FINAL REPORT

Critical Decision (CD)-1
Independent Project Review (IPR)

Savanah River Plutonium Processing Facility (SRPPF)

Savanah River Site (SRS)
Aiken, SC

March 15-19, 2021

National Nuclear Security Administration

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Mark Edelson, Chair
Director, Office of Project Analysis, Oversight and Review, NA-APM-1.1

EXECUTIVE SUMMARY

The project is on track for CD-1 approval in May 2021, pending final cost reconciliation and potential scope adjustment. Documents are complete, processes are well developed, and the management team is mature.

The project has completed conceptual design, the safety basis is approved, the schedule is well constructed, the risk analysis is detailed, NEPA is complete, and the commissioning management plan approved. Aspects of the cost estimate, notably hotel load, appear high in comparison with other projects.

<u>Technical</u>
All safety in design documents required for CD-1 have been approved; the technology readiness assessment and preliminary technology maturation plan have been developed; the project meets the criteria for CD-1 conceptual design; and the 3D model is substantially developed.

Entering preliminary design, multiple technical details require close attention to avoid future conflicts: maximum radiation exposure during glovebox work, radiation hazards during material handling, integration of equipment into gloveboxes, layout of gloveboxes in existing rooms, hierarchical application of controls, reuse of embeds, and qualification of the existing structure.

The broad array of design entities and the scale of the project demand a well-structured approach to define and track the technical basis, integrate design, manage configuration, verify assumptions, and ensure requirements are met. Completing the "Advanced Work Packaging" software suite is essential for the project.

<u>Cost, Schedule, and Risk</u>
The FY21 budget profile is insufficient ($4.6B vs $16.5B) to fund the dual-line base case project. The hotel load of $26M/month is substantially greater than that of analogous projects, does not appear consistent with DOE guidance, and should be reviewed and adjusted. The application of risks, including correlation and duplication, may have inflated the estimate. The cost estimate is well developed and comprehensive for this phase. The estimate's use of actuals for gloveboxes and equipment estimates reduces cost risk for these items.

The project does not meet the 50 pits per year production requirement of 2030. The schedule is well developed and detailed. The 54-month schedule margin properly represents the threats to the project, including glovebox and equipment procurement and engineering and craft availability. The schedule Monte Carlo simulation was thorough. The CD-4 date represents the beginning of hot operations, with development, process prove-in, and qualification following. The maturity level and rigor applied to the risk analysis exceeds what is commonly achieved at CD–1 but would benefit from a correlation analysis, removal of redundancies, and explicitly capturing missing threats.

<u>Management and Acquisition</u>
With 26 of 29 documents required for CD-1 complete, and the remaining three under final review, the project is positioned for approval. An alternative must be selected, the cost range finalized, and the acquisition strategy confirmed. Two sole-source design contracts (~$200M each) are planned for award July 2021. The project structure is reasonable based on the scale and complexity of the project. The project has mature procedures established and implemented for risk, design, and change management. The conceptual design has integrated physical,

information, and cybersecurity requirements. The project would benefit from improved security partnering and the Energy Facility Contractors Group's (EFCOG) effort to address glovebox procurements.

Environment, Safety, Health (ES&H) and Quality Assurance

The project's Record of Decision was published November 2020; NEPA actions are complete. The project has all expected safety and quality plans, documents, and procedures for this stage of development. While SRS is covered by a corrective action program, the process does not appear to be effectively used during the project's conceptual design phase.

Commissioning

Issuance of a commissioning management plan (CMP), having a commissioning authority in place at CD-1, inclusion of the CMP in the CD-1 package, and having the Operations Manager, Commissioning Manager/Authority and Readiness Manager involved with commissioning planning for over a year are all notable achievements. Commissioning risks are not clearly identifiable in the risk register. An operational release plan will be needed, particularly considering that CD-4 occurs before the start of plutonium operations.

TABLE OF CONTENTS

SECTION 1 – INTRODUCTION

BACKGROUND

NNSA is pursuing a two-site approach to the production of plutonium pits: produce a minimum of 50 pits per year at the Savannah River Site (SRS) and a minimum of 30 pits per year at Los Alamos National Laboratory (LANL) in New Mexico. This approach would provide an effective, responsive, and resilient nuclear weapons infrastructure with the flexibility to adapt to shifting requirements. To produce a minimum of 50 pits per year at SRS and to develop the ability to implement a short-term surge capacity to enable NNSA to meet the requirements of producing pits at a rate of not less than 80 pits per year beginning during 2030 for the nuclear weapons stockpile, NNSA proposes to repurpose the existing mixed oxide fuel fabrication facility (MFFF) (226-F) and associated administrative and support facilities for the Savanah River Plutonium Processing Facility (SRPPF) project. Repurposing 226-F requires internal modifications and installation of manufacturing and support equipment for the pit production mission. New facilities, such as a new administration building, maintenance facility, vehicle inspection facility, and environmental storage facilities, will be constructed, as well as the modification of existing facilities, such as the training and operations center and mechanical and electrical buildings.

CHARGE TO COMMITTEE

Dr. Charles Verdon, Acting Administrator and Deputy Administrator for Defense Programs, requested that NA-APM-1.1 organize and conduct a Critical Decision (CD)-1 Independent Project Review (IPR) of the SRPPF project. The on-site review (to the extent possible due to COVID-19 challenges) should occur March 15 - 19, 2021. The purpose of the review is to ensure early integration of safety into the design process and determine the project's readiness to achieve CD-1,"Approve Alternative Selection and Cost Range." The review focused on and made recommendations against the dual-line base case project specified in the requirements document.

THE REVIEW PROCESS

SRPPF project personnel supplied information on the dual-line base case project to the Committee in advance of, and during, the onsite review. The onsite portion of the review was held at the Savannah River Site. The document examination was followed by interviews and discussions with the Project staff. The review agenda and lines of inquiry were developed collaboratively by the Committee and the federal and contractor project teams. The review consisted of five subcommittees. The first day of the review consisted of a plenary session with overview presentations by principals of the federal and contractor project teams followed by a tour. The second and third days consisted of breakout sessions and individual interviews to explore issues of interest. On the fourth day subcommittees discussed and drafted material for the closeout briefing and for the final report. Preliminary results were presented to the full Committee during a dry run of the closeout briefing. On the final day, the exit brief was presented to the Acting Administrator, senior leaders from NNSA Headquarters, senior federal project and contractor management, and the project team.

This report was individually authored then reviewed and edited by the Committee Chair.

SECTION 2 – TECHNICAL SUBCOMITTEE

The charge for the Technical Subcommittee was:

Have safety criteria been incorporated into the design as required?
Yes.

Has technology associated with the project achieved Technology Readiness Level-4?
Yes.

Is the conceptual design sufficiently developed and demonstrate coordination among the following areas and disciplines: safety basis, code of record, confinement, criticality, seismic, civil/structural, fire protection, and electrical?
Yes.

OVERVIEW

The SRPPF Project sufficiently developed the technical portion of the conceptual design to support CD-1. Some areas for improvement were noted, but these did not affect CD-1 and can be addressed during design.

- Revisit the personnel dose calculations during preliminary design to ensure compliance with 10 CFR 835-1002(b) exposure limits
- Include DOE O 151.1D emergency management interfaces in the SDRD
- Ensure the project implementation software is NQA-1 compliant
- Implement requirements and assumptions management tools to address open, unresolved, TBD and TBV items
- Define, develop, and implement appropriate interface control documents
- Develop and approve a revision to the SDS which addresses the hierarchy of controls for applying controls closest to the hazard
- Ensure the facility meets current seismic requirements.

Personnel Dose

The SRPPF design needs to evaluate personnel exposure, particularly regarding the requirements of 10 CFR § 835.1002 - Facility design and modifications, which requires that,

> *During the design of new facilities or modification of existing facilities, personnel exposure from external sources of radiation in areas of continuous occupational occupancy (2000 hours per year) shall be to maintain exposure levels below an average of 0.5 millirem (5 µSv) per hour and potential exposure to a radiological worker where occupancy differs from the above shall be ALARA and shall not exceed 1 rem per year.*

The worst personnel dose appears that it will occur in Metal Preparation, where plutonium will be recovered from the molten salt and electrorefining spent salt. This dose could be reduced if the spent salt is packaged and sent directly to the Waste Isolation Pilot Plant (WIPP). If spent pyro salts went directly to WIPP, SRPPF would no longer need the processes of salt scrub and spent salt oxidation and would realize a cost saving by avoiding recovering the plutonium in the spent salt using aqueous processing. Shipment to WIPP may have implications for trans-uranic (TRU) waste management (higher MAR loading per container) and programmatic feedstock planning (less recycled Pu available for reuse).

The conceptual foundry design uses gloveboxes without a lead layer in the metal structure, leaded windows, and gloves. In the 1980s, the LANL foundry was running close to the proposed production rate of SRPPF, and most foundry technicians (although limited to a minimal number) were getting an annual dose of several rems; without the lead shielding, their exposure would have been much higher. Weapons grade plutonium has some plutonium 238, which produces a low energy gamma that is responsible for a large amount of dose. When a new plutonium 238 process was developed using about one gram of plutonium 238, the dose at the glovebox window was 500 millirem, but only 15 millirems through the leaded glovebox gloves, and when a leaded window shield was added to the glovebox window the dose dropped to less than 15 millirems.

DOE STD-1189 states that a project or facility depends on full implementation of safety management programs (SMPs) and evaluation of project interfaces. The safety-in-design process identifies hazards that can be mitigated through engineered controls and specifies those controls. The Radiation Protection SMP relies on controls to achieve "As Low as Reasonably Achievable" (ALARA) worker doses and represents a fundamental design philosophy required by 10 CFR Part 835, *Design and Control and Facility Design and Modifications*. Subpart K of 10 CFR Part 835, provides key inputs into the design process. DOE O 458.1 Admin Chg. 3, *Radiation Protection of the Public and the Environment*, and DOE G 441.1-1C, *Radiation Protection Programs Guide for Use with Title 10, Code of Federal Regulations, Part 835, Occupational Radiation Protection*, provide additional guidance for radiological design considerations.

Radiological hazards are generally mitigated using confinement or shielding strategies to minimize worker exposure. These strategies will evolve to design requirements through the project life cycle. It is beneficial in projects with significant shielding needs to establish ALARA design goals along with the ALARA strategy for areas where workers could be present. This guides design of the shielding as well as potential operational restrictions. 10 CFR 835.1002 states that "During the design of new facilities or modification of existing facilities" that "Optimization methods shall be used to assure that occupational exposure is maintained ALARA in developing and justifying facility design and physical controls." At SRS, radiological design requirements are implemented through Engineering Standard 01064, Radiological Design Requirements, which incorporate the occupational dose limits and ALARA optimization.

At this point in the project, an ALARA review has been performed, and some results indicate that shielding is not needed for certain glovebox processes. The project plans on using multiple operators for certain processes, and that the ALARA review concluded that no shielding was required for those processes. Several subcommittee members have experience at other NNSA sites performing similar process work at bench scale, and in every case those processes required shielded enclosures to adequately address ALARA. It is reasonable that production scale processes will generate even higher occupational exposures without shielding.

The ALARA analysis appears to use the alternate criterion for non-continuous occupational occupancy (1 rem/yr or 20% of the limit of 5 rem/year) rather than the primary objective of 0.5 millirem/hour. 10 CFR 835.1002 (b) states

> *The design objective for controlling personnel exposure from external sources of radiation in areas of continuous occupational occupancy (2000 hours per year) shall be to maintain exposure levels below an average of 0.5 millirem (5 µSv) per hour and as far below this average as is reasonably achievable. The design objectives for exposure rates for potential exposure to a radiological worker where occupancy differs from the above shall be ALARA and shall not exceed 20 percent of the applicable standards in § 835.202.*

DOE G 441.1-1C provides guidance for meeting the 10 CFR 835 requirements, primarily through engineered controls such as confinement, shielding, and remote handling. Administrative controls (such as limiting working hours on a process) shall be incorporated only as supplemental methods and for specific activities where engineered controls are demonstrated to be impractical. Temporary engineered controls can be considered when installed engineered controls do not provide the desired level of protection.

It is understood that the design and technology development is still evolving, that additional ALARA reviews are scheduled for 2021 and 2022, and that at this point in the design a definitive ALARA analysis is not possible. As the design and ALARA analysis mature, the personnel dose calculations (and occupancy assumptions) to ensure compliance with 10 CFR 835 exposure limits. Glovebox design considerations (shielding) deserve attention to ensure that any engineered hazard controls have adequate time to be incorporated into the design.

In the new design of gloveboxes at LANL a lesson learned is that what looks to be a great way to help the workers see more of the process with larger windows will increase the dose to the worker.

Emergency Management

DOE-O-151.1D, *Comprehensive Emergency Management System*, details emergency response requirements and capabilities for DOE sites and facilities. The Savannah River Site has an existing emergency management system; however, design requirements necessary to meet the objectives of DOE-O-151.1D in a new project must be identified during the preliminary design. The IPT should ensure all security and emergency management interfaces are adequately captured prior to CD-1.

Confinement

DOE Order 420.1C Section 3.b.(3)(c), Chap 1 recommends an Active Confinement Ventilation System to confine release of radiological materials. Based on the safety analysis, an SDC-3 Limit state C active confinement ventilation will be provided. The project intends to meet these requirements using a sand filter. Based on the SRPPF Sand Filter Study (Report U-ESR-F-00093 Revision 0, April 2020) the sand filter has several advantages over the HEPA filter. One disadvantage of the sand filter is that it will cover 90,000 square feet. SRS has experience with smaller sized sand filters; it does not have experience with such a large one. SRNS has specifically identified this as a risk and has implemented mitigative measures such as scale model performance testing. A value engineering study was performed and documented (Y-VES-F-00003 SRPPF OPTIMIZE SRPPF VENTILATION EXHAUST SYSTEM). It provides additional details on the approach using HEPA as 1st stage for the gloveboxes, with that exhaust and ventilation from the rest of the facility flowing through the sand filter.

The failure mode of the active confinement ventilation system has not yet been established. DOE Order 420.1C Chap 1, Section 3.b.(3)(7) requires that active systems must be designed to meet single failure criteria. The single failure criteria is identified in the CSDR as a design requirement for the SC active confinement ventilation system.

The Preliminary Hazards Analysis (PHA) credited Safety Class (SC) negative pressure function of Active Confinement Ventilation System (ACVS) and needs to be translated into ACVS SDD as a safety system requirement. The System Design Description (SDD) for Ventilation System designated ACVS as a SC system. A key function of ACVS leading to its SC designation is its ability to maintain a negative pressure with respect to adjacent rooms and outside atmosphere. This SC function is credited by PHA; however, the SDD established the negative pressures requirements for normal and maintenance operations only and not for the credited ACVS' safety class operation. Hence, the safety class HVAC calculations have no acceptance criteria against which to assess their results.

System Interaction

The project has not performed a systematic and comprehensive review of system interactions to ensure there is no adverse impact on safety systems from non-safety systems (e.g., two-over-one). This review should include interactions due to seismic and other natural phenomena hazard events where impacts of SSCs of a lower classification on SSCs of a higher classification are evaluated. There are two general types of interactions: direct, i.e., physical impact, and indirect.

There is general services (GS) water bearing systems, e.g., fire protection, safety shower & eyewash, drinking water, etc in areas potentially collocated with SC and SS SSCs. This could have the potential to lead to failure of an SC or SS SSC performing its safety function or potential to cause a criticality concern.

Safety Basis

The SRPPF Project has appropriately developed and NNSA appropriately reviewed all the safety basis documents required for the preliminary design phase and to support CD-1. Noteworthy was the extent of review provided by NNSA and the detailed documentation of the resolution of NNSA's comments by the SRPPF Project. The SDS appropriately provided *preliminary information on the scope of anticipated significant hazards and the general strategy for addressing those hazards* as required by DOE Order 413.3B.

There are some specific issues related to the safety basis documents which remain open and should be addressed to support the identification of all appropriate safety controls as the project proceeds to the preliminary design phase.

<u>Safety Design Strategy (SDS)</u>

The SRPPF Project issued the SDS, Revision 0 in May 2019. The SDS provides information on anticipated significant hazards and the general strategy for addressing these hazards including design criteria, major safety structures, systems, and components (SSCs), and significant project safety risks associated with SRPPF Project.

The Chief of Defense Nuclear Safety (CDNS) review of the SDS concluded that it satisfies the intent of DOE STD 1189. The CDNS identified three recommendations in his August 2019 Advice Memorandum.

- The SRPPF Project should re-evaluate the SDS for inclusion of current DOE nuclear safety requirements for inclusion into the Code of Record developed during CD-1.
- The SRPPF Project should consider the July 15, 2019, Central Technical Authority position memorandum regarding the consideration of evaluation basis events in criticality safety evaluations.
- The SRPPF Project should define a pro-active date for determining other important facilities needed to support the project.

The Savannah River Field Office (SRFO) performed a review of the SDS in accordance with DOE STD 1104 and documented its review in a Safety Review Letter dated August 2019. The SRFO review concluded that the submitted SDS complies with requirements and expectations delineated in DOE STD 1189. There were no open issues and the review concluded that the design strategy is sufficient to continue with the design process.

