**Attachment C   
Design Deliverable Schedule, 30-60-90-100%**

1. **Purpose**

This document includes a template for the LANL project engineer to edit as necessary/allowed and impose on design agency (e.g., via EOR task order, subcontract, etc.). *Guidance: ES-EPD, in conjunction with ASM, has standard task order Exhibit D templates intended to capture the information in this document, and these templates should facilitate the task of implementing this document in most cases.*

1. **General Usage Requirements (LANL Project direction):**
2. Applicability: This schedule is required for construction-type projects with a total initial estimated unburdened cost of over $500k[[1]](#footnote-1) or a design unburdened cost over $150k. It is intended for preliminary and final design and design support during/after construction, not conceptual design or studies. ES-EPD Group Leader may allow other approaches. *Guidance: Other projects may adapt as desired.*
3. 30/60/90 refers to the typical, formal design review schedule used for a new, medium-sized GPP building, where the numbers represent the approximate percentage of design effort for the combined preliminary and final design effort (aka Title II). (For line item projects, this may not correlate precisely with the project’s overall project design maturity timeline, so modify as needed per the “Modification” paragraph below[[2]](#footnote-2)).
4. Modification: To reduce or relax this schedule, the project shall obtain concurrence from an ES Group Leader or Project Manager.  The Project Manager may only approve modifications to the 30% and 60% reviews. Modifications to the 90% review for Alt Level 2B[[3]](#footnote-3) and higher projects require approval from the ES-EPD Group Leader. If Alt Level 2A or below modification of the 90% review deliverables may be made by the FDAR. Mark as N/A (preferred) or delete rows not applicable to given project.
5. Deliverables listed are EOR responsibility, both in-house and outside EOR (unless noted otherwise in their contract). The project may also assign some tasks (e.g., telcom design, commissioning) to the LANL Facility Design Authority Representative (FDAR) organization or another LANL entity if not required of EOR by Z10 Attachment B or subcontract. *EOR should propose additional modification prior to entering into a contract for work.*

*CAUTION (Guidance): This document does not contain the entirety of EOR work, or all possible design work.*

1. **General Requirements (EOR/Design Agency)**
2. Deliverables listed are EOR responsibility, both in-house and outside EOR (unless noted otherwise in their contract). Deliver to LANL STR or their designee (e.g., Project Engineer); for in-house design, project engineer, or equivalent.
3. Over-the-shoulder (OTS): The reviews at 30% and/or 60% may be conducted as an OTS review by LANL project manager decision. OTS is typically an on-site, half-day meeting to perform a walk down and page turn review of the design and obtain comments from LANL. The design submittal shall be provided three working days prior to the OTS. The OTS comments will be formally submitted to the EOR by LANL. Comment responses shall be provided by the EOR and accepted comments incorporated into the next design phase submittal (e.g., 60% or 90%) submittal.
4. The ESM contains additional detail on these deliverables as well as additional required deliverables. Project-specific documents such as SOWs, performance criteria, RCDs, and other design criteria documents may also contain deliverable requirements not contained here.
5. General maturity requirements are as follows:

**Table Z10-AttC-1 Maturity Requirements by Review/Phase**

| **Level, %** | **Overall Maturity Required** | **Specification Maturity Required** |
| --- | --- | --- |
| 30 | EOR’s understandable presentation of the 30% deliverables specified. Although the design is far from complete, a few deliverables will be final or near-final while most will be preliminary or not yet expected. | Not expected. |
| 60 | EOR’s understandable and thoroughly developed presentation of the 60% deliverables specified. Although the design is not complete at this stage, most technical content should be provided (rare exceptions as noted herein). | Portray complete scope of work, Sections have non-applicable portions removed. Some quality, manufacturer, and execution details may be TBD. Unedited masters are unacceptable. |
| 90 | EOR’s complete, QA-checked, and final-quality documents – i.e., either already PE-sealed or ready for PE seal (when required by Section Z10) and the designer willing to stand behind them. *Guidance: LANL’s 90% review should merely be a final check of comment resolution from the 60% review and a review of the additional development from that time\.* | Be complete, checked, cross-discipline coordinated, and ready for LANL acceptance. |
| 100 | The 90% submittal documents with all compliance comments resolved, all others dispositioned as necessary, and documents approved and issued for LANL acceptance by the EOR. | |

1. **Schedule Usage/Format**
2. Collectively, the rows are a compilation of the majority of EOR deliverables ultimately required for design acceptance and project permitting.
3. The percentage columns indicate the expectations for each review phase[[4]](#footnote-4)—what is required at those percent-complete reviews (these may include final versions of some documents). Xs represent the first time a deliverable is required; however, submit up-to-date versions at each subsequent phase.
4. Responsiveness: For each subsequent deliverable/phase, previous LANL compliance-problem (“C”) comments shall have been resolved, and all others dispositioned.
5. Phased design: This schedule does not preclude phased design whereby a sub-package (e.g., foundation design) is submitted before remaining scope package(s).
6. *Shading guidance: Items shaded yellow should be produced at the 5% phase and items shaded green should be done at the 15% phase due to interdependencies. LANL’s first review will generally be at 30% unless EOR desires sooner.*

