OAK RIDGE NATIONAL LABORATORY
OAK RIDGE, TENNESSEE

Campus Infrastructure Modernization Project
Critical Decision-1 Support
Scope of Work
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Campus Infrastructure Modernization Project (CIMP)
Critical Decision-1 Support

Scope of Work

Prepared by

UT-Battelle

for

OAK RIDGE NATIONAL LABORATORY
Oak Ridge, Tennessee 37831

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Note: These role assignments are subject to change. Updates will be provided if changes occur.

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OVERVIEW

Oak Ridge National Laboratory (ORNL – Company) utility infrastructure is at the core of supporting ORNL's scientific strategy. Without high performance and reliability, these utility systems will not be able to support the numerous Department of Energy (DOE) scientific missions conducted at the Laboratory. Failures and unplanned outages of utility systems can have a catastrophic impact on mission critical operations, including loss of years in experimental preparation.

ORNL proposed a large-scale utility repair, replacement and or upgrades project for DOE-SLI funding to address numerous deficiencies and issues associated with aging infrastructure. The Project will replace, repair, and upgrade several critical utility systems to reduce deferred maintenance (DM) and Repair Needs (RN) and the risk of unplanned service outages, safety concerns and other impacts to operations. The project achieved Critical Decision-0, Approval of Mission Need, in Fiscal Year 2020.

The scope of the mission need focuses on the most critical repairs and investments associated with several major utility systems including chilled water, steam, condensate, natural gas, storm, sanitary sewer, potable water, electric and telecommunication systems.

BACKGROUND

The Company operates and maintains the majority of the utility infrastructure within the site boundaries. ORNL is defined by areas:

1) Bethel Valley
    a) West Campus (buildings numbered 0900, 1000)
    b) Central Campus (buildings numbered 2000, 3000)
    c) East Campus (buildings numbered 4000, 5000, 6000)
    d) 7000 Area (buildings numbered 7000-7100)
2) Melton Valley
    a) Buildings numbered 7500, including the Molten Salt Reactor Experiment (MSRE)
    b) Buildings numbered 7900, including High Flux Isotope Reactor (HFIR) and Radiochemical Engineering Development Center (REDC)
3) Energy Systems Test Complex, also known as EGCR: buildings numbered 7600
4) Chestnut Ridge: buildings numbered 8000, including Spallation Neutron Source
5) Tower Shielding: buildings numbered 7700
6) DOSAR: buildings numbered 7700
7) Jones Island area numbered 0800

Previous utility studies and all other documents provided by the COMPANY are only provided for guidance. The Sitewide Utility Master Plan is provided in Attachment 1. Consultant shall independently develop all deliverables based on on-site visits and workshops.

CIMP GENERAL PROJECT APPROACH

Utility Systems and Supporting Infrastructure: The utility systems, the supporting assets, and other considerations to be included in the scope of the project include:

1) Chilled Water Generation and Distribution
2) Steam Generation and Distribution
3) Condensate Return and Treatment
4) Natural Gas Distribution
5) Potable Water Supply, Storage and Distribution
6) Sanitary Sewer Collection and Treatment
7) Storm Sewer Collection
8) Electrical Distribution
9) Telecommunications Distribution
10) Facilities, structures, and other infrastructure integral to protection and housing of utility systems
11) Artificial Intelligence (AI)/or Machine Learning

The major assets contained in each utility system are provided in Appendix 1, Utilities Facilities List.

Funding Profile: The CIMP is currently estimated to be funded for approximately $30 - 40+/- MM per year over 10 years. The deliverables should align with the expected funding profile.

Project Phasing: The CIMP will be organized into a parent project and multiple subprojects. Each subproject will be managed as a distinct effort with their own budgets, schedules, and critical decision reviews (CD-2, CD-3, and CD-4). Each subproject may have multiple component projects. The SELLER shall provide recommendations and options for improving the proposed subproject structure. Company will assist in developing the list of subprojects. The conceptual design report will include all scope and will be a comprehensive plan of the entire project for CD-1 but will be aligned with the subproject structure. Subprojects and their component projects shall be stand alone and should be easily interchangeable based on urgency, funding, risk, requirements, etc.

Project Administration: Seller is responsible to comply with the following:

1) Under the overall line-item project there could be minor construction projects ($<20M) that are created when sub-projects are identified at CD-2.x.
2) One line-item ideally with multiple sub-projects identified after CD-1.
3) Any changes to cost range need to be reviewed/approved by PME. If the high-end cost range (as established at CD-1) increases by 50% or more, CD-1 will be reconducted and a new AoA will be required. SELLER is responsible for the development of the new AoA till DOE approval is achieved.
4) CD-1 will provide as much detail on the project's sub-elements as possible; information on individual elements that have good design maturity can provide an early start with more confidence in the TPC range however creating sub-projects may introduce uncertainty with regard to the TPC.
5) Sub-project definition approach will be described in the CD-1 documentation.

6) Set appropriate levels of contingency (risk management) to address unknown conditions. Ensure objective and threshold KPPs are defined appropriately.
7) To avoid confusion with partial CD efforts (i.e. a CD-3A conducted for long-lead procurement/site preparation / partial evaluation of the whole sub-project's CD-3), the consensus is to use numerical nomenclature for sub-projects: CD-2.1 for sub-project 1, CD-2.2 for sub-project 2, etc. Subprojects' CD-3As will be designated as CD-3A.1 / CD-3A.2 with the ".1" and ".2" etc., being used to indicate the subprojects 1, 2, etc.

Key Performance Parameters (KPPs): Seller is responsible to comply with the following:

1) KPPs for the "Parent Project" should be consistent with each of the sub-projects' KPPs.
2) Sub-projects will be described to the greatest extent possible at CD-1, including preliminary KPPs that will be captured in PPEP. Preliminary KPPs should meet the performance required to meet mission need and be consistent with future sub-projects. When sub-projects are defined at CD-2, KPPs can be further refined.
3) KPPs should be measurable and include a functional element to ensure the scope fulfills its purpose (not just scope). Make sure the KPP is measurable. SELLER is responsible to develop, maintain and update measurable KPPs
4) Threshold and objective KPP language should be detailed enough to support the TPC point estimate
5) Threshold KPPs must meet Mission Needs. KPPs should be defined to meet minimum mission need and not be overstated. Coordination with SLI needed to ensure funding/budget remains in alignment with the KPP range.

