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RECORD OF REVISIONS

Rev	Date	Description	POC	RM
0	2/9/04	Initial issue. Collected/expanded on topics in other ESM chapters; added new topics (backfit, D&D, specs); App A (SD)	Tobin Oruch, <i>FWO-DO</i>	Gurinder Grewal, <i>FWO-DO</i>
1	6/9/04	Refined designer, temporary definitions; added code of record documentation; revised "conflict;" revised constants; added MEL population; clarified output submittals and programmatic applicability; added various spec requirements, Buy American Act guidance.	Tobin Oruch, <i>FWO-DO</i>	Gurinder Grewal, <i>FWO-DO</i>
2	5/18/05	Updated Definitions. Added Applicability section. Under Code of Record section, added new rules for projects underway superseding LIR. Under Design Output, clarified sealing of design. Under Repairs & Alterations, changed 50% rule to IEBC for building systems. Changed variance requirements based on IMP 311. Under Quality Requirements, added more references. App A became ESM Ch 14. Changed FWO to successor orgs.	Tobin Oruch, <i>ENG-CE</i>	Gurinder Grewal, <i>ENG-CE</i>
3	2/1/06	Added Design Goals and life cycle costing guidance (App E). Added drawing CM category suggestions (App A) and baseline deliverables tables (to App B) formerly in CM LIR along with MDL requirements. Added Shed requirements. Added 15-30-60-90/100 requirements (App C). Added App D, FDD Requirements. Relocated interpretation and variance section and attached forms from Ch 1 Section 100. Deleted detailed backfit requirements now in AP. Minor changes based on indep external review: 3.0.B; 11.2.G – calcs per QAP or use LANL's procedure. Updated ref's (IMP, ISDs, spec section numbers).	Tobin Oruch, <i>ENG-CE</i>	Mitch Harris, <i>ENG-DO</i>
4	10/27/06	Moved Applicability to new Introduction document; 2.0: revised re State laws and App G, moved IBC/IEBC requirements to Ch 16; 11: modified PE sealing exemption for fire; 11.4.A.2: added superseded drawing practices under design/evaluation criteria. Organization changes. Authorizing IMP became 341, Conduct of Engineering vice 342, Engineering Standards; ESM now ISD 341-2.	Tobin Oruch, <i>CENG</i>	Kirk Christensen, <i>CENG</i>
5	6/19/07	Re-instituted NM building code compliance in Codes and Stds; tweaked D&D, clarified PE overstepping and fire exemptions in Design Outputs; added Details to Specs subsection; adjustment 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.	Tobin Oruch, <i>CENG</i>	Kirk Christensen, <i>CENG</i>
6	6/16/08	Added DOE-STD-1189. State code, NCR, Code of Record clarifications including engineering during construction requirement. MDL harmonized to AP-341-403, MEL per AP-341-404. New section on Env Management. Temporary Facilities redefined. Minor changes to App A, C, D.	Tobin Oruch, <i>CENG</i>	Kirk Christensen, <i>CENG</i>

PLEASE CONTACT THE ESM GENERAL POC
 for upkeep, interpretation, and variance issues

Section Z10	General POC/Committee
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The LANL Eng Standards including this one are available to all at <http://engstandards.lanl.gov>

Z1010 ADMINISTRATION (PROGRAMMATIC & FACILITY¹)

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 ACRONYMS AND DEFINITIONS

Term	Definition
ADE	Associate Director for Engineering and Engineering Sciences
ADPMGT	Project Management Services Directorate of LANL (formerly PM Division)
AE (or A/E)	Architect-Engineer. A design agency, normally not within LANL, but including the SSS (e.g., KSL).
AHJ	Authority having jurisdiction. Per IMP 342 , Design Authority, this is the Standards Discipline POC for all but fire/life safety and NEC/electrical safety matters relating to design and construction.
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]. Also see Record Document.
Building official	See ESM Chapter 16 Section IBC-GEN and LBO definition.
CENG	Conduct of Engineering Office in ADE (Office Director for approvals)
ChEng	LANL Site Chief Engineer in ADE
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 (future)].
Consider	When used in a guidance (e.g., italicized) statement, it is suggesting the designer

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 and is described further in the ESM [Introduction](#).

Term	Definition
	<p>look at and think about following the guidance offered.</p> <p>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.”</p>
Constructor	Term for the entity performing fabrication or physical construction activity, generally being phased out in preference to Subcontractor.
Contractor	Procurement (ASM) proforma (boilerplate) defines this as LANS, the prime contractor to DOE; however, elsewhere within the Engineering Standards 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 to LANS or a LANS employee. When the intention is that task be performed by LANS, then the term LANL is preferred since unambiguous.
CSI format Specifications	The numbering and 3-part format defined by the Construction Specifications Institute’s MasterFormat and SectionFormat documents (see LMS below).
DCP	Design Change Package, a design change control mechanism for nuclear facilities. Ref PD341 Engineering Processes Manual.
Design agency	The LANL organization or subcontractor (A/E) responsible for the preparation of engineering design and documentation [from IMP 342].
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. [IMP 342, Design Authority]. The <u>receiving DAR</u> is the person to be responsible for the equipment once a project is turned over to operations.
designer	Anyone working in a design agency capacity, whether engineer, architect, drafter, or designer.
DSM	LANL’s Drafting Standards Manual
ECN	Engineering Change Notice, a design change control mechanism for non-nuclear facilities. Ref PD341 , Engineering Processes Manual.
eng	engineering
ES	Engineering Services Division of LANL (includes design and system engineers).
ESM	LANL’s Engineering Standards Manual, ISD 341-2, of which this section is a part
F&OR	Functional and Operational Requirements. F&ORs are “developed from the Mission Need, Program Requirements Documents, and specific facility characterization data to more concisely quantify and qualify project requirements. [LANL ADPMGT Proc 301]
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]

Term	Definition
	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., potable water system); refers to individual SDDs for details on critical systems
FOD	Facility Operations Director. One of approx. 10 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.” [IMP 313]
Hazard category	For nuclear, the DOE-STD-1027 category (1, 2, or 3). For non-nuclear, per IMP 111 , Facility Hazard Classification (High, Medium, Low, Office): <ul style="list-style-type: none"> • 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
IMP	Implementing Procedure, a LANL policy document that replaced LIRs and is being replaced by PDs.
Important to safety	Here, those nuclear safety, defense-in-depth SSCs in addition to SC and SS [DOE-STD-3009 and 10CFR830]
IRM	Institutional Records Management Division of LANL. IRM-DC is the Document Control group of IRM.
ISD	Implementation Support Document, a LANL policy document such as the ESM that supports an IMP.
LANS	Los Alamos National Security, the prime contractor at LANL
LIR	LANL Implementing Requirement (a policy document type being replaced by PDs, etc.)
LMS	LANL Master Specifications in LMS Manual. These CSI numbered/formatted specifications address construction-type work and maintenance (maintenance examples: piping repairs and testing, carpet and other like-for-like replacements). Formerly titled LANL Construction Specifications Manual from 1990’s through 2005.
Major modification	Mod to a nuclear facility that substantially changes the existing safety basis for the facility [adapted from DOE-STD-1189-2008]
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

