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This mandatory functional series document is available online at http://engstandards.lanl.gov.

It derives from P342, Engineering Standards, which is issued under the authority of the Associate Director of Engineering and Engineering Sciences (ADE) as part of the Conduct of Engineering program implementation at the Laboratory.

Please contact the ESM General POC for interpretation, variance, and upkeep issues.

Z1010 ADMINISTRATION (R&D/PROGRAMMATIC & FACILITY[1])

Where appropriate throughout the ESM, guidance is provided to aid in the implementation of requirements. Guidance will be *italicized* text or otherwise clearly indicated (e.g., by headings). All other text (plain type) indicates mandatory requirements unless prefaced with wording identifying it as guidance or a recommendation. Italics used in the title of a document after its number is not in and of itself indicative of guidance.

1.0 CODES AND STANDARDS

A. Follow the ESM Introduction at http://engstandards.lanl.gov/ESM_Chapters.shtml

B. Contract: Comply with the applicable portions of the latest edition of each code, standard, DOE Order, and other document invoked by the ESM, design and/or build subcontract, and the LANS contract (*most in Appendix G)* unless the ESM or AE contract indicates a different edition [referring here to actual ESM requirements (e.g., adoption of IBC-2006 specifically), not citations of code editions in footnotes, endnotes, or other ESM references/commentary].[2]

1. For App G matters, the ESM is designed to implement the majority of directives relating to design; however, projects are responsible to ensure they comply with App G and the LANS Contract. Best (internal): http://int.lanl.gov/orgs/pcm/. External: http://www.doeal.gov/laso/NewContract.aspx [3]

C. Federal: Follow all laws and applicable Codes of Federal Regulation (CFRs)[4], latest edition. Follow Executive Orders only when mandated by DOE or LANL documents[5]. If 10CFR851 or the LANL/DOE or project contract states a later edition than the ESM, then that governs; conversely, if the ESM or project contract states a later edition than the CFR, then the ESM or contract governs [e.g., NFPA 70 edition shall be per ESM Ch 7; ASME code editions per ESM Ch 17 (*i.e., latest*)]. *Rules, Orders, and Laws can be found at:* http://www.lanl.gov/orgs/eng/engstandards/helpful_links.shtml.

D. State and Local: Comply with applicable laws and regulations. *Guidance: There may be statutory exemptions or other legal exclusions under which certain laws or regulations may not apply to LANS. Therefore, one must be careful in determining with which state and local*

[1] This parenthetical indicates that Z1010 applies to both programmatic and facility work (except for topics obviously directed to one type or the other). This heading convention is used throughout the ESM.
[2] A/E contracts shall call for edition required by ESM; to do otherwise is an ESM non-compliance.
[3] The DOE Directives system is explained briefly and well here
[4] CFRs are self-invoking federal agency requirements that have the force of law
[5] EOs are mandates to Federal agency heads who must then direct their departments to comply through Order or other directive. LANS follows such implementing directives when imposed, not the EO itself unless invoked by reference in the directive.

laws LANS need comply. If there is any question as to whether specific laws and regulations apply to LANS, confer with LANL Legal Council.[6]

1. The New Mexico building codes must be followed[7] as modified below. Thus, comply with the NM Commercial Building, Electrical, Fire, Energy, Plumbing, and Mechanical Code versions in the NM Administrative Code; however:
   a. NM amendments that strengthen the model codes on which they are based must be followed unless specifically excluded by the LANL Standards.
   b. NM Code relaxations versus the model codes cannot be taken unless specifically and unambiguously referenced/adopted by the ESM chapters.[8]
   c. Where LANL standards are more stringent than the NM codes, LANL documents govern. As examples, LANL currently adopts the model building codes in ESM Chapter 16 IBC Program with strengthening amendments; such LANL modifications must be followed. Likewise, for new buildings, LANL follows DOE energy mandates (see ESM Ch 14) that are generally more stringent than the NM Energy Conservation Code.
   d. Where a LANL standard may be less stringent than NM code, follow the more stringent State requirements.
   e. *The affected Standards Discipline POCs should maintain awareness of NM building code provisions affecting LANL projects.*

E. National consensus codes and standards and DOE standards, guides, and handbooks: If an entire document is required by the ESM or contract then its "shall" statements must be followed if applicable — and its "should" statements either followed or the reason for not following them documented and accepted by the Design Authority Representative (same as "shall consider" definition). If the ESM or LMS specifically mandates selected sections (including optional/non-mandatory sections or appendices) of national/DOE-type documents, then those sections obviously become required.[9]

1. Tentative Interim Amendments to NFPA documents[10] and all errata (correct errors) to any document are mandatory regardless of contract award date (see Code of Record subsection later). Other interim updates such as addenda and supplements to national consensus standards (but not building codes[11]) shall likewise be considered adopted upon issue.

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[6] From LANS Contract Section I Page 44; "I-123 DEAR 970.5204-2 LAWS, REGULATIONS, AND DOE DIRECTIVES (DEC 2000) (DEVIATION) (a) In performing work under this contract, the contractor shall comply with the requirements of applicable Federal, State, and local laws and regulations (including DOE regulations), unless relief has been granted in writing by the appropriate regulatory agency." This is consistent with GSA policy in P100.

[7] Per Ritschel, 5/30/2007, LC-BL 07-005, re NM Building Code applicability (EMRef-55), LANL is subject to the NM-specific Codes to the extent they do not conflict with other laws or LANL or DOE directives, but not the enforcement activities of the Construction Industries Division that oversees them. This is corroborated by Technical Position NSEP-TP-2007-1: *Technical Position on the Requirement in DOE O 420.1B to Use National Consensus Industry Standards and the Model Building Codes*, which is a contractual document as are all TP per Prime Contracts.

[8] Since this would require DOE approval per NSEP-TP-2007-1.

[9] Driver for use of national standards (until captured in P342): DOE O 252.1A CRD states: "…the contractor, when...selecting technical standards for use to support assigned DOE missions and functions, must: 1. Select, use, and adhere to appropriate voluntary consensus standards (VCSs), except where use of VCSs is inconsistent with law or impractical…

[10] NFPA states: "An official NFPA Document at any point in time consists of the current edition of the document together with any Tentative Interim Amendments and any Errata then in effect."

[11] Unless NM adopts. An example is ASHRAE 90.1 which is under continuous maintenance through addenda (in this particular case the ESM requirements in Ch 14 relate to an older edition, at time of writing). NFPA states: "An official NFPA Document at any point in time consists of the current edition of the document together with any Tentative Interim Amendments and any Errata then in effect."

2. Official interpretations shall be utilized as if written in the ESM/code/standard itself[12].

F. Online Codes and Standards: Free access to many national codes and standards is available to those with a LANL IP address (or token card) at: http://library.lanl.gov/infores/stand/

G. NFPA: Comply with all NFPA codes and standards except NFPA 5000. For NFPA 70 (NEC), follow edition required by ESM Chapter 7.[13]

1.1 LANL Engineering Standards

A. LANL Engineering Standards Manual (ESM), STD-342-100[14]

This Section's numbering (Z10, Z1010, etc.) and most other chapters are organized by the UNIFORMAT II 1998 system promulgated by the Construction Specifications Institute (CSI), described in ASTM E 1557, and summarized in ESM Chapter 12, Nuclear, App A.

B. LANL Master Specifications Manual (LMS), STD-342-200

1. See Subsection on Specifications later in this Section Z10.
2. R&D/Programmatic work: LMS sections required for R&D or programmatic work are those referenced in ESM sections designated as such in their headings or otherwise.
3. *The LMS sections were renumbered to the CSI MasterFormat 2004 system in February 2006. Crosswalks between old and new numbers/titles are on the specs webpage.*

C. LANL Drafting Standards Manual (DSM), STD-342-300

1. Comply with the DSM when creating or revising drawings for facility work or R&D or programmatic systems similar to facility systems (see DSM for details). *This manual does not address weapons or R&D or programmatic component design work.*

D. LANL Standard Drawings and Details, STD-342-400

1. This includes Example Drawings and the "ST-" series repeatable details.
2. Comply with Standard Detail Drawings unless indicated as guidance in the ESM. Edit the details to reflect the particular details of the work by delete portions that in no way apply. Do not delete potentially-applicable requirements without ESM Discipline POC approval.
3. CAUTION: Example drawings depict required content and format with potentially mock data and so, unlike Standards Details, are not necessarily valid design templates.

E. LANL Design Guides, STD-342-500

1. This is a non-mandatory collection of guides available to LANL internal network users that may be useful in designing certain facility, R&D, or programmatic systems or components.

[12] Code and standard users are not expected or required to locate and manage all such interpretations; however, they must follow same for any identified by the ESM, POC, or SMPO.
[13] Mandate of 10CFR851
[14] The LANL eng stds material originated in the 1980s. In 1998, LIR 220-03-01 established the FEM etc. In 2003, FEM renamed LEM, later ESM (OST220-03-01-ESM, etc.). LIR became IMP342, ESM was renumbered ISD 342-1 in 2005, then ISD 341-2 in 2006. The IMP became PD342 in 2009; became P342 in 2010 (this created STD-342-100 etc.)

2.0 CLARIFICATIONS, ALTERNATES, VARIANCES, AND NONCONFORMANCES

2.1 Clarifications and Interpretations

A. *SMPO: LANL Safety Management Program Owners (SMPO) are responsible for the technical content of the LANL Standards. They have delegated various authorities to SMPO Representatives (SMPOR, better known as POCs).*

B. *Standards users should contact the Standards Discipline POCs first for assistance. Standards webpages and ESM documents list contact information (contact Alternates only when primarily is unavailable in necessary timeframe). For larger projects, ADPMSS procedures for RFIs (e.g., CMP 300) may dictate communication pathways.*

C. *Informal "staff opinions" may be requested by and responded to via phone or email. Responses should include a statement such as "This staff opinion is for informational purposes only."*

D. Official clarification and interpretation requests may only be submitted by LANL personnel and require the use of LANL Form 2176, *CoE Formal Clarification or Interpretation Request* in accordance with Table Z10-1 below.

E. *The POC may respond directly to interpretations and clarifications, or first call upon the assistance of others including their technical committee. Responses should be copied to the ESM Standards Manager and tech committee when significant or of interest.*

General-interest (non-project-specific) interpretation, clarification, and variance documents are normally posted for viewing on the LANL web until such time the variance is no longer relevant (e.g., the ESM is revised to incorporate it).

2.2 Alternate Methods, Variances, and Non-Conformances

A. Personnel must not deviate from the LANL Standards in developing the technical requirements (including programming, functions & requirements, and requirements & criteria documents), in design, in practice (execution), or in written direction to any LANL entity or subcontractor unless the Standards Program has formally granted such variance as described below.

