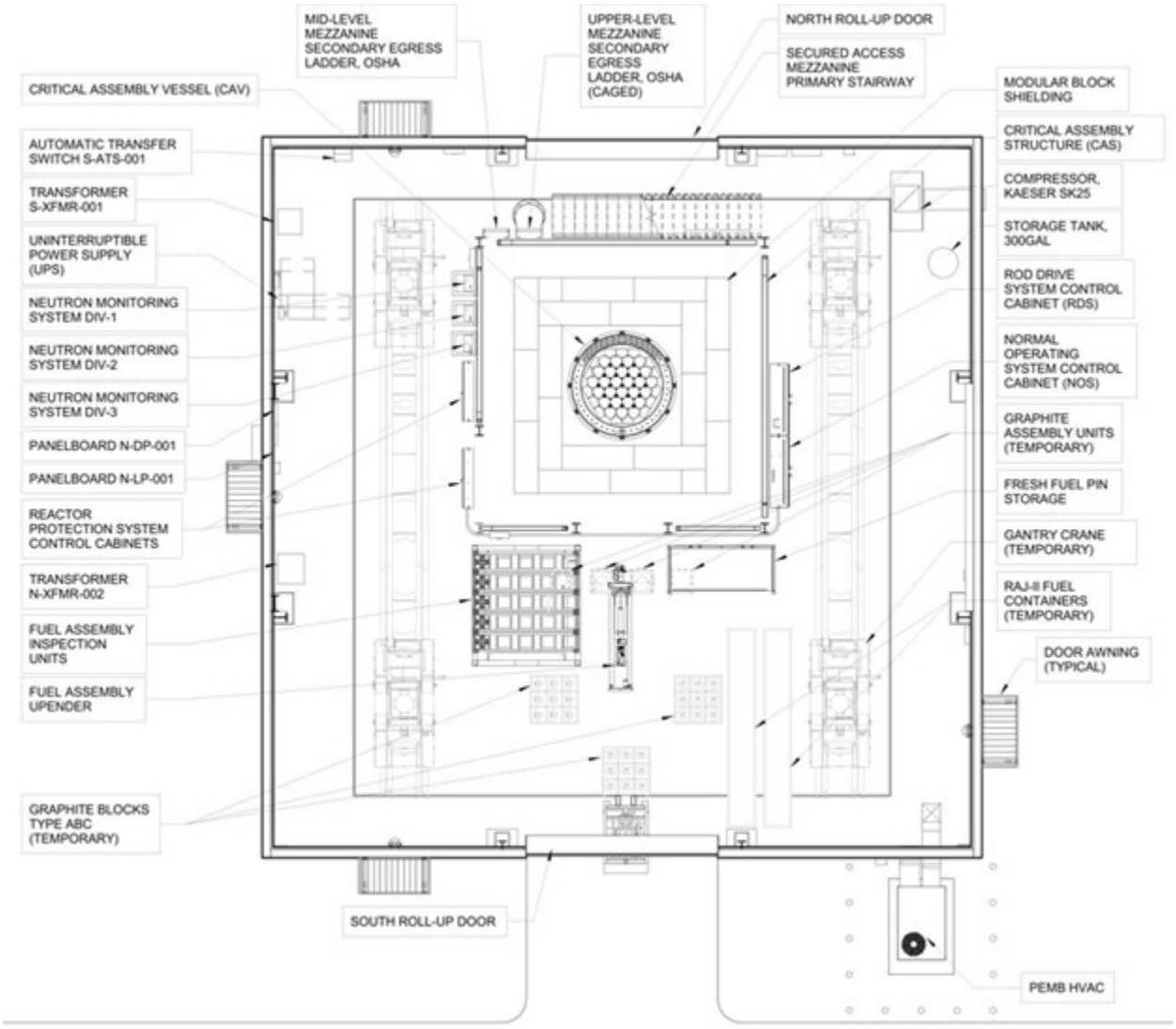


Figure 3: Section view of CAF, looking north, showing