GENERAL SELLER RESPONSIBILITIES

The Architect/Engineer (Consultant) referred to hereinafter as Seller, shall furnish the resources necessary to prepare the following per the attached spreadsheet.

The SELLER's (Consultant) Services shall include all normal and customary professional services of a qualified, professionally licensed SELLER and its consultants required in connection with the conceptual design project. The SELLER shall furnish or provide the architectural and engineering services necessary to complete the deliverables listed in the spreadsheet in compliance with Company and DOE requirements. The SELLER will be required to comply with current DOE Order 413.3B, *Program and Project Management for the Acquisition of Capital Assets,* for each deliverable submitted. Two updates and revisions as required after final acceptance (100%) shall be the responsibility of the Seller.

Work Plan: SELLER shall submit their approach to providing the deliverables in a Work Plan document with the proposal. The Work Plan shall lay out a detailed schedule (Excel sheet) and describe the data collection and production processes, to provide a final set of deliverables.

Safety Expectations: The Company expects that all SELLER provided personnel shall actively participate in

achieving the Company's safety goal of zero lost work time accidents while performing this scope of work. SELLER employees and subcontractors performing field work (inspections, walkdowns, etc.) on the ORNL campus will perform such work in compliance with Company's safety requirements. The SELLER will be required to prepare a Job Hazard Analysis (to be reviewed and approved by Company); complete Company safety orientation; and attend other safety training for specific hazards expected to be encountered during the work.

Meetings/Workshops: SELLER shall include cost of attending all virtual and on-site meetings.

1) Workshops as required including presenting a detailed Power Point presentation at 30% - 60% - 100% deliverable stages. SELLER shall submit the presentation and deliverables at least five (5) workdays in advance of each presentation for each deliverable in the spreadsheet.
2) SELLER shall also include separate workshops for each utility system as part of 30%-60%-100% submissions. Additional workshops for each utility system shall be included for each deliverable in the spreadsheet.
3) The SELLER shall conduct and participate in project processes such as Design reviews and presentations.
4) Number of on-site visits shall be proposed separately listing the number of staff visiting, number of trips required and cost of each trip at Government rates. Cost shall be all inclusive and receipts shall be submitted for verification with the invoice. Payment shall be made based on Government rates.
5) The SELLER will provide minutes of meetings within 5 business days to the project team. The SELLER shall establish a meeting schedule coordinated with COMPANY, to meet at COMPANY with COMPANY's representatives and to obtain all information necessary for completion of the final deliverables.
6) As a minimum the SELLER shall allow for a kick off meeting to include a review of the current data and subsequent working meetings with Subject Matter Experts and COMPANY's representatives to obtain all the necessary information for completion of the deliverables.

Correspondence: SELLER is responsible to comply with the following:

1) SELLER shall provide access to Bluebeam and Microsoft Teams or Company required virtual platform during the entire course of the project to Company staff and all project stakeholders.
2) SELLER shall propose submittal tracking and storage solution for all deliverables to be accessed by all stakeholders.
3) All deliverables shall be reviewed and commented after they are uploaded on Bluebeam separately with individual links for each deliverable to all stakeholders. A minimum of 10 working days shall be allowed in the schedule for review and comment. 30-60-100% deliverables shall be a minimum of 10 workdays for Company review.
4) Filename for each deliverable - Example – Due Date MM.DD.YYYY - Deliverable name
5) All files shall be stored on Microsoft Teams site for easy reference included commented deliverables.
6) SELLER shall submit all native files to the Company as and when requested and as part of closeout documents and prior to final invoicing.

7) Company shall retain 5% of the awarded contract value until all final deliverables are accepted by DOE as final submission.
8) SELLER shall develop, maintain, update, distribute a RFI log on Microsoft Teams to correspond and store all RFIs for discussion on Excel editable spreadsheet.
9) SELLER shall develop, maintain, update, distribute a submittal log for all deliverables require review and comment. All submittals shall be submitted with a transmittal sheet with the filename as noted above. Seller shall submit a spreadsheet with responses to comments made by reviewers on each Bluebeam session.
10) SELLER shall submit professionally created Power Point presentations with graphics for each deliverable per DOE requirements.
11) SELLER shall submit a RFI and submittal log weekly at a minimum.
12) Document and Design Requirements - The SELLER shall comply with COMPANY-provided drafting standards for all design and drawing work.

Maintain Records: The SELLER shall keep COMPANY informed of the progress of the SELLER's work. The SELLER shall maintain records of the deliverable development progress as COMPANY may require, including reasonable access to all books, documents, drawings, and records of the SELLER concerning the Project.

Monthly Progress Reports: The SELLER will prepare and submit a status report (max 2 pages) on a monthly basis using COMPANY approved format. The SELLER shall submit proposed status report format for COMPANY approval. The Status Report is the SELLER's concise narrative assessment of the status of the work being performed under the contractual agreement. The Report shall contain the following sections:

1) Assessment and Forecast: This is to be a short statement summarizing the current project status and projected project activities. An overall (by project phase) percent complete estimate is to be included.
2) Project Progress During Month: Include statement of activities during the month with emphasis on accomplishments, i.e., all calculations prepared and checked, layout and planning sketches completed, and individual design drawing status (percent completion)
3) Earned Value Progress Metrics: The SELLER's status report is to include a report of the SELLER's cost and schedule progress using earned value measurement techniques.
4) Variances: Briefly describe any planned or actual changes in the work scope and/or schedule occurring during the reporting month. Include estimates of expected design schedule impacts due to the scope changes.
5) Open Items: This section is to highlight any significant problems or unresolved items that occurred during the reporting month that may have an impact on the timely completion of the work.

Deliverable Schedule: SELLER shall propose a detailed deliverable schedule illustrating submittal at 30%-60%-100% completion for each deliverable in the Excel spreadsheet to meet the completion date of **seven (7) months** including all weekends and holidays from award date. The draft of the final deliverables shall be submitted for COMPANY review a minimum of two (2) weeks prior to final submission.

1) The Deliverable Schedule shall be completed in the Excel spreadsheet as requested. In addition

to the Excel spreadsheet, submit pdf files in your proposal for the price form and deliverable schedule.

