



Conduct of Engineering

LANL Engineering Standards Program

Recent Changes

April 2015

LA-UR-03-3240
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Tobin Oruch, Standards Manager ES-DO

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Engineering Standards Manual and other Changes

Since August 2014



- Chapter 1 General, Section Z10
 - Chapter 5 Structural
 - Chapter 6 Mechanical
 - Chapter 7 Electrical
 - Chapter 8 I&C
 - Chapter 10 Hazardous Process
 - Chapter 12 Nuclear
 - Chapter 16 IBC Program
 - Chapter 17 Pressure Safety
 - Chapter 18 Secure Communications
 - Chapter 19 Communications (New)
- Plus -- CAD Standards Manual (formerly Drafting Standards)

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Major Driver for Many Revisions

- DOE O 420.1C Facility Safety added to LANS contract in 2013 replacing 420.1B
- Implementation plan required that design-related requirements be implemented through Engineering Standards Manual (ESM) by Sept 2014 except:
 - Fire Chapter completed Nov 2013
 - Structural Chapter by Mar 2015

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Chapter 1 General

Chapter 10 Hazardous Process

Chapter 12 Nuclear

Chapter 16 IBC Program

Chapter 18 Secure Communications

Chapter 19 Communications

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Chapter 1 General Section Z10

Rev 11 (9/29/14) changes mainly to

- Applicability
- Required national standard editions (when not IBC)
- Amendments (e.g., Variances) and NCRs
- Code of record (COR)
 - Design shelf-life now 24 months
 - Effect of 420.1C (see next slide)
- Engineering during construction,
- Prof engineer sealing

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COR: New nuclear facilities and modification of existing nuclear SSCs has a new graded approach on approval authority on varying from ESM based on 420.1C.

Major Mod: Change to a nuclear facility that substantially changes the existing safety basis. Determination is made through a checklist (see [SBP114-1](#), Att 2)

Does any part of work include...	Then...
<p>Nuclear facility “major mod”</p> <p>See App A for definition of major mod</p>	<p>Follow DOE O 420.1C as implemented by ESM, except when project is D&D. Exception or equivalency beyond ESM normally requires Site Chief Engineer plus NNSA and/or HQ; see Alternate Methods (etc.) heading above.</p>
<p>Nuclear facility SSC mod less than major</p>	<p>Latest ESM requirements apply but original or lesser requirements may be used when allowed by the ESM (e.g., IEBC) or by a variance. Tailoring of national standards is allowed where specifically discussed by chapters. Variance from Site Chief Engineer may be possible.</p>

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Chapter 1 Section Z10 Attachment Changes Sept-March

- Att C Design Deliverable Schedule, 30-60-90/100%:
Threshold for use, specs maturity, electrical deliverables,
pressure safety documentation. (March)
- Att F Specifications: Required critical characteristics per
AP-341-607 for ML-1/2. Section 01 3300 vice Exh I Att B
Submittal Summary; Submittal reduction (next slide) Exh
H (Quality) coordination. (March)
- Att G Engineering Deliverables for Projects (Guidance):
Initial issue of division of responsibility checklist for
design agency and others. (Sept)

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Submittal Reduction Initiative

- **“SR projects” shall meet all of the following criteria:**
 - The work is ML-3 or -4 and also not critical to personnel safety (i.e., not fire alarm/suppression/egress, pressure safety, medium or high voltage electrical, etc.).
 - The work is to be performed entirely by LANL workforce (“self-perform”) -- e.g., MSS or Construction
 - The work is a repair or modification
 - The total effort is under \$500k (GPP/IGPP limit), even when multiple jobs or projects are created to produce a desired outcome.

Table Z10-F-2. Submittal Tailoring Approach

Criteria affecting Design Agency ability to reduce LMS-listed submittals	Ability to Tailor Submittals?
Meets all criteria for SR above	Yes. It’s mandatory per SR requirements above.
Doesn’t qualify as SR... ...but <u>doesn’t</u> require LANL concurrent or consecutive review per LMS 01 3300 Submittal Procedures’ schedule	Yes. And is encouraged where appropriate.
Doesn’t qualify as SR... ...but LMS 01 3300 <u>does</u> require LANL concurrent or consecutive review	Depends. Must obtain permission from Standards POC listed for LMS because LANL normally wants to review these (along with any outside AE review).