The SRPPF Project has initiated a revision of the SDS. It would be beneficial for the SRPPF Project to address the following safety-in-design issues identified during reviews of the SDS and the CSDR:

- Preference for controls closest to the hazard and engineering controls over administrative controls.
- Addressing change in design to utilize a sand filter versus a High Efficiency Particulate Air (HEPA) Filter system for confinement ventilation
- Addressing potential for the need for safety controls for the Transuranic (TRU) Waste Pad

The revised SDS and subsequent CDNS review and approval of it will provide early determination of the safety controls to support the preliminary design phase of the SRPPF.

<u>Conceptual Safety Design Report (CSDR)</u>

The SRPPF Project issued the CSDR in October 2020. The CSDR summarizes the hazards analysis efforts and safety-in-design decisions incorporated into the conceptual design.

The following safety positions were addressed in the CSDR:

- Preliminary assessment of the applicable Natural Phenomena Hazard (NPH) design criteria
- Preliminary identification and analysis of the facility hazards and Design Basis Accidents (DBAs)

- Hazard categorization of the SRPPF (including the TRU Waste Pad)
- Approach to meeting the safety design criteria of DOE Order 420.1C, Change 3
- The need for Safety Class (SC) and Safety Significant (SS) hazards controls

The safety positions addressed in this CSDR were consistent with the initial discussions in the SRPPF SDS except for following:

- Crediting the sand filter in lieu of HEPA filtration as part of the SC Active Confinement Ventilation System
- Adjusting the anticipated functional classification associated with some SSCs
- Updating the codes and standards

These changes are attributed to:

- Concurrence with the proposed optimization opportunity formalized by NNSA letter dated April 22, 2020 (NNSA-SRPPF-20-0025) directing use of a sand filter for the conceptual design
- Completion of safety analysis efforts performed as part of the CSDR
- Completion of a Code of Record for the project in accordance with a NNSA letter dated September 11, 2019 (NNSA-SRPPF-19-0004A) which directed SRPPF to use current codes and standards for the project.

NNSA reviewed the CSDR in accordance DOE STD 1104 and identified several issues and recommendations, including:

- SRPPF Project should address during preliminary design whether there is a need for a safety related air supply to support the Active Confinement Ventilation System in the event the normal non-safety supply air system is lost.
- Savannah River Nuclear Solutions (SRNS) should develop an action plan to address the Criticality Safety Support Group observations and recommendations during preliminary design.
- SRPPF should develop a throughput model that will support the identification of the Material at Risk during the preliminary design.

In addition, DOE's Office of Enterprise Assessment reviewed the CSDR (and supporting safety basis documents) as required by Section 303 of Public Law 115-31, *Consolidated Appropriations Act, 2017*. One comment remains open from this review, i.e.:

> *The CSDR …. does not address the hierarchy requirement that controls closest to the hazard should be chosen. A conservative approach is warranted at early stages of design to prevent costly design revisions.*

Examples that DOE's Office of Enterprise Assessment cited where the hierarchy was not followed included:

- Not identifying area fire suppression or glovebox inerting as safety controls to prevent and/or mitigate fires.
- Only designing gloveboxes that contain molten metal to withstand a seismic event.

The SRPPF Project position with NNSA's concurrence is that the Active Confinement Ventilation System is an adequate SC control to mitigate glovebox events, which could cause a release of radioactive material, and crediting this system is consistent with DOE STD 3009 for selection of SC/SS controls is *judgment-based and depends on multiple factors, such as: hierarchy of available controls, the control's effectiveness as determined per Section 3.2.3, and relative reliability of selected controls* and DOE STD 1189 control hierarchy preference for c*ontrols that are effective for multiple hazards can be resource-effective*.

This is an important issue that should be addressed early in preliminary design as it could have a substantial impact on the control strategy.

<u>Safety Basis Risk and Opportunities</u>

The SRPPF Project has identified some important safety basis related risk and opportunities in the SRPPF Risk and Opportunity Assessment Report dated January 2021. These include:

- Discoveries during nuclear safety analyses require design changes, negatively impacting project
- Functional classification revisions result in additional SS or SC than currently in Conceptual Design
- Type B Packaging fire test does not bound facility fire requirements

It is important to continue to track and evaluate these as the project moves into preliminary design; in particular, the first one which include risks from changing requirements, missed requirements, and/or differing interpretations of requirements by others. Coordination with the SRFO, SBAA, and CDNS on any safety basis issues and clear documentation of resolution of the issues during the preliminary design phase would help reduce project risk.

Glovebox Design

Not all the gloveboxes are developed and defined for all the processes to full maturity, but work is a sufficient representation for CD-1 needs. A large portion of the 200+ gloveboxes are of standard size and layout. More unique gloveboxes are categorized as type 2, 3, or 4. The standardization will assist with contracting and manufacturing but does not alleviate the shortage of manufacturers certified to build gloveboxes for hazard category 2 facilities. At this point the gloveboxes that are standards are well defined because the equipment going into them is better defined. Any changes will be minor in scope compared to the type 2, 3, 4 gloveboxes. The type 3 and type 4 gloveboxes have an approximate size designed to the largest machine that is being looked at for the process.

The conceptual design indicates that some parts of the machine assembly are designed to be mounted outside of the gloveboxes to make for ease of maintenance on those machines. In the case of the disassembly lathes, it is our experience that not totally encapsulating the machine in the box results in the glovebox leaking due to the seals failing due to vibration. The tradeoff between maintenance and seal leakage during operations needs to be fully considered. We recommend that machinery should be totally within the glovebox instead of trying to contain only a portion of the machine.

All disciplines need to review room layouts, trunkline, and gloveboxes for safety (e.g., ergonomics, emergency exiting, ventilation, housekeeping, radiation safety, installation, equipment/glovebox removal). Location of the production lines and the space available has made for a very difficult design of the trunkline, with sufficient access to gloveboxes for maintenance and operations likely limited. There should be doorways or exits built in to be able to remove or replace gloveboxes or equipment without major D&R to the lines. All rooms need to be finished with access doors to maintain the correct ventilation flow for safe operation of the gloveboxes and rooms.

The project's casting furnace design is based on the LANL R&D casting furnace, which was designed in the 1950's, although a newer one is also in service. The last plutonium casting furnace in the United States that was fully demonstrated with plutonium was the Rocky Flats Retech tilt-pour furnace system. Each Retech tilt-pour furnace system contained two large gloveboxes, each of which contained one casting furnace, and the system footprint was over five times larger than the current LANL casting furnace footprint. These two predecessors give the project starting points but adapting the Rocky Flats methods to current safety standards and methods and the LANL R&D approach to production will be a difficult transition. There is an SRS group now tasked with developing a new casting furnace, but this will take time.

Technology and Design Maturation

The SRPPF conceptual design maturity has been estimated at 29% to 34% as documented in the Conceptual Design Maturity Report (G-ESR-F-00102). This overall design maturity is based in part on repurposing an existing hardened facility (i.e., former Mixed Oxide [MOX] Fuel Fabrication Facility [MFFF]) as well as the fact that the process design is primarily based on the proven Los Alamos National Laboratory (LANL) plutonium pit production flowsheet. The baseline design for SRPPF nominally includes two similar process lines to achieve the required 50 ppy production rate. The individual process steps and glovebox (GB) designs for the LANL application have been reconfigured to accommodate the specific footprint within the repurposed MFFF. For example, the project has identified several "optimizations", some of which resulted in installing two furnaces in a single GB for multiple applications. This provided a significant reduction in the number of GBs required and reduced the overall footprint of the integrated system. It is not clear if these optimizations have been completely evaluated for impacts to operability and the interface requirements with ancillary systems (e.g., heat management, gas flow requirements/limits, fire protection, pressure differential, etc.) within the impacted GB systems. This impact needs to be evaluated.

The technologies that constitute the pit production flowsheet have been used in similar applications and environments at the Rocky Flats Plant (RFP), Lawrence Livermore National Laboratory, and LANL. Due to the age of those system designs, many of the key technologies (e.g., pyro-processing, furnaces, material transfer system, etc.) will have to be adapted from commercial systems for this specific application, including incorporation into a GB environment. The project conducted formal Technology Readiness Assessments (TRAs), in accordance with DOE O 413.3B, for process and non-process systems, as documented in SRNS-TR-2020-00109 and G-ESR-F-00098, respectively.

The Non-Process TRA document (G-ESR-F-00098) describes all support systems in the facility (e.g., ventilation, fire protection, waste management, safety systems, etc.) and assesses potential critical technology elements (CTEs) for each system. Only one of the identified technologies, Ventilation System, was determined to be a CTE and it was judged to be at technology readiness level (TRL) 7. Accordingly, the project has not developed a Technology Maturation Plan (TMP) for the non-process CTEs.

For the Waste Management System, the TRA report notes that "Although discussed as not currently being performed at SRS, solidification of liquid waste is performed within the DOE complex. Therefore, it was not determined to be a new technology." As a result, it was not assigned a TRL. Waste treatment and solidification development efforts can be extensive for new waste streams to satisfy waste acceptance criteria for disposal. The project's Safety Design Strategy (SDS) document, N-SDS-F-00001, Rev. 0, notes the following: "It is possible that the disposal of more unusual waste forms (e.g., Am-241 salts) may require considerable work to develop a disposal method that will be acceptable for the disposal location." It is likely that experience from LANL in managing these waste streams can be leveraged; however, this does represent a project risk if not addressed in time to ensure a process can be implemented within the available footprint in SRPPF.

The Waste Inventory and Characterization Study (SRNL-TR-2019-00298) projects annual total generation of about 485 cubic meters of transuranic (TRU) waste, with no differentiation between contact handled (CH) and remote handled (RH). The design of the TRU Waste Storage building must balance two competing factors: 1) be large enough to provide adequate surge capacity in case operations at the Waste Isolation Pilot Plant (WIPP) restrict shipments for an extended period, while 2) being small enough to be considered extremely unlikely (i.e., likelihood less than 10^{-6}/year conservatively calculated) for an aircraft crash scenario. The Annual Transuranic Waste Inventory Report 2020 (DOE/TRU-20-3425) indicates a much higher generation rate of TRU waste from SRPPF operations, approaching 1,000 cubic meters of CH TRU and 110 cubic meters of RH TRU annually. The project should ensure that the appropriate quantities and types of TRU waste are considered when determining the final size and configuration of the TRU Waste Storage building and that this is accounted for in the hazard analysis.

The SRPPF Technology Readiness Assessment (TRA) Report (SRNS-TR-2020-00109), which is for the process systems, determined that all 33 identified CTEs are at TRL 6 or higher. The TRA report states that TRL-6 is required by the SRPPF Program Requirements Document (PRD) (NNSA-2019-001048) for CD-1. The Rocky Flats process, which produced between 1,000 and 2,000 ppy, has not operated in several decades, and the current operating process at LANL has produced minimal pits in the last 25 years. Accordingly, the SRPPF project team recognizes that significant work will be required to design, integrate, and validate the performance of the SRPPF flowsheet. The SRPPF Functional and Operational Requirements (F&ORs) document (G-FRD-F-00001) requires 50 War Reserve (i.e., "diamond stamped") ppy with an annual production assurance of 90% (i.e., the design accommodates only 10% failure). The project developed a Preliminary Technology Management Plan (TMP) (SRNL-TR-2020-00421) to address the five (of 33) CTEs that were determined to be below TRL 7. These include:

- Foundry Section: Shape casting and Heat treat
- Machining Section: Machine inner and outer diameter to final and Remove waist band
- Assembly Section: Surface preparation.

While the SRPPF Process TRA team recognized that the CTEs may be mature as standalone technologies, the specific technologies have never been fully incorporated into a GB environment as an integrated, functional system and at the production level envisioned for SRPPF. Accordingly, an additional study was completed, and the results documented in the SRPPF Process Equipment Systems Integration Report (PESIR) (SRNL-TR-2020-00029). This integration report identifies the critical system integration issues and other integration challenges that will require substantially more design and development efforts and equipment to successfully implement them into SRPPF operations. It also notes that insight into these upcoming challenges will allow them to be accurately reflected in the conceptual design and cost estimates required to support the CD-1 package. While the report identifies these challenges and uncertainties, it does not define specific development, testing, studies, or other actions required to address them. As part of the design maturation process, the SRPPF Equipment Report (SRNL-TR-2020-00132) was developed, which documents the status of commercially available equipment and components to implement the SRPPF Flow Sheet (SRNL-TR-2019-00331).

As the project has continued to consider the design maturation needs, and in response to the Conceptual Design Review comments and direction received from NNSA (NNSA-SRPPF-21-0019, December 3, 2020), the project developed several Task Technical Plans (TTPs) that are focused on addressing the recognized challenges. Tthe following TTPs had been issued, with others planned:

- SRNL-TR-2020-00246 – TTP for SRPPF Material Transfer System (MTS) Development (note that the NNSA review team specifically noted that the MTS appeared to have been over-estimated in technical maturity.)
- SRNL-TR-2020-00260 – TTP for SRPPF Casting Development
- SRNL-TR-2020-00262 – TTP for SRPPF Development of Pyroprocessing Control
- SRNL-TR-2020-00361 – TTP for SRPPF Hydride/Dehydride Casting (HYDEC) Development

Given the number of design, development, and testing activities that will be conducted by multiple entities to support SRPPF, the project should consider developing a comprehensive design maturation plan that identifies all the technical, logistical, schedule interfaces, and interdependencies. The project has developed the SRPPF Design Management Plan (G-ESR-F-00085), in accordance with DOE O 413.3B, but it does not include the level of detail necessary to ensure integration of all requirements into, and coordination of, the ongoing and planned design efforts. In response to direction from NNSA, the project issued the SRPPF Plan for Engineering Studies and Evaluations (G-ESR-F-00105), which identifies a dozen ongoing or planned studies, including the TTPs previously mentioned, but it only provides high level descriptions of the planned work with no details regarding schedule, risks, or interdependencies. An integrated Design Maturation Plan would significantly benefit the project in these planning efforts, but also better address specific actions identified by NNSA to 1) prepare and submit a document that summarizes design studies required for design execution risk mitigation, and 2) present a plan to NNSA on how SRNS will manage risk to the project.

There is a variety of equipment to support the production process still under development such as the material transport system, molten salt extraction and pyrochemical operations, shape casting, heat treat, surface prep, radiography, precision machining, CMM inspection, weld (hemi-shell and final assembly, tube press and weld station, hemi-shell weld inspection), final assembly tube installation, and the HYDEC and disassembly melt furnace. Some of these systems represent greater risk and overall impact to the project than others. The project should consider adding granularity to the risk mitigation actions such that technology-specific actions are defined, and the risk can be reduced as these specific challenges are addressed.

Requirements Management

The project has developed a comprehensive approach for identifying and managing the many requirements that must be verified, tracked and flowed down to all design input documents, starting with the Functional and Operational Requirements (F&OR) (G-FRD-F-00001). The F&OR document includes many 'to be determined" (TBD) values, but this is expected at the conceptual design stage. The Requirements Management Plan (RMP) (Y-RMV-F-00001) recognizes the challenges related to managing the project requirements due to its scope and structure:

> *The organizational and technical interfaces across the SRPPF Project are complex not only due to the nature of the products being made, but also by the following:*
>
> - *Two Weapon Design Agencies (WDAs), Los Alamos National Laboratory (LANL) & Lawrence Livermore National Laboratory (LLNL), are associated with different SRPPF deliverables,*
> - *Multiple National Nuclear Security Administration (NNSA) sites providing information and/or parts,*
> - *Multiple design organizations (SRNS, Merrick and Fluor) located in different offices across the US,*
> - *Complexity of processes and their integration with confinement and transport systems within an existing facility built for a different purpose,*
> - *Numerous plans required to be coordinated to execute the complex scope.*

Accordingly, the RMP describes how the requirements are defined, documented, and validated, including the overall document hierarchy. The RMP also describes the use of Interface Control Documents (ICDs) to manage the technical interfaces (e.g., physical configuration, operational constraints, etc.). The key tools planned to be implemented for management of the project requirements is IBM Rational DOORS® database and the overall Integrated Electronic Data Environment (IEDE). The SRPPF native documents will include embedded structured data tables to capture all requirements, including TBD, "to be verified" (TBVs), HOLD, and assumptions. The Assumptions Management Process (Y-ESR-F-00034) describes the process through which all TBDs, TBVs and General Assumptions are collected in the Assumptions Management Register to ensure they are tracked to closure. However, at this time none of these tools and systems have been fully implemented, nor have any ICDs been developed for the SRPPF project.

The Systems Engineering Management Plan (SEMP) (Y-SEMP-F-00006) states that all technical requirements will be uniquely identified, with the overall requirement hierarchy tracked (i.e., upper tier requirements that are the basis for lower tier requirements). The uniquely identified requirements are documented in the System Design Descriptions (SDDs) and Facility Design Description (FDD). In addition to the known requirements, each TBD, TBV, Assumption, HOLD, and Classified Value (CV) requirement will have a unique identifier. The process for addressing and closing TBDs, TBVs, and HOLDs is described in the SRPPF Configuration Management Plan (CMP) (G-ESR-F-00086).