2) All deliverables listed in this Scope of Work are the responsibility of the SELLER and shall be developed, maintained, and updated two times after 100% Company staff acceptance.
3) Deliverables shall be submitted to Company in draft format as required to evaluate progress for payments and shall be maintained on SELLER's TEAMS site for access anytime.
4) Native files of all deliverables shall be submitted to the Company prior to final payment application. Pdf, Excel and all other formatted files shall also be submitted for each deliverable as required by the Company.
5) SELLER shall not reproduce / copy / use the content of the deliverables in this Contract in any shape or form for any use.

Quality Assurance: The seller shall comply with the following to ensure quality deliverables.

1) Designate a quality assurance representative for controlling the quality of the work performed by the SELLER and coordinating all actions and technical contacts through the COMPANY TPO.
2) Perform and document periodic Quality Assurance examinations of all work including drawings, calculations, etc. studies, etc. for accuracy, consistency, completeness, conformance to the requirements of the scope of work, and SELLER best practices.
3) Provide in a reasonable time period (allowing for due professional care) as requested by COMPANY, both verbal and written answers to questions, conditions and problems.

TASKS

Task 1 – Within five (5) working days following contract award, Seller shall arrange and hold a kickoff meeting with Company to discuss logistics and establish the Work Plan course of action for delivery of the deliverables. The kickoff meeting will be held virtually via web conference using Teams or a similar Company platform. Prior to the meeting, Seller shall prepare at a minimum an annotated outline of the proposed schedule submitted as a part of the proposal for discussion during the meeting. SELLER shall submit a detailed workshop and meeting schedule for each utility system/asset aligned with the deliverables.

Task 2 – Within five (5) business days following the kickoff meeting, prepare and submit to Company the schedule for on-site visit and approach to evaluating all assets as a part of the condition and functionality assessments.

Task 3 – Based on the SELLER'S proposed schedule, SELLER shall submit to Company an annotated outline with a Table of Contents of the deliverables as noted in the Excel spreadsheet to comply with the deliverable milestone dates.

Task 4 (optional) – If this option is exercised by the COMPANY, Seller shall conduct a detailed condition assessment of each asset including all structures, equipment, and distribution lines for each utility system throughout the entire campus. Seller shall do this independently without any input from the Company and comply with the format of the report as required by the Company. Seller shall submit a detailed plan of how they plan to assess the condition of each asset per DOE and Company requirements.

Task 5 - Conduct the analyses and develop the deliverables according to the Company-approved Work Plan.

Invoices shall be submitted based on the deliverable milestone schedule, not on a monthly basis.

BASE SCOPE DELIVERABLES

Conceptual Design Report

The SELLER shall develop a Conceptual Design Report (CDR). The CDR shall describe how the CIMP will close the capability gaps described in the Mission Need Statement. The CDR shall align with the results of the Analysis of Alternatives conclusions and other deliverables. The CDR shall be organized by project scope chunks, as mutually agreed with Company.

1. Sub-projects for simple projects will have their design documented in the Sitewide Utility Master Plan prior to CD-2. It is possible that grouping different linear utilities within a single subproject (e.g., utility corridor) into a sub-project will make sense from an execution and operation (maintenance) perspective.
2. The condition assessments used to develop the CDR should be recent (i.e., less than 5 years).
3. As part of the conceptual design process, AI or machine learning should be analyzed as part of a potential solution.
4. The CDR shall provide acceptable level of detail to meet the DOE 413 requirements not limited to the following:
    a. Scope required to satisfy the Program mission requirements
    b. Project feasibility
    c. Attainment of specified performance levels
    d. Assessment of project risks and identification of appropriate risk handling strategies
    e. Reliable cost and schedule range estimates for the alternatives considered
    f. Project criteria and design parameters
    g. Impact on the site Sustainability Plan
    h. Identification of requirements and features
5. Company shall have the final discretion on the content and format of CDR and other deliverables and SELLER shall comply with those requirements.
    a. For more complex projects (e.g., facilities, complex systems, etc.), more developed design may be necessary.
    b. The sub-projects design should be defined in the Preliminary Design Report prior to CD
    c. All scope will be described in the CDR at CD-1. The analysis would be performed for each sub-project to define the detail of the actual scope of work for that sub-project.
    d. A CDR or equivalent document is required for CD-1.
    e. SELLER shall develop different strategies to divide scope into sub-projects (e.g., by time period, location, utility system, impact on DM) depending on the impact to the Lab's mission. It may be advantageous to include opportunities for efficiency in design in the CDR. The PPEP should provide a discussion on the methodology on how the sub-projects were prioritized and divided. For example:
        i. Lab Operational Risk Mitigation [i.e., consideration of age/condition, life expectancy, recent failures, regulatory requirements, etc]
        ii. Constructability/cost efficiency
        iii. Impact on deferred maintenance
        iv. Impact to Lab Operations
        v. The PPEP shall include the overall integration of the different designs of the sub-projects. The CDR shall include:
            I) Master Utility Plan

II) Sub-project CDRs for facilities, complex systems, etc.
III) Crosswalk between the CDR and the PPEP to identify which projects are part of an individual subproject identified in the PPEP. For example, the CDR may cover several underground chilled water utility piping replacements and a chilled water plant. Those projects would be shown to align to one subproject in the PPEP.

f. The AoA should evaluate high level considerations for alternate designs. The value engineering step should be performed.

The CDR Table of Contents shall be submitted as part of the proposal.

The completed conceptual design and all other deliverables shall be clear, definite, comprehensive, and developed to appropriate scales of detail to be conducive to performing a preliminary design per Company and DOE requirements and shall include, but not limited to the following:

1. Building and site infrastructure coordination and existing condition verification
2. Architectural
3. Structural
4. Geotechnical consultant
5. Fire protection and life safety consultant
6. Civil (including necessary campus utilities, extensions, and street improvements)
7. Mechanical (heating, cooling, ventilation, plumbing, fire protection, temperature control systems, utilities metering, campus and building mechanical utilities, campus mechanical utilities coordination, campus and building automation network)
8. Electrical (including standard and special voltage systems, security and/or life safety systems, electrical metering, and campus electrical utilities)
9. Graphics and signage
10. Lighting
11. Landscaping
12. Code consultant
13. Building Security
14. Information technology and communications including building automation systems
15. Environmental, safety and health compliance specialist
16. Sustainability / HPSB principles
17. Cost estimating
18. Resource Loaded Schedule
19. Risk Register

Overall, the projections and analysis performed under this contract will be presented in a Conceptual Design Report.