**Table Z10-AttC-2 EOR Deliverables Schedule**

| **DISCIPLINE** | **REVIEW (%)** | | |
| --- | --- | --- | --- |
|  | **30** | **60** | **90** |
| **GENERAL** |  |  |  |
| 30% review comments addressed[[5]](#footnote-5) |  | **X** |  |
| 60% review comments addressed5; design complete |  |  | **X** |
| **General (Division 01) Specs** |  |  |  |
| See General Requirements table above for spec maturity at 60% and 90% |  | **X** | **X** |
| **Other** |  |  |  |
| When IBC/IEBC, Design Professional in Responsible Charge designation form (ESM Chapter 16, IBC-GEN, Form 3) final | **X** |  |  |
| When IBC/IEBC, (1) Test and Inspection Requirements (TIP or VIT) and (2) Statement of Special Inspections when required by ESM Chapter 16, IBC-GEN; ref. IBC-IP Att. B and I |  |  |  |
| Preliminary |  | **X** |  |
| Final |  |  | **X** |
| Clearly-defined testing requirements and acceptance criteria for the safety and functionality of all subsystems |  |  | **X** |
| Design verification evidence document meeting NQA-1 or DOE O 414.1, e.g., Design Verification Matrix and/or Design Verification Report[[6]](#footnote-6) including design review documentation, qualification test plans and results, and alternate calculations. Where DV approach includes individual design deliverables reflecting peer-type DV review, evidence of same should be on each final (e.g., 90% deliverable), including those listed herein. Projects subject to ESM Ch 20 have additional DV requirements. |  |  | **X** |
| **Project Equipment List** (MEL input, per Z10 and ESM Ch. 1 Section 200) | | | |
| Equipment identification numbers chosen with concurrence by LANL system engineers (and on P&IDs) | **X** |  |  |
| Preliminary – major equipment pieces as a minimum with MLs |  | **X** |  |
| Final including all known components (may lack unknown data for constructor-supplied SSCs) |  |  | **X** |
| **Project Document List** (per Z10) |  |  |  |
| Documents in process to date |  | **X** |  |
| Documents in process or issued to date |  |  | **X** |
| **Facility Design Description and/or System Design Descriptions** (if required for project, e.g., by Z10 App B or ESM Chapters 10–Hazardous Process or 12–Nuclear) |  |  |  |
| Preliminary – major systems described conceptually, preliminary design criteria and constraints, and other data indicated for this phase (by DOE-STD-3024, *Content of System Design Descriptions* and/or Z10 App D on FDDs). | **X** |  |  |
| Updated – major system descriptions matching drawing representations and complete design criteria and constraints; minor systems described conceptually and have preliminary design criteria and constraints, other data per drivers listed at “preliminary.” |  | **X** |  |
| Final – SDDs and all FDD information per drivers listed at “preliminary.” |  |  | **X** |
| For existing and new facilities requiring (re)configuration of floor plan(s) notify the ES-DE POC for Record Floor & Emergency Evacuation Plans updating |  |  | **X** |
| **DEMOLITION** |  |  |  |
| **Demo Drawings**  Demolition drawings, if applicable, prepared using digital photographs of existing facility structures, systems & components (including security) as base drawings to the maximum extent practicable. Items to be removed or demolished to be indicated by annotation or editing of the photographs (government camera, DC/RO approved-release) |  |  |  |
| Preliminary layout drawings and elevations with pictures of existing inserted | **X** |  |  |
| Fully annotated drawings with details for demolition of critical SSCs |  | **X** |  |
| Fully annotated drawings with details for demo and/or temporary support of critical SSCs |  |  | **X** |
| **Demo Calculations (partial and entire buildings)** |  |  |  |
| Preliminary structural calcs for any temporary shoring or structures required | **X** |  |  |
| All calcs complete, checked, cross-discipline coordinated, and ready for LANL acceptance |  | **X** |  |
| **Demo Specs** |  |  |  |
| See General Requirements table above for spec maturity at 60% and 90% |  | **X** | **X** |
| **CIVIL** |  |  |  |
| Site survey to establish existing site grading, drainage, structure locations, existing overhead and underground utilities, and special site conditions and/or constraints | **X** |  |  |
| Existing site conditions plan with locations of existing buildings, structures, existing contours, and drainage features | **X** |  |  |
| Preliminary site grading and drainage plan with establish building location and orientation, access roads, parking location, and finish floor elevations | **X** |  |  |
| **Civil Calculations** |  |  |  |
| Preliminary, for topics described in ESM Chapter 3, Civil | **X** |  |  |
| All design calcs, including, but not limited to, the following: |  | **X** |  |
| Drainage calcs and hydrologic analysis, where applicable |  | **X** |  |
| Earthwork calcs of cut and fill volumes with applicable cross sections |  | **X** |  |
| Pressure, demand, and capacity analysis for sizing and material proposed in the utility system improvements |  | **X** |  |
| Pavement design calcs |  | **X** |  |
| Road design calcs including horizontal and vertical alignment, curve data, super elevation, minimum sight distances, and pavement thickness |  | **X** |  |
| Traffic counts and future volume projections to a traffic impact analysis and to establish design parameters as required |  | **X** |  |
| All calcs complete, checked, cross-discipline coordinated, and ready for LANL acceptance |  |  | **X** |
| **Civil Drawings** |  |  |  |
| Preliminary plan view of proposed improvements including geometry, typical sections, pavement sections, site grading and drainage, utility locations with applicable clearance offsets. For new construction/Guiding Principles-applicable facility, document the site is not in the floodplain and design is EISA 438 compliant. | **X** |  |  |
| Plan view of proposed site grading and drainage improvements identifying locations of roads, curb and gutter, parking areas, sidewalks, buildings and structures |  | **X** |  |