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ESM Chapter 10 Hazardous Process Revision (Sept)

- Revision led by then-POC Lowell Christensen (now Devin Gray)
- Requirements and guidance changed to reflect DOE O 420.1C and DOE G 420.1-1A
- Streamlined by referring to other ESM chapters
- Lessons learned incorporated

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ESM Chapter 12 Nuclear Revision (Sept)

- Requirements and guidance changed to reflect DOE O 420.1C and G 420.1-1A
- Streamlined by referring to 420.1C, DOE-STD-1189 on integration of safety into design process, and DOE G 420.1-1A.
- Lessons learned incorporated

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Chapter 16 IBC Program

- IBC-GEN revised March 2015:
 - Minor changes to scope tables, flowchart, etc.
 - Adopted IBC-2015 and selected other I-Codes by revision of Att A LANL Building Code and Att B LANL Existing Building Code to Minor changes to associated forms
 - Still using 2009 IAPMO Uniform Plumbing and Mech Codes
- IBC-IP revised to:
 - Update templates (SSI, etc.) to IBC-2015

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Chapter 18 Secure Communications

Adrian Trujillo, POC



Minor revision February 2015

- Allowing EMT in some circumstances (4.G.5.a)
- labeling changed (4.J.1)

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Chapter 19 Communications

Pete Lowe POC

New Chapter Feb 2015 with 2 Sections:

- D60 Communications -- Superseded Ch 7 D5030. Changes for server equipment rooms and to reflect Cat6A cabling requirements, j-box, and conduit size. New wireless section.
- G50 Site Communications -- Superseded Ch 7 G4030. Changes to address redundant paths, SME reviews, construction requirements under parking lots and roadways, update refs.

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Standards Intro Course 24140

- Is taught occasionally, and there is one session scheduled for next Wednesday, April 15, 8 a.m. – 4 p.m., in this room.

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Chapter 5, Structural

Glen Pappas, Structural Engineer
ES-EPD

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Ch. 5, Sects. I – III Changes: Codes & Standards

- 420.1C requires compliance w/ DOE-STD-1020-2012, 2012 or later IBC, AISC 360-10, etc.
- 1020 requires compliance w/ ANS 2.26-2004 (R2010), ASCE 7-10, etc.
- LANS contract w/DOE requires compliance w/NM State Building Code
 - IBC 2015 adoption pending in NM
- Design and analysis (D&A) of SSCs for NPH at LANL will be per IBC 2015, ASCE 7-10, ACI 318-14, AISC 360-10, ANS 2.26-2004 (R2010), ACI 349-13, AISC N690-12, etc.

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Ch. 5, Sects. I – III: Designation

- Longstanding designation for D&A of SSCs for NPH was Performance Category (PC): PC-3 is high hazard nuclear; PC-0 – PC-2 are less hazardous or non-nuclear.
- 1020 required use of new designation:
 - NPH Design Category (NDC) for nuclear:
 - NDC-1 – NDC-3
 - Risk Category (RC) for non-nuclear:
 - RC I – RC IV
- ‘IBC / ASCE 7 +’ will be used for NDC-1 & -2

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Ch. 5, Sect. I has crosswalks from PC Cat to new designations

use for minor work on existing SSCs

Table I - 1a Non-Nuclear Facility Designations

Formerly	Now
PC-0	RC I
PC-1	RC II
PC-2	RC IV

Table I - 2b Nuclear SSC Designations (Haz Cat 1 – 3)

Formerly	Now	
	Seismic NPH ^{1.a}	Other NPH ^{1.b}
PC-1	SDC-1, LS A	WDC-1, PDC-1
PC-2	SDC-2, LS B	WDC-2, PDC-2
PC-3	SDC-3, LS C	WDC-3, PDC-3

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Some Ch. 5, Sect. II anchorage changes began with a Nov 2014 Sect. II revision :

- 1) Added PI Anchorage to Masonry
 - Taken from ASCE 7-10, Ch. 13; only for use w/ non-structural components, and in grouted masonry
 - Anchor selection quite limited (vs. that for anchorage to concrete)

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Ch. 5, Sect. II, Changes, cont'd

- 2) Revised P-I Adhesive Anchors in Concrete
 - ACI 318-11; small tweaks to design requirements, & huge changes to installation & inspection requirements
 - ICC ES-ESRs that didn't indicate compliance w/ 318-11 were to be cancelled in Jan 2015
- Spec Sect 05 0520 (formerly 03 1534) Updates for above published
- 3) ALL non-nuclear anchorage provisions now in Section II App. A

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Section IV Geotechnical Investigations

- Revised in March to incorporate ASME NQA-1 2008/9, IBC 2015, and CMRR lessons.

