2018 EM CDAT Construction Project Definitions and Target Score Criteria

The following definitions describe the criteria required to achieve a maximum rating or maturity value of 5. It should be assumed that maturity values of 0-5 represent a subjective assessment of the quality of definition and/or the degree to which the end-state or maximum criteria have been met, or the product has been completed in accordance with the definition of maturity values.

Criteria for Maximum Rating

A. COST

A1	Cost Estimate	A cost estimate has been developed and formally approved by FPD and is the basis for the cost baselines. The cost estimate is a reasonable approximation of Total Project Costs (TPCs), and covers all phases of the project. The estimate is prepared in accordance with DOE requirements. The estimate bases are fully documented and traceable. Supporting backup information has been collected and organized and is available in a central file or location. Major estimate assumptions, especially those affecting major cost drivers, are fully documented and explained. Estimate exclusions or qualifications are clearly documented. Estimated costs are time-phased and escalated using current DOE or other justifiable escalation rates. For cost estimate point values AACEI Cost Recommended Practice 17R-97 is a useful reference. A Class I (CDAT score of 5) estimate is developed from quantity take offs from completed design plans and specifications. Whereas the Class 5 estimate (CDAT score 1) is of a rough order of magnitude estimate useful for determining the range of costs for various alternatives at CD-0.

Project Phase (DOE O 413.3B)	Level of Project Definition	Estimate Class	CDAT Maturity Value
CD-0/Approve Mission Need	0% to 15%	Class 4/5	1
CD-1/Approve Alternative Selection & Cost Range	10 to 15%	Class 3	2
CD-2/Approve	30% to 70%	Class 2	3-4
CD-3/Approve Start of Construction	505 to 100%	Class 1	5

	Criteria for Maximum Rating	
A2	Cost Risk/Contingency Analysis	The cost estimate includes contingency allowances developed in accordance with DOE guidance. In addition to any deterministic contingency analyses that may have been developed, a probabilistic risk analysis has been performed. The assumptions, rationale and methodology used to perform the probabilistic analysis are explained. The cost risk analysis builds on and is tied to the Project Risk Management Plan. Risk mitigation costs, if appropriate, have been included in the baseline cost estimate, or addressed by the risk analysis model. Costs related to schedule contingency also are included. The use of management reserve by contractors in procurement actions has been evaluated. The confidence level of the baseline cost estimate is clearly stated and explained. All of the preceding requirements are documented in the project record.

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A3	Funding Requirements/Profile	Funding requirements have been defined and the project timeline is in compliance with the DOE budget timeline/process. Required budget documentation, including Project Data Sheets (where required), reflects current project cost and schedule estimates/forecasts. The funding profile is based on quantified resource requirements derived from the cost estimate, time-phased through integration with the project baseline schedule. Resource constraints (personnel, budget authorizations, etc.) have been considered when developing the project schedule, and an iterative process used to correlate the cost estimate, schedule and funding profile. The funding profile is based on full consideration of available or expected budget or funding levels for the project. The impact of any projected funding shortfalls has been assessed and management strategies developed to accommodate those shortfalls have been considered and incorporated in the project plans. All of the preceding requirements are documented in the project record.
A4	Independent Cost/Schedule Review	In addition to any internal cost and schedule estimate reviews, the cost estimate and schedule have been subjected to an independent review by an organization not directly involved with the project (Independent Cost Estimate, when required). The independent review has been documented, including the techniques used and type of review performed. The results, findings and recommendations of the independent review have been reconciled with the cost and schedule estimates and changes have been incorporated.
A5	Life Cycle Cost	he project Life Cycle Costs (LCC) includes relevant assumptions, bases of estimate, qualifications, and exclusions. LCC includes the estimated cost for government commitments that result from execution of this project, including downstream projects/facilities and eventual disposition of the facilities constructed for this project. The LCC estimate should meet the requirements of Office of Management and Budget directives and DOE Orders and guidance. LCC of competing projects or alternative strategies are estimated and documented on a comparable basis. For nuclear projects, or other projects with significant safety hazards, accidents mitigation costs associated with structures, systems, and components (SSCs) have been included. For high hazard facilities, safety mitigation costs are often a key discriminator in competing projects or alternatives.
A6	Forecast of Cost at Completion	The cost baseline is approved and the measurement of actual performance is begun, forecasts of costs at completion (actual costs to-date plus “to-go” costs) are developed and issued at regular intervals. Cost forecasts are developed in accordance with project procedures. Key assumptions supporting the baseline estimate are documented and periodically re-evaluated and the impacts of changing assumptions are reflected in the estimates of “to-go” costs. Forecasts are related to the Change Control system and incorporate both approved and pending changes, as appropriate. The forecast of cost at completion is a reasonable projection based on the status of the project and experience to-date.
A7	Cost Estimate for Next Phase of Work	A detailed cost estimate is prepared and approved for the work scope to be accomplished during the next phase of the project (i.e., the efforts needed to successfully complete the prerequisites for the next Critical Decision). Cost estimates are defensible with an appropriate level of supporting detail and documentation. Assumptions are clearly documented and stated.
B. SCHEDULE		**Criteria for Maximum Rating**