Term	Definition
	facility. At present, drawings are mirrored in the online MOADS 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 PassPort CMMS 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-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.
OST	Operations Support Tool, a LANL policy document type being replaced by ISDs such as this one.
PD	Program Description, a LANL policy document replacing IMPs and LIRs.
POC	Point-of-Contact
priority document	<p>Defined in PD341 Eng 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:</p> <ul style="list-style-type: none"> • 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]
project	Any activity involving the installation, modification, or permanent removal of an SSC at LANL. Includes related fabrication, construction, procurement, and maintenance activities.
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 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]

Term	Definition
Safety Class (SC) SSC	A nuclear facility term, <i>Safety class structures, systems, and components</i> 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 they failed.
Safety Significant (SS)	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 [DOE O 6430.1A]. “Must” denotes the same and is the preferred term in internal policy documents [LANL P311-1]. (“Will” is sometimes used to convey 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. [6430.1A]
Site Chief Engineer	Individual in ADE charged with ultimate Design Authority responsibility for LANL; see also IMP 342 , Design Authority.
specifier	A designer who authors or edits specifications
SSC	Structure, system, or component
SSS	LANL’s Support Services Subcontractor (e.g., KSL) that was to phase out in 2008. Once gone, SSS work will be performed by 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.

Term	Definition
Subcontractor	Preferred term for entity under contract to LANS (sub to DOE). Sub-tier Subcontractors work for Subcontractors.
Standard Drawings and Details	The example drawings and repeatable details on the Engineering Standards website.
temporary (and permanent)	See Section Z1030 in this document
VSS	Vital safety systems are safety-class systems, safety-significant systems, and other systems that perform an important defense-in-depth safety function.[DOE-STD-1073]
WSS	Work Smart Standards, a subset of contractual documents on environment, health, and safety contained in Appendix G of the former UC/DOE contract. The LANS contract beginning 6/1/2006 did not include this set in its App G. http://int.lanl.gov/orgs/pcm/ (best, internal). External: http://www.doeal.gov/laso/NewContract.aspx

2.0 CODES AND STANDARDS

- A. Follow the ESM Introduction at <http://engstandards.lanl.gov/index.html#esm>
- B. Contract: Comply with the applicable portions of the latest edition and addenda of each code, standard, DOE Order, and other document invoked by the ESM or by the subcontract or LANL M&O [contract](#) (*most in Appendix G*) unless the ESM or AE contract indicates a different edition (referring here to actual ESM requirements, not citations of codes/editions in footnotes, endnotes, or other commentary). 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. <http://int.lanl.gov/orgs/pcm/> (best, internal). External: <http://www.doeal.gov/laso/NewContract.aspx>²
- C. Federal: Follow all laws and applicable Codes of Federal Regulation (CFRs), latest edition. CFRs are federal agency requirements that have the force of law. Follow Executive Orders only when mandated by DOE or LANL documents. *Rules, Orders, and Laws can be found at: http://engstandards.lanl.gov/engrman/HTML/Universe_links.htm*. If [10CFR851](#) or the LANL/DOE or project contract states a later edition than the ESM, then that governs.
- 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 laws LANS need comply. If there is any question as to whether specific laws and regulations apply to LANS, confer with LANL Legal Council.*³

² The DOE Directives system is explained briefly and well at <http://www.hss.energy.gov/NuclearSafety/nsps/ourdocs.html>

³ 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.

1. The New Mexico building [codes](#) shall be followed⁴ as described below. Thus, comply with the NM Commercial Building, Electrical, 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.⁵
 - c. Where LANL standards are more stringent than the NM codes, LANL documents shall be followed. As an example, LANL currently adopts IBC-2006 with strengthening amendments in ESM Chapters 5 and 16; such LANL modifications must be followed. Likewise, LANL follows DOE energy standards (see ESM Ch 14) that are 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.
 - As an example, the ESM Mechanical Chapter currently references the 1997 UPC/UMC while NM has adopted 2006; where the 2006 or NM state amendments are more stringent in the specifics than the 1997, those specifics must be followed (simplest in this case is to simply follow the 2006 plumbing and mechanical codes in their entirety plus LANL strengthening amendments).
 - e. Permitting, inspection, and other administrative matters shall be per ESM Ch 16-IBC Program.
 - f. *The affected Standards Discipline POCs should maintain awareness of NM building code changes affecting LANL projects.*
- H. For national and DOE standards, guides, and handbooks, if that 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 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) of national/DOE-type documents, then those sections obviously become required.
- I. **Online Codes and Standards:** Free access to many national codes and standards is available to anyone with a LANL IP address (or token card) at:
<http://library.lanl.gov/infores/stand/ihs/index.htm>
- J. International Building Code: See ESM Chapter 16, IBC Program, Section IBC-GEN, for required edition, amendments, and related requirements
- K. NFPA: Comply with all NFPA codes and standards except NFPA 5000. For NFPA 70 (NEC), follow edition as required by ESM Chapter 7.

⁴ 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.

⁵ Since this would require DOE approval per NSEP-TP-2007-1.

- L. Nuclear Facilities: DOE-STD-1189⁶: Projects that have not yet reached CD-1 prior to June 11, 2008 shall follow [DOE-STD-1189](#), *Integration of Safety into the Design Process*, which applies to the design and construction of the following:
- new DOE Hazard Category 1, 2, and 3 nuclear facilities;
 - “major modifications” to DOE Hazard Category 1, 2, and 3 nuclear facilities (see Definitions); and
 - other modifications to DOE Hazard Category 1, 2, and 3 nuclear facilities managed under the requirements of DOE O 413.3A, Chg 1., *Program and Project Management for the Acquisition of Capital Assets*

2.1 LANL Engineering Standards

- A. LANL Engineering Standards Manual (ESM), ISD 341-2⁷

This chapter's section 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)

1. See Subsection on Specifications later in this Section Z10.
2. Programmatic work: LMS sections required for programmatic work are those referenced in ESM sections designated for programmatic.
3. NOTE: LMS sections were renumbered to the CSI MasterFormat 2004 system in February 2006. Crosswalks between old and new numbers/titles are available on the specs webpage.

- C. LANL Standard Drawings and Details

1. This includes example drawings and the “ST-“ series repeatable details.
2. Comply with standard detail drawings unless indicated as guidance in the ESM (e.g., italicized detail title). Edit the details to reflect the particular details of the project by delete portions that in no way apply. Do not delete potentially-applicable requirements without ESM Discipline POC approval.