The SELLER shall prepare the conceptual design based on approved program of requirements, site analysis, urgency, risk, budget parameters, etc. The purpose of conceptual design is to explore and define the overall scope, character, cost of the project based on urgency, risk, requirements, etc. Conceptual design shall consist of drawings, character sketches, 3D mass models, etc. to sufficiently describe the

concepts.

The SELLER will discuss Company proposed chunking concepts for further development prior to COMPANY's selection of a final preferred chunking concept. The main objective of chunking is to break down the large-scale scope of the project into more manageable sub-projects in a logical way that works with the schedule and funding profile and other deliverables.

Provide needed technical support to the Company to prepare for the DOE Conceptual Design Review, any tailored DOE Critical Decision type review, or similar Conceptual Design phase reviews and other deliverable reviews.

In order to ensure the project captures the highest priority Utility repair work, some of the smaller scope items may be removed and new ones added to the project after meeting with Company utility subject matter experts. Any changes to the scope included in the project must be approved by the Company .

The CDR should contain separate graphics per utility identifying the location of all work included for that specific utility superimposed over a map of Company campus, call outs, etc. For example, there should be a graphic identifying the location of all chilled water work, all steam and condensate work, etc., separately for each area of the campus and for the entire campus on different graphics.

The CDR should contain separate graphic per project chunk identifying the location of all work included for that specific chunk superimposed over a map of Company campus.

Fully integrate sustainable design principles such as High-Performance Sustainable Buildings (HPSB) into the conceptual design to take maximum advantage of the flexibility afforded in the early design stages of the project. Company's Sustainability group will work with the SELLER to maintain required HPSB checklists that can be attached to the CDR as appendices.

Seller shall identify any opportunities to implement Artificial Intelligence (AI)/or Machine Learning on the project. A section of the CDR shall include analysis of possible opportunities to utilize/design these technologies for installation during the construction phase including applicable upgrades to the site Building Automation System and Utility Metering.

At the beginning of the conceptual design work, the SELLER will provide a detailed resource loaded schedule to track cost and schedule progress using earned value measurement techniques. The schedule will include enough time for the Company to conduct design reviews and adjust the conceptual design following stakeholder input.

Analysis of Alternatives

The SELLER shall develop an Analysis of Alternatives (AoA) for the project. The AoA is an analytical comparison of the operational effectiveness, suitability, risk, and life cycle cost (or total ownership cost, if applicable) of alternatives that satisfy validated capability needs. The AoA shall be developed in compliance with DOE G 413.3-22, *Analysis of Alternatives Guide*, and the Government Accountability Office (GAO) best practices (see GAO report GAO-16-22, *Amphibious Combat Vehicle, Some Acquisition Activities Demonstrate Best Practices; Attainment of Amphibious Capability to be Determined, Appendix 1*, dated October 2015. The suggested DOE tailored process uses a systems engineering methodology that integrates requirements analysis based on mission need, identification and analysis of alternatives, risk identification and analysis, and concept exploration in order to evolve a cost effective, preferred alternative to meet a mission need.

1. The AoA shall be conducted at the parent project and the subproject level.
2. AoAs are a long-standing requirement for CD-1; however, past utility projects have found defining credible alternatives can sometimes be difficult and can result in binary choices such as replace a particular section of pipe, or do not replace it.
    a. Omitting the requirement to perform an AoA is not feasible so the projects should look to identify reasonable alternatives at the subproject level.
    b. At a minimum the AoA can compare the status quo vs another option.
3. At a minimum the following alternatives should be considered. Any alternative that is reasonable to accomplish the Mission Need but includes the "status quo" alternative. Alternatives should not be considered that are not reasonable or are non-viable.
    a. To be analyzed at a minimum:
        - Fund individual repairs, improvements, and modernization (on a system-by-system basis)
        - Geographical utility corridors (multi-system-based, common geographical approach)
        - Combination of corridors and individual upgrades
        - Modernize Systems (replace and repair existing systems while integrating capacity expansion)
        - Repair only the highest risk system and deferred the rest.
    b. Should not be analyzed:
        - Maintain Status Quo (Does not meet Mission Need) – SHOULD BE INCLUDED AS AN ALTERNATIVE, BUT NOT ANALYZED.
4. A separate Subject Matter Expert review of the AoA shall be conducted. SELLER shall submit a qualified SME.
5. Potential alternatives should be evaluated regardless of cost.
6. A priority list may serve as an AoA for addressing the sub-projects that have a single viable alternative; Allow for the ability to re-evaluate the priorities every 1-2-3 years.
    a. As long as list falls within Mission Need.
    b. Maintain as an appendix to PPEP/PEP.
7. Recent (less than 5 years old) Condition Assessment is required for prioritized list of sub-projects.
8. Alternatives shall meet at a minimum the established Mission Need.
9. The Office of Project Assessment (OPA) recommends::
    a. Look at the worst first.

b. AoA:
    i. Prioritize list of systems with defined criteria
    ii. Repair systems per list as funding becomes available
    iii. Elaborate on items/sub-projects on which you can expand and perform a full AoA where various alternatives are considered.
10. Prepare a single, complete AoA for CD-1 to include the priority list system upgrades, and alternatives considered and selected for complex systems/sub-projects.
11. Benefits/outcome of the alternatives (both qualitative and quantitative) should be considered as part of the selection.
12. In sum, alternatives under consideration may require a time frame beyond the proposed project's total schedule. This would also be true for the proposed, maximum total project cost range.
13. Include qualitative and quantitative reasons for how an alternative was selected.
14. Use a failure risk ranking including risk to science operations (informed by the SELLER's condition assessment survey (With a camera and other tools as appropriate and potentially additional failure mode analysis) to prioritize the systems and locations. Prioritize the project's subproject scope elements to address those highest risk items. These items will range from local system repairs to large scale system modernizations. It is possible this ranking can change.
15. All systems should consider replacement with the best available technology.
16. SELLER shall provide a complete report with spreadsheets to evaluate alternatives and validate with costs, risks, etc. As with any alternative evaluation, cost, maintainability, lifecycle, longevity, reliability, and flexibility would be assessed and compared with other alternatives.
17. Examples for top measures used to differentiate sub-projects to name a few. SELLER shall further refine, add measures to meet DOE requirements at a minimum:
    a. Risk/priority (as it relates to science and need)
    b. Maturity level of the sub-project
    c. Benefit to the Lab, alignment with the science mission
    d. Funding profile
    e. Constructability/logistics impacts/geographical area/system/related function
18. Standard criteria and associated weights for scoring alternatives. SELLER shall determine a reasonable approach for their circumstances. SELLER shall refine, add to the following possible criteria for consideration to include at a minimum:
    a. Alignment with Lab Strategy
    b. Alignment with Mission Need Goals
    c. Operational Efficiencies
    d. Construction Effectiveness
    e. Life Cycle Cost Analysis
    f. Regulatory Requirements
    g. Reliability, Availability, Quality, and Safety