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Criteria for Maximum Rating

B1	Project Schedule	A schedule has been developed, documented and approved by DOE, is identified in regulatory milestones, and is the basis for the Schedule Baseline. The schedule is a reasonable layout of project activities for all phases of the project and is at a level of development that will allow project execution. Included project activities are consistent with the Work Breakdown Structure (WBS), and the schedule is prepared in accordance with DOE guidance and practices. The schedule is activity-based and includes milestones, reasonable durations and acceptable logic. Schedules and milestones should align after negotiations and change packages are complete. Lower level schedules are developed and tiered to support the baseline schedule and/or Project Master Schedule. Project-specific conditions are included. Assumptions are defined. Interface requirements (including technology development and Government Furnished Services and Items (GFSI) are incorporated into the schedule. The baseline schedule covers the full scope of the project through CD-4, including the startup and transition to operations phases. An appropriate method of developing the schedule is used, including an acceptable software package such as P-3, when applicable. The project schedule has undergone an independent documented check for completeness and accuracy.
B2	Major Milestones	Milestones are included at each level of the project schedule to establish a baseline and indicate significant progress against the work to be completed. Stakeholder and regulatory milestones are included, as appropriate. Milestones are tiered to support project decisions, performance, approvals, etc. A milestone dictionary is provided which defines the requirements for successful completion. An appropriate number of milestones are included to control the project.
B3	Resource Loading	The schedule is resource loaded, considers critical resources, and is consistent with the funding profile. The resource loading is documented, and is reasonable, considering such elements as ramp-up, lead times, constraints, etc.
B4	Critical Path Management	A Critical Path is defined. Near-Critical Path activities are identified and sensitivity analyses have been conducted. Schedule management practices are properly focused on Critical Path and Near-Critical Path activities.
B5	Schedule Risk/Contingency Analysis	A probabilistic risk assessment has been conducted on the baseline schedule, and appropriate contingency added, as required. Assumptions, rationale, and methodology, used in the analysis are documented. Schedule risks are fully integrated with the risk management plan.
B6	Forecast of Schedule Completion	The schedule baseline is approved and the measurement of actual performance has begun, forecasts of completion dates are developed and issued at regular intervals in addition to presentations of schedule progress. Schedule forecasts reflect actual performance, to date, and projections. Forecasts are related to the Change Control system and incorporate both approved and pending changes.
B7	Schedule for Next Phase of Work	A detailed schedule is approved for activities to be accomplished during the next phase of the project (i.e., the efforts needed to successfully complete the prerequisites for the next Critical Decision). The schedule is defensible with an appropriate level of supporting detail and documentation.
C. SCOPE/TECHNICAL		**Criteria for Maximum Rating**

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Criteria for Maximum Rating

C1	Systems Engineering /System Design Descriptions	Systems engineering is used to transform mission operational requirements or remediation requirements into system architecture, performance parameters, and design details. Beginning with the definition of a need, the systems engineering process is viewed as a hierarchy that progresses through a baseline and ends with verification that the need is met, including interfaces, fit, and completeness. The application of systems engineering to a project is tailored to the project's needs and documented. System Design Descriptions (SDD) have been prepared and kept updated to include flow-down of safety and non-safety requirements, and design features shown on design drawings, including safety functions and waste streams/interfaces. SDDs identify the analysis and tests which demonstrate that the design satisfies requirements and performance criteria. Flow charts of major systems have been mapped. Monitoring and surveillance have been established to track successful execution. Related systems are successfully integrated. Appropriate safety considerations have been applied on a system-wide basis. These activities should be conducted in accordance with DOE's expectations for incorporating safety into the design process as prescribed in DOE STD 1189-2008, Integration of Safety into the Design Process; and DOE O 420.1B, Facility Safety, as they may apply and appropriate. An independent review has been conducted by a team with appropriate experience and engineering disciplines. Comments have been documented, as well as actions taken for disposition of the comments.
C2	Alternatives Analysis	A subset of reasonable project alternatives/viable alternatives has been determined by means of a documented screening analysis. Major alternatives have been identified and viable alternatives have been analyzed. Alternative Analysis includes comparisons of LCC, Feasibility (including Technology Development requirements), Stakeholder Values, Safety, Regulatory Compliance, constructability and other factors, as appropriate. Life-cycle costs should include costs for structures, systems and components (SSCs) needed to mitigate hazards, as well as life-cycle costs associated with operations and maintenance of the SSCs. The preferred option(s) is identified and justified. The overall condition and status of the facility at project completion (end state) is defined. The process should be part of the safety in design activities as defined by DOE STD 1189-2008, as they may apply and are appropriate.
C3	Functional and Operational Requirements (F&ORs)	Within Project Management, F&ORs translate program requirements into design products at the early stages of project development. Project technical requirements are translated from the mission need statement, to program requirements, to F&ORs, to design criteria, and finally documented in Facility/System Design Descriptions. The F&OR will describe the processes and systems that should be included in a project to meet program requirements and fulfill program capabilities articulated in the program mission statement. To contrast to an F&OR in project management, in safety basis, functional requirements define design requirements necessary to support the safety functions associated with Safety Class (SC) and Significant Safety (SS)-SSCs, e.g., for example facility structure should meet Performance Criteria (PC)-3 seismic design loads. F&ORs and functional requirements for the project is documented, approved (by users, key stakeholders, and the DOE program office as appropriate) and are under configuration control. The process should be part of the safety in design activities as defined by DOE STD1189-2008, as they may apply and as appropriate.

