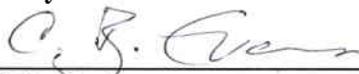


**Capability Replacement Laboratory
Project Plan**

**325 Building Life Extension Safety Design Strategy
CRL-PLAN-ESH-001, Revision 1
Effective Date: May 2007**

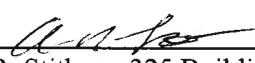
Submitted by:



C. B. Evans

5/8/07
Date

Reviewed by:



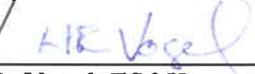
A. R. Stithem, 325 Building Safety Basis Engineer

5/8/07
Date



J. L. Smith, Project Quality Officer

5/9/07
Date



H. R. Vogel, ES&H

5/9/07
Date



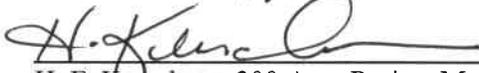
F. G. Buck, 325 Building Manager

5.9.07
Date



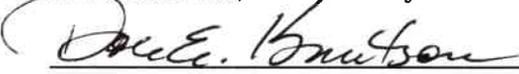
L. O. Casazza, Nuclear Operations Division Director

5/10/07
Date



H. F. Kerschner, 300 Area Project Manager

5-09-07
Date



D. E. Knutson, Deputy Project Director

5-9-07
Date

Approved by:



J. K. McClusky, Project Director

5/10/07
Date

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Change History

Revision Number	Description of Change
0	Initial Issue
1	Revised to incorporate DOE comments; added criteria for major modification determination; updated to reflect results of 325 Building Safety System Assessment, NPH evaluation, and minor editorial changes.

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1.0 Introduction

The Capability Replacement Laboratory (CRL) Project consolidates mission-critical technical capabilities currently housed in multiple buildings throughout the Hanford 300 Area. The CRL will retain and extend the operational life of four 300-Area buildings to house some of the mission-critical capabilities and reduce the footprint of new construction on the PNNL Site.

One of the 300-Area facilities retained is the 325 Building. The 325 Building is a hazard category 2 (HC-2) nuclear facility currently operating under a DOE-EM approved safety basis, which will maintain five mission-critical capabilities:

- Shielded Operations
- Radiation detection
- Materials Science and Technology
- Chemistry and Processing
- Subsurface Science

To provide for these long-term capabilities (nominally 20 years), physical upgrades are planned that promote operational flexibility and the life extension of the 325 Building. These include removal of several fume hoods, addition of several small, modular hot cells and gloveboxes, roof repair, improved personnel access, and new Personnel Contamination Monitors.

In support of 325 Building life extension are activities that evaluate 325 Building structures, systems, and components (SSC) and administrative programs important to safe operation. These activities include evaluation of recent applicable DOE direction and guidance for new projects and long-term operational facilities, and implementation of Defense Nuclear Facility Safety Board (DNFSB) recommendations.

In addition, the development of the current 325 Building documented safety analysis (DSA) did not anticipate long-term operation of 325 Building and requires upgrade to meet current DOE expectations. The CRL Project is developing a Safety Design Strategy (SDS) that provides the plan for meeting these expectations. Development and approval of the SDS will be coordinated with the DOE Safety Basis Approval Authority.

2.0 Purpose of 325 Building Safety Design Strategy

The SDS reflects an initiative within the draft DOE-STD-1189, *Integration of Safety into the Design Process*, to establish the strategy and approach to safety basis development during the design of a project. There is no plan to implement DOE-STD-1189 elements for the CRL Project except as provided by this SDS.

The 325 Building Life Extension SDS establishes the basis and process for integrating safety basis considerations into the 325 Building life extension aspect of the CRL project. This includes safety basis activities associated with establishing an appropriate 325 Building extended life safety basis, facilitating the transition to DOE-SC nuclear safety regulation of the 325 Building, and performing any necessary upgrades to 325 Building structures, systems, and components (SSCs)

This involves understanding the hazards, nuclear safety requirements, and DOE expectations associated with the extended 325 Building mission in order to preclude or minimize potential safety and project impacts early in the design process. Because much of this effort is driven by nuclear safety requirements and associated DOE expectations, determining the regulatory drivers is among the initial efforts.

To achieve this purpose, the 325 Building SDS must ensure the following activities are performed:

1. Determine the safety basis-related regulatory and contractual requirements for the project and formal guidance associated with these requirements
2. Incorporate the expectations of DOE safety basis review and approval authorities associated with extending the 325 Building mission and transferring regulatory authority to DOE-SC
3. Perform a comparison of the existing 325 Building safety basis against contemporary requirements and guidance (CRL-TECH-ESH-003, *DOE Requirement Review – RPL Extended Mission*)
4. Update criteria for classifying 325 Building SSCs
5. Update the 325 Building hazard analysis based on extended mission operations
6. Evaluate the need to upgrade the 325 Building design and safety basis documentation with respect to
 - A natural phenomena hazard assessment conducted in accordance with DOE O 420.1 and associated guidance
 - An assessment of 325 Building ventilation systems consistent with DOE technical evaluation guidelines established in response to DNFSB 2004-2, Active Confinement Ventilation
 - An assessment of 325 Building safety systems with respect to the 325 Building extended mission
 - Other conditions as determined by safety analysis

Activities within the scope of the CRL Project are executed and managed using the CRL integrated project schedule.