B. Forms and authorities for alternate methods and variance are summarized in Table Z10-1.

Table Z10-1 Standards Clarification, Interpretation, Alternates, and Variances — Methods, Approvals, and Appeals

	LANL Spec, Standard Detail or Procedure, or Drafting Manual (Non-Code/Non-Regulation)			Engineering Standards Manual or Code or Regulation Matter where Authority IS Delegated to LANS			Prime Contract Compliance Matter where Authority is NOT Delegated to LANS		
	Method	**Issuing Authority**	**Appeals**	**Method**	**Issuing Authority**	**Appeals**	**Method**	**Issuing Authority**	**Appeals**
Staff Opinion	Phone or Email	POC	N/A	Phone or Email	POC	N/A	Phone or Email	POC	N/A
Formal Clarification or Interpretation	Form 2176	POC	SMPO	Form 2176	SMPO	Progressively higher levels of management	Form 2176	SMPO	Progressively higher levels of management or DOE
Alternate Method or Variance (prior to work)	Form 2137	POC	SMPO	Form 2137	SMPO	Progressively higher levels of management	Form 2137 + P 310-1, *Exemptions to Appendix G Requirements or* 10CFR851 variance website; etc.	SMPO + DOE Los Alamos Site Office or higher	DOE HQ
Alternate Method or Variance (after work is submitted for acceptance)	Same as above, but also requires an NCR								

Staff Opinion	Informal assistance from Standards Program staff (POCs) for informational purposes only. For official direction use LANL Form 2176.
SMPO, SMPOR	The Safety Management Program Owner (SMPO) is the technical authority. The POC is the SMPO representative. Both are listed on the Standards POC webpage.
Clarify	To make the Eng Standards or referenced document understandable and free from confusion
Interpret	To formally provide an acceptable method of compliance with the Eng Standards or referenced document
Alternate Method	A deviation from an Eng Standards or referenced code technical requirement that includes compensatory measures that accomplish the desired intent or results but using a different approach with alternative materials, design, or methods of construction or equipment
Variance	A deviation from the explicit expectations in the Eng Standards or referenced code or standard; an exception

1. Alternate methods and variances must proceed as follows:
    a. Requestor (must be LANS) discusses with POC and develops the Request Form 2137, ideally using the Engineering Service Request System available from ES-Division homepage [use of this system allows assignment to responsible POC(s)].
        - As it is in the best interest of LANL to consistently follow the Standards, it is expected that variances will be granted only rarely, and only when a strong justification exists. As such, it is incumbent upon the requestor to provide sufficient justification in their request, and to show that the variance has significant long-term cost savings, programmatic benefit, etc. associated with it.

    b. POC/SMPOR reviews the request, and either concurs with or without comments or amendments or recommends against; then forwards to approval authority for final action.

        i. NOTE: Variance to LANL Specs, Standard Details or Procedures, or the Drafting Manual within the Standards Program that do not impact regulation or code matters may be granted in writing by the POC alone using Form 2137; in these cases additional approvals are N/A.

Caution: When an alternate method, variance, NCR, or deficiency report may negatively impact worker health or safety as regulated by 10CFR851[15] , then DOE approval may be required per 10CFR851 Subpart D. Similarly, exceptions to DOE O 420.1[16] and other LANL contractually-required Orders and their references such as the IBC requires DOE approval.[17] Contact the Standards Manager for guidance when this potential exists. IBC-related issues require LANL Building Official approval (or a Deputy LBO if LBO is unavailable; see ESM Ch 16 IBC-GEN). Fire protection and electrical safety equivalencies and exemptions may have additional or alternative forms.[18]

C. LANL review, acceptance, or lack of rejection of design or other submittals not meeting the Engineering Standards or Contract does not constitute an approved alternate or variance to the Standards – nor tacit approval to continue with non-acceptable work. Compliance is required unless variance is formally granted per above.

D. When specifically allowed by ESM sections, the tailored application of codes and standards is not considered a variance to the ESM. When the tailoring approach is used to define the appropriate methodology for code and standard application, that methodology and rationale must be formally documented and become part of the design documents. The applicable LANL Engineering Standards POC is the approval authority of the form and content of the documentation. *Example: The graded application of IEEE nuclear standards for safety class electrical work.*

E. Nonconformances (NCRs) and Variances for LANL Engineering Standards-related Work: Alternates and variances discussed above are primarily intended for proposed, future work; conversely, proceeding with work contrary to the LANL Engineering Standards – particularly when done willfully – is an entirely unacceptable practice. Moreover, when work (construction, fabrication, etc.) is submitted for acceptance and then recognized by LANL as non-conforming with the Standards or work scope (e.g., Subcontract) and not immediately corrected, a

[15] Primarily areas of OSHA, construction safety; fire protection; firearms safety; explosives safety; pressure safety; electrical safety; industrial hygiene; occupational medicine; biological safety; and motor vehicle safety; see 851.23, .27
[16] Latest rev was 420.1B Chg 1 at time of writing
[17] P 310-1 Exemptions to Appendix G Requirements. IBC 104.10 grants LBO authority re alternate approaches when intent is met.
[18] PD 1220.1 Fire Protection Program

nonconformance report (NCR) or equivalent[19] must be generated and used to disposition the situation, address causes of non-compliance, and gain necessary approval signatures (along with a variance form with some dispositions; see below). Replacement or rework is generally the necessary outcome, while use-as-is and repair dispositions may be granted in rare cases.

1. *P330-6, Nonconformance Reporting controls the broader LANL NCR process.*
2. Disposition options and implications:
   a. *Use-As-Is* dispositions are considered design changes, thus requiring a corresponding change to the associated design media.
   b. *Repair* cannot make the item like the original and, therefore, also is a design change requiring a corresponding change to the associated design media. Specific repair directions must be provided by the design professional in responsible charge (DPIRC).
   c. Rework will restore the item exactly as the original (not a design change).
   d. Reject or Scrap should result in replacement with a conforming item.
3. **For use-as-is and repair dispositions only** (for all tasks, including those underway):
   a. Initial approval must be by LANL Design Authority Representative (DAR).
   b. Standards Program involvement: When work is contrary to the LANL Standards, the DAR or Project Engineer must then submit NCR or equivalent (e.g., deficiency report) to the applicable Standards Discipline POC(s) and attach a Variance Form 2137.
      i. The POC must validate or augment the NCR's disposition and technical justification and consider the technical and DOE-contractual ramifications for not meeting requirements and document on the Form 2137. When code or other prime contract issues may exist, the POC should involve the Standards Manager in the process who helps ensure appropriate functions such as LANL Building Official or DOE are involved and correct processes are followed.
   c. For all ESM and code requirement violations, the POC must forward the NCR and 2137 Form to the SMPO for concurrence signature, with copy to Standards Manager. [Step not required for Table Z10-1 Column 1 violations (non-code spec, detail, or Drafting Manual); insert "n/a" in signature blocks for same].[20]
4. Standards Program rejection at any step shall result in nonconformance disposition change to rework or scrap (from use-as-is or repair) and return of NCR to the requestor.

F. Subcontractor Deviation Disposition Requests (SDDRs, LANL Form 2178) proposing to deviate from LANL Engineering Standards shall follow the same Standards Program concurrence process as Variances for NCRs.

3.0 CODE OF RECORD

A. General: By definition, the codes and standards used to perform the design and construction are considered the "code of record (COR)."[21]

[19] Requirement for NCRs for all ML levels is beyond P330-6 but is appropriate for construction and fabrication work. In construction work, NCRs may be deferred/forgone for pending rework/scrap when allowed (and tracked) by LBO Chief Inspector (ref. ESM Ch. 16).
[20] Provides same level of review and approval for nonconformance acceptance as exists for requirement-setting and variances.
[21] For a nuclear facility, the COR contains or references requirements that directly affect public, worker, environmental, or nuclear safety; engineering disciplines, including civil, structural, mechanical, electrical, instrumentation and control, piping, and fire protection; and management systems including safety, security, and quality assurance. The COR includes Federal and state laws and regulations, DOE requirements, and specific design criteria defined by national codes and standards. This includes national codes and standards invoked through 10 CFR Part 830, Nuclear safety management; 10 CFR Part 851, Worker safety and health program; the design criteria in DOE O 420.1, Facility Safety, and through applicable state and local building codes.

B. Establishment and maintenance of a facility or system's design basis during design and construction, including COR is required, and must include documentation required by this Section Z10 and other applicable ESM chapters. Projects must document and maintain the specific edition of the design codes and standards (including LANL ESM, DOE Standards, and national and state codes and standards[22]) used as their basis in a project record document once they have reached the "underway" date discussed below.

C. Codes and major standards must be documented on the Drawings (title sheet ideally). *Guidance: Larger and more complex projects will be required to develop and maintain a Requirements & Criteria Document (RCD) per AP-341-602 that can serve the purpose of controlling COR.*

Producing a CD-ROM of the LANL Standards can be helpful and greatly aid design reviewers; CENG will produce these upon request.

At time of writing, other parts of the ESM and Conduct of Engineering Program require additional documentation of the COR. For example:

- *Architectural Chapter 4 Section B-C-GEN requires a drawing sheet that summarizes occupancy classification, type of construction, building areas and number of stories, corridors and area separations, floor and roof loadings, and hazard classifications*
- *Structural Chapter 5 Structural Section I requires a Design Basis Document;*

D. For COR issues for modifications, see ESM Chapter 16 Appendix B on IEBC.

E. Application to Projects and Underway Concept

LANL STRs must ensure that subcontracts require designers to produce designs that ensure final project complies with applicable portions of the Standards including the following criteria (ensure in subcontracts):

1. Major projects: For projects formally managed per SD350, Management of Projects, the version of the Engineering Standards and its references to be used will generally be the date of design contract award[23] -- but in no case may version be earlier than 30 days prior to the TSME approval date of the Request for Proposal for AE design services (including design-build), nor shall the version be earlier than 6 months before subcontract award.[24] The COR is initiated during conceptual design and is placed under configuration control during preliminary design. This remains the COR for the final design and for construction (and operation phase) unless the project (or operating organization) makes the unusual decision to change to adopt a newer code or standard (e.g., for compelling safety benefit).[25] For buildings, once there is occupancy (partial or full) per ESM Ch 16

From Office of Environmental Management Interim Policy, Code of Record for Nuclear Facilities, Dae Chung, 9/3/09, available from POC.

[22] Design standards, but not necessarily commodity standards such as ASTMs on conduit or rebar

[23] The default is that ASM proforma (Exh A GCs 9/15/2010) fixes the editions as date of contract award: "GC-7 STANDARDS AND CODES (Jun 2009): Wherever references are made in this subcontract to standards or codes in accordance with which the Work under this subcontract is to be performed, the edition or revision of the standards or codes current on the effective date of this subcontract shall apply unless otherwise expressly stated. In case of conflict between any referenced standards and codes and any Subcontract Documents, the General Condition titled "SUBCONTRACT INTERPRETATION" shall apply.

[24] Thirty days allows a project to issue its RFP (not with detailed ESM, code, and standard edition dates. These are ideally updated during best and final; they must be expressly stated in Subcontract per Exh A (e.g., GC-7). For especially protracted procurements cycles, update during best and final will be mandatory to meet 6 month limit. Minor change order cost proposals are not considered RFPs here.

[25] DOE O 413.3B on nuclear facilities: "the COR is controlled during final design and construction with a process for reviewing and evaluating new and revised requirements. This will determine their impact on project safety, cost and schedule before a

Section IBC-GEN or it has gone operational, then repairs, alterations, additions etc. follow the IEBC edition required by IBC-GEN App B (this may alter the COR for affected areas).

2. Maintenance Projects/Work: For projects not meeting the criteria above, the date used for determining applicability of new or revised Standards is the managing organization's (e.g., FOD or programmatic line manager) approval to proceed with final design (or 30 days prior to date of RFP for design services, if sooner).