Life Cycle Cost Analysis

Life Cycle Cost Estimates (LCCEs) for each viable alternative identified during the AoA process is required. A complete LLCE includes all costs from inception of the project through design, development, deployment, operation, maintenance, and disposal. The AoA team shall include a cost expert who is responsible for development of a comprehensive, well-documented, accurate, and credible cost estimate for each viable alternative in the AoA study. The LCCA is required as part of the CD-1

documentation. Consider the benefit/outcome of each alternative, along with the Life Cycle Cost Analysis (LCCA) in selecting an alternative. SELLER shall determine their LCCA approach. LCCAs may in some cases only include first and replacement costs as operational costs are negligible.

1. Methodology should be used to develop the Life Cycle Cost Analysis (NIST model, local expertise, etc.). This decision shall be based on the project scope and other deliverables.
2. The legitimate useful life for various utilities to capture costs for maintenance – Varies by system, and use facility management standards at a minimum.

As a separate deliverable from the CDR, a prepare life cycle cost analysis (LCCA) for new equipment and a comparison of upgrading it. This analysis will include a minimum of two (2) additional viable alternatives for each at a minimum. Other viable alternatives shall be developed by the SELLER with guidance from the Company. The table below illustrates possible alternatives to be developed by the SELLER and included in the LCCA.

Example Alternatives for LCCA

	Chilled Water Plant	**Boiler Plant**
Alternative 1	Build New	Build New – Separate from Existing
Alternative 2	Replace/Renovate Existing Plant	Replace/Renovate Existing Plant
Alternative 3	Combination New/Renovate Existing	Combination New/Renovate Existing

In addition to an estimated construction contract price, the life cycle cost estimate for the equipment/facility should include at a minimum: capital construction, design, management, operating and disposal cost for the facility assuming a 50-year life cycle.

Work Breakdown Structure Dictionary

The Work Breakdown Structure (WBS) divides the entire project into its component elements in order to establish a framework for effective management control of the project scope, schedule, and budget. The WBS is a multi-level framework that organizes and graphically displays elements representing work to be accomplished in logical relationships. Each descending level represents an increasingly detailed definition/division of a project component. It is the structure and code that integrates and relates all project work (technical, schedule, and budget) and is used throughout the life cycle of a project to identify, assign, and track specific work scopes.

The WBS shall be described in a WBS dictionary in order to provide an adequate description of the work involved. The WBS dictionary is a set of specific definitions that describe the scope of each work element identified in the WBS. It defines each element to at least the control account level in terms of the content of the work to be performed. The WBS dictionary shall clearly describe the specific technical scope (tasks) which must be performed to produce the project deliverables (products or outcomes) for each WBS element.

Cost and Schedule Assumptions / Basis Of Estimate

The SELLER shall prepare and submit a Cost and Schedule Assumptions document. The cost and schedule assumptions shall be organized by the project WBS.

Cost Estimates

The SELLER shall prepare construction cost estimates in compliance with DOE G 413.3-21A, Cost Estimating Guide. Cost estimates should be appropriate for the level of project definition. The summary of the aggregate construction estimates during the design process shall ensure that the design remains within Company's funding profile as the conceptual design is developed. The cost estimate should be formatted so it may be sorted by project "chunk" and by each area of campus and/or utility system. At a minimum, the SELLER shall prepare and submit construction estimates at the following design milestones:

- 30%
- 60%
- 100%

Total Project Cost (TPC) includes cost for all Construction Labor Agreement rates, Company staff, Contractor OH&P, detailed design and preliminary studies to commence the project.

SELLER shall prepare detailed estimates of construction contract price for each sub project proposed and ensure the project remains within Company's construction anticipated funding profile. Any existing cost information from Company's source documents shall be reviewed and updated appropriately. Estimates shall include the following:

a. SELLER shall submit a professionally qualified estimator for approval and comply with Company and DOE format and requirement for the entire project, subprojects and aligned with a detailed resource loaded schedule (Number of labor, material, equipment broken down for each activity and a critical path clearly demonstrated with cost) and risk register.
b. Seller shall submit a Basis of Estimate document clearly describing the pricing and quantities were acquired, provide a database or your pricing for each resources (not a blended rate mixing and combining resources equaling to a generic rate), validate the pricing from projects implemented, vendors, subcontractors etc. Seller shall submit a detailed Basis of Cost Estimate clearly substantiating how and where the cost of each items was included in the estimate. Each item in the cost estimate will be substantiated with a detailed master list of all resources individually priced. A pre-approved cost estimator will be used by the Seller for developing the estimates. Cost estimates shall align with resource loaded schedule, risk register, chunking etc.
c. Coordinate with COMPANY for any additional project costs that may need to be captured in the CDR estimates including; Construction Labor Agreement rates, Engineering/CM fees, Commissioning Agent Fees, PM oversight, and laboratory overhead costs.
d. Seller shall develop and submit detailed cost estimates based on real time costs from suppliers and vendors for major items only. Cost estimates shall be submitted in an editable Excel format

for each individual project whether derived through chunking or other methods. Cost estimates shall be broken into resources (Labor, material, equipment, etc., including all other costs noted above. All material costs shall be acquired as a proposal from a local vendor as necessary to substantiate estimate.

e. Resources broken down into Labor, material, equipment, etc. No blended rates combining resources.
f. Format for the estimate per Company requirements and should be able to cross reference to activities in resource loaded schedule, risk register, chunking items, for each utility system in each area of the campus.
g. Estimates shall be provided in Excel editable format per Company and DOE requirements.
h. Seller shall clearly state within what +/- % is construction cost developed.
i. Quantities for each area of the Campus and for each system separately on separate worksheets
j. Estimates to match activities in resources loaded schedule, risk register, funding profile, risk register and resource loaded schedule.
k. Detailed estimates as noted above and summaries of each utility system for each area of Campus (minimum 7 areas) and for each utility system for the entire campus
l. Seller shall complete estimate reconciliation based on comments received from DOE.
m. Estimates will include Davis Bacon, CLA rates, escalation through midpoint of construction, OH & P, etc. as applicable.

