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National Nuclear Security Administration
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JUL 17 2002

MEMORANDUM FOR DR. DAVID H. CRANDALL, NA-11
ASSISTANT DEPUTY ADMINISTRATOR FOR
RESEARCH, DEVELOPMENT AND SIMULATION

FROM: MICHAEL K. HOOPER
ASSISTANT MANAGER FOR NATIONAL SECURITY

SUBJECT: Transmittal of Phase II Assessment of B625 Fire Sprinkler System (AMNSNST:020043)

REFERENCE: Letter from L. Pendexter to M. Brown, *Assurance Review Report on Phase II Assessment of B625 Fire Sprinkler System (ARO 02-004)*

LLNL has completed and submitted the Phase II Assessment of the B625 Sprinkler System. Oakland (OAK) agrees with the general scope of the attached LLNL Assurance Review Office Report on Phase II Assessment of the B625 Sprinkler System (ARO 02-004), the technical accuracy of the Report, and that the subject system meets the operability criteria as identified in the Criteria Review and Approach Document (CRAD).

However, OAK did not agree that the overall intent of the configuration management portion of the review was met. There were still some issues concerning the flowdown of requirements into facility specific procedures and the status of design and construction drawings. We took into consideration that LLNL is in the process of implementing a new configuration management program. In addition, the Laboratory has committed to reviewing the structure for this program as a part of DNFSB 2000-2 required Phase 2 assessment during May 2003. As a result, OAK will re-evaluate the overall status of configuration management as part of these efforts.

In addition, our reviewers identified several issues that require follow-up. These issues included:

(1) The note regarding the need for seismic bracing for the Fire Department connection to the B625 sprinkler system was based on discussions with a maintenance technician. Based on further discussions and analysis of the B625 Fire Hazards Analysis (prepared and reviewed by registered professional

fire protection engineers) it has been determined that the existing system, including the Fire Department connection, meets all requirements of the NFPA, including seismic. The statement that "The earthquake bracing is a best management practice and not required by NFPA code" refers to the additional brace suggested by the maintenance technician. Based on the analysis above, this item is closed.

(2) A reviewer questioned whether the B625 sprinkler system was designed with a pipe schedule system, or if it was hydraulically designed. OAK, in conjunction with LLNL will follow-up on this issue. Follow-up will include identifying whether the B625 sprinkler system was designed with a pipe schedule system, or if it was hydraulically designed. As-built drawings of the B625 sprinkler system will be finalized. Drawings are needed due to the complexity of the B625 fire sprinkler system, and to be part of an effective Configuration Management program.

(3) One of the reviewers questioned why the failure to record alarm times on the Sprinkler Preventative Maintenance Data Sheet is noted as a concern in the Opportunities for Improvement. OAK, in conjunction with LLNL will follow-up on this issue. Follow-up will include describing why the failure to record alarm times on the Sprinkler Preventative Maintenance Data Sheet is noted as a concern in the Opportunities for Improvement, verifying whether the dispatcher's console has a built in time recorder, and describing the advantage of recording times on the Sprinkler Preventative Maintenance Data Sheet in addition to recording times on the dispatcher's built-in recorder. This item represents an Opportunity for Improvement and can be addressed at the discretion of the Laboratory.

(4) The attached revision to the report contains additional biographical/professional information regarding the fire protection engineer, Dr. Lambright.

LLNL is also preparing a corrective action plan to address the "Opportunities for Improvement" identified in the subject report. This corrective action plan will be submitted to OAK by September 1, 2002.

If you have any questions on this or other related subjects to DNFSB 2000-2 at LLNL, please call Mr. John Wood at (925) 422-0683 (john.wood@oak.doe.gov) or Ms. Carol Sohn at (925) 424-3308 (carol.sohn@oak.doe.gov).

Attachment: Assurance Review report on Phase II Assessment of the B625 Fire Sprinkler System (ARO 02-004)

AMNSNST:020043:MBrown:ldl:070202

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Lawrence Livermore National Laboratory

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1952-2002

May 31, 2002

Mr. Michael G. Brown
Deputy Director for Waste Management
U.S. Department of Energy, Oakland Operations Office
Livermore Site Office, L-574

Subject: Assurance Review Report on Phase II Assessment of B625 Fire Sprinkler System (ARO 02-004)

Attached is the ARO report for the B625 Fire Sprinkler System assessment completed May 30, 2002. This review satisfies an LLNL commitment to perform a Phase II assessment using the criteria and review approach document (CRAD) approved and agreed to by DOE/OAK.

The assessment did not find operability or reliability issues with the B625 Fire Sprinkler System. The report does document some opportunities for improvement. Also, attached is certain biographical information on the team members.

If you have any questions please feel free to call me at (925) 423-2799 or Rey Bocanegra of my staff at (925) 423-5309.

Larry Pendexter, Director
Assurance Review Office

Attachment
ARO 02-004
Team Members Biographies

xc: Carol Sohn
Phil Hill

Revised & sent by Lab to OAK 7/02

Attachment A
(Revision 1)
Assessment Team Biographies

Rey Bocanegra (Team Leader)
Mr. Bocanegra is a nuclear engineer in the Assurance Review Office at the Lawrence Livermore National Laboratory. He is a qualified Lead Auditor, has over 19 years experience in the nuclear field, and holds Master's Degrees in Nuclear Engineering and Radiological Health Physics. Mr. Bocanegra has a strong nuclear facility operations background, having been performing assessments of nuclear facility systems for 15 years including work as a qualified NRC Resident Inspector and qualified DOE Facility Representative at the Hanford Site. He has lead numerous assessment teams over the past 10 years including participation as the DOE lead investigator on a DOE Accident Investigation Board. In the past, Mr. Bocanegra has served as principle technical expert and advisor to senior DOE-RL (Richland Operations Office) management on radiation protection regulations, requirements, standards, and industry practices. His experience with safety basis documentations included principle reviewer of contractors' Integrated Safety Management Plans, Safety Requirements Documents, and Initial Safety Analysis Reports.

Edward W. Bradley (Team Member)
Mr. Bradley is a physicist in the LLNL Assurance Review Office. He is a Board Certified Health Physicist with over 28 years experience in radiological safety/control and regulatory compliance in US commercial nuclear power, DOE facilities, and medical physics. He has a Bachelors of Science degree in Physics and a Masters of Science degree in Biophysics from the University of California, Davis campus. Mr. Bradley has extensive experience in the development and review of authorization/safety basis documentation specializing in the area of radiological safety and control. He has held positions of increasing responsibility including Radiation Research Associate, Radiological Engineer, Corporate Health Physicist, Senior Consulting Health Physicist, and Senior Radiological Protection Officer. Mr. Bradley has also been an active member of the Health Physics Society at both the local and national level serving on various boards and committees, and was on the Toxic Substances Commission for the City of Sacramento, CA.

Tom Pehl (Team Member)
Mr. Pehl has over thirty years experience in the oversight and assessment of contractor application of contractual requirements for the testing, operations, defueling, refueling and maintenance of naval nuclear propulsion and commercial nuclear power plants. This experience includes oversight of prime contractor implementation of Naval Sea Systems Command requirements at

Mare Island Naval Shipyard and Department of Energy requirements at the Shippingport Atomic Power Station, Lawrence Livermore National Laboratory and Los Alamos National Laboratory. He received a B.S. degree in Industrial Technology from the University of Southern Illinois, Carbondale. Presently, he is assigned to the LLNL Assurance Review Office to provide support in the evaluation processes performed by the Office.

Tony F. Lentz (Team Member)
Mr. Lentz is a Nuclear Engineer in the LLNL Assurance Review Office. He has over 30 years experience in reactor operation and regulatory compliance on US Commercial, DOE & Foreign Reactors. He has a Bachelors of Science degree in Nuclear Engineering from North Carolina State University. Mr. Lentz has extensive experience in the development of Safety Analysis Reports and Hazards Analysis, and Unreviewed Safety Question Evaluation. Mr. Lentz has specialized in nuclear operations, licensing and regulatory support. He has held positions of increasing responsibility including Design Engineer, Quality Assurance Engineer, Project Engineer, and First and Second Level Management positions. Mr. Lentz has also been an active member of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code committee. He is past Chairman of the Subgroup on Water Cooled Systems, Chairman of Subgroup on Nondestructive Examination and a member of the Subcommittee on Nuclear Inservice Inspection.

John A. Lambright II (Subject Matter Expert)
Dr. Lambright is a nuclear engineer and a certified Fire Protection Engineer. He performed authorization basis and safety analysis work at the Idaho National Engineering and Environmental Laboratory, including evaluations of fire safety at the Advanced Test Reactor Critical, Test Area North, and the Radioactive Waste Management Complex facilities. At Los Alamos National Laboratory, he performed authorization basis and safety analysis work which included evaluations of fire safety for the Chemical and Metallurgy Research (CMR) and TA-55 Plutonium facilities. Dr. Lambright also performed evaluations of fire safety for Buildings 371 and 771 for the United States Department of Energy at Rocky Flats Environmental Site. His work for the International Atomic Energy Agency has included evaluations of the fire safety programs and fire probabilistic safety assessments. Dr. Lambright also developed and presented a fire protection engineering training course for the International Atomic Energy Agency. In the past, Dr. Lambright developed methods for the United States Nuclear Regulatory Commission to evaluate external event risks for nuclear power plants. He developed the methodology for the fire risk assessment techniques used for NUREG-1150. Dr. Lambright received an award for excellence recognizing his contributions to state-of-the-art fire probabilistic risk assessment methods and the insights to NUREG-1150 that resulted from their application. Many risk-based applications of these methods have been performed for the DOE, United States Nuclear Regulatory Commission, and international nuclear power plants. Dr. Lambright earned his Ph.D. in Nuclear Engineering at the University of New Mexico. He has authored over 80 fire/risk related publications.

