Independent Oversight Review of the Technical Area 55 Safety Class Fire Suppression System at Los Alamos National Laboratory

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Office of Safety and Emergency Management Evaluations
Office of Enforcement and Oversight
Office of Health, Safety and Security
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Table of Contents

Acronyms

CM	Configuration Management
COR	Code of Record
CRAD	Criteria, Review, and Approach Document
CSE	Cognizant System Engineer
DCP	Design Change Package
DOE	U.S. Department of Energy
DSA	Documented Safety Analysis
FHA	Fire Hazard Analysis
FSS	Fire Suppression System
gpm	Gallons per Minute
HSS	Office of Health, Safety and Security
ITM	Inspection, Testing, and Maintenance
NA-LA	Los Alamos Field Office
LANL	Los Alamos National Laboratory
NFPA	National Fire Protection Association
NNSA	National Nuclear Security Administration
OFI	Opportunity for Improvement
PC	Performance Category
PF	Plutonium Facility
PIV	Post Indicator Valve
SAC	Specific Administrative Control
SSCs	Structures, Systems, and Components
SSO	Safety System Oversight
TA	Technical Area
TSR	Technical Surveillance Requirement
USQ	Unreviewed Safety Question

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1.0 PURPOSE

The U.S. Department of Energy (DOE) Office of Enforcement and Oversight (Independent Oversight), within the Office of Health, Safety and Security (HSS), conducted an independent review of the Los Alamos National Laboratory (LANL) Technical Area 55 (TA-55) Plutonium Facility (PF) safety class fire suppression system (FSS), concurrent with a scheduled Los Alamos Field Office (NA-LA) vital safety system assessment. The independent review was one part of a targeted assessment of fire protection at nuclear facilities across the DOE complex, including National Nuclear Security Administration (NNSA) sites.

The purpose of the NA-LA assessment was to evaluate the functionality and operability of the FSS (a vital safety system) and to ensure that the system complied with DOE orders and standards and other applicable standards and requirements. The assessment was conducted April 29 through May 20, 2013. Issuance of this HSS report was deferred until completion of the related NA-LA report, issued in late August 2013.

The purpose of the Independent Oversight independent review was to evaluate the implementation of program requirements that are intended to ensure that adequate controls have been implemented to reduce the risk associated with events resulting from a fire or explosion at nuclear facilities. Existing HSS criteria, review, and approach documents (CRADs) were adapted to establish a focused set of inspection criteria, activities, and lines of inquiry for the independent review. The independent review of LANL is designed to evaluate selected core fire protection elements and to provide the site and responsible NNSA line management organizations with information for benchmarking their program effectiveness. This independent review also provides data for an ongoing HSS effectiveness review of the Department's implementation of Commitment #16 of the DOE implementation plan for Defense Nuclear Facilities Safety Board Recommendation 2004-1 regarding verification of Federal nuclear safety assurance capabilities.

This report discusses the background, scope, methodology, results, and conclusions of the review, as well as providing an opportunity for improvement (OFI) and items for follow-up.

2.0 BACKGROUND

NA-LA oversees LANL and is responsible for administering the performance-based contract, executing assigned NNSA and DOE programs, and conducting oversight of work performed at LANL in support of NNSA requirements and priorities.

LANL's primary mission is to develop and apply science and technology to ensure the safety, security, and reliability of the U.S. nuclear deterrent; reduce global threats; and solve other emerging national security challenges. For more than 60 years, LANL has served as a research center in the world of science, technology, and engineering, and has made achievements that focus on safety, security, environmental stewardship, nuclear deterrence, threat reduction, operations, communications, and community involvement. Los Alamos National Security, a partnership that includes the University of California, the Babcock and Wilcox Company, Bechtel National, Inc., and URS Corporation, holds the

contract to manage and operate LANL, and completed the transition in June 2006.

The independent oversight program is designed to enhance DOE safety and security programs by providing DOE and contractor managers, Congress, and other stakeholders with an independent evaluation of the adequacy of DOE policy and requirements, and the effectiveness of DOE and contractor line management performance in safety and security and other critical functions, as directed by the Secretary. The independent oversight program is described in and governed by DOE Order 227.1, *Independent Oversight Program*, and a comprehensive set of internal protocols and CRADs.

Fire protection was identified as an Independent Oversight targeted review area for 2013 in an HSS memorandum from the Chief Health, Safety and Security Officer to DOE senior line management, entitled *Independent Oversight of Nuclear Safety – Targeted Review Areas Starting in FY 2013*, dated November 6, 2012.

