DOE/EIS-0247-SA-02

Supplement Analysis:
Spallation Neutron Source
Second Target Station
Oak Ridge National Laboratory
Oak Ridge, Tennessee

U.S. DEPARTMENT OF
ENERGY | Office of
Science

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Introduction

The Department of Energy (DOE) has prepared this Supplement Analysis (SA) to evaluate the existing Environmental Impact Statement (EIS) (listed below) considering changes that could have bearing on the potential environmental impacts previously analyzed.

The Council on Environmental Quality (CEQ) National Environmental Policy Act (NEPA) regulations direct agencies to prepare a supplement to either a draft or final EIS if the "agency makes substantial changes in the proposed action that are relevant to environmental concerns" or there are "significant new circumstances or information relevant to environmental concerns and bearing on the proposed action or its impacts" (40 CFR 1502.9(d)(1)(i)–(ii)). DOE's NEPA regulations state that when it "is unclear whether or not an EIS supplement is required, DOE shall prepare a Supplement Analysis" (10 CFR 1021.314(c)). This SA provides enough information for DOE to determine whether (1) to supplement the existing EIS, (2) to prepare a new EIS, or (3) no further NEPA documentation is required (10 CFR 1021.314(c)(2)(i)–(iii)).

Existing EIS evaluated in this SA:

- DOE/EIS-0247 Final Environmental Impact Statement Construction and Operation of the Spallation Neutron Source Facility dated April 1999, available using the following URL address: https://www.energy.gov/nepa/eis-0247-construction-and-operation-spallation-neutron-source

Proposed Change or New Information[1]

This SA was prepared because of changes to the Spallation Neutron Source (SNS) Second Target Station (STS) proposed since the completion of DOE/EIS-0247 Final Environmental Impact Statement, Construction and Operation of the Spallation Neutron Source Facility dated April 1999. An initial SA (DOE/EIS-0247/SA1) was also completed for the SNS in February 2000. The original SNS EIS analyzed environmental impacts over the projected life of the facility, both operating at an initial power level of 1 megawatts (MW) and at the maximum potential upgrade power level of 4 MW. The SA completed in February 2000 evaluated a superconducting linear accelerator (linac) proposed as a replacement for a portion of the ambient temperature linac that was included in the Project Baseline. The STS was included in the original SNS EIS as part of the proposed action.

The need for the new SA stems from the construction phase of the proposed STS. It involves clearing and development of an adjacent greenfield area located beyond the bounds of the original project footprint, tied to construction and operation of the STS. Although the STS itself was covered in the original SNS EIS, it was determined that this SA should also include a brief comparison of potential impacts identified in the original EIS with actual operational impacts since SNS operations commenced.

[1] Throughout this document, the phrase "proposed change or new information" refers to a substantial change in a proposed action that may be relevant to environmental concerns or significant new circumstances or information that may be relevant to environmental concerns and have bearing on the proposed action or its impacts consistent with 40 CFR 1502.9(c).

Due to the complex topography of the SNS site, limited area is available to support the STS construction activities. Based on preliminary studies, an approximate 15-acre area immediately to the east of perimeter ring road was selected as the location for the construction support area (Figure). The construction support area would be graveled and designated for a trailer area, 350 construction craft parking spaces, and a construction laydown area. Temporary water and electrical utilities would be provided to serve the construction support area.

The STS project would eliminate or limit construction traffic through the existing roadway network to avoid potential conflicts between SNS personnel, visitors, and existing facilities operations. During previous studies, new construction access routes from Bethel Valley Road were analyzed. The two primary routes studied were the existing Walker Branch roadway and the unimproved Hawks Nest roadway. The Hawks Nest access route is the preferred option to eliminate construction impacts to the Walker Branch environmental study area (Figure 1).

The length of the Hawks Nest roadway is approximately 1 mile, and it would have direct access to the proposed construction support area east of the STS. The route shown is based on a preliminary analysis of the site topography. The lower half of the proposed access route alignment already exists and would become an improved and widened roadway. The upper portion of the alignment does not exist and would require more extensive clearing and grading to construct. An alternative construction access route under consideration includes use of Spallation Drive and a spur road to the northeast that would connect with the upper portion of the proposed Hawks Nest alignment. The spur road from Spallation Drive would be located just south of the ORNL Guest House.