| Roadway or drainage structure plan and profile sheets with appropriate horizontal and vertical design information |  | **X** |  |
| Utility plan sheets identifying the proposed improvements with existing utilities clearly identified in locations where conflicts could exist |  | **X** |  |
| Profile for (gravity) sanitary sewer or steam and condensate lines |  | **X** |  |
| Details if required |  | **X** |  |
| Final |  |  | **X** |
| **Civil Specs** |  |  |  |
| See General Requirements table above for spec maturity at 60% and 90% |  | **X** | **X** |
| Commissioning Plan for utilities ready to issue for approval |  |  | **X** |
| **ARCHITECTURAL** |  |  |  |
| **Architectural Calculations** |  |  |  |
| Completed Design Criteria (Including Life Safety and IBC/IEBC Code Analysis, ADA requirements, Sustainable Design) (LANL will provide initial IEBC Alteration Level and ICSSC RP-8 seismic risk analysis determinations) | **X** |  |  |
| Updated Design Criteria if required |  | **X** |  |
| All calcs complete, checked, cross-discipline coordinated, and ready for LANL acceptance. See Fire section for code analysis. |  |  | **X** |
| **Architectural Drawings** |  |  |  |
| Plan layouts and exterior elevations—preliminary | **X** |  |  |
| Updated version of 30% plan layouts and exterior elevations; preliminary wall sections and details ADA requirements finalized |  | **X** |  |
| Preliminary landscaping plans and schedules |  | **X** |  |
| All plans, elevations, sections, details, interior elevations, and schedules completed, authorized, and ready to issue for approval |  |  | **X** |
| **Architectural Specs** |  |  |  |
| See General Requirements table above for spec maturity at 60% and 90% |  | **X** | **X** |
| Test and inspection requirements for arch systems including roofing |  |  | **X** |
| **STRUCTURAL** |  |  |  |
| **Design Basis Document** (ref LANL ESM Chapter 5, Sect I) |  |  |  |
| Draft with building function, design methodology, performance category, hazard category, acceptance criteria, etc. | **X** |  |  |
| 30% review comments addressed |  | **X** |  |
| 60% review comments addressed, complete |  |  | **X** |
| **QA Plan for Structural Design** (ref LANL ESM Chapter 5, Sect I) |  |  |  |
| Final | **X** |  |  |
| Statement of Special Inspections (see GENERAL above) |  |  |  |
| Statement identifying the frequency and extent of the structural observation per IBC 1704.6 |  | **X** |  |
| **Structural Calculations** (ref LANL ESM Chapter 5) |  |  |  |
| Foundation description and preliminary sizing (e.g., footings, mats, slabs, piles, tie-beams, etc.) |  | **X** |  |
| Superstructure description and preliminary sizing (e.g., concrete or steel, cast-in-place vs pre-stress, lateral force resisting system, demonstration of complete load path, etc.) |  | **X** |  |
| Structural anchorage design (see also topic under Drawings below) |  | **X** |  |
| Descriptions of special structural considerations | **X** |  |  |
| Completed structural scheme with all members sized |  | **X** |  |
| Calcs or manufacturer’s catalog data validating sizing and selection of all components |  | **X** |  |
| Secondary component designs (e.g., base-plates, seismic bracing, support stands, etc.) |  | **X** |  |
| Foundation design(s) |  | **X** |  |
| All calcs complete, checked, cross-discipline coordinated, and ready for LANL acceptance |  |  | **X** |
| **Structural Drawings** (ref LANL ESM Chapter 5) |  |  |  |
| Preliminary floor plans and cross-sections | **X** |  |  |
| Complete and accurate with correct dimensions, tolerances, detail references, general and keyed notes and compatibility with other disciplines |  | **X** |  |
| Beam, column and footing schedules as applicable |  | **X** |  |
| Secondary component details |  | **X** |  |
| Foundation details |  | **X** |  |
| Anchorage details, including main structural framing and non-structural components (including, for existing concrete: strength, thickness, and min. embedment depth as required by ICC-ESR).  NOTE: Non-structural component anchorage design of major equipment may be deferred to after procurement; distribution systems like HVAC duct or electrical may be deferred to shop drawings submitted prior to installation. In either case, deferment shall be noted in EOR’s design. |  | **X** |  |
| Reinforcement and connection details, including bolt and weld sizes |  | **X** |  |
| Final (ensure notes give accurate instructions including SFRS indicated, AWS D1.8 welds, NDE, pointer to SSI document—and/or requirement that shop dwgs contain this) |  |  | **X** |
| **Structural Specs** (ref LANL ESM Chapter 5, Sect I) |  |  |  |
| See General Requirements table above for spec maturity at 60% and 90% |  | **X** | **X** |
| **HVAC** |  |  |  |
| **HVAC Calculations** |  |  |  |
| Preliminary HVAC heating and cooling loads corrected for altitude, and meeting ASHRAE 55. | **X** |  |  |
| Preliminary ASHRAE 62.1 ventilation calcs with exhaust, outside air and building pressurization requirements | **X** |  |  |
| Preliminary duct sizing calcs including system pressure drops | **X** |  |  |
| Energy conservation/sustainable design analysis (see Ch 14 Sust. Design deliverables) |  |  |  |
| EISA 523 Life Cycle Cost Analysis or design for a solar hot water system to provide at least 30% of the domestic hot water for the facility. | **X** |  |  |
| Updated and resolving/addressing comments from the 30% design |  | **X** |  |
| All calcs complete, checked, cross-discipline coordinated, and ready for LANL acceptance |  |  | **X** |
| **HVAC Drawings** |  |  |  |
| Preliminary mechanical symbols and legend | **X** |  |  |
| Preliminary HVAC floor plans showing major equipment, duct runs, and VAVs/heating coils | **X** |  |  |
| Preliminary HVAC plans showing office layout and equipment room, major equipment, penetrations, and pipe/duct runs | **X** |  |  |
| Preliminary PFDs/airflow diagrams including major equipment, supply & return diffusers, transfer grills, dampers, VAV/reheat coils, airflow rates, and facility/room pressurization requirements | **X** |  |  |