3. Design Shelf-life: For all tasks, when the design has been substantially completed but construction has not begun within 12[26] months, the design must be updated to current LANL Standards prior to beginning construction (or process Variance Form 2137 showing cost/benefit of not doing so and receive approval). Similarly, if the design process is stopped part-way for over 12 months, upon restart of design the COR must be reset to no earlier than 30 calendar days prior to the date of restart of design and latest LANL Standards met.[27]

F. COR Change: In rare cases involving safety, the ESM or Site Chief Engineer may require analysis and possible adoption of new criteria for projects underway[28]. *Guidance: It is allowable and often to a project's or subcontractor's advantage to voluntarily adopt newer standards during design. Newer LANL and national standards and specs incorporate local and national lessons learned for safety, cost effectiveness, new products, and overseer expectations, and have updated product information and logistical information for working at LANL. These can improve the design, construction, start-up, and operation phases – though there might be added cost of redesign if the newer code or standard is adopted while the design is on-going (less so with time and materials than fixed price) or complete. There is a limitation that certain structural standards require POC approval (see ESM Ch 16 IBC-GEN App A, LANL Building Code). The COR should be controlled during final design and construction with a process for reviewing and evaluating new and revised requirements to determine their impact on project safety, cost, and schedule before a decision is taken to revise the COR. New or modified requirements are implemented if technical evaluations determine that there is a substantial increase in the overall protection of the worker, public,*

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decision is made to revise the COR. New or modified requirements are implemented if technical evaluations determine that there is a substantial increase in the overall protection of the worker, public or environment, and that the direct and indirect costs of implementation are justified in view of this increased protection.,.the COR will be included as part of the turnover documentation from a design and construction phase contractor to the operating phase contractor…" Also, generally consistent with GSA P100-2010 (Facilities Stds) 1.1: "The design team must review compliance with the building program at each stage of the project, as required in Appendix A [Submission Requirements], to ensure that the requirements of the program, the P100, and relevant codes and standards have been met and to guard against unplanned expansion of the program because of design and engineering choices."

[26] At time of writing, modifications to existing nuclear/HH systems require an adequacy review after 3 months per LANL CoE AP-341-518 Hardware Mod Traveler, FM01 r0, 8.1 Design Change Package Approved within Last Three Months.

[27] One year maintains the original "Code of Record." This allows projects to not have to update because a few LANL Standards documents have changed. Past one year there is typically enough change to warrant a review, update, and reissue. In most cases, changes are small and completely redesigning the job is not necessary. A good recent example of the need/benefit of design rework is the new seismic criteria issued in 2007; the previous criteria significantly under-represented the risk. Depending on the project, proceeding to build using old seismic design criteria might have even jeopardized approval to operate, thus wasting money (an extreme example and in this case the Structural Chapter directed analysis for projects underway, but it makes the point). Other examples are the relatively new requirements of the Welding Program and IBC Program -- big safety/quality gains requiring minor changes to design package/construction RFP. Further basis is that, now, per ESM Ch 16, completed design gets the LANL Building Official mark of approval to construct -- LANL's version of a permit. IBC 105.5 Expiration says that permits expire in 180 days if work has not commenced (or if halted 180 days), though extensions are possible. LANL's 1-year requirement can be viewed as one automatic LBO extension past the IBC's 180 days.

[28] Past examples include occupancy permits; DOE-STD-1189 compliance; and increased seismic spectrum per Chapter 5 Section I.1.3

or environment, and that the direct and indirect costs of implementation are justified in view of this increased protection.

G. Engineering Services Contracting Method: Use of design-build contracts is highly discouraged for moderate and high hazard, less-than-haz-cat-3 (e.g., radiological), and nuclear systems and facilities.[29]

H. Engineering Services during Construction: Projects must retain the original design agency to provide engineering services during construction – or LANL's Project Engineer, Project Manager, and DAR must agree when doing otherwise.

1. Scope of services must include: review and approval of submittals including shop drawings and "or equal" substitutions; processing of non-conformance reports; creation and approval of design revision documents per AP-341-519, Design Revision Control; seismic anchorage and bracing design of architectural, mechanical and electrical components (if not completed in design phase); LEED submittal handling per ESM Chapter 14 where required; structural observation where required by ESM Ch 16; and incorporation of redlines. *Guidance: Scope should also include general work observation for conformance to design.*[30]

2. For ML-1 and ML-2 work and for priority drawings, AE must also be contracted to provide "as-built" record documents (not just as-found/documented) of key design outputs delivered [e.g., drawings, commercial grade dedications (CGD), specs (including changes as a result of switching from supplier qual to CGD), vendor data, SDDs, databases, and final calcs with verified assumptions].[31]

I. Guidance: Requests for Proposal ("bid documents") should state the key design basis codes/editions such as Building Code of Record (e.g., IBC-20XX) and Life Safety Code of Record (e.g., IBC-20XX, IFC-20XX, and NFPA 101-20XX where XX is actual year.

1. As of Rev. 7, LANL Acquisition Services Management's procurement contract provisions specify that the required standards for that contract are those in effect on the date of the solicitation unless the Request for Proposal specifically invokes a different set.

4.0 "CONFLICTS" AND ADEQUACY

A. "Conflicts": The most stringent requirement among contractual requirements including ESM chapters and the codes and standards invoked by them must be followed, even when they might be conflicting, without exception. Refer remaining questions concerning "conflicts" in the Engineering Standards manuals to the applicable LANL discipline POC. The Site Chief Engineer has authority to resolve general and multi-discipline issues, and has delegated discipline-specific authority to the ESM Discipline POCs.

[29] Lesson learned, RLUOB. Complexity of design and high potential for late-emerging requirements makes this fixed-price, fast-track construction contracting method undesirable.
[30] These services are essential to an effective design change process. Original EOR generally provides highest quality and most efficient services, particularly if this work scope is in original AE contract. When EOR is outside LANL, using them maintains unambiguous liability and responsibility for design adequacy. IBC 107.3.4.1 also discusses designer continuity.
[31] As-built records are essential to ensure alignment between design and field as discussed by DOE-STD-1073 Configuration Management.

B. "Guidance Conflicts": Similarly, having a requirement in one place and a guidance statement in another place that is similar or addressing the same issue is not a conflict and the requirement must be followed (*this is often intentional – practicing technique of having the mandate in one/best place and referring to it or reiterating it elsewhere*).

C. Specs "Conflicts": If the ESM and LMS conflict, the ESM has precedence[32] and the project-specific spec must be made to complement the ESM by the designer. Similarly, the designer must update LMS sections where they have become outdated. *Guidance: Some of the architectural and structural specs had known issues at time of writing.*

D. Codes and Standards: If a requirement in any LANL document exceeds a minimum code or standard requirement, it is not considered a conflict, but a difference, so comply with the most stringent requirements among the documents. If the same term is defined in the ESM and a code or standard, then the term shall have the meaning given it in the ESM; also, if a term is not defined in a code or standard but is defined in the ESM, the term shall have the ESM meaning.

E. Incorrect Standards: The adequacy of design inputs is generally the responsibility of the design authority. Nevertheless, if the design agency believes the LANL Standards (a design input) to be incorrect (e.g., compliance will cause a problem), it is their responsibility to bring the issue to the attention of the applicable ESM Discipline POC (via the STR or LANL Project Engineer as appropriate) for resolution.

5.0 "CONSTANTS"

Following are "constants" to be used for most design at LANL. These are generally adequate and conservative; however, when other ESM chapters contain other constant values, they take precedence. Also, there may be instances where these or other ESM "constants" are not conservative; then, designer must use conservative or actual values.

A. Altitude: 7500 feet[33]

B. Latitude: 35.9 deg N, Longitude 106.3 deg W (TA-6 weather station)

C. Barometric Pressure (avg): 11.10 psia (22.65 inches Hg).

D. Air Density (7,500 feet): I-P: 0.057 pounds/cubic foot (0.075 pcf at standard air)[34]

- S-I: 0.00091 g/cm3 (0.0012 at standard air/sea level)

E. Air Density Ratio: 0.075/0.057 = 1.32 (reciprocal = 0.76)

Note: Exceptions to the above (where altitude and the other data must be corrected to actual):

1. For mechanical and electrical design near upper West Jemez Road (TAs 16/22/8/9/28) use 7700 feet; at TA-57 Fenton Hill site use 8600 feet (both approximate actual elevations). For lower Pajarito Road and other areas use actual elevation when required for adequate design margin.

[32] In subcontracts, the *ASM Construction pro forma order of precedence is per Exhibit A (9/15/10) GC-6 which states that "D" Scope of Work has precedence over "D" Technical Specifications which has precedence over "E" drawings.*
[33] Altitude at LANL generally ranges from 6250 ft at TA-39 to 7780 ft at TA-16; 7500 is generally conservative for most calculations with exceptions noted. Info from USGS 1:24000 quadrangles: Frijoles, NM and White Rock, NM. Altitude affects design and operation of many mechanical, electrical, and other components; this effect is addressed in more detail in those ESM chapters
[34] FWO Calculation No. 00-00-CALC-M-0003

2. Design "clean" fire extinguishing agents using a design altitude no higher than actual (using ESM LMS Section 21 2200); furthermore, to ensure conservatism, use 5% less than actual altitude or use 5% more agent than calculated at actual altitude.

6.0 DESIGN GOALS

A. When designing new systems and facilities, consider how decommissioning and demolition might be performed and design to facilitate it where practical, including waste minimization, recycling, and reuse (*additional requirements for hazardous systems appear in ESM Chapter 10; actual D&D controlled by Ch 16 IBC-GEN).*

B. Unless stated as otherwise in the project-specific documents, designers must use the following parameters for decision analysis and design goals, and materials and finishes must be chosen accordingly:

Systems	Expected Life, years[35]
HVAC control system	10
Other HVAC/R system components	As shown in ASHRAE HVAC Applications manual (Owning and Operation Costs chapter), but never more than 40 years[35]
Roofs	20
Other systems — active/moving components of systems in architectural, mechanical, electrical, I&C, and nuclear systems	20
Structures	
Office Trailer	20
Light Construction [e.g., modular, pre-engineered, or GPP (~$10M maximum) facility]	35
Medium Construction (e.g., line item office or lab)	50
Heavy Construction (e.g., bunker, nuclear facility or other concrete-walled/roofed structure)	60

C. Difficult-to-replace systems and components must be designed to perform for the life of the facility with minimal life-extension activity. Examples of such systems and components:
- Structural and architectural components of concrete, metal, ceramic, and stone including exterior wall finishes
- Flooring, hard-surface (e.g., polished concrete or ceramic or quarry tile)
- Building services piping concealed in walls, floors, and overheads
- Ductwork and other passive mechanical components
- Electrical wiring, conduit, fixtures, transformers

D. For systems and components that cannot be reasonably expected to perform for the system or facility life without replacement or life extension, design for lowest life-cycle cost and ease of replacement/life-extension.

[35] These goals are both for projects and form the basis for the technical chapters and specs of the LANL Engineering Standards. Numbers consistent with those used by MSS Maint Eng Group 11/2005 for decision making and modeling per K. Carr. IRS depreciation period for commercial buildings is 39 years; LANL and other government buildings are usually used even longer. R.S. Means may also have useful data but was not used. For energy LCC calcs, 42 USC 8254 revised 2007 says 40 years for public (e.g., line item quality) buildings unless fewer years is more appropriate. CMRR-NF goal is 50 but life extension likely.

1. Systems and Components for which replacement or life extension is anticipated in less than 35 years:
    - Roofing (see table above)
    - Flooring (carpet and rolled goods)
    - Mechanical equipment (active)
    - Electrical equipment with moving parts or contacts
    - Controls (see table above)

2. *Guidance on life cycle analysis is provided in Z10 Attachment E. Additional design life standards are available from www.caisinfo.doe.gov, under the documentation tab (left side of page), both for building systems and other structures and facilities (OSFs).*

E. Worker Safety[36]
1. Design to ensure the safety of construction, operation, and maintenance personnel. Use best available, cost-effective technology and good engineering judgment to achieve this. When in doubt, consult system engineering, operations, maintenance, and safety professionals.
2. Reviewer "compliance" comments regarding safety will be arbitrated by the Standards POC if necessary.
3. *Guidance: For special hazards (those other than normal, industrial hazards), a team composed of the functions listed in (1) above should be formed and follow a documented ISM process that considers and mitigates the hazard through design and/or administrative controls. The design documentation must include a table or other document showing:*
    a. Hazards with probability and consequence judgments
    b. Methods evaluated to eliminate or reduce the hazards
    c. Applicable regulations and codes along with requirements of the regulation or code specific to the identified hazards
    d. Engineered hazard controls evaluated
    e. Engineered hazard control features included in the design, and justification for not including any such controls in the design
    f. Administrative controls (including PPE) recommendations if necessary
4. For hazardous processes design including nuclear, also see requirements in ESM Chapter 10 and OSHA Process Safety Management. For nuclear design, also follow ESM Chapter 12 and DOE-STD-1189, *Integration of Safety into the Design Process*, as applicable.