reactor components

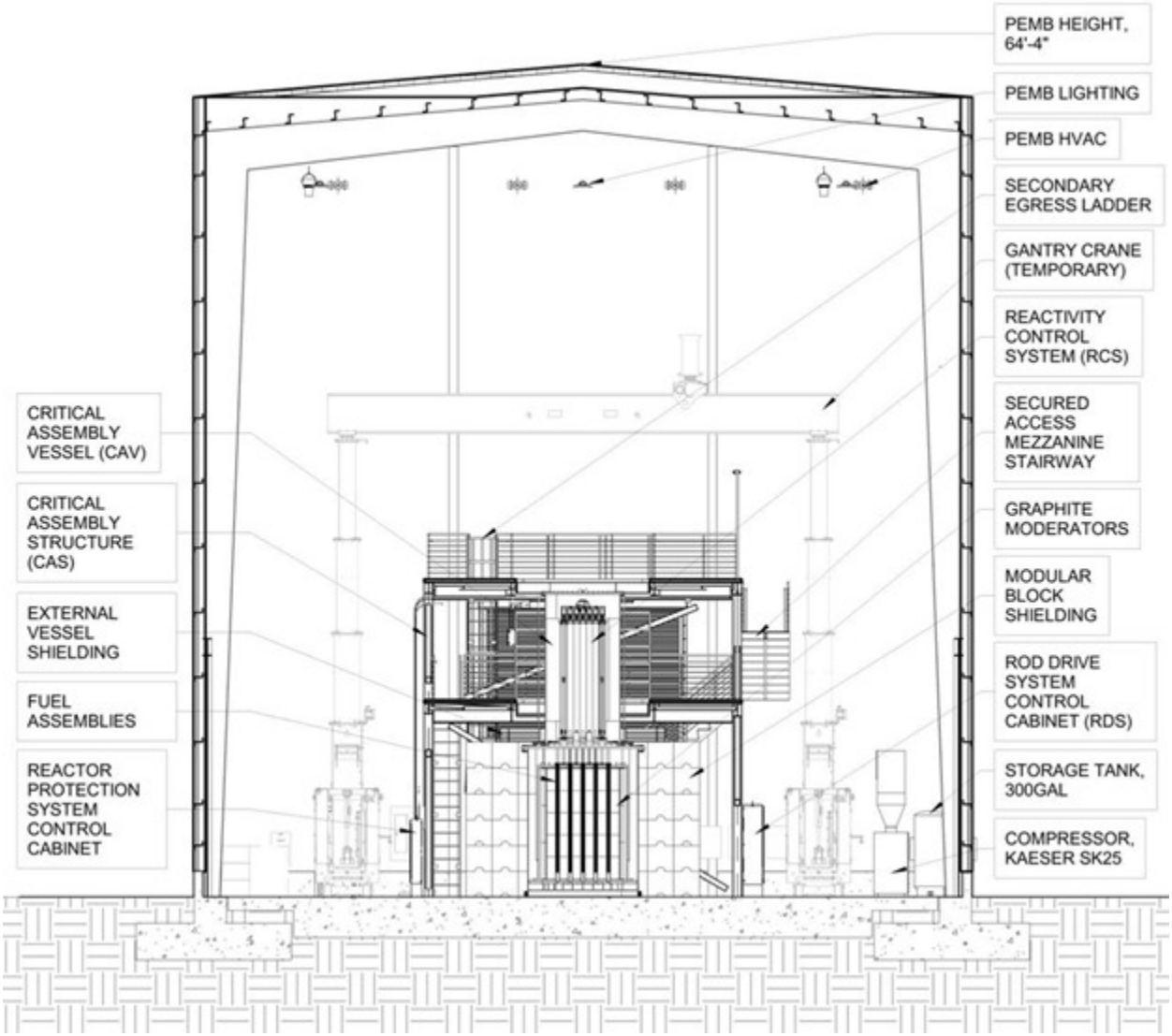


Figure 4: Axonometric view of