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C4	Design Basis (How)	The set of requirements that bound the design of systems, structures and components within the facility. These design requirements include consideration of safety, plant availability, efficiency, reliability, and maintainability. Project design basis is developed and reviewed including appropriate level of approval from users, key stakeholders, site management, and DOE. Design Basis has clearly defined key performance expectations and provided a sound framework for subsequent design activities, including the regulatory context. Design basis has been peer reviewed by appropriate technical experts. The process should be part of the safety in design activities as defined by DOE STD 1189-2008, as they may apply and as appropriate.
C5	Design Criteria/Design Margins (How to)	Design Criteria have been clearly defined and quantified including the specification of applicable codes and standards. Design Margins for all structures, systems and components must also be specified. The facility (including safety class and safety significant SSCs) Safety Design Criteria [e.g. DOE O 420.1(b)] have been clearly defined and quantified. Margins for safety design criteria must also be specified. Design criteria for worker safety, security and safeguards have been clearly defined, including the Design Criteria that address the Design Basis Threat. Design Criteria must address both Material Control and Accountability. Design Margins must also be addressed. Requirements and guidelines that govern design of the project have been reviewed by users and appropriate discipline experts and the criteria have been approved. Design margins to cover contingency in the design itself have been reviewed and approved, and placed under configuration control. Criteria include items such as: 1. Regulations, 2. DOE Orders, 3. Codes and Standards (Federal, State and local), 4. Engineering Standards (DOE and contractor); functional performance. These activities should be conducted in accordance with DOE's expectations for incorporating safety into the design process as prescribed in DOE STD 1189-2008, Integration of Safety into the Design Process; and DOE O 420.1B, Facility Safety, as they may apply and as appropriate.
C6	Technology Needs Identified	Availability of new technology for the project is established, the technology has been evaluated, including benefits and risks. Technology development requirements for each alternative are documented. Deployment of a new technology for the project should be part of the project risk assessment and is reflected in the project schedule and cost estimate. The process should be part of the safety in design activities as defined by DOE STD 1189-2008, as they may apply and as appropriate.
C7	Technology Needs Demonstrated	New technology has been tested and determined to meet project objectives (technical, cost and schedule). Maturity of new technology to be used has been evaluated and factored into risk analysis by means of a Technology Readiness Assessment, or its equivalent (Reference: DOE G 413.3-4, *Technology Readiness Assessment Guide,* dated 10-12-09). An evaluation of the inappropriateness of existing technology has been documented to justify the need. The process should be part of the safety in design activities as defined by DOE STD 1189-2008, as they may apply and as appropriate.

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C8	Trade-Off/Optimization Studies	The Trade-Off Studies are performed, as needed, to reach a reasonable level of project risk consistent with project phase and overall project cost/schedule. These trade-off studies are a part of conceptual and later design phases to optimize the design of the selected alternative. The studies include alternative design and process controls, and optimization approaches with consideration of technical safety requirements. The studies conducted should be well documented and the conclusions justified. The process should be part of the safety in design activities as defined by DOE STD 1189-2008, as they may apply and as appropriate.
C9	Site Location	The geographical location of proposed project is defined and approved. The rationale for the decision process is documented, as appropriate. The site selection process is considered a viable option and relative strengths and weaknesses of alternate site locations were assessed. The selection criteria are complete and include major considerations of stakeholders and current operations.
C10	Plot Plan	Plot plan is complete and shows location of the project in relation to adjoining facilities. It should include items such as: □ Plant grid system with coordinates □ Green space coordinates □ Buildings □ Project boundaries □ Major pipe racks □ Temporary staging areas □ Gates and fences □ Laydown areas □ Decontamination areas □ Off-site facilities □ Construction/fabrication areas □ Rail facilities □ Tank farms □ Major utilities □ Roads and access ways □ Nearby residences □ Surface water
C11	Process Flow Diagrams (PFDs)	All major systems have associated process flow diagrams showing the entire process, from beginning to end, including raw materials and waste products. Process flow diagrams are complete and annotated with material balances for design basis. Drawings include items such as: System Major equipment items and major system components System Flow of materials to and from the major equipment items
C12	Natural Phenomena	Architectural, civil/structural, seismic and other natural phenomena design plans and specifications are in compliance with established standards of practice and are documented. The process should be part of the safety in design activities as defined by DOE STD 1189-2008, as they may apply and as appropriate.

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C13	Layout Drawings and Equipment List	All engineered equipment and/or materials are fully specified, bid, and tabulated, as necessary, to support the project schedule. Long-lead items has been identified and documented with supporting technical basis. Equipment having safety functions is identified with appropriate quality levels. Drawings are comprehensive, reasonable, and show all major elements in a logical format. Individual drawings for major systems are shown in consistent orientation and scale. Layout and major equipment location/arrangement drawings that identify locations of each item of equipment are complete and finalized. All appropriate parties affected by equipment placement (operations, maintenance, etc.) have had the opportunity to provide input and have reviewed the layout. The facility, systems and major component equipment list is complete. The process should be part of the safety in design activities as defined by DOE STD 1189-2008, as they may apply and as appropriate.
C14	Piping & Instrumentation Diagrams (P&ID)	The final version of revised P&IDs is available. The P&ID have been issued as a configuration control document. P&IDs include all changes identified from the preliminary hazard analysis (PHA), and the maintenance and operations review. The diagrams show piping, valves with tag numbers, piping tie-ins to existing lines, discharge and monitoring points, utilities and storage tanks/sumps. Comprehensive reviews are complete and results incorporated. Examples of these reviews include (but are not limited to), Safety Analysis Reports, maintenance and operations requirements, and final construction and fabrication detail reviews. The P&ID drawings have been independently reviewed and approved. The process should be part of the safety in design activities as defined by DOE STD 1189-2008, as they may apply and as appropriate.
C15	Mechanical (Piping)	Process/mechanical design plans and specifications are approved and issued for construction, as appropriate, include: ☐ Mechanical Design ☐ Mechanical Equipment List ☐ Piping Specialty Items List ☐ Piping system criteria ☐ Valve List with tag numbers ☐ Tie-in List for all piping tie-ins to existing lines ☐ Piping stress analysis ☐ Specifications (design, performance, manufacturing, material, and code requirements) ☐ Utility flow diagrams ☐ Utility Sources with supply conditions The plans and specifications have been independently reviewed and approved and placed under configuration control. The process should be part of the safety in design activities as defined by DOE STD 1189-2008, as they may apply and as appropriate.