- D. LANL Drafting Standards Manual (DSM)

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

- E. LANL Design Guides

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

⁶ Added to LANS Contract 6/11/08 by [Mod 46](#)

⁷ This document was numbered OST220-03-01-ESM prior to Dec 2005, and ISD 342-1 until October 2006

3.0 CLARIFICATIONS, INTERPRETATIONS, ALTERNATES, VARIANCES, AND NON-CONFORMANCES

3.1 Clarifications and Interpretations

- A. Standards users may contact the Standards Discipline [POCs](#) directly for assistance (*for major projects, ADPMGT procedures for RFIs dictate communication pathways*). When a written response is appropriate, users should consult with the POC; they may be asked to submit the request in writing to the POC using the ES Division [Engineering Service Request](#) (ESR) System (preferred method), by email, or using Z10 Form FM1 (Att 1) in accordance with Table Z10-1 below. Standards webpages and ESM documents list POC contact information (may contact alternate when the POC is unavailable).
- B. When clarification or interpretation e-mails or paper requests reach the appropriate POC(s), POCs shall respond promptly (and in writing if received as such).
- C. The POC for each respective technical committee may respond directly to interpretations and clarifications, or first call upon the assistance of others including the respective 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, variance, and exception data are normally posted for viewing on the LANL web until such time the exception or variance no longer physically exists, or the ESM is revised to incorporate the exception or variance. When incorporation into the ESM is planned it should indicate such plans in the web posting.

3.2 Alternate Methods, Variances, Exceptions, and Non-Conformances

- A. Personnel shall not deviate from the LANL Standards in developing the technical project requirements (including programming documents, F&OR, and performance criteria), in design, in practice (execution), or in written direction to any LANL subcontractor unless the Standards Program has formally granted such variance to the project as described below.
- B. Forms and authorities for alternates and variance are summarized in Table Z10-1.
 1. Exceptions to the LANL Master Specs, Drafting Manual, Standard Drawings and Details (ST drawings, etc.), and welding procedure specs may be granted in writing by the discipline POC in a manner similar to the interpretation process described above.
 2. Variances and exceptions to the [ESM](#) proper shall proceed as follows:
 - a. Requestor discusses with POC and, ideally, develops the request using the ES Division [Engineering Service Request](#) System available from ES-Div homepage normally [use of this system allows assignment to responsible POC(s) by CENG].
 - 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 reviews the request, ideally enters into ESR system, and makes a decision, which may include one of the following options:
 - i. Concur with the request, as-is (initiate form Section Z10 Attachment 2, [Form-FM2](#) for requestor if not already initiated); form then requires additional approvals including responsible requesting manager and CENG or Site Chief Engineer.
 - ii. Concur with a modified request (requires same additional signatures)
 - iii. Table the request until additional requested information is provided by the requestor.
 - iv. Reject the request.
- c. Requestor takes action in accordance with the decision, or, if rejected, appeals to CENG or Site Chief Engineer).

Caution: When an alternate method, variance, or NCR may affect worker health or safety as regulated by [10CFR851](#) (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), then DOE approval may be required per 10CFR851 Subpart D. Similarly, deviations from DOE O 420.1B and other LANL contractually-required Orders may also require DOE approval. Contact the Standards Manager for guidance when this potential exists. Fire protection equivalencies and exemptions may have additional or alternative forms (contact Fire Marshal).⁸

- 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 graded/tailored application of codes and standards is not considered a variance to the ESM. When the graded approach is used to define the appropriate methodology for code and standard application, that methodology and rationale shall be formally documented and become part of the project design documents. The applicable LANL Engineering Standards POC is the authority having jurisdiction for approval of the form and content of the documentation. *Example: The graded application of IEEE nuclear standards for safety class electrical work.*
- E. Nonconformances (NCRs) for LANL Engineering Standards-related Work: Alternates, variances, and exceptions discussed above are only applicable for proposed, future work. While use of these processes is not encouraged, there are instances when they are appropriate. On the other hand, 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 as non-conforming with the Standards or Subcontract, a nonconformance report (NCR) shall be generated and used to disposition the situation and address causes of non-compliance. Replacement or rework is generally the necessary outcome, while use-as-is and repair dispositions may be granted in rare cases.
 1. *Project Management Directorate Procedure 0313, Nonconformance Reporting, [P330-6, Nonconformance Reporting](#), or other approved procedure can be used when more appropriate procedures/forms do not exist.*

⁸ PD [1220.1](#) Fire Protection Program

2. Disposition options and implications:
 - a. Use-As-Is disposition are considered design changes requiring a corresponding change to the associated design media.
 - b. Repair dispositions are considered design changes requiring a corresponding change to the associated design media. Repair dispositions indicate that the repair cannot make the item like the original and therefore; specific repair directions must be provided by the design professional in responsible charge (DPIRC).
 - c. Rework dispositions indicate that the rework process will allow the item to be restored exactly as the original (not a design change).
 - d. Reject or Scrap dispositions may require the DPIRC to include instruction on how to dispose of the item or component in a manner that is safe and non-deleterious to the environment or safety of the workers or public.
3. For use-as-is and repair dispositions only:
 - a. Initial approval shall be by LANL Design Authority Representative (DAR).
 - b. POC involvement: The DAR or Project Engineer must then submit NCR to the applicable Standards Discipline POC(s). The POC shall understand and document the technical and DOE-contractual ramifications for not meeting requirements on the Variance/Exception Form FM2 and attach it to the NCR. When code or other contractual issues may exist, POC shall involve the Standards Manager in the process (Standards Manager responsible for ensuring appropriate functions such as LANL Building Official or DOE are involved and correct outcome is reached). POC shall sign and indicate acceptance or rejection.
 - c. For all ESM requirement violations, the POC shall forward the NCR to the Site Chief Engineer or CENG Office Director for concurrence signature, with copy to Standards Manager). (Step not required for spec, detail, or Drafting Manual violations; insert "n/a" in signature block for same).⁹
 - d. Rejection at any step shall result in nonconformance disposition change to rework/scrap (from use-as-is or repair) and return it to the LANL project engineer.

⁹ Provides same level of review and approval for nonconformance acceptance as exists for requirement-setting and variances.