Robert Paedon (Team Member)
Mr. Paedon is a Management Systems Consultant and Project Manager with Science Applications International Corporation. He has over 30 years of Practical Management, Assessment, Risk Management and Evaluation, Environmental, and Engineering experience. His Navy Nuclear Propulsion Program experience includes 12 years in Engineering and Operations (civil/mechanical/nuclear engineering and industrial operations), 9 years in Facilities, Engineering, and Quality Control Management. In addition, he has over 14 years experience as a consultant in Nuclear Management Systems, Risk Management and Evaluation, Healthcare, Information Technology, Environmental Management, Engineering systems, and ESH&QA systems services. He has supported assessment programs for LLNL and the Assurance Review Office for the past 11 years including development and implementation of quality assurance systems for the Plutonium Immobilization Program, implementation of Integrated Safety Management Systems (ISMS), Nuclear Criticality Safety, and the Quality Management Program for the Environmental Protection Program.

Assurance Review Office Report
Phase II Assessment of
B625 Fire Sprinkler System
ARO 02-004

May 31, 2002

University of California
Lawrence Livermore
National Laboratory

Prepared by:

Rey Bocanegra — 5/30/02

Rey Bocanegra, Lead Assessor — Date

Approved by:

5/30/02

Larry Pendexter, Director — Date
Assurance Review Office

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EXECUTIVE SUMMARY

Statement of System Operability

The assessment team determined Building 625 fire sprinkler system operability and reliability to be adequate based on the safety basis documentation, material condition of the system, and implementation of the maintenance and surveillance program. The team found the individuals that implement the maintenance and surveillance-testing program to be knowledgeable, and have an appropriate level of technical qualification. The team concluded that each of the objectives and criteria in the Criteria and Review Approach Document (CRAD) were met.

Operability Issues/Concerns

The description of operability in the glossary to the CRAD and the operability criteria found in the LLNL Fire Protection Program were used to determine system operability. There were no fire sprinkler system operability issues or concerns noted during the assessment.

Opportunities for Improvement

- Documentation from a preventive maintenance task noted that the fire department connection piping needs to be earthquake braced. Based on documentation review and interviews, the item is being addressed but has not been completed because of its low priority. The earthquake bracing is a best management practice and not required by the NFPA code.
- Original construction drawings for the fire sprinkler system are not available. Draft plan drawings of the fire sprinkler system were available during the walkdown but used as information only as the drawings have not been finalized.
- Differences were found between FSP-612, section "TSR Fire Protection Program" and the TSR paragraph 5.4.
- In an interview, the FS&C Compliance Coordinator stated that the revision of FSP-612 was not entered into the USQ Process.
- Conduct of operations issues related to human factors were identified in the maintenance and surveillance test procedures. For example, in procedure Task Code IE-156, the eleventh check calls for verification that all audible and visual water flow alarm devices operate properly and that an alarm was received at the FACO and the Dispatcher's console. The task states the receipt of the alarm is to be recorded. The attached Sprinkler PM Data Sheet does not clearly provide for recording receipt of the alarm and completed data sheets reviewed did not have alarm times recorded. Step 5 in Task IE-156 also calls for the 2-inch main drain valve to be fully opened and residual water supply pressure to be recorded. There is no subsequent direction to shut the drain valve after completing this check. The specific valves and their expected initial and final positions are not identified in the body of the procedures.
- Consideration should be given to requiring a routine technical review of the results of fire sprinkler test procedures by the facility manager's organization to determine trends in the material status of the system.

- The policy for staging spare sprinklers in the premises should be reviewed against the requirements of the NFPA 25, Section 2-4.1. It is recommended that sprinklers that are stored in the facility match only the type and rating of the installed sprinklers in accordance with NFPA, and that other types be removed to prevent inadvertent installation of the incorrect type. After the assessment was completed, the assessment team was informed that this opportunity for improvement had been addressed. The team did not verify that appropriate sprinkler heads were staged due to lack of time.
- The HWM QAP document contains an outdated reference to the Quality Assurance rule and has not been revised since 1998.

Good Practices

The HWM Procedures & Document Control Server stores copies of approved, authorized for use, safety documents and work procedures that are centrally located and readily available to everyone electronically.

Design Performance Questions Raised:

During the review, three questions were raised to the system engineer and facility's fire protection engineer regarding facility and system design performance that are peripherally related to this assessment. The team was unable to develop details of the potential issues due to lack of time and because the questions raised did not have a clear link to the approved CRAD and sprinkler system operability and reliability. They are only briefly mentioned here for completeness and are not explored any further as part of this assessment report. The facility will be provided available detail on these questions for them to address outside this report at a later date.

The three questions raised included, 1) the appropriateness of the assumptions and parameters used in a fire accident parametric analysis, 2) the behavior and response of the fire sprinkler system to small fires taking into consideration the height of the ceiling and distance from the sprinkler head to the ceiling, and 3) applicability of the assumptions used for dose calculations inside B625 to the dose calculations for accidents inside the containment tent located in B625.

Lessons Learned

The DOE generic CRAD used to develop the assessment-specific CRAD was useful. It helped keep the team keep focused on the purpose of the assessment. There was not a clear distinction between criteria and approaches; however, the team addressed all the criteria and approaches that were applicable. The generic CRAD could be improved by specifying more clearly the criteria for classifying an issue as an opportunity for improvement versus an operability issue. The operability criteria used for this report were those found in the LLNL Fire Protection Program which are based on NFPA.

LIST OF ACRONYMS

AD	Associate Director
ARO	Assurance Review Office
B625	Building 625
CMMS	Computerized Maintenance Management System
CRAD	Criteria and Review Approach Document
DAP	Discipline Action Plan
DNFSB	Defense Nuclear Facilities Safety Board
DOE	Department of Energy
EBA	Evaluation Basis Accident
ES&H	Environment Safety and Health
EVA	Emergency Voice Alarm
FDC	Fire Department Connection
FHA	Fire Hazards Analysis
FHE	Focused Hazards Evaluation
FSAR	Final Safety Analysis Report
FSP	Facility Safety Plan/Procedure
FS&C	Facilities, Safety & Compliance
HWM	Hazardous Waste Management
IE	Industrial Electronics
IP	Implementation Plan
IWS	Integration Work Sheet
LLNL	Lawrence Livermore National Laboratory
MIP	Maintenance Implementation Plan
M&O	Maintenance & Operations
M&TE	Measurement and Test Equipment
NIST	National Institute of Standards and Technology
NFPA	National Fire Protection Association
OAK	Oakland
OSHA	Occupational Safety and Health Administration
PCB	Polychlorinated Biphenyls
PM	Preventive Maintenance
QA	Quality Assurance
QAP	Quality Assurance Plan
RFP	Request for Proposals
SAR	Safety Analysis Report
SSCs	Systems, Structures, and Components
TRU	Transuranic
TSCA	Toxic Substances Control Act
TSR	Technical Safety Requirements
USQ	Unreviewed Safety Question
USQD	Unreviewed Safety Question Determination
VSS	Vital Safety Systems
WSS	Work Smart Standards

1. INTRODUCTION

On March 8, 2000, the Defense Nuclear Facilities Safety Board (DNFSB) issued Recommendation 2000-2, *Configuration Management, Vital Safety Systems*, concerning the degrading conditions of vital safety systems (VSS) and the capability to apply engineering expertise to maintain the configuration of these systems. In recommendation 2000-2, the DNFSB expressed concern that many DOE nuclear facilities were constructed years ago and are approaching the end of their design life. The DNFSB advised that as facilities age, a combination of age-related degradation and deficient maintenance might affect the reliability and ability of vital safety systems to perform their safety functions as designed.

While DOE acknowledged the DNFSB's concern, it also recognized that VSSs can remain operable and reliable into perpetuity with proper condition monitoring and assessment, maintenance, modification, repair or replacement of aging components, and analysis of long-term facility missions and system requirements to support these missions.

The DOE 2000-2 Implementation Plan (IP) specified two phases of assessments. Phase I assessments call for a review of operational and maintenance records and a qualitative determination of a "readiness state" for each vital safety system within defense nuclear facilities of interest. In Phase II assessments a vertical-slice-examination will be performed upon key facilities and systems, by performing a detailed review of the operational readiness of systems.

As stated in a written communication from DOE/OAK, based upon the total curie quantity and bounding accidents with the Documented Safety Analysis (DSA), DOE/OAK selected the Building 625 Container Storage Unit (B625) fire sprinkler system for a Phase II assessment. DOE/OAK had identified several issues with the fire sprinkler system as part of the DSA reviews. As agreed to with DOE the assessment was performed by the LLNL Assurance Review Office staff, augmented by outside subject matter experts.

2. BACKGROUND

Building 625 Container Storage Unit
Building 625 was constructed in 1982 and is a steel frame structure measuring 120 feet by 40 feet with corrugated metal sides and roof. The facility is designated as a DOE Hazardous Category 3 nuclear facility. The facility is used to store hazardous wastes, radioactive wastes, mixed wastes, Toxic Substances Control Act (TSCA) regulated wastes such as polychlorinated biphenyls (PCB) and asbestos, California-only regulated wastes, TRU wastes, and TRU mixed wastes. This facility can be used to store both liquid and solid wastes. Waste handling operations conducted in this facility include repacking, sampling, transferring, pH adjustment, and over packing.

The structure has lighting, electrical, and plant air services. Fire protection sprinklers and a 3-ton overhead bridge crane have been installed. The FSAR states in Chapter 4 that there are no safety class components or systems in the facility.

Fire Sprinkler System and Support System
Building 625 is provided with an automatic wet-pipe fire sprinkler system. A temporary confinement tent is located inside Building 625 and is also provided with fire sprinklers. The action of the water flowing through the sprinkler line activates an alarm at the Emergency Dispatch Center and notifies the LLNL Fire Department. The sprinkler system is described in the FSAR as a mitigative and "defense in depth" design feature that is not required to prevent or mitigate the release of radioactive material, prevent an inadvertent criticality, or prevent dose exposure consequences. The design criteria considered for the HWM facilities are those for non-safety class systems and exclude design criteria for engineered safety feature systems. The FSAR also states that, " design criteria for non-safety class systems and for Nonseismic Category I systems are obtained from conventional building codes, except as modified by DOE Order 420.1, DOE G 420.1-2, and DOE-STD-1020-94."