Background

The STS project is an upgrade to the existing SNS wherein a second target station with its own instrumentation and supporting infrastructure is added to the existing accelerator facility. The power of the existing accelerator will increase from a current 1.4 MW to 2.8 MW as part of the Proton Power Upgrade Project. The accelerator would provide the capabilities needed to divert every fourth proton pulse produced by the accelerator to a new beamline serving the STS. As outlined in the SNS STS Conceptual Design Report (ORNL 2020), the STS project would provide researchers from a wide range of disciplines with a facility that offers wholly new experimental capabilities for addressing key questions in science, engineering, and human health. This STS project also seeks to keep the United States at the forefront of neutron scattering technology.

The STS would utilize the existing SNS accelerator, storage ring, and infrastructure. The preliminary project scope meets the mission need through construction of the following:

- The STS would include the capability to support 22 new beamlines. Instrument Systems would deliver eight initial advanced neutron scattering instruments to multiply the greater than 20x increase in STS cold neutron brightness relative to the First Target Station (FTS) and capitalize on neutrons with moderate wavelength resolution as a source for reflectometry, medium-resolution spectroscopy, and high-intensity instruments.

- A water cooled rotating solid tungsten target with closely coupled compact moderators.

- A Ring to second target (RTST) beam transport line, operating at 15hz pulse, would transport proton pulses to the STS target by separating the beam from the first ring to the target beam transfer line (RTBT) with a septum magnet and then transporting the beam to the second target with standard quadrupole magnets and dipole magnets.

- Integrated Control Systems include the control systems and computing infrastructure for the accelerator, neutron scattering instruments, and target; control systems for technical-systems utilities for conventional facilities; plus, the data acquisition software and hardware for the neutron scattering instruments.

- New building structures to house the second target, instrument halls, beam transport line, secondary facilities, and supporting systems and infrastructure.

The SNS initially included an FTS with a capacity of 24 instrument beamlines. The provision for the STS in the original EIS was included to accommodate growth and expansion of the accelerator facilities, target facilities, instrument buildings, laboratories, offices, and secondary supporting facilities.

The STS project requires substantial site development at the SNS campus, including approximately 400,000 gross square feet of new building construction. In addition to the individual building sites, the project includes underground site utilities, roadways and parking areas, storm water management and landscaping. The site design also accommodates temporary construction staging, trailers, parking, and access roads.

Resource Areas Considered but Not Analyzed in this SA Document

Geology and Soils – Erosion and siltation during construction of the SNS had negligible effects on soils or site stability and were minimized by the implementation of best management practices. During operation of the SNS it was determined that leaching of neutron-activated soil in the shielding berm for the linac tunnel could result in localized contamination of groundwater with radionuclides. However, it was concluded that radioactive decay would eliminate any significant effects to human or ecological receptors because of the slow movement by the groundwater.

There is also a potential for soil leaching and activation of the groundwater with operation of the STS. Following a 2-year (2004-2006) baseline period, an operational groundwater program for the SNS was implemented. This groundwater monitoring program would be continued for the STS. Additionally, engineering control measures have been implemented to further reduce activation of the groundwater. The addition of the proposed STS and new information does not affect the analysis and conclusions in the EIS.