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Chapter 6, Mechanical

Michael Ladach, Mechanical Engineer
ES-EPD

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DOE Order 420.1C

- Added text that directs the designer to DOE O 420.1C and G 420.1-1A for additional design criteria.
 - Confinement Ventilation System for Nuclear Facilities
 - Directs designer to use DOE STD 1189 for new facilities and major modifications.
 - Active confinement preferred, versus passive
 - Fire Protection in HVAC
 - Directs designer to use DOE-STD-1066-2012 as an acceptable means to achieve compliance

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Duct Smoke Detectors

- Previously, duct smoke detectors were not required in 100% Outside Air Systems. These are now required per DOE-STD-1066-2012. The NFPA 90A requirement for shutdown upon smoke detection may be omitted if approved by LANL Fire Protection Division.

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Specification Updates Planned, FY15

- LANL Master Specifications need to be updated to remove conflicts between the ASME B31 codes and the existing specs.
- 23 2113 Hydronic Piping: Multiple conflicts with part numbers mentioned in the specification not being listed components per the codes. Either provide an alternative analysis for these part numbers or provide part numbers that are considered listed components
- 22 0813 Testing Piping Systems: There are durations and procedures in this specification that do not match what is required by code.

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Chapter 7, Electrical

Duane Nizio, Electrical Engineer
ES-EPD

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ESM Chapter 7 Electrical

- Section D5000 Rev. 7 was issued September 2014
 - Major change to D5000 was updating part 12 to incorporate DOE Order 420.1C
 - D5000 part 12 was revised to include additional IEEE standards per 420.1C
 - Clarifying notes for the list of standards were relocated to better emphasize where to note apply
 - Additional changes to D5000
 - Part 5.3 was modified to clarified the location where the fault capacity is to be applied
 - Part 5.10 was added to clarify that circuit breakers are to be used for all overcurrent protection not just in switchgear, switchboards, MCCs, and panelboards
 - Part 6.2M was revised to prohibit installing electrical distribution equipment in corridors, stairwells or janitor closets without prior written permission from the Chapter 7 POC

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ESM Chapter 7 Electrical

- Section D5090 rev 5 was issued December 2013
 - Part 8 was revised to reply to the lack of lightning protection system technical base line drawings identified during a DOE audit
 - Paragraph 8.1 criteria
 - Was revised to match the latest revision of NFPA 780
 - Paragraph 8.2 grounding system
 - 8.2.B was added to require grounding system test wells for new installations
 - Paragraph 8.3 installation design
 - This paragraph was rewritten to require the design agency to prepare the installation drawings instead of accepting the installers shop drawings.
 - Added a minimum set of data to be included on the drawings
 - Revised the master specification sections for lightning protection

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ESM Chapter 7 Electrical

- Revisions to Sections D5010 and D5030 under development:
 - D5010 2.4. Metering
 - Paragraph 1 will be revised per DOE O 436.1 to require electrical metering for each service entrance
 - D5010 2.5 Surge protection
 - This section was deleted and a reference was added to Section D5000 to see Section D5090 for the requirements for surge protection
 - D5010 2.6 Switchgear, Switchboards and Power panels
 - Paragraph 4 was revised to include direction how to perform load calculations using the panel schedule
 - D5030 Communications and G4030 Site Communications
 - As noted earlier, both revised and moved to NEW ESM Chapter 19 Communications with a different POC in February 2015

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ESM Chapter 7 Electrical

- Planned changes to the Master Specifications:
 - Reformat the entire set of electrical master specifications
 - To make the sections outlines consistent
 - Correct formatting errors
 - Several sections of the electrical master specifications need to be revised to incorporate several variances which have been issued
 - Delete the requirement for XHHWN-2 insulation per variance VAR-2014-007
 - Delete the requirement for the use of crimp lugs per variance VAR-2014-008
 - Delete the requirement for a viewing window in all safety switches per variance VAR-2013-029
 - Revise the requirements to allow the use of tritium exit signs in additional locations per variance VAR-2014-046
 - Delete the requirement for sealing locknuts on indoor equipment per variance VAR-2013-057