3. SCOPE OF ASSESSMENT

The Phase II assessment of the B625 fire sprinkler system evaluated the effects of age-related degradation on the system, and the processes in place to ensure that age-related degradation will not compromise the future ability of the B625 fire sprinkler system to accomplish its safety function when required. The Phase II assessment obtained the appropriate information to fully understand and characterize any system operability or reliability issues, problems, or concerns identified during the Phase I assessment.

For completeness, the assessment scope includes all components within the system boundary. The scope also includes operability of support systems that are necessary for the proper functioning of the B625 fire sprinkler system.

As agreed-to with DOE/OAK, the assessment scope did not include an in-depth review of site-wide support systems. A Laboratory-wide assessment of a support system, the site emergency voice alarm (EVA), is already planned for the near future. One of the support functions of the EVA is personnel notification in case of fire. The assessment team reviewed the request for proposals for the planned work. The work identified in the RFP included reviewing existing documentation and inspection of field installations. According to the RFP, the final report will discuss current condition of the system, its life expectancy, and recommendations for improvements.

The Phase II assessment of the B625 fire sprinkler system did not reanalyze the safety basis, authorization basis, or design of the system or support systems, and did not second-guess the approval of safety basis, authorization basis, or design documentation. The current approved safety basis, authorization basis, and available design information were reviewed to identify and understand the system safety functions, system requirements, and performance criteria of the system.

4. ASSESSMENT RESULT SUMMARY

Safety Function Definition
The role of the B625 fire sprinkler system in detecting, preventing, or mitigating analyzed events is adequately described in the safety/authorization basis documentation including support documentation such as the TSR Implementation Plan and Fire Hazards Analysis Building 625. The HWM Facilities Final Safety Analysis Report (FSAR) describes the B625 fire sprinkler system as an automatic wet-pipe system. It is a mitigative and "defense in depth" design feature that is not required to prevent or mitigate the release of radioactive material, prevent an inadvertent criticality, or prevent dose exposure consequences.

Opportunity for Improvement
None.

CONFIGURATION MANAGEMENT
The change control process is implemented through the HWM Quality Assurance Plan (QAP) and HWM Administrative Procedures. The HWM QAP states that it addresses the requirements of 10CFR 830.120, Quality Assurance, and contains applicable Configuration Management elements on Design Control, Procurement Document Control, Procedures and Instructions, Document Control, Control of Purchased Items and Services.

The document change control processes for facility procedures were evaluated. The ES&H Manual controls changes to the safety analysis that is documented by the HWM SAR and TSR and implementation of safety controls in the FSP. The Safety Analysis Report is developed in accordance with ES&H document 3.1 and reviewed by the ES&H Team leader and the facility manager, and approved by the facility Associate Director (AD). The facility AD submits the SAR to the DOE/Oakland Field Office for approval.

The FSP is developed in accordance with ES&H Manual document 3.3. Changes to HWM procedures (other than FSPs) are implemented by ADM 101, which describes the processes for initiating, preparing, reviewing, approving, controlling, and revising HWM administrative procedures and standard operating procedures. ADM 103 describes the methods for controlling HWM documents, and for revising, canceling, and reactivating HWM controlled documents.

The assessment team concluded that LLNL and facility processes are in place to properly control the configuration of vital safety system components. In addition, HWM is in the process of implementing a division specific configuration management program to incorporate requirements from the LLNL Configuration Management Program into HWM facilities and operations.

The fire sprinkler system was walked down to ascertain whether it was designed and installed in accordance with NFPA 13-1980 that is the code of record. The system was visually compared against selected portions of the NFPA code, e.g., arrangement, sizing, sprinkler location, protection against freezing and earthquakes, drainage, test features,

etc. The walkdown was performed from the ground level without any benefit of ladders or man-lifts. The walkdown concluded that the installation of the fire sprinkler system met the requirements of NFPA 13-1980.

Original construction drawings for the fire sprinkler system are not available. As a prelude to the 2000-2 Phase I assessment, Plant Engineering took measurements of the as-built sprinkler piping in B625. Draft plan drawings of the fire sprinkler system were available during the walkdown but used for information only. Plant Engineering informed the HWM System Engineer that they are working on a process to have the drawings finalized. The lack of availability of a complete set of drawings (elevations and riser details) does not hinder the facility from safely operating. The availability of drawings, although desirable, is not deemed to be a deficiency since operability of the system is determined frequently through associated system testing and maintenance.

The review of the revision process for FSP-612 and interviews of B625 personnel concluded that not all appropriate document revision requirements are being met. ES&H document 3.3 requires that the Facility AD, facility manager, or facility point of contact shall ensure that the facility safety plan (FSP) complies with the technical safety requirements (TSRs) for nuclear facilities. The FSP covering B625 operations (FSP-612, TSR Fire Protection Program) and TSR paragraph 5.4.5 differ in wording and implied intent. The TSR referenced DOE Order 420.1 while the FSP referenced DOE Order 5480.7A which was superceded by 420.1 in the WSS. **The FSP prohibits flammable liquid storage in B625 while the TSR prohibits flammable liquids in B625.**

ES&H Manual document 51.3 requires that all proposed changes, including changes to hardware or procedures (temporary or permanent), must be entered into the USQ process so that the impact on the authorization basis can be evaluated and the appropriate approval level (LLNL or DOE) can be ascertained. In an interview, the FS&C Compliance Coordinator stated that the revision of FSP-612 was not entered into the USQ Process.

HWM maintains a database of safety documents and work procedures. HWM's controlled procedures are made available electronically on the Procedures & Document Control Server. All documents posted to the file server are required to be current and authorized for use.

Opportunities for Improvement:

Potential Seismic upgrade deficiency identified during PM was not yet addressed. Documentation from a preventive maintenance task noted that the fire department connection piping needs to be earthquake braced. Based on documentation, interviews, and walkdowns conducted, the facility has not completed addressing this item due to low priority.

There are no existing records of the construction of B625. Original construction drawings for the fire sprinkler system are not available. As a prelude to the 2000-2 Phase I assessment, Plant Engineering took measurements of the as-built sprinkler piping in B625. Draft plan drawings of the fire sprinkler system were available during the walkdown but used as information only as the drawings have not yet been finalized.

Differences in Facility Safety Procedure and Technical Safety Requirements. Some differences were found between FSP-612, section "TSR Fire Protection Program" and the TSR paragraph 5.4.

Revision to FSP-612 did not go through the USQ process as required. In an interview, the FS&C Compliance Coordinator stated that the revision of FSP-612 was not entered into the USQ Process.

The HWM QAP document is out of date. The QAP contains an outdated reference to the Quality Assurance rule and has not been revised since 1998.

Good Practice:
Availability of approved documents. The HWM Procedures & Document Control Server stores copies of approved, authorized for use, safety documents and work procedures that are centrally located and readily available to everyone electronically.

SYSTEM SURVEILLANCE AND TESTING

The fire suppression sprinkler system maintenance program is linked to the listed safety basis documents through the LLNL *Maintenance Implementation Plan for Nonreactor Nuclear Facilities*. In addition, the LLNL *Health and Safety Manual, Subpart 22.5 Fire* implements the work smart standards that include the National Fire Codes (NFPA). The underlying guidance for system requirements and performance criteria, as well as the inspection, testing and maintenance procedures performed on the Building 625 sprinkler system, are the applicable NFPA Codes 25 and 13. Maintenance actions are performed in accordance with a standard set of preventive maintenance procedures and under a Generic Integration Work Sheet that includes a wide range of plumbing, pipefitting and welding operations. Interviews and document reviews indicate that the mechanics, supervisors and managers involved in maintaining the sprinkler system are knowledgeable of the procedures and the underlying basis for the maintenance and the various inspections and tests.

Opportunities for Improvement:
Conduct of Operations. Conduct of operations issues related to human factors were identified in the maintenance and surveillance test procedures. For example, in procedure Task 156, the eleventh check calls for verification that all audible and visual water flow alarm devices operate properly and that an alarm was received at the Dispatcher's console. The task states the receipt of the alarm is to be recorded. The attached Sprinkler PM Data Sheet does not clearly provide for recording receipt of the alarm and 9 of 12 completed data sheets reviewed did not have the alarm times recorded. Task 156 also calls for the 2-inch main drain valve to be fully opened and residual water supply pressure to be recorded. There is no subsequent direction to shut the drain valve after completing this check. The specific valves and their expected initial and final positions are not identified in the body of the procedures

Lack of formal surveillance test data review. Consideration should be given to requiring routine technical review of the results of fire sprinkler test procedures by the facility manager's organization to determine trends in the material status of the system.

SYSTEM MAINTENANCE

Specific components of the system are inspected and tested during the performance of the monthly and quarterly inspection and preventive maintenance procedures. Any noted deterioration or defects require corrective maintenance if it is identified. All system components are walked down and inspected, including identifying signs and freeze protection insulation, as part of the annual wet sprinkler preventive maintenance procedure. During the performance of the Fire Riser 5 Year Preventive Maintenance procedure, the system is walked down and the prescribed preventive maintenance is performed. This includes internal inspection of specified components and verification that all components perform properly. Gauges are changed out and all valves are lubricated.

Assessment team walk downs did not reveal any evidence of poor or degraded conditions that would require any additional maintenance. Systems appeared in generally good condition. Interviews with personnel that perform periodic maintenance and reviews of completed inspection test and maintenance documents verify that periodic walk downs and maintenance is performed as scheduled.

Opportunity for Improvement

Spare sprinkler storage does not meet NFPA. The policy for staging spare sprinklers in the premises should be reviewed against the requirements of the NFPA 25, Section 2-4.1. It is recommended that sprinklers that are stored in the facility match only the type and rating of the installed sprinklers, and that other types be removed to prevent inadvertent installation of the incorrect type. After the assessment was completed, the assessment team was informed that this opportunity for improvement had been addressed. Due to lack of time, the assessment team was unable to verify that sprinkler heads of the appropriate types and temperature rating were staged at the facility.