The project has developed 29 System Design Descriptions (SDDs) and a Facility Design Description (FDD) that are aligned with the expectations of DOE-STD-3024. As expected for this stage, the SDDs and FDD include many design and functional requirements that are TBD or TBV. The SEMP and CMP are not being followed in that numbering for TBDs and TBVs do not use the same formatting, nor are they unique between SDDs. It is not clear how these will be readily compiled and tracked without significant revision of the existing documents. Other instances were noted where a requirement number was used in both the F&OR and the FDD (P-FDD-F-00001) although the description/topic of the two requirements were different. The requirements will become increasingly difficult to manage and validate if a more consistent system is not implemented (i.e., full implementation of the planned tools and systems).

The SRPPF project should accelerate implementation of the IEDE/DOORS® platform as planned. With multiple organizations located in geographically disparate locations, having a common set of requirements, each with a unique identifier and associated with specific system, structures, and components, will significantly reduce the risk of unacceptable designs and design breakage. As described, plans are in place to manage requirements, but it is not clear how well they are being implemented. As the project documentation and parallel activities continue to grow commensurate with the design maturity these will be increasingly difficult to manage without the planned systems and tools fully implemented, including establishing ICDs.

The SRPPF project should fully implement the RMP, as well as the SRPPF Project Interface Management Plan (V-IMP-F-00001). This plan describes the mechanisms that are appropriate for managing interfaces at each level and is aligned with the expectations for ICDs described in the RMP. However, as mentioned, with no ICDs developed, there is limited evidence indicating that interface management has been fully implemented. Key ICDs are needed at the system/sub-system level, facility/site level, and external. ICDs are the most effective method to come to agreement and understanding of key functional and design requirements that must be consistently implemented by external organizations conducting design services; they will also keep attention on the interface requirements that are TBD or TBV. To focus the near-term efforts, the project should consider developing a listing of specific ICDs that are required, develop templates for ICDs to ensure consistency, and determine the date by which each are needed. This action coupled with full implementation of the requirements management process will provide risk mitigation for the project relative to functional and operational requirements and help reduce potential design breakage due to miscommunication.

Preliminary Design Actions

The Communication System SDD (E-SYD-F-00017) is missing design requirements for the emergency notification system as required by DOE-O-151.1D. The PFHA and Fire Protection SDD, F-SYD-F-00004, need to recognize that NFPA 72 is the SRS site adopted design and installation standard for Emergency Notification Systems.

The Criticality Alarm System (CAS) is Safety Significant (SS) and identified in CD-1 design documentation as requiring an 8-ft radius from radio interference. There may not be sufficient space available to ensure this requirement is met solely through design. The Project plans for this to be controlled with administrative procedures and will rely primarily on administrative controls (floor markers, signage, facility training, etc.), and possible use of a newer CAS technology that is less sensitive to radio interference. Emergency responders are a concern as they will likely not be aware of these limitations and are the most likely to use a radio when in the area, especially if responding to a medical or other emergency call. This may result in spurious criticality alarms due to inadequate engineered features or selection of CAS equipment during the design planning phase. The Project has confirmed this is a risk that will be added to the project risk register prior to CD-1.

The PFHA and FSD has been approved and implemented into the CSDR appropriately. The PFHA is under revision to address improvements, including acknowledgement of the International Building Code (IBC), International Fire Code (IFC), and NFPA requirements for waste chemical storage, of which were not captured in the Waste Management System Design Description (SDD), Q-SYD-F-00001.

The design of the casting glovebox relies on personnel avoiding the high voltage coils or conductors when doing manual operations. The use of engineering controls to protect workers from contacting these high voltage coils or conductors should be investigated during preliminary design.

Updated seismic analysis and structural code changes may require design revisions. The 3D Model adequately captures the as-built structural components of the existing MFFF building. New design within the SRPPF project scope is conceptually included in the model by volumes and space allocations. The evolution of new structural design appears to be light in the model. The design of the new additional floors do not show member sizes of floor beams and girders. There are opportunities to progress the new structural design scope (without major hurdles or information needed at this point) further than it is currently shown in the model. Proactive structural design should be considered and pursued in preliminary design to allow for rebar cutting in concrete walls and slabs due to post-installed anchor installation. This will require investigation of wall and slab segments used for the new design and calculation of reduced wall and slab capacities by discrediting longitudinal and transverse rebars.

Building 226-F was designed and constructed in accordance with American Concrete Institute (ACI)-349-1997. According to NNSA-SRPPF-19-0004 (Ref. 73) letter, new constructions will be designed to the most recent version of ACI 349 code. SRNS performed a preliminary structural analysis documented in the SRPPF Report number T-ESR-F-00028, entitled: “Preliminary Structural Analysis Report for SRPPF Conceptual Design Revision 1”, that documents the gap between the ACI-349-1997 and ACI 349-2013, the current code of record and will evaluate the existing 226-F concrete structure in accordance with ACI 349-2013. The preliminary conclusion of this report was that the changes in ACI-349-2013 requirements do not affect the structural integrity of Building 226-F.

ACI 349 current versions requirements such as providing “boundary” elements for walls resisting earthquakes and openings with the walls should be evaluated and implemented if the analysis requires. Building 226-F already includes many openings and the repurposing for the SRPPF may require additional openings. Implementing boundary elements in a constructed structure could add risks.

DOE Standard 1020-2016, Section 2.3.3.4 states: “During the conceptual design phase of a new Hazard Category 2 nuclear project, the SSC structural design should preliminarily default to SDC-3 and limit state D in the absence of site-specific information on design basis seismic motion and limit state.” Given that the site Preliminary Seismic Hazard Analysis (PSHA) is older than ten years, it may not be conservative to lower the Limit State of Building 226-F prior to updating the site Natural Phenomena Hazard every ten years or sooner as required by DOE Order 420.1C and STD 1020-2016.

Section 2.4.5 of STD 1020-2016 requires that: “For a new facility, in designing an SDC-3, SDC-4, or SDC-5 building structure that has a direct confinement safety function, the limit state level shall be commensurate with the degree of confinement needed or the permissible leak rate used in the hazard and safety evaluation.” Based on the American Society of Civil Engineers (ASCE)-43-05, Limit State C allows permanent distortion with minimal damage, while Limit State D designated structures are required to remain essentially elastic with no damage. ANSI/ANS 2.26 Appendix B for SSC Type – Confinement barriers and systems containing hazardous material (e.g., gloveboxes, building rooms, and ducts) states for Limit State C “Barriers could be designed to this Limit State if exhaust equipment is capable of maintaining negative pressure with few small cracks…” versus Limit State D “Systems with barriers designed to this Limit State may not require active exhaust…” Given that Building 226-F function is to confine release of radiological materials and the design of the SC active exhaust is conceptual, it may be preferrable to continue designating the structure as “Limit State D,” until the draft Preliminary Documented Safety Analysis is prepared.

Seismic

Recognizing that there was analysis performed during the engineering evaluation for this project to determine the cost/benefit of MFFF reuse, there are several aspects of the seismic performance and code requirements that need to be evaluated as design advances. The site PHSA is not current, and the SASSI software is not current and not compliant with DOE requirements. Because the facility design was based on the ACI 349-1997 requirements, and the code of record is the ACI 349-2013, implementing the ACI-349-2013 requirements may result in modifications, including adding “boundary elements” to structural walls and around openings. According to SRS Engineering Standard, additional soil investigation will be needed to update the seismic requirements for SDC-3 new facilities. There is the potential that a DOE-compliant SASSI analysis will result in increasing the building’s responses, i.e, resulting in much higher peak-ground acceleration than that used for the MFFF; hence, extra efforts such as more refined structural modeling and analysis may be needed to modify the building.

Section 2.3 of the preliminary structural analysis report compares the seismic response spectra used for the MFFF with the SDC-3 seismic response spectra at 5 percent damping contained in the SRS Engineering Standard 01060 amplified by 1.2. The 1.2 factor is due to uncertainty in the currently adopted SRS seismic hazard. Based on this comparison, the MFFF spectra (based on a 0.2g scaled Reg Guide 1.60 generic spectra) envelopes the site SDC-3 spectra except between 0.5 to 1 HZ frequencies, which are below the structure fundamental frequencies. The fundamental frequency was reported to be 9.2 HZ in E-W direction and 8.8 HZ in N-S direction with more than 60% mass participation in each direction.

These are generally favorable results. A comparison of vertical spectra was not reported and may also require analysis.

DOE STD 1020-2016 Section 9.2.1.(a) requires that: "For DOE nuclear facilities with safety SSCs classified as NDC-3 or higher, review of site and facility Natural Phenomena Hazard (NPH) assessments shall be conducted at least once every ten years and whenever significant changes in NPH data, models, or analysis methods have been identified." Site NPH is required to be evaluated through PSHA.

The new SRPPF facilities and upgrades to existing or partially constructed facilities may require additional soil data to confirm the spectra. Section A5.2.1.9 "Earthquake Load" of the SRS STD 1060 states that a PSHA for the SRS site was conducted in 2014. However, the Next Generation Attenuation – Eastern United States (NGA-East) has since been released. The SRS STD 1060 indicates that: "A qualitative assessment of the NGA-East impacts [A3] on the SRS PSHA indicates the PC-3 spectra with 1.2 amplification factor as used in past revisions of this standard generally bounds the expected NGA-East results with the exception of low frequency content generally outside the structure range of interest (0.5 Hz to 1.0 Hz). SRS is presently planning another PSHA that will incorporate NGA-East data with the expectation that any increases in seismic hazard will be minimal." Further, SRS STD 1060 states that for existing facilities that have previously been designed to SDC-3 or PC-3 loads, confirmation of the spectra is a simple process.

An SSI was conducted for the MFFF to establish force-moment demand. The SSI analysis methodology used for the MFFF may not conform to the current approach approved by DOE. Current DOE SSI methodology is based on DOE Memorandum Dated August 20,2015; while the current method called "Direct Method," in which every node within and on the volume of the excavated soil volume is treated as an "interaction node" coupling the free-field soil system and the excavated soil volume.

Furthermore, Section "1.2.2 Variable Backfill Stiffness" MPR Report: MOX Fuel Fabrication Facility Assessment of Civil/Structural Issues Document Number: 1300-1324-0002, Revision 0, dated January 2014 states: "Prior to construction, the original soil at the MFFF site was over-excavated due to concerns about its suitability. Originally, the intent was to backfill the entire area up to the foundation level using compacted engineered fill material. While the engineered fill was placed in many areas, some areas were backfilled with Controlled Low-Strength Material (CLSM) rather than engineered fill. There is a postulated concern that the stiffness of the CLSM may be significantly greater than the engineered fill in nearby areas. Because of the potentially different stiffnesses of the backfill materials, structures placed above the less-stiff engineered fill may settle more than those above the CLSM, leading to increased stresses in certain areas." Due to softness of the fill, SSI analysis may result in high structural response.

As a first step, SSI is required to be performed to create input to reanalyze and design Building 226-F based on SRPPF design requirements. Input to the SSI is required to be the site free-field ground motion commensurate with the facility SDC category, i.e., SDC-3. Given that the current Site PSHA is outdated and the new one may not be available soon and would require new soil investigation, the result of SSI may not be reliable if the current SDC-3 (PC-3) spectra are used and may be required by SRS Engineering Standard 1060.

In addition, ASCE 43 Section 3.4.1 requires that concrete structures stiffness be reduced by 50% for beams and walls assumed to be cracked. SSIs are typically performed for both cracked and uncracked sections. Reduction in stiffness will result in lowering the fundamental frequencies of the structure which could be further reduced because of uneven stiffness of underlying soils as explained above. The resulting frequency shift, potential change in seismic responses that may result from the planned PSHA, could exceed the Reg Guide 1.6 spectra that is discussed above. This potential increase in ground motion and softer engineered fill could affect the SSI and increase structural responses that may require potential repair to the constructed structure.

Therefore, the cumulative effects of the above factors, e.g., reduction in concrete stiffness required by ASCE 43, potential changes in site peak ground motion resulting from new PSHA, and SSI using current DOE methodology, could change the Building 226-F fundamental frequency, which may result in exceeding Reg Guide 1.6 acceleration at lower frequencies and could result in the need for facility modifications.

Embeds

Re-qualification of existing embedded plates to the extent possible will reduce post-installed anchor installations, which pose additional construction risks due to rework and quality control. The project plans to utilize existing embed plates and post-installed anchors as options to attach to the primary structure. For the embed plates, a qualifying design approach has not yet been established. For the post-installed anchors, project specific design procedures to define post-installed anchor application should be pursued during the preliminary design.

Qualification of existing embed plates can be achieved by various means (e.g. (1) adaptation of the old codes/ standards, (2) reconciliation of the old codes/standards into the current code/standards project framework, and (3) sample load testing of existing embed plates). To determine the engineering efforts associated with re-qualification of existing embed plates, it is encouraged, that the structural design team progresses with the design of the additional floor systems above the delivering bays including support attachments to the existing MFFF walls. The additional floors require little interdisciplinary coordination, since they provide personnel function areas not process lines. This activity will enable the project to estimate the average engineering efforts (in hours) needed to re-qualify a typical existing embed plate. A systematic design approach outlining the use of post-installed anchors for non-significant and non-safety related applications including adequate tolerances in structural steel will reduce future construction risks. Establishing design processes and procedures to perform formal interdisciplinary design coordination (e.g., use of Interdisciplinary Coordination Sheets with sign-off) among affected disciplines and functions will ensure proper review and concurrence among disciplines.

Project Implementation Software

The project should accelerate implementation of the tools for consistent flow-down of requirements, capturing of conceptual design calculations, addressing unresolved data gaps, and communicating interface requirements to ensure consistent application of requirements, assumptions, and technical interface needs across agents. In addition to discussions above addressing a lack of negative pressure values for SC operation of ACVS, a lack of a systematic and comprehensive review of system interactions, the IPR review identified a general lack of safety class calculations included in the CD-1 package. The Configuration Management Plan (CMP) lists only the following calculations: Architectural, Lighting, and (some) Structural.

The software to be used for SRPPF project implementation (e.g., design, construction, procurement, test, operation, configuration management, etc.) needs to be properly qualified. The SRPPF project is configuring Smart Plant Foundation (SPF) to be used for design, procurement, configuration control (conduct of engineering processes, procedure review and approval processes, configuration management processes, and technical baseline, etc.), construction work packages, test, and commissioning, etc.

Constructability

Walkdown of the MFFF revealed some constructability challenges on the Mezzanine Level. Initial design proceeded with construction input and how material movement, staging, and sequencing would be solved. The Mezzanine Level (1.5 Level) in the MFFF is only accessible by a narrow stairwell. Engineering progressed without full consideration of how equipment could be transported to the area. A temporary construction opening may be needed to transport equipment to the Mezzanine. A construction opening for the Mezzanine would require deconfliction with work occurring on the 1st Floor.

This design issue happened even though the project has established constructability reviews and a comprehensive Operation & Maintenance Strategy. This reinforces the need to continuously seek feedback from construction, maintenance, and operation within a formal interdisciplinary coordination process during the preliminary design.

Design Margin

SRNS design team should establish an approach to compile and manage critical design margins during preliminary and final design. The SRNS team is actively pursuing to capture critical design margins. The project began to compile a list of project critical design margins as part of the Design Interface Document Development completion. The project has benchmarked the Uranium Processing Facility (UPF) using UPF procedure DG-EG-801768-A006 UPF Design Margins. Once the list of design margins for critical SSCs are established, design margins should be tracked and maintained (e.g., within a database and by a management process) to be available during the construction phase.

Electrical

The electrical power and distribution system for this project is well defined. The system as described is both robust and redundant. The emergency power system and associated safety class equipment meets the requirements mitigating single-failure loss of power to safety class SSCs and for incorporating safety criteria in the design process.

DOE-STD-1189-2016 requires that the design organization identify the functional and performance requirements of major safety systems in a timely manner to ensure that safety becomes an integral part of the design. The System Design Description for the Electrical Power Distribution System (E-SYD-F-00015) provides information for the Electric Power Distribution System (EPDS). The SDD identifies the functional and safety requirements of the emergency diesel generators (EDGs). The safety class (SC) EDGS provide emergency power to SC sand filter exhaust fans. A third Safety Significant (SS) diesel generator will provide emergency power to systems deemed critical to the SRPPF process and SS electrical equipment located in the SRPPF and elsewhere as required. Uninterruptible Power Supplies (UPSs) ensure power is continually supplied after normal power loss and during transition to alternate power sources to SSCs that cannot tolerate unplanned power interruption or whose continued operation is required for safety functions or essential non-safety functions.

DOE O 420.1.C, Facility Safety, establishes that the single failure criterion, requirements, and design analysis must be applied to safety class SSCs during the design process as the primary method of achieving reliability. The 4.16kV Emergency Power is derived from the two independent and redundant SC Emergency Diesel Generators (EDG). Each is assumed to be 3000kW. Each diesel generator will have 8 hours of fuel in the SC day tanks. These day tanks are SC; however, the underground storage tanks are not required to be safety class. The SRPPF team stated that there is a safety requirement for an 8-hour capability.

The Conceptual Safety Design Report (S-CSDR-F-00001 Rev 0) defines the Emergency Electrical Power system. Emergency Electrical Power supports the SRPPF Active Containment Ventilation System (ACVS) SC safety function by ensuring power is available to the SRPPF ACVS during and following a seismic event and during non-seismic loss of power events. The Emergency Electrical Power system is credited as SC for a loss of offsite power event and for a seismic event.