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ESM Chapter 7 Electrical

- Planned Changes to the Master Specifications cont.
 - Add requirements for ground rods to support the lightning protection specifications
 - Clarify when an equipment ground conductors is required
 - 26 0526 Grounding and Bonding for Electrical Systems
 - Clarify when an equipment ground conductor is required
 - Add requirements for ground rod to support specifications 26 4100 and 4115
 - Add requirements for the use of a Uffer Grounding Electrode for all installations when such a system exists, or to install a two rod ground electrode system where a Uffer ground does not exist per New Mexico amendment to the 2014 NEC
 - 26 0533 Raceway and Boxes for Electrical Systems
 - Deleted the mounting heights for FA devices and reference specification 28 3100
 - Delete the mounting heights for telephone and data outlets and reference specification 27 3000
 - Delete the CCTV outlets per new ESM Ch 19
 - 26 0553 Identification for Electrical Systems
 - Modify the Arc-Flash Hazard Labels to agree with the upcoming revision to LANL P 101-13 when issued
 - Revise the requirements for the Category I Nameplates
 - 26 230, 26 2413, 26 2416 and 26 2419
 - Update the LANL specification reference for surge protectors
 - 26 2419 Motor Control Centers
 - Add the requirements to use MCCs that are arc-resistant-rated

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Chapter 8, Instrumentation and Controls

Allen Hayward, P.E., Electrical and Mechanical Engineer
ES-EPD

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Overview

- New Required Codes and Standards (420.1C)
- New Section Addressing Building Automation Systems
- New Requirements for SS/SC Calculations for Control Systems
- Adoption of ISA-84-2005 Standard with adaptations for SS Alarm systems.

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New Required Codes and Standards (420.1C)

- ANSI/ANS 58.8 (SS/SC)
 - Time Response Design Criteria for safety-related operator actions
- ANSI/ANS 59.3 (SS/SC)
 - Nuclear Safety Criteria for Control Air Systems
- IEEE 7-4.3.2 (SS/SC)
 - Standard Criteria for Digital Computers in Safety Systems of Nuclear Power Generating Stations
- All Applicable NFPA Codes (SS/SC)
- DOE-STD-1195-2011 (SS)
- ASHRAE 90.1 (All)

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New Section Addressing Building Automation Systems (BAS)

- Places more burden on the Design Agency to provide a complete design.
- Incorporates standing variances for acceptable vendors and night setback requirements.
- New criterion for when BAS systems are required.
- Establishes minimum requirements for equipment safety controls
 - Freeze stats, High duct pressure shutdown and Fire alarm shutdown
- Establishes minimum requirements for general design of BAS systems
 - Coil freeze protection, Makeup air unit control sequences, Heat trace monitoring, Control panel fabrication and locations, Interface requirements for packaged units.

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New Requirements for SS/SC Calculations for Control Systems

- ANSI/ISA-67.04.01 - Design Agency Responsible for Nuclear Setpoint Calculations at Design Time.
- ANSI/ISA-84-2005 - Design Agency Responsible for SIL Calculations at Design Time.
- If changes are made during construction (i.e. equipment substitution) that affect the calculations, it is the Project's responsibility to update the calculations to support the change.

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Adoption of ISA-84-2005 Standard with adaptations for SS Alarm systems.

- ANSI/ISA-84-2005 – Has been adopted
 - Significantly more requirements for SS control systems.
- DOE-STD-1195-2011 – Has been adopted
 - Significantly reduces implementation issues with ISA-84
- New requirements on how SS alarm only systems are to be implemented using ISA-84 principles.
- Defines minimum requirements for Stakeholders involved in the SS control system design.

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Chapter 17, Pressure Safety

Ari (Ben) Swartz

CPSO

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Brookhaven National Laboratory (BNL) Natural Gas Relief Valve Failure

- Pressure relief systems are of critical importance and can be quite complex. When designing and installing a pressure relief system, the configuration of the inlet and outlet piping is critical to its performance.
- Flow restrictions and excessive pressure drop can result in reduced relieving capacity and system damage.