7.0 DESIGN OUTPUT REQUIREMENTS (CALCS, DWGS, SEALING, ETC.)

7.1 Complete Design: The design agency is responsible for a complete, coordinated design package (e.g., drawings or sketches, specifications, etc.), up-to-date and integrated and meeting project-specific requirements.

A. Design agency must perform required internal checking and reviews (including independent for ML-1/2 work) in accordance with their QA plan prior to submitting to LANL reviewers. Externally produced design will be reviewed by LANL in accordance

[36] Lesson learned, RLUOB deep-shaft lift station. Supports 10CFR851 Subpart C (.21, .22)

with AP-341-622, LANL Review of Designs Produced by External Design Agencies and AE must resolve comments in accordance with that AP.

B. In general, design must stand alone and not rely on reference to the ESM for the directing the work of the constructor (e.g., Subcontractor; exceptions allowed for reference to complex LANL programs such as Welding and NDE; however, IBC Program is addressed by Section 01 4000).[37] *Guidance: The LANL Standards are not intended to cover all design requirements and construction specifications necessary to provide a complete operating facility or system. Some LANL policy documents (P's, PD's) may also provide design criteria/requirements.*

7.2 Project Files — General

A. Document design by a set of calculations, drawings and/or sketches, and design/evaluation criteria commensurate with project scope that demonstrate the design is both safe and cost effective. The project file must include information important to the accomplishment of the design. *This should include significant written correspondence, summary of significant telephone calls, design and design-evaluation criteria whether furnished by LANL or designer-generated, working notes, and calculations.* When the design is complete, there must be a historical record showing how the design progressed and reasons for changes.

7.3 Calculations[38]

A. Prepare design calculations to document analytical determinations in accordance with the design agent's Quality Assurance Plan. Room numbers, equipment nomenclature, fixture numbers, zone numbers, or any other designations must be consistent with those indicated on the drawings or in the specifications. Calculations must be checked, reviewed, sealed when required, signed and dated by the designer and the checker, complete in all respects and must reflect the basis for selection of systems and components. For design agents who do not have formal calculation procedures, calculations must be prepared in accordance with LANL AP-341-605, Calculations.

B. Provide a narrative description of purpose, methods, and conclusions for each calculation. Note references (source) for unusual formulas or methods of analysis, including edition of the reference and page number. Clearly identify numbers in formulas as to the units involved; e.g., psi, gpm, etc. List all assumptions and exceptions, and define all units. Provide copies of tabulated data used.

C. Neatly arrange sketches, input, output, and other material pertinent to the analysis and use 8 ½ x 11 inch sheets, where practical, and include in the complete analysis presentation.

D. Submit calculations to LANL for design authority review and acceptance as requested or required. This approval does not relieve the designer of any responsibility for correctness and coordination with the drawings and specifications.

E. The calculations will become record calculations for LANL and may be used in the future for modifications.

[37] Merely referring to the ESM necessitates inclusion of those portions of the ESM in the RFP; this increases RFP volume and complexity. This also holds for design-build: although no separate construction RFP exists, the constructor should not be expected to integrate the ESM and specs/drawings; this is AE design purpose/responsibility.

[38] "Every calculation based on experience elsewhere fails in New Mexico," attributed to a communication from Gen. William T. Sherman to Gen. Lew Wallace, NM Territorial Governor 1878-1881, and used by Wallace (Lew Wallace: An Autobiography, 1906). The rigor required here helps ensure calcs are correct regarding LANL conditions and can be checked.

F. Computer Calcs: When performing design calculations with computers:

1. Present complete documentation of new programs used. Present in fundamental language such that an engineer unfamiliar with the program can understand the functions, limitations, and method of analysis used. Include explanation of the method used in computer (or calculator) programs, playback of input data, and clear formats for computer-generated information. Provide sufficient documentation to enable the verification of the method of data input and the interpretation of the output calculations.
2. Commercial software may be used if it has been benchmark tested and yields acceptable results when working textbook problems or worked examples in documents such as ASHRAE or the IEEE Red Book. Software QA:
    a. Each calc submittal that is based on commercial software must contain a statement from the AE that the software used has been benchmark tested and provides results that are consistent with results from using the applicable industry standard procedures (such a statement can be based on either certifications from the software company or benchmark testing performed by the design organization).
3. In addition, other programs can be used that have been approved for use by the LANL Design Authority and, for facility work, the ESM Discipline POC as well. Approvers must maintain a basis for program acceptance (e.g., benchmark testing and/or standardization).
4. Software must follow in-house or subcontractor requirements for SQA and control detailed in LANL procedures P1040 *Software Quality Management* (and P1041 *Nuclear or Radiological Facility Safety Software Quality Management* where applicable), and be used within established bounding conditions and on operating systems for which the specific release (version) was tested.
5. Submit plans, flow diagrams, sketches, etc., to completely illustrate the source of input data in such fashion that another engineer can easily check the input data for accuracy.
6. Deliver an executable file and complete computer listing of input and output data (native files) on CD. Also, signed pdf files for records are acceptable in lieu of paper.

G. Hand calculations may be microfilmed or scanned by LANL. For this reason, calculations must be printed clearly and with sufficient darkness to assure clarity if reproduction or scanning from the microfilm is necessary. Index calculations in a logical order and include adequate sketches to allow an engineer to follow and comprehend them easily.

7.4 Drawings and Other Outputs

A. Projects for new buildings and building systems must categorize and label their Priority drawings in accordance with Attachment A of Z10, the Drafting Manual, and especially AP-341-405, Identification and Control of Technical Baseline in Operating Facilities. This categorization subject to approval by the receiving LANL Design Authority Rep.

B. The designer must prepare a Field Change Notice (FCN) Criteria document per AP-341-519, Design Revision Control, which governs the field changes that may be made simply by the constructor. Submit draft to LANL at 60% design complete, final at 100%. If practical, attach to Test & Inspection Plan (required for IBC work; see ESM Ch 16 IBC-IP Att B).

C. When required by Attachment B, SDDs must be numbered per LANL AP-341-611.[39] For other non-drawing documents, LANL Project Engineer must consult Conduct of Engineering documents to determine how they will be numbered.

D. Project Master Document List (MDL): An index of all project drawings, calcs, trade study reports, and other technical baseline documents with number, title, and categories below must be delivered as a turnover document prior to close-out of the project.

1. The designer, unless otherwise stated in the Contract Documents, is responsible for populating all required fields of an Excel spreadsheet, saving it as a CSV (comma delimited) file type, and submitting to the LANL STR for subsequent receiving LANL Design Authority review, approval, and submission to the Records Center so that they can be entered into the document management systems.

Table Z10-2 Minimum MDL Fields[40]:

Fields to Include	Field Data Requirements
Document Type	drawing, report, calc, SDD, etc.
Title of Doc.	
Revision Number/Level	
Engineering Document Number	
CM Document Category	Priority, Support, or General
Security Classification	U, UCNI, etc.
Management Level	ML-1, 2, 3, or 4
Doc. Owner	LANL division or facility—e.g., TA-55, WETF
Approval Date	
Effective Date	if different
Next Review Date	if applicable
Current Status	not assigned, preliminary, in-process, approved, verified, etc.
TA (Tech Area)	2 digit—e.g., 03
Bldg or Facility Name	
Bldg Number	4 digit—e.g., 0410
System Name	per ESM Ch 1 Section 210
System Identifier (acronym)	per ESM Ch 1 Section 210
System Class	Programmatic or Facility
Pending changes	list outstanding FCRs, DCPs, ECNs, DFCs, DCRs
System Engineer	if known
Baseline Type	Design Input Requirement or Design Output/Configuration Mgmt
DCRM Custodian	IRM-DC, NMT, etc.
Document Location	TA-63, PF-4, etc.
Document Media	
IRM/DC Control Number	If known
Comments	

Guidance: If it is likely that System Engineer wants calcs and other documents cataloged and retrievable individually from IRM, then consider following the LANL document numbering format and use numbers assigned by IRM so the documents can be entered directly into the LANL system after LANL approval. For a larger project, it may be possible to assign blocks of numbers. Failing that, AE would use internal numbering and LANL would approve/adopt and assign LANL doc number.

[39] These are living documents that must go into document control using LANL SDD numbering.
[40] AP-341-403 Master Document List

E. Drawing content and format must comply with the LANL Drafting Manual. When 3D CAD or building information modeling (BIM) is used, the entire, useable model/database must be delivered to LANL along with other required deliverables. *Guidance: Projects intending to require BIM should incorporate relevant portions of AIA E 201, E202[41], AIA's integrated project delivery contract set, and/or ConsensusDOCS 301[42].*

F. Sealing (Stamping): Comply with the New Mexico Engineering and Surveying Practice Act (Chapter 61, Article 23 NMSA 1978 http://www.state.nm.us/pepsboard/act.html) codified in the NM Administrative Code Title 16, Chapter 39 (esp 16.39.3.12**)**. http://www.nmcpr.state.nm.us/nmac/_title16/t16c039.htm

1. However, in addition, all plans, calculations, designs, specifications, designs for ECNs, DCPs, DCFs, reports, and other engineering outputs including drawings and diagrams (including P&IDs and PFDs and details based on LANL Standard Details) prepared by non-LANL engineers, consultants, contractors (i.e., Subcontractors) that are involved in the practice of engineering must bear the seal (stamp) and signature of a professional engineer (PE), currently licensed in New Mexico, in responsible charge and directly responsible for the engineering work (including demolition direction).

   Exceptions for sealing:

   a. Shop drawings (unless they contain engineering design; see also Fire topic below).

   b. Building repair, or modification design meeting the IEBC Level 1 Alteration definition (replacement in kind) and which presents no unusual conditions, hazards, change of occupancy, or code violations need not bear a PE stamp.[43]

   c. Field change requests (even those involving sketches) unless they affect an existing calculation or require a new calculation, necessitate a new drawing or revision to existing drawing for clarity of new design, or any other circumstances when the project engineer determines a more formal design change is warranted.

   d. Cost estimates.

   e. Reports that draw no conclusions and contain no original engineering (e.g., an SDD that is based on other technical baseline documents).

   f. Sealing of as-found drawings (reconstitution without design work) and red-line incorporations (as opposed to true as-builts) is not normally required except as noted below or in the subcontract.

      i. If the build team's AE is responsible for 100% inspection or true as-builting (full design responsibility), then the AE must seal.

      ii. If an AE merely incorporates the constructor's red-lines, then AE must sign the revision but need not seal.[44]

2. PEs must only seal those discipline drawings for which they are in responsible charge and directly responsible for the engineering work, none for which they are not.

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[41] E201™–2007 Digital Data Protocol Exhibit…Parties not covered under such agreements should consider executing AIA Document C106™–2007, Digital Data Licensing Agreement."

[42] Paper from 2008 ABA Construction Forum Plenary 5: BIM BREAKS THROUGH: The ConsensusDOCs new Building Information Modeling (BIM) Addendum and How to Make it Work for You and Your Clients

[43] For protection of LANL's interests, more restrictive than exceptions allowed by NMAC 14.5.2 on permits

[44] Red-lines done by a constructor are often not wholly the AE's product. Memo from T. Oruch to M. Koop dated 3/14/02 (EMref-4) and ESM Interpretation No. 2002-02, Rev. 0.