The SELLER's Services shall include, but not be limited to, the design and specification of materials and assemblies of construction.

Project Design and Construction Schedule

As a separate deliverable from the CDR, develop a conceptual design and construction schedule based on the project chunking plan and funding profile. Assume that each chunk will have its own design and construction phases. In general, chunks will be executed in series but may have some overlap duration if it is logical to do so. Include resource loading based on the results of the CDR cost estimates. The resource loaded schedule will be used to support project planning, including confirmation of overall design and construction durations and budget authority/budget obligation timing feasibility. This schedule will also be used to identify the ideal project funding profile that can be communicated to sponsors. Detailed design and construction activities are not necessary; activities can be kept very high level. Procurement of long lead equipment should be included in the schedule, if any. Coordinate with COMPANY and the CM for any additional project costs that may need to be captured in the CDR estimates including; Engineering/CM fees, Commissioning Agent Fees, PM oversight, and laboratory overhead costs.

The SELLER shall submit a Deltek Acumen Fuse Schedule Quality Report or COMPANY approved equivalent.

<u>Resource Loaded Schedule Requirements</u>
The resource loaded schedule shall be aligned with the funding profile and not appear to be level of effort.

The resource loaded schedule shall comply with the following:

1. Resource loaded schedules shall be developed based on priorities for each system and for each area of the campus as per mutual agreement.
2. The resource loaded schedule shall be maintained separately for each system as well as each area of the campus so it can be used independently should the priorities change during the project.
3. The activities in the resource loaded schedule shall match the detailed cost estimate line items and quantities and vice versa.
4. Resource loaded schedule shall include labor, material, equipment and should match the line items in the detailed cost estimates for each system in each area of the campus.
5. Resource loaded schedule should match the risk register and should be traceable to the detailed cost estimates.

Responsibility Assignment Matrix (RAM)

The Responsibility Assignment Matrix (RAM) is an essential element of the project plan that integrates the organization structure with the scope of work outlined in the WBS. The RAM establishes ownership of the work depicted in the WBS, by linking the WBS and the Organizational Breakdown Structure (OBS). The intersection of the WBS and OBS is the Control Account (CA). RAMs should identify the Control Account Managers (CAMs) for these intersection points by name. The intersection point will also include the budgeted planned value (PV), resulting in a "dollarized RAM". The sum of the CAs will total the total project PV. Each project will have a RAM unique to that project.

Risk Register

Risk Management is an essential element of every project and must be analytical, forward looking, structured and continuous. Risk assessments are started as early in the project life cycle as possible and should identify critical technical, performance, schedule and cost risks. Risk registers shall be developed for each subproject. Once risks are identified and prioritized, sound risk mitigation strategies and actions are developed and documented in the Risk Register. An example risk register is provided. Native files for the risk register will be provided.

1. Risk register shall include risks based on the prioritization of the severity of the service upgrade or replacement as necessary in a format provided by the Company.
2. Risk register shall be populated with probabilities of occurrence, cost estimates, comments, and alternates as required for DOE submissions validated with available data and walk throughs conducted on site.

OPTIONAL SCOPE DELIVERABLES

Condition And Functionality Assessments

SELLER shall perform assessments of each distribution systems or equipment, plants separately in compliance with DOE Order 430.1C Chg 2, *Real Property Asset Management*. Condition Assessments include the physical inspection, assessment, measurement, and interpretation of the resultant data to indicate the condition of a specific asset so as to determine the need for some preventative or remedial action. It is a crucial part of asset management to determine its current condition, remaining useful life

and estimated cost to correct any deficiencies.

The Seller shall clearly indicate inspection methods, such as visual inspection, use of remote cameras to assess underground piping or any other devices/method that shall be used for assessments. The Seller shall indicate reports that will be submitted, duration and cost. Any assessments of existing equipment shall be conducted with Company staff.

Each Condition Assessment Report shall be documented in the (sample) format provided in Attachment 2. Condition Assessments shall include, at a minimum:

1. List of components that make up each specific utility system. Ex: piping, Chiller plant, cooling towers etc. Include all structures, systems and components that are tied together as part of the system.
2. Each component should be reviewed for current condition. If there are deficiencies identified they should be recorded at the WBS Uniformat II code level.
3. A determination of whether the deficiency is a Repair Need or Deferred Maintenance must be made, based on FIMS definitions and the flow chart that is provided in the scope document.
4. Each identified deficiency shall have an estimated repair cost calculated. Cost estimates must be based on a nationally recognized cost estimating system that is formatted in UNIFORMAT II and based on annually updated unit cost data (e.g. RS Means; Building News; Craftsman Book Company; Richardson General Construction Estimating Standards).
5. In conjunction with the condition assessment, perform a Functionality Assessment. The Functionality Assessment is an objective review to determine the difference between an asset's current physical condition and its capability to meet mission requirements to serve a designated function or use. Functional assessments result in designations such as *adequate, substandard, and inadequate* and are used to identify an asset's functionality. This assessment includes reporting Modernization Costs. FIMS definitions have been provided in Attachment 2. These are costs associated with filling a Mission Gap, not necessarily required to resolve a deficiency with the existing infrastructure.
6. Seller shall be responsible to physically walk through each asset, identify and record in detail the condition of each item within the asset and the asset itself.
7. Condition assessment shall be provided in Company format with photographs demonstrating the condition of the item.
8. Seller shall propose the most optimal method and submit the advantages and disadvantages compared to other methods as part of their proposal.