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- In addition, inlet and outlet piping as well as their support structure must be designed to withstand static and dynamic loads.
- Compatibility of system components should be verified according to the applicable design and safety codes.
- See ESM Chapter 17 ADMIN-2-RO 1.T Pressure Relief Requirements
- http://engstandards.lanl.gov/esm/pressure_safety/ADMIN-2-RO.pdf

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Brookhaven National Laboratory (BNL) Natural Gas Relief Valve Failure



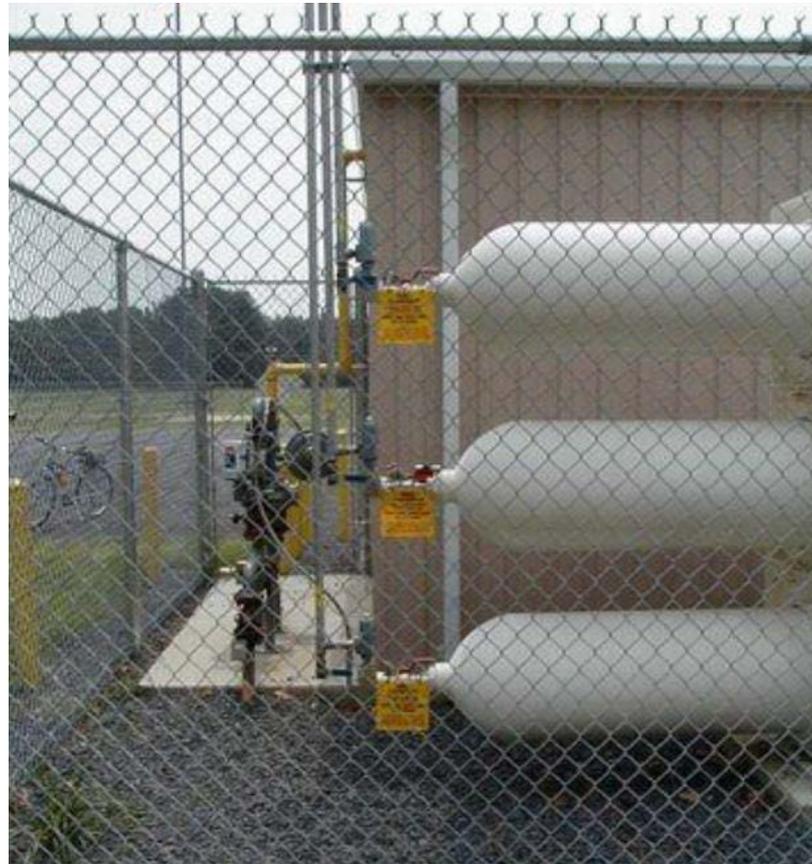
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Brookhaven National Laboratory (BNL) Natural Gas Relief Valve Failure



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Brookhaven National Laboratory (BNL) Natural Gas Relief Valve Failure



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BLEVE (Boiling Liquid Expanding Vapor Explosion)

- Below is a link to a demonstration so you can see the worst case outcome of a compressed natural gas tank that fails due to an over-pressure condition from a fire. There are many other videos showing where this has happened as well.
- https://www.youtube.com/watch?v=UM0jtD_OWLU

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ESM Chapter 17 2014

DOE 420.1C Impacts were addressed in ESM
Chapters 1 and 6

Changed Chapter from all in one to multiple
smaller sections:

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ESM Chapter 17 2014

- GENERAL - Apply to All Pressure Systems
 - ASME - Requirements for NEW ASME Systems
 - NASME - Requirements for New NON-ASME Systems
 - EXIST - Requirements for all Existing (Legacy) systems
 - ADMIN - LANL direction to implement pressure safety
 - REF - Reference Sections
-
- Having 40 documents gives us a better chance of maintaining the program up-to-date
 - None of the documents are titled Section I as was previous single document, so they are all Rev. 0
 - As documents are updated the Rev. will increment

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GENERAL

Apply to All Pressure Systems

Definitions

Exclusions

OSHA Requirements (new Section but covered
when following ASME)

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ASME - Requirements for NEW ASME Systems

Apply most applicable Code for system

- B31.1 – Power Piping (Steam)
- B31.3 – Process Piping
- B31.5 – HVAC
- B31.8 – Natural Gas (Distribution)
- B31.9 – Building Services
- B31.12 – Hydrogen

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NASME- Requirements for New NON-ASME Systems

- Applicable for B31.3 Process Piping systems that do not have a boiler, pressure vessel, or compressed air accumulator.
- Other limits to applicability

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EXIST - Requirements for all Existing (Legacy) systems