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C16	Instrument and Electrical	The National Electrical Code and state and local relevant codes are incorporated into the design and project plans. Safety and security components have appropriate designations and separation criteria have been considered in their design. Instrument and Electrical requirements, as appropriate, including the following, are approved and issued for construction: ☐ Electrical Area Classifications ☐ Substation Requirements ☐ Electrical Design Requirements ☐ Electrical One-Line Diagrams ☐ Utility flow diagrams ☐ Instrument Set Point document ☐ Substation Design ☐ Instrument Index ☐ Logic Diagrams ☐ Instrument and Electrical Specifications ☐ Utility sources with supply conditions The plans and specifications have been independently reviewed and approved and placed under configuration control. The process should be part of the safety in design activities as defined by DOE STD 1189-2008, as they may apply and as appropriate.
C17	Physical Site Characteristics	Assessments of site-specific attributes are complete. Survey and geotechnical evaluations of the proposed site are complete. Investigation and development of site-specific characteristics are sufficient to support final Natural Phenomena Hazard design basis and key assumptions are clearly documented. Remediation plan to address identified site characterization deficiencies has been developed, if appropriate. Areas of potential risk are identified. Evaluation and results of the investigation characterize the following: ☐ Hydrology ☐ Geology ☐ Seismic ☐ Underground obstructions and utilities ☐ Environmental contamination ☐ Geotechnical attributes The process should be part of the safety in design activities as defined by DOE STD 1189-2008, as they may apply and as appropriate.
C18	Waste Characterization and Disposition	Waste streams generated (gaseous, solid, and liquid, both hazardous and non-hazardous) through construction, demolition, or building preparations are sufficiently characterized to identify appropriate disposition alternatives and worker protection levels and documented in a Waste Management Plan. Samples have been collected, analyzed and validated to produce reliable, high quality data. Necessary plans and actions have been taken to confirm conditions, prepare documents and perform the discovery action, including resolving surveillance and monitoring activities and safety considerations. Historical data and process knowledge are fully documented. All waste streams have their disposition finalized and included in the project costs, risks and schedule. The on-site or off-site Waste Acceptance Criteria are documented, approved, and included in the design requirements for the project.

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C19	Pollution Prevention and Waste Minimization	A detailed waste minimization/pollution prevention plan for the project and operational phase is complete. A description, estimated costs, and present implementation plan for design, operation, and mitigation features that will minimize wastes and prevent pollution are approved. A detailed waste management plan describing quantities and types of wastes to be generated and plans for their waste treatment, storage or disposal are complete. The plan should: □ Support the waste management cost estimate for the process as well as any facilities. Estimated costs considered in Critical Decision process.) □ Identify project options for waste treatment, storage, and disposal, including availability of future disposal capacity and sites. □ Integrate waste management plans with waste minimization/pollution prevention plans. □ Characterize regulatory benefits and concerns associated with types and quantities of wastes expected.
C20	Waste Storage, Packaging and Transportation	Storage, packaging and transportation requirements for nuclear and hazardous materials and wastes are identified and documented, including both off-site and in-plant transportation, as well as methods and equipment (casks, overpacks, etc.) for packaging, receiving/shipping materials (e.g., rail, truck, air, marine). The waste packaging and shipping requirements are identified, documented and included into the project design. Storage areas have required permits. Storage, packaging, and transportation specifications are fully identified for each waste stream.
C21	NEPA Documentation	Major environmental regulations are identified. Potential environmental permitting issues have been identified. Strategy for addressing environmental permitting issues is defined and documented. Environmental permitting authorities have been contacted and briefed on potential releases to the environment, and the project approach to meeting requirements for air emissions, water discharges, land disposal, and disposition of waste streams. Requirements have been defined and incorporated into design criteria for air emissions, wastewater discharges, land disposal of hazardous wastes, and disposition wastes. Structures, systems, and components are designed consistent with approved environmental permitting requirements. All wastes have a path forward for ultimate disposition. Structures, systems and components in the final design drawings are consistent with approved environmental permitting requirements. All NEPA activities, including NEPA strategy and requirements, are complete and compliant with DOE Orders, as necessary.
C22	Long Lead/Critical Equipment & Materials List	The need for long-lead items and critical equipment has been documented. Long-lead items are listed. Procedures for their acquisition, vendors, and impacts on the schedule have been documented. Any necessary R&D prior to ordering, fabrication or installation has been integrated to the project scope, risks, schedule and costs.