the CAF showing reactor components

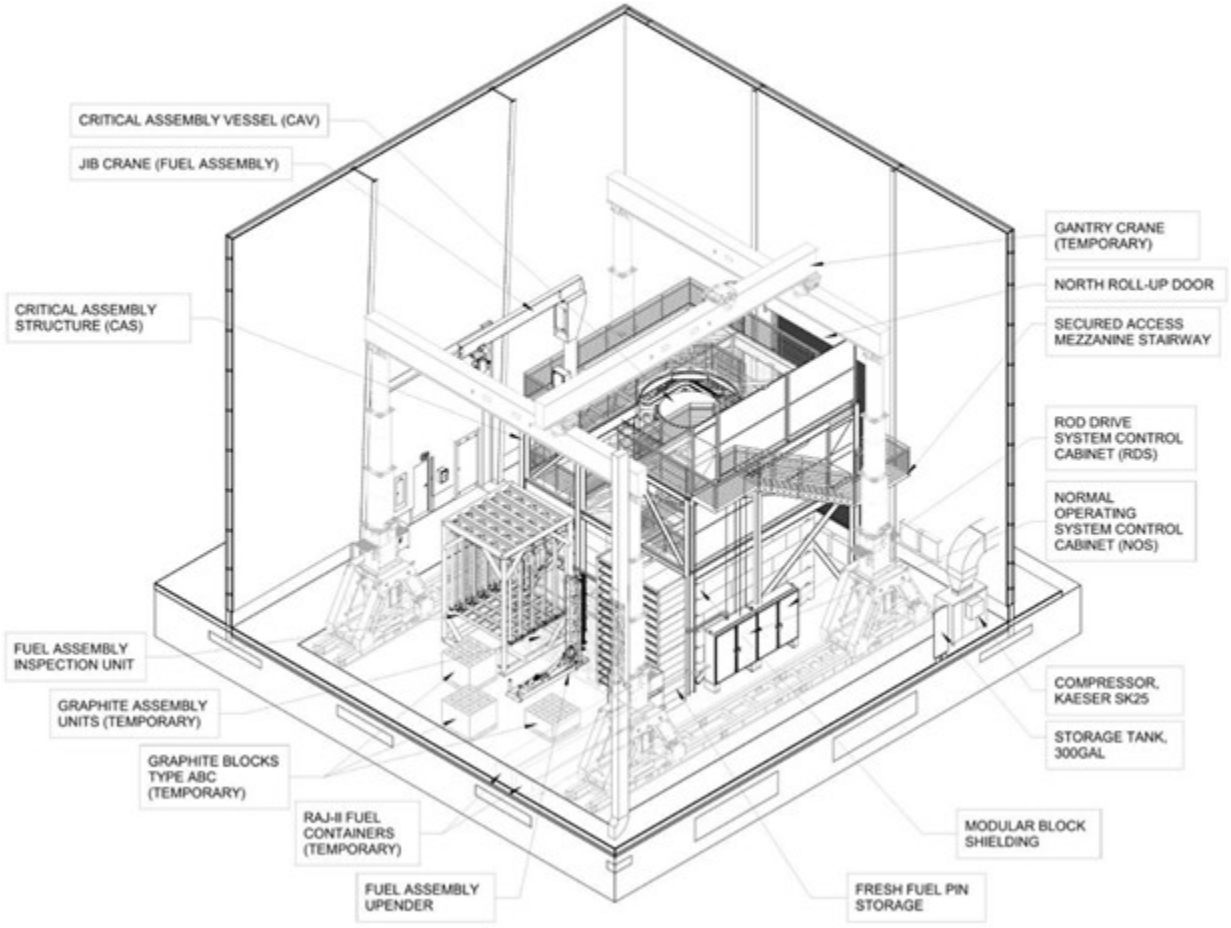


Figure 5: New