

**FINDING OF NO SIGNIFICANT IMPACT FOR THE
LINAC COHERENT LIGHT SOURCE-II PROJECT
SLAC NATIONAL ACCELERATOR LABORATORY**

AGENCY: U. S. Department of Energy (DOE)

ACTION: Finding of No Significant Impact (FONSI)

SUMMARY: The U. S. Department of Energy (DOE) has completed an Environmental Assessment (DOE/EA-1975) on a project to expand the existing Linac Coherent Light Source (LCLS) facility at the SLAC National Accelerator Laboratory (SLAC).

One of SLAC's major scientific facilities is the LCLS, the world's first hard X-ray free electron laser. The LCLS X-ray laser beams enable the simultaneous investigation of a material's electronic and structural properties on the size (sub-nanometer) and time (femto-second) scales that determine their function. Research programs at SLAC include materials science, catalytic science, structural molecular biology, and molecular environmental science. The LCLS and other facilities at SLAC are considered "user" facilities because they are made available to researchers at SLAC as well as students and scientists from universities, industry, foreign institutions, and other national laboratories.

SLAC now has new scientific research needs that derive from the success of operating LCLS. Starting with the first experiments in the fall of 2009, the demand for LCLS beam time has exceeded the available beam-time by more than four to one. The proposed LCLS-II would allow DOE to expand LCLS capabilities to extend the photon energy range, increase control over photon pulses, and enable two-color pump-probe experiments. The X-ray laser beams generated by LCLS-II would enable a new class of experiments: the simultaneous investigation of a material's electronic and structural properties.

To provide these new capabilities, SLAC would upgrade the existing LCLS by replacing existing equipment within areas of the accelerator housing and klystron gallery with new superconducting accelerator equipment, as well as upgrades to existing utilities. In addition, SLAC would construct a cryogenic plant which would be located near Sector 4 of the existing klystron gallery and a smaller plant may be constructed, if necessary, adjacent to the primary plant or near Sectors 0-1 to provide additional production capacity and backup during maintenance shutdowns.

DOE has determined based on the findings of this EA, that the Proposed Action to construct, operate, and decommission at the end of its useful life the LCLS-II project does not constitute a major federal action that would significantly affect the quality of the human environment within the meaning of the National Environmental Policy Act (NEPA).

This EA complies with the NEPA, the Council on Environmental Quality (CEQ) Regulations Implementing the Procedural Provisions of NEPA (40 Code of Federal Regulations [CFR] Parts 1500-1508), DOE NEPA Implementing Procedures (10 CFR 1021), and DOE's NEPA Compliance Program (DOE Order 451.1B).

PURPOSE AND NEED:

LCLS-II would build on the experimental results obtained from LCLS, and its added capabilities would help to drive new discoveries to advance our understanding of the fundamental mechanisms of chemical reactivity and allow us to tailor materials to transport and store energy more efficiently. LCLS-II would

allow us to probe matter with near-atomic resolution that has not been possible using existing optical techniques. In addition to new capabilities, LCLS-II would double the number of laser sources providing photon beam to the experimental stations to accommodate additional users. Adding capability and capacity would be an important step toward maintaining LCLS-II as the world's premier X-ray laser facility.

The discoveries from LCLS-II would enhance our ability to understand processes at the most basic atomic level. LCLS-II could provide knowledge that would allow scientists to control chemical transformations at the molecular level. LCLS-II's extended photon energy range may reveal the molecular structures of complex biological systems and lead to the development of new materials with designs based on biological principles, or "bio-inspired" materials. DOE, SLAC, and the scientific community envision that LCLS-II will help scientists and engineers attain a deeper understanding of the mechanisms that control nature and that this will help them design and tailor new materials and systems to solve technological challenges related to energy, information science, and medicine. These challenges relate to time – the dynamic nature of chemical processes; energy – how electrons influence material properties; and space – how the structure of complex molecules describes their function in living systems.

DESCRIPTION OF THE PROPOSED ACTION:

The Proposed Action would be an upgrade to the existing LCLS to enhance its experimental capabilities and perform new types of experiments. These upgrades will require dismantling and removing existing equipment and utilities within Sectors 0 through 10 of the existing accelerator housing and klystron gallery and installing new superconducting accelerator equipment. It would also require upgrades to existing LCLS equipment and utilities including those contained in the Beam Transport Hall (BTH), Undulator Hall (UH), Near Experimental Hall (NEH), and Far Experimental Hall (FEH). One of the upgrades would be the installation of a second beamline, which would accommodate additional researchers and allow completion of more experiments.