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C23	Design Completion	Design drawing needed to support construction and system/equipment/component procurements are complete and should include (among others as required): general arrangements and site layout drawings; architectural drawings; structural drawings; mechanical (HVAC, fire protection) drawings; special process equipment design drawings (build to print); piping drawings; electrical drawings; instrumentation and control drawings; process flow diagrams; and arrangements showing the limits of any existing facility demolition. A complete listing of design specifications for structures, systems and components (SSCs) has been developed which contains requirements to construct, procure, fabricate, install and test. Any drawings which are intended to provide specification requirements for SSCs procurements have been identified. Drawings have been checked and reviewed by an independent team with appropriate experience and engineering disciplines. Comments and resolutions have been documented and accepted by reviewers. Back-up files include engineering files, trade-offs, calculations, etc. Safety is integrated into the design. The design authority has signed off on all design drawings. The process should be part of the safety in design activities as defined by DOE STD 1189-2008, as they may apply and as appropriate.
C24	Design Reviews	Design reviews have been conducted at each appropriate project phase (at a minimum i.e., Conceptual, Preliminary and Final Design). They have been performed by a multi-functional team representing appropriate disciplines and, if appropriate, external experts have been utilized. Review results, comments and resolutions have been documented and accepted by reviewers. Safety issues have been resolved. The process should be part of the safety in design activities as defined by DOE STD 1189-2008, as they may apply and as appropriate.
C25	Interface Planning and Control	System interfaces (consistent with System Design Descriptions) have been identified and defined, and, if necessary, an Interface Control Plan is approved and implemented. All internal and external stakeholders have been involved in project development and planning. Appropriate ties to project logic have been accomplished for each stakeholder (i.e., material receipt, transportation, safeguards and security, safety, worker's health, regulatory, effect on current operations, etc.). The process should be part of the safety in design activities as defined by DOE STD 1189-2008; DOE 440.1B, May 2007, Worker Protection Program for DOE; 10 CFR 851, Worker Safety and Health Program; as they may apply and as appropriate.
C26	Operating, Maintenance, and Reliability (OMR) Concepts	OMR concepts are approved and appropriately documented in the design. Operations personnel are involved with the development of OMR requirements and these requirements have been incorporated/considered in the design development. The process should be part of the safety in design activities as defined by DOE STD 1189-2008; DOE 440.1B, May 2007, Worker Protection Program for DOE; 10 CFR 851, Worker Safety and Health Program; as they may apply and as appropriate.
C27	Safeguards and Security	Major safeguards and security issues were identified and documented in the Mission Needs Statement. An initial security vulnerability assessment and a cyber security plan were prepared for the project. Security system design requirements based on performance requirements of the Graded Security Protection Policy, DOE O 470.3B, have been identified and incorporated into the project. The final security vulnerability assessment report and cyber security plan were approved and placed under configuration control. At the conclusion of the final design, all safeguard and security requirements as required by DOE M 470.4 series directives are satisfied by the facility design and/or proposed operational features.

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C28	Heat and Material Balances	The heat and material balance calculations needed to design and size major plant equipment have been completed. All calculations needed to conduct a Hazard Analysis of the Preliminary Design for major equipment and process operations (substantiate the key flow rates in process flow diagrams) have been completed. The heat and balances calculations have been independently reviewed. The process should be part of the safety in design activities as defined by DOE STD 1189-2008, as they may apply and as appropriate.
C29	Reliability, Availability, Maintainability and Inspectability (RAMI) Analysis	A high level RAMI analysis is performed for each of the reasonable/viable project alternatives. Design features needed to mitigate impact to workers have been considered and results documented. A RAMI analysis (to include trade-off studies) has been performed to ensure the equipment selected and the design configuration represents the optimal system to meet throughput and other mission requirements at both the high and lower system levels. The RAMI analysis has been reviewed by an independent team with RAMI experience and review comments are documented and disposed with supporting rationale. Results of the RAMI have been incorporated into the technical baseline. The process should be part of the safety in design activities as defined by DOE STD 1189-2008, as they may apply and as appropriate.
C30	Materials Loading/Unloading/Staging	There is a complete list of requirements for loading, unloading, and staging of raw materials and products along with their specifications including cranes and remote handling equipment for the installation/removal or operation of process equipment. This list should include such items as: □ Material Safety Data Sheets created □ Instantaneous and overall loading/unloading rates □ Details on supply and/or receipt of containers and vessels □ Storage facilities to be provide and/or utilized □ Specification of any required special isolations provisions □ Specification for process handling equipment, including robotics, remote devices and cranes
C31	Constructability and Construction Planning	A constructability assessment has been performed. The assessment of alternatives should consider the technical construction challenges and resources required by various alternatives. The constructability assessment has been documented and independently reviewed. Construction planning has been completed and performed by personnel with construction experience on similar projects and documented as part of the final design review.
C32	Sustainable Design	Leadership in Energy and Environmental Design (LEED) target level (i.e. silver, gold) has been selected and a set of energy efficient and sustainable design features have been identified. Requirements consistent with the selected LEED design features have been incorporated into the design criteria. Final energy efficient design features derived from the LEED target level (i.e. silver, gold) have been identified in the design criteria and the design drawings.