APPENDIX A

DETAILED DISCUSSION OF RESULTS

TOPIC AREA: SAFETY FUNCTION DEFINITION

OBJECTIVE

Safety basis-related technical, functional, and performance requirements specific to the B625 fire sprinkler system (e.g., as discussed or cited in the facility safety analysis documents) are identified/defined in appropriate safety documents.

Criteria:
Safety/Authorization Basis documents identify and describe:
1) The B625 fire sprinkler system safety functions and the safety functions of any essential supporting systems.
2) The system requirements and performance criteria that the B625 fire sprinkler system must meet to accomplish its safety functions.

APPROACH

Document Review:
Review the appropriate safety/authorization basis documents, such as safety analysis reports, basis for interim operations, technical safety requirements, safety evaluation reports, and hazards and accident analyses, to determine if the definition/description of the safety functions of the B625 fire sprinkler systems include, (1) the specific role of the systems in detecting, preventing, or mitigating analyzed events, (2) the associated conditions and assumptions concerning system performance, (3) system requirements and performance criteria for the B625 fire sprinkler systems and its active components, including essential supporting systems, for normal, abnormal, and accident conditions relied upon in the hazard or accident analysis.

Persons Interviewed:
HWM System Engineer
DOE Facility Representative
ES&H Team 4 Fire Protection Engineer

RESULTS

Evaluation:
The specific role of the B625 fire sprinkler system in detecting, preventing, or mitigating analyzed events is described in the safety/authorization basis documentation including support documentation such as the TSR Implementation Plan and Fire Hazards Analysis Building 625. The HWM Facilities Final Safety Analysis Report (FSAR) describes the B625 fire sprinkler system as an automatic wet-pipe system. It is a mitigative and "defense in depth" design feature that is not required to prevent or mitigate the release of radioactive material, prevent an inadvertent criticality, or prevent dose exposure consequences.

The HWM FSAR states that the fire sprinkler system is designed to normal industry standards except as modified by DOE O 420.1. The HWM Facility Engineer stated that no exceptions to normal industry standards were taken and the assessment team did not note any. The HWM FSAR further states in Chapter 11, that the system design relies on fire being detected by facility personnel and sprinkler-flow. The action of the water flowing through the sprinkler line activates an alarm at the Emergency Dispatch Center and notifies the LLNL Fire Department. The confinement tent located in B625 is also equipped with sprinklers.

The FSAR requires that the B625 fire sprinkler system be tested quarterly to ensure operability. A letter from DOE added a condition that LLNL implement operability requirements for the sprinklers in B625. The Area 625 Facility Safety Plan states that fire protection including detection capabilities, fire sprinkler systems, and portable fire extinguishers, will be operational and continuously available.

There are no identified system requirements and performance criteria for the B625 fire sprinkler system for normal, abnormal, and accident conditions relied upon in the hazard or accident analysis. No credit is taken for the B625 fire sprinkler system in the FSAR accident analysis and the evaluation of on-site and off-site consequences.

The Emergency Dispatch Center and LLNL Fire Department are alerted to a potential fire in Building 625 by an alarm initiated by sprinkler system flow or personnel calling 911. Two walk downs of Building 625 were performed as part of the Phase II assessment of the sprinkler system. Based on the results of the walkdowns the team concluded that the sprinkler system complied with NFPA 13 requirements at the time of construction.

Conclusion:
The criterion was met.

Operability Issues/Concerns:
None

Opportunities for Improvements:
None.

Good Practices:
None noted.

TOPIC AREA: CONFIGURATION MANAGEMENT

OBJECTIVE

Changes to safety basis-related requirements, documents, system configuration and installed components are controlled.

Criteria:

1. Changes to B625 fire sprinkler system safety basis requirements, documents, and installed components are designed, reviewed, approved, implemented, tested, and documented in accordance with controlled procedures. Consistency is maintained among system requirements and performance criteria, installed system equipment and components, and associated documents as changes are made.
2. Technical walkdown of selected system components verifies that the actual physical configuration of these components conforms to documented design and safety basis documents for the system.
3. Changes to the B625 fire sprinkler system's safety basis requirements, documents, and installed components conform to the approved safety/authorization basis (safety envelope) for B625; the appropriate change approval authority is determined using the Unreviewed Safety Question (USQ) process; and consistency is maintained among system requirements and performance criteria, installed system equipment and components, and associated documents.
4. Facility procedures ensure that changes to the B625 fire sprinkler system's safety basis requirements, documents, and installed components are adequately integrated and coordinated with those organizations affected by the change.

APPROACH

Document Review:

On a sample basis, review and evaluate the change control process and procedures and associated design change packages and work packages to determine whether the change control process and procedures are adequate and effectively implemented. Determine whether, (1) SSCs and documents affected by the change are identified, (2) changes are accurately described, reviewed and approved as appropriate, (3) installation instructions, certification/installation records, post-modification testing instructions and acceptance criteria for turnover to facility operations are specified, and (4) important documents affected by the change (e.g., operating and test procedures, Master Equipment List, etc.) are revised in a timely manner.

Determine whether engineering (including the design authority and technical disciplines), operations, and maintenance organizations are made aware of B625 fire sprinkler system changes that affect them, and are appropriately involved in the change process. Verify integration and coordination with other organizations that could logically be affected by the change such as facility training, document control, construction, radiological control, OSHA occupational safety, industrial hygiene, occupational medicine, hazard analysis/safety basis, safeguards and security, and fire protection.

Review documentation, such as change travelers and change packages, and interview individuals responsible for processing selected changes made to B625 fire sprinkler system requirements, installed equipment, and associated documents. Determine whether, (1) documents affected by the change are identified, (2) changes are accurately described, reviewed, and approved as appropriate, (3) systems, structures, and components affected by the change are identified for facility management, system engineer, users, operators, or others affected by the change, (4) changes to the system are reviewed to ensure that system requirements and performance criteria are not affected in a manner that adversely impacts the ability of the system to perform its safety functions, (5) the USQ process (i.e., USQ screens and USQ safety evaluations/ determinations) is used, (6) installation instructions, post-modification testing instructions and acceptance criteria for turnover to facility operations are specified, and (7) important documents affected by the change are revised timely.

Interviews:
Interview a sample of cognizant line, engineering, QA managers and other personnel to verify their understanding of the change control process and commitment to manage changes affecting design and safety basis in a formal, disciplined and auditable manner.

Personnel Interviewed:
HWM System Engineer
Plant Engineering Plumber Fitter
Plant Engineering Designer
DOE Facility Representative
Facility Engineer
Storage & Disposal Group Leader/FPOC
FS&C Compliance Analyst
ES&H Team 4 Fire Protection Engineer
Safety Analyst

Observations:
Walkdown of selected B625 fire sprinkler system components and compare the actual physical configuration of these components to documentation in system design and safety basis documents, such as safety or authorization basis documents, system design descriptions, or piping and instrumentation drawings. Identify any temporary changes, or configuration discrepancies that call into question (1) the operability or reliability of the B625 fire sprinkler system or (2) the adequacy of the change control or document control processes, including drawing revision, applied to the systems.

CRITERION 1:
Changes to B625 fire sprinkler system safety basis requirements, documents, and installed components are designed, reviewed, approved, implemented, tested, and documented in accordance with controlled procedures. Consistency is maintained among system requirements and performance criteria, installed system equipment and components, and associated documents as changes are made.

RESULTS

Evaluation:
The change control process and procedures that implement the process in Building 625 were reviewed. The change control process is implemented through the HWM Quality Assurance Plan (QAP) and HWM Administrative Procedures. The HWM QAP addresses the requirements of 10CFR 830.120, Quality Assurance, and contains applicable Configuration Management elements on Design Control, Procurement Document Control, Procedures and Instructions, Document Control, Control of Purchased Items and Services.

If a decision is made that a change to an HWM facility will be made, then ADM 117 will be used for determining the level of design and engineering control required for HWM structures, systems, components, and items to assure compliance with the HWM QAP. ADM 117 applies to HWM design and engineering activities involving new construction/fabrication or modifications of HWM systems, structures, and components or items. These activities include design changes, design interfaces, design reviews, and conduct of technical, operational, and peer reviews for the design of an item, system, structure or process. In addition, ES&H Document 51.3 provides requirements for evaluating proposed activities for potential USQs. These processes and guidance are in place to assure that work activities conducted in HWM facilities are properly requested, reviewed, and authorized before being performed and that such work activities are performed in a formal and deliberate manner with emphasis on safety.

For changes to vital safety system components, the Integration Work Sheet (IWS) process that is described in the LLNL Environment, Safety, and Health (ES&H) Manual document 2.2 implements configuration management. The electronic database on IWS was queried for all IWSs applicable to B625. No Active or Archived IWSs were found that related to physical modification of B625 fire sprinkler components. According to facility personnel and the ES&H Team Fire Protection Engineer, the only modification of the B625 fire sprinkler system was performed around 1997 before the start of the IWS process. The implementation of the pre-IWS process was not assessed. The assessment team concluded that LLNL and facility processes are in place to properly control the configuration of vital safety system components. In addition, HWM is in the process of implementing a division specific configuration management program to incorporate requirements from the LLNL Configuration Management Program into HWM facilities and operations. This new system will enhance Configuration Management and ensure and maintain consistency between systems, structures and components, documentation, and processes.

The document change control processes for facility procedures were evaluated. The ES&H Manual controls changes to the safety basis that is documented by the HWM SAR and TSR and implementation of safety controls in FSP. The Safety Analysis Report is developed in accordance with ES&H document 3.1 and reviewed by the ES&H Team leader and the facility manager, and approved by the facility AD. The facility AD submits the SAR to the DOE/Oakland Field Office for approval. The SAR describes the hazards, and controls associated with facility operations. Controls for hazards associated with activities not commonly performed by the public included in the SAR are implemented through the FSP for the facility. It is especially important that these plans also include the controls for maintaining the Technical Safety Requirements and required (life safety systems identified in the SAR, as they are critical to maintaining the approved risk of operations.

The FSP is developed in accordance with ES&H Manual Document 3.3. Changes to other HWM procedures are implemented by ADM 101, which describes the processes for initiating, preparing, reviewing, approving, controlling, and revising HWM administrative procedures and standard operating procedures. ADM 103 describes the methods for controlling HWM documents, and for revising, canceling, and reactivating HWM controlled documents.