3.0 SCOPE

For this review, Independent Oversight reviewed selected elements of the fire protection program at LANL and assessed the effectiveness of its implementation by LANL with specific attention to implementation of the safety class FSS at the TA-55 PF. This review evaluated engineered design features, technical surveillance requirement (TSR) surveillance and testing, and configuration management (CM) for the FSS and systems that support the safety-related functions of the FSS at the PF, consistent with the NA-LA vital safety system assessment scope defined in the NA-LA *Safety System Oversight Independent Assessment Plan for the TA-55 Fire Suppression System and Components Vital Safety System Assessment*, dated March 20, 2013.

The scope of this review also included a focused assessment of the NNSA NA-LA processes for Safety System Oversight (SSO) to oversee safety systems and to monitor performance of the laboratory's cognizant system engineer (CSE) program.

The scope of this review did not include evaluating key programmatic elements of the fire protection program, including program documentation; fire and related safety hazards and self-assessments; fire prevention and protection; baseline needs assessments; and fire hazard analysis (FHA)/documented safety analysis (DSA) integration. These review areas will be assessed and reported separately in a follow-on scheduled independent review in November 2013 described in HSS *Plan for the Independent Oversight Targeted Review of the Fire Protection Program at the Los Alamos National Laboratory*, dated September 25, 2013.

4.0 METHODOLOGY

The following sections of HSS CRAD 45-34, Revision 1, *Fire Protection Inspection Criteria, Approach and Lines of Inquiry*, were used to define the scope of this independent review:

Section III	Engineered Design Features, FP-5
Section IV	TSR Surveillance and Testing, FP-6
Section V	Configuration Management, FP-7

In addition, Section VII, Cognizant System Engineer and Safety System Oversight of HSS CRAD 45-11, Revision 3, *Safety Systems Inspection Criteria, Approach and Lines of Inquiry*, was used as part of the review scope for this independent review.

Independent Oversight review activities included: review of documentation supporting the design and safety basis requirements of the system, including supporting analyses, drawings, and technical procedures; walkdowns of the FSS and supporting and interfacing structures, systems, and components (SSCs); and interviews with facility engineering and safety basis staff, including the CSE for the FSS, the NA-LA fire protection engineer, and NA-LA safety basis and engineering staff.

5.0 RESULTS

5.1 Los Alamos Field Office Oversight

The DOE Field Office has established and implemented an effective Safety System Oversight (SSO) program for qualifying staff to apply engineering expertise in its oversight of the assigned safety systems and to monitor performance of contractor's CSE program.

Independent Oversight last reviewed the NA-LA SSO program in December 2011 in conjunction with an NA-LA self-assessment documented in *Independent Oversight Review of the Los Alamos National Laboratory Site Office Safety System Oversight Program Self-Assessment*, dated March 2012. Overall, Independent Oversight concluded that the SSO program met all of the performance objectives and was implemented in a compliant and effective manner. SSO assessments were performed rigorously and effectively evaluated safety systems' abilities to perform their credited functions and the adequacy of the contractors' CM and CSE program implementation. Independent Oversight also determined that, while there is evidence that NA-LA follows up on SSO findings, the process is not formalized, and that current practices do not fully demonstrate that corrective actions are consistently assessed in accordance with NA-LA management expectations.

During the current independent review, the Independent Oversight team found that NA-LA's assessment was competently performed by knowledgeable NA-LA personnel using appropriate review criteria. The NA-LA team members were technically qualified and demonstrated a high degree of familiarity with the TA-55 facility and, specifically, the FSS. The assessment scope was well defined in the NA-LA assessment plan, and included follow-up activities for prior assessment findings (both external and internal) and reviews of the implementation of DSA conditions of approval. The assessment included appropriate performance-based elements, such as walkdowns of portions of assessed systems and components, reviews of as-built drawings, interviews of engineering and operations personnel, review of surveillance test results, and review of design modification packages and associated unreviewed safety question (USQ) determinations. The NA-LA assessment was conducted with sufficient rigor and depth, and identified a number of substantive findings that were appropriately characterized and documented in the NA-LA final report. Although the NA-LA assessment plan clearly identified vital safety system assessment corrective actions from previous assessments, and it was evident that the assessment did follow-up on prior corrective actions and areas of potential weaknesses, formal documentation to support these actions is lacking in the final report. Capturing this information is important in order to support feedback to the laboratory on the effectiveness of its contractor assurance system (see **OFI-1**).

The NA-LA assessment, in conjunction with Independent Oversight, identified twelve findings and six observations that are described in detail in the NA-LA assessment report. The NA-LA report concluded that three of the five NA-LA assessment objectives were met; however, the safety function definition and system surveillance and testing objective areas were not met. The following sections describe the results of Independent Oversight's review and reflect some concerns identified by the Independent Oversight team, in conjunction with the NA-LA assessment team, which could challenge the ability of the FSS to perform its credited safety functions as documented in the safety basis.