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C33	Transition and Startup Planning	Project strategy addresses critical issues for transition from construction/restoration to startup/testing to operations, if appropriate. Project transition strategy is finalized. “Cold Start-Up” and “Hot Start-Up” planning sufficiently complete to include identification of sub-system and system testing required, indicating and recording instrumentation required to monitor and assess test performance, and schedule duration and costs needed to successfully conduct the tests. There is an appropriate start-up plan for transition to operation, including maintenance and inspection schedules, reliability testing and monitoring, and documentation. Resources are appropriately identified and integrated into the project schedule. At a minimum, the following critical issues are addressed: ☐ Subsystem/system turnover criteria and documentation ☐ Test acceptance criteria ☐ Turnover (transition) security issues (such as access control and subsystem/system isolation) ☐ Craft jurisdictional issues ☐ Integrated testing plans, etc. ☐ Operational, process engineering, and maintenance personnel readiness for project operations. ☐ Start-up organization established; roles, responsibilities and authority established and defined
C34	Operations Plans and Procedures	Operating plans and procedures are defined and development plans are in place, including operating procedures that reference technical specifications and administrative limits, as necessary. Monitoring and training requirements for operations are in place, if appropriate. Training input and planning is developed. Disposition considerations and training requirements are defined, approved, and incorporated, as appropriate. Simulation and mockup facilities are defined and established, as necessary. If applicable, processing and production plans and schedules are in place and include such items as: ☐ All production/characterization/sampling steps are identified and integrated ☐ Assumed throughput and production efficiencies are defined and reasonable ☐ Assumptions are supported by time and motion studies, calculations and operating experience ☐ Resource requirements for each step identified ☐ Failure/reject rate assumptions documented and supported ☐ Equipment and material needs including availability and reliability defined ☐ Initial production plan formulated ☐ Design approach has optimized processing and production objectives considering spare capacity
C35	Civil, Structural and Architectural	Architectural, civil/structural requirements; seismic and other natural phenomena design requirements are fully documented. Civil/Structural design plans and specifications are approved and issued for construction. The plans and specifications have been independently reviewed and approved and placed under configuration control. The process should be part of the safety in design activities as defined by DOE STD 1189-2008, and are applied as appropriate.
D.	**MANAGEMENT PLANNING AND CONTROL**	**Criteria for Maximum Rating**

2018 EM CDAT Construction Project Definitions and Target Score Criteria

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Criteria for Maximum Rating

D1	Mission Need Statement (MNS)	An approved Mission Need Statement exists. The project MNS demonstrates that the project relates to and supports execution of Program Strategic Plan goals and objectives as well as the DOE Strategic Plan. A MNS describes shortfalls or performance gaps between the current gaps and the required state. It articulates DOE expectations for safety in design based on a pre-conceptual hazard analysis and categorization, when applicable and appropriate, as prescribed in DOE STD 1189-2008. Mission needs are reassessed after major changes in a program, at budget submission, and at Critical Decisions.
D2	Acquisition Strategy/Plan	An Acquisition Strategy/Plan has been developed and approved in accordance with DOE requirements and orders. The acquisition strategy and plans should be sufficient to accomplish the project using a tailored approach, as appropriate. The project is in compliance with the site/complex strategic plan. The approved Acquisition Strategy supports all contracts, subcontracts, long lead procurements, and major procurements (both foreign and domestic) for the project. The plan addresses the methodology of incorporating project specific issues [such as, nuclear quality assurance-1 (NQA-1)].
D3	Key Project Assumptions	A complete list of critical facts and circumstances that would affect project outcome if changed is available. These assumptions have been reviewed and approved by appropriate parties. Project assumptions are reflected in technical/cost/schedule baselines and risk management plans. The process should be part of the safety in design activities as defined by DOE STD 1189-2008, as they may apply and as appropriate.
D4	Project Execution Plan (PEP)	The PEP has been developed and approved in accordance with DOE requirements/orders. The PEP is the primary agreement on project planning and objectives between all parties, and establishes roles and responsibilities and defines how the project will be executed, including tailoring general requirements and processes to the specifics of the project. The PEP should include: □ Performance Baseline (Scope, Cost and Schedule), including a Resource Loaded Schedule for the duration of the project. □ Identification of any long-lead equipment and materials (including the technical basis for equipment sizing as well as a risk analysis with respect to long-lead equipment being properly sized). □ Project organization and roles and responsibilities. □ Process for baseline change control and configuration management. □ Discussion of planned design reviews and how they are to be conducted. □ Project quality assurance organization and implementation approach. The PEP has been updated to reflect current project status, plans and performance baseline. - Note: The Preliminary Project Execution plan (PPEP) which is required at CD-1, should be based on a defined concept and, although not fully developed, is expected to contain substantial detail in all of the areas listed above. Thus a compliant PPEP would be rated at an expected maturity value of 3.

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Criteria for Maximum Rating

D5	Integrated Project Team (IPT) and Charter	The project organization and IPT charter are in place and functioning. The Integrated Project Team (IPT) has been in place since early project phases. The IPT participants' roles and responsibilities are clearly articulated. The composition of the IPT reflects the major areas of expertise needed to execute the project. The project is staffed with sufficient numbers of project management, technical, and acquisition specialists suitably qualified to accomplish project objectives. A qualified (certification level) Federal Project Director has been identified and formally assigned.
D6	Conceptual Design Report (CDR)	The CDR -should have detailed supporting documentation for the recommended alternative, Total Project Cost range, and the system requirements and applicable codes and standards for design and construction, to include environmental, safety and security considerations. Conceptual design drawings have been reviewed by an independent team with appropriate engineering disciplines and relevant experience. Review comments have been documented and disposed with supporting rationale. CDR has been approved by DOE. The process should be part of the safety in design activities as defined by DOE STD 1189-2008, as they may apply and as appropriate.
D7	Baseline Change Control	There is a DOE approved process to review and approve proposed changes to cost, schedule, and technical baselines and to determine the impact of changes. Baseline Change Control Boards (CCB) are established at appropriate levels of the organization, the thresholds for each level are defined, and appropriate procedures are in place and being used. The process is described in the Project Execution Plan.
D8	Project Control	A project control system is being used to manage the project baseline applying earned value techniques, variance analysis, contingency/management reserve and effective reporting in accordance with DOE Orders and guidelines.
D9	Project Work Breakdown Structure (WBS)	Project Work Breakdown Structure is established and reflects the project through completion. WBS dictionary is complete, including a detailed Statements of Work (SOWs). Project schedule and costs directly aligned with WBS structure, and deliverables are defined. The WBS is defined to an appropriate level of detail needed to successfully manage the project.
D10	Resources Required (People/Material) for Next Phase	The resources required for next phase are identified and available. These resources are reflected in the resource-loaded schedule.
D11	Configuration Management	A configuration management program is functioning to ensure consistency among requirements, criteria, design, existing facilities, physical configuration, and interfaces within project documents. The process should be part of the safety in design activities as defined by DOE STD 1189-2008, as they may apply and as appropriate.