- Modification or Maintenance of Existing Systems
- Disposition Requirements of Existing Systems
- Risk Based Evaluation Process for Existing Systems

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ADMIN- LANL Directions to Implement Pressure Safety

- Pressure Safety Implementation Plan (new)
 - Codes, R2A2 for req'd forms, etc.
- Specific Design Requirements
- Documentation
- LANL review process for Certification
- Inspection and Testing Requirements
- Flexhoses, regulators, pressure vessels, relief devices

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References (internal webpage)

Site Content

- Chapter 17, Pressure Safety Reference Data
 - Air Force Manual
 - Army Corp Eng Manual
 - Calculations
 - CGA and Bottles
 - Conflat Flanges
 - Dept of Labor
 - Inspection
 - LLNL
 - Piping General
 - Relief Protection
 - SRS

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CAD Standards Manual (formerly Drafting Standards)

Scott Richardson, Architect

ES-EPD

CAD Standards Manual POC

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CAD STANDARDS MANUAL (CSM)

Rev. 5 (of former Drafting Manual, Rev 4), as the first revision in 8 yrs, will incorporate lessons learned and best available technology / practices.

- Updates terminology (“drafting “ vs. CAD) and all references to standards, organizations and procedures while deleting the obsolete.
- Relies more heavily upon the National CAD Standard (NCS) with fewer LANL amendments.
 - NCS site-wide license became available Jan 2015

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CAD STANDARDS MANUAL, cont'd

- Number of title blocks and associated templates have been reduced:
 - eliminates “A” & “C” size sheets/title blocks
 - replaces “plates” (for ES, CDRs, ERs, DC) with sketches & reduces requirements for sketches
 - Allows single title block template for construction drawings & electronic sketches
 - Updates the standard template (template largely ensures compliance to CSM).

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CAD STANDARDS MANUAL, cont'd

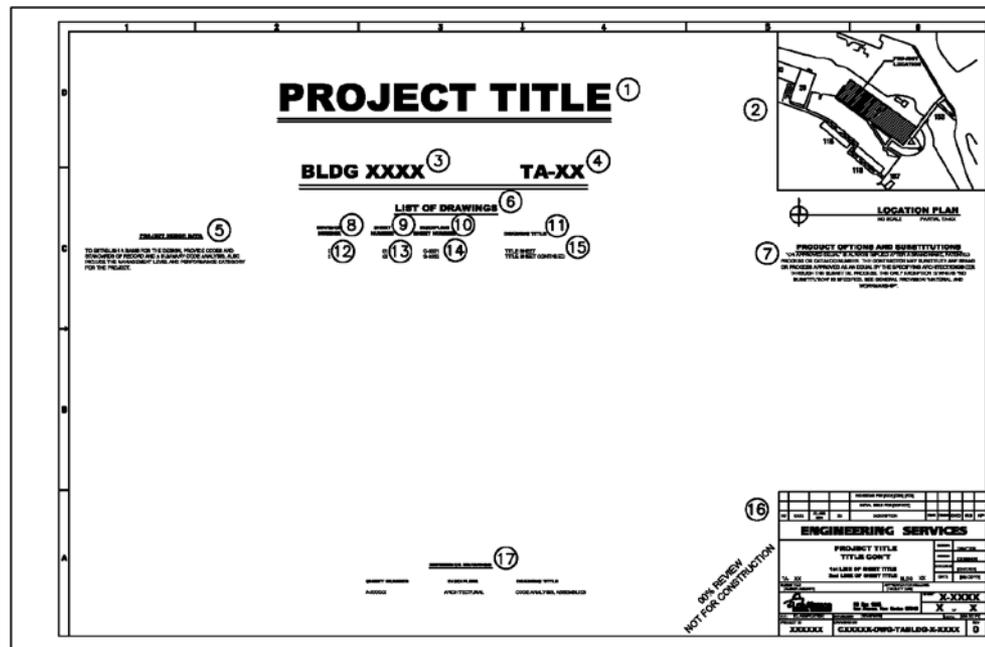
- Standardizes drawing / sketch document numbers to match Documentum EDMS format
- Reduces line width options & eliminates color (plotter) pen requirements as obsolete

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CAD STANDARDS MANUAL, cont'd

- New standard font (true type) – modern appearance & allows word search capability

ARIAL BLACK and ARIAL



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Questions and Comments



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