| Preliminary P&IDs including major system equipment, control devices, control wiring & logic, and sequence of operation – and revisions under change control. | **X** |  |  |
| Preliminary equipment schedule including all major equipment with significant operating parameters and equipment specs | **X** |  |  |
| Drawings updated and that resolve/address comments from the 30% design |  | **X** |  |
| Preliminary mechanical sections, elevations, and details |  | **X** |  |
| Complete P&IDs and PFDs, revisions under change control. |  | **X** |  |
| All other drawings complete, authorized, and ready to issue for approval |  |  | **X** |
| **HVAC Specs** |  |  |  |
| See General Requirements table above for spec maturity at 60% and 90% |  | **X** | **X** |
| **PIPING AND PLUMBING (see also Pressure Safety section below)** |  |  |  |
| **Piping Calculations** |  |  |  |
| Preliminary piping system calcs including flow rates, pipe sizing with friction factors, velocities, expansion/contraction and system equipment pressure drops for pump selection | **X** |  |  |
| Preliminary plumbing systems calcs including the water supply and drainage fixture unit requirements per the UPC | **X** |  |  |
| Preliminary roof drainage system calcs sized per the requirements of ESM, Chapter 6 (ref. D2040 §10A in Section D20 r6) | **X** |  |  |
| Preliminary natural gas system calcs including flow rates and pipe sizing per the requirements of UPC, UMC, and NFPA 54 | **X** |  |  |
| Preliminary steam/condensate system calcs incl. flow rates and pipe sizing | **X** |  |  |
| Preliminary Plumbing Equipment Schedule including all major equip. and fixtures | **X** |  |  |
| Updated and resolve/address comments from the 30% design |  | **X** |  |
| All calcs complete, checked, cross-discipline coordinated, and ready for LANL acceptance |  |  | **X** |
| **Piping Drawings** (refer to the LANL Standard Details for mechanical) |  |  |  |
| Preliminary heating water P&ID – and revisions under change control | **X** |  |  |
| Preliminary chilled water P&ID (as necessary) – and revisions under change control | **X** |  |  |
| Preliminary process P&ID – and revisions under change control | **X** |  |  |
| Preliminary piping & plumbing Symbols and Legend (see app. E1 to E3 of the LANL Drafting Manual) | **X** |  |  |
| Preliminary Plumbing and piping-related Floor Plans including office layout, restrooms, janitor’s closets and equipment room, major equipment locations, fixture locations, and distribution and vent piping; enlarged plans may be required to clearly show the plumbing systems in certain areas, e.g. equipment rooms (coordinate with Architectural for ADA requirements) | **X** |  |  |
| Preliminary Plumbing Diagrams including riser diagrams for the potable water system, sanitary waste/vent system, roof drainage, and make-up water system. Major equipment, fixtures, and piping included on the riser diagrams | **X** |  |  |
| Preliminary HVAC Piping Plans including all major equipment, pipe runs, pipe sizes (including refrigerant), and water flow rates. Enlarged plans may be required to clearly show the systems in certain areas, e.g., equipment rooms | **X** |  |  |
| Preliminary Piping Plans Enlarged plans may be required to clearly show the systems in certain areas, e.g., equipment rooms | **X** |  |  |
| Complete P&IDs – revisions under change control (locked down) |  | **X** |  |
| Preliminary Plumbing Details include major equipment requirements and specialties, e.g. backflow preventer installation assemblies, PRV piping details, floor drain details, and cleanout details |  | **X** |  |
| Floor Plans – under change control (locked down) |  | **X** |  |
| Piping Plans -- Enlarged plans as required to clearly show the systems in certain areas, e.g., equipment rooms |  | **X** |  |
| Piping Details -- include major equipment requirements and specialties, e.g., pressure vessels, boilers, air receivers, and pressure relief devices piping details |  | **X** |  |
| P&ID – Final |  |  | **X** |
| Floor Plans – Final |  |  | **X** |
| Piping Details -- Final |  |  | **X** |
| **Piping Specs** |  |  |  |
| See General Requirements table above for spec maturity at 60% and 90% |  | **X** | **X** |
| **PRESSURE SAFETY** |  |  |  |
| **Pressure Safety Implementation Plan** (determination of code of record, roles and responsibilities, documentation requirements as defined in the ESM Chapter 17) |  |  |  |
| Initial | **X** |  |  |
| Final draft |  | **X** |  |
| Final |  |  | **X** |
| **Calculations** |  |  |  |
| Preliminary piping system calcs including flow rates, pipe sizing with friction factors, velocities, expansion/contraction and system equipment pressure drops for pump selection, compressor and pressurized gas systems (bottle or cryogen) | **X** |  |  |
| Pressure systems calcs — preliminary | **X** |  |  |
| Equipment schedule including all major equip. and fixtures — preliminary | **X** |  |  |
| Natural gas system calcs including flow rates and pipe sizing per the requirements of 40 CFR 192 and ASME B31.8 — preliminary | **X** |  |  |
| Updated and resolve/address comments from the 30% design |  | **X** |  |
| Pressure safety calcs and other documentation for piping and vessels per ESM Chapter 17 |  | **X** |  |
| All calcs complete, checked, cross-discipline coordinated, and ready for LANL acceptance |  |  | **X** |
| **FIRE PROTECTION** |  |  |  |
| **NOTE:** Detailed alarm and sprinkler system design, installation (shop or working) drawings, and calcs are typically prepared by the installing sub-contractor after the construction contract is let. These plans are reviewed and approved by LANL as required deferred design submittals prepared in accordance with the applicable NFPA codes and standards. If being deferred/delegated, note as such in design. Basic fire protection performance criteria and details cannot be deferred, and shall be captured in the Title II design documents to direct the detailed (Title III) designs. |  |  |  |