The DOE Handbook for Design Considerations (DOE-HDBK-1132-99) states that loads that require a high degree of service reliability may be accommodated by redundant services from the utility or a single service supplied from a loop-type transmission/distribution system having sectionalizing features. The project will receive power from an existing 115/13.8 kV substation operated by the local utility. The substation is served by two 115 kV transmission lines arranged in a ring bus configuration providing sectionalizing capability and protection from a single contingency outage of the 115 kV system. The 115 kV power is transformed to 13.8 kV power through two redundant 115/13.8 kV transformers. Each transformer is rated at 37 MVA and each can serve all SRPPF loads. There are other non-SRPPF loads on these transformers. The project is confident these loads will not impact the SRPPF; however, the project will need to validate this assumption.

The 13.8 kV power is supplied to SRPPF by two independent feeds and transformed to supply to two independent 4160 V busses (Train A and B). These busses supply power 4160/480 V transformers in the facilities. There are no 4160 V loads. Train A and B loads are independent and redundant.

DOE-STD-1189 requires that utility infrastructure needs, existing capabilities and constraints be identified by the project in the as early as practicable in the design process. A preliminary load study in support of the latest Power Service Utility Permit (PSUP) submittal confirmed that the electrical load requirements are within the power source capability. Specific evaluation of the utility power infrastructure needs and existing power distribution system capabilities are to be completed based on the facilities preliminary modeling. At this conceptual stage in the project, no constraints in the utility power infrastructure needs or the existing power distribution system capabilities have been identified. The Electrical Power and Distribution System Statement of Work (G-SOW-F-00110) is a comprehensive document which includes general arrangement drawings and electrical single line diagrams to the detail level corresponding to conceptual design. Electrical as-built drawings are assumed to be accurate and are included in the on-going walkdowns and verification process. Since all existing MFFF electrical equipment will be removed as part of the D&R as-built drawings should not be an issue going forward with design.

The project has created a code of record (P-ESR-F-00008). The code of record established the appropriate codes to support the SRPPF and identifies the code used for the legacy MFFF project. The I&C control strategy is addressed in multiple documents contained in the CD-1 package at a level sufficient to advance the I&C preliminary design. The Controls and Instrumentation Design Strategy J-ESR-F-00049 establishes flow down design requirements, principals, and standards, and establishes the functional relationship between the Main Control Room, Local control, and Radiography control room. The SRPPF Control Automation Plan J-PMP-F-00001 defines the control system automation strategy and standardization with respect to the Process Control System. The Balance of Plant includes System Design Descriptions with an operational overview and simplified flow diagram, plus Scope of Work documents with associated automation plans. The Process includes System Design Descriptions with an operational overview and simplified flow diagram, and Special Facility Equipment (SFE) with P&IDs. High level narratives describing the approach to facility operations and interactions with automation are addressed in the SRPPF LCCE Operations Statement of Work V-SOW-F-00010.

Fire Protection

The fire protection analyses, design documentation, and 3D model were well developed and of sufficient detail to support CD-1. This attention to detail and emphasis early in the design process will ensure that fire protection considerations are well integrated into the design as the project matures.

The SRPPF Project identifies applicable industry codes, standards, orders, and guides used for the design of fire protection systems in the project Code of Record, P-ESR-F-00008, including the 2018 edition of the International Code Council Performance Code (ICCPC). The use and implementation of the ICCPC in DOE facilities is a novel concept, so the Project has developed an implementation plan, F-FPIP-F-0001, to ensure the performance-based design process is thoroughly defined, documented, controlled, and implemented. The implementation plan also notes that performance-based designs in accordance with The SFPE Guide to Performance-Based Fire Safety Design are recognized approaches in DOE-STD-1066-2016, *Fire Protection*, to demonstrate building and fire code compliance. In addition to the ICCPC, the conceptual design implements many other performance-based solutions that maximize stakeholder objectives and minimize costs. In support of performance-based design and approval of CD-1, the Project developed a Performance-Based Design Proof of Concept Report For SRPPF, F-DRR-F-00001, which evaluates the life safety of the facility and demonstrates that all occupants are capable of self-rescue during and after several postulated fire events, therefore meeting the objectives of NFPA 101, *Life Safety Code*. This effort provides reasonable assurance that the performance-based design process will be successful.

The SRPPF Project uses multiple methods that ensures integration of safety into the design by incorporating Fire Protection Systems and consideration of Facility Operations, with an emphasis on standard industrial practices. A Preliminary Fire Scenario Document (FSD), F-FSD-F-00001, has been developed that describes and substantiates the bounding fire scenarios in support of the Preliminary Accident Analysis, S-CLC-F-00712, and Preliminary Consolidated Hazard Analysis, S-CHA-F-00024, as required by DOE-STD-1189. In accordance with DOE-STD-1066-2016, a Preliminary Fire Hazards Analysis (PFHA), F-PFHA-F-00045, has been developed that evaluates the latest conceptual design against the applicable requirements. Several open issues have been identified in the PFHA and some items have been added to the Project Risk Register for tracking; however, not all Open Items identified in the PFHA and other fire protection documents are adequately tracked to closure. The project has developed and will implement an Assumptions Management Process (AMP) that is intended to ensure that assumptions (TBD, TBV, Open Items, etc.) are validated.

Glovebox Fire Hazard Evaluations (FHEs), as required by AGS-G-010-2011, have only been completed at a high level in support of CD-1, due to the limited amount of information available necessary to complete such evaluations. Until FHEs are completed with more detailed information, fire protection glovebox design input cannot be specifically determined. The current FHEs support a cost-bounding CD-1 estimate; however, during review of project documentation, it was not well defined as to when the FHEs will be at a level of maturity necessary to fully support design and construction of SRPPF gloveboxes. This should be identified as a Project Risk or otherwise addressed prior to CD-1. The FSD notes that preliminary FHEs have been developed and that the FSD evaluation is bounding of the much smaller glovebox fire scenarios.

Together, the PFHA and FSD lay a good foundation for meeting fire protection design in DOE Order 420.1C and DOE-STD-1066. All participants on the PFHA Team are well qualified for development of the document. Additional qualified fire protection engineers capable of supporting nuclear facilities will be needed to support the project after CD-1. As soon as design output documents are developed to address open items in the PFHA and other fire protection deliverables, additional information should be reviewed and compared to the assumptions currently utilized in safety documentation and design.

SRPPF is providing multiple fire barriers to meet NFPA 221, *Standard for High Challenge Fire Walls, Fire Walls, and Fire Barrier Walls*, some of which are Safety Class (SC). All the penetrations in these walls must be a listed/approved system. The material transfer system has design challenges that will need to be addressed after CD-1 to ensure fire is not allowed to propagate past the credited SC fire barriers. Variables such as differential pressure, various fluids, piping configurations, combustible/flammable fuels, and others will be analyzed to ensure the credited function of the walls are maintained. Other walls in support of life safety or property protection will be general service but still require a similar analysis.

Program interruption costs due to a fire event where the long lead items are being temporarily stored should be analyzed. An FHA should discuss the storage of long lead items and the possibility of program interruption costs if a fire event which has the potential to exceed the $150 or $350M Maximum Possible Fire Loss (MPFL) thresholds was to occur. The MPFL would need to consider the cost of equipment as well as impact to the program and project costs for loss of stored equipment from a fire event. The loss of the equipment could lead to delays and costs that require consideration from DOE O 420.1C.

RECOMMENDATIONS

1. None

SECTION 2 – COST, SCHEDULE, AND RISK SUBCOMITTEE

The charge for the Cost, Schedule, and Risk Subcommittee was:

Is the cost reasonable and funding profile executable?
No. The CPDS FY21 funding profile does not support project execution.

Is the schedule reasonable and sufficient to verify progress?
Yes.

Is the risk program sufficiently developed?
Yes.

Does the project have a reasonable plan to achieve CD-2/3?
Yes.

OVERVIEW

The SRPPF CD-1 cost estimate is reasonable for this phase of the project. The point estimate is $12.4B, which includes the cost to CD-1, the five subprojects, management reserve (MR), contingency, and escalation. It does not include Fee or NNSA Other Direct Cost (ODC), both of which are still being developed, typically they are 4% and 2% respectively. The approved FY21 funding profile of $4.5B is not adequate to cover the project's spend plan, which shows significant deltas beginning in FY21. The IPT's schedule maturity at the pre-CD-1 stage is impressive and exceeds requirements. To ensure continued schedule quality, margin should be added, along with all applicable DOE O 413.3B deliverables needed to achieve CD-2/3. The IPT's quantitative risk analysis exceeds the maturity level and rigor commonly achieved prior to CD-1. There are several risk areas that warrant attention, including capturing missing threats, removing redundancies, expanding handling strategies, and analyzing the correlation between risks.

OBSERVATIONS

Cost

The CD-1 estimate is a Class 4 with a point estimate of $12.4B and a cost range of $8.7B - $16.5B, based on Association for the Advancement of Cost Engineering International (AACEI) criteria and assuming -28% to +34% for the range. The point estimate includes cost to CD-1, the five subprojects: Process Building (Y799), the Utilities and Site Infrastructure (Y808), the Administration Building (Y810), Safeguards and Security (Y811), and the Training and Operations Center (Y812), MR and NNSA contingency. However, and it does not currently include Fee or ODC as both elements are still being negotiated with NNSA. The Total Project Cost (TPC) range included in the CD-1 package did not include any of the costs incurred prior to CD-1. Consequently, the package documentation showed a cost range of ($8.7B - $16.2B). The information contained in this report has adjusted the range numbers to include the CD-1 costs, making the range $8.7B to $16.5B.

The CD-1 estimate was comprehensive and well developed for a CD-1 package. The use of actuals, where possible, from other Savannah River Site (SRS) projects for glovebox and equipment estimates added credibility and cost realism to the estimate. Escalation was included in the estimate at 4% in accordance with NNSA guidance. The rate (compounded annually) was applied until the end of the project to cover the multiple construction efforts and out-year labor rate increases.

The current hotel load (December 2020 – February 2021) for the project is $6.2M per month with 360 Full Time Equivalent (FTEs). As the project progresses, these costs will increase. The projected (FY32 costs assumed) hotel load used to calculate MR and contingency margin is inconsistent with standard practice and appears high at $26M per month. The CSR Subcommittee provided NNSA-HQ guidance to the project and recommends the calculation be reviewed for compliance with the NNSA guidance. DOE "Risk Management" Guide, DOE G 413.3-7A of 1-12-2011, provides the that, *Hotel Loads: A term used to identify the cost associated with level of effort activities and fixed costs that will be incurred until a given piece of work is complete. These costs can include the costs for project management and administration and other direct costs associated with generic facilities, rentals, and other indirect costs that are not part of the direct production activities.*

The $26M/month hotel load used for MR calculations appears to also include craft costs, variable costs, and project material. It is also the highpoint MR, so would be appropriate only for those risks that would take place during that time.

The budget reserves: MR $2.4B (19.1%) and contingency $639M (5.2%), when combined, equates to 24.3% of the TPC. In comparison with other DOE nuclear projects, this rate is low. Data provided by the project team during the In-brief, indicated the CMRR NF project had an MR only rate of 24% of base (direct) cost and UPF (at CD-2/3) had a 31% MR rate of base cost. These projects are smaller and arguably less complex and ambitious than SRPPF and therefore the low percentage of budget reserves should be reviewed.

The FY21 funding profile of $4.5B from the Construction Project Data Sheet (CPDS) is not adequate to cover the project's spend plan and indicates significant deltas ($180M+) beginning in FY21. The project needs to work with NNSA to develop an executable funding and spending profile to keep the project on track. The funding shortfall for the project is $11.9B.

At the time of the review, the Cost Estimating and Program Evaluation (CEPE) Independent Cost Estimate (ICE) reconciliation with the project's estimate was not completed and discussions were on-going. Preliminary indications were that significant differences remained to be worked out before a reconciled position could be determined.

Table 1 provides a summary of the Total Project Cost (TPC) estimate and Table 2 shows the project Funding and Spending profile.

Table 1. SRPPF Total Project Cost Estimate

SRPPF Total Project Cost ($M)	Estimate
CD-1	$273.9
Y799 (Process Bldg.)	$7,645.1
Y808 (Utilities)	$483.9
Y810 (Admin)	$149.0
Y811 (S&S)	$529.8
Y812 (TOC)	$271.7
Management Reserve (MR)	$2,360.9
Fee	$0.0
NNSA ODC	$0.0
NNSA Contingency	$639.0
Total Cost	$12,353.3

Table 2. SRPPF Funding and Spending Profile

SRPPF Funding and Spending Profile ($M) – High End Estimate								
Description	Prior yrs	FY21	FY22	FY23	FY24	FY25	Out years	Total
Funding (FY21 CPDS)	$326.0	$351.9	$495.0	$674.0	$656.0	$570.0	$1,517.1	$4,590.0
Spending	$273.9	$586.9	$1,202.4	$1,332.4	$1,787.1	$1,639.5	$9,674.0	$16,496.2
Delta by year	$52.1	-$235.0	-$707.4	-$658.4	-$1,131.1	-$1,069.5	-$8,156.9	-$11,906.2
Carryover	$52.1	-$183.0	-$890.4	-$1,548.7	-$2,679.8	-$3,749.3	-$11,906.2	

Schedule

For the purposes of this review the following P6 schedule files were analyzed:

- 101320-CR-N8-T- Fluor Level III/IV Detail Schedule (Working)
- L-SRPPF-Y799-SFE-WF-CR-N8-T - Savannah River Site LANL_MERRICK - SRPPF CD-1 Process Building Rev. 2 (Working)
- L-SRPPF-Y809-SFE-WF-CR-N8-T- Savannah River Site LANL_MERRICK - SRPPF CD-1 Engineered Equipment Procurement (Working)
- L-SRPPF-Y812-SFE-WF-CR-N8-T- Savannah River Site LANL - SRPPF CD-1 TRAINING & OPS
- Y799A-CR-N8-T- Y799 - SRPPF Process Buildings Projects
- Y799B-CR-N8-T - Y799 - SRPPF Engineered Procurement Project
- Y799C-CR-N8-T - Y799 - SRPPF D&R Project
- Y808-CR-N8-T – Y808 SRPPF Utilities/Site/Infrastructure Project
- Y810 - SRPPF Administration Buildings Project
- Y811 - SRPPF S&S Project
- Y812-CR-N8-T- Y812 - SRPPF Training & Operations Center (TOC) Project

Additionally, a “Plan of the Week” (POW) schedule used to track near-term CD-1 deliverables is being employed, which the IPT plans to continue to use for CD-2/3 deliverables.

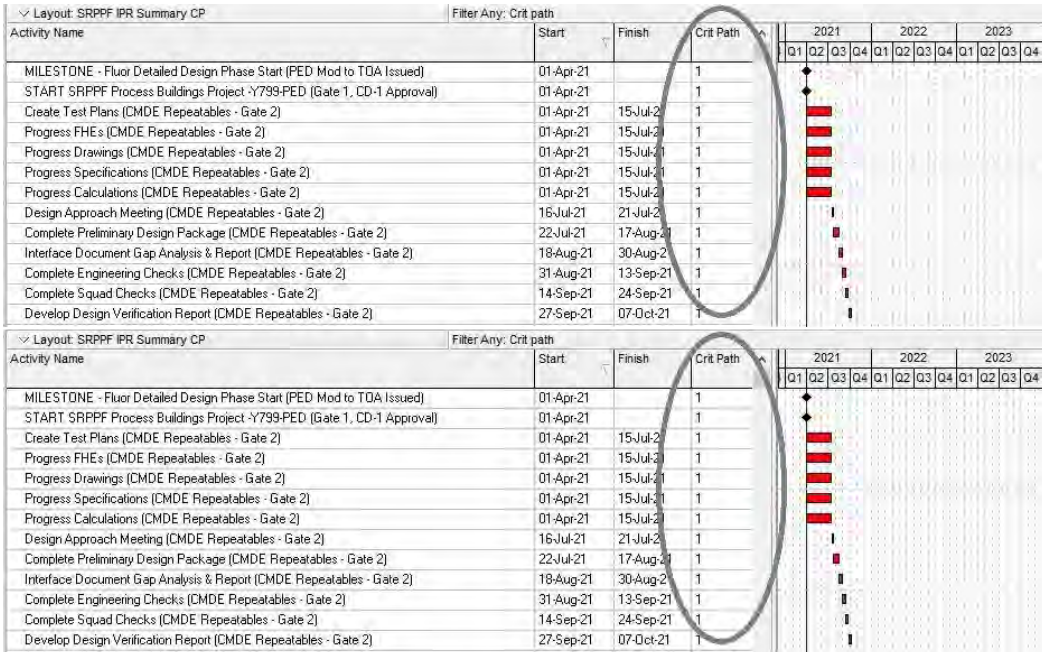
Design, procurement, and construction work scope has been divided into eleven, interlinked, XER files (listed above). The schedules are partially resource loaded, a level of maturity not usually seen pre-CD-1 but are lacking activities for margin such as management reserve, and federal contingency.