CAF Facility Lines

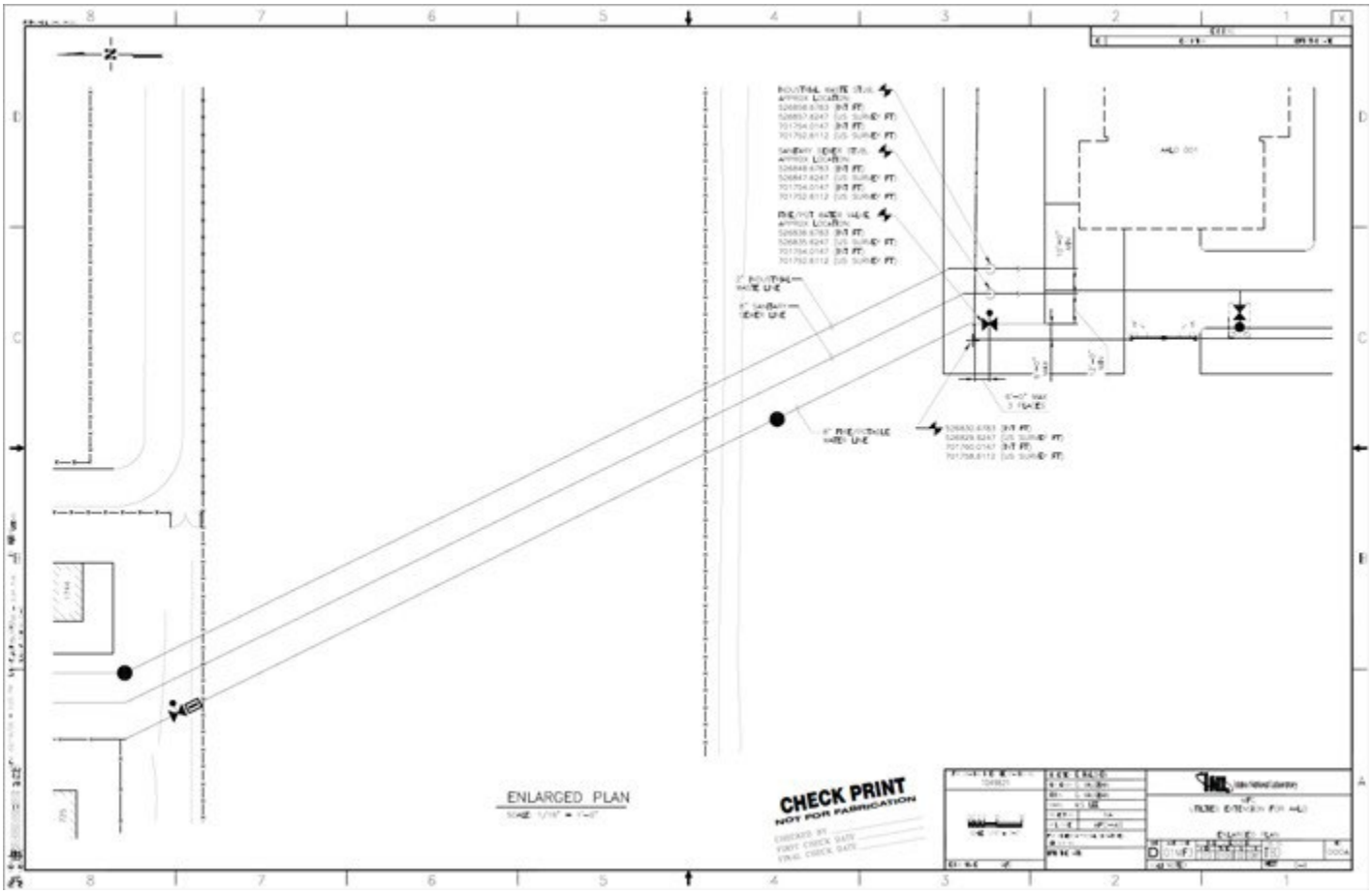


Figure 6: Conex Tent Sectional Looking East