| **Summary of Scope**  Location, size, number of stories, construction, and occupancy and hazard classification of buildings and; identification of locations to be provided with fire protection and fire alarm systems. | **X** |  |  |
| **Fire Calcs** |  |  |  |
| **Note:** Calculations in Title II are required to establish the capabilities of the service supplying the downline fire protection system. Preliminary fire protection system calculations are necessary to ensure feasibility When the detailed design is not deferred to Title III, the calculations for fire protection systems required in Title II must be in accordance with the requirements of standard governing the detailed design. |  |  |  |
| Water supply calculations for new water sources and/or distribution | **X** |  |  |
| Hydraulic calculations for fire suppression systems (e.g., sprinkler, standpipe). | **X** |  |  |
| Fire alarm calculations (e.g., battery loads, voltage drops, circuit impedance). | **X** |  |  |
| Occupant load, egress capacity, and related calculations. | **X** |  |  |
| Calculations for any special fire protection systems (e.g., smoke control/removal, special hazard, performance-based calculations, etc.). | **X** |  |  |
| Emergency lighting calculations (interior). | **X** |  |  |
| Emergency lighting (exterior). |  | **X** |  |
| Updated to resolve/address comments from the 30% design. |  | **X** |  |
| Updated to resolve/address comments from the 60% design, complete, checked, cross-discipline coordinated, and ready for approval. |  |  | **X** |
| **Fire Drawings** |  |  |  |
| Building plans show building layout, vertical openings, fire or smoke rated walls/barriers/partitions. | **X** |  |  |
| Site plan showing size, type and location of underground water mains and location of hydrants, sprinkler system lead-ins, and sectional valves; and fire department access roadways. | **X** |  |  |
| The architect’s code analysis with applicable codes of record, IBC construction type, IEBC Alteration Level and IBC and NFPA 101 occupancy classification, and additional code analysis as required to demonstrate design compliance. (The scope and scale of the project dictates the contents and level of detail of the code analysis. See ESM Ch. 2 Fire Protection *Section 5.0 Design Documents.*) | **X** |  |  |
| Performance criteria of fire alarm, fire detection, fire suppression, and other fire protection and life safety systems identified and shown on fire protection drawings | **X** |  |  |
| Life safety plans, showing (as necessary for scope and scale of project). | **X** |  |  |
| Fire protection requirements shown in coordination with other discipline (e.g., HVAC, architecture) drawings. | **X** |  |  |
| Further detailing of information in life safety plans or other coordinating with other discipline drawings, including details, system numbers, locations of all components and access panels. |  | **X** |  |
| Further detailing of fire protection and fire alarm drawings, including areas to be protected/covered (or areas exempt), features of construction impacting sprinkler or fire alarm detailed design, finalized interfacing and input/output function details. |  | **X** |  |
| All the above complete, checked, cross-discipline coordinated, and ready for approval |  |  | **X** |
| **Fire Specs** |  |  |  |
| See General Requirements table above for spec maturity at 60% and 90% |  | **X** | **X** |
| Specs for fire related construction features including rated walls, doors, and dampers |  | **X** |  |
| Specs for built-up roof construction, where used |  | **X** |  |
| Sprinkler systems  Specify type of system – (wet pipe, dry-pipe, deluge) how actuated; type, style, and temperature rating of sprinkler heads; hydraulic design criteria, (e.g., Ordinary Hazard, Group 2) Allowed types of pipe and fittings, backflow preventer, other equipment anticipated on the installation |  | **X** |  |
| For alarm systems: type of system, type of detectors, what calcs will be required, what interlocks are to be provided. |  | **X** |  |
| **FP Detailed Design / Shop Drawings (Typ. Deferred to Title III)** |  |  |  |
| **Fire Suppression/Sprinkler** |  |  |  |
| Complete drawings, including floor plans, section views, riser diagrams, details; and all piping, sprinkler heads, and valves. |  | **X** |  |
| Complete hydraulic calculations on all remote/design areas, including peaking analysis; all hanging (if required) and seismic bracing calculations. |  | **X** |  |
| Complete materials and equipment package with technical datasheets, and listing or approval certifications when required. |  | **X** |  |
| Drawings, calculations, and M&E updated to resolve/address comments from the 60% design, complete, checked, cross-discipline coordinated, and ready for approval. |  |  | **X** |
| **Fire Alarm/Detection** |  |  |  |
| Complete drawings, including floor plans, section views, riser diagrams, wiring diagrams, details, and input/output matrix; and all panels, devices, conduit, and conductors shown. |  | **X** |  |
| Complete hydraulic calculations on all remote/design areas, including peaking analysis; all hanging (if required) and seismic bracing calculations. |  | **X** |  |
| Complete materials and equipment package with technical datasheets, listing or approval certifications when required, and bill of materials. |  | **X** |  |
| Drawings, calculations, and M&E updated to resolve/address comments from the 60% design, complete, checked, cross-discipline coordinated, and ready for approval.  (Provide fire alarm panel program and installation instructions with 100% deliverable.) |  |  | **X** |
| **ELECTRICAL** |  |  |  |
| **Electrical Calculations** |  |  |  |
| Preliminary electrical load estimate for component sizes | **X** |  |  |
| Preliminary fault current calcs or 1st approximation/estimate | **X** |  |  |
| Interior lighting (daylighting calcs for a Guiding Principles-applicable Project) calcs complete | **X** |  |  |