A. Competency: Except as noted in (B) & (C) below, PEs shall only practice or seal for those disciplines listed as a competency on the NM Licensure Board website. The Site Chief Engineer and ES-DE discipline leads may waive this requirement based on significant demonstrated experience and competency.[45]

B. Overstamping: For the purposes of the Act, a licensee of the NM Board "has 'responsible charge of the work' as defined in Section 61-23-3, para. K, and may sign, date and seal/stamp plans, specifications, drawings or reports which the licensee did not personally prepare when plans, specifications, drawings or reports have been sealed only by another licensed engineer, and the licensee and/or persons directly under his personal supervision have reviewed the plans, specifications, drawings or reports and have made tests, calculations or changes in the work as necessary to determine that the work has been completed in a proper and professional manner." (16.39.3.12.E) [46]

C. Incidental Practice: The single seal of either an NM engineer or architect meets the requirement for professional certification on projects which do not exceed a construction valuation of $400k AND do not exceed a total occupant load of 50.[47] However, when a majority of the work is of a specialized nature such as fire, structural, or electrical, or if an electrical design becomes necessary as defined in D5000 (*1.1-E*), then the appropriate PE's certification must appear on the documents as may be required by this Section or the NM Construction Industries Division.

3. Non-NM PEs: An NM-licensed engineer or landscape architect may "overstamp" plans prepared and stamped by a registered engineer or landscape architect respectively in another state for submittal to LANL only when all of the following circumstances have been met: [48]
   (a) the drawings have been prepared by an engineer or landscape architect registered in a US jurisdiction;
   (b) the reviewing engineer or landscape architect has the authority to make any changes to the construction documents in accordance with his professional knowledge and judgment, and is of the same engineering discipline;
   (c) the engineer or landscape architect has reviewed the plans prior to the preparation and sealing of the final set of construction documents to be submitted; and
   (d) out-of-state-license work does not exceed 30% of the project's total design work in hours or cost.

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[45] An example of meeting this requirement is that only PEs with an "R" designation may perform structural designs (civil is insufficient), but true of all displines. Per NMAC 16.39.3.8.A, NM does not license by discipline but does webpost the discipline(s) for which an engineer demonstrates competency, leaving it to the PE's client to judge competency. LANL exerts this right as owner (and ultimate client in the case of subtiers doing engineering work).

[46] From LANS Contract Section I Page 44, I-123 DEAR 970.5204-2 LAWS, REGULATIONS, AND DOE DIRECTIVES (DEC 2000) (DEVIATION) (a) "In performing work under this contract, the contractor shall comply with the requirements of applicable Federal, State, and local laws and regulations (including DOE regulations), unless relief has been granted in writing by the appropriate regulatory agency." The NM Engineering and Surveying Practice Act, paragraphs 61-23-3.E, 61-23-21, and 61-23-22 define the practice of engineering and establish qualification and performance requirements for registered professional engineers as a matter of public safety.

[47] NM Architectural Act, 61-15-2(B) and NMAC 16.30.1.7(G); and the Engineering Act, 61-23-22(A) and NMAC 16.39.4.8. The incidental practice provisions of both statutes establish this requirement. Also, see NM "Handbook for Building Officials, 2007 Edition" Section I, Para B.2.a http://www.sblpes.state.nm.us/handbook.html

[48] Points (a)-(c) from NM "Handbook for Building Officials, 2007 Edition" para V.E.30, with same discipline proviso added. Pts (d)-(e) protect LANL from excessive out-of-state outsourcing which can decrease design quality because of unfamiliarity with LANL environmental conditions and logistical issues with travel and ready access.

4. Design-Build: Documents must be sealed before construction begins. Exceptions: Site preparation and excavation can proceed. LANL STR may authorize construction-start prior to sealing at risk and with LANL Building Official approval.[49] See ESM Chapter 16 Section IBC-GEN.
5. Architectural: Follow the requirements above except that output documents must bear the seal of a NM-registered architect per the NM Architectural Act based on Article 15 of Ch 61.[50] http://www.nmbea.org/Law/law_frames.htm
6. Fire: Per NMAC 16.39.3.8 (G) (7/1/06) regarding fire protection engineering design for subcontracted design work, factory-qualified, NICET Level-III-certified fire alarm and fire sprinkler specialty subcontractors are allowed to continue to perform their role of preparation of shop drawings, fabrication drawings, final hydraulic calculations, fabrication, installation, and commissioning without sealing on work involving 5 or less fire alarm or detection devices or 9 or less fire sprinkler heads.
    a. For work exceeding this, and for hazard analysis and determining the appropriate design density and area of application, the A/E or FPE of record performing oversight of the specialty subcontractor's work, including change orders/additions/corrections, etc. must seal such work as their own except when waived by LANL Fire Marshal. (National Institute for Certification in Engineering Technologies).[51]

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[49] Basis: Helps ensure safety of construction workers, limits LANL liability with safety and unacceptable work.

[50] From NMSA 1978, Section 61-15-9 on Project exemptions:

D. A New Mexico registered professional engineer who has complied with all the laws of New Mexico relating to the practice of engineering has a right to engage in the incidental practice, as defined by rule, of activities properly classified as architectural services; provided that the engineer does not hold himself out to be an architect or as performing architectural services; and further provided that the engineer performs only that part of the work for which the engineer is professionally qualified and uses qualified professional engineers, architects or others for those portions of the work in which the contracting professional engineer is not qualified. The engineer shall assume all responsibility for compliance with all laws, codes, rules and ordinances of the state or its political subdivisions pertaining to documents bearing an engineer's professional seal.

From architecture regulations at NMAC 16.30.1.7:

G. "Incidental practice of architecture and engineering" means:
(1) architectural work incidental to engineering shall be that architectural work provided on projects with a building construction value not greater than four hundred thousand dollars ($400,000) and having a total occupant load not greater than fifty (50);
(2) engineering work incidental to architecture shall be that engineering work provided on projects with a building construction value not greater than four hundred thousand dollars ($400,000) and having a total occupant load not greater than fifty (50);
(3) all buildings and related structures within the regulatory provisions of the New Mexico Building Code (NMUBC) will require the proper authentication of the building construction documents by all participating disciplines in accordance with their respective governing acts on projects with a building construction value greater than four hundred thousand dollars ($400,000) or having a total occupant load greater than fifty (50), with the exception of [excerpts]:
    (d) nonresidential buildings, as defined in the New Mexico Building Code [NMCBC], or additions having a total occupant load of ten (10) or less and not having more than two (2) stories in height, which shall not include E-3 Day Care), H (Hazardous) or I (Institutional) occupancies;
    (e) alterations to buildings or structures which present no unusual conditions, hazards or change of occupancy.
(4) the owner, user or using agency shall select the prime design professional (architect or engineer) for any project based on the requirements and nature of the project.
(5) occupant load shall be defined and determined by the method set forth in the current, adopted code.

[51] Fire exemption based on 9/26/06 memos from Streit and Wolfe (Phoenix policy) regarding 9/25 opinion from Counsel (Ritschel) (EMRef-54). Nine heads was recent LANL practice with the SSS and more conservative than 20 which is used by Phoenix and being contemplated by NM.

7. LANL engineers performing engineering services involving the operation of LANL on LANL property are exempt from the licensing requirements of the New Mexico Engineering and Surveying Practice Act.[52]

7.5 Design/Evaluation Criteria

A. Documentation must include, but is not limited to, the following:

1. Design output documents required per Attachment B and following the schedule for submission in Attachment C (Deliverable Schedule 15-30-60-90/100% for new facilities over $500k); FDDs, when required by App B, per App D; design basis documents required by Conduct of Engineering APs; and additional documents required by the project's requirements and other ESM chapters (e.g., Structural Chapter's design basis document, and documents required by Hazardous and Nuclear Chapters).
2. For modifications to existing systems and facilities with technical baseline documents (e.g., Priority and Support drawings), modify the existing drawings using ECN-, DCF-, or DCP-controlled sketches preferentially to creating new drawings. Where use of only sketches is not possible, projects may create new drawings but these must include notes referring to existing (affected or superseded) drawings — and project must cloud/revise existing drawings to refer to new ones or "supersede" status if so affected prior to closeout (see Drafting Manual for additional requirements on drawing revision). The ECN, DCF, or DCP must identify affected facility drawings.
3. Equipment Selection Criteria: Include information such as flow rates, pressure or head requirements, operating temperatures, voltage, amperage, efficiency, energy consumption, and sound ratings. If manufacturer selection program is used, verify that altitude correction (e.g., fuel-burning, air-moving, motor size) is properly performed.
4. Include copies of catalog sheets showing equipment performance points for all major equipment included in the systems design.[53] *Guidance: For equipment on larger projects (i.e., over $300k), when CSI format specs are not used for procurement, one or two page data (specification) sheets should be produced. These are common in the chemical processing industry. They are useful for procurement and later by LANL as the starting point for meeting AP-341-520, Item Lifecycle Management. Equipment Data Books (EDBs) are also useful for operations and maintenance; they contain organized and indexed submittal information. NMT-14 had developed about 100 EDBs for glovebox systems, stand-alone laboratory systems, and facility systems (hardcopy form and eventually electronic form). A draft procedure has also been written for developing EDBs at TA-55* (*Guide for Preparing and Maintaining Equipment Data Books) and is available upon request from SB-PF at TA-55 (DeVolder).*

8.0 ENVIRONMENTAL MANAGEMENT

A. 10 CFR 851, Worker Safety and Health Program, requires contractors (LANL) to roll down their 10 CFR 851 program health, safety, and environmental requirements to all subcontractors. Design documents must comply with the environmental requirements defined in Exhibit F of the design contract document, and provide mitigations to potential

[52] Memos from Lab Counsel to Tobin Oruch, 7/19/01 and 9/25/06 (EMref-3 and 53). Direct-report (staff augmentation/job shop) subcontractors to LANS are also considered exempt from sealing as they are LANL employees of a sort, albeit not LANS per se; task-order subcontractors are not exempt. Direct-report means that the LANS engineers are in "responsible charge" of the work. "Responsible charge" defined in requirement above.
[53] As allowed by copyright law. Gain manufacturer permission or suppler certifications if necessary.

environmental insult appropriate to the scope of the project. Such mitigations could include but are not limited to the following:

- Design for pollution prevention/waste minimization, including but not limited to:
  - evaluation of non-hazardous material substitution alternatives;
  - evaluation of alternative technologies that result in reduced waste or contaminant generation;
  - design that results in overall reduction in the use of natural resources;
  - use of energy and water efficient equipment and appliances;
  - use of environmentally preferable products, furnishing and equipment;
  - minimization of waste generation, with a special emphasis on mixed waste generation; and
  - recycling/reuse options.

- Waste management and disposal
- Working within the boundary of a potential release site
- National Environmental Policy Act
- Wastewater discharges
- Storm water management
- Air quality
- Threatened or endangered species
- Cultural resources
- Floodplains and wetlands
- Environmental reporting
- Coordinate review of designs at each stage of development with ENV Division SMEs[54].

Additional requirements related to the environment and waste are located in Chapter 3 Civil (disturbance, runoff, etc.); Ch 6 Mechanical (boilers); Ch 7 (diesel generators); Ch 10 Hazardous Processes; Ch 14 Sustainable Design; and ADPMSS Procedure 403, Environmental Planning.

[54] ADPMSS 403 r1 pg3. This is a LANL Project Engineer responsibility. Use of PRID helps ensure this.

9.0 ENVIRONMENTAL QUALIFICATION [55]

A. The requirements identified within this section are for safety SSCs or those SSCs that provide a mission critical, defense in depth, or worker safety function or whose failure may impact the operation of safety SSCs.

B. For non-safety systems, this EQ section may be taken as guidance that establishes sound engineering practice for the proper and reliable performance of SSCs.