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

	LANL Master Spec, Standard Drawing or Detail, or Drafting Manual			LANL Engineering Standards Manual			LANL Standard by Contract or Rule		
	Form	Approve/ Issue	Appeals	Form	Approve / Issue	Oversight/ Appeals	Form	Approve/ Issue	Appeals
Clarification or Interpretation	e-mail	ESM Discipline POC	CENG or ChEng (may involve POC and Tech Comm)	ESR, email, or Interp Form Att 1-FM1 of Z10	AHJ (usually the ESM POC shown on website)	CENG or ChEng (may involve Tech Comm)	ESR, email, or Att 1-FM1 of this Section Z10	AHJ (usually the ESM POC shown on website)	CENG or ChEng (may involve Tech Comm)
Alternate Method	e-mail	ESM Discipline POC	CENG or ChEng (may involve POC and Tech Comm)	ESR or email + Variance Form Att 2-FM2 of Z10	AHJ (usually the ESM POC shown on website)	CENG or ChEng, then progressively higher levels of management if necessary	ESR + Att 2-FM2 of this Section Z10	CENG or ChEng (see 851 Caution above)	Progressively higher levels of management
Variance or Exception	e-mail	ESM Discipline POC	CENG or ChEng (may involve AD, POC and Tech Comm)	ESR or email + Variance Form Att 2-FM2 of Z10	POC + CENG or ChEng	Progressively higher levels of management	Memo or other DOE approval of project document clearly showing acceptance	DOE Los Alamos Site Office or higher (see 851 Caution above)	DOE HQ

Clarify	To make the Eng Standards or referenced code or standard understandable and free from confusion
Interpret	To formally provide an acceptable method of compliance with the Eng Standards or referenced code or standard
Alternate Method	A deviation from an Eng Standards or referenced code technical requirement that includes compensatory measures that accomplish the desired intent or results intent 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
Exception	Relief from all or a part of the requirements in the Eng Standards or referenced code or standard

4.0 CODE OF RECORD

- A. General: By definition, the codes and standards used to perform the design are considered the “codes of record.” Establishment and maintenance of a facility or system’s design basis during design and construction, including “codes of record” is required, and must include documentation required by this Section Z10 and other chapters including Structural, Hazardous, and Nuclear.
- B. For code-of-record issues for existing facilities that are not addressed by ESM Chapter 16 Appendix B on IEBC, the Site Chief Engineer-approved Design Authority Representative shall reach agreement with the AHJ(s) to determine the path forward (Site Chief Eng resolving conflicts). *Guidance: The design basis includes the design inputs such as design criteria and codes, plus design decisions captured in studies and calculations. Also see ESM Chapter 16 Section IBC-GEN App B on IEBC regarding updating to current codes during modifications.*

C. Application to New Projects (Underway Concept)

LANL STRs shall ensure that subcontracts for design or construction require compliance with applicable portions of the Standards including the following criteria (ensure in subcontracts).

1. **Major projects:** For projects meeting the threshold of [IMP 353](#), *Capitol Assets Acquisition Project Management*, the point used for determining the application of the Engineering Standards (code of record) shall be 30 days prior to the final issue date of every Request for Proposal with a statement of work that includes AE design services. Thus, for a very large project in which the F&OR work, conceptual design, and preliminary/final design is subcontracted by LANL separately, each successive engineering contracting activity must require use of the latest standards at the time, not the set in existence for the previous engineering contract. In rare cases involving safety, the ESM or Site Chief Engineer may require analysis and possible adoption of new criteria for projects underway (e.g., increased seismic spectrum, see Chapter 5 Section I.1.3).
2. **Small Projects:** 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 or preliminary/final design (or date of RFP for final AE services, if sooner).
3. **Design Shelf-life:** For all projects, when the design has been substantially completed but construction has not begun within 12¹⁰ months, the design shall be evaluated against current LANL Standards through documented cost/benefit analysis via ESM Variance Form acceptable to the Site ChEng or CENG and the design updated if warranted prior to beginning construction. Similarly, if the design process is stopped part-way for over 12 months, upon restart it must then be evaluated against the Standards that were effective no earlier than 30 calendar days prior to the date of restart of design.¹¹

¹⁰ At time of writing, modifications to existing 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.

¹¹ One year maintains the original “Code of Record.” This allows projects to not have to update constantly because a few LANL Standards documents have changed. Past one year there is typically enough change to warrant a review, update, and reissue. In

Guidance: It is often to a project's or subcontractor's advantage to voluntarily adopt newer standards during design. Newer LANL 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 or complete.

- D. **Code of Record Documentation for Projects:** Projects shall document and maintain the specific edition of the codes and standards used as their basis in a project record document once they have reached the “underway” date discussed above (including LANL ESM and specs, DOE Standards, and national and state codes and standards). *Guidance: Producing a CD-ROM of the LANL Standards can accomplish that portion of the whole and greatly aid design reviewers; CENG may produce these upon request.* NOTE: At time of writing, other parts of the ESM require additional documentation of the code of record. 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 Section I requires a Design Basis Document;
 - Nuclear Chapter 12 (and some hazardous facilities per Ch 10) requires a detailed design criteria document, etc.
- E. **Engineering Services during Construction:** Projects shall retain the original design agency to provide engineering services during construction (LANL's Project Engineer, Project Manager, and DAR shall agree when original Engineer of Record is not used).
- i. Scope of services shall include: review and approval of submittals, processing of non-conformance reports, creation and approval of Design Revision Notices (DRNs) per [AP-341-519 Design Revision Control](#), structural observation where required by ESM Ch 16, and incorporation of redlines. *Scope should also include general work observation for conformance to design.*
 - ii. For priority drawings and ML-1 and ML-2 work, AE shall also be contracted to provide “as-built” record documents (not just as-found/documented) of all design outputs delivered (e.g., drawings, calcs, specs, SDDs, databases).¹²

most cases, changes are small and "redesigning" the package is not necessary. A good recent example of this 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 even directed some 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 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.

¹² These services are essential to an effective design change process. Original EOR will generally provide highest quality and most efficient services, particularly if this work scope is in original AE contract. When EOR is outside LANL, using them

- F. *Guidance: Requests for Proposal (“bid documents”) should state the key design basis codes/editions such as Building Code of Record (e.g., IBC-2006) and Life Safety Code of Record (e.g., IBC-2006 and NFPA 101-2006).*
- i) *At time of writing 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.*

5.0 “CONFLICTS” AND ADEQUACY

- A. “Conflicts”: The most stringent requirement among contractual requirements including ESM chapters and the codes and standards invoked by them shall 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.
- 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 shall be followed (*this is often intentional – practicing technique of having directive 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 and the project-specific spec shall 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 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, the term shall have the meaning given it in the ESM. If a term is not defined in a code or standard but is defined in the ESM, the term shall have the meaning given it in the ESM.
- 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.
- F. Complete Design: The engineer/designer is responsible for a complete, coordinated design package (e.g., drawings or sketches, specifications, etc.) as required to meet project specific requirements. Refer questions concerning the contents in the Engineering Standards manuals to the applicable LANL discipline POC. *Guidance: The manuals are not intended to cover all design requirements and construction specifications necessary to provide a complete operating facility or system. Some LANL IMPs and LIRs may also provide design criteria/requirements.* The design organization is responsible to provide a complete design

maintains unambiguous liability and responsibility for design adequacy. For ML-1/2, as-built records are essential to ensure alignment between design and field as directed by DOE-STD-1073 Configuration Management.

package, including all necessary specifications, updated and integrated as necessary (see Specifications and Details subsection below).

6.0 “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 shall use conservative or actual values.

- A. Altitude: 7500 feet
- 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).¹
- D. Air Density (7,500 feet): I-P: 0.057 pounds/cubic foot (0.075 pcf at standard air)¹³
 - 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):

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.¹⁴
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.

7.0 DEACTIVATION, DECOMMISSIONING, AND DEMOLITION (D&D)

- A. When designing new systems and facilities, consider how D&D 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*).