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Criteria for Maximum Rating

D12	Project Risk Management Plan/Assessment	A risk management plan is developed and is included in the Acquisition Strategy/Plan and/or PEP, as appropriate. A risk mitigation strategy is in place. Project risk (technical and programmatic) is an accurate and complete estimate of the probability and severity of cost, schedule and other impacts (environment and safety) associated with uncertainties in the project, including a time-frame in which these risks are expected to occur. Risks are tracked, reported, and controlled. Project risks are reflected in the project cost estimate and schedule. Risk Mitigation Plans/Strategies have been identified in the plan and included in the Performance baseline. The process should be part of the safety in design activities as defined by DOE STD 1189-2008, as they may apply and appropriate. Risk Management and Ownership continues to be actively used, as demonstrated by periodic (i.e. at least quarterly) updates of the risk register and regular reporting and re-evaluation and status reporting of cost and schedule contingency.
D13	Quality Assurance Program	A quality management system is defined and integrated into the processes governing activities that implement the project mission in compliance with requirements of 10CFR 830 Subpart A, Quality Assurance Requirements, DOE O 414.1C, Quality Assurance, and other applicable project specific quality requirements. A Quality Assurance (QA) program/plan is established. QA factors, including standards, specifications, and limitations are identified and have been communicated to the project staff and contractors. A Quality Control (QC) and QA oversight organization is in place and functioning. The process should be part of the safety in design activities as defined by DOE STD 1189-2008, as they may apply and as appropriate.
D14	Value Engineering	Where appropriate, a value engineering program complying with DOE Orders is in place and qualified personnel have analyzed appropriate project functions using accepted industry techniques with the aim of improving performance, reliability, quality, safety and life cycle costs of products, systems or procedures. The value engineering analyses are documented in a formal report and have provided unbiased, outside opinion and/or senior expertise (as appropriate) as inputs to the design process and an independent review of concept, design, and schedule. Measures, taken to minimize project cost and maximize the return on investment for delivering the project, have been documented and cost savings have been quantified. Project criteria have been re-evaluated when value engineering analyses have determined them to have poor value or a high cost-to-worth ratio. The process should be part of the safety in design activities as defined by DOE STD 1189-2008, as they may apply and as appropriate.
D15	Procurement Packages	Procurement packages are being developed in accordance with the Acquisition Plan and will have added details for Design-Build procurements (if appropriate). Contractor selection processes and procedures are in place. Procurement packages reflect all requirements for security, safety and environmental considerations and pass on appropriate responsibilities and risks to contractors and subcontractors.
D16	Project Acquisition Process	The project is being accomplished in accordance with the established DOE Project Acquisition Process and in compliance with DOE O 413.3A, Program and Project Management for the Acquisition of Capital Assets, including Critical Decisions and Energy System Acquisition Advisory Boards (ESAAB) or the ESAAB-equivalent process.

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Criteria for Maximum Rating

D17	Integrated Regulatory Oversight Program	Applicable Federal, state, and local government permits, licenses, and regulatory approvals, including strategies and requirements are identified and obtained in a timely manner or milestone dates established. Schedule for receipt of authorization from regulators should be realistic based on experience. Requirements and milestone dates are updated as necessary and kept current. Regulators are stakeholders and have been involved with the project since its planning phase.
D18	Inter-Site and On-Site Coordination	Key inter-site and on-site coordination issues are identified, addressed and resolved or plans are in place to accomplish their resolution.
D19	Stakeholder Program	A stakeholder program was established early in the planning phase of the project to take into account the concerns and ideas of Federal, state and local regulators, local citizens, the project staff, the laboratory, DOE' site office, the Program Office, and other entities involved in the planning, design, or implementation of the project. The stakeholder program includes a mechanism for incorporating stakeholder feedback into the planning process and for communication between the project team and stakeholders in a timely and meaningful way.
D20	Funds Management	A funds management system is in place to ensure funds are allocated to support the project baseline elements for the current fiscal year. A system is in place to periodically review the annual costs to ensure that the annual funding will not be exceeded.
D21	Reviews/Assessments	Reviews (including External Independent Reviews (EIRs), Independent Project Reviews (IPRs) and Technical-IPRs) and assessments are performed and the findings, assessments, and recommendations are documented and presented to appropriate levels of management. A Corrective Action Plan is in place and being monitored and implemented, as necessary. Appropriate reviews and self-assessments are conducted as an integral part of the project, based on project complexity, size, duration and Critical Decision points.
E. SAFETY AND SECURITY		**Criteria for Maximum Rating**