    a. SELLER is required to report condition assessments for utilities and facilities. Re-prioritize the five-year effort to move up utility assessments as high priorities over scheduled lower risk facility assessments without penalty to the lab will be explored.
    b. Condition Assessments are necessary to complete the CDR. The inputs for these assessments could come from a range of different sources including:
    c. Intrusive inspection (e.g., borescoping lines, U/T, etc.)
    d. Quantitative data review of faults
    e. System model review (i.e., identify redundancy/capacity vulnerabilities)
    f. Visual inspection
    g. Age/Deferred Maintenance
    h. Operator/SME Interviews

i. Tabletop discussions

Acquisition Strategy

The SELLER shall develop an Acquisition Strategy for the project. The acquisition strategy is a comprehensive high-level technical and business management approach designed to achieve project objectives within specified resource constraints. It is also considered the framework for the next phases of planning, organizing, staffing, controlling, and leading a project. In sum, the acquisition strategy provides an approach for activities essential for project success and for formulating functional strategies and plans. The acquisition strategy shall be in compliance with the most recent version of DOE G 413.3-13, *U.S. Department of Energy Acquisition Strategy Guide for Capital Asset Projects*. The Acquisition Strategy document shall use the template provided on the DOE Office of Project Assessment website: https://science.osti.gov/opa/Project-Management/Processes-and-Procedures

1. SELLER is responsible to develop, update and maintain the Acquisition Strategy.
2. It is not possible nor reasonable for a project to make a long-term commitment to one specific acquisition strategy for all sub-projects.
3. It is possible to have individual acquisition alternatives for individual sub-projects under a larger parent project.
4. It is acceptable/appropriate to identify and discuss in the AS, a small number of acquisition alternatives that may be selected for each sub-project.
5. Company need flexibility on acquisition strategy based on risks, constraints, known/unknowns, prescriptive/performance, and maturity of scope.
6. A minimum of two options shall be considered while developing Acquisition Strategies:
    a. The CD-1 Acquisition Strategy will likely document an overarching approach for the parent project, and include appendices describing specific types of acquisition methods and the rationale for selecting a particular strategy on a future subcontract.
    b. OPA advised the Acquisition Strategy can be simplified by writing a paragraph stating the M&O contractor will manage the project and construction will be performed by a General Contractor.
7. The specific acquisition strategy for a sub-project can be identified in the PEP during CD-2 at Company's discretion.
8. Acquisition strategies for construction delivery will primarily include Design-Build, Design-Bid-Build, and Construction Management/General Contractor.
9. Contracting mechanisms include vehicles such as Indefinite Delivery, Indefinite Quantity (IDIQ), Best Value Firm Fixed Price, etc., shall be evaluated.
10. Use of incentives should be proposed. Example incentives include safety performance, early completion, minimization of outage/disruption
11. Develop procurement schedule and discuss in advance with key stakeholders
12. Strategy
    a. Because for a multi-million-dollar, multi-year project with varying constraints, maturity of scope, and risk levels, it is best to have the Company have a variety of acquisition alternatives/mechanisms to choose from on each sub-project. The overarching AS should contain all of these alternatives/mechanisms and an AS appendix developed to support the acquisition alternative/mechanism selected for use at that respective projects' CD-2/3 stage. See DOE 413.3b: Appendix C, item 27: Tailoring: b – Phasing

b. Each sub-project/task order should have an acquisition strategy appendix with respective alternative/mechanism selected for use at that projects' CD-2 and CD-3 stage
c. Have an overarching Acquisition Strategy (AS) with a variety of alternatives/mechanisms of delivery methods as appendices; each sub project would select an appendix for use on that project at projects' CD-2 and CD-3 stage.
d. Have Acquisition Strategy for each individual sub-project/task order
e. Continue to utilize the principles of project management tailored like General Purpose Projects. In addition, leverage more expeditious contracting mechanisms, such as Task Order Contracts, providing the trade-offs have been appropriately evaluated.
f. Have an overarching Acquisition Strategy (AS) with a variety of alternatives/mechanisms of delivery methods as appendices; each sub project would select an appendix for use on that project at projects' CD-2 and CD-3 stage.
g. No, alternatives for different types of sub-projects/task orders will be documented.
h. The acceptable DOE acquisition alternatives
    - Design-Bid-Build (D-B-B)
    - Design-Build (D-B)
    - Construction Manager (CM)
    - Integrated Project Delivery (IPD); unknown if a DOE project has used this acquisition method?
    - Indefinite Delivery, Indefinite Quantity (IDIQ)
i. The Baseline Change Control (BCC) table approval thresholds set for the "Parent Project" versus "Sub-projects" Like the AS, a higher limit for overall project and each sub-project/task order has a BCC table

SUPPORTING DOCUMENTS

Applicable Orders, Guides and Reports shall be integrated into the deliverables. Additional Orders, Guides and Reports may be identified for inclusion. The most recent versions of the supporting documents shall be used. The Seller shall confirm the version of the supporting documents used during development of deliverables.

DOE Order 413.3B, *Program and Project Management for the Acquisition of Capital Assets*
https://www.directives.doe.gov/directives-documents/400-series/0413.3-BOrder-b-chg6-ltdchg

DOE G 413.3-22, *Analysis of Alternatives Guide*,
https://www.directives.doe.gov/directives-documents/400-series/0413.3-EGuide-22

OMB Circular A-94
https://www.whitehouse.gov/sites/whitehouse.gov/files/omb/circulars/A94/a094.pdf

GAO report GAO-16-22, *Amphibious Combat Vehicle, Some Acquisition Activities Demonstrate Best Practices; Attainment of Amphibious Capability to be Determined, Appendix 1*
https://www.gao.gov/assets/gao-16-22.pdf

DOE G 413.3-21A, *Cost Estimating Guide*
https://www.directives.doe.gov/directives-documents/400-series/0413.3-EGuide-21A

DOE Order 430.1C Chg 2, *Real Property Asset Management*
https://www.directives.doe.gov/directives-documents/400-series/0430.1-BOrder-c-chg2-adminchg

DOE G 413.3-13, *U.S. Department of Energy Acquisition Strategy Guide for Capital Asset Projects*
https://www.directives.doe.gov/directives-documents/400-series/0413.3-EGuide-13-admchg1