The remaining paragraphs refer to the actual D&D process:

- B. As a minimum, perform D&D to a plan that describes the scope of work, work boundaries, utility de-energizations and locations, and protection of non-scope SSCs.
- C. As appropriate, further describe D&D work using drawings or sketches. *Guidance: Use clouding or other methods as described by the LANL Drafting Manual. The addition of photos in the drawings is a common and helpful technique for helping to describe the work.*

¹³ FWO Calculation No. 00-00-CALC-M-0003.

¹⁴ Basis: Altitude at LANL generally ranges from 6250 ft at TA-39 to 7780 ft at TA-16. Info from USGS 1:24000 quadrangle maps: 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.

- D. Obtain ES-DE approval of D&D plans prior to work initiation, except those meeting ESM Chapter 16 Section IBC-GEN exemptions regarding minor scope/risk.¹⁵
- E. For electrical demolition refer to ESM Chapter 7 and LMS Section 02 4115, Electrical Demolition

8.0 DESIGN ADEQUACY AND BACKFIT OF NUCLEAR/HAZARDOUS SSCs

- A. When an existing structure, system, or component (SSC) is upgraded to safety class, ML-1, safety significant, ML-2, or other SSC important to nuclear safety, the Design Authority organization (*typically the system engineer or their management*) shall perform a formal adequacy analysis. The analysis process shall determine if the SSC complies with the current standards or, if not, establish the feasibility and cost effectiveness of modifying the SSC to comply with current standards.¹⁶
 1. Follow LANL Conduct of Engineering [AP-341-515](#), System Adequacy Analysis.
 2. *Guidance: This process has been followed at LANL by WETF, DVRS, TA-55, and elsewhere, and examples are available. For confinement ventilation systems, follow DOE <https://www.hss.energy.gov/deprep/archive/rec/2004-2.asp>*

9.0 DESIGN GOALS

- A. Unless stated as otherwise in the project-specific documents, designers shall use the following parameters for decision analysis and design goals:

Systems	Expected Life, years ¹⁷
HVAC control system	10
Other HVAC/R system components	As shown in ASHRAE HVAC Applications manual (Owning and Operation Costs chapter)
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 (~\$5M maximum) facility]	35
Medium Construction (e.g., line item office or lab)	50
Heavy Construction (e.g., bunkers, other concrete-walled/roofed structures)	60

¹⁵ Satisfies LANL Building Official review requirement of IBC 105.1 and ESM Chapter 16, IBC Program

¹⁶ DOE 420.1B requires that safety SSCs be designed per the Order and its Guides, and under a quality assurance program that satisfies 10CFR830.120. The DNFSB has identified that, in some cases, these existing SSCs designated as safety SSCs have not been evaluated to ensure that they can reliably perform their credited safety function and the SSCs may not satisfy current codes and standards for design or current quality expectations. [from EFCOG White Paper referenced in 8.0.C] Since most existing LANL SSCs would not meet the current Order requirements, design adequacy analysis must be performed.

¹⁷ Numbers consistent with those being used by Maint Eng Group for decision making and modeling per Carr 11/2005. 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.

- B. Materials and finishes shall be chosen accordingly.
- C. Difficult-to-replace systems and components shall 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., 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.
1. Systems and Components for which replacement or life extension is anticipated in less than 35 years:
 - Flooring (carpet and vinyl)
 - Mechanical equipment (active)
 - Electrical equipment with moving parts or contacts
 2. Guidance on life cycle analysis is provided in Appendix E.

10.0 DESIGN OUTPUT REQUIREMENTS

10.1 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 shall 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 shall be a historical record showing how the design progressed and reasons for changes.

10.2 Calculations¹⁸

- A. Prepare design calculations to document analytical determinations. Calculations shall be checked, reviewed, sealed when required by the following subsection, signed and dated by the designer and the checker, complete in all respects and shall reflect the basis for selection of systems and components.

¹⁸ "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 and can be checked.

- B. Submit calculations to LANL design authority for review and approval as requested or required. This approval does not relieve the designer of any responsibility for correctness and coordination with the drawings and specifications.
- C. The calculations will become record calculations for LANL and may be used in the future for modifications. Room numbers, equipment nomenclature, fixture numbers, zone numbers, or any other designations shall be consistent with those indicated on the drawings or in the specifications.
- D. These calculations may be microfilmed or electronically scanned if electronic copies are not available. For this reason, calculations shall 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.
- E. 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. Include explanation of the method used in computer (or calculator) programs, playback of input data, and clear formats for computer-generated information. 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. If a computer program was used, provide input file on CD.
- F. Computer Calcs: When performing design calculations with computers:
 - 1. 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; each calc submittal that is based on commercial software should 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). 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 shall maintain a basis for program acceptance (e.g., benchmark testing and/or standardization).
 - 2. Present complete documentation of new programs used. Present this information in fundamental language such that an engineer unfamiliar with the program can understand the functions, limitations, and method of analysis used.
 - 3. Provide sufficient documentation to enable the verification of the method of data input and the interpretation of the output calculations.
 - 4. 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.
 - 5. Present a complete computer listing of input and output data (CD acceptable).
 - 6. Neatly arrange sketches, input, output, and other material pertinent to the analysis and use 8 1/2 x 11 inch sheets, where practical, and include in the complete analysis presentation.

- 7. Software shall be controlled with a graded approach consistent with LANL software quality assurance documents (see Subsection Z1020 below).
- G. Calculations shall be prepared in accordance with the design agent’s Quality Assurance Plan. For design agents who do not have formal calculation procedures, calculations shall be prepared in accordance with [AP-341-605](#) Engineering Calculations. Submit the calcs for review per LANL Project Management or other established procedures.

10.3 Drawings and Other Outputs

- A. Projects for new systems and buildings shall categorize and label their Priority drawings in accordance with Table Z10-2 below¹⁹, Appendix A, and the Drafting Manual. This categorization subject to approval by the receiving LANL Design Authority Rep.
- B. 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 shall be delivered as a turnover document prior to close-out of the project. A spreadsheet that can be uploaded to the LANL institutional engineering drawing database (e.g., MOADs) shall be submitted when over 5 documents are transmitted. 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 MOADs.
- C. The minimum fields to be included are²⁰:

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, UCNl, 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

¹⁹ These 3-4 categories are suggested by DOE-STD-1073, Configuration Management. They are used throughout the DOE complex where Priority is often called Essential. “Priority” has been in use since the 1990’s at LANL, introduced in Sonalyst-authored PWI procedures. They are proceduralized in PD341 Eng Processes Manual, and its APs.