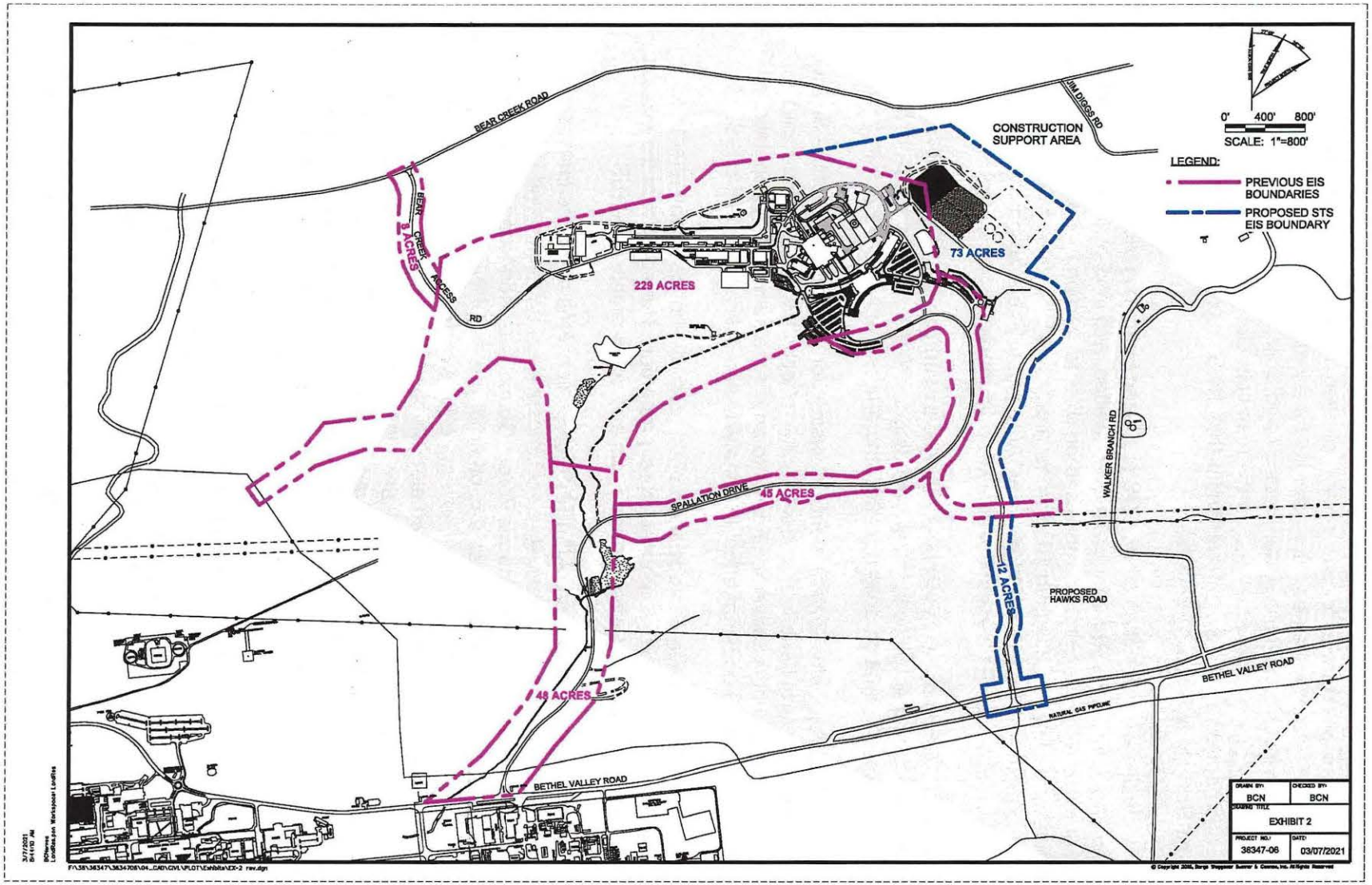
BEAR CREEK ROAD
JIM DIGGS RD
CONSTRUCTION SUPPORT AREA
0' 400' 800'
SCALE: 1"=800'
LEGEND:
PREVIOUS EIS BOUNDARIES
PROPOSED STS EIS BOUNDARY
BEAR CREEK ACCESS RD
1 ACRES
229 ACRES
73 ACRES
WALKER BRANCH RD
SPALLATION DRIVE
45 ACRES
12 ACRES
PROPOSED HAWKS ROAD
48 ACRES
BETHEL VALLEY ROAD
NATURAL GAS PIPELINE
DRAWN BY: BCN
CHECKED BY: BCN
DRAWING TITLE: EXHIBIT 2
PROJECT NO.: 36347-06
DATE: 03/07/2021

Figure 1

Water Resources – Construction of the SNS had no effect on floodplains. Implementation of best management practices (BMPs) for erosion and siltation control minimized any potential increase in run-off from disturbed areas. The potential for a localized increase in groundwater radionuclide concentrations is covered under Geology and Soils. The addition of the proposed STS and new information does not affect the analysis and conclusions in the EIS. Wet weather conveyances, and portions of stream and wetland within the STS project construction area are discussed in the Ecological Resources section.