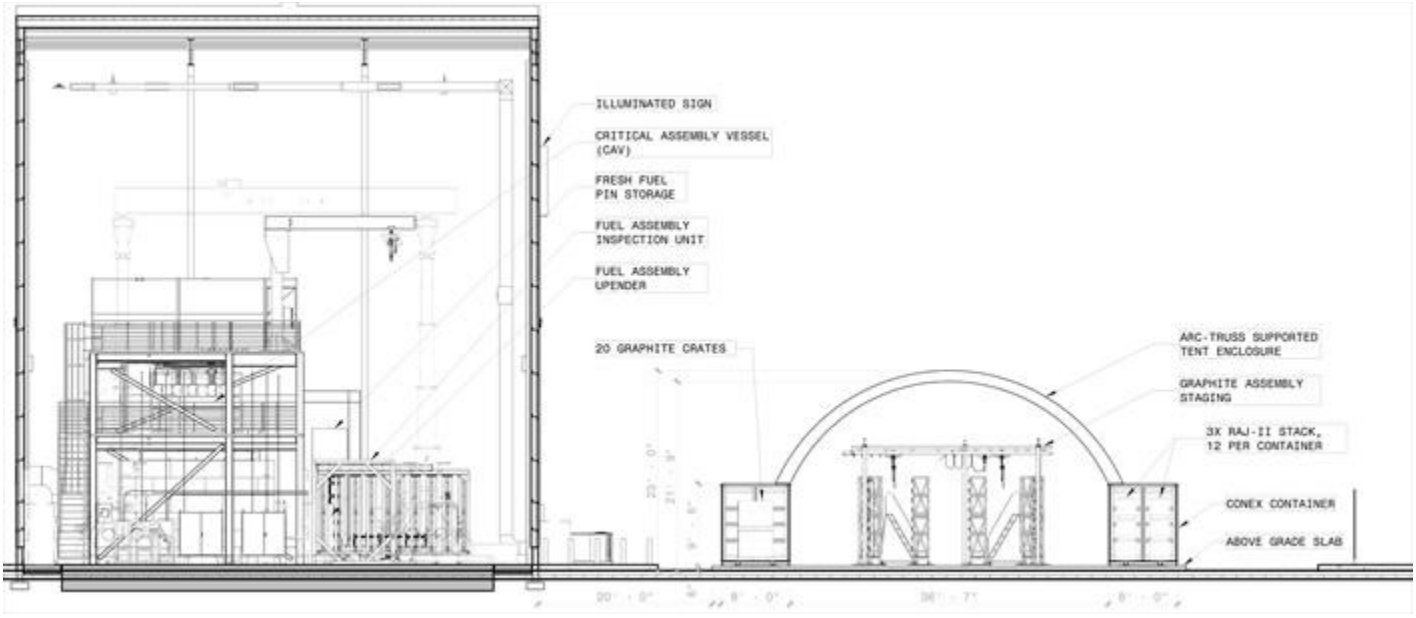
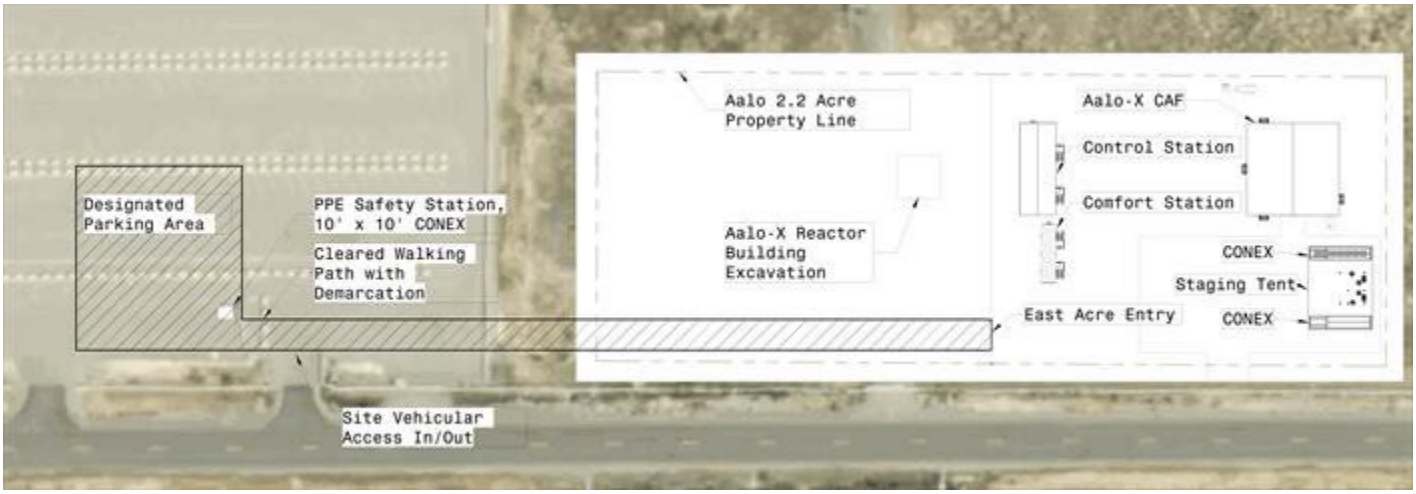