A Monte Carlo risk analysis was performed on the schedule in Oracle Primavera Risk Analysis (OPRA), using 1000 iterations. A thorough SME review was conducted, and risk uncertainty was assigned to activities at the work package level. The analysis produced a 53-month margin which has yet to be incorporated directly into the schedule. While seemingly conservative, the review team found that the somewhat long margin—roughly 35% of the total schedule—properly represents threats to the project, including glovebox and equipment procurement and engineering and craft availability.

The schedule base data date is April 1, 2021 and coincides with the previously planned CD-1 approval date. The overall schedule duration for the SRPPF project, beginning with CD-1 approval in April 2021 and ending with CD-4 approval in February 2034, is 154 months. There are four additional, post CD-4, milestones for the start of hot operations, operations, process prove-in (PPI), and 50 Pits delivered. The post CD-4 operations milestones extend the schedule for an additional 24 months to February 2036, and as such, the Program Requirements Document (PRD) date of 2030 for 50 Pits per year (PPY) is not met in the current schedule.

Although the P6 files are interlinked, the critical path is being derived manually. SME input is used to select activities deemed to be critical and then those activities are assigned the code entitled “Crit Path”. (See Figure S-1 below.) The IPT chose the manual method as a stop gap because there are many level of effort (LOE) activities on the software generated critical path. These LOE activities can be expected to move off the critical path once the design matures and activity granularity, logic, and coding is refined.

The IPT is aware that their chosen method of assigning a critical path is not a best practice and has begun the process of improving logic and coding to allow the software to identify critical and near critical activities and calculate critical paths. The POW schedule does not use the manual CP method and allows the software to generate critical paths.



Layout: SRPPF IPR Summary CP — Filter Any: Crit path

Activity Name	Start	Finish	Crit Path
MILESTONE - Fluor Detailed Design Phase Start (PED Mod to TOA Issued)	01-Apr-21		1
START SRPPF Process Buildings Project -Y799-PED (Gate 1, CD-1 Approval)	01-Apr-21		1
Create Test Plans (CMDE Repeatables - Gate 2)	01-Apr-21	15-Jul-21	1
Progress FHEs (CMDE Repeatables - Gate 2)	01-Apr-21	15-Jul-21	1
Progress Drawings (CMDE Repeatables - Gate 2)	01-Apr-21	15-Jul-21	1
Progress Specifications (CMDE Repeatables - Gate 2)	01-Apr-21	15-Jul-21	1
Progress Calculations (CMDE Repeatables - Gate 2)	01-Apr-21	15-Jul-21	1
Design Approach Meeting (CMDE Repeatables - Gate 2)	16-Jul-21	21-Jul-21	1
Complete Preliminary Design Package (CMDE Repeatables - Gate 2)	22-Jul-21	17-Aug-21	1
Interface Document Gap Analysis & Report (CMDE Repeatables - Gate 2)	18-Aug-21	30-Aug-21	1
Complete Engineering Checks (CMDE Repeatables - Gate 2)	31-Aug-21	13-Sep-21	1
Complete Squad Checks (CMDE Repeatables - Gate 2)	14-Sep-21	24-Sep-21	1
Develop Design Verification Report (CMDE Repeatables - Gate 2)	27-Sep-21	07-Oct-21	1

Layout: SRPPF IPR Summary CP — Filter Any: Crit path

Activity Name	Start	Finish	Crit Path
MILESTONE - Fluor Detailed Design Phase Start (PED Mod to TOA Issued)	01-Apr-21		1
START SRPPF Process Buildings Project -Y799-PED (Gate 1, CD-1 Approval)	01-Apr-21		1
Create Test Plans (CMDE Repeatables - Gate 2)	01-Apr-21	15-Jul-21	1
Progress FHEs (CMDE Repeatables - Gate 2)	01-Apr-21	15-Jul-21	1
Progress Drawings (CMDE Repeatables - Gate 2)	01-Apr-21	15-Jul-21	1
Progress Specifications (CMDE Repeatables - Gate 2)	01-Apr-21	15-Jul-21	1
Progress Calculations (CMDE Repeatables - Gate 2)	01-Apr-21	15-Jul-21	1
Design Approach Meeting (CMDE Repeatables - Gate 2)	16-Jul-21	21-Jul-21	1
Complete Preliminary Design Package (CMDE Repeatables - Gate 2)	22-Jul-21	17-Aug-21	1
Interface Document Gap Analysis & Report (CMDE Repeatables - Gate 2)	18-Aug-21	30-Aug-21	1
Complete Engineering Checks (CMDE Repeatables - Gate 2)	31-Aug-21	13-Sep-21	1
Complete Squad Checks (CMDE Repeatables - Gate 2)	14-Sep-21	24-Sep-21	1
Develop Design Verification Report (CMDE Repeatables - Gate 2)	27-Sep-21	07-Oct-21	1

Figure S-1 – Manually generated Critical Path coding, SRPPF February 2021 schedule

The manually identified critical path runs through the process building scope including, Flour detailed design start, CD-3E for process equipment engineered procurement, glovebox fabrication and installation, and building 226-F balance of scope work for piping, mechanical, and electrical installation and system tie-ins and testing.

Layout: SRPPF IPR Summary CP		Filter Any: Crit path	
Project ID	Activity Name	Start	Finish
Savannah River Plutonium Processing Facility (SRPPF) Project		01-Apr-21	27-Feb-36
SRPPF Process Buildings Project - Y799		01-Apr-21	27-Feb-36
Project Support - Preliminary/Final Design Phase		01-Apr-21	18-Oct-22
BOP Project Support - Design Agency Subcontractor (LOE)		05-Apr-22	29-Sep-22
Project Support - Support of CD-3F Package Prep & Design Review		05-Apr-22	29-Sep-22
SFE Project Support - SFE Design Agency Subcontractor (LOE)		01-Apr-21	18-Oct-22
Project Management / Project Controls Support		01-Apr-21	18-Oct-22
Project Support - Preliminary/Final Design Phase		19-Oct-22	13-Jun-23
Project Support (LOE)		19-Oct-22	13-Jun-23
CD-3E Package Prep		19-Oct-22	13-Jun-23
Common Design Elements (CMDE)		01-Apr-21	18-Oct-22
Repeatables		01-Apr-21	29-Nov-21
Consolidated Deliverables		03-Mar-22	18-Oct-22
CD-2/3 - Balance of Scope - Construction Execution		31-Jul-23	02-Jan-31
CD-2/3 - Balance of Scope - Mechanical/Piping		14-Dec-26	24-Jan-30
CD-2/3 - Balance of Scope - Gloveboxes		31-Jul-23	15-Sep-26
CD-2/3 - Balance of Scope - Electrical		19-Jan-29	02-Jan-31
CD-2/3 - Balance of Scope - Instrumentation		21-Nov-28	07-Oct-30
CD-2/3 - Balance of Scope - Construction Turnover		08-Oct-30	03-Jul-31
CD-2/3 - Balance of Scope - System Tie-Ins and Testing		08-Oct-30	02-May-31
CD-2/3 - Balance of Scope - System Testing and Turnover		05-May-31	03-Jul-31

Layout: SRPPF IPR Summary CP		Filter Any: Crit path	
Project ID	Activity Name	Start	Finish
Savannah River Plutonium Processing Facility (SRPPF) Project		01-Apr-21	27-Feb-36
SRPPF Process Buildings Project - Y799		01-Apr-21	27-Feb-36
Project Support - Preliminary/Final Design Phase		01-Apr-21	18-Oct-22
BOP Project Support - Design Agency Subcontractor (LOE)		05-Apr-22	29-Sep-22
Project Support - Support of CD-3F Package Prep & Design Review		05-Apr-22	29-Sep-22
SFE Project Support - SFE Design Agency Subcontractor (LOE)		01-Apr-21	18-Oct-22
Project Management / Project Controls Support		01-Apr-21	18-Oct-22
Project Support - Preliminary/Final Design Phase		19-Oct-22	13-Jun-23
Project Support (LOE)		19-Oct-22	13-Jun-23
CD-3E Package Prep		19-Oct-22	13-Jun-23
Common Design Elements (CMDE)		01-Apr-21	18-Oct-22
Repeatables		01-Apr-21	29-Nov-21
Consolidated Deliverables		03-Mar-22	18-Oct-22
CD-2/3 - Balance of Scope - Construction Execution		31-Jul-23	02-Jan-31
CD-2/3 - Balance of Scope - Mechanical/Piping		14-Dec-26	24-Jan-30
CD-2/3 - Balance of Scope - Gloveboxes		31-Jul-23	15-Sep-26
CD-2/3 - Balance of Scope - Electrical		19-Jan-29	02-Jan-31
CD-2/3 - Balance of Scope - Instrumentation		21-Nov-28	07-Oct-30
CD-2/3 - Balance of Scope - Construction Turnover		08-Oct-30	03-Jul-31
CD-2/3 - Balance of Scope - System Tie-Ins and Testing		08-Oct-30	02-May-31
CD-2/3 - Balance of Scope - System Testing and Turnover		05-May-31	03-Jul-31

Figure S-2 – Summary Level Critical Path SRPPF, Process Building, February 2021 schedule

Figure S-3 lists the major milestones for the projects.

Key Milestone (CD Approvals)	
CD-1 All Projects	4/1/2021* (*BCP for 7/1/2021)
Y799 Process Buildings	
CD-3B MOX-T CWIP Material	5/6/2021
CD-3A D&R	5/11/2021
CD-3C D&R Structural	3/9/2022
CD-3F Early Bulk Materials	7/29/2022
CD-3G BOP/S&S Equipment - Engineered Procurement	3/29/2023
CD-3D N&S Annex Structures	5/3/2023
CD-2/3 Balance of Scope	5/31/2023
CD-3E Process Equipment - Engineered Procurement	6/13/2023
CD-4 D&R	**3/16/2024**
CD-4 Process Building	**2/27/2034**
Y808 Utilities/Site/Infrastructure Project	
CD-3A S-1 Sitework	7/9/2022
CD-2/3 Utilities/Site	2/11/2023
CD-4 Utilities/Site/Infrastructure	**2/2/2031**

Key Milestone (CD Approvals)	
Y810 Admin Buildings Project	
CD-3A Admin Bldg.	4/1/2021
CD-3B Construction/Maintenance Bldg.	11/9/2022
CD-4A Admin Bldg.	**10/31/2024**
CD-2/3 Cafeteria/Office Building	8/18/2026
CD-4B Construction/Maintenance Bldg.	**1/6/2032**
CD-4 Cafeteria/Office Building	**3/24/2033**
Y811 S&S Project	
CD-2/3 S&S Construction	9/24/2023
CD-4 S&S Construction	**3/25/2033**
Y812 Training & Operations Center Project	
CD-2/3 TOC Construction	2/9/2025
CD-4 TOC	**10/28/2029**

Figure S-3 – SRPPF Project CD milestones

To optimize the schedule, the project will use a multiple CD-3X strategy, employing as many as ten separate CD-3X packages for work such as, demolition and renovation of existing rooms, early site and utility work, and equipment and material procurements. While the project should be lauded for the creative solution and early planning work, producing and submitting multiple CD-3X packages will be labor intensive, and the review and approval process will require proactive management.

Although pre-CD-1, the schedule generally adheres to industry standards for quality and scores well when measured against metrics for the DCMA 14-Point Assessment, and the GAO's best practices. An Acumen Fuse analysis of the February 2021 schedule for quality, revealed the following results:

Project / Snapshot	Ribbon Analyzer									
	Missing Logic	Logic Density™	Critical	Hard Constraints	Negative Float	Insufficient Detail™	Number of Lags	Number of Leads	Merge Hotspot	Score
Y799A-CR-N8-T	15 (1%)	4.00	183 (7%)	0 (0%)	0 (0%)	62 (2%)	162 (6%)	0 (0%)	164 (6%)	87%
Y799B-CR-N8-T	9 (0%)	2.14	21 (1%)	0 (0%)	0 (0%)	60 (2%)	221 (7%)	0 (0%)	35 (1%)	90%
Y799C-CR-N8-T	13 (6%)	3.34	19 (8%)	0 (0%)	0 (0%)	10 (5%)	16 (7%)	0 (0%)	29 (13%)	77%
Y808-CR-N8-T	28 (4%)	7.14	38 (5%)	0 (0%)	0 (0%)	13 (2%)	83 (10%)	0 (0%)	265 (33%)	60%
Y810-CR-N8-T	12 (2%)	3.56	114 (20%)	0 (0%)	0 (0%)	0 (0%)	43 (7%)	0 (0%)	70 (12%)	85%
Y811-CR-N8-T	1 (0%)	3.89	33 (3%)	1 (0%)	0 (0%)	4 (0%)	94 (9%)	0 (0%)	117 (11%)	85%
L-SRPPF-Y799-SFE-WF-CR-N8-T	1 (0%)	3.04	511 (18%)	0 (0%)	0 (0%)	175 (7%)	99 (4%)	0 (0%)	213 (8%)	84%
L-SRPPF-Y809-SFE-WF-CR-N8-T	1 (1%)	2.57	34 (19%)	0 (0%)	0 (0%)	20 (14%)	22 (12%)	0 (0%)	10 (5%)	74%
L-SRPPF-Y812-SFE-WF-CR-N8-T	2 (50%)	1.50	4 (100%)	0 (0%)	0 (0%)	4 (100%)	0 (0%)	0 (0%)	0 (0%)	0%
101320-CR-N8-T	4 (0%)	3.96	1966 (15%)	0 (0%)	0 (0%)	16 (0%)	2241 (18%)	0 (0%)	1,451 (11%)	73%
Y812-CR-N8-T	0 (0%)	3.57	139 (19%)	0 (0%)	0 (0%)	4 (1%)	60 (8%)	0 (0%)	39 (5%)	88%

Project / Snapshot	Ribbon Analyzer									
	Missing Logic	Logic Density™	Critical	Hard Constraints	Negative Float	Insufficient Detail™	Number of Lags	Number of Leads	Merge Hotspot	Score
Y799A-CR-N8-T	15 (1%)	4.00	183 (7%)	0 (0%)	0 (0%)	62 (2%)	162 (6%)	0 (0%)	164 (6%)	87%
Y799B-CR-N8-T	9 (0%)	2.14	21 (1%)	0 (0%)	0 (0%)	60 (2%)	221 (7%)	0 (0%)	35 (1%)	90%
Y799C-CR-N8-T	13 (6%)	3.34	19 (8%)	0 (0%)	0 (0%)	10 (5%)	16 (7%)	0 (0%)	29 (13%)	77%
Y808-CR-N8-T	28 (4%)	7.14	38 (5%)	0 (0%)	0 (0%)	13 (2%)	83 (10%)	0 (0%)	265 (33%)	60%
Y810-CR-N8-T	12 (2%)	3.56	114 (20%)	0 (0%)	0 (0%)	0 (0%)	43 (7%)	0 (0%)	70 (12%)	85%
Y811-CR-N8-T	1 (0%)	3.89	33 (3%)	1 (0%)	0 (0%)	4 (0%)	94 (9%)	0 (0%)	117 (11%)	85%
L-SRPPF-Y799-SFE-WF-CR-N8-T	1 (0%)	3.04	511 (18%)	0 (0%)	0 (0%)	175 (7%)	99 (4%)	0 (0%)	213 (8%)	84%
L-SRPPF-Y809-SFE-WF-CR-N8-T	1 (1%)	2.57	34 (19%)	0 (0%)	0 (0%)	20 (14%)	22 (12%)	0 (0%)	10 (5%)	74%
L-SRPPF-Y812-SFE-WF-CR-N8-T	2 (50%)	1.50	4 (100%)	0 (0%)	0 (0%)	4 (100%)	0 (0%)	0 (0%)	0 (0%)	0%
101320-CR-N8-T	4 (0%)	3.96	1966 (15%)	0 (0%)	0 (0%)	16 (0%)	2241 (18%)	0 (0%)	1,451 (11%)	73%
Y812-CR-N8-T	0 (0%)	3.57	139 (19%)	0 (0%)	0 (0%)	4 (1%)	60 (8%)	0 (0%)	39 (5%)	88%

Figure S-4 - Acumen Fuse Analysis – Schedule Quality- SRPPF February 2021 schedule

At this early stage of development, a schedule health analysis is less meaningful because activities, durations, and logic ties are being refined and can be expected to change. The metric for Logic Density, shows the highest number of red squares, indicating that the average number of logic links per activity was found to be above the acceptable maximum of 4. Ideally, the number of links per activity should be 4 or less, as higher densities can be indicative of overly complex logic.