| Preliminary paging system sound distribution calcs (if being deferred/delegated, note that) | **X** |  |  |
| Load study with best estimates; circuits sized and distribution components selected |  | **X** |  |
| Fault current calcs with best estimates |  | **X** |  |
| Voltage drop calcs with best estimates |  | **X** |  |
| Preliminary coordination study |  | **X** |  |
| Preliminary arc-flash hazard calculations |  | **X** |  |
| Exterior lighting calcs with best estimates |  | **X** |  |
| Paging system calcs complete; wiring sized and components selected (if being deferred/delegated, noted as such in design) |  | **X** |  |
| All calcs complete, checked, cross-discipline coordinated, and ready for LANL acceptance |  |  | **X** |
| **Electrical Drawings** |  |  |  |
| Preliminary site plan includes power and telephone service connection points and routing to project | **X** |  |  |
| Preliminary one-line diagram portrays service and distribution system arrangement | **X** |  |  |
| Preliminary power plans include electrical rooms and major electrical equipment locations | **X** |  |  |
| Preliminary enlarged electrical room plans show electrical service and distribution equipment and NEC required working spaces (if required) | **X** |  |  |
| Preliminary lighting plans include luminaire locations, type designators, and control device locations | **X** |  |  |
| Preliminary luminaire schedule includes basic descriptions of luminaires shown on the preliminary lighting plans | **X** |  |  |
| Preliminary paging system plans show speaker locations | **X** |  |  |
| Site plan further developed to include site lighting |  | **X** |  |
| One-line diagram further developed to show all component sizes and calculated fault currents |  | **X** |  |
| Power plans further developed to show receptacles, mechanical equipment, building equipment, user equipment, and preliminary branch circuiting |  | **X** |  |
| Final enlarged electrical room plans (if required) |  | **X** |  |
| Lighting plans further developed to show complete branch circuiting and lighting controls |  | **X** |  |
| Luminaire schedule further developed to include complete descriptions and catalog numbers of all luminaires |  | **X** |  |
| Paging system plans further developed to show speaker circuiting and equipment locations (if being deferred/delegated, noted as such in initial construction package and provided later) |  | **X** |  |
| Preliminary paging system riser diagram include paging controllers, amplifiers, speakers, and interconnections |  | **X** |  |
| Preliminary lightning protection system plans include locations of air terminals, main conductors, down conductors, ground ring, test wells, and surge protective devices (may not be delegated to construction Subcontractor) |  | **X** |  |
| Preliminary grounding diagram include main grounding electrode, main electrode ground bar, supplemental ground bars, and bonding locations for piping and structural steel |  | **X** |  |
| Preliminary motor control diagram created for typical each motor control configuration |  | **X** |  |
| Preliminary Panel Schedules created for each panel not detailed on the one-line. Include load descriptions and values. |  | **X** |  |
| Preliminary Nameplate Schedules including information required for equipment ID tags, category I nameplates, and arc-flash warning labels |  |  | **X** |
| All the above complete, checked, cross-discipline coordinated, and ready for approval |  |  | **X** |
| **Electrical Specs** |  |  |  |
| See General Requirements table above for spec maturity at 60% and 90% |  | **X** | **X** |
| **INSTRUMENTATION AND CONTROLS** |  |  |  |
| **NOTE:** Detailed control system design, installation drawings, and calcs are typically prepared by the installing subcontractor after the construction contract is let. If being deferred/delegated, note as such in design. |  |  |  |
| **I&C Calculations** |  |  |  |
| Preliminary device sizing calcs |  | **X** |  |
| Preliminary calcs for all engineered instrumentation devices |  | **X** |  |
| All calcs complete, checked, cross-discipline coordinated, and ready for LANL acceptance |  |  | **X** |
| **I&C Drawings** |  |  |  |
| Preliminary network drawing |  | **X** |  |
| Preliminary control or P&ID drawing for each system, nearly final, under change control | **X** |  |  |
| Preliminary sequence of operations |  | **X** |  |
| Preliminary BAS I/O list |  | **X** |  |
| Preliminary Instrument List |  | **X** |  |
| Preliminary Control Schematics (as required) |  | **X** |  |
| Preliminary instrument location drawing (may be on P&ID) |  | **X** |  |
| Complete P&IDs under change control |  | **X** |  |
| Drawings updated to portray complete scope of work and substantially complete |  | **X** |  |
| Completed instrument point list |  |  | **X** |
| Completed Instrument List |  |  | **X** |
| Completed instrument location drawing (may be on P&ID; include critical distances/diameters from bends, etc.) |  | **X** |  |
| Major control panels shown on mechanical and electrical drawings |  | **X** |  |
| Control power feeds shown on electrical floor plans and panel schedules |  | **X** |  |
| Finalized with Bill of Materials and ready to issue for approval |  |  | **X** |
| **I&C Specs** |  |  |  |
| Outline or preliminary specs, to include commissioning requirements including pre-functional testing, functional testing, and checklists, include start up and testing requirements. |  | **X** |  |
| See General Requirements table above for spec maturity at 60% and 90% |  | **X** | **X** |
| **Software QA/Control Documentation** |  |  |  |
| Development, operating, and verification documentation for any design agency developed process-operating software |  |  | **X** |
| **PHYSICAL SECURITY** |  |  |  |
| **Security Calculations** |  |  |  |
| Preliminary versions of any required calcs | **X** |  |  |
| All calcs complete, checked, cross-discipline coordinated, and ready for LANL acceptance |  |  | **X** |