Climate and Air Quality – Construction of the SNS produced temporary increases in suspended particulates (primarily fugitive dust) from clearing, excavation, and land contouring. Combustion of natural gas during operations primarily emits carbon dioxide, carbon monoxide, nitrogen dioxide, and particulate matter (less than 10 microns in diameter). Off-site levels of all pollutants were estimated to be less than 20 percent of the NAAQS limits. The addition of the proposed STS and new information does not affect the analysis and conclusions in the EIS.

Noise – During SNS operations, it was foreseen that noise sources would be relatively minor and consistent with ongoing activities in the surrounding ORNL area. The addition of the proposed STS and new information does not affect the analysis and conclusions in the EIS.

Socioeconomic and Demographic Environment – Construction and operation of the SNS was determined to result in several beneficial socioeconomic effects. It was also determined that the SNS would not cause high and/or adverse impacts to any of the surrounding populations. The addition of the proposed STS does not affect the analysis and conclusions in the EIS.

Cultural Resources – Construction and operation of the SNS did not have any effects on prehistoric or historic resources or traditional cultural properties. The addition of the proposed STS and new information does not affect the analysis and conclusions in the EIS.

Land Use – Construction and operation of the SNS raised concerns about the impacts on the National Oceanic and Atmospheric Administration/Atmospheric Turbulence and Diffusion Division (NOAA/ATDD) Temperate Deciduous Forest Continuous Monitoring Program (TDFCMP) in the Walker Branch Watershed and other long-term ORNL ecological research projects in the area. To mitigate the potential adverse effects on the TDFCMP, the NOAA/ATDD meteorological monitoring tower was replicated atop Chestnut Ridge, west of the SNS. There have been no adverse impacts to the TDFCMP and other ecological research projects from operation of the SNS. The NOAA/ATDD also determined that increases in water vapor emissions with the addition of the SNS would not impact the ongoing research in the Walker Branch Watershed. The addition of the proposed STS does not affect the analysis and conclusions in the EIS.

Support Facilities and Infrastructure – During construction and operations, increased general congestion over current traffic levels were predicted for existing access roads. Although some utility infrastructure construction was required, there was and is adequate capacity to supply the SNS. The addition of the proposed STS and new information does not affect the analysis and conclusions in the EIS.

Waste Management – No environmental impacts were anticipated for sanitary, hazardous, low-level radioactive (LLW), and mixed wastes. DOE has contracts in place for disposal of wastes

as generated, as per the standard DOE practice of off-site disposal in licensed facilities. ORNL has waste certification processes in place to assure LLW and mixed wastes sent to off-site disposal facilities meet the waste acceptance criteria of the facility. The addition of the proposed STS and new information does not affect the analysis and conclusions in the EIS.

Resource Areas Analyzed in this SA

Ecological Resources – The ORNL Natural Resources Management Program and Aquatic Ecology Group staff completed a natural resources assessment for the STS project (ORNL 2020[2]). At the time of the report, the proposed STS project consisted of an operations area comprising 55.4 acres and a total natural resources review area for potential construction comprising approximately 224 acres. The evaluation in this SA is focused on the 55-acre operations area since this is the proposed location for the construction support area, Hawk Nest roadway alignment, and alternative spur from Spallation Drive. The review area is located primarily within forested natural areas of the ORR with minor development in the form of power-line rights-of-way and secondary/graveled road.