Interviews were conducted with the HWM System Engineer, ES&H Team 4 Fire Protection Engineer, Facility Engineer and line management. HWM has documented a Vital Safety System (VSS) System Engineer Qualification Program for B625 fire sprinkler system in courses EP-5040 and EP5040-005. A System Engineer was appointed last year and completed the HWM Vital Safety System Qualification Program. The System Engineer was interviewed to determine the extent of training, knowledge and understanding of the system engineer roles and responsibilities. The HWM Vital Safety System (VSS) Qualification Program consists of education requirements, experience requirements, and a reading assignment of the SAR and TSR. While the System Engineer is not a fire protection engineer nor did the HWM VSS Qualification Program require any fire protection training, the System Engineer has become very familiar with the B625 fire sprinkler system operation, design, inspection, testing, and maintenance. The System Engineer and the facility rely on the ES&H Team Fire Protection Engineer for technical expertise related to fire protection issues. The ES&H Team Fire Protection Engineer is a registered Fire Protection Engineer and is very knowledgeable of fire protection issues and the B625 fire sprinkler system. Interviews with the System Engineer, the ES&H Team Fire Protection Engineer and other cognizant personnel indicate that personnel are aware of configuration management requirements.

Conclusion:
The criterion was met.

Operability Issues/Concerns:
None.

Opportunities for Improvements:
The QAP contains an outdated reference to the Quality Assurance rule and has not been revised since 1998.

Good Practices:
None noted.

CRITERION 2:
Technical walkdown of selected system components verifies that the actual physical configuration of these components conforms to documented design and safety basis documents for the system.

RESULTS

Evaluation:
The fire sprinkler system was walked down to ascertain whether it was designed and installed in accordance with NFPA 13-1980 that is the code of record. The system was visually compared

against selected portions of the NFPA code, e.g., arrangement, sizing, sprinkler location, protection against freezing and earthquakes, drainage, test features, etc. The walkdown was performed from the ground level without the benefit of ladders or man-lifts. The walkdown concluded that the installation of the fire sprinkler system met the requirements of NFPA 13-1980.

A second walkdown was performed of selected portions of the fire sprinkler system. Original construction drawings for the fire sprinkler system were not available. According to the System Engineer and the Fire Protection Engineer, there are no existing records of the construction of B625. As a prelude to the 2000-2 Phase I assessment, Plant Engineering took measurements of the as-built sprinkler piping in B625. Draft plan drawings of the fire sprinkler system were available during the walkdown but used for information only as the drawings have not been finalized. Two minor comments were noted during the walkdown and the System Engineer will provide them to Plant Engineering. The two drawings do not completely document the configuration of the sprinkler system. There are no plans to provide elevation drawings or detail drawings of the control & check valve configuration. A review of the Phase I assessment report was also conducted. The report notes that the fire sprinkler system was available to support its safety function and building operation. The lack of availability of a complete set of drawings does not hinder the facility from safely operating. The availability of drawings, although desirable, is not deemed to be a deficiency since operability of the system is determined frequently through associated system testing and maintenance.

The *Fire Hazards Analysis Building 625* states in Section 3.1.2 that the building interior system was upgraded to meet new earthquake standards in 1997. Preventative Maintenance Task PIPE-06 performed on August 16, 2001 noted that the F.D.C. (fire department connection) piping needs to be earthquake braced but the "client" did not want it done at this time. The client representative was the HWM Maintenance Manager. Based on documentation, interviews, and walkdowns conducted, the facility has not yet completed addressing the item due to its low priority. The earthquake bracing is a best management practice and not required by the NFPA code.

Conclusion:
The criterion was met.

Operability Issues/Concerns:
None.

Opportunities for Improvements:
The *Fire Hazards Analysis Building 625* states in Section 3.1.2 that the building interior system was upgraded to meet new earthquake standards in 1997. Preventative Maintenance Task PIPE-06 performed on August 16, 2001 noted that the F.D.C. (fire department connection) piping needs to be earthquake braced but the client did not want it done at this time. The client representative was the HWM Maintenance Manager. Based on documentation and interviews conducted, the facility has not yet completed addressing the item due to its low priority. The earthquake bracing is a best management practice and not required by the NFPA code.

Original construction drawings for the fire sprinkler system were not available. As a prelude to the 2000-2 Phase I assessment, Plant Engineering took measurements of the as-built sprinkler

piping in B625. Draft plan drawings of the fire sprinkler system were available during the walkdown but used as information only as the drawings have not yet been finalized.

Good Practices:
None noted.

CRITERION 3:

Changes to the B625 fire sprinkler system's safety basis requirements, documents, and installed components conform to the approved safety/authorization basis (safety envelope) for B625; the appropriate change approval authority is determined using the Unreviewed Safety Question (USQ) process; and consistency is maintained among system requirements and performance criteria, installed system equipment and components, and associated documents.

RESULTS

Evaluation:
Based on the review of Integration Work Sheets related to B625 and interview of B625 personnel the team concluded that HWM is appropriately implementing the work control process. The only active IWS for work in B625 is not related to the fire sprinkler system. The team determined through interviews with facility personnel that the IWS process should adequately control activities related to the fire sprinkler system.

Through the review of the revision process for FSP-612 and interviews of B625 personnel, the team concluded that not all appropriate document revision requirements are being met. ES&H Document 3.3 requires that the Facility Associate Director, facility manager, or facility point of contact shall ensure that the facility safety plan complies with the Technical Safety Requirements (TSRs) for nuclear facilities. The FSP covering B625 operations, FSP-612, TSR Fire Protection Program, and TSR paragraph 5.4.5 differ in wording and implied intent. The TSR references DOE Order 420.1 while the FSP references DOE Order 5480.7A which was superceded by 420.1 in the Work Smart Standards set (WSS). The FSP prohibits flammable liquid storage in B625 while the TSR prohibits flammable liquids in B625.

ES&H Manual Document 51.3 requires that all proposed changes, including changes to hardware or procedures (temporary or permanent), must be entered into the USQ process so that the impact on the authorization basis can be evaluated and the appropriate approval level (LLNL or DOE) can be ascertained. ADM 126 provides Hazardous Waste Management (HWM) personnel with guidance for initiating and tracking the Unreviewed Safety Question (USQ) process and requires as a minimum that a proposed physical, procedural, or operational change, be at least prescreened to determine whether the issue requires further screening or can be eliminated from the USQ process. In an interview, the FS&C Compliance Coordinator stated that the revision of FSP-612 was not entered into the USQ Process.

Conclusion:
The criterion was met.

Operability Issues/Concerns:
None

Opportunities for Improvements:
FSP-612 is developed in accordance with ES&H Manual document 3.3. Document 3.3 requires that the facility Associate Director, facility manager, or facility point of contact shall ensure that the facility safety plan complies with the Technical Safety Requirements (TSR) for nuclear facilities. The assessment team noted that FSP-612, Section "TSR Fire Protection Program" and the TSR paragraph 5.4.5 differ in wording and implied intent. The TSR references DOE Order 420.1 while the FSP references DOE Order 5480.7A which was superceded by 420.1 in the WSS. The FSP prohibits flammable liquid storage in B625 while the TSR prohibits flammable liquids in B625. According to the FPOC, the intent of the TSR is to prohibit storage not the use of flammable liquids in B625.

ES&H Manual document 51.3 requires that all proposed changes, including changes to hardware or procedures (temporary or permanent), must be entered into the USQ process so that the impact on the authorization basis can be evaluated and the appropriate approval level (LLNL or DOE) can be ascertained. ADM 126 provides Hazardous Waste Management (HWM) personnel with guidance for initiating and tracking the USQ process and requires as a minimum that a proposed physical, procedural, or operational change, be at least prescreened to determine whether the issue requires further screening or can be eliminated from the USQ process. In an interview, the FS&C Compliance Coordinator stated that the revision of FSP-612 was not entered into the USQ Process.

Good Practices:
None noted.

CRITERION 4:
Facility procedures ensure that changes to the B625 fire sprinkler system's safety basis requirements, documents, and installed components are adequately integrated and coordinated with those organizations affected by the change.

RESULTS

Evaluation:
ES&H Manual Document 2.2 states that safety documents are to be readily available to all individuals who need access to the information in order to perform their work activities safely. The HWM QAP specifies that control of documents involves timely distribution and /or distribution of change notices of new or revised documents to individuals at designated locations and ensuring that the latest documents are available prior to commencing work.

HWM maintains a database of safety documents and work procedures. HWM's controlled procedures are made available electronically on the Procedures & Document Control Server. All documents posted to the file server are required to be current and authorized for use. "READ

ME FIRST" instructions provide notice to users that before using a downloaded or printed copy of a controlled procedure to perform work, they should ALWAYS compare the revision number and date of the working copy to the controlled copy located on this server to assure that they are following the most current authorized procedure. During the course of the assessment when HWM personnel were interviewed and asked to look at a requirement in a safety document or procedure, they invariably turned to the server to ensure that they were looking at a controlled copy of the document. The server contains a listing of the Authorization Basis documents applicable to HWM and a copy of those documents. Electronic notifications are sent to all HWM employees each time a new or revised procedure is added to the server.

Conclusion:
The criterion was met.

Operability Issues/Concerns:
None

Opportunities for Improvements:
None noted.

Good Practice:
The HWM Procedures & Document Control Server stores copies of approved, authorized for use, safety documents and work procedures that are centrally located and readily available to everyone electronically.

TOPIC AREA: SYSTEM SURVEILLANCE AND TESTING

OBJECTIVE

Surveillance and testing of the B625 fire sprinkler system demonstrates that the system is capable of accomplishing its safety functions and continues to meet applicable system requirements and performance criteria (e.g., safety basis requirements such as Technical Safety Requirements/Limiting Conditions for Operation).