5.2 Engineered Design Features

Within the scope of the review, the safety authorization basis consistent with the fire hazards analysis demonstrates the adequacy of controls provided by the fire protection systems to eliminate, limit, or mitigate identified hazards, and defines the process for maintaining the controls current at all times and controlling their use.

Technical, functional, and performance requirements for the systems are specified in (or referenced in) the facility authorization basis documents consistent with the facility fire hazards analysis. Safety/authorization basis documents identify and describe the system safety functions, and these criteria are translated into design calculations and procedures.

Items and processes are designed using sound engineering/scientific principles and appropriate standards.

Items are designed, installed, tested, and maintained to assure they can satisfy the required safety functions under appropriately analyzed and plausible accident or incident conditions.

The TA-55 DSA credits the FSS as a safety class control to limit the size, temperature, and duration of fires. The FSS is comprised of the fire suppression sprinkler system in the PF (wet pipe) and the fire suppression water supply system. The FSS includes two water tanks dedicated to TA-55. One tank is located on the east side of the TA-55 complex and the other is on the west side; each tank is located adjacent to a fire pump house. Each pump house has a diesel fire pump, an electric fire pump, a jockey pump, and various support equipment. A jockey pressure pump is located in each pump house and maintains pressure in the FSS. The pump houses provide protection and environmental temperature control for the jockey and fire pumps. The water supply system provides water from the loop through post indicator valves (PIVs) to a total of four risers. Two risers serve the first-floor sprinklers, while the other two serve the basement sprinklers.

Independent Oversight reviewed the technical, functional, and performance requirements for the FSS, as identified in the safety basis documents. The FSS is classified as safety class for operational events, but not for events caused by natural phenomena. Therefore, the FSS is not credited for a Performance Category-3 (PC-3) evaluation basis earthquake, but is credited for PC-2 events. The Independent Oversight team reviewed documentation, including design analyses that support the performance of fire protection SSCs and that establish TSR surveillance test acceptance criteria. Specifically, the FSS performance criterion in part requires:

1. An open flow path from the water storage tanks to the PF sprinkler distribution system.
2. The fire supply tanks shall be capable of providing water for a two hour duration fire.
3. The FSS shall meet National Fire Protection Association (NFPA) 13 Ordinary Hazard Group 2 coverage, with additional 300 gpm hose stream and a 103.4 gpm plenum cool-down spray to the high-efficiency particulate air (HEPA) filter plenum.

Evaluation of these criteria was completed by reviewing the safety basis documents (DSA and TSRs), the FHA, and other documents that support and establish the performance criteria of the fire protection SSCs. Contrary to DOE-STD-3009, several technical bases documents that are used to establish DSA specified performance criteria for the FSS are not conservative and do not meet the DOE expectations for a safety-class system. The review of the following calculations revealed inaccuracies as follows:

a. CALC-10-TA55-0004-019-FP, Fire Suppression System Hydraulic Analysis, Revision 1:

   i. Based on a field change request to Design Change Package (DCP) 10-003 (Field Change Request #2), Fire Riser Installations, a reduction in size was made to the originally sized 4-inch riser, thereby installing a 3-inch riser section in its place. The change consisted of replacing the 4-inch riser with 3-inch piping just prior to penetrating the first floor core bore, continuing the 3-inch pipe to a height above the door jamb, and then transitioning the fire riser piping back to 4 inches using Victaulic coupling prior to the riser penetrating the drywall ceiling. LANL determined this change did not require a USQ determination per USQ TA55-10-513-S, because "the change in diameter of the pipe will have no substantial impact on the fire suppression system performance." This size change was not accounted for in the hydraulic calculation, added additional system pressure loss, and adversely altered the hydraulic characteristics of the system.

   ii. Calculation Appendix 1, page 5, depicts the PF first floor area supply and demand curve and identifies curve label D1 (elevation pressure) as 7.4 pounds per square inch. D1 is defined as the difference in elevation of the hydraulically most remote sprinkler head and the elevation at the water source (W1). For this case, the elevation of the water source (W1) is input as 15.17 feet, which is not consistent with other area calculations and appears to be non-conservative.

   iii. The NA-LA and Independent Oversight teams performed a walkdown of the PF basement and observed the newly installed risers. Nameplate data on the new southwest riser indicated a different flowrate than that documented in the hydraulic calculation.