To provide new capabilities, SLAC would construct a primary cryogenic plant to produce extremely cold liquid helium and circulate it through the superconducting accelerator equipment via new utility connections. The primary cryogenic plant would be located on the north side, near Sector 4 of the existing klystron gallery and would consist of a steel-framed building to house compressors and control rooms. The plant's exterior would consist of piping, storage tanks for liquid helium and nitrogen (refrigerant), electrical transformers, and site access improvements. SLAC may also construct a smaller cryogenic plant, if necessary, adjacent to the primary plant or near Sectors 0 – 1 to provide additional production capacity and backup capability during maintenance shutdowns.

ALTERNATIVES CONSIDERED: This section describes alternatives considered during conceptual design but rejected because they do not meet the purpose or mission need, or would be cost-prohibitive and therefore infeasible. The alternatives considered included constructing LCLS-II at a "green field" site at SLAC or at another DOE location.

Build LCLS-II at a "Green Field" SLAC Location

Under this alternative, LCLS-II, including installation of a new linac, would be sited and constructed at a new location at SLAC. An alternative site would require substantial additional investigations and construction of a new accelerator housing and klystron gallery. This alternative would not be able to take advantage of existing facilities or LCLS equipment and infrastructure, and there would be increased environmental disturbance from construction of duplicate facilities. Further, construction of duplicate facilities would be cost-prohibitive and therefore infeasible. For these reasons, this alternative was not included in the detailed environmental evaluation.

Build LCLS-II at another DOE Site

Under this alternative, LCLS-II would be constructed at another DOE facility. However, this would require construction of duplicate facilities that are already available at SLAC, which would be cost prohibitive. Construction of LCLS-II at SLAC would reuse approximately \$400 million in existing equipment and infrastructure and would maximize the \$500 million already invested in LCLS. Thus, SLAC is clearly the most effective choice among alternative sites for LCLS-II based on cost and the relatively small incremental environmental consequences of siting the project in and adjacent to existing buildings. Therefore, siting the project at an alternate DOE property was not considered reasonable and was not evaluated in detail as an alternative in this EA.

No Action

As required by NEPA, this EA also evaluated the no action alternative. No Actions means that LCLS would continue to operate under current management practices. In the event that LCLS-II is not constructed, planned research would be constrained to the capabilities and capacity of the existing experiments and research institutions.

ENVIRONMENTAL CONSEQUENCES: DOE evaluated the potential environmental effects of the Proposed Action, including dismantling and removing existing equipment, installing new equipment, operations, and eventual decommissioning. DOE considered fourteen environmental resource areas: air quality, biological resources, vegetation, wildlife, fisheries, cultural resources, geology and soils, health and safety, hydrology and water quality, noise and vibration, socioeconomics and environmental justice, transportation, visual resources, and waste management. DOE determined that either there would be no impacts or the potential impacts would be minor, short-term or both.

During construction of the proposed project, short-term impacts from excavation and grading activities would include the potential for soil erosion and sediment transport from the project site. Appropriate soil erosion control measures, such as the use of Best Management Practices (BMPs) to divert runoff from exposed soil surfaces, re-vegetating disturbed areas, and other measures would be implemented. The use of BMPs and implementation of a construction site Storm Water Pollution Prevention Plan (SWPPP) would ensure that impacts on soils would be minor and short-term. Operations would not result in any incremental impacts beyond those associated with routine facility and grounds maintenance activities.

The potential construction-related health and safety impacts would be limited to areas within the SLAC site boundary. While there would be an increase in off-site truck traffic from import of construction materials and off-site material disposal, any risk of accidents would be minimized by implementing avoidance and minimization measures, including preparing and implementing a traffic control plan for the project. Therefore, any vehicle-related health and safety impacts of the Proposed Action to the public would be minor and short term.

Potential hazards associated with construction activities, including excavation, heavy equipment use, high voltage, traffic, dust, fumes and noise are addressed through existing SLAC health and safety program requirements, engineering and/or administrative controls, and use of appropriate personal protective equipment. All areas accessible to workers would be routinely monitored by DOE, SLAC and subcontractor personnel and appropriate signs would be posted. These hazard controls and implementation of applicable health and safety requirements to the Proposed Action would reduce the potential for construction-related accidents and injuries.