²⁰ [AP-341-403 Master Document List](#)

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	

Table Z10-2 Document Configuration Management Categories -- Priority, Support, and General²¹

Document Category	Assignment Criteria	Typical Incorporation Time Frame (actual timeframe requirements in CoE Eng Processes Manual, PD341)
Priority	<ul style="list-style-type: none"> • P&IDs and single lines in nuclear, rad, and mod/high hazard facilities • Master Document List for the Priority drawings • Operating and surveillance procedures • Master Equipment List for the safety-related SSCs • Other documents required by Alarm Response, Emergency, or Abnormal Operating Procedures (and consider the procedures themselves) • Required to determine plant event compensatory actions • Required by Technical Safety Requirements (TSR) to clarify technical requirements 	<p>Revise after field work complete and prior to release to operations. Methods for documenting field work complete are described in AP-WORK documents. Methods for documenting release to operations may include the Lockout/Tagout Form.</p> <p>Incorporation of amendments into Priority Documents may be extended for 30 calendar days with documented approval by the Design Authority and the Operations Manager. These signatures signify that operations can commence without a safety concern with change paper attached.</p>
Support	Information that provides engineering, maintenance, and operations details necessary for plant operations (e.g., process flow sheets, instrumentation, fire protection, etc.)	<p>Revise after release to operations and within 30 calendar days of an amendment determined by the Design Authority to be complex or upon receipt of the fifth field complete amendment. Complex is defined as the inability of the users to interpret the technical baseline document/amendment(s) such that safety and efficient operations are compromised.</p> <p>Ensure unincorporated technical baseline changes are tracked with a status that indicates field completion and a cross-reference to the affected document.</p>
General	Information that provides engineering details necessary for construction (e.g., structural, architectural, civil, etc.).	<p>Revised at the discretion of the Project/Facility Engineering Manager or designee.</p> <p>Ensure unincorporated technical baseline changes are tracked with a status that indicates field completion and a cross-reference to the affected document.</p>
Non-Technical Baseline (NTB)	Reference or legacy documents not intended to be maintained.	N/A

D. Beyond the Table Z10-2 requirements above, Appendix A provides a matrix of additional types of technical documents and their suggested CM categories for a typical facility or

²¹ LANL PD [341](#), Engineering Processes Manual App F

system; it is guidance and can be used as a starting point to record project drawing requirements.

- E. Drawing content and format shall comply with the LANL Drafting Manual. When 3D CAD or building information modeling (BIM) is used, the entire model/database shall be delivered to LANL along with other required deliverables.
- 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, or subcontractors that are involved in the practice of engineering shall 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). The single exception is that building 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.²²
 2. 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)²³
 3. PEs shall 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.
 - a. Exception: The single seal of either an engineer or architect meets the requirement for professional certification on projects which do not exceed a construction valuation of

²² For protection of LANL’s interests, more restrictive than exceptions allowed by NMAC, <http://www.nmcpr.state.nm.us/NMAC/parts/title14/14.005.0002.htm>

²³ 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 New Mexico 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.

\$400k AND do not exceed a total occupant load of 50.²⁴ However, when a majority of the work is of a specialized nature such as fire or electrical, or if an electrical design becomes necessary as defined in D5000 (1.1-E), then the appropriate P.E.'s certification must appear on the documents as may be required by this Section or the NM Construction Industries Division.

4. **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:²⁵
 - (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) engineer or landscape architect has reviewed the plans prior to the preparation and sealing of the final set of construction documents to be submitted;
 - (d) the new "engineer of record" has professional liability insurance that is commensurate with the magnitude of all the work being stamped (N/A for LANL engineers);
 - (e) out-of-state-license work does not exceed 30% of the projects total design work in hours or cost.
5. **Design-Build:** Documents shall be sealed before construction begins. Exceptions: Site preparation and excavation can proceed. LANL STRs may authorize construction-start prior to sealing at risk and with LANL Building Official approval.²⁶ See ESM Chapter 16 Section IBC-GEN.
6. **Architectural:** Follow the requirements above except that output documents shall bear the seal of a NM-registered architect per the NM Architectural Act based on Article 15 of Ch 61. http://www.nmbea.org/Law/law_frames.htm
7. **Fire:** Per 16.39.3.8 (G) NMAC (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. 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. shall seal such

²⁴ 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/press.html> bottom of page

²⁵ 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.

²⁶ Basis: Helps ensure safety of construction workers, limits LANL liability with safety and unacceptable work.

work as their own except when waived by LANL Fire Marshal. ([National Institute for Certification in Engineering Technologies](#)).²⁷

8. LANS 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.²⁸
9. Sealing Record Drawings (as opposed to as-builts) is not normally required. If an AE merely incorporates Constructor's red-lines, then AE shall sign the revision but need not seal. If the build team's AE is responsible for 100% inspection or true as-building, then the AE shall seal. *Guidance: The PE must be in "responsible charge" of any work product they seal/sign. Responsible charge is usually defined as directing the work, making the decisions, and reviewing the final product. Merely reviewing the work does not suffice. State law requires sealing all drawings issued by the AE that are wholly his product. However, red-lines done by a constructor are often not wholly the AE's product.*²⁹

10.4 Design/Evaluation Criteria

- A. Documentation shall include, but is not limited to, the following:
 1. Design output documents required per Appendix B and following the schedule for submission in Appendix 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 as required by change control procedures (e.g., DCF, ECN, DCP) if present; 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 shall 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 for motor size is properly performed.

²⁷ 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 is recent LANL practice with KSL and more conservative than 20 which is used by Phoenix and being contemplated by NM.

²⁸ Memos from Lab Counsel to Tobin Oruch, 7/19/01 and 9/25/06 (EMref-3 and 53). Direct-report (job shop) contractors to LANS are also considered exempt as they are employees of the entity of a sort, albeit not LANS per se; task-order contractors are not.

²⁹ Memo from T. Oruch to M. Koop dated 3/14/02 (EMref-4) and ESM Interpretation No. 2002-02, Rev. 0.

4. Include copies of catalog sheets showing equipment performance points for all major equipment included in the systems design. *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 Equipment Data Books (EDBs) 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).*

11.0 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 shall comply with the environmental requirements defined in Exhibit F of the design contract document, and provide mitigations to potential 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, recycling/reuse options, and minimization of mixed waste generation.
 - Waste management and disposal
 - Working within the boundary of a potential release site
 - 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 SMEs³⁰.

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 ADPMGT Procedure [403](#), Environmental Planning.

³⁰ ADPGMT 403 r1 pg3. This is a LANL Project Engineer responsibility.

12.0 ENVIRONMENTAL QUALIFICATION³¹

- A. The requirements identified within this section are for safety SSCs or those systems that provide a mission critical, defense in depth, or worker safety function or whose failure may impact the operation of safety SSCs. For non-safety systems, this section shall be interpreted as guidance that establishes sound engineering practice for the proper and reliable performance of such SSCs.

12.1 General

- A. The environmental conditions in which SSCs must operate or which can affect the proper or continued operation of SSCs shall be clearly identified and considered in design and equipment selection and documented (e.g., the basis for the selected parameters shall be captured in the SDD). Normal ambient, abnormal operating, climatic, and event conditions shall be evaluated in the identification of applicable environmental conditions.