b. CALC-10-TA55-0004-015-SP, Freeze Analysis for Pump House/Tanks, Revision 0:

   i. This calculation determines the time it takes for the water in the fire water tanks to cool from 40 to 32 degrees, and the time it takes for 12- and 8-inch mains in the PF pump houses to cool from 50 to 32 degrees during winter months without heat in the pump houses. The time durations determined are used to establish the frequency of performing the TSR surveillance temperature verification (SR 4.3.1.1 and 4.3.1.3). The frequency for these surveillances is daily; however, the analysis determined that the 8-inch piping would cool from 50 to 32 degrees in 16.3 hours. If the daily surveillance is performed once a day at the same time of the day (i.e., every 24 hours), the surveillance frequency would violate the analytical basis of 16.3 hours. Additionally, no analysis was performed for the potential for water to freeze in the smaller than 8-inch piping (i.e., freezing will occur more rapidly in the smaller piping).

c. Calculation to Validate Sizing of Pump House Combustion Air Intake Louvers:

   i. There is no formal calculation that confirms the adequacy of the combustion air intake louvers in the PF pump houses. Currently, one stationary and one adjustable louver provide combustion and dilution air. Upon request by the Independent Oversight team, an engineering estimate of the rationale for the existing louver free area was made available. The estimate methodology criteria does not conform to the requirements stated in NFPA 54, Section 9.3.3, or as reiterated in the International Mechanical Code, Section 703, that requires the use of louver free area based on the combined Btu/h rating of all fuel burning components drawing combustion and dilution air. Although the existing louver free open area appears to be adequate, a formal calculation should be performed according to the appropriate criteria.

Due to the inaccuracies identified in the technical bases documents identified above, NA-LA issued a finding (SSO-TA-55-FSS-F-13-01) as documented in the NA-LA assessment report.

Independent Oversight reviewed operator response during a seismic design basis event. The current configuration of the water supply system loop is such that some buildings that are not qualified to PC-2

design criteria receive water from the supply loop through a normally open PIV. Currently, operations procedure TA55-AERI-001 specifies that operations response to a seismic event is to manually isolate PIVs to the non-seismically qualified buildings. This action is relied on in order for the safety-class FSS system to perform its safety function, but is not designated as a specific administrative control (SAC). This situation is contrary to the requirements of DOE-STD-1186 that requires an administrative control that is relied on for a safety-related SSC to perform its safety function to be classified as a SAC. In part, this issue was previously identified as a condition of approval #14 in the Safety Evaluation Report (SER) PF4.01, but still remains open; however, additional items have been identified during this assessment. The following FSS seismic performance issues also exist:

a. In response to a seismic event, closing or isolating (in some fashion) PIVs for the non-seismically qualified buildings is not achievable in a timely fashion, and periodic drills that would confirm this compensatory measure are not performed. Additionally, timely identification of the location of water flow to the non-seismically qualified facilities is questionable.

b. During a seismically induced fire in the PF, and imposing a single failure of the west pump house diesel fire pump to start, and considering a pipe break in piping to the non-seismic buildings, there would be insufficient water in the fire water storage tank to service the PF fire. Additionally, DSA Chapter 3, Appendix 3-3, page 5-8, Failure Mode Effects Analysis, does not adequately and accurately address seismically induced fire in the PF and pipe failure to non-seismic buildings. Since isolation of these facilities during a seismic event could impact the safety function of the FSS in the PF, operator response to a seismic event to isolate PIVs to non-seismic buildings should be classified as a SAC. (Reference Alarm/Emergency Response Procedure TA55-AERI-001.) DSA Table 4-12, Fire Suppression System - Performance Criteria and Associated Evaluations, identifies the FSS vulnerability that "not all buildings or FSS components connected to the TA-55 fire loop are qualified to PC-2 standards. Therefore, in the event of a PC-2 seismic event, if these buildings fail, there is the potential for FSS water flow to be diverted from the PF."

Due to the absence of a SAC that would be required as a result of a seismic event, NA-LA issued a finding (SSO-TA-55-FSS-F-13-02) as documented in the NA-LA assessment report.

Independent Oversight performed a walkdown inspection of the FSS in the PF and observed additional seismic vulnerabilities that were not in compliance with NFPA 13 seismic criteria:

a. Pipe penetrations through the concrete floor, which were made during the riser upgrade design modification, do not have the specified clearance required by NFPA 13. NFPA 13, Section 9.3.4.2, requires the diameter of the hole to be nominally 2 inches larger than the pipe for piping that is 1 inch to 3 1⁄2 inches nominal, and 4 inches larger than the pipe for pipe that is 4 inches nominal and larger to preclude damage to the pipe during horizontal building floor movement during a seismic event. The Independent Oversight team's walkdown of several of the FSS's fire riser first floor penetrations indicated that fire riser first floor penetrations do not fully meet the seismic requirements of NFPA 13.

b. Flexible couplings are not installed at concrete floor penetrations or at the upgraded FSS risers, as required by NFPA 13.

c. Safety class FSS piping in the basement is supported from ventilation system ductwork. This piping support method is contrary to requirements identified in NFPA 13, Section 9.2.1.5, that stipulates that where sprinkler piping is installed below ductwork, piping shall be supported from the building structure or from the ductwork supports, provided such supports are capable of handling both the load of the ductwork and the load specified. Additionally, the Independent Oversight team observed that the subject ventilation ductwork appeared to be non-seismically supported or seismically

qualified to lesser than safety class system requirements that are necessary for the FSS; therefore, field verification is necessary to ensure adherence to two-over-one system interaction criteria.