Potential on-site employee and general worker health and safety hazards associated with the Proposed

Action include heavy equipment use, material handling/rigging, and excavation. Potential hazards associated with the use of hazardous materials during construction would be avoided or minimized by: conducting task-specific hazard analyses; delineating and establishing project boundaries and barriers; implementing existing site and project health and safety programs, policies, procedures and worker training; and conducting routine inspections.

Existing health and safety programs and policies and procedures already in place at SLAC include measures to protect workers and residents from construction hazards and potential exposure to chemicals and radionuclides in soil, therefore, construction of the proposed project would result in only minor risks of impacts to worker health and safety.

Potential hazards for SLAC employees and other site workers associated with routine operations include fire, electric shock, and exposure to hazardous materials, seismic risks and other adverse effects from the environment. These potential hazards are addressed in existing site health and safety programs, policies, and procedures.

Other potential health and safety impacts could result from accidents and malevolent acts from internal or external sources. The most serious radiation accident that could occur during operations would be the total loss of the injector beam at the maximum possible current and energy. This exposure, however, would last for only a fraction of a second before the beam would shut down, thereby producing a negligible radiation dose compared to the DOE dose limit of 100 mrem/year.

During construction, we have the necessary radiation controls in place to minimize exposure to As Low as Reasonably Achievable (ALARA). Potential hazards associated with ionizing and non-ionizing radiation exposure during operations is minimized through design and engineering measures such as electron beam dumps and thick concrete walls used for shielding, and use of administrative controls and personal protective equipment. Radioactivity in air, soil, groundwater and wastewater, and modeled doses based on constant presence on site, does not result in significant human health risk from radiation beyond naturally occurring levels. Measurements of direct radiation at locations along the site boundary and calculations of collective dose to the surrounding population from ongoing operations have historically been well below naturally occurring background levels and comply with DOE and Environmental Protection Agency requirements for direct radiation and airborne radioactivity. The Proposed Action would provide an additional source of radiation; however, given the design and engineering measures referenced above, off-site radiation exposure would continue to remain much lower than the naturally occurring background levels. Similarly, any exposure of biological resources would be below exposure standards and, therefore, any impacts from the Proposed Action would be minor.

To address potential surface water quality impacts associated with construction, trenching, grading and stockpiling activities, SLAC would obtain a General Permit for Discharges of Storm Water Associated with Construction Activity. The permit requires the development and implementation of a construction SWPPP, which includes project-specific BMPs, a visual monitoring program, and a chemical monitoring program, if necessary. The construction SWPPP would focus on preventing sediment from reaching storm drains and San Francisquito Creek through implementation of BMPs for management of disturbed soil and excavated material, and use of secondary containment and drip pans for temporary storage of chemicals and heavy and oil-filled equipment. Therefore, potential water quality impacts from the accidental release of hazardous materials would not likely occur. Operations would have minor effects on stormwater quality. Additional vehicles may contribute increases in oil and fuel use, as is the case in any parking lot or roadway; however, runoff from all

parking areas at SLAC are managed through BMPs as required by the site-wide SWPPP.

The Proposed Action would be implemented largely within the footprint of existing facilities and would use existing disturbed or paved areas for much of the staging and construction. The Proposed Action would comply with existing stormwater regulations and would allow percolation of stormwater in detention basins or implementation of other BMPs. Therefore, the proposed project would have no impact on flooding. SLAC's wastewater discharges are regulated under Mandatory Wastewater Discharge Permit No. WB061216 issued by Silicon Valley Clean Water (formerly South Bayside System Authority) and the West Bay Sanitary Sewer District and compliance with these discharge permit requirements for operational discharges from the project would result in no impacts.

Groundwater quality would not be impacted by construction of the Proposed Action. Existing SLAC experiments have minor impacts on surrounding soils through formation of radionuclides that can potentially migrate to groundwater. This risk is most prominent at the End Beam Dump (EBD), which is approximately 30 feet above the groundwater table. To accommodate the higher powers that will be used for LCLS-II, the shielding at the EBD would be redesigned to keep concentrations of radionuclides in groundwater below detection limits. With this and other measures, the potential for migration of radionuclides from the soil to the groundwater is very low.