9.1 Requirements

A. The environmental conditions in which SSCs must operate or which can affect the proper or continued operation of SSCs must be clearly identified in design and equipment selection and documented (e.g., the basis for the selected parameters captured in the SDD).

i. Normal ambient, abnormal operating, climatic, and event conditions must be evaluated in the identification of applicable environmental conditions.

ii. For safety-class SSCs, see ESM Chapter 12 for additional requirements.

iii. Guidance: The environmental factors that should be considered when selecting SSC location or SSCs for a location include, but are not limited to, the following:

- *humidity and temperature extremes including fire-induced*
- *barometric pressure variations*
- *airflow*
- *corrosive atmospheres*
- *area flooding*
- *acoustic noise*
- *electronic noise, or electromagnetic interference (EMI)*
- *power supply quality (electrical surges, frequency variations, etc.)*
- *grounding*
- *lighting*
- *lightning protection*
- *physical security*
- *vibration*
- *interference from large motors and power feeders*
- *chemical and particulate (dust) contamination*

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[55] The environmental considerations are "good engineering practice" and must be established for safety-related systems to ensure that the environment in which the systems will be placed is conducive to the performance attributes of the selected components. DOE G 420.1-1, Section 5.1.1.3, establishes the requirement for SC EQ as deemed necessary to ensure reliable performance of a safety system under those conditions and events for which it is intended.

The requirements and guidance were developed through several standards. ASME AG-1, "Code on Nuclear Air and Gas Treatment," Article IA-4000 – Design Considerations, requires the identification of environmental conditions for safety-related systems. Additional requirements and guidance were developed through several standards that identify environmental conditions that could adversely impact the operability of the most sensitive (e.g., I&C) equipment. These standards establish methods to recognize and classify such environmental conditions. The standards are: ISA-71.01, "Environmental Conditions for Process Measurement and Control Systems: Temperature and Humidity;" ISA-71.02, "Environmental Conditions for Process Measurement and Control Systems: Power;" ISA-71.03, "Environmental Conditions for Process Measurement and Control Systems: Mechanical Influences;" ISA-71.04, "Environmental Conditions for Process Measurement and Control Systems: Airborne Contaminants;" IEEE 1-2000, "Recommended Practice – General Principles for Temperature Limits in the Rating of Electrical Equipment and for the Evaluation of Electrical Insulation;" IEEE-1159, "Recommended practice for Monitoring Electric Power Quality;" IEEE 323, "IEEE Standard for Qualifying Class 1E Equipment for Nuclear Power Generating Stations;" and IEEE-1100, "Recommended Practice for Powering and Grounding Electronic Equipment IEEE Emerald Book."

- *radiation*
- *elevation above sea level*
- *seismic considerations including proximity to earthquake faults*

10.0 EQUIPMENT LOCATION/DESIGN

A. Maintenance: Active mechanical, electrical, controls, and similar equipment must be accessible for inspection, service, repair, and replacement without removing permanent construction or necessitating abnormal or unsafe action (e.g., crawling on ducts, piping, conduit, or cable trays)[56].

1. If safety-related (SC, SS, important-to-safety, hazardous process related) equipment is not accessible with a man-lift or rolling platform, then provide permanent OSHA compliant structures for access to equipment installed 12 feet or higher above finished floors (e.g., HVAC and controls).[57] *Guidance: This requirement should be considered not only for safety-related equipment but for any component that is located 12 feet or higher, especially if frequent access is necessary.*

B. Outside: Select sites carefully when locating equipment on grade. Ensure that factors such as snow accumulation and drift, ice, windy areas, rainwater from roof overhangs, etc., do not affect equipment performance and maintenance. *Avoid locations on the north side of the building.*

C. Noise: Locate equipment to minimize noise and sound vibration transmission to occupied areas of the building and adjacent occupied areas/structures.

D. Roofs: Locate equipment a minimum of 10 feet from the edge of roof or inside face of parapet. If the distance is less than 10 feet, specify a 42-inch-high restraint, e.g., guard rails, parapet, screen wall, etc.[58]

E. Security: Locate equipment in lowest practical security zone area when possible to facilitate maintenance. Consider protecting critical equipment from attack (e.g., gunfire and explosives); see ESM Chapter 9, Security.

F. ALARA: To the extent practical, locate major equipment in non-radiation areas (see ESM Ch 11, Radiation Protection).

G. Provide new and modified equipment with energy isolating devices capable of accepting a lockout device.[59]

11.0 MASTER EQUIPMENT LIST (MEL)

A. Projects must develop project-specific MEL as a turnover document prior to close-out. SSCs must include, as a minimum, all safety SSCs and all other facility SSCs requiring maintenance or surveillance or critical to mission objectives or facility operations or desirable

[56] Lesson learned, RLUOB fan coil units

[57] 1997 IAPMO UMC, Section 305. Also DOE-HDBK-1140, "Human Factors / Ergonomics Handbook for the Design for Ease of Maintenance," Section 4.9.3.6, identifies a maximum usage height of 12 feet for a painter's type stepladder. For safety-related systems this represents the minimum height for ease of surveillance and maintainability given the potential apparatus available for the performance activities.

[58] 29 CFR 1926.501 requires fall protection; 10 feet minimum distance allows for equipment door swings and removal of equipment while remaining 6 feet from edge. http://www.osha.gov/Publications/osha3146.pdf

[59] CRAD 9.10 for the CMR Con Ops Assessment, 2-20-2009

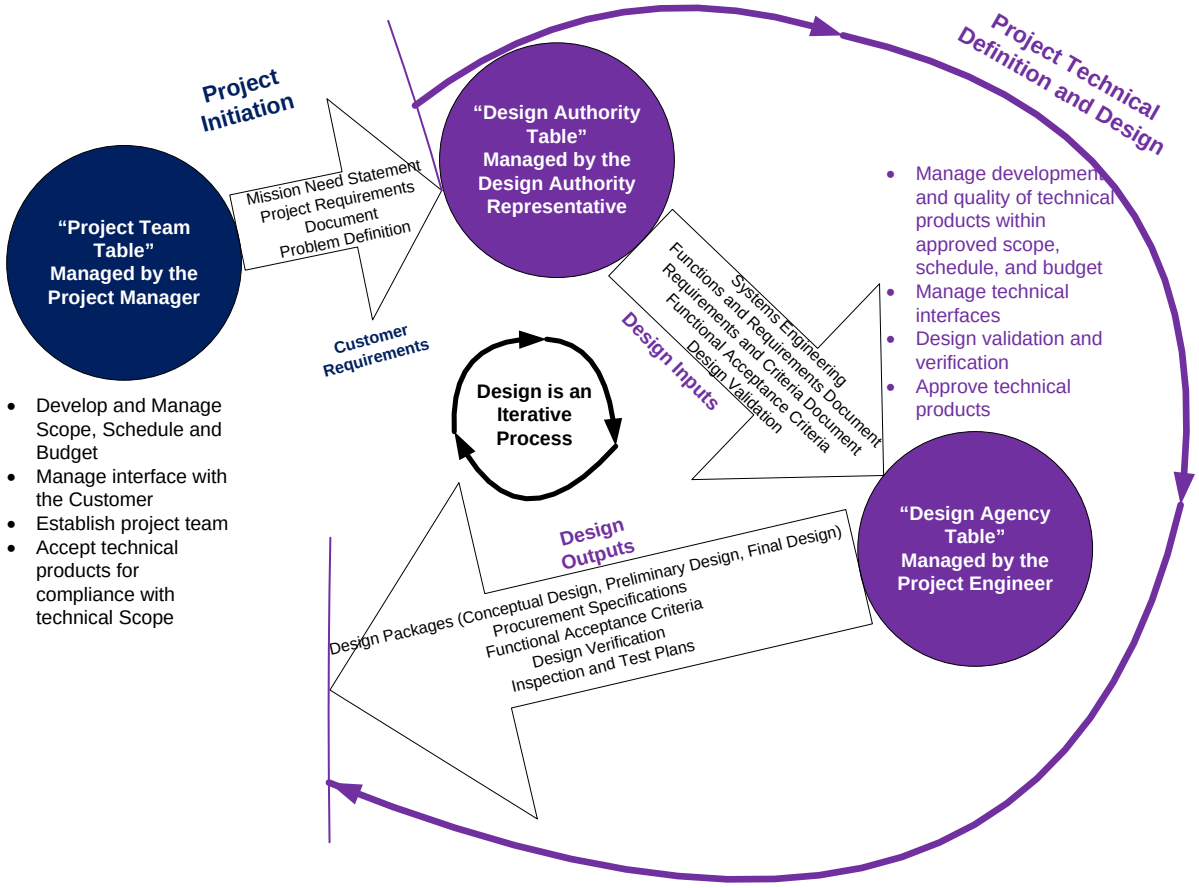
for inclusion in the maintenance program for other reasons. Special tools and equipment should be included in this master list.[60]

B. When data is not entered directly into the MEL, a spreadsheet that can be uploaded to the MEL in the Computerized Maintenance Management System (CMMS; now PassPort, becoming Asset Suite) must be provided. The AE, unless otherwise stated in the Subcontract Documents, is responsible for populating all required fields of a spreadsheet where data is known (listing unknowns like model and serial numbers as TBD), saving it as a CSV (comma delimited) file type, and submitting to the LANL STR for subsequent constructor finalization (per pro forma Exhibit I[61] and/or LANL Master Spec Section 01 3300 Submittal Procedures) and then LANL system engineer review, approval, and incorporation into the MEL per AP-341-404 Master Equipment List. The spreadsheet format to be used is controlled by that AP's App B.

12.0 PROJECT ENGINEERING

A. Guidance: LANL's approach to project engineering is described in greater detail in Engineering Processes Manual PD341 and elsewhere; however, for the benefit of ESM users who may not have access to PD341, the following graphic depicting the working relationship of various LANL parties to the design process is included below to facilitate understanding of the terms and concepts herein.

[60] DOE O 433.1A, Maintenance Management Program for DOE Nuclear Facilities, Att. 1 CRD para 2.a.1; and DOE G 433.1-1 para 4.4.3.1
[61] Exhibit I is available from the internal ASM SharePoint site under "Section: Other." With time it may be moved to "Section: Exhibit I" and/or pointers added under Quick Links.



13.0 SHED AND CONTAINER REQUIREMENTS (MOVED TO CH 16 IBC-GEN)

14.0 SIGNS, LABELS, AND TAGS

A. Identify SSCs in accordance with the nomenclature indicated in LANL Engineering Standards Manual, Chapter 1, Section 200, Numbering and Labeling.

B. Label SSCs in accordance with:

- LANL Master Specification Section 22 0554, *Identification for Plumbing, HVAC, and Fire Piping and Equipment*; and
- LANL Master Spec 26 0553, *Identification for Electrical Systems*

C. Building/structure signage (including wayfinding signage) is addressed in ESM Chapter 4, Architectural (Section B-C_GEN).

D. *Guidance: Additional information on labeling may be found in the LANL Conduct of Operations Manual P 315 (Section 18).*

E. For other signs refer to LANL P 101-19, Safety Signs, Labels, and Tags.

F. Labeling: In addition:

- Label mechanical equipment labeling per ESM Mechanical Chapter 6 Section D10-30GEN.
- Label electrical equipment per ESM Electrical Chapter 7 Section D5000; also, on renovation projects, install arc-flash warning labels on existing electrical equipment where lock-out/tag-out will be required for the renovation work.
- Chemical container labeling is described by P 101-14, Chemical Management.

15.0 SPECIFICATIONS AND STANDARD DETAILS

For specification requirements, see Section Z10 Attachment F. Standard Detail usage requirements are consistent with those for Master Specs:

1. When a LANL Standard Detail (STD-342-400) applicable to the work exists, its requirements must be followed regardless of who performs the work or the authorizing or contractual methods used to initiate the work.