Due to the seismic vulnerabilities identified above, NA-LA issued a finding (SSO-TA-55-FSS-F-13-03) as documented in the NA-LA assessment report.

5.3 TSR Surveillance and Testing

Surveillance and testing of the system demonstrates that the system is capable of accomplishing its safety functions and continues to meet applicable system requirements and performance criteria.

Surveillance and test procedures confirm that key operating parameters for the overall system and its major components remain within safety basis, NFPA, and applicable consensus standards operating limits.

The acceptance criteria from the surveillance tests used to confirm system operability are consistent with the safety basis.

Instrumentation and test equipment for the system are calibrated and maintained.

The NA-LA and Independent Oversight review of the safety basis and TSRs showed that FSS SSCs credited to perform a safety function are tested and/or inspected on an acceptable periodic timeframe. Generally, TSR safety system surveillance testing confirms the adequacy of safety SSC credited controls performance requirements. Surveillance and testing of the FSS generally demonstrates that the system is capable of accomplishing its safety functions and continues to meet applicable system requirements and performance criteria. However, although the overall FSS TSR surveillance testing is generally compliant, the methodology employed for the annual testing of the diesel driven fire pumps, SR 4.3.1.8, deviates from the requirements specified in NFPA 25. This standard requires that theoretical factors for correction to the rated pump speed be applied when determining the compliance of the pump per the test. The fire pump assembly is considered acceptable if the pump test performance indicates no less than 95 percent of the pressure at rated flow and rated speed of the initial unadjusted field acceptance test curve, provided that the original acceptance test curve matches the original certified vendor's pump curve by using theoretical factors. Use of theoretical factors, sometimes referred to as normalization, corrects the data obtained during the surveillance test using the pump affinity laws, so that test data can be appropriately compared to the vendor's certified pump curve. Furthermore, the pump flow and commensurate developed pressure acceptance criteria documented in test procedure TA-55-STP-306, R2, Section 4.1, does not appear to be consistent with data derived from the vendor's certified pump curve. Based on informal theoretical evaluation of the pump test data, Independent Oversight concluded that pump degradation was within acceptable limits as defined by NFPA; however, revision to the methodology used to evaluate test results is required, and test acceptance criteria should be reconsidered. This is a repeat area of concern previously identified as a finding in *Independent Oversight Report, Inspection of Environment, Safety, and Health Programs at the Los Alamos National Laboratory,* dated November 2005. Due to the testing inaccuracy, NA-LA issued a finding (SSO-TA55-FSS-F-13-10) as documented in the NA-LA assessment report.

Independent Oversight also reviewed SR 4.3.1.2 that requires verification that the PF pump houses' room temperatures are greater than 50.1 degrees Fahrenheit and is conducted daily during September through April only. Although the surveillance procedure is comprehensive and adequate for its stated purpose, the analysis that serves as the basis for the acceptance criteria of 50.1 degrees requires that verification of room temperature be performed every 16.3 hours. Contrary to this requirement, the surveillance requires daily verification (i.e., every 24 hours) and is based on freezing limitation considered for an 8-inch pipe;

smaller piping exists in the pump house and would present a more limiting condition. Refer to Section 5.2 of this report. Due to the surveillance inspection frequency inaccuracy identified, NA-LA issued a finding (SSO-TA-55-FSS-F-13-01) as documented in the NA-LA assessment report.

The TA-55 PF FSS for the most part integrates the required NFPA inspection, testing, and maintenance program (ITM) into the facility TSR surveillance testing procedures. The requirements of NFPA 25, *Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems*, and other applicable NFPA standards and code ITM requirements are integrated into the facility TSR surveillance testing program. Independent Oversight reviewed surveillance test procedures and confirmed that safety basis attributes of the testing were not adversely influenced by preconditioning in order to accomplish the NFPA-required ITM.

5.4 Configuration Management

Configuration management process adequately integrates the elements of system requirements and performance criteria, system assessments, change control, work control, and documentation control, as required by DOE Order 420.1B.

Configuration management is used to develop and maintain consistency among system requirements and performance criteria, documentation, and physical configuration for the SSCs within the scope of the program.

System design basis documentation and supporting documents are kept current using formal change control and work control processes.