Construction would require the use of heavy equipment including excavators, loaders, and haul trucks. The majority of the construction would be conducted during the daytime hours. To minimize nighttime noise impacts and comply to the extent practicable with local noise standards and objectives, the construction contractor would conduct the excavation required for the cryogenic plant foundations and the related site preparation and grading, as well as construction of utilities, during the day. Construction would include trucking of removed equipment and building materials, staging, assembly of components, construction of the cryogenic plants, installation of the cryomodels, and trenching of utilities. The majority of the work would be conducted at the west end of the accelerator housing and klystron gallery. Construction workers and trucks would use both the Alpine Gate and SLAC's main entrance on Sand Hill Road. Trucks would follow the haul road and enter the accelerator housing using a ramp, vault, and tunnel near Sector 10. Trucks would also occasionally use the west gate on Sand Hill Road near Whiskey Hill Road.

The Proposed Action would have negligible, if any, impacts on the existing or future population or demographics of the area of study. Construction would be extremely unlikely to result in any in-migration that could adversely affect the population or demographics of the area of study. Construction of the proposed project would require an average work force of 20 with a peak of approximately 40 workers during concurrent installation of the superconducting linac components and the cryogenic plants. The construction employment needs of the Proposed Action could easily be met with local resources; therefore, there would be no in-migration of workers to meet the construction labor demands of the project, and no impacts on the population or demographics or to the local housing market.

Potential impacts such as noise and increased traffic would be addressed through impact avoidance and minimization measures. These impacts would be borne uniformly by the population as a whole; thus, there would be no disproportionate effects from construction to minority or low-income populations. There would be no major environmental or socioeconomic impacts as a result of the operations as any potential impacts would be mitigated as part of the Proposed Action, and these impacts would be borne uniformly by the population as a whole. Thus, there would be no disproportionate effects on minority or low-income populations.

During operations, the Proposed Action would increase the number of daily employees and users of the site from approximately 1,630 now to approximately 1,650 in the future. This increase would be inconsequential and is less than the fluctuation in the number of SLAC employees over 1 year (60 to 100 people) because of shutdowns, construction activities, and temporary labor. The projected increase, however, would result in less than 1.0 dBA increase in traffic-related noise levels along Alpine Road or Sand Hill Road near SLAC's main entrance and would be below detection at the locations of sensitive receptors. Therefore, any operational effects from the Proposed Action on traffic noise would be minor. Construction traffic typically would occur outside the normal commute peak periods. Minor disruption of traffic may occur when the trucks and other construction-related vehicles turn into the site entrance. SLAC has established procedures for inspecting and clearing vehicles through the gated entrance to prevent excessive queuing of construction vehicles.

The proposed project would generate only a nominal amount of hazardous waste in the form of oily waste, but would generate substantial amounts of solid waste from demolition and excavation. However, solid waste disposal impacts on landfill capacity and operations would be minimized by recycling approximately 75 percent of the building demolition debris and by relocating excavated material on site. Through maximizing recycling and proper disposal of minor quantities of construction-generated hazardous waste, the Proposed Action would have a minor effect on waste management.

LCLS-II would require soil excavation for cryogenic plant construction. The project would require a permit from SLAC's Excavation Clearance Program to ensure proper soil screening, waste characterization and disposal. The permitting process would identify and minimize potential hazards associated with excavation work at SLAC. Prior to construction, SLAC's Excavation Clearance Program would review past activities performed in the area and collect soil samples, as needed for analysis of organic (e.g., total petroleum hydrocarbons (TPH) and inorganic (e.g., lead) chemicals. Based on the analytical results the soils would be reused at the cryogenic plant sites to construct perimeter berms, relocated to another area at SLAC, or disposed of at a Class II landfill. Excavated materials would be stored and handled as outlined in the project-specific SWPPP.

During excavation and construction, generation of hazardous waste would be limited to fuels and lubricants used for heavy equipment maintenance and fueling. Maintenance activities would occur in a designated area with appropriate controls to minimize the potential for overflows or spills. Construction of the Proposed Action may include limited use and storage of hazardous materials, such as paints, epoxies, fuels and lubricants, as well as lead for shielding purposes and would be handled in accordance with existing procedures. SLAC would minimize generation and disposal of solid waste by salvaging and recycling construction materials and demolition debris, such as concrete, clean soils, asphalt and wood. Therefore, the potential adverse impacts of generating these solid wastes would be short term and minor.