| **Security Drawings (Note, device design/details normally by LANL)** |  |  |  |
| Prelim. Arrangement including fence, gate, barrier, PIDA(D)S, Limited Area, vault, VTR, and SCIF locations/boundaries | **X** |  |  |
| Preliminary security plans include room locations and preliminary cable tray routing | **X** |  |  |
| Updated security plans including rough-in/device locations, type designators, and circuiting |  | **X** |  |
| Device schedule including basic descriptions of devices shown on the preliminary plans |  | **X** |  |
| All the above complete, checked, cross-discipline coordinated, and ready for approval |  |  | **X** |
| **Security Specs** |  |  |  |
| See General Requirements table above for spec maturity at 60% and 90% |  | **X** | **X** |
| **TELECOMMUNICATIONS,  including Secure (design normally by LANL NIE-TS)** |  |  |  |
| **Telecom Calculations** |  |  | **X** |
| Preliminary versions of any required calcs | **X** |  |  |
| All calcs complete, checked, cross-discipline coordinated, and ready for LANL acceptance |  |  | **X** |
| **Telecom Drawings** |  |  |  |
| Preliminary site plan includes service connection points and routing to project | **X** |  |  |
| Preliminary plans including telecom room, rack locations, and preliminary cable tray routing | **X** |  |  |
| Updated telecom room plans include cable trays, receptacles, grounding, and equipment racks |  | **X** |  |
| Beyond-room plans showing telecom outlet locations and final conduit and cable tray routing |  | **X** |  |
| Telecom system riser diagram includes system from service to station outlets |  | **X** |  |
| All the above complete, checked, cross-discipline coordinated, and ready for approval |  |  | **X** |
| **Telecom Specs** |  |  |  |
| See General Requirements table above for spec maturity at 60% and 90% |  | **X** | **X** |
| **R&D AND PROGRAMMATIC** |  |  |  |
| Anchorage designs (see Structural) |  |  |  |
| Services hookup design (see Piping, Mechanical, Electrical, etc.) |  |  |  |
| **SUSTAINABLE DESIGN (SD; ESM Ch. 14)** |  |  |  |
| Guiding Principles Checklist (formerly “HPSB”) and/or LEED certification proposed credits worksheet based on applicability | **X** | **X** | **X** |
| Life cycle cost analysis reports for any Guiding Principles marked N/A due to cost. | **X** | **X** |  |
| Energy calculation showing 30% better than ASHRAE 90.1-2013 (or otherwise if not life-cycle cost-effective, but no less than meeting 90.1), reflecting architectural, mechanical, and electrical inputs | **X** | **X** | **X** |
| LEED registration - copy of application or USGBC webpage printout showing registered, when LEED is mandated | **X** |  |  |
| Specs modified as appropriate to incorporate SD acquisition requirements per ESM Ch. 14 |  |  | **X** |
| **COMMISSIONING (when required by ESM Chapter 15 or SOW)** |  |  |  |
| **Cx Plan** |  |  |  |
| Preliminary plan defining Cx authority, how authority will verify that design agency and constructor will implement the F&OR requirements, and addressing coordination of all disciplines from design through the construction and warranty periods (by LANL unless in SOW) |  | **X** |  |
| Finalized including list of design checklists, list of all Cx spec sections |  |  | **X** |
| **Cx Specs** |  |  |  |
| See General Requirements table above for spec maturity at 60% and 90% (Note: Cx submittal requirements shall be coordinated with project submittal procedures) |  | **X** | **X** |
| **Cx Procedures** |  |  |  |
| Completed Cx procedures and construction requirements including those for Division 01 and all applicable disciplines |  | **X** |  |
| Procedures complete, checked, cross-discipline coordinated, and ready for approval |  |  | **X** |
| **Cx Schedule** |  |  |  |
| Proposed Cx Schedule |  |  | **X** |
| **SYSTEMS ENGINEERING** |  |  |  |
| ESM Chapter 20 is applicable to capital projects over $20M total project cost modifying or building hazard category 1–3 nuclear facilities. Also, projects below those thresholds but subject to DOE O 413.3 implement it in a tailored fashion to meet the Order. Ch. 20 has a number of deliverables both during and at the conclusion of all project phases, and some correspond to the 30-60-90% design maturity deliverables (these are summarized in Ch. 20’s Table SE-PL-1 Summary for Chapter 20 Systems Engineering Deliverables). Projects subject to Ch. 20 shall deliver all required deliverables, and those tied to 30-60-90% milestones at those points. |  |  |  |
| **SOFTWARE** |  |  |  |
| For Non-SSC software (e.g., design): Summaries for potentially safety affecting – preliminary (ref. Ch. 21, SOFT-GEN [e.g., r1 article 2.1]) | **X** |  |  |
| For Non-SSC software (e.g., design): Summaries for potentially safety affecting – Updated (ref. Ch. 21, SOFT-GEN [e.g., r1 article 2.1]) |  | **X** |  |
| For Non-SSC software (e.g., design): 2033 forms for potentially safety affecting – Final |  |  | **X** |
| For SSC software, all documents required by Ch. 21, leaving approvals for LANL to complete -- Preliminary | **X** |  |  |
| For SSC software, all documents required by Ch. 21, leaving approvals for LANL to complete -- Updated |  | **X** |  |
| For SSC software, all documents required by Ch. 21, leaving approvals for LANL to complete -- Final |  |  | **X** |
| **ML-1 AND 2 NUCLEAR WORK** |  |  |  |
| **Drawings**: ML and/or SS/SC boundaries indicated |  | **X** |  |
| **Specs** |  |  |  |
| See General Requirements table above for spec maturity at 60% and 90% |  | **X** | **X** |
| Specs, using tracked changes from LANL masters, portraying complete scope of work, non-applicable sections removed; unedited masters are unacceptable. Include preliminary safety functions and critical characteristics except where latter are being developed by third party dedicator. |  | **X** |  |
| Specs, with continued use of tracked changes from 60%, complete, checked, cross-discipline coordinated, and ready for approval, including identification of safety functions and, where applicable, critical characteristics. |  |  | **X** |