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Criteria for Maximum Rating

E1	Hazard Analysis/Safety Documentation	Addressing hazards early ensures that safety is “designed in” early instead of “added on” later with increased cost and decreased effectiveness. Hazards include both project hazards (such as fire hazards, criticality, radiological, chemical, and explosives), as well Natural Phenomena Hazards such as earthquakes, flood, hurricanes, and lightening. Analysis of hazards results in the identification of potential accident scenarios and the determination of how to prevent or mitigate the accidents. Structures, systems, and components (SSCs) are identified and incorporated into the design to prevent or mitigate the consequences of hazards to the facility worker, the collocated worker and the public. These SSCs are classified as safety class, safety significant, or defense in depth as required by the safety function. Requirements on the Integrated Safety Management System (ISMS) to be followed are described in DOE P 450.4, Safety Management Policy, dated 10-15-96. New nuclear facility design activities or major facility modifications as defined in 10CFR 830, Subpart B, -must be conducted in accordance with DOE O 420.1B, Facility Safety, dated 12-22-05; DOE STD 1189-2008; and 10 CFR 851. The ISMS process is applied to all Critical Decisions (CDs) and the Office of Health, Safety and Security (HSS) activities and documentation (among others as applicable and appropriate) that should be followed by the project are described below: <u>Prior to CD-0 (Mission Need)</u>: • Inventory of available documents based on existing facilities/sites identified in the scope of the project to facilitate hazard analysis and project planning. • Identify the potential hazards and their safety and risk implications in the mission need statement. • Include in the mission need DOE expectations for safety in design; identification of Safety in Design Tailoring Strategy; and identification of high level applicable safety regulations, safety codes, and safety standards (e.g. DOE O 420.1B, etc.).

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Criteria for Maximum Rating

E1	Hazard Analysis/Safety Documentation (continued)	CD-0 to CD-1 (Alternative Selection and Cost Range): • Documented Hazard Analysis of the conceptual design that identifies project hazards and natural phenomena hazards associated with systems for material processing, treatment, storage, and radioactive, chemical, and hazardous waste disposition. • Hazardous conditions and associated likelihoods and consequences, both mitigated and unmitigated for each reasonable alternative are documented. Hazards have been identified for control under safety management programs (Integrated Safety Management System, industrial safety, radiation protection, etc.) or uniquely analyzed under a Design Basis Accident (DBA). • Development of a Safety Design Strategy, Conceptual Safety Design Report, and a Conceptual Safety Validation Report (DOE STD 1189-2008, Sections 2.3 and 4.2) and integrate into project planning documentation. • SSCs that prevent or mitigate the frequency and/or consequences of DBAs associated with project hazards and natural phenomena hazards (NPH) are identified. • Requirements for worker safety, radiation safety, criticality safety, fire safety, industrial safety, and life safety are identified and incorporated into the project Facility and Operational Requirements, and design criteria documentation. • Determine the qualified safety and health professionals in the Integrated Project Team necessary to support the Federal Project Director. CD-1 to CD-2 (Performance Baseline): Safety analysis activities should be integrated and performed concurrently and iteratively with design activities in order to establish an accurate and defendable performance baseline that adequately incorporates nuclear safety basis requirements, as applicable. Safety basis documents that are developed for CD-2 are: • Completed Preliminary Safety Design Report and the Preliminary Safety Validation Report. • Updated Safety Design Strategy • Requirement for worker safety, radiation safety (including ALARA), criticality safety, industrial safety, fire safety, life safety, and chemical safety identified and incorporated into the project design. • The Hazard Analysis Report has been updated, reviewed and approved. CD-2 to CD-3 (Start of Construction): • Completed Preliminary Documented Safety Analysis (PDSA) and the Safety Evaluation Report. • Before the detailed design of the facility is accepted, all design requirements that were generated from safety considerations should be documented in the PDSA.
E2	Integrated Safeguards & Security Planning	The security approach and potential requirements for the project are documented to aid in the development of the integrated safeguard and security plan. Safeguard and security requirements are identified and documented and incorporated into detailed design drawings and specifications. Security levels are appropriate for the designation of the facility as nuclear or non-nuclear.

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E3	E3 ES&H Management Planning	Environmental, safety and health requirements, as delineated in Federal, DOE, state, site and local laws and regulations, are included in the project design requirements. Any exceptions are documented, justified and approved. The requirements, methodology, and responsibility for ES&H activities are clearly communicated. An Integrated Safety Management System (ISMS) has been implemented in support of the project in accordance with the requirements of DEAR 970-5204-2. The site's ISMS Document includes mechanisms for integrating ISM into the project activities and these mechanisms have been implemented. Safety Plans include fire, occupational, radiological, industrial hygiene, etc., and are complete, thorough and an integral part of all design efforts. Site procedures and mechanisms ensure that during the project planning, hazards are analyzed, controls are identified, and feedback and improvement programs are in place and effective. Line managers are using these processes effectively, consistent with their management functions, responsibilities and authorities.
E4	E4 Emergency Preparedness	Emergency planning and preparedness considerations are adequately reflected in the project design and meet emergency preparedness requirements of DOE O 151.1D and DOE O 420.1C, where appropriate. Emergency response services and related factors are considered in the facility site selection. Specialized issues and considerations for emergency preparedness are adequately identified and documented Preparedness planning is complete for the disposition effort, and post-disposition emergency planning has been initiated, if appropriate. This planning has been coordinated with site and external response organizations. Specialized issues and considerations for emergency preparedness are adequately identified and documented.