Component manufacturing and system installation may also produce hazardous wastes, such as used solvent from degreasing operations or spent cutting fluids. These wastes are routinely managed and controlled during ongoing operations at SLAC, in compliance with SLAC's existing policies and procedures for the management of hazardous materials and waste minimization.

The project will also procure components and hardware from outside vendors. Generation of hazardous wastes will be controlled by the vendors' existing policies and procedures to minimize impact on the workers and the environment. Component or equipment manufacturers will follow their respective state or municipal requirements.

Any material removed from within the accelerator housing would be surveyed for residual radioactivity, labeled and held on site for disposal evaluation in accordance with established SLAC procedures. Radioactive material with an identified future would be stored indoors or on covered and properly controlled and maintained areas. SLAC would handle and dispose of all radioactive wastes in accordance with SLAC procedures.

During the operational phase of the LCLS-II, only minimal quantities of hazardous materials including paints, epoxies, solvents, oils and lead in the form of shielding would be used. Existing site-specific procedures for chemical storage, storage inspection and secondary containment are in place for the safe handling, storage and transport of hazardous materials. There would be little to no impact on hazardous materials handling, use or storage as a result of operation of the LCLS-II facility. Wastes expected to be generated as a result of LCLS-II operations would be similar to wastes generated at existing experimental facilities at SLAC. There would be minimal impact on hazardous waste generation during operation of the facility. Therefore, the Proposed Action would not result in any incremental impacts on hazardous materials and waste management beyond that resulting from previous or existing LCLS operations and impacts would be minor.

In addition to evaluating impacts specific to the proposed action, impacts were also evaluated based on consideration of past, present, and reasonably foreseeable future projects that could result in cumulative effects when considered together with the Proposed Action. The cumulative effects evaluated were air quality, biological resources, cultural resources, geology and soils, health and safety, hydrology and water quality, noise, socioeconomics and environmental justice, and waste management.

A review on air quality indicated that the Proposed Action would be below the *de minimis* levels for conformity with the approved State Implementation Plan limits for each of the non-attainment criteria pollutants. Thus, the future cumulative air quality impacts would be minor. Operation of the proposed project would generate Greenhouse Gas (GHG) emissions from direct sources such as natural gas combustion and motor vehicles as well as indirect sources, such as water and wastewater use, waste generation, and electricity consumption. Based on a comparison with regional emissions data, the proposed project would result in emissions that would be a small percentage of the regional emissions, ranging from 0.008 to 0.2 percent. Therefore, the impact of emissions from the Proposed Action on regional air quality would be minor.

The Proposed Action would have a local, long-term, minor impact on vegetation. The grassland areas at SLAC are adjacent to existing industrial facilities and do not provide suitable habitat for special-status species and none have been observed at SLAC. After the Proposed Action is completed, any disturbed grassland areas would be restored to preconstruction conditions. Therefore, the Proposed Action would have only minor cumulative effects on grasslands when considered together with other anticipated projects.

The Proposed Action would involve excavation and could affect undiscovered cultural resources. Any unanticipated discoveries during the LCLS-II project construction would be addressed through consultation with a qualified archaeologist. Any fossil discoveries on SLAC would be addressed through consultation with a qualified paleontologist and, with minimization measures in place, only minor cumulative impacts would result. Short-term impacts on soils would occur, including increased risk of erosion due to vegetation removal caused by the use of heavy equipment; however, these potential effects would be reduced through erosion control BMPs. The Proposed Action alternative would have minor cumulative effects on soils and geology.

In conjunction with LCLS, the Proposed Action would have long-term minor impacts on worker health and safety by proportionately increasing potential sources of radiation and frequency of operation. However, these impacts would be managed through SLAC's existing health and safety programs and any cumulative effects would be minor. In addition, LCLS and the proposed project could have a cumulative beneficial effect on public health from breakthroughs related to health care, such as cancer treatments.