Changes to system requirements, documents, and installed components are formally designed, reviewed, approved, implemented, tested, and documented.

An USQ process has been established in accordance with Code of Federal Regulations (CFR) 830 and is being appropriately implemented to control changes to safety systems including documents governing work on the systems.

Independent Oversight's review of CM included a selected review of the CM process required by DOE Order 420.1B, *Facility Safety*. The team's assessment involved reviewing the safety basis documents (DSA and TSRs); the system design description; and various facility configuration products, such as drawings, calculations, and modification change packages. Concurrently, the facility CM procedures were reviewed to ensure compliance with DOE requirements and guidelines.

The LANL institutional procedure PD340, *Conduct of Engineering for Facility Work*, describes the requirements of the engineering process and engineering program requirements. Procedure P341, *Facilities Engineering Process Manual*, establishes, communicates, and implements the overall engineering processes for performing engineering for facility, project, and program work. These process documents form a generally comprehensive and acceptable foundation for the performance of engineering activities.

Although these documents adequately prescribe process activities and expectations, Independent Oversight identified some engineering products that were deficient. Namely, some FHA, DSA, and TSR/bases documents include conflicting references to NFPA Standard code dates. The Code of Record (COR) is not clearly defined for the FSS. The FHA indicates NFPA 13, 1975, but other design documents reference NFPA 13, 2007, and NFPA 13, 2010. The 2011 TA-55 TSRs, Rev. 1.4,

Appendix A - Bases, for Section 3.3, Fire Protection, refers to NFPA 13, revision 2007, as well as revision 2010, leading to confusion as to the codes and standards design requirements of the SC FSS.

Due to the conflicting references to the COR, NA-LA issued a finding (SSO-TA-55-FSS-F-13-08) as documented in the NA-LA assessment report. Additionally, there are numerous references to previous versions of the FHA found in the DSA. The 2006 version of the FHA contains various analyses still used as a basis for performance of fire protection controls that do not exist in the latest approved FHA, and yet, this older version of the FHA is still referenced, rather than making the analyses stand- alone controlled documents (see **OFI-2**). Additionally, DSA Section 3.3.2.3.1, Planned Design and Operational Improvements, lists planned and completed improvements to the FSS and the Confinement Ventilation System. The list of improvements is a living document and changes regularly as improvements are completed or new ones are added, rendering the DSA inaccurate at any given time (see **OFI-3**).

Other document inadequacies were identified. For example, open PIVs that supply non-safety buildings from the safety class fire protection underground loop are not fully and accurately discussed in the DSA. Chapter 4 and the TSR bases discuss the open PIV scenarios; however, this information is not brought forward to Chapter 3, where a SAC control would be deemed necessary and should be identified.

6.0 CONCLUSIONS

Overall, the NA-LA vital safety system assessment was competently performed by knowledgeable, experienced personnel using appropriate criteria based on the NA-LA Management Procedure 06.02, Revision 5, *Safety System Oversight*, implementation assessment CRAD, and the final report accurately reflects the results of the assessment. Independent Oversight concurs with the objectives and results of the NA-LA assessment. Although follow-up of prior assessment findings is addressed in the NA-LA FSS assessment plan, formal documentation of results of follow-up in the assessment report could be improved.

TA-55 safety basis documents generally identify and describe the system safety functions and the safety functions of essential supporting systems. The facility risks associated with fire were well defined, and appropriate controls were generally identified. These controls were adequately documented in the technical baseline documents, including the FHA and the DSA. The FSS safety system design and functional requirements and appropriate consensus standards are described and referenced.

However, some concerns identified by the Independent Oversight team, in conjunction with the NA-LA assessment team, could challenge the ability of the FSS to perform its credited safety functions as documented in the safety basis. In some cases, several analyses that are relied on to establish and confirm system performance criteria and to establish TSR surveillance frequency were found to contain inaccuracies. Also, Independent Oversight's review revealed that operator response post seismic event should be reclassified as a SAC, since these actions can influence the performance of the FSS safety function. Independent Oversight also observed that the TSR annual diesel-driven pump surveillance test deviates from the requirements defined by NFPA. This is a repeat area of concern previously identified as a finding in *Independent Oversight Report, Inspection of Environment, Safety, and Health Programs at the Los Alamos National Laboratory*, dated November 2005.

7.0 OPPORTUNITIES FOR IMPROVEMENT

This Independent Oversight review identified the following OFI. This potential enhancement is not intended to be prescriptive or mandatory. Rather, it is offered to the site to be reviewed and evaluated by

the responsible line management organizations and accepted, rejected, or modified as appropriate, in accordance with site-specific program objectives and priorities.

OFI-1: NA-LA should ensure vital safety system assessment reports specifically address results of follow-up activities to prior findings. Consider establishing a standard report format that includes a listing of previous vital safety system assessment issues and follow-up items in the assessment scope section and the overall results section.