Criteria:

1. Requirements in applicable DOE Rules and Orders are invoked for the B625 fire sprinkler system.
2. Requirements for surveillance and testing necessary to demonstrate overall system reliability and operability are accommodated by the system design and are linked to the technical safety basis.
3. Surveillance and test procedures confirm that key operating parameters for the overall system and its major components are maintained within operating limits.
4. Instrumentation and measurement and test equipment for the B625 fire sprinkler system are calibrated and maintained.

PROCESS

Personnel Interviewed:
IE Group Leader
IE Maintenance Coordinator
Support Plant Engineering Shops – Plumbers/Pipefitters Lead
Support Plant Engineering Shops – Plumber/Pipefitter
Site Fire Protection Engineer
ES&H Team 4 Fire Protection Engineer

Operations Observed:
The assessment team requested that maintenance workers perform a walkthrough of the Plant Engineering Preventative Maintenance Procedures, Tasks Code IE-159, Wet Sprinkler Quarterly PM and Task Code IE-156, Wet Sprinkler Annual PM. During the conduct of the procedure walkthrough, the plumber/pipefitter was asked to explain how each step in the procedures was accomplished and documented. This exercise was conducted to assess whether the procedures demonstrate fire sprinkler system reliability and compliance with applicable NFPA 25 requirements.

CRITERION 1:

Requirements in applicable DOE Rules and Orders are invoked for the B625 fire sprinkler system.

RESULTS

Evaluation:
Contract No. W-7405-ENG-48 Appendix G, Directive List identifies that DOE Order 420.1, *Facility Safety* and NFPA Volumes 1-13, May 2001, Edition are mandatory for fire protection at

LLNL. These requirements are incorporated into the LLNL Fire Protection Program (Fire Protection Engineering Standard 1.2) and are applicable to all LLNL work processes, including those performed by subcontractors, guests, visitors, and construction or labor contractors.

The LLNL Plant Engineering Department has invoked the standard NFPA 25, *Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems* into the preventive maintenance system program for surveillance and testing of the B625 fire sprinkler system and essential support systems.

In addition to the inspection and testing conducted by the Plant Engineering Division, the LLNL Emergency Management Division Polices and Procedure 1500 requires the conduct of inspections of the main control valve, section valve, and fire department connection. The procedure also requires a quarterly flow test of the automatic sprinkler system in B 625.

Based on review of Plant Engineering M&O Division Task Codes IE-156, IE-159, and PIPE-06, and LLNL Emergency Management Division Polices and Procedure 1500, the assessment team determined that DOE Order requirements applicable to surveillance and testing of the B625 fire sprinkler system is incorporated into the appropriate documents.

Conclusion:
The criterion was met.

Operability Issues/Concerns:
None.

Opportunities for Improvement:
None.

Good Practices:
None noted.

CRITERION 2:
Requirements for surveillance and testing necessary to demonstrate overall system reliability and operability are accommodated by the system design and are linked to the technical safety basis.

RESULTS

Evaluation:
The sprinkler system is described in safety basis documentation as a mitigative and "defense in depth" design feature that is not required to prevent or mitigate the release of radioactive material, prevent an inadvertent criticality, or prevent dose exposure consequences. The design criteria considered for B625 are those for non-safety class systems. In Section 4.2, DOE Order 420.1 requires that fire protection used to achieve "defense in depth" meet NFPA Codes and Standards. The LLNL Plant Engineering Department has invoked the standard NFPA 25, *Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems* into the preventive maintenance system program for surveillance and testing of the B625 fire sprinkler system.

The team reviewed the above referenced documents and determined that the procedures are sufficient to demonstrate compliance to the inspection, system flow, and flow alarm check requirements of NFPA 25. The tasks in the procedures address, (1) notification of the Emergency Dispatcher (Fire Department) prior to commencement of these procedures, (2) recording static and residual B625 fire sprinkler system pressures, (3) visual inspection of sprinkler heads, the condition of valves, gauges, identifying signs, and insulation, (4) checking material condition and position of system valves, (5) main drain test, (6) testing valve position supervisory switches for remote alarm indication, (7) verification of that all audible and visual water flow alarm devices operate properly and that remote alarm indications are activated, (8) verification that each valve is secured (locked or sealed) in its normal position and labeled for function, (9) returning system to service, and (10) recording inspection readings for system pressures, flow switch timing, supervisory switches and comments.

Plant Engineering personnel, including the IE Maintenance Coordinator and a Plumber/Pipefitter, as well as the site fire protection engineer, were interviewed regarding the origin, scheduling, performance and review of these procedure.

The IE Maintenance Coordinator is knowledgeable of the NFPA standards and their implementation for preventative maintenance tasks. The Plumber/Pipefitter was knowledgeable of the procedures and the actions necessary to accomplish the tasks. The site fire protection engineer was familiar with the procedure and reviews the procedures for compliance to national standards and laboratory policy prior to implementation.

Requirements for surveillance and testing found preventative maintenance procedures Tasks Code IE-159, Wet Sprinkler Quarterly PM and Task Code IE-156, Wet Sprinkler Annual PM were determined to be accommodated by the system design and were appropriately linked to the technical safety basis. These procedures are necessary to demonstrate overall system reliability and operability. Some conduct of operations issues were identified with the procedures.

Conclusion:
The criterion was met.

Operability Issues/Concerns:
None.

Opportunities for Improvement:
The assessment team identified the following conduct of operations issues related to human factors concerning the surveillance test procedures:

- The specific valves and their expected initial and final positions should be identified in the body of the procedures. For the Fire Sprinkler System in B625, a statement to verify each valve is secured (locked or sealed) in its normal operating position and properly labeled for function may be sufficient. However, such action is highly dependent upon the skill and experience of test personnel in understanding the operating parameters of a system and the objective of the test.
- In Task IE-156, the fifth check calls for the 2-inch main drain valve to be fully opened and residual water supply pressure to be recorded. There is no subsequent direction to shut the drain valve after completing this check. During the procedure performance, the

Plumber/Pipefitter stated he shuts the valve based upon his knowledge and experience in inspecting and testing this system.

- In Task IE-156, the eleventh check calls for verification that all audible and visual water flow alarm devices operate properly and that an alarm was received at the Dispatcher's console. The task states the receipt of the alarm is to be recorded. The attached Sprinkler PM Data Sheet does not clearly provide a mechanism for recording receipt of the alarm and 9 of 12 completed data sheets reviewed did not have alarm times recorded.
- The Sprinkler PM Data Sheets, generated as a result of these procedures, are forwarded by the Plumber/Pipefitter to his shop supervisor for review. In turn, the supervisor determines if further action is needed in maintaining the fire sprinkler system. Consideration should be given to requiring a technical review of the results of these procedures by the facility manager's organization to determine trends in the material status of the system and to determine if the context of these procedures continues to be adequate in meeting the concerns of the facility manager.
- The assessment team observed a small valve used as a drain valve for restoring the water header supply for the temporary tent in B625. Consideration should be given to identifying this valve in the test procedure as possible source of a loss of water pressure and subsequent flow alarm in B625.

Good Practices:
None noted.

CRITERION 3:
Surveillance and test procedures confirm that key operating parameters for the overall system and its major components are maintained within operating limits.

RESULTS

Evaluation:
Plant Engineering personnel including the IE Maintenance Coordinator and a Plumber/Pipefitter, as well as the site fire protection engineer, were interviewed regarding the origin, scheduling, performance and review of the test procedures.

The team witnessed a procedure walkthrough performed by a Plumber/Pipefitter and determined that these procedures produce valid results for system flow, flow alarm activation, alarmed valve position, and material condition. The maintenance Plumber/Pipefitter was very knowledgeable of the procedures and was able to satisfactorily demonstrate performance of the procedures. All appropriate data as called out in the procedures were explained and how they would be recorded was demonstrated to the team. Questions as to actions in the event of significant deviation of test results with expected results were satisfactorily explained.

Based on the documents reviewed and procedure walkthrough, the team determined that the procedures as written assure operability that the fire sprinkler system flow alarm will function in the event of flow activation of the system. The maintenance Plumber/Pipefitter was very knowledgeable regarding performance of the surveillance test procedures.

Conclusion:
The criterion was met.

Operability Issues/Concerns:
None.

Opportunities for Improvement:
None.

Good Practices:
None noted.

CRITERION 4:
Instrumentation and measurement and test equipment for the B625 fire sprinkler system is calibrated and maintained.

RESULTS

Evaluation:
Review of documents and inspection of installed instrumentation for the B 625 fire sprinkler system found no objective evidence that pressure gauges are calibrated during the performance of Task Codes IE-156 & IE-157.

Plant Engineering replaces the B625 fire sprinkler system installed gauges with new factory gauges during the 5-year Fire Riser maintenance. This practice is in compliance with the NFPA 25 requirement that gauges shall be replaced every 5 years or tested every 5 years by comparison with a calibrated gauge. The replacement of these gauges is not identified or recorded in LLNL Plant Engineering Department Preventive Maintenance Division Procedure Task Code PIPE-06, Fire Riser 5 Year PM.

The Assessment Team determined that the instrumentation and measurement and test equipment (M&TE) for the B625 fire sprinkler system is not calibrated and maintained, but is instead periodically replaced in accordance with NFPA requirements.

Conclusion:
The criterion was met based on meeting NFPA requirement to calibrate or replace.

Operability Issues/Concerns:
None.

Opportunities for Improvement:
None.

Good Practices:
None noted.

TOPIC AREA: SYSTEM MAINTENANCE

OBJECTIVE

The B625 fire sprinkler system is maintained in a condition that ensures its integrity, operability and reliability.

Criteria:

1. For the B625 fire sprinkler system, maintenance processes consistent with safety classification are in place for prescribed corrective, preventive, and predictive maintenance.
2. The B625 fire sprinkler system is periodically walked down in accordance with maintenance requirements to assess its material condition.

APPROACH

Records Review:

Verify that maintenance for the B625 fire sprinkler system satisfies system requirements and performance criteria in safety basis documents or other local maintenance requirements.

Evaluate maintenance of aging B625 fire sprinkler system equipment and components. Determine whether there are criteria in place to accommodate aging-related system degradation that could affect system reliability or performance.