Because the Proposed Action would be constructed largely within the footprint of existing facilities and would comply with stormwater detention requirements, any increased runoff volume would be addressed through existing stormwater programs and would not increase the peak runoff rate. Therefore, any cumulative flooding impacts would be minor. In conjunction with other SLAC and Stanford University projects, and given implementation of the SWPPP and other BMPs, the Proposed Action would have only minor cumulative effects on water quality and any such impacts would be monitored and addressed according to state and local stormwater regulations. The Proposed Action would result in only minor, local groundwater impacts.

During construction, the Proposed Action would generate noise from excavators on the site access roads, from vehicles transporting workers, equipment and materials to and from the site. Noise modeling demonstrated that noise and vibration from construction equipment would be minimal and would not exceed applicable noise standards. Other projects at SLAC, including construction of research buildings and facility upgrades, could generate short-term, local noise impacts. Based on the schedule for other planned construction at SLAC, some projects would overlap with the Proposed Action. In addition to any nighttime construction associated with the Proposed Action, there would be limited nighttime construction attributable to other SLAC or Stanford University construction projects in the area. Overall, operational noise levels would be below local noise thresholds for both daytime and nighttime periods and would have minimal impact. Potential effects from maintenance activities on noise levels may be detectable over short durations; however, given the distances to the nearest sensitive receptors, any potential increases in operational noise levels would be minor. Other projects at SLAC, including construction of research buildings and facility upgrades and operations, could result in noise impacts that would overlap with the construction and operation of the Proposed Action. However, other SLAC projects would be approximately two miles or more from the cryogenic plant sites, which are the only LCLS-II components with potential offsite effects. Therefore, no cumulative impacts would result.

The Proposed Action would result in short-term construction-related increases in traffic during demolition and waste disposal activities, and from delivery of construction equipment and materials. However, most worker traffic and deliveries would occur at off-peak times. Other projects in the area would not have substantial traffic impacts on roads affected by project construction. In the long term, other SLAC infrastructure upgrades would have no cumulative impacts because they would not overlap with operational traffic from the Proposed Action. Other projects in the region would add truck trips on regional highways. Any cumulative impacts attributable to the Proposed Action would be minor considering the short-term construction effort and the relatively small number of trucks transporting material on and off-site. Because a relatively small volume of excavated material and demolition debris will be transported off-site for disposal, any cumulative traffic impacts on regional highways would be inconsequential.

DOE received a letter, dated April 30, 2014, documenting formal concurrence from the State Historic Preservation Office (SHPO) on the National Historic Preservation Act Section 106 consultation

required for the Proposed Action. The SHPO concurred that this undertaking, as proposed, will not adversely affect historic properties pursuant to 36 CFR Part 800.5(b).

NO ACTION ALTERNATIVE: Under the no-action alternative, DOE assumed that the Proposed Action would not be constructed. Existing facilities at SLAC would continue to operate under current management practices, and future research would be constrained to the capabilities and capacity of the existing facilities.

PUBLIC AVAILABILITY: DOE issued the draft EA in June, 2014 and advertised its availability in the *San Mateo County Times* and the *Menlo Park Almanac* that was published on June 6, 2014 allowing for 30 days public response ending on July 7, 2014. DOE also made available a copy of the draft EA at the Menlo Park Library in Menlo Park, California. DOE transmitted copies of the Notice of Availability of the draft EA to the appropriate state and local regulatory agencies, Indian tribes, and other interested stakeholders. On June 3, 2014, DOE transmitted the Notice of Availability of the draft EA and 15 electronic copies (CDs) to the State of California, Office of Planning and Research (OPR), which has responsibility for the distribution of environmental documents to the appropriate regulatory agencies. The State Clearinghouse of the State of California OPR distributed the draft EA document to the appropriate state and local agencies for their review. DOE also made the draft EA available on the SLAC NEPA website at <http://www-group.slac.stanford.edu/esh/groups/ep/epg/nepa.htm> and the DOE NEPA website at <http://www.energy.gov/nepa/doe-nepa-documents>.

DETERMINATION: Based on the findings of this EA, DOE has determined that the Proposed Action to construct, operate, and decommission at the end of its useful life the proposed LCLS-II project does not constitute a major federal action that would significantly affect the quality of the human environment within the meaning of the National Environmental Policy Act, 42 U. S.C. 4321 et seq. Therefore, the preparation of an environmental impact statement is not required, and DOE is issuing this FONSI.

Issued in Menlo Park, California, this 31 day of July, 2014.



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