Figure 7: Conex Tent and PPE Structure Locations



Environmental Aspects or Potential Sources of Impact:

Air Emissions

Radionuclides:

A conservative bounding analysis was performed assuming continuous operation at 10 watts for 8,760 hours per year, 100% release of noble gas fission products, and no credit for filtration, plate-out, or decay estimates the following maximum annual radionuclide production:

- Noble gases: approximately 1.2 × 10^-6 curies per year
- Iodine isotopes: less than 1.0 × 10^-9 curies per year
- Particulates: less than 1.0 × 10^-10 curies per year

Using EPA-approved CAP88 dose modeling methodology with INL meteorological data, the maximum effective dose equivalent to the maximally exposed individual at the INL site boundary is conservatively estimated to be less than or equal to 0.001 mrem per year. This value is substantially below the 10 mrem per year regulatory limit established under 40 CFR Part 61, Subpart H.

Project activities have the potential to generate fugitive dust.

Discharging to Surface-, Storm-, or Ground Water

This project is located outside of the boundary of the storm water corridor and therefore is not considered to have reasonable potential to discharge to "Waters of the U.S.". However, site stormwater controls will need to be coordinated with MFC.

Disturbing Cultural or Biological Resources

There is the potential for this work to impact vegetation and for project personnel to interact with various wildlife species. A Biological Resource Review will be arranged within two weeks prior to the initiation of any activities that might disturb soil or vegetation and again following completion of project activities. A nesting bird survey is included with the Biological Resource Review for actions occurring between April 1 - October 1 per compliance with the Migratory Bird Treaty Act. Bat surveys are also included with the Biological Resource Review in accordance with the INL Bat Protection Plan.

Several Cultural Resource Reviews (CRRs) were performed on the CAF project site by DOE M&O Contractor, BEA, resulting in a No Adverse Effect determination that was concurred upon by the State of Idaho Historic Preservation Office (SHPO).

Generating and Managing Waste

Hazardous or universal waste generated from maintenance activities is anticipated to be less than 500 pounds per year. Hazardous waste will be managed in accordance with the Resource Conservation and Recovery Act and applicable Idaho Hazardous Waste Management Act requirements.

During total operation of the CAF, less than 100 pounds of low-level radioactive waste is anticipated being generated from any of the following possible waste streams: activated or contaminated tools, components, shielding, or materials not designated as fuel.

No transuranic waste is anticipated.

Used nuclear fuel management will be conducted consistent with applicable DOE requirements and the Other Transactional Agreement (OTA). Fuel handling activities include receipt, interim storage in NRC-certified transportation containers, controlled handling and assembly, and shipment to the Sponsor's authorized facility. Coordination with DOE Office of Environmental Management will occur, as applicable, to ensure appropriate storage, disposition planning, and compliance with DOE requirements. No fuel reprocessing activities are included within the scope of this action.