Review the plans and schedules for monitoring, inspecting, replacing, or upgrading system components needed to maintain system integrity, including the technical basis for such plans and schedules

Determine whether maintenance source documents such as vendor manuals, industry standards, DOE Orders, and other requirements are used as technical bases for development of B625 fire sprinkler system maintenance work packages. Verify that the B625 fire sprinkler system is inspected periodically according to maintenance requirements.

Review system or component history files for selected system components for the past three years. Identify whether excessive component failure rates were identified. Determine how failure rates were used in establishing priorities and schedules for maintenance or system improvement proposals. Review the procedure and process for performing walk downs of the B625 fire sprinkler system.

Interviews:

Verify through manager and worker interviews that personnel performing walk downs understand operational features, safety requirements and performance criteria for the system.

Observations:

On a sample basis, inspect the material condition of installed components and determine whether any observed deficiencies have been already identified and addressed in a facility condition assessment or deficiency tracking system.

Personnel Interviewed:
LLNL Subject Matter Expert Fire Protection Engineer and Fire Marshal
Emergency Management Division/Fire Chief
Industrial Electronics Group Leader
HWM System Engineer
Plumber/pipefitter Lead
Plumber/pipefitter
Plumber/pipefitter Operations Supervisor
ES&H Team 4 Fire Protection Engineer
Superintendent of Facilities Maintenance

CRITERION 1:
For the B625 fire sprinkler system, maintenance processes consistent with safety classification are in place for prescribed corrective, preventive, and predictive maintenance.

RESULTS

Evaluation:
The HWM Facilities and Equipment Maintenance Manual, Rev. 2 (October 2001) implements the LLNL *Maintenance Implementation Plan for Nonreactor Nuclear Facilities*. In addition, the LLNL ES&H Manual, *Document 22.5* implements the work smart standards that include the NFPA standards. The underlying guidance for system requirements and performance criteria, as well as the inspection, testing and maintenance procedures performed on the Building 625 sprinkler system, are the applicable NFPA standards 25 and 13. Maintenance actions are performed in accordance with a standard set of preventive maintenance procedure and under a Generic Integration Work Sheet that include a wide range of plumbing, pipefitting and welding operations. Interviews and document reviews indicate that the mechanics, supervisors and managers involved in maintaining the sprinkler system are knowledgeable of the procedures and the underlying basis for the maintenance and the various inspections and tests.

System preventive and corrective maintenance is an integral part of the system periodic inspection and testing process. Annual inspections include inspection criteria that are consistent with identifying age-related system degradation. In addition, the plumber/pipefitters that perform the quarterly testing are trained to note, and take corrective action if any conditions are observed that indicate system degradation. The five year Fire Riser 5 Year PM (PIPE-06) maintenance procedure is performed by the same crew of maintenance personnel that perform the quarterly and annual inspections and tests. The successful identification of conditions is heavily dependent on the knowledge and experience of the plumber/pipefitters and other craftsmen that perform the procedures. During interviews and system walkthroughs, these craftsmen were able to describe in detail the inspection processes and the criteria that they look for to determine the material condition of the sprinkler system.

Each of the system quarterly, annual, and five-year preventive maintenance procedures is controlled and scheduled through the Computerized Maintenance Management System (CMMS). This system "automatically" notifies the maintenance organization of upcoming scheduled inspection, test and maintenance for Building 625. When the required inspection, test or maintenance is due, the CMMS produces the required procedure, and it is forwarded to the maintenance organization for performance. A review of completed preventive maintenance

procedures, over the past three years, indicates that all CMMS scheduled inspections, tests, and maintenance were performed.

The assessment team performed a detailed review of completed inspection, test and maintenance procedures (IE-159, IE-156 and PIPE-06) over the previous three-year period. These documents confirm that the system has been operable and has met inspection criteria over that period. Only two minor "repairs" (one adjusted packing and one loose hanger) were noted. The maintenance organization stated that if such minor items can be corrected within the time period allowed for the inspection and test, they are corrected on the spot and no other work authorization or funding is required. Based on the sample of system history reviewed by the assessment team, there was no apparent trend or documented failure that would affect operability of the system. If failures had occurred that required more extensive corrective action, they would result in additional funding and a work package to authorize the repair. If this type of activity occurs, it would be entered into the CMMS and could be used as the basis for trending failures in the sprinkler system. The fire riser five-year preventive maintenance procedure requires the replacement of major system components, whether deterioration or failure has occurred. This policy ensures that components are maintained (by replacement) within NFPA Code guidelines for maintenance.

Based on the review of the sample of completed preventive maintenance procedures, the assessment team found that the procedures were generally completed as required. There was, however, one comment in the Fire Riser 5 Year PM (PIPE-06), dated August 2001, that appeared to be unresolved and is further discussed in the Configuration Management section of this report.

The assessment team interviewed the plumber/pipefitter, operations supervisor, and the plumber/pipefitter leader that are responsible for performing system maintenance. The procedures and overall control processes for the maintenance procedures were discussed in detail. In addition, the plumber/pipefitter led a complete system walk down and procedure walkthrough for the assessment team. Each person interviewed demonstrated a thorough understanding and familiarity with the operational features, safety requirements and performance criteria for the system. Because of the large number of buildings involved in the LLNL fire suppression system maintenance program, and the relative small number of qualified personnel to perform the sprinkler system inspection, testing and maintenance, each person is required to perform the preventive maintenance procedures several hundred times each year. This experience is the cornerstone of the maintenance program.

A general walkthrough of the Building 625 fire suppression sprinkler system was conducted by the HWM System Engineer as part of the introduction of the system to the assessment team. In addition, the maintenance personnel conducted a detailed walkthrough of the system for the assessment team. The walkthroughs and discussions included the quarterly, annual and five year inspection, testing and maintenance procedures, and a demonstration of the activities that are accomplished during periodic testing, inspection and maintenance.

Based on these walk downs, the assessment team did not observe any deficiencies that were already identified and addressed in facility condition assessment or deficiency tracking systems. There were two conditions of concern observed by the assessment team in the maintenance area. One condition is documented in the comments of Fire Riser 5 Year PM performed in August 2001 (described above in this section). The comment stated that the F.D.C. piping needs to be

earthquake braced. This condition has been discussed in detail with the System Engineer. The other condition that was observed involves the staging of spare sprinkler in the facility premises. During the walk down of the system, it was observed that the spare sprinklers stored in the facility did not appear to match the sprinklers installed in the system. The installed sprinklers were observed to be upright 212-degree type throughout the building and exterior, except in the tent area where a pendant type sprinkler is installed. The sprinkler heads staged in the storage box on the wall of the facility were of temperature ratings 212 and 165, and none appeared to be pendant type sprinklers. The ES&H Team 4 Fire Protection Engineer commented during a system and facility walk down that this supply of sprinklers is not relied on to replace sprinklers and that the real supply is kept in either the central stores, or carried on the fire trucks. Although this condition does not directly affect operability of the system, this condition does not appear to be consistent with the maintenance guidance of the NFPA 25, section 2-4.1. In addition, the practice of staging sprinklers that are not the same as the installed sprinklers presents the potential for replacement with the incorrect type or rating if these spares are ever used. After the assessment was completed, the assessment team was informed that the condition had been addressed. However, due to lack of time, the team was unable to verify that appropriate head types and temperature ratings were now staged as stated by the Facility Engineer.

Conclusion:
The criterion was met.

Operability Issues/Concerns:
None.

Opportunities for Improvements:
The policy for staging spare sprinklers in the premises should be reviewed against the requirements of the NFPA 25, Section 2-4.1. It is recommended that sprinklers that are stored in the facility match only the type and rating of the installed sprinklers, and that other types be removed to prevent inadvertent installation of the incorrect type. After the assessment was completed, the assessment team was informed that the condition had been addressed. However, due to lack of time, the team was unable to verify that appropriate head types and temperature ratings were now staged as stated by the Facility Engineer.

Good Practices:
None noted.

CRITERION 2:
The B625 fire sprinkler system is periodically walked down in accordance with maintenance requirements to assess its material condition.

RESULTS

Evaluation:
Maintenance of the Building 625 fire sprinkler system for the purpose of this report is encompassed in the overall inspection, test and maintenance program described in Criterion 1 above. Specific components of the system are inspected and tested during the performance of the monthly and quarterly inspection and preventive maintenance procedures. Any noted deterioration or defects require corrective maintenance if it is identified. All system components

are walked down and inspected, including identifying signs and freeze protection insulation, as part of the annual wet sprinkler preventive maintenance procedure.

During the performance of the Fire Riser 5 Year Preventive Maintenance procedure, the system is walked down and the prescribed preventive maintenance is performed. This includes internal inspection of specified components and verification that all components perform properly. Gauges are changed out and all valves are lubricated. Assessment team walk downs did not reveal any evidence of poor or degraded conditions that would require any additional maintenance. Systems appeared in generally good condition. Interviews with personnel that perform periodic maintenance and reviews of completed inspection test and maintenance documents verified that periodic walk downs and maintenance is performed as scheduled.

Conclusion:
The criterion was met.

Operability Issues/Concerns:
None

Opportunities for Improvements:
None noted.

Good Practices:
None noted.