OFI-2: Superseded versions of the FHA contain controlled analyses that serve as the basis for fire protection controls performance. LANL should consider making these analyses be made stand-alone controlled documents so that reference to a superseded FHA would not be necessary.

OFI-3: LANL should consider removing the detailed listing of planned improvements currently found in the DSA and maintain the listing elsewhere.

8.0 ITEMS FOR FOLLOW-UP

The NA-LA report was formally issued to the contractor, identifying twelve findings in the areas of safety function definition, CM, and system surveillance and testing. LANL was directed to review the report and provide confirmation that the identified issues were entered into the facility's corrective action program.

Based on the conclusions drawn in the NA-LA report, and the significant nature of some of the findings, Independent Oversight will monitor actions being taken to resolve selected findings identified in the NA-LA report, including:

- Revision to selected technical bases documents identified in this report that are used to establish DSA-specified performance criteria for the safety-class FSS.
- Reclassification of operator response to a TA-55 seismic event to be designated as a SAC.
- Revisions to the annual diesel fire pump surveillance test procedure to correct collected data for pump speed variations.
- Validation that the frequency of surveillance inspections, as identified in this report, is appropriate.

Appendix A
Supplemental Information

Dates of Review

Onsite Review: April 29 – May 10, 2013

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Appendix B
Documents Reviewed, Interviews, and Observations

Documents Reviewed:

- LANL TA-55 Documented Safety Analysis, TA55-DSA-2011-R1.4, 2/7/2013
- LANL TA-55 Technical Safety Requirements, TA55-TSR-2011-R1.4, 2/7/2013
- LANL TA-55 Building PF Facility Fire Hazards Analysis, TA55-FHA-001, Revision 3, 9/28/2012
- LANL TA-55 Fire Protection System Description, SDD-TA55-FP-018, Revision 3, 9/28/2012
- LANL TA-55 PF Safety Evaluation Report, SER-PF4.01, Revision 9, 2/11/2013
- CALC-10-TA55-0004-019-FP, R1, *Fire Suppression System Hydraulic Analysis*, 8/5/10.
- CALC-10-TA55-0004-015-SP, R0, *Freeze Analysis for Pump House/Tanks*, 6/7/10.
- CALC-08-TA55-0004-012-M, R0, *Room Fire Effect to Zone 1 Duct*, 8/12/08.
- CALC-10-TA55-0012/14-030-FP, R1, *Fire Water Supply Storage Tanks (V-701 /704) Level*, 10/18/10.
- CALC-10-TA55-0004-022-FP, R0, *TA-55 FSS Tank NPHS*, 6/9/10.
- CALC-10-TA55-0012/14-031-FP, R1, *Fire Water Supply Storage Tanks (V-701 /704) Temperature*, 10/20/10.
- CALC-08-TA-55-0004-0016-M, R0, *Room Fire Effect to the Area Plenum Discharge Duct*, 9/23/08.
- CALC-10-TA55-0004-023-FP, R0, *Fire Pump Fuel Consumption Capacity*, 9/9/10.
- CALC- 10-TA55-0010/0011-013-FP, R0, *Set Point Calculation: Fire Suppression System - Fire Pump Controllers Mercoid Pressure Switches*, 4/4/10.
- FPEE-11-003, *Requirements for Automatic Sprinkler Protection within PF Exhaust Filter Plenums*, 9/11.
- LA-UR-02-1385, *TA-55 PF Room PMMA Fire*, 3/02.
- SB-DO-CALC-08-024, R0, *Sprinkler Response for PF Room at TA-55*, 6/23/08.
- TA55-ASI-020, TA-55 Surveillance Instruction, R5, *Non-PF FSS Flow, Main Drain, and Alarm Surveillance*, 6/30/08.
- TA55-ASI-021, TA-55 Surveillance Instruction, R02.4, *FSS Control Valve Alignment Inspection*, 7/19/11.
- TA55-ASI-022, TA-55 Surveillance Instruction, R7.1, *Fire Suppression Water Supply System Control Valve Operational Testing*, 12/5/12.
- TA55-DOP-307, TA-55 Detailed Operating Procedure, R0, *TA-55 Quarterly Fire Pump House and Tank Inspection*, 2/8/13.
- TA55-DOP-311, TA-55 Detailed Operating Procedure, R1, *TA-55 Fire-Year Fire Sprinkler Alarm Check Valve, Check Valve, and Piping Interior Inspection*, February 2/14/11.
- TA55-DOP-312, TA-55 Detailed Operating Procedure, R0, *Diesel Fire Pump Supply Sampling for PF Pump Houses*, 2/9/12.
- TA55-ISI-613, TA-55 In-Service Inspection Procedure, R3, *PF, Pumphouses and FSS Piping and PF FSS Water Storage Tank Wear and Degradation In-Service Inspection*, 10/31/12.
- TA55-STP-004, TA-55 Surveillance Test Procedure, R15.1, *Surveillance Rounds*, 1/29/13.
- TA55-STP-301, TA-55 Surveillance Test Procedure, R6, *PF Weekly Fire Pump Test and Inspection*, 11/30/12.
- TA55-STP-302, TA-55 Surveillance Test Procedure, R7, *PF Weekly Fire Pump Test and Inspection*, 11/30/12.
- TA55-STP-303, TA-55 Surveillance Test Procedure, R2, *PF Main Drain and Flow Test; Inspection, Testing, and Maintenance*, 10/2/12.
- TA55-STP-304, TA-55 Surveillance Test Procedure, R3, *PF FSS Control Valve Inspection*, 7/26/12.