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

- temperature and/or humidity extremes
- 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

³¹ 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 environmental qualification 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 within the section are 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

13.0 EQUIPMENT LOCATION

- A. Maintenance: Mechanical, electrical, controls, and similar equipment shall be accessible for inspection, service, repair, and replacement without removing permanent construction, as required by code and as recommended by the manufacturer. Locate equipment in a non-rad, unsecured area (when possible) to facilitate maintenance.³²
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).³³ *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.³⁴
- E. Security: 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).

14.0 MASTER EQUIPMENT LIST (MEL)

- A. Projects shall develop project-specific MEL as a turnover document prior to close-out of the project. 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

³² LANL ISD 101-19, [Safety Signs, Labels, and Tags](#) and 1997 IAPMO UPC, Section 601.2.

³³ 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 step ladder. For safety-related systems this represents the minimum height for ease of surveillance and maintainability given the potential apparatus available for the performance activities.

³⁴ [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>

desirable for inclusion in the maintenance program for other reasons. Special tools and equipment should be included in this master list.³⁵

- B. When not entered directly into the MEL, a spreadsheet that can be uploaded to the MEL in the PassPort Computerized Maintenance Management System (CMMS) shall be provided. The AE, unless otherwise stated in the Contract 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 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 <http://int.lanl.gov/orgs/ceng/APs.shtml> (internal website, available on request).

15.0 REPAIRS, ALTERATIONS, CHANGES OF OCCUPANCY, ADDITIONS, ETC.

See ESM Chapter 16, IBC Program, for requirements.

16.0 SHED AND CONTAINER REQUIREMENTS

- A. Sheds include storage buildings, garages, and carports made by Morgan, Tuff Shed, etc. Containers include transportainer, SeaLand, SeaTrain, and similar steel shipping/storage boxes. All are considered structures and, as such, are subject to the following requirements for customization and installation in addition to national code and standard requirements applicable to such structures.

NOTE: Subcontractor structures in an approved project lay-down area are exempt

- Anchorage: Tie down with wind straps or other anchorage approved by LANL ES-DE Civil/Structural Team Leader.
- Bonding: Electrical bonding to a ground system (as is done with fences/gates) is suggested for personnel safety reasons should lightning strike nearby.
- Clearances/Siting: Get siting approval via [P 941](#), Site Planning. Comply with underground utilities and overhead power line right-of-way requirements in ESM Civil and Electrical Chapters (see Chpt 3 Civil G30 part 9.0 and 10.0). If there will be adjacent structures, follow ESM Fire Chapter for exposure acceptance criteria (e.g., [DOE-STD-1088](#), *DOE Standard on Fire Protection for Relocatable Structures* -- placement in accordance with Table in Section 6.1, a simplification of NFPA 80A techniques [the primary concern from these are the fire exposure they pose to more permanent and valuable structures]; Section 6.2 provides rules of thumb about placement; etc.).
- Hazardous Material Storage: Generic sheds and containers shall not be used for this; instead; use lockers or cabinets designed for safe storage (and containment if appropriate) and labeled for the purpose (e.g., NFPA 704 diamond); see also ESM Ch 10.³⁶

³⁵ 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

- Lightning Protection: This is typically not required because containers are normally used for low-value goods; however, if cost due to lightning-induced fire would be over \$100K, follow ESM Electrical Chapter requirements for making a needs determination (uses NFPA 780 exposure and importance criteria).
- Occupancy: Shipping containers shall not serve as occupied work areas. They are intended by design for shipping and storage purposes only. Personnel time inside shall be infrequent, of short duration, and controlled – and comply with basic life safety issues such as asphyxiation/confined space entry, stability of stacked materials, and IBC egress pathway. Structures for use in occupancy are covered by the IBC and must conform for that specific occupancy type.
- Signage: As described in ESM Chapter 4 Architectural, structure number signs are required.

17.0 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 [ISD 315-1](#) (Section 18).*
- E. For other signs refer to LANL ISD 101-19, [Safety Signs, Labels, and Tags](#).
 1. 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.
 - Chemical container labeling is described by [P101-14](#), Chemical Management.

18.0 SPECIFICATIONS AND STANDARD DETAILS

- A. When a LANL Master Specification Manual (LMS) section (“spec”) or Standard Detail applicable to the work exists, its requirements shall be followed regardless of who performs the work or the authorizing or contractual methods used to initiate the work.

³⁶ Hazardous material and chemical storage is subject to management requirements of LANL’s RCRA Permit - Module VIII, Section B.1, of the Laboratory’s Hazardous Waste Facility Permit (NM0890010515-1) as of 6/2008

- B. Like all office masters throughout industry, LANL Master Specifications are templates that the designer must start from, not finished products. Designers must tailor LANL Masters to the project's needs, modifying and augmenting the existing verbiage (to facilitate this, the Specs are webposted in Word, plus pdfs). For those nuclear and high hazard projects that need additional rigor beyond the ordinary, the need to augment the LANL Masters is particularly important. When editing sections for a project, the specifier 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 specifications must also be edited to delete specification requirements for processes, items, or designs that are not included in the project -- and hide or delete specifier notes in the masters.
- C. The designer must update LMS sections and Details used where they are incorrect, incomplete, uncoordinated, or have become outdated. *Guidance: A few structural specs had known minor issues at time of writing.*
- D. To seek a variance from requirements in the LANL Master Specifications or Details that are applicable, contact the Engineering Standards Discipline POC (see Clarifications section earlier in this document).
- E. Because most projects require specs for work results beyond what the LANL Masters cover, creating additional spec sections is normally also required.
1. When adding (non-LMS) specification sections, number them in accordance with the CSI [MasterFormat 2004](#) (MF04) system. The minor numbering differences between MasterFormat and the major commercial spec services are allowed (i.e., MasterSpec, SpecText, BSI). *Guidance: Engineering firms generally have their own office masters they draw from and/or they access commercial masters like MasterSpec, SpecText, and BSD. LANL subscribes to some of these.*
 2. The designer shall correct LMS sections to properly reference other LANL sections used as necessary -- and designer-added sections (and visa-versa). NOTE: LMS sections were renumbered to the MF04 system in February 2006, and a crosswalk from old to new numbers/titles is available on the specs webpage.
- F. Ultimately, the designer must produce a clear, concise, complete, and correct project work description as is also the case outside the LANL context.
- G. Packaging: A CSI-format Specification (spec package/book of sections) adequately describing the work must be prepared by the Design Agency and followed by the Subcontractor whenever either of the following criteria are met:
1. The work is ML-1 or ML-2.
 2. The estimated construction cost is \$300k or more.

NOTE: Both the Chapter 1 and ESM POC of the most-affected discipline can grant variance to the above.

Guidance: A CSI spec package is recommended for all other projects, and especially when multi-discipline or complex. Very basic projects may be able to capture needed instructions

elsewhere (in ECN or DCP instructions, sketches, or drawings). Specifications are preferred over extensive drawing notes.