All waste streams will be characterized prior to disposition and managed through established INL waste management processes. Based on defined management pathways and compliance with applicable federal and state regulations, hazardous waste, low-level radioactive waste, and used nuclear fuel generated by the project can be managed in accordance with applicable requirements.

Construction activities associated with installation of the Aalo-X critical assembly within the existing CAF will generate typical non-hazardous construction debris, including packaging materials, scrap metal, wood, and minor concrete or hardware waste. No unique or reactor-specific construction waste streams are anticipated.

Releasing Contaminants

When chemicals are used during the project there is the potential for spills that could impact the environment (air, water, soil).

Using, Reusing, and Conserving Natural Resources

Project description indicates materials will need to be purchased or used that require sourcing materials from the environment. Being conscientious about the types of materials used could reduce the impact to our natural resources.

The Aalo site is on previously disturbed land. It is not located within a 100-year floodplain, wetland, or designated critical habitat. The facility is accessible via existing paved INL roadways and utilizes existing INL utility infrastructure.

Determination

References: B5.26 "Advanced Nuclear Reactors"

B5.26: Authorization, siting, construction, operation, reauthorization, and decommissioning of advanced nuclear reactors, provided the DOE determines 1) the project's attributes, including potential fission product inventory, fuel type, reactor design, and operational plans, reduce sufficiently the risk of adverse offsite consequences from the release of radioactive or hazardous waste, and 2) the project demonstrates that any hazardous waste, radioactive waste, or spent nuclear fuel generated by the project can be managed in accordance with the applicable requirements. For the purposes of this category, a project may include multiple reactors within a nuclear facility.

The proposal fits within the classes of actions listed in Appendix B to 10 CFR Part 1021 or Appendix B and C of DOE's NEPA Implementing Procedures and satisfies the conditions that are integral elements of the classes of actions therein. The proposal does not: (1) threaten a violation of applicable statutory, regulatory, or permit requirements for environment, safety, and health, or similar requirements of DOE or Executive Orders; (2) require siting and construction or major expansion of waste storage, disposal, recovery, or treatment facilities (including incinerators), but the proposal may include categorically excluded waste storage, disposal, recovery, or treatment actions or facilities; (3) disturb hazardous substances, pollutants, contaminants, or CERCLA-excluded petroleum and natural gas products that preexist in the environment such that there would be uncontrolled or unpermitted releases; (4) have the potential to cause significant impacts on environmentally sensitive resources, including, but not limited to, those listed in paragraph B(4) of 10 CFR Part 1021, Appendix B; (5) involve genetically engineered organisms, synthetic biology, governmentally designated noxious weeds, or invasive species, unless the proposed activity would be contained or confined in a manner designed and operated to prevent unauthorized release into the environment and conducted in accordance with applicable requirements, such as those listed in paragraph B(5) of 10 CFR Part 1021, Appendix B.

There is no extraordinary circumstance related to the proposal that is likely to cause a reasonably foreseeable significant adverse effect or for which DOE does not know the environmental effect. Extraordinary circumstances are unique situations presented by specific proposals, including, but not limited to, scientific controversy about the environmental effects of the proposal; uncertain effects or effects involving unique or unknown risks; and unresolved conflicts concerning alternative uses of available resources.

The proposal has not been segmented to meet the definition of a categorical exclusion. Segmentation can occur when a proposal is broken down into small parts in order to avoid the appearance of significance of the total action. However, segmentation does not include proposals that are developed and potentially implemented over multiple phases where each phase results in a decision whether to proceed to the subsequent phase.

Based on my review of the proposed action, I have determined that the proposed action fits within the specified class(es) of action, the other regulatory requirements set forth above are met, and the proposed action is hereby categorically excluded from further NEPA review.

Approved by Jason L Anderson, DOE-ID NEPA Compliance Officer on: 4/14/2026