Project / Snapshot	Ribbon Analyzer													
	1. Logic	2. Leads	3. Lags	4. SS/FF Relations	4. SF Relations	5. Hard Constraint	6. High Float	7. Negative Float	8. High Duration	9. Invalid Foreca...	10. Resources	11. Missed Activities	12. Critical Path Test	13. CPLI
Y799A-CR-N8-T	7 (0%)	0 (0%)	158 (4%)	445 (12%)	0 (0%)	0 (0%)	1,848 (74%)	0 (0%)	399 (16%)	0 (0%)	381 (15%)	0 (N/A)	X	1.00
Y799B-CR-N8-T	9 (0%)	0 (0%)	234 (7%)	138 (4%)	0 (0%)	0 (0%)	2,882 (96%)	0 (0%)	214 (7%)	0 (0%)	1162 (39%)	0 (N/A)	X	1.00
Y799C-CR-N8-T	13 (6%)	0 (0%)	16 (4%)	52 (14%)	0 (0%)	0 (0%)	169 (78%)	0 (0%)	22 (10%)	0 (0%)	35 (16%)	0 (N/A)	X	1.00
Y808-CR-N8-T	27 (4%)	0 (0%)	110 (5%)	226 (10%)	0 (0%)	0 (0%)	411 (56%)	0 (0%)	35 (5%)	0 (0%)	355 (48%)	0 (N/A)	N/A	1.00
Y810-CR-N8-T	12 (2%)	0 (0%)	56 (7%)	132 (16%)	0 (0%)	0 (0%)	307 (55%)	0 (0%)	68 (12%)	0 (0%)	89 (16%)	0 (N/A)	N/A	1.00
Y811-CR-N8-T	1 (0%)	0 (0%)	98 (6%)	206 (13%)	2 (0%)	0 (0%)	894 (85%)	0 (0%)	357 (34%)	0 (0%)	479 (45%)	0 (N/A)	X	1.00
L-SRPPF-Y799-SFE-WF-CR-N8-T	1 (0%)	0 (0%)	97 (3%)	975 (29%)	0 (0%)	0 (0%)	1,536 (60%)	0 (0%)	366 (14%)	0 (0%)	144 (6%)	0 (N/A)	✓	1.00
L-SRPPF-Y809-SFE-WF-CR-N8-T	0 (0%)	0 (0%)	14 (8%)	30 (18%)	0 (0%)	0 (0%)	105 (76%)	0 (0%)	28 (20%)	0 (0%)	1 (1%)	0 (N/A)	✓	1.00
L-SRPPF-Y812-SFE-WF-CR-N8-T	2 (50%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	4 (100%)	0 (0%)	0 (0%)	0 (N/A)	✓	1.00
101320-CR-N8-T	1 (0%)	0 (0%)	2804 (19%)	5571 (37%)	14 (0%)	0 (0%)	2,900 (29%)	0 (0%)	5096 (51%)	0 (0%)	5288 (53%)	0 (N/A)	✓	1.00
Y812-CR-N8-T	0 (0%)	0 (0%)	51 (5%)	175 (18%)	2 (0%)	0 (0%)	515 (72%)	0 (0%)	197 (28%)	0 (0%)	103 (14%)	0 (N/A)	N/A	1.00

Project / Snapshot	Ribbon Analyzer													
	1. Logic	2. Leads	3. Lags	4. SS/FF Relations	4. SF Relations	5. Hard Constraint	6. High Float	7. Negative Float	8. High Duration	9. Invalid Foreca...	10. Resources	11. Missed Activities	12. Critical Path Test	13. CPLI
Y799A-CR-N8-T	7 (0%)	0 (0%)	158 (4%)	445 (12%)	0 (0%)	0 (0%)	1,848 (74%)	0 (0%)	399 (16%)	0 (0%)	381 (15%)	0 (N/A)	X	1.00
Y799B-CR-N8-T	9 (0%)	0 (0%)	234 (7%)	138 (4%)	0 (0%)	0 (0%)	2,882 (96%)	0 (0%)	214 (7%)	0 (0%)	1162 (39%)	0 (N/A)	X	1.00
Y799C-CR-N8-T	13 (6%)	0 (0%)	16 (4%)	52 (14%)	0 (0%)	0 (0%)	169 (78%)	0 (0%)	22 (10%)	0 (0%)	35 (16%)	0 (N/A)	X	1.00
Y808-CR-N8-T	27 (4%)	0 (0%)	110 (5%)	226 (10%)	0 (0%)	0 (0%)	411 (56%)	0 (0%)	35 (5%)	0 (0%)	355 (48%)	0 (N/A)	N/A	1.00
Y810-CR-N8-T	12 (2%)	0 (0%)	56 (7%)	132 (16%)	0 (0%)	0 (0%)	307 (55%)	0 (0%)	68 (12%)	0 (0%)	89 (16%)	0 (N/A)	N/A	1.00
Y811-CR-N8-T	1 (0%)	0 (0%)	98 (6%)	206 (13%)	2 (0%)	0 (0%)	894 (85%)	0 (0%)	357 (34%)	0 (0%)	479 (45%)	0 (N/A)	X	1.00
L-SRPPF-Y799-SFE-WF-CR-N8-T	1 (0%)	0 (0%)	97 (3%)	975 (29%)	0 (0%)	0 (0%)	1,536 (60%)	0 (0%)	366 (14%)	0 (0%)	144 (6%)	0 (N/A)	✓	1.00
L-SRPPF-Y809-SFE-WF-CR-N8-T	0 (0%)	0 (0%)	14 (8%)	30 (18%)	0 (0%)	0 (0%)	105 (76%)	0 (0%)	28 (20%)	0 (0%)	1 (1%)	0 (N/A)	✓	1.00
L-SRPPF-Y812-SFE-WF-CR-N8-T	2 (50%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	4 (100%)	0 (0%)	0 (0%)	0 (N/A)	✓	1.00
101320-CR-N8-T	1 (0%)	0 (0%)	2804 (19%)	5571 (37%)	14 (0%)	0 (0%)	2,900 (29%)	0 (0%)	5096 (51%)	0 (0%)	5288 (53%)	0 (N/A)	✓	1.00
Y812-CR-N8-T	0 (0%)	0 (0%)	51 (5%)	175 (18%)	2 (0%)	0 (0%)	515 (72%)	0 (0%)	197 (28%)	0 (0%)	103 (14%)	0 (N/A)	N/A	1.00

Figure S-5 - Acumen Fuse Analysis – DCMA 14 Point- SRPPF Feb 2021 schedule

Metric #6 for High Float had the greatest number of red boxes, indicating that too many activities had float values of longer than two months (ranging between 29% and 96% of the overall schedules). Activities with high float values should be considered for schedule optimization to prioritize those activities; these values are expected to go down as schedule development continues.

Appropriate work calendars have been assigned to activities throughout the schedule and are specific to the varied work schedules at each site or subcontractor workplace. For example, the '*Merrick Std 5 Day Wrkwk w/Basic Holidays thru 2025'* calendar is assigned to work performed by Merrick.

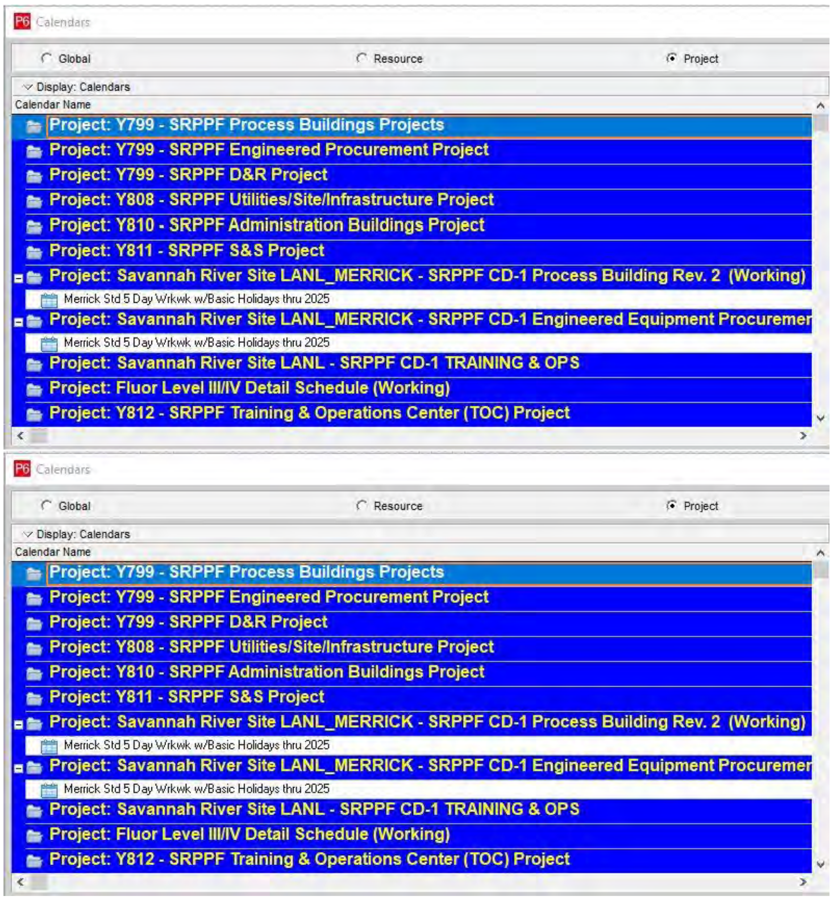


Figure S-6 - P6 calendars – SRPPF schedule

Although the schedule is relatively mature at the pre-CD-1 stage, the review team suggests that the IPT update the planned CD-1 date, ensure all applicable DOE O 413.3B deliverables have been captured, and add margin to the schedule to reflect the CD-4 date accurately. To reduce confusion as to the CD-4 date, any operational and production milestones should be removed and tracked separately from the design and construction schedule.

Risk

Total risk for the SRPPF project is comprised of technical and programmatic (T&P) risk and uncertainty associated with cost and schedule estimates. The SRPPF IPT estimates contractor MR at $2.4B and NNSA contingency at $639M. Table R-1 summarizes the distribution of MR and contingency among the risk categories.

Table R-1. SRPPF Project Total Risk: Technical and Programmatic Risk, Cost Uncertainty, and Schedule Uncertainty (Dollars in Millions)

SRNS				NNSA		
	Management Reserve Estimate Uncertainty				Contingency	
T&P Risk[a]	Cost	Schedule	Total	T&P Risk[a]	Schedule[b]	Total
$442.3	**$519.8**	**$1,398.8**	**$2,360.9**	**$639.0**	**—**	**$639.0**

[a] Calculated at the 85% confidence level
[b] Captured in schedule margin.

The IPT's January 2021 T&P risk analysis was based on 115 open risks as of December 2020. The distribution of the estimated T&P risk between SRNS MR and NNSA contingency is summarized in Table R-2. Approximately 79% of T&P risk is captured by contractor MR, while NNSA contingency represents 21% of the estimated T&P risk dollars.

Table R-2. SRPPF Project Technical and Programmatic Risks, (Dollars in Millions)

SRNS Management Reserve	
Active Risks	106
Most Likely T&P dollar value at 85% confidence	$442.3
Management Reserve	$2,360.9
Expended	-0-
Remaining	$2,360.9
NNSA Contingency	
Active Risks	9
Most Likely T&P dollar value at 85% confidence	$639.0
Contingency	$639.0
Expended	-0-
Remaining	$639.0
Total Remaining MR and Contingency	**$2,999.9**

A combined risk register for T&P risks is maintained by SRNS and NNSA, as presented in the January 2021 *Risk and Opportunity Assessment Report (ROAR)*. The IPT has identified 105 active threats and 10 open opportunities. The distribution of T&P risks between SRNS and NNSA is summarized in Table R-3. Because much planning remains, such as determining government furnished versus contractor-acquired equipment, it is likely that additional threats and/or opportunities will be identified and retired.

Table R-3. SRPPF Project Technical and Programmatic Risks

	SRNS		NNSA		Total	
	Threats	Opportunities	Threats	Opportunities	Threats	Opportunities
Open	96	10	9	0	105	10
Closed/Retired	67	23	6	0	73	23
Total	163	33	15	0	178	33

The IPT's assessment of threats and opportunities at this phase is noteworthy, as it exceeds the maturity level and rigor (i.e., a quantitative analysis) commonly achieved prior to CD–1. As is common at this early phase in the project life cycle, refinements to the risk assessment are needed in key areas, Specifically, the risk assessment should be revisited to address the analytics applied, missing risks, redundancies, and ambiguities.

An analysis of the correlation between risks is warranted, consistent with a Government Accountability Office (GAO) "best practice". As stated in the January 2021 (Revision 2) *Risk and Issue Management Plan,* the IPT examined the correlation between the cost of each risk and total project cost only (and not between risks). Results of a correlation analysis between risks will impact the estimate for MR; the CSR Subcommittee was advised that the IPT will soon be augmented with new software and additional staff to better address this GAO "best practice".

The risk analysis does not explicitly address important areas of project threat. For example, there are no threats identified directly associated with commissioning. Numerous risks will eventually impact commissioning, such as the inability to properly test the sand filter after construction (i.e., Risk 7956) or the availability of war reserve tools, parts, and fixtures at CD-4 (Risk 6693). The IPT should consider including the unavailability of engineers to perform the necessary tests to achieve commissioning and eventual turnover to operations (TTO), and the impacts of significant construction deficiencies identified during startup. Additionally, missing are threats to schedule performance due to delays in developing, verifying, and validating the Advanced Work Package software tool. The IPT maintains that this software tool is a "must have" and vital to performing production. Accordingly, it represents a project threat rather than an opportunity, as currently captured in the risk analysis (i.e., Risk 7031, *Integrate Project Documentation Electronically to Improve Project Cost and Schedules*). Further, the IPT should consider including threats addressing the impact of on/off project accidents that can result in temporary work stoppages and stand-downs that negatively impact schedule.

There are few vendors qualified to supply customized gloveboxes to Nuclear Security Enterprise (NSE) projects. Accordingly, the NNSA has a history of supply chain difficulties in obtaining timely delivery of this equipment. The anticipated quantity demanded by the SRPPF project in addition to other on-going construction efforts may overwhelm the capability of glovebox vendors to satisfy demand. Consequently, this may result in inflationary pressure on glovebox prices. The IPT should consider including this threat in the risk analysis.

Additional areas of the SRPPF project risk assessment that warrant attention pertain to the granularity exercised in identifying threats and associated handling strategies. For example, there are two entries for the threat to project performance due to the unavailability of non-craft labor personnel. One risk is generic, as it refers to non-labor "critical" staff (i.e., Risk 6519). Another risk (i.e., 6524) refers to the availability of "nuclear material control and accountability" staff. Both staff are non-labor and critical. Therefore, rather than create multiple risks, the IPT should consider a single risk with specific handling strategies for each non-labor staff category, as appropriate. Another example pertains to major delay barrier (MDB) doors. There is one risk that addresses the concerns pertaining to MDB doors holding off adversaries (i.e., Risk 8080) and another addressing life safety concerns in the event of a fire (i.e., Risk 6525). The IPT should consider capturing threats to MDB doors in a single risk with discrete handling strategies for each concern, as appropriate. Lastly, Risk 7990, *Final Design of Key Pieces of Production Equipment Incomplete prior to Glovebox (GB) Design and Procurement Negatively Impacting Project Schedule*, refers to a range of technologies and more than a dozen pieces of equipment. In this example, additional granularity should be considered for applicable handling strategies. Greater granularity among handling strategies within a single risk is often preferable than multiple risks because it tends to focus and facilitate implementation and tracking of resolution activities; it should be considered as the IPT updates the risk analysis.

The SRPPF project risk assessment carries a threat associated with the new Caerus security system (Risk 7904, *Development of Caerus System delays PSCOE's Detail Design during PED phase*).

Currently the M&O is assigned ownership of this threat. However, because the (ROAR) description of this risk includes utilizing government and commercial off-the-shelf software, SRNS versus NNSA implementation responsibilities are unclear. Consequently, the risk description and handling strategy warrant review to resolve ambiguities between contractor and federal government responsibilities for implementation and cost sharing obligations.

The timely delivery of war reserve parts, gloveboxes, specialty hand tools, machines, and fixtures are among the principal threats to the SRPPF project. In addition to these supply chain risks, the availability of the requisite number and type of craft and non-craft labor personnel are expected to hinder SRPPF project performance as it has other NSE projects. Multiple NNSA projects and private sector construction activities will be competing for similar personnel, especially craft labor. SRNS has addressed the threat of labor shortages in threat ID 6988 which has a handling action ID 7662 to perform a formal labor survey. The survey will help determine the timing and magnitude of candidate incentives to achieve the necessary workforce; it will be performed by the labor relations manager. The IPT is encouraged to examine the lessons learned from the vendor incentives initiated by the UPF IPT to combat delayed delivery of materials, equipment, and supplies.

RECOMMENDATIONS

1. By April 9, 2021, IPT reconcile the cost estimates, including consideration of hotel load, risk correlation, and risk duplication.
2. By August 6, 2021, IPT adjust planned project execution to match funding availability.

SECTION 3 – MANAGEMENT AND ACQUISITION SUBCOMMITTEE

The charge for the Management and Acquisition team was:

Are documents sufficiently developed to achieve CD-1 on schedule?
Yes.

Does the project satisfy all aspects of the program requirements document?
No. The schedule does not meet the need date.

Is the planned M&A approach reasonable regarding to contract structure, risk management, design management, and change control?
Yes.

Has the project sufficiently integrated physical, information, and cyber security requirements.
Yes.

OVERVIEW

The project is being properly managed by the M&O contractor and the Acquisition and Project Management Office (APMO). Both M&O contractor and the APMO are dedicated, working as an efficient team, and committed to meeting project deliverables on time and on budget.

The project has sufficiently developed all required CD-1 documents. Completion of the acquisition strategy and the Preliminary Project Execution Plan are pending reconciliation of the independent cost estimate.