2. Standard Details are templates that the designer must start from, not finished products. Designers must tailor them to the task's needs, modifying and augmenting the existing verbiage (to facilitate this, they are webposted in AutoCAD).

3. When editing, the designer must add job-specific requirements. Brackets are used in the text to indicate designer choices or locations where text must be modified by the designer (then remove brackets). The details must also be edited to delete requirements for processes, items, or designs that are not included in the scope of work — and hide or delete designer notes. The designer must also update Details used where they are incorrect, incomplete, uncoordinated, or have become outdated. Product callouts may be changed if new callouts meet original design intent and all stated requirements (unless "no substitution" is indicated.

   a. For those nuclear and high hazard tasks that need additional rigor beyond the ordinary, the need to augment them is particularly important.

4. The forgoing activities are not considered a variance -- but to seek a variance from a requirement that is applicable, contact the Engineering Standards Discipline POC (see Clarifications etc. heading earlier in this document).

Z1020 QUALITY REQUIREMENTS (PROGRAMMATIC & FACILITY)

A. Projects must comply with applicable LANL QA-related requirements documents. *These may include:*

- *DOE O 414.1C, Quality Assurance (or successor)*
- *DOE G 414.1-2, Quality Assurance Management System Guide for use with 10 CFR 830.120 and DOE O 414.1*
- *DOE G 413.3-2, Quality Assurance Guide for Project Management*
- *10CFR830 Nuclear Safety Management, SubPart A, Quality Assurance Requirements*
- *SD 330 LANL Quality Assurance Program [and related P documents]*
- *P330-6, Nonconformance Reporting*

- *P330-11, Identification and Control of Items [including storage levels]*
- *PD340, Conduct of Engineering*
- *P1040, Software Quality Management*
- *P1041, Nuclear or Radiological Facility Safety Software Quality Management*
- *Additional requirements in other ESM chapters*
- *Division or project-specific QA requirements*

B. Safety Class, Safety Significant, vital safety systems, ML-1 and ML-2 items, and any project imposing ASME NQA-1 requirements requires use of suppliers from the Institutional Evaluated Supplier List (IESL) *http://int.lanl.gov/orgs/qa/pq/ (internal only)* and/or use of a commercial grade dedication process (see AP-341-703, Item Dedication). For nuclear safety-related projects, see ESM Chapter 12—Nuclear, Quality Assurance Subsection, for additional requirements (*including 10CFR830*).

C. Ensure that MLs are sufficiently delineated in the scope documents (e.g., Exhibit D) such that the supplier can readily correlate the QA program requirements to the associated scope using MLs (not critical when all ML-4).

D. *LANL personnel using suppliers and products for various management level applications should be aware that these suppliers and products may also need to be approved by the LANL Building Official (LBO) when such work is on buildings or building systems. This is because the IBC requires LBO approval for a wide range of testing, fabrication, and special cases. See ESM Chapter 16 Section IBC-GEN.*

E. Follow LANL Master Specification Section 01 4000, Quality Requirements, for facility related work (may adapt for other work). For ML-1 through ML-3 projects, harmonize Spec Section 01 4000 with ASM Exhibit H.

F. Section Z10 Attachment F Specifications has additional, related discussion.

Z1030 TEMPORARY FACILITIES (SEE ESM CH 16 SECTION IBC-GEN)

Z1040 PROJECT CLOSEOUT (FACILITY)

A. At the completion of facility projects, transmit drawings, specifications, and other project records to IRM-DC in accordance with LANL Master Specifications Section 01 7839, Project Record Documents (or project-specific spec section with equivalent or superior requirements). *For projects subject to review beyond the facility managing organization, this should be done as a project submittal through the ES-DE technical review process. When the project is not subject to such review, send directly to IRM-DC Team, M/S K788, at TA-63-121.*

1. Records must be sent to satellite records centers only when IRM-DC team has agreed to such arrangements in writing.
2. For drawings, follow additional requirements for transmittal in the LANL Drafting Manual.
3. For projects subject to SD350, Management of Projects, follow ADPMSS Procedure 606, Project Acceptance and Closeout.
4. In addition to any hardcopy requirements, transmit all submittals electronically in native format (e.g., Word, AutoCAD, etc.) when that is available, pdf otherwise.

HISTORY (RECORD OF REVISIONS)

While not stated, an effort is made to update references including org changes with each revision.

Rev	Date	Description	POC	RM
0	2/9/04	Initial issue. Collected/expanded on topics in other ESM chapters. New topics: backfit, D&D, specs, App A on Sustainable Design.	Tobin Oruch, *FWO-DO*	Gurinder Grewal, *FWO-DO*
1	6/9/04	Added various spec requirements, Buy American Act guidance, COR documentation, MEL population. Refined designer, temporary definitions, "conflicts," constants, output submittals, and programmatic applicability.	Tobin Oruch, *FWO-DO*	Gurinder Grewal, *FWO-DO*
2	5/18/05	Added Applicability section, new rules for projects underway superseding LIR. Clarified sealing of design. For building systems, changed 50% rule to IEBC. Matched variance requirements to IMP 311. App A became ESM Ch 14.	Tobin Oruch, *ENG-CE*	Gurinder Grewal, *ENG-CE*
3	2/1/06	Added Design Goals, App A-E, shed requirements. Attached interp and variance forms from Ch 1 Section 100. Deleted detailed backfit requirements in AP. Minor changes based on indep external review.	Tobin Oruch, *ENG-CE*	Mitch Harris, *ENG-DO*
4	10/27/06	Moved Applicability to new ESM Introduction doc; revised re State laws and App G, moved IBC/IEBC requirements to Ch 16; modified PE sealing exemption for fire; added superseded drawing practices under design/evaluation criteria.	Tobin Oruch, *CENG*	Kirk Christensen, *CENG*
5	6/19/07	Clarified D&D, PE overstamping, fire exemptions. Added Details to Specs; adjusted for new ML level definitions; minor clarifications throughout and in App A and E. App B clarified to also apply to new systems and major mods. Re-instituted NM building code compliance in Codes and Stds.	Tobin Oruch, *CENG*	Kirk Christensen, *CENG*
6	6/16/08	Added DOE-STD-1189, Env Mgmt. Clarified State code, NCR, COR including eng during construction, Temp Facilities, MDL and MEL per APs. Minor changes to App A, C, D.	Tobin Oruch, *CENG*	Kirk Christensen, *CENG*
7	5/21/09	Added worker safety and Exhibit I discussion; D-B for high risk projects discouraged. Clarified ESM not be part of construction RFP; calcs requirements and F.9 re sealing of FCRs, shop drawings. Deleted backfit pointer. Former Apps became Atts and moved defs to App A.	Tobin Oruch, *CENG*	Gary Read, *CENG*
8	1/7/10	Clarified use of addenda and supplements; new variance Form 2137; added design review reqts, FCN Criteria Document; deleted drawing type table in AP; clarified access to equipment, spec coordination and development.	Tobin Oruch, *CENG*	Larry Goen, *CENG*
9	8/25/10	SMPO term added. Official interpretations/clarifications now require Form 2176. All variances require Form 2137. Code issues require SMPO approval. Specs moved to Appendix F. Temp Facilities and Sheds articles moved to Ch 16 IBC-GEN. PD342 became P342, ESM became STD-342-100, etc.	Tobin Oruch, *CENG*	Larry Goen, *CENG*
10	6/20/11	Use of interps, order of precedence, COR changes; moved D&D to IBC-GEN; added PE graphic. Condensed revision history.	Tobin Oruch, *CENG*	Larry Goen, *CENG*

ATTACHMENTS

ATT. A TECHNICAL BASELINE DRAWINGS GUIDANCE

ATT. B TECHNICAL BASELINE DELIVERABLES (NEW FACILITIES AND SYSTEMS)

ATT. C DELIVERABLE SCHEDULE 15-30-60-90/100% (PROJECTS OVER $500K)

ATT. D FACILITY DESIGN DESCRIPTIONS (NEW FACILITIES)

ATT. E LIFE CYCLE COST METHODOLOGY GUIDANCE

ATT. F SPECIFICATIONS

APPENDICES

APP. A ACRONYMS AND DEFINITIONS

APPENDIX A ACRONYMS AND DEFINITIONS

For reference only:
Other DOE-wide definitions may be found in DOE-HDBK-1188.
Other LANL terms may be defined in the Definition of Terms, Acronym Master List, LA-UR-05-0929; PM Glossary, Packaging & Transportation Glossary, Engineering Processes Manual , or Safety Basis Definitions and Acronyms WI110-2.

Term	Definition
ADPMSS	Project Management and Site Services Directorate of LANL (formerly PM Division and ADPMGT, has MSS and parts of former ADISS)
AE (or A/E)	Architect-Engineer. A design agency, normally not LANL but could be.
AHJ	Authority having jurisdiction. Term for technical authority in NFPA, explosives safety, and Uniform Plumbing and Mechanical documents. This and similar terms are known generically as Safety Management Program Owners at LANL (see SMPO).
AHJR	AHJ Representative; see also SMPOR.
As-built	Documentation (for example, Piping and Instrumentation Diagrams, and database records) verified by physical inspection as depicting the actual physical configuration and verified as consistent with the design requirements. [DOE-STD-1073-93]. Alternatively, see Record Document.
Building Official	See ESM Chapter 16 Section IBC-GEN and LBO definition.
CD-0	Critical Decision 0 is Approve Mission Need, per DOE O 413.3. Conceptual design begins.
CD-1	Critical Decision 1 is Approve Alternative Selection and Cost Range, per DOE O 413.3. Preliminary design begins.
CD-2	Critical Decision 2 is Approve Performance Baseline, per DOE O 413.3. Final design begins.
CD-3	Critical Decision 3 is Approve Start of Construction, per DOE O 413.3
CD-4	Critical Decision 4 is Approve Start of Operations or Project Completion, per DOE O 413.3
CENG	Conduct of Engineering Office (CoE Office, officially CENG-OFF). In the context of approvals this refers to the CENG Office Director.
ChEng	LANL Site Chief Engineer.
Commissioning	A systematic process of assuring, by verification and documentation, from the pre-design phase to a minimum of one year after construction, that all facility systems perform interactively in accordance with the design documentation and intent, and in accordance with LANL's operational needs [see ESM Chapter 15, Commissioning when issued]
Consider	When used in a guidance (e.g., italicized) statement, it is suggesting the designer look at and think about following the guidance offered. When "consider" is used in a requirement statement it strongly indicates that LANL does not want the suggestion dismissed out of hand. Good practice is to document the thought process of this consideration, particularly when rejecting the suggestion partially or wholly. In some cases in the ESM, documentation is specifically required (e.g., design notes or memo to file); in other cases, submittal of such documentation for approval is required. See also "shall consider."
Constructor	Term for the entity performing fabrication or physical construction activity used primarily in the Engineering Standards but not contracts. When not LANL self-performed, this is the Subcontractor