1. **Design and other Tasks during Construction Phase**

As-builts: At the completion of construction, provide “as-built” record documents of key design outputs delivered—drawings, specs, SDDs, databases, and final calculations with verified assumptions.

**Deferred Design**

Deferral of design for the fabrication of (1) technical specialties (e.g., fire protection, controls, HVAC) and (2) nonstructural anchorage design for major equipment not selected by EOR or distribution systems (e.g., HVAC duct, field-routed raceway) may be completed after the 100% submittal if this approach is consistent with the ESM and SOW/Subcontract—and indicated on specs or drawings (e.g., “delegated to construction Subcontractor”). See table that follows. *Guidance: LBO may treat first submission as a 60% document from a review maturity standpoint using Section 01 3300; see ESM Chapter 16 IBC-GEN for additional requirements on deferred/delegated design.*

|  |
| --- |
| **Deferred Design Deliverables** |
| **Calculations** |
| Nonstructural anchorage |
| Fire suppression |
| **Drawings** |
| Nonstructural anchorage |
| Fire alarm |
| Fire suppression |
| Building automation systems |

*Further EOR scope of services during/after construction are addressed in ESM Chapter 1 Section Z10 and include such tasks as:*

1. *Review and approval of submittals including shop drawings and “or equal” substitutions;*
2. *Review and approval of deferred design;*
3. *RFI and SDDR review and dispositioning;*
4. *Review/comment on change order requests affecting scope or quality;*
5. *Review and approval of nonconformance reports with a use-as-is or repair disposition;*
6. *Creation, review, and/or disposition of design revision documents (DRN, FCR, etc.; ref. AP-341-519, Design Revision Control);*
7. *Seismic anchorage and bracing design of architectural, mechanical and electrical components (if not completed in design phase);*
8. *Structural observation where required by ESM Chapter 16, and work in general for other disciplines for conformance to design*
9. *LEED submittal handling per ESM Chapter 14 where required, and delivery of final certification. Final reports on guiding principles, IECC compliance, and energy efficiency when LEED is not required.*
10. *Project close-out activities which include participating in the final inspection; preparation of record documents including updated drawings, delivery of native CAD files, MDL/documents for EDMS, Project Equipment Listing, and assisting in completing the certificate of occupancy.*

**Record of Revision**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Rev** | **Date** | **Description** | **POC** | **RM** |
| 0 | 2/1/06 | Initial issue | Tobin Oruch,  *ENG-CE* | Mitch Harris,  *ENG-DO* |
| 1 | 10/27/06 | Added code analysis pg. 3 Arch design criteria | Tobin Oruch,  *CENG* | Kirk Christensen,  *CENG* |
| 2 | 6/16/08 | Added energy deliverables under Multi-Discipline heading. | Tobin Oruch,  *CENG* | Kirk Christensen,  *CENG* |
| 3 | 5/21/09 | Admin changes; was App. C | Tobin Oruch,  *CENG* | Gary Read,  *CENG* |
| 4 | 8/25/10 | FCN Criteria doc. 90% expectations. | Tobin Oruch,  *CENG* | Larry Goen,  *CENG* |
| 5 | 5/16/13 | Dropped 15% column. Added phasing, deferred design, spec expectations, IBC/IEBC forms, submittal schedule input, struct obs, arc-flash calcs, fire alarm, security, Cx, ML1-2, Title 3. Other minor updates. | Tobin Oruch,  *ES-DO* | Larry Goen,  *ES-DO* |
| 6 | 3/23/15 | Changes on threshold for use, specs maturity, electrical deliverables, pressure safety, telcom. | Tobin Oruch,  *ES-DO* | Mel Burnett,  *ES-DO* |
| 7 | 11/28/18 | Separated LANL instructions for usage/editing of template from design agency direction. Added design verification, test/acceptance, TIP, SE, and software expectations; other minor changes throughout. | Tobin Oruch,  *ES-FE* | Larry Goen,  *ES-DO* |
| 8 | 05/09/21 | Evaluated deliverables based on required dependencies and adjusted accordingly.  Added guidance for pre-30% deliverable development to help ensure 30% deliverables are delivered on time.  Deleted spec-related requirements at 30%. Major changes for fire protection, pressure safety. Added direction on deferred designs. Other minor changes throughout. | Tobin Oruch,  *ES-FE* | Jim Streit,  *ES-DO* |

1. SD350 GPP/IGPP lower limit; an appropriate threshold for use of this approach. $500K comes from the DOE Financial Management Accounting Handbook Chapter 10, and brought forward in the LANL CFO procedures CFO-B3032 and CFO-B3049. [↑](#footnote-ref-1)
2. (A) LINE ITEMS: With a line item, a CDR is produced for CD-1 (normally 30% of the overall project design effort), an EOR performs CD-2/3 design, LANL wishes to review their effort at 3 points, and calls those 30/60/90 (same with GPPs that normally don’t do much conceptual).  So for LIs, 30/60/90 reviews are really a rough division of the given EOR effort, not the overall project design effort/maturity; the reviews are probably closer to 50/70/90% of start-to-finish design effort, but we don’t confuse matters by calling them that. The 2018 [Raines memo](https://www.lanl.gov/orgs/eng/engstandards/esm/general/Raines-memo-2018-5-1.pdf) on NNSA line items also addresses CD-0 and CD-1 deliverables.

   (B) GENERAL: Guidance on expectations for design and other project documentation deliverables not addressed in ESM is available in (1) [DOE G 413.3-12, U.S. Department of Energy Project Definition Rating Index Guide](https://www.directives.doe.gov/directives/0413.3-EGuide-12) and (2) the maturity matrices at the end of AACE 56R-08: Cost Estimate Classification System - As Applied for the Building and General Construction Industries (Rev. Dec. 5, 2012) ([www.aacei.org](http://www.aacei.org/), by purchase or Chapter POC). [↑](#footnote-ref-2)
3. Alt 2B and higher means the project is in the highest risk category per ESM Ch. 16 IBC-GEN (ref. r11, Table IBC-GEN-3 Three-Tiered Graded Approach, Part 2 of 2). [↑](#footnote-ref-3)
4. Note: For nuclear projects over $10M, DOE defines minimum maturity expectations for CD-2 (approval to construct) as a 90% deliverable (80-90% for non-nuclear); this recognizes that true 100% design is achieved when design activities during construction are complete. This LANL document does not conflict with that idea; when this gives percentages including 90 and 100%, it is referring to the completeness percentage of the package needed for the building official to permit construction start, recognizing that deferred design occurs afterwards. DOE mandates: DOE-STD-1189 and/or DOE O 413.3. [↑](#footnote-ref-4)
5. I.e., formal written responses to all comments, all compliance comments resolved, all others dispositioned as necessary. [↑](#footnote-ref-5)
6. ESM [Ch 20](https://engstandards.lanl.gov/ESM_Chapters.shtml#esm20) Systems Engineering describes these DV concepts, includes a sample matrix. When in-house design, follow AP-341-620 process instead. [↑](#footnote-ref-6)