- TA55-STP-305, TA-55 Surveillance Test Procedure, R6, *PF Annual Fire Pump Flow Test & Inspection*, 2/10/13.
- TA55-STP-306, TA-55 Surveillance Test Procedure, R5, *PF Annual Fire Pump Flow Test and Inspection*, 3/26/13.
- TA55-STP-314, TA-55 Surveillance Test Procedure, R2, *PF Sprinkler Inspection*, 12/7/12.
- Drawings, Support Drawings and P&IDs:
  - AB310 sheets 1 through 55, Fire Suppression System Original Drawings P&ID's
  - 55Y-002868, Sheets 1 thru 21, TA-55 PF Fire Protection P&ID
  - 55Y-002864, Sheets 1 thru 4, TA-55 PF East Pump House Fire Protection P&ID
  - 55Y-002865, Sheets 1 thru 4, TA-55 PF West Pump House Fire Protection P&ID
  - 55Y-002863-TA-55, TA-55 Fire Protection P&ID (Fire Water Loop)
  - C49912-DCP-97-014, TA-55 Fire Protection Yard Main System Replacement Project
  - C-85554, Fire Water Tanks
- TA55-AERI-001, R7, *Operations Center Alarm/Emergency Response Instruction*, 3/26/13.
- DCP 10-003, Design Change Package, *Fire Riser Installations, PF*, 11/23/09.
- DCP 06-048, Design Change Package, *Cross Connect Fire Sprinkler System in Areas*, 5/28/06.
- DCF-305, *Upgrade Seismic Bracing for PF Fire Suppression System in First Floor of PF*.
- DCF-215, *Modify PF N 1st Floor Sprinkler System to Eliminate Gaps in Coverage as Identified in the PF Fire Protection Hydraulic Calculations CALC-10-TA55-0004-019-FP ESR-13444*.
- Performed Surveillances:
  - TA55-ASI-022, performed June 14, 2012
  - TA55-ASI-022, performed June 26, 2011
  - TA55-DOP-311, performed September 30, 2011
  - TA55-ISI-613, performed July 20, 2011
  - TA55-ISI-613, performed October 10, 2012
  - TA55-ISI-613, performed October 18, 2011
  - TA55-STP-301, performed April 10, 2013
  - TA55-STP-301, performed April 19, 2013
  - TA55-STP-301, performed April 24, 2013
  - TA55-STP-302, performed April 10, 2013
  - TA55-STP-302, performed April 17, 2013
  - TA55-STP-302, performed April 25, 2013
  - TA55-STP-303, performed March 19, 2013
  - TA55-STP-303, performed September 30, 2012
  - TA55-STP-303, performed March 20, 2012
  - TA55-STP-304, performed March 5, 2013
  - TA55-STP-304, performed April 1, 2013
  - TA55-STP-304, performed April 3, 2013
  - TA55-STP-305, performed March 25, 2013
  - TA55-STP-305, performed March 26, 2012
  - TA55-STP-305, performed March 31, 2011
  - TA55-STP-306, performed March 27, 2012
  - TA55-STP-306, performed March 29, 2011
  - TA55-STP-306, performed April 2, 2013
  - TA55-STP-314, performed October 10, 2012
  - TA55-STP-314, performed October 12, 2011
- LANL Institutional Procedure PD340, *Conduct of Engineering.*
- LANL Institutional Procedure P341, *Facility Engineering Processes Manual.*

Interviews:

- TA-55 Fire Protection Primary CSE
- Operations Center Supervisor
- Operations Center Technicians (2)
- Safety Basis Manager
- Safety Basis Analyst
- Fire Protection Engineer assigned to TA-55
- Acting Facilities Operations Director

Activities:

- Walkdown of the TA-55 exterior including both fire pump buildings
- Walkdown of PF interior