The STS natural resources assessment report includes a compilation of new and existing data regarding sensitive flora and fauna, forest condition, and cultural and historical resources that might be impacted by the proposed STS project. In total, 151 species of wildlife were documented within the survey area. Of these, at least 10 species are afforded special legal protection under state or federal law, and in addition, 59 bird species are afforded protection under the Migratory Bird Treaty Act (MBTA) (16 U.S.C. §§703-711). Few special status plant species occur within the STS project area.

The highest richness and diversity of sensitive resources in the STS survey area appears to occur where the primary development of the STS facilities is proposed (in the northeastern to central portion of the survey area). The holding pond along the perimeter road also adds considerable value in an otherwise well-drained landscape, as evidenced by the presence of several pond-breeding amphibians. A borderline ephemeral wetland also exists nearby in what appears to be suitable habitat for state-listed four-toed salamanders.

The northeastern to central portions of the survey area also produced the greatest number of reptiles during visual encounter surveys. These areas contain some of the most suitable habitat for pine snakes on the ORR. Although not detected during surveys, pine snakes might occur given historical records in nearby areas and the suitably dry forest and infertile soils that characterize the area. Eastern slender glass lizards should not be considered present until additional specimens are discovered. However, likely habitat exists along edges and open canopy habitats with infertile soils surrounding SNS.

The only federally listed species within the STS project area are bats. At least three status bat species were considered present: federally endangered gray bats (*Myotis grisescens*), state threatened little brown bats (*Myotis lucifugus*), and state threatened tricolored bats (*Perimyotis subflavus*). Four additional status species were considered probable or possible residents: state deemed in need of management Rafinesque's big-eared bats (*Corynorhinus rafinesquii*), state

[2] Oak Ridge National Laboratory (ORNL) 2020. Natural Resources Assessment for the Spallation Neutron Source Second Target Station, Oak Ridge, Tennessee. ORNL/TM-2020/1698. September

deemed in need of management eastern small-footed bats (*Myotis leibii*), federally threatened northern long-eared bats (*Myotis septentrionalis*), and federally endangered Indiana bats (*Myotis sodalis*). The northeastern to central portion of the study area is likewise expected to harbor unusually high bat richness and abundance owing to a high density of potential roost trees. Acoustic monitors also detected a high number of calls within this area.

The southern portion of the STS project area, from Bethel Valley Road to the primary facility expansion area, contains the widest range of habitat types. However, the thick understory (within forest and rights-of-way) made much of this area difficult to survey. State listed southern bog lemmings were once abundant within the lower, moist habitats nearest Bethel Valley Road. The occurrence of this species within the STS project area is questionable, although its presence remains possible. Suitable habitat was largely eliminated during construction of much of the ORNL campus, and targeted surveys during summer 2020 failed to detect this species. A large breeding population of four-toed salamanders was identified in the wetland and moist forest in the southernmost portion of the STS footprint, where bog lemmings were historically known to occur.

The Tennessee Department of Environment and Conservation (TDEC) and Tennessee Wildlife Resources Agency (TWRA) must be notified concerning known impacts to state-listed fauna if the STS project proceeds. Moreover, acceptable mitigation measures for many species, notably bats, depend on the type of habitat (e.g., foraging, roosting, hibernacula). Given that the primary planned construction area of the STS site contains extensive roost habitat for federally listed bats, and federally listed bats were detected via acoustic survey, informal consultation with the United States Fish and Wildlife Service (USFWS) will be initiated. Informal consultation between DOE and USFWS will also be initiated for migratory birds under existing agreements between the two agencies.

The STS review area is primarily upland forest. However, it does contain extensive wet weather conveyances, and portions of stream and wetland are intersected by the project area. Final design and siting plans would be reviewed prior to the start of construction to determine if any specific aquatic resources would be disturbed and to what extent. Wetland delineations and jurisdictional determinations, stream evaluations, and hydrologic determinations of currently unclassified streams and wet weather conveyances would be conducted for any potentially impacted aquatic area, as applicable. DOE would also secure all required Section 404 and/or aquatic resource alteration permits and comply with all mitigation, which might be required as a condition under each applicable permit. Additionally, BMPs (e.g., sedimentation and erosion control measures) would be implemented to minimize direct and indirect impacts from the construction activities. The few streams and small estimated wetland area of <1 acre suggests that avoidance of impacts to these areas is achievable with strategic site designs.