Appendix 1

Utilities Facilities List

PROPERTY ID	PROPERTY NAME
XAREA-01	**Site Wide Compressed Air System**
2519-PGT	2518 Compressed Air Receivers
920015	Compressed Air Line System
XAREA-02	**Site Wide Electrical Distribution System**
0901	13.8 KV Switch Yard (X920901)
0977	Voltage Regulating Station
1563	Substation No. 234-4 for 1505
2632	5000 KVa Substation
2646	Substation No. 33-6, 2500 Area
3000	13.8 KV Substation
3609	Substation No. 31-11
4000	13.8/2.4 KV Secondary Substation
4011	MRF Switchgear Building
4509-SUB	4509 Substation
4513	HTML Substation
5554	Electrical Substation For 5505
6010-SUB	6010 Substation
7044	Substation 27-8, West of 7003
7640	ORNL 161 kV Primary Substation Yard
7661	Electrical Utility Facility (X187685)
8911	Switch Yard
8912	Switch House - 8912SH
X10-EP	Site Electrical Poles
X920000	Overhead Electrical Distribution System
XAREA-03	**Site Wide Telecommunications System**
920021	Telephone System, Underground Conduit
XAREA-05	**Site Wide Natural Gas Distribution Syst.**
0905-NG	Natural Gas Reducing Station No. 3
2519-NG	Natural Gas Reducing Station #2
X920030	Natural Gas Distribution Lines
XAREA-07	**Site Wide Steam Distribution System**
2519	Steam Plant
2555	Fuel Oil Storage Facility (2519)
2719	Bio-Mass Steam Plant (BMSP)
7530	Melton Valley Steam Plant

PROPERTY ID	PROPERTY NAME
7530B	Building 7530 Diesel Fuel Storage Tank
7603A	7600 Complex Diesel Fuel Storage Tanks
X10-SCRL	Site Steam Condensate Return Lines
X920013	Steam Lines, Supply (Plant Wide)
XAREA-09	**Site Wide Water Distribution System**
0902A	Rubb Tent for Parts Storage
0902B	Rubb Tent for Parts Storage
0926	Water Reservoir
0926A	0926 Valve House
0975	Water Reservoir
0975A	0975 Valve House and Compressor Building
6551	West Reservoir, Haw Ridge
6552	East Reservoir, Haw Ridge
6553	Standby Generator and Valve Pit (X182688)
7099	Pressure Reducing Valve Station
7553	Pump House - TSF Water
7755	DOSAR (HPRR) Reservoir
7756	Meter House, HPRR
7953	HPRR Pump House
8914	SNS Water Storage Tank
8950	Potable Water Pumphouse
920052	Underground Water Line, Potable
XAREA-10	**Site Wide Non-Potable Water System**
2003	Process Water Control Station
920014	Water Lines, Non-potable
XAREA-17	**Site Wide Sewage System**
1063	Building 1060 Sewage Lift Station
2521	Sewage Treatment Plant Control Facility
2521A	Sewage Treatment Aeration Facility
2521C	Sludge Drying Beds
2521D	Aerators and Shed, East and West Lagoons
2521E	Sewage Treatment Plant Polymer Building
2521-FS	Sewage Trt. Plant Filter Sys. (X189189)
2521G	Sewage Sludge Holding Tank
2543	East Aeration Pond
2544	West Aeration Pond
2548	Sludge Drying Facility (X188036)
2561	STP Pump Station Electrical Building
2570	Sewage Treatment Plant Headworks Facility
2573	Intermediate Pump Station

PROPERTY ID	PROPERTY NAME
2574	Influent Pump Station
2643A	Sewage Plant Effluent Ozonation Facility
2656	Sewage Trt Plt Water Monitor Station
2663	Peracetic Acid Effluent Disinfection Facility
2664	Sodium Metabisulfite Facility
3501	Sewage Pumping Station
7000	Septic Tank for 7000 Area
920016-2	Site Pressurized Sanitary Sewer Lines
X920016	Sanitary Sewer, Underground
XAREA-18	**Site Wide Storm Water Drainage System**
920023	Storm Water Drainage System
XAREA-20	**Site Wide Chill Water Distribution Syst.**
4509	Central Chill Water Plant
4510	Cooling Tower for 4509
4521	Cooling Tower for Building 4509
920060	Chilled Water Lines, Supply
X10-CWRL	Site Chilled Water Return Lines
XA-02GN	**Site Wide Generators**
0902-80	Optional Standby Generator (X184005)
0926B	Optional Standby Generator
0966-80	Level 1 (Emergency) Generator (X111111)
1005-80	Level 1 (Emergency) Generator (X188915)
2519A	Standby Emergency Genera for Steam Plant
2519B	Level 1 (Emergency) Generator (X188451)
2519C	Optional Standby Generator for 2519
2521-80	2521D Optional Standby Generator
2521-TK	2521D Diesel Fuel Storage Tank (X188034)
2572	Emergency Generator for 2500
2572-TK	2572 Diesel Fuel Storage Tank (X188141)
2645	Emergency Generator, Coal Handling
3027A	Dispatch Center Level 1 (Emer) Generator
3047-GEN	3047 Emergency Generator
3047-TK	3047 Diesel Fuel Storage Tank (X188085)
3598	Emergency Generator For 3500 Area
3598-TK	3598 Diesel Fuel Storage Tank (X188090)
4100A	Emergency Diesel Generator
4500N-80	4500N Emergency Diesel Generator X190437
4503	Standby Emergency Generator for 4500N
4514	Equipment Facility- HTML
5505-80	Level 1 (Emergency) Generator (X188930)

PROPERTY ID	PROPERTY NAME
7063	Level 2 (Emer) Generator for Bldg 7003
7506G-80	7506G Level 1 (Emergency) Generator
7530A	MV Steam Plant Emergency Generator
7618	Diesel Generator for 7600
7662	Emergency Generator (X187687)
7921	Emergency Generator for Building 7920
7931	Emerg Gen Bldg For B7930
7987	Diesel Generator for 7977 (X188749)
7988	Diesel Generator for 7977
XF1305-8	Level 1 (Emergency) Generator (X111111)
Other	**Other Mechanical Utilities**
0902-PAD	Water Dist. Sys. Maint Materials Storage
2536	Sanitary Sewer Preparation Building
2644	Mechanical Utilities Maint. and Strg. Shop
4511A	Chilled Water Operations Shop
4517	Chilled Water Operations Office
7000A	Sewage Pumping Station Equipment Storage
Other	**Other Electrical Utilities**
0973	Solar Photovoltaic Array 1
5300-SP	Single-Axis Tracking Photovoltaic System
Other	**Proposed Utilities**
0980	Bethel Valley 161KV Primary Substation Yard
0981	Bethel Valley 161KV Primary Switch House
0982	Oil Water Separator Tank
0983	Oil Storage

ATTACHMENT 1

Sitewide Utility Master Plan

ATTACHMENT 2

Condition Assessment Information