The project does not satisfy all aspects of the program requirements documents. The current schedule for SRPPF does not achieve the required production capability by 2030.

The management and acquisition approaches are reasonable regarding the planned sub-project and contract structures. The risk, design and change management control procedures are adequate.

The integration of the physical information and cyber security requirements appear reasonable. The conceptual design has integrated physical, information and cyber security requirements.

OBSERVATIONS

Required CD-1 documents

Critical Decision-1 (CD-1) approval requires completion of 29 documents. The SRPPF project has completed 26 of the 29 required. The three outstanding documents are the Independent Cost Estimate (ICE), the Preliminary Project Execution Plan (PPEP), and the Acquisition Strategy (AS). The ICE has been substantially completed and is in the process of reconciliation with the SRPPF project estimate. The ICE was expected to be completed in March 2021 as needed to support CD-1. The reconciliation process must also be completed to populate the final tables in the PPEP, and Acquisition Strategy needed for CD-1 approval. NNSA Other Direct Cost (ODC) and related staffing calculations have not been finalized by the FPD and need to be added to the PPEP (Section 5.6, Table 5-4) before it can be submitted for approval.

There are two additional, non-413.3B required documents: One-for-One Replacement Legislation, as mandated in House Report 109-86, and review/analysis of the Critical Decision by the Project Management Risk Committee (PMRC) and submittal of recommendations to the ESAAB, CE, or PME prior to Critical Decision Approval.

The Conceptual Design Report, G-CDR-F-00005, section 2.3.4 One-for-One Replacement, addresses this issue by building. It showed 448,300 square feet of building space would be added but 669,400 square feet of building space would be repurposed or eliminated.

The project documentation also reflects incorporation of three best practices for projects at this stage of development. These are (1) use of early configuration management planning, (2) inclusion of high-level Work Breakdown Structure (see Cost, Schedule & Risk Subcommittee section), and (3) use of a Functional & Operational Requirements (F&OR) document.

Program Requirements Document (PRD)

The project schedule submitted with the Conceptual Design Report (CDR) does not meet the PRD of 2030. Details regarding the schedule delivery date can be found in the Cost, Schedule, and Risk section of this report.

The project is using a requirements management plan that includes a system's approach to establish and verify requirements are being met. The project satisfied all aspects of the program requirements document with exception of the 2030 production delivery. The project captures requirements using screening and evaluation criteria followed by development and tracking of desired attributes. The PRD is dynamic and subject to numerous changes until CD-1 is achieved.

Management Approach

Both the management and acquisition approaches were found to be reasonable.

The project intends to use a tailoring strategy of five sub-projects with multiple milestones (CD-3X) planned to support early procurements and site preparation activities between 2021 and 2023. The five subprojects are:

- Process Building (Y799)
- Utilities, Site, Infrastructure (Y808)
- Administration Buildings (Y810)
- Safeguards and Security (Y811)
- Training and Operations Center (Y812)

These multiple CD-3X milestones planned for early procurement and site preparation will require considerable coordination within NNSA.

Acquisition Approach

The planned approach is reasonable. Based on a review of the draft acquisition strategy plan and interviews confirming the current contract structure aligns with the CD-1 milestones. The project has achieved the conceptual design milestone required for CD-1.

The project is planning two sole source Architect and Engineering (AE) subcontracts to continue post CD-1 to support the design. The project needs to award these contracts in August and September 2021 to remain on schedule.

Areas of concern include the two vacant full-time employee (FTE) positions in the SRS Contract Management section supporting the SRPPF project. The project would benefit from timely filling of the vacant Federal Contracting 1102 series billets. An appropriate course of action to mitigate this concern is for the APMO to perform a staffing analysis as workload increases. Particular attention should be made to project controls as the Project and APMO Director have multiple vacancies to fill as well. The SRS Contract Management would benefit from contracting for technical contracting management support. This would augment and assist the Lead contracting officer with non-inherently governmental work in the interim until the federal positions are filled.

The existing M&O Contract has been modified to include CLINs and SubCLINs to support the SRPPF project until the period of performance end date of 30 September 2022. The RFP for the follow-on M&O contract is expected to be released Spring 2021 by DOE-EM. Further delays may result in a potential break in service and consequently a slip in the program's schedule. We encourage the APMO to continue its work with NNSA M&O Contracting Office to ensure SRPPF Project award remains on schedule to maintain the anticipated milestone award date. The RFP is expected to include engineering, procurement, construction (EPC) experience as a source selection factor. M&O Contract Transition risks have been incorporated into the risk planning for each of the three involved M&O contracts: LANL, SRNL, and SRNS.

The project team intends to include performance incentives. These have not yet been determined but would focus on schedule performance.

Glovebox Procurement

The project scope requires procurement and fabrication of approximately 411 gloveboxes which is approximately six times the number of gloveboxes required for the Los Alamos Plutonium Pit Production Project (LAP4). LAP4 requires approximately 70 gloveboxes and the CMRR project requires approximately 40 gloveboxes. The glovebox procurement and fabrication at SRPPF, LAP4, and CMRR have overlapping acquisition schedules which may strain vendors.

As a result of experience with other SRS projects and a market survey from glovebox vendors, Liquidated Damages (LD's) clauses will not be included in the RFP for glovebox acquisition; the project team determined that inclusion of LD's would unnecessarily limit an already constrained resource, as there are only six known domestic vendors and over half expressed unwillingness to propose if LDs were included.

The project and all other NNSA projects sites procuring gloveboxes would benefit from the Energy Facility Contractors Group (EFCOG) effort to address glovebox procurement for the Nuclear Weapons Enterprise.

The SRPPF project team should be commended for its efforts in seeking best practices and lessons learned associated for procuring gloveboxes; the project has reached out to the LANL and Y-12 to obtain lessons learned. This is anticipated to greatly help the project with its glovebox procurement planning.

Project Management

The project has mature procedures established and implemented for risk, design, and change management. Compliance to these procedures will be critical to success as well as timely revisions to the procedures based on best practices, lessons learned, and new requirements.

The Earned Value Management (EVM) system description document and EVM procedures and processes are in place and used by the Project Team. The EVMS is scheduled to be certified with the Surplus Plutonium Disposal project

The Federal APMO organizational chart identifies multiple deputy Federal Project Directors (FPDs), engineering/design, and contract management subject matter expert vacancies. This should be an area of focus for the APMO Director.

Other capital line-item projects and general plant projects at SRS will be underway concurrent with the Project. Technical and management resources must be allocated sufficiently. The pending organizational alignment change of design assets and development of site policies specifically for capital asset construction will be a notable improvement to the current situation, which is optimized for continuing operations.

Security

The Project met requirements for integration of physical, information and cyber security.

The project developed additional documents and established processes & procedures to ensure integration of Safeguards and Security into the SRPPF Project and improve overall communication and coordination. The team has developed a Security Design Requirements Document to integrate and establish a set of S&S requirements baseline to enable prudent project management throughout the duration of the project. The team developed an SRPPF Safeguards and Security Issue Resolution Process procedure to help resolve any issues between NA-70, SRFO and the IPT. The team also established a Security Design Integration Team, like the Safety in Design Integration Team (DOE STD 1189) which is staffed by all key S&S functional stakeholders including representatives from NA-70, SRFO, SRNS, PSCOE and SRS Protective Force representatives to actively manage issues and integrate throughout the evolution of design and construction.

Although the SRPPF team has been proactive integrating S&S, there continues to be an underlying issue with NA-70 concerning SRS's over specifying Functional and Operational requirements that are outside norms being implemented within the NNSA enterprise. To overcome these concerns and differing perceptions each organization needs to accept the organization's roles and responsibilities with transparent communication and verification of the design and implementing project documentation.

The project team has prudent processes and procedures to enable integration, identification, and control of requirements and to review design deliverables to ensure complete flow down and implementation of requirements. Although there are design elements that address many of the physical, information and cyber security facets of the project, one key document, the System Security Plan (SSP), was not provided for review, but it is intended that an existing plan for another site project will be modified to add the systems of this project as subordinate SSPs.

The Authorizing Official (AO)[1] needs a high-level information and cyber systems and security design description, which includes a summary of all SRPPF information and cyber systems to support comprehensive planning for the risk assessment, approval to operate, and system oversight by the AO.

There are many design features of the project that would potentially mitigate the vulnerabilities either identified, or potentially identified in the analysis. These are the layers of physical, information, and cyber protection. Physical protection described in the various documents are fences and gates, doors, locks, and badging systems, patrols, guards, cameras, recording devices, and intrusion detection devices. Information protection in the form of "air gapped systems"[2], dedicated fiber optic network, firewalls, and encryption is found in The Data Management Conceptual Design Package, G-SOW-F-00100. The combination of these two forms the basis for cyber security of the project. Additional information is needed to ensure the planning and design protects information from the source to destination as well as at rest in servers.

The collection of system design descriptions provides individual detail appropriate for the concept stage of development. There is a Conceptual Design Report that covers all aspects of the project, to include information and cyber, but it does not adequately tie together the information and cyber systems for system authorization purposes.

A Vulnerability Analysis has been drafted to provide a basis to integrated physical security requirements into the conceptual design. This includes conceptual vulnerability assessment (CVA) and a preliminary vulnerability assessment (PVA). SRPPF completed a gap analysis due to the timing of the PVA and evolution of the Conceptual Design. While physical security vulnerabilities are addressed, information and cyber vulnerabilities have not been addressed. The conceptual vulnerability analysis should be reviewed

[1] Authorizing Official (AO) – Official with the authority to formally assume responsibility for operating an information system at an acceptable level of risk to agency operations (including mission, functions, image, or reputation), agency assets, or individuals. Source: https://csrc.nist.gov/glossary/term/Authorizing_Official

[2] Air-gapped systems are those that do not connect to other systems, especially to external networks, such as the Internet. However, there is a security fallacy associated with air-gapped systems in that an insider, or a physical intruder, can introduce cabling or media which can subvert the expected security of the air-gap.

and updated to address information and cyber vulnerabilities. The vulnerability analysis should identify potential attack and system failure vectors that can be turned into system and procedure design requirements. These requirements can then be incorporated into the System Security Plan and the accompanying controls and implementations of those controls to improve physical, information, and cyber security of the project.

The security system owner had not seen a systems overview identifying the various systems and their conceptual interconnectivity. From the number of conceptual design descriptions, it is apparent that there are multiple systems, a) some serial and not connected to other networks, b) some Internet Protocol (IP) and not connected to other networks, and c) others IP and connected to other networks. It will be important to identify as many of these conceptually for the AO to consider and plan for the review and authorization. There are 25-30 individual systems in the balance of plant (BOP), and each of them have a system design description. There is an overview document in the form of the Conceptual Design Report. Information and cyber systems are part of the Conceptual Design Report but are not described in a way that make clear how they connect, or not, and how they report to the control room, if that is part of the design.

The project has a well-developed, mature risk management program, as well as other aspects, from an existing project, Tritium. There are some registered risks that are specific to information and cyber.

NA-70 deployed field staff to SRS to provide liaison between the project team and NA-70. The project manager has added staff to work with the NA-70 liaison. The SRPPF leadership and the NA-70 field staff agreed that there were routine meetings, weekly and monthly, during which the attendees discuss security, and that issues were raised, resolved, and documented. However, NA-70 leadership is under the impression that several issues remain to be resolved. The following observations apply:

- NA-70 has been actively engaged in the SRPPF Senior Management Team meetings.
- Safeguards and Security is an integral part of the Federal IPT, and all functional areas follow the SRPPF Project Systems, Processes, and procedures.
- SRPPF Safeguards and Security roles, responsibilities, accountabilities, and authorities should be in accordance with DOE O 413, DOE O 470, NNSA SD 470.4-1 and 470.4-2.
- Best Practices: SRPPF developed a Security Design Requirements Document and a Security Interface Procedure which were subsequently approved by NA-70, SRFO, and the FPD.
- Best Practice: A Security Design Integration Team, like the Safety Design Integration Team, has been established to integrate all Safeguards & Security into the project. In addition, a Security Integrator position was established to better integrate NA-70 & SRFO.
- Security representatives from NA-70 (three FTEs), SRFO (two FTEs), IPT Security Representative (one FTE), Security Integrator (one FTE) regularly support the weekly SRPPF IPT meeting.
- PSCOE is the Design Agent for physical security, however, the PSCOE Physical Security design was authorized by NA-70 without coordination with the FPD/IPT.

There are cyber security devices and processes in the design, as well as potentially protected dedicated circuits, but it was not clear that the design includes circuit protection in uncontrolled spaces. The Process Control Conceptual Design Package, G-SOW-F-00099, Attachment 4.1, and the Data Management Conceptual Design Package, G-SOW-F-00100, Attachment 4.1, include drawings which display plans for firewalls between SRPPF production and other existing systems and encryption between production and ESN. Para 3.0, page 9, states that “[a] dedicated classified fiber optic network connects the various networked DMS equipment within and between the buildings [as] identified …” earlier in the document.

Future documents and drawings need to describe and specify the pathway between buildings and through unsecure areas within buildings that these circuits follow and how they are protected.

The collection of system design descriptions provides individual detail appropriate for the conceptual stage of development. There is a Conceptual Design Report, G-CDR-F-00005, which "… describes the SRPPF Project and serves as an assemblage of all the design related project planning documents and key strategies developed to support approval of CD-1 in accordance with DOE O 413.3B, Program Management for the Acquisition of Capital Assets." However, this report covers every aspect of the project, and, although it includes information and cyber, it does not adequately tie together the information and cyber systems for system authorization purposes. The project is conducting a formal, internal review of network architecture and have invited the AO to that review.

Cyber security considerations for process control and data management conceptual design packages are well-documented.

No areas of concern regarding cyber security were found in the Fire Protection Conceptual Design Package, G-SOW-F-00111, but it would serve to ensure cyber security if a review was conducted of the fire protection systems cyber perimeter to ensure there is no data leakage nor vulnerability of system failure caused by outside actors or insiders, without detection.

There is only one Qualified Fire Protection Engineer (QFPE-II) directly supporting SRPPF, responsible for development and review of all SRPPF fire protection program requirements (operations, procedures, construction, maintenance, etc.), analyses (fire hazards analyses, fire scenario documents, glovebox fire hazard evaluations, etc.), review of design interfaces (SDDs, layouts, and other ancillary programmatic duties as required by the site fire protection program, 2Q). Although additional support will be provided by the site fire protection program group following approval of CD-1, none are expected to be qualified, nor are they planned to be qualified in the near term necessary to support SRPPF without oversight by the one (1) assigned Qualified Fire Protection Engineer. An SRPPF QFPE Staffing Needs Analysis is needed to justify and adequately support the qualification level and quantity of personnel necessary to support SRPPF through CD-2 and beyond.

The Safeguards and Security System Conceptual Design Package, G-SOW-F-00098 has extensive descriptions and drawings of the physical protections, electrical systems supporting the physical protections, as well and wiring between subsystems. The Safeguards and Security System Description, S-SYD-F-00005, includes general information in Section 3.2.11 about Boundaries and Interfaces, and identifies the SECS boundary at the SAS will be the Argus console supporting the SRPPF SECS, but identifies no specifics. That document also has a placeholder in Section 4.1.2 for Boundaries and Interfaces. There is an indication of connection to other networks, so that would be an important factor to review in detail. The site should identify all potential cyber interfaces with other systems and review the interconnection design to ensure adequate protections are in place to achieve the anticipated controls.

The project plans to implement Sandia's new security system software to eventually replace Argus. The new system is being developed to be compatible with Argus devices and data. They have registered a project risk associated with the Argus replacement, to be certain they continue to address development of the new software and potential points of failure.

All systems should be identified by following the Risk Management Framework *prepare* step and categorized for confidentiality, integrity, and availability of information collected, processed, stored, and disseminated by following the RMF *categorize* step. This information should be recorded in the initial Systems Security Plan.

Acquiring equipment with Bluetooth and/or Wi-Fi capability presents an uncontrolled network edge device that must be addressed during design, acquisition, or installation.

It is intended that the gloveboxes be under local control, that is, not connected to a network. Such a design may not require further security design, but the serial network should be identified, and the decision documented, and put under configuration controlled. However, there may be temperature and other monitors, and possibly cameras, that would require network connectivity to reach the control room. The control room will be in the SRPPF building complex. This will be easier to control, but still must be identified as one, or more networks, and security controls put in place.

Other control systems may also be networked and connected to the control room. Those are nitrogen, argon, and other gas supply and release detection, instrument air, ventilation and HVAC, and electrical system monitoring. These also should be identified, just as any IT network would need to be.

The project may be overly conservative with its estimate of what needs to be in the protected area and will benefit by an assessment of the protected boundary.

The Federal Integrated Project Team (IPT) Charter is adequate and includes an NA-SV (local Field Office) IT and Cyber member, but the project team may benefit by including a member from NA-IM, to provide complex-wide experiences (lessons learned) perspective on incorporating evolving cyber and information security requirements for line item projects.

RECOMMENDATION

1. By April 30, 2021, the IPT complete required CD-1 documents.

SECTION 5 – ENVIROMENTAL, SAEFTY AND HEALTH AND QUALITY ASSURANCE

The charge for the ES&H and QA Subcommittee was:

Are ES&H and QA programs, controls, documents (including National Environmental Policy Act), and processes sufficiently mature?
Yes.