Notable in the mature forest on the northwest side of the SNS survey area are more than 100 whorled horsebalm (*Collinsonia verticillata*) plants. This species is not listed in the state of Tennessee but has a global rank of G3 (vulnerable) as determined by NatureServe (a nongovernmental organization of national, state, and provincial heritage programs). Five sites for American ginseng (*Panax quinquefolius*) also occur in this forest. Ginseng has a state status of special concern-commercially exploited. A small population of pink lady-slipper (*Cypripedium acaule*), also a commercially exploited species, occurs in the southern portion of the survey area.

Human Health – In the EIS, SNS emissions at 1-MW power were estimated to contribute an annual radiation dose of 0.40 mrem, or 4% of the 10-mrem limit (40 CFR Part 61), to the maximally exposed individual (MEI). For operations at 4-MW power, the MEI was estimated to receive an annual radiation dose of 1.5 mrem, or 15% of the limit, to the MEI. Considering population density and proximity, these estimated emissions were determined to have minimal effects on the health of workers and the public.

The SNS has been operational since 2006. In 2020, neutron production operations were conducted at 1.42 MW average power for approximately 4,910 hours. SNS emissions contributed 0.03 mrem to the ORR MEI. In the future, operations at the SNS FTS will gradually increase power to 2.0 MW, and emissions at 2.0 MW are estimated to contribute 0.08-0.09 mrem/year to the MEI. The STS would deliver a facility with the capability to operate at 0.70 MW proton beam power to STS, and support > 5000 hours of proton beam on target per year. This power level is approximately one-half the power of the existing target station, and if neutron production operations are conservatively assumed to be conducted for 6,000 hours per year, then radiological emissions from the second target station are estimated to contribute 0.02 mrem/year.

Thus, total radiological emissions from the SNS are estimated to contribute 0.08-0.09 mrem/year from FTS operations at 2.0 MW, and 0.02 mrem/year from the STS at 0.70 MW. For these combined operations, total radiological emissions would contribute approximately 0.11 mrem/year to the MEI, or approximately 1% of the 10-mrem limit. This is far below the 1.0 MW and 4.0 MW cases evaluated in the FEIS, which were estimated to contribute 0.40 mrem/year and 1.5 mrem/year, respectively. Furthermore, the maximum worker dose measured in 2020 was 276 mrem and the average was 21 mrem. Consequently, there would be minimal effects on the health of workers or the public.

Mitigation

Consultation with appropriate agencies (i.e., USFWS and TDEC) will be undertaken to determine if any mitigation measures for water and biological resource impacts are required. Avoidance of sensitive resources is the preferred first approach. The wetland and small number of streams might be avoided via minimal changes to the site design, reducing or eliminating the need for permitting and potential mitigation. Prior to the start of the permitting process, DOE will work with the ORNL Natural Resources Management Program and Aquatic Ecology Group to perform an early survey and flagging of the proposed construction access route in order to avoid and/or minimize stream and wetland disturbance. Once a final site clearing plan is developed, DOE will consult with the USFWS on a negotiated mitigation of impacts to endangered bat habitat that would be disturbed. DOE will comply with and accommodate all mitigation requirements identified during the consultation and permitting process.

Determination

In accordance with CEQ and DOE regulations implementing NEPA, DOE prepared this SA to evaluate whether the STS project at the SNS requires supplementing the existing EIS or preparing a new EIS. DOE will comply with and accommodate all mitigation requirements identified during the consultation and permitting process and concludes that the proposed new actions relevant to environmental concerns are not significant and therefore do not require a supplement to DOE/EIS-0247. No further NEPA documentation is required.

Approved in Oak Ridge, TN, on this 12 th day of September 2021

Johnny O. Moore
ORNL Site Office Manager