- H. Specification packages (“books”) shall comply with LMS general requirements (e.g., LMS Section 100-200) including Table of Contents, approval sheet, format, language, and tailoring of spec to match project requirements (including deletion of unneeded subsections and paragraphs). Books and single sections shall also have footers with Project ID.
- I. When assembling a specification package, include applicable specifications from all Divisions, especially Division 1, General requirements. (e.g., *Submittal Procedures, Product Options & Substitutions, and Project Record Documents, etc.*)
- J. Spec Numbering: Buy American Act: Comply with this Act ([41 U.S.C. 10a - 10d](#)) as promulgated in the Federal Acquisition Regulation ([FAR](#)) Section 52.225-9. *Guidance: LANL policy for compliance is that American products shall be specified except when they are unavailable or the lowest acceptable offer for a domestic end product or construction material will exceed the lowest acceptable offer for a foreign end product or foreign construction material, inclusive of duty, by more than 6% if the domestic offer is from a large business, or more than 12% if the domestic offer is from a small business concern.*³⁷
- K. ML-1/ML-2 Specs: Draft changes from LMS spec sections for ML-1/ML-2 SSCs shall be produced using Word “Track Changes” features (*deletions should be **Strikethrough** and additions be **bold** text with a right border line*).
1. Electronic review drafts shall be made available to LANL reviewers upon request.
 2. Hardcopy drafts and finals shall not show tracking (e.g., “Final” view; plain, clean text).
- L. **ML-1, 2, and 3 Warning:** Most LMS specs and the Details were not intended for ML-1, 2, or 3 projects and therefore did not receive the independent review required before issuance of such documents (most warn of ML-1/ML-2 but don’t all as yet warn about ML-3 for which the definition changed early 2007; these notes were being changed in the Spring/Summer of 2008 for ML level and to improve clarity). ML-1 and 2 LMS specs have received independent technical review by a qualified reviewer.

ML-1, 2, and 3 projects shall ensure that their final specs and drawings contain adequate QA requirements. *Guidance: Typical additions for ML-1/2 specs and details (and such designs in general) are intended to increase reliability as appropriate for the credited functions in the documented safety analysis. For these and for ML-3 specs/details, appropriate strengthening may include:*

- *Submittal/acceptance of QA program including qualifications of designers and installers, non-conformance program, etc.*
- *Qualified vendor*
- *identification of critical characteristics,*
- *more detailed construction submittals,*
- *more rigorous material receipt and control, possibly including inventory control,*

³⁷ FAR 52.225-9 and -13, and LANL ASM Acquisition Practices Section 3251 Buy American Act Rev 1 10/22/07

- *storage, maintenance, and handling requirements*
- *more rigorous field quality control,*
- *test and inspection including receipt inspection,*
- *traceability of materials, possibly including installation map for wire, steel, rebar, welds, etc.*
- *seismic and other environmental qualification requirements including system interaction.*

Good examples of ML-1/2 specs are LMS Sections on gloveboxes (11 5322 series) and high-confidence concrete anchors (03 1512 and 03 1550).

Z1020 QUALITY REQUIREMENTS (PROGRAMMATIC & FACILITY)

- A. Projects shall comply with applicable LANL QA-related requirements documents. *These may include:*
- [*DOE O 414.1C*](#), *Quality Assurance*
 - [*DOE G 414.1-2*](#), *Quality Assurance Management System Guide for use with 10 CFR 830.120 and DOE O 414.1*
 - [*10CFR830*](#) *Nuclear Safety Management, SubPart A, Quality Assurance Requirements*
 - [*IP330*](#) *LANL Quality Assurance Program [and related ISDs]*
 - [*P 330-6*](#), *Nonconformance Reporting*
 - [*IMP 341*](#), *Conduct of Engineering*
 - [*P 1040*](#), *Software Quality Management*
 - [*P 1041*](#), *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 system, ML-1, and ML-2 items require use of suppliers from the Institutional Evaluated Supplier List (IESL) [*http://int.lanl.gov/orgs/qa/pq/*](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. LANL personnel qualifying 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 code transcends all ML classes and the code requires LBO approval for a wide range of testing, fabrication, and special cases. See ESM Chapter 16 Section IBC-GEN.
- D. Follow LANL Master Specification Section [*01 4000*](#), *Quality Requirements for facility related work (may adapt for other work)*.

Z1030 TEMPORARY FACILITIES (FACILITY)

- A. Temporary facilities are required to meet all DOE contractual requirements including the most stringent of NM State law, NM building codes, and this ISD -- and their definitions of temporary³⁸. *Guidance: At time of writing this essentially results in a maximum of one year with the possibility of extensions by LANL Building Official for some structures [not to exceed three (3) years].*
- B. In addition, temporary facilities shall meet all ESM requirements for security and safety/health of occupants, the public, and the environment.
- C. Sheds and containers have additional requirements (see that heading above).
- D. Facilities that will be in place for less than three (3) years are **not** required to meet ESM requirements that reduce the life-cycle cost of typical facilities.³⁹ The discipline POCs are the AHJs should questions on this arise.
- C. *Guidance: For subcontracted construction work, subcontracts may contain requirements for the Subcontractor regarding temporary facilities to support construction (e.g., offices, restrooms in the proforma/boilerplate or Spec Section 01 5200). These are outside the scope of this section when not occupied by LANL.*

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 shall 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.

³⁸ ESM Chapter 16 IBC-GEN App A LBC 107 allows a 1 year permit with extensions based on NMAC [14.5.2.17](#) allowing 1 year with extensions for good cause and 14.12.3 that allows 1 year [NMAC Title 14 Ch 12 Manufactured Housing Section [14.12.3](#), Off-Site Conventionally Built Modular-Manufactured Unit Standards, Subsection 14.12.3.18 (2-16-2003) states "A. Modular units may be installed on a temporary foundation for a period of up to one year. Units installed as temporary and remaining in place after the one-year period must be placed on a permanent foundation. B. Modular units installed as temporary shall meet all requirements of these standards except the permanent foundation requirement."]

³⁹ 3-year timeframe allows LANL-occupied construction project trailers to be sited temporarily and cost-effectively. Most other trailers and transportables tend to remain much longer than originally planned (often 25+ years) and, as such, are to meet life-cycle cost standards.

3. For major projects subject to the IMP 353, *Capitol Asset Acquisition Project Management Project Management for Capital Assets*, follow ADPMGT 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.

APPENDICES

APP A TECHNICAL BASELINE DRAWINGS GUIDANCE

APP B TECHNICAL BASELINE DELIVERABLES (NEW FACILITIES AND SYSTEMS)

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

APP D FACILITY DESIGN DESCRIPTIONS (NEW FACILITIES)

APP E LIFE CYCLE COST METHODOLOGY GUIDANCE

ATTACHMENTS

ATT 1 ESM CLARIFICATION/INTERPRETATION FORM, FM1

ATT 2 ESM VARIANCE AND EXCEPTION FORM, FM2