Do integrated project team personnel have the requisite nuclear safety-related qualifications?
Yes.

OVERVIEW

The project has appropriately identified, planned for, and integrated ES&H and QA activities in the project commensurate with the project maturity. The programs, controls, documents, and process are sufficiently mature for CD-1.

OBSERVATIONS

Environment, Safety & Health

The Project complies with DOE regulatory compliance programs. Quarterly, annual, and routine reports will be submitted as required. The NEPA process was initiated with the completion of an environmental evaluation checklist. The project's Record of Decision was published November 2020; NEPA actions are complete. Successfully obtaining a record of decision ahead of schedule is commendable and mitigated a project risk. There is a robust process for screening design changes with the potential to impact the Environmental Impact Statement (EIS). The Project was recognized with an award, the "NA-50 Award of Excellence," which was a shared award with LANL, for completing EIS documents in record time.

There is a strong safety and health program. The SRNS Workers Safety and Health Plan was completed by the site safety team and approved in March 2020. The site safety program is mature relative to the project. The project will increase the construction and craft personnel entering and working on the site by 2,500 to 3,000 people. This is a significant increase. The SRPPF safety team will need to stay on top of safety to ensure personnel and subcontractors have and maintain the same superior safety culture that presently exist at SRNS. The project should consider a specific source selection criterion using "safety" as a weighted measurement in the selection of subcontractors.

Quality Assurance

The site is covered by a DOE approved Quality Assurance Management Plan (QAMP). A SRPPF project specific Quality Assurance Program has been implemented for compliance with DOE requirements. SRS and the SRPPF project have mature QA processes. The corrective action program requires additional direction and oversight.

The M&O contractor and Federal technical oversight employees assigned to the project are suitably qualified for their respective roles. Federal employees with QA oversight responsibilities must complete the required qualifications.

10 CFR 830 Subpart A and DOE O 414.1D requirements apply to DOE Nuclear Facilities including the Savannah River Site (SRS). "SRS Management and Operations (M&O) Quality Assurance Management Plan (QAMP)" SRNS-RP-2008-00020 covers QA activities at the site. This QAMP was approved by DOE in May 2018. A project specific Quality Assurance Program G-PSQ-F-00011 outlines the SRNS Quality Assurance Management Program to be implemented on the SRPPF Project for compliance with 10 CFR 830 Subpart A and DOE O 414.1D requirements. This was issued in July 2020.

The QA program is implemented using ASME NQA-1 as the primary implementation standard for meeting

10 CFR 830 Subpart A and DOE O 414.1D requirements.10 CFR 830 Subpart A, Criterion 3 “Management / Quality Improvement” is implemented using NQA-1 Requirement 16, “Corrective Action”. The corrective action program is not being used during the SRPPF conceptual design. While SRS is covered by a corrective action program, the process does not appear to be effectively used during the Project’s design phase and requires additional direction and oversight. The project needs to take this opportunity to implement the management and quality improvement measures required by 10 CFR 830 Nuclear Safety Management in the way of an effective corrective action program before entering project phases requiring the program; the project team must address this weakness as it begins design.

The M&O contractor has an effective system for training employees and maintaining training records as e implemented following the SRS Management and Operations (M&O) Quality Assurance Management Plan (QAMP) SRNS-RP-2008-00020 Section 5.2, which addresses DOE QA Criteria 2, Management / Personnel Training and Qualifications.

The Federal technical oversight team personnel are covered by the Technical Qualification Program and have either completed or are working towards obtaining the necessary qualifications. The Federal Quality Assurance team does not have individuals qualified to DOE-STD-1150-2002 (or latest version) as required by DOE O 414.1D Chg. 1. The standard also states: “Equivalencies may be granted for individual competencies based on objective evidence of previous education, training, certification, or experience” and this option should be explored by the FPD.

RECOMMENDATIONS

1. None

SECTION 6 – COMISSIONING SUBCOMITTEE

The charge for the Commissioning Subcommittee was:

Has the Program Office defined the preliminary criteria for project completion to achieve CD-4 approval?
Yes.

Is there a document control system in place to identify and retain documents?
Yes.

Are staffing, training, waste management, and interfaces with other sites, operations, and projects understood for inclusion in the commissioning plan?
Yes.

OVERVIEW

Commissioning is well developed for this phase of the project. A Commissioning Authority has been assigned and has been in place from over a year. A Readiness Manager and Operations Manager are also in place. A Commissioning Management Plan (CMP) and Transition to Operations Plan (TOP), not required until CD-2, have been issued. The CMP and TOP address requisite topics for this phase of the project. The CMP identifies personnel who will provide, track, and ensure fulfillment of commissioning related requirements along with developing an initial testing approach and set of testability requirements to inform the design process. The TOP provides an outline for transition to the SRPPF operations phase. The CMP and TOP will be updated as the project progresses.

OBSERVATIONS

SRPPF has issued Commissioning Management Plan (CMP), V-PRP-F-00007, Rev 1, dated March 2020 and Transition to Operations Plan (TOP), V-PRP-F-00008, Rev 0, dated January 2020. The CMP provides an outline of the processes and resources required to properly transition from the Project Phase to the Operational Phase for SRPPF. This Plan will be revised throughout the life of the Project to provide greater levels of detail as they become available. The CMP discusses commissioning planning, design commissioning, construction and preoperational testing, operational readiness, transition to operations, closure of the CMP, risks and opportunities, and assumptions. These topics are addressed commensurate with the level of maturity of the project. The TOP provides an outline of the processes and resources required to properly transition from the Project Phase to the Operational Phase for SRPPF and defines the basis for attaining initial operating capability and full operating capability. The plan is commensurate with the level of maturity of the project and will be revised throughout the life of the project to provide greater levels of detail as they become available.

The SRPPF will be cold commissioned at CD-4. Plutonium will not be introduced into the facility for testing. The CD-4 strategy for SRPPF is to conduct most of the system testing in a Training and Operations Center (TOC), consisting of mockups of equipment, components, systems, controls, and gloveboxes. Surrogate material will be used in testing and troubleshooting the process in a non-radiological environment. Some Key Performance Parameters (KPPs) will be verified using process modeling software. Commissioning capabilities will include demonstration of production throughput, waste generation, entry control, facility throughput, receipt and shipping of plutonium and waste.

It is noteworthy that the Operations Manager, Commissioning Authority/Manager, and Readiness Manager all have been in place for well over a year. They have been actively involved and engaged in design, commissioning, transition to operations, and readiness planning. The Operations Manager, Commissioning Authority/Manager, and Readiness Manager understand the scope of the project and are actively planning mitigations for known risks, like the potential shortfall for qualified readiness and commissioning personnel. Preliminary staffing levels for these activities show approximately 600 FTE operations staffing positions needed for several years prior to CD-4 to accomplish transition to operations and readiness. The project has implemented many of the best practices in DOE G 413.3-23 Commissioning of Nuclear Facilities, such as establishment of the Commissioning Authority, Design Authority and Construction Manager, early development of the readiness strategy, the decision regarding hot commissioning, and use of a simulator for testing.

SRPPF uses the SRNS Document Control System (EPFM), Records System (EDWS), and the Classified Records System (CARDS) for identifying and retaining documents. Documents from multiple National Labs and projects will be received, entered, and maintained in these document record systems. The staff understands the challenges in coordinating the large and diverse documentation required for operational readiness.

The project Senior Management Team (SMT) developed the approach for KPPs completion prior to Performance Baseline establishment. The approved Program Requirements Document, Rev 2, dated March 2019 contains requirements for SRPPF. The Conceptual Design Report references requirements in the Functional Design Description and System Design Description documents that will be used for Preliminary design. Per the SMT, KPPs will be documented in the Project Execution Plan by CD-2/3.

The IPT had to identify commissioning associated risks as they were not tagged in the system to specifically identify them as commissioning risks. The interviewees were very knowledgeable about the risks and were able to provide detailed information about them. The project would benefit by identifying risks that are specific to commissioning and capturing broad commissioning risks, e.g., if testing does not proceed as planned, if readiness or commissioning requirements are revised, if required staffing is not available, etc.

The Program should plan for development of an “Operational Release Plan” to ensure program requirements are met. Commissioning and Transition to Operations have been high risk activities on other nuclear projects. The Deputy Secretary Memo of August 11, 2016, requires an “Operational Release” milestone for DOE Projects, as experience has shown that “DOE's complex nuclear, chemical processing, and one-of-a-kind scientific facilities can have significant risks that continue after project completion (Critical Decision 4). This requirement applies to SRPPF, as CD-4 for SRPPF includes testing systems outside the production facility, using surrogate material, verification of KPPs through software modeling, and completion of readiness activities.

RECOMMENDATIONS

1. None.

APPENDIX A – CHARGE MEMORANDUM

Department of Energy
National Nuclear Security Administration
Washington, DC 20585

February 9, 2021

MEMORANDUM FOR MARK EDELSON
DIRECTOR, PROJECT ANALYSIS, OVERSIGHT AND REVIEW
OFFICE OF ACQUISITION AND PROJECT MANAGEMENT

FROM: CHARLES P. VERDON
DEPUTY ADMINISTRATOR
FOR DEFENSE PROGRAMS

Charles P. Verdon
Digitally signed by Charles P. Verdon
Date: 2021.02.09 08:49:03 -05'00'

SUBJECT: Critical Decision (CD)-1 Independent Project Review (IPR) of the Savannah River Pit Processing Facility (SRPPF) project at the Savannah River Site (SRS)

I request that you organize and conduct a CD-1 IPR of the SRPPF project. The on-site review (to the extent possible due to COVID-19 challenges) should occur March 15 - 19, 2021. The purpose of the review is to ensure early integration of safety into the design process, determine the project's readiness to achieve CD-1, *Approve Alternative Selection and Cost Range*, and respond to the following questions for this phase of the project:

1. Technical: Have safety criteria been incorporated into the design as required? Has technology associated with the project achieved Technology Readiness Level-4? Is the conceptual design sufficiently developed and demonstrate coordination among the following areas and disciplines: safety basis, code of record, confinement, criticality, seismic, civil/structural, fire protection, and electrical?

2. Cost, Schedule, and Risk: Is the cost reasonable and the funding profile executable? Is the schedule reasonable and sufficient to verify progress? Is the risk program sufficiently developed? Does the project have a reasonable plan to achieve CD-2/3?

3. Management and Acquisition (M&A): Are documents sufficiently developed to achieve CD-1 on schedule? Does the project satisfy all aspects of the program requirements document? Is the planned M&A approach reasonable regarding contract structure, risk management, design management, and change control? Has the project sufficiently integrated physical, information, and cyber security requirements?

4. Environment, Safety, and Health (ES&H) and Quality Assurance (QA): Are ES&H and QA programs, controls, documents (including National Environmental Policy Act), and processes sufficiently mature? Do integrated project team personnel have the requisite nuclear safety-related qualifications?

5. Commissioning: Has the Program Office defined the preliminary criteria for project completion to achieve CD-4 approval? Is there a document control system in place to identify and retain documents? Are staffing, training, waste management, and interfaces with other sites, operations, and projects understood for inclusion in the commissioning plan?

Thank you for agreeing to support this review. Mr. Scott Cannon, the Federal Project Director, will serve as the point of contact for this review. I would appreciate receiving your report within 60 days of the review's conclusion.

cc: P. Calbos, NA-10
J. McConnell, NA-50
R. Raines, NA-APM
J. Allison, NA-SV
M. Thompson, NA-10
S. Jones, NA-19
R. Haldeman, NA-191
D. Sigg, NA-51
K. Hamilton, NA-APM
C. Manning, NA-APM-20
S. Cannon, NA-APM-1.4

APPENDIX B – DOCUMENTS REVIEWED

All documents provided can be found on the NA-APM 1.1 MAX.Gov site.

APPENDIX C – COMMITTEE ROSTER

Mark Edelson, Committee Chair, NA-APM-1.1

Dwight Henderson, Committee Chair Deputy, NA-APM-1.1

TECHNICAL

Tim Haley*	**NA-APM-1.1**
Shah Jaghoory	NA-APM-1.1
Ingo Brachmann	NA-APM-20
Jim O'Brien	NA-512
David Hall	NA-513
Jose Munoz	NA-512
Robert Plonski	NA-513
Michael Shlyamberg	TechSource
Michael Blau	TechSource
John Balog	TechSource
Kevin Thornton	TechSource
Jay Roach	Terranear

COST, SCHEDULE & RISK

Glenn Betts*	**Parsons**
John Bielecki	Tecolote
Tracy Cangelosi	Parsons
Dave Berkey	TechSource

MANAGEMENT & ACQUISITION

Ben Pina*	**NA-APM-20**
Amanda Clark	NA-APM-20
Frank Gonzales	NA-APM-123
Wayne Akerson	Parsons
Jack Oden	Parsons

ENEVIROMENT, SAFETY, AND HEALTH AND QUALITY ASSURANCE

Ben Pina*	**NA-APM-20**
Amanda Clark	NA-APM-20
Frank Gonzales	NA-APM-123
Wayne Akerson	Parsons
Jack Oden	Parsons

COMISSIONING

Jon Tanke*	**Longenecker**
Todd Seagraves	Parsons

INTEGRATORS

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Celeste Hermano	Harkon, Inc.

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Irvin Rubin	NA-511
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Esther Archuleta	NA- APM-123
Tyler Wean	NA-APM-20
Freddie Overbay	NA-APM-1.4
Adam DaeGorn	NA-APM-1.4
Mike Pearson	NA-APM-1.4
Dale Christenson	NA-APM-1.4
Shivam Bhakta	NA-MB-91
Abhijeet Deshmukh	NA-MB-92
Julie Anderson	NA-MB-921
Alfred Levinson	NA-MB-921
Robert Strand	NA-MB-921
Qin Pan	NA-MB-922
Dave Chisenhall	PM-20
Perry Barker	PM-20
David Cleaves	Defense Nuclear Facilities Safety Board (DNFSB)
Robert Csillag	DNFSB
Roman Kazban	DNFSB
Patrick Migliorini	DNFSB
Scott Seprish	DNFSB
Sonia Thangavelu	DNFSB
Mark Sautman	DNFSB
Zachary McCabe	DNFSB
David Anderson	DNFSB
Rahsean Jackson	DNFSB
James Parham	DNFSB
Peter Foster	DNFSB
Mark Wright	DNFSB
Mark Bradisse	DNFSB
David Grover	DNFSB
Richard Tontodonato	DNFSB

*** Subcommittee Lead**

APPENDIX D – ACRONYMS

AoA	Analysis of Alternatives
BOE	Basis of Estimate
BOP	Balance of Plant
CAAS	Criticality Accident Alarm System
CD	Critical Decision
CDNS	Chief of Defense Nuclear Safety
CDR	Conceptual Design Report
CHA	Consolidated Hazards Analysis
CSDR	Conceptual Safety Design Report
CWIP	Construction Work-In-Progress
D&R	Dismantle and Removal
DNFSB	Defense Nuclear Facilities Safety Board
DOE	Department of Energy
EA	Engineering Assessment
EEC	Environmental Evaluation Checklist
ECF	Entry Control Facility
EEP	Emergency Electrical Power
EIS	Environmental Impact Statement
ETF	Effluent Treatment Facility
FY	Fiscal Year
G	Guide
GAO	Government Accountability Office
HEPA	High-Efficiency Particulate Air
IPT	Integrated Project Team
ITO-AR	Threat and Opportunity Analysis Report
LANL	Los Alamos National Laboratory
LEED	Leadership in Energy and Environmental Design
LLNL	Lawrence Livermore National Laboratory
M&O	Management and Operating
MR	Management Reserve
MAA	Material Access Area
MFFF	Mixed Oxide Fuel Fabrication Facility
MNS	Mission Need Statement
MOX	Mixed Oxide
NEPA	National Environmental Policy Act
NNSA	National Nuclear Security Administration
NPH	Natural Phenomena Hazard
NRC	Nuclear Regulatory Commission
PA	Protected Area
PF-4	Plutonium Facility-4
PIDAS	Perimeter Intrusion Detection and Assessment System
PPEP	Preliminary Project Execution Plan
ppy	Pits Per Year
PRD	Program Requirements Document
PSCOE	Physical Security Center of Excellence
S&S	Safeguards and Security
S-2	Deputy Secretary of Energy
SC	Safety Class
SDIT	Safety Design Integration Team
SDRD	Security Design Requirements Document
SDS	Safety Design Strategy
SFE	Special Facility Equipment
SME	Subject Matter Expert
SNL	Sandia National Laboratory

SOW	Scope of Work
SPEIS	Supplemental Programmatic Environmental Impact Statement
SRNL	Savannah River National Laboratory
SRNS	Savannah River Nuclear Solutions, LLC
SRPPF	Savannah River Plutonium Processing Facility
SRS	Savannah River Site
SS	Safety Significant
SSC	Structures, Systems, and Components
TBD	To Be Determined
TEP	Team Execution Plan
TOC	Training and Operations Center
TPC	Total Project Cost
TRL	Technology Readiness Level
UPF	Uranium Processing Facility
U.S.	United States
VTR	Vault-Type Room
WBS	Work Breakdown Structure
WR	War Reserve