APPENDIX B

Documents and Records Reviewed

1. Letter, 7/29/98, LLNL (L.L. Cleland) to DOE/OAK (J.T. Davis), Subject: *Positive Unreviewed Safety Question – Request for one-time variance from our Technical Safety Requirement limit of 120 grams of fissile material per waste drum.*
2. Letter, 10/19/98, LLNL (L.L. Cleland) to DOE/OAK (J.T. Davis), Subject: *Changes to the Technical Safety Requirements Report for Hazardous Waste Management Facilities (USQ-HWM-98-012)*
3. Letter, 11/2/98, DOE/OAK (J.T. Davis) to LLNL (L.L. Cleland), Subject: *Modified Approval for Unreviewed Safety Question (USQ) 98-012, Changes to Criticality Safety Technical Safety Requirements (TSRs)*
4. Letter, 11/2/98, DOE/OAK (J.T. Davis) to LLNL (L.L. Cleland), Subject: *Modified Approval for Unreviewed Safety Question (USQ) 98-004, Changes to Aqueous Waste Handling Technical Safety Requirements (TSRs)* [4/24/98 letter, LLNL (C. van Warmerdam) to DOE/OAK]
5. Letter, 1/25/99, DOE/OAK (J.T. Davis) to LLNL (L.L. Cleland), Subject: *Approval of Unreviewed Safety Question (USQ) for Disposition of Assayed Drums at Area 612 (USQ-HWM-98-011)*
6. Letter, 3/6/00, DOE/OAK (Mike Brown) to LLNL (K.V. Gilbert), Subject: *Oakland Information Management System (OIMS) Surveillance Report, FR-2000-KW-0008, of the Fire Protection Program*
7. Letter, 3/21/00, LLNL (L.L. Cleland) to DOE/OAK (J.T. Davis), Subject: *Hazardous Waste Management FSAR Comments,* Reference: *Letter from James T. Davis to L. Lynn Cleland dated February 16, 2000*
8. Letter, 7/27/00, DOE/OAK (J.T. Davis) to LLNL (L.L. Cleland), Subject: *Hazardous Waste Management (HWM) USQDs (HWM-00-002 and HWM-00-007) Related to Operations at the Gasoline Filling Station Located Adjacent to Area 612*
9. Letter, 9/12/00, DOE/OAK (J.T. Davis) to LLNL (L.L. Cleland), Subject: Approval of *Hazardous Waste Management (HWM) Facilities Safety Analysis Report (SAR) and Technical Safety Requirements (TSR) Updates*
10. *Hazardous Waste Management Facilities Final Safety Analysis Report*, UCRL-CR-113523 Rev. 2, May 2000
11. Hazardous Waste Management Technical Safety Requirements for Area 514, Area 612, and Building 693 Facilities, UCRL-AR-125167 Rev. 1, May 2000
12. *Safety Evaluation Report*, DOE OAK, September 2000
13. Letter, 9/26/00, LLNL (L.L. Cleland) to DOE/OAK (J.T. Davis), Subject: *Dismantlement of U622 Propane Plant Tanks*
14. Letter, 10/12/00, LLNL (L.L. Cleland) to DOE/OAK (J.T. Davis), Subject: *Submittal of Documents in Response to DOE's Safety Evaluation Report (SER)*
15. Letter, 12/21/00, DOE/OAK (J.T. Davis) to LLNL (L.L. Cleland), Subject: *Acceptance of the Hazardous Waste Management (HWM) Facility Technical Safety Requirement Implementation Plan (TSR-IP) and Removal of Interim Controls associated with the Dismantled Propane Plant Tanks*
16. Letter, 12/29/00, LLNL (L.L. Cleland) to DOE/OAK (J.T. Davis), Subject: *Schedule extension request for submittal of the Technical Safety Requirements – Implementation Plan (TSR-IP)*

17. Letter, 1/10/01, DOE/OAK (J.T. Davis) to LLNL (L.L. Cleland), Subject: *Approval of Extension Request for the Hazardous Waste Management (HWM) Technical Safety Requirements – Implementation Plan (TSR-IP)*
18. DOE Memorandum, 2/20/01, *Establishment of System Engineer Programs under Implementation Plan for Defense Nuclear Facilities Safety Board (Board) Recommendation 2000-2, Configuration Management, Vital Safety Systems*
19. Letter, 2/21/01, LLNL (L.L. Cleland) to DOE (J.T. Davis), Subject: *Technical Safety Requirement Implementation Report (UCRL-AR-142238)*
20. Letter, 3/2/01, DOE/OAK (C. Y. Hoo) to LLNL (L.L. Cleland), Subject: *Approval of Additional Time to Prepare Evaluation Basis Accidents and Fire Hazards Analyses for the Hazardous Waste Management (HWM) Technical Safety Requirements Implementation Plan (TSR-IP)*
21. Letter, 3/30/01, LLNL (L.L. Cleland) to DOE/OAK (J.T. Davis), Subject: *HWM Evaluation Basis Accident and Fire Hazards Analysis*
22. Letter, 4/04/01, DOE/OAK (C. Y. Hoo) to LLNL (L.L. Cleland), Subject: *LLNL's February 21 Interim Deliverable for the Hazardous Waste Management (HWM) Facilities Technical Safety Requirement Implementation Plan (TSR-IP)*
23. Letter, 5/03/01, DOE/OAK (J.T. Davis) to LLNL (L.L. Cleland), Subject: *Lawrence Livermore National Laboratory's (LLNL) Final Deliverable for the Hazardous Waste Management (HWM) Facilities Technical Safety Requirements Implementation Plan (TSR-IP)*
24. Letter, 5/11/01, DOE/OAK (J.T. Davis) to LLNL (L.L. Cleland), Subject: *LLNL's March 30 Interim Deliverable for the Hazardous Waste Management (HWM) Facilities Technical Safety Requirements Implementation Plan (TSR-IP)*
25. Letter, 7/30/01, DOE/OAK (J.T. Davis) to LLNL (D.K. Fisher), Subject: *Approval of 20 Pu-equivalent Curies per Drum TSR Change Request*
26. Letter, 1/25/02, LLNL (D.K. Fisher) to DOE/OAK (J.T. Davis), Subject: *Resubmission of the Fire Accident Analysis/Parametric Study for the HWM Facilities*
27. Letter, 3/15/02, LLNL (D.K. Fisher) to DOE/OAK (C.Y. Hoo) Subject: *Resubmission of the TSR-IP Focused Hazards Evaluation including resolution of DOE comments*
28. Letter, 4/05/02, DOE/OAK (C.Y. Hoo) to LLNL (D.K. Fisher), Subject: *Acceptance of the Fire Accident Analysis/Parametric Study*
29. Technical Safety Requirement Implementation Plan Resolution Report, 2/13/01
30. Fire Hazards Analysis Building 625, September 14, 2001
31. Fire Protection Discipline Action Plan (DAP) for Buildings assigned to the H&S Technician supporting 612 Complex, ES&H Team 4, March 2002
32. Fire Accident Analysis/Parametric Study (Evaluation Basis Accident), UCRL-AR-143310, March 23, 2001
33. Fire Accident Analysis/Parametric Study for the HWM Facilities, FCS-02-005, January 2002
34. ES&H Manual Document 2.2, *Managing ES&H for LLNL Work*, April 1, 2001
35. ES&H Manual Document 22.5, *Fire*, January 9, 2002
36. ES&H Manual Document 3.1, *Safety Analysis Program*, April 1, 2001
37. ES&H Manual Document 3.3, *Operational and Facility Safety Plans*, April 1, 2001
38. ES&H Manual Document 51.3, *Unreviewed Safety Question Process*, April 1, 2001
39. Facility Safety Plan, FSP-612, *Radioactive, Hazardous, and Mixed Waste Treatment and Storage Facility*, April 30, 2002
40. *Fire Protection Program Manual*, UCRL-MA 116646, Rev. 7, February 2001
41. *HWM Facilities Final Safety Analysis Report*, UCRL-CR-113523, Rev. 2, May 2000

42. HWM procedure, ADM-101, *HWM Procedure Development and Revision*, Rev. 2, August 7, 2001
43. HWM procedure, ADM-103 (old # AP 166), *HWM Document Control Process*, Rev. 2, January 13, 2000
44. HWM procedure, ADM-108 (old # AP 160), *TSR Implementation Plan*, Rev. 1, January 25, 2000
45. HWM procedure, ADM-117 (old # AP 117), *Design and Engineering Control*, Rev. 2, January 18, 2000
46. HWM procedure, ADM-126, *HWM Initiation and Tracking of USQs*, Rev. 1, April 2, 2001
47. HWM QA Implementation Matrix, Memo # FS&C01-066, October 19, 2001
48. *HWM Quality Assurance Plan*, Rev. 6, December 30, 1998
49. HWM Vital Safety System (VSS) Reading Assignment, *B625 Fire Suppression System (Includes 625 Tent Sprinklers)*, EP5040-005, Rev. 0, March 12, 2002
50. HWM Vital Safety System (VSS) Reading Assignment, *Qualification Requirements for System Engineers at LLNL Nuclear Facilities*, EP5040, Rev. 0, March 12, 2002
51. IWS 530.01, *SD00-019 Visual Verification & Repackaging LLW Drums*
52. NFPA 13-1980, *Standard for the Installation of Sprinkler Systems*, 1980 edition
53. PLM2002-625-001D, *B625 Hazardous Waste Storage*, draft
54. PLM2002-625-002D, *B625 Hazardous Waste Storage – Tent Area*, draft
55. Preventative Maintenance Task PIPE-06, *Fire Riser 5 year PM*, performed August 16, 2001 on PMI Equip. No. 625MFR01-1
56. USQ Worksheet Form HWM-01-001, *HWM FSAR Facilities Sprinkler System Maintenance*, January 16, 2001
57. Robert Solomon, "Automatic Sprinkler Systems Handbook," 5th Edition, National Fire Protection Association, October 1991.
58. "CMR Basis for Interim Operations," Los Alamos National Laboratories, July 1999.
59. John Lambright, "Evaluation of CMR Building Sprinkler System Performance," Lambright Technical Associates, July 2000.
60. "CFAST User's Manual," National Institute of Standards and Technology.
61. "Fire Protection Engineering Handbook," National Fire Protection Association.
62. LLNL Maintenance Implementation Plan (MIP), Appendix B.5, HWM Complex Maintenance Implementation Plan
63. EMD procedure, #1500, *Fire Protection Testing and Inspection Program*, Revised 4/30/98
64. Preventative Maintenance Task IE-159, *Wet Sprinkler Quarterly PM*, performed October 2001, April 2001, January 2001, September 2000, April 2000, January 2000, September 1999, April 1999
65. Preventative Maintenance Task IE-156, Wet Sprinkler Annual PM, performed July 2001, July 2000, June 1999
66. NFPA 25-1998, *Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems*
67. Integration Work Sheet 13.02, Plumbing/Pipe Fitting/Welding, expires September 2002
68. Contract No. W-7405-ENG-48 Appendix G: Directive List DOE O 420.1: *Facility Safety*