Term	Definition
Contractor	Procurement (ASM) proforma (aka boilerplate) defines this as LANS, the prime contractor to DOE; however, in older ESM chapters this term may still be in use as the entity performing the work which may be design, offsite fabrication, onsite construction, and/or maintenance. This may be a subcontractor of LANS' or a LANS employee. When the intention is that task is performed by LANS, then the term LANL is preferred since unambiguous and more timeless.
DCP	Design Change Package, a design change control document for nuclear facilities used with a Hardware Mod Traveler. Ref P341 Engineering Processes Manual. (becoming P341)
Design agency	The LANL organization or subcontractor (A/E) responsible for the preparation of engineering design and documentation [PD342]. See also DPIRC and EOR.
Design Authority Representative (DAR)	The individual appointed by LANL Site Chief Engineer to be responsible for the implementation of laws, DOE Orders, national codes and standards, and LANL Engineering Standards required for the engineering activities in their functional area of responsibility. [PD340]. The receiving DAR is the person to be responsible for the equipment once a project is turned over to operations.
Design basis	This includes the design inputs such as design criteria and codes, plus design decisions captured in studies and calculations.
Designer	Anyone working in a design agency capacity, whether engineer, architect, drafter, or designer.
DPIRC	Design professional in responsible charge; the engineer or architect of record in the Design Agency. DPIRC term is used by IBC (e.g., 106.3.4) and ESM Chapter 16. For AEs, the persons sealing (stamping) the documents.
DSM	LANL's Drafting Standards Manual
ECN	Engineering Change Notice, a design change control mechanism for non-nuclear facilities. Ref P341, Engineering Processes Manual.
EOR	Engineer of Record; same as DPIRC in the Design Agency.
EQ	Environmental qualification. A process to ensure SSCs perform intended function under normal and off-normal conditions. See Z10 subsection by this title.
eng	engineering
ES	Engineering Services Division of LANL (includes design, project, and facility system engineers).
ESM	LANL's Engineering Standards Manual of which this document is a part
FRD	Functional and Requirements Document, formerly Functions & Operating Requirements. Required for large projects, FRDs are developed from the Mission Need, Program Requirements Documents, and specific facility characterization data to more concisely quantify and qualify project requirements. [AP-341-601]. Precursor to RCD.
Facility	A synonym for Real Property and Installed Equipment. RP&IE is the land, improvements on the land such as buildings, roads, fences, bridges, and utility systems and the equipment installed as part of the basic building construction that is essential to normal functioning of a building space, such as plumbing, electrical and mechanical systems. This property/equipment is also referred to as institutional or plant and was formerly known as Class A. [DOE Order 4330.4B] Note: In nuclear space, DOE O 420.1 and 10CFR830 uses this term to include the programmatic activities that occur within the facility also.
FDD	Facility Design Description: Document that identifies top-level functions and requirements associated with SSCs; provides basis requirements and describes features of the facility; Describes simple, less important systems without having to develop separate SDDs (e.g.,

Term	Definition
	potable water system); refers to individual SDDs for details on critical systems. Ref App D of this document.
FOD	Facility Operations Director. One of approx. eight LANL managers responsible for the operation, engineering, and maintenance of facilities and tenants. "The FOD takes direction from the RAD and is the senior line manager who provides owner stewardship and overall facility operations. The FOD provides organizational leadership for facility Maintenance; Operations; Environment, Safety, Health, and Quality (ESH&Q); Waste Services; and Engineering. The FOD has the role of coordinating the efforts of these managers to ensure that all facility and programmatic activities are performed in a safe and compliant manor. Facility operations related deployed personnel will report through the FOD; exceptions for unique reasons will report through the RAD." [P313]
Hazard category	For nuclear, the DOE-STD-1027 category (1, 2, or 3). For non-nuclear, per SBP111-1, Facility Hazard Categorization [Accelerator; High, Moderate, Low; Office; Less-than-Low, etc.]: • High Hazard: The hazards analysis shows the potential for significant offsite consequences. (DOE STD 3009 Chg Notice 2) • Moderate Hazard: The hazards analysis shows the potential for significant on-site consequences (DOE STD 3009 Chg Notice 2) • Low Hazard: The hazards analysis shows the potential for only significant localized consequences (DOE STD 3009 Chg Notice 2)
IBC	International Building Code, published by the International Code Council. See ESM 16.
IMP	Implementing Procedure, a LANL policy document that replaced LIRs and is being replaced by Procedures (P) or Program Descriptions (PD).
Important to safety	Here, those nuclear safety, defense-in-depth SSCs in addition to SC and SS [DOE-STD-3009 and 10CFR830]
IRM	Information Resource Management Division of LANL. IRM-DCS is the Document Control Services group of IRM.
ISD	Implementation Support Document, a former LANL policy document that supported an IMP. ISD have been replaced by P-numbered documents (Procedures).
LANS	Los Alamos National Security, the prime contractor at LANL
LIR	LANL Implementing Requirement (a policy document type replaced by IMPs and ISDs (and now Procedures, Program Descriptions, etc.). LIGs were guidance documents.
LMS	LANL Master Specifications. These CSI-numbered/formatted specifications address construction-type work, fabrication, and maintenance (maintenance examples: piping repairs and testing, carpet and other similar replacements).
Major modification	Change to a nuclear facility that substantially changes the existing safety basis [adaptation of DOE-STD-1189-2008]. Determination is made through a checklist (last page of rev. 0 of SBP112-1, *Nuclear Safety Basis Documentation)*
MDL	Master Document List: a database of the engineering and facility related documents. Such listings are the responsibility of the Information Resource Management Document Control Services (IRM-DCS) team at their TA-63 facility. At present, drawings are mirrored in the online MOADS document system, and floor plans of record also have a stand-alone webpage. [AP-341-403]
MEL	Master Equipment List: an online database of installed equipment (SSCs) that require maintenance or surveillance. The MEL is in the CMMS (e.g., PassPort, Asset Suite) system for most facilities. [AP-341-404]
ML	Management level: A classification system for determining the degree of management control that is applied to work. There are four categories (in descending order): ML-1, ML-

Term	Definition
	2, ML-3, and ML-4. Defined in AP-341-502.
Nonreactor nuclear facility	Those facilities, activities, or operations that involve, or will involve, radioactive and/or fissionable materials in such form and quantity that a nuclear or nuclear explosive hazard potentially exists to the workers, the public (all individuals outside the DOE site boundary), or the environment, but does not include accelerators and their operations and does not include activities involving only incidental use and generation of radioactive materials or radiation such as check and calibration sources, use of radioactive sources in research and experimental and analytical laboratory activities, electron microscopes, and X-ray machines.
P	Procedure, a LANL policy document replacing certain IMPs, ISDs, and LIRs.
PD	Program Description, a LANL policy document replacing certain IMPs, ISDs, and LIRs.
POC	Point-of-Contact. Every document in the Standards set has one person responsible for its interpretation, upkeep, and general assistance. Same as SMPOR.
priority document	Defined in P341 Engineering Processes Manual, documents that are required to respond to an event that can cause loss of life or serious injury to a worker or the public or which can cause significant environmental damage or off-site release. Examples are: • Alarm Response, Emergency, or Abnormal Operating Procedures, • Documents required to determine event compensatory actions (e.g. selected P&IDs, selected Electrical Single Lines, selected fire protection drawings, etc.), • Documents required by Technical Safety Requirements (TSR) or Operational Safety Requirements (OSR) to clarify technical requirements
programmatic	A synonym for Personal Property and Programmatic Equipment. PP&PE is equipment used purely for programmatic purposes, such as reactors, accelerator machinery, chemical processing lines, lasers, computers, machine tools, etc., and the support equipment dedicated to the programmatic purpose. This property/equipment is also referred to as organizational, research, production, operating or process and was formerly known as Class B. [DOE Order 4330.4B]. Also called R&D, and most process equipment will be such.
project	As used in the Engineering Standards only, ANY activity involving the installation, modification, or permanent removal of an SSC at LANL managed formally or otherwise. Includes related fabrication, construction, procurement, and maintenance activities (may not be a formal project per SD350 definitions). Task is also used in this sense.
RCD	Requirements and Criteria Document. Establishes design requirements and maintains the technical baseline for a project. Required for line item, GPP, and complex projects. Will be based on FRD if present. [AP-341-602]
RFP	Request for Proposal, a solicitation to bidders that includes the technical scope of work.
Record Document	Term popular in AE community describing typically-provided documents that incorporate significant changes redlined by constructor (e.g., subcontractor) but not necessarily verified by the AE. These are not as-builts (see that definition above. [based on DPIC's Contract Guide (risk management handbook for AEs), pgs III-23 thru 25]
Safety Class (SC) SSC	A nuclear facility term, *Safety class structures, systems, and components* means the structures, systems, or components, including portions of process systems, whose preventive or mitigative function is necessary to limit radioactive hazardous material exposure to the public, as determined from safety analyses. [10 CFR 830: § 830.3 Definitions.]
Safety-related	See Safety SCC below
Safety SSC	A term meaning safety class, safety significant, and safety-impacting ML-1 and ML-2 SSCs; any of these could potentially impact worker or public safety or the environment if

Term	Definition
	they failed.
Safety Significant (SS)	Nuclear facility term for structures, systems, and components not designated as safety-class SSCs but whose preventive or mitigative function is a major contributor to defense in depth (i.e., prevention of uncontrolled material releases) and/or worker safety as determined from safety analyses. [10 CFR 830: § 830.3 Definitions, except parenthetical note.] As a general rule of thumb, safety-significant SSC designations based on worker safety are limited to those SSCs whose failure is estimated to result in an acute worker fatality or serious injuries to workers. Serious injuries, as used in this definition, require medical treatment for immediately life-threatening or permanently disabling injuries (e.g., loss of eye, loss of limb) from other than standard industrial hazards. It specifically excludes potential latent effects (e.g., potential carcinogenic effects of radiological exposure or uptake). [DOE-STD-3009 Chg. 1]
SDD	System Design Description: Document that provides detailed description of SSCs; identifies requirements associated with SSCs; provides bases for requirements to explain why they exist; describes features of system design provided to meet requirements.
shall	Denotes a requirement (versus "should") [DOE O 6430.1A and DOE Std Style Guide]. "Must" denotes the same and is the preferred term in DOE orders and LANL policy documents [LANL P311-1]. ("Will" is sometimes used to convey future LANL actions, often in specifications for a Subcontractor).
shall consider	Requires that an objective assessment be performed to determine to what extent the specific factor, criterion, guideline, standard, etc., will be incorporated into or satisfied by the design. The results and basis of this assessment shall be documented. Such documentation shall be submitted to Design Authority Representative for approval upon request and can be in the form of engineering studies, meeting minutes, reports, internal memoranda, etc. [DOE O 6430.1A]
Site Chief Engineer	Individual charged with ultimate Design Authority responsibility for LANL; see also PD340. Sometimes abbreviated as ChEng.
SMPO	Safety Management Program Owner. Term for the technical authority on issues relating to certain national code and standards, DOE Orders, and Engineering Standards. As examples, the SMPO for the IBC is called the LANL Building Official. The SMPOs for NFPA and the Uniform Plumbing and Mechanical codes are the AHJs discussed in those documents. Security has authority delegations similar to those for safety. [comes from 10 CFR 830.3 that gives examples of SMPs]
SMPOR	SMPO Representative. More commonly called POC. The LANL Site Chief Engineer designates POC for the majority of subject areas of the Engineering Standards including civil, architectural, structural, mechanical, pressure safety, etc. The SMPOs of other LANL Safety Management Programs (e.g. fire protection, radiation protection, electrical safety, etc.), Security, etc. may designate POCs in their areas of responsibility.
SSC	Structure, system, or component
SSS	LANL's Support Services Subcontractor (e.g., KSL), which was in-sourced and thus eliminated December 2008. If term appears, take to mean LANL or its subcontractors.
STR	Subcontract Technical Representative. The LANL STR has technical and performance oversight of the Subcontractor's Scope of Work, including but not limited to engineering, procurement, safety, quality, schedule, and coordinated execution of the Work that is carried out by the Subcontractor. The STR has no authority to direct commercial or technical changes to the Subcontract.
Subcontractor	Term for entity under contract to LANS. Subtier Subcontractors (Subtiers) work for Subcontractors. Prime Subcontractor is a term used occasionally to reinforce responsibility of that entity (versus subtier responsibilities).

Term	Definition
Standard Drawings and Details	The example drawings and repeatable details on the Engineering Standards website.
temporary	See ESM Ch 16 IBC-GEN for definition.
VSS	Vital safety systems are safety-class systems, safety-significant systems, and other systems that perform an important defense-in-depth [nuclear] safety function.[DOE-STD-1073]