3.0 Regulatory Requirements And Defense Nuclear Facility Safety Board Recommendations

3.1 Title 10 Code of Federal Regulations, Part 830 (10 CFR 830), *Nuclear Safety Management*

Section 830.206 of 10 CFR 830 requires a preliminary documented safety analysis (PDSA) to support a “major modification” to a HC-1, 2, or 3 nuclear facility. A major modification is defined as one that “substantially changes the existing safety basis for the facility.” The current assumption is that the 325 Building life extension upgrades do not represent a substantial change to the safety basis that requires development of a PDSA, and therefore does not represent a major modification. The criteria for establishing the existence of a major modification and thus the need for a PDSA are provided in Appendix A.

The upgraded DSA will meet the safe harbor methodology of 10 CFR 830, Subpart B, *Safety Basis Requirements*, for a Hazard Category 2 nuclear facility.

3.2 DOE O 420.1B, Facility Safety

DOE O 420.1B design criteria are applicable to design and construction of new facilities or major modifications of existing HC-1, 2, or 3 nuclear facilities. They are not applicable to the 325 Building, since 325 Building is not undertaking a major modification.

CRL-TECH-ESH-003 identified other elements of DOE O 420.1B, including requirements for fire protection, criticality safety, and natural phenomena which will be addressed during development of the upgraded DSA.

Also, the Order contains a provision for an assessment of natural phenomena hazards every 10 years. The required evaluation of the facility is documented in CRL-INC-07-0014, *Seismic and Wind Evaluation of Building 325 at Pacific Northwest National Laboratory*, and the evaluation results and recommendations for providing seismic upgrades to the facility are included in the project baseline.

3.3 Safety System Assessment

The CRL Project has planned to conduct assessments of 325 Building safety systems in support of operational life extension. The first of these, based on the Phase I Criteria Review Approach Document (CRAD) developed to implement DNFSB Recommendation 2000-2, *Configuration Management, Vital Safety Systems* (see Attachment 1) was completed (CRL-INC-07-007, *325 Building Safety System Assessment*). The results of this Phase I assessment indicate that a followup Phase II assessment is not necessary. Attachment 1 includes the Phase II CRADs, which would be tailored to the area(s) of concern resulting from Phase I if required. The assessments will be performed in two parts:

Part 1 – assess the 325 Building safety systems as documented by the existing DSA. This assessment was performed during CY 2007 by CRL project and 325 Building staff.

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Part 2 – assess any additional safety systems identified by the safety analysis for the upgraded 325 Building DSA. These assessments will be scheduled by the CRL Project working with 325 Building management. Preliminary results of the Scoping Hazard Analysis indicate no additional active safety systems are required for 325 Building extended life.

The Pacific Northwest Site Office (PNSO) participated in the Phase I safety system assessment and is anticipated to participate in overseeing any further 325 Building safety system assessments, which will be documented in accordance with existing PNNL procedures.

3.4 Defense Nuclear Facility Safety Board (DNFSB) Recommendation 2004-2, Active Confinement Systems

This Recommendation involves the desire of the DNFSB that safety-related confinement ventilation systems (CVS) provide and maintain active confinement of hazardous particulate material in the event of an accident that could otherwise lead to the uncontrolled release of this material (e.g., fires, explosions, spills). The assertion of DNFSB 2004-2 is that passive confinement, whereby only an unfiltered leak path factor is relied on to confine hazardous material throughout accident conditions, is not an appropriate confinement strategy for safety-related CVS.

Under the DOE Implementation Plan (IP) for DNSFB 2004-2 the 325 Building ventilation system was identified as non-safety related, requiring follow-up evaluation under IP commitment 8.8. The implementation of DNFSB 2004-2 assigned a low priority to the 325 Building due to its short operational life prior to the life extension planning. Because of the life extension activities, the PNSO formally directed implementation of DNFSB 2004-2 (PNSO 2007). This evaluation is currently scheduled to be completed during May of 2007.

Any actions resulting from the results of the assessments described in Sections 3.2, 3.3, and 3.4 above will be reflected in an update of this SDS and managed under the CRL integrated project schedule.

4.0 Safety Basis Upgrade

4.1 Comparison of Existing 325 Building Safety Basis to Current Standards

The 325 Building DSA consists of 10 Chapters, two of which are reference and glossary sections. The DSA format and content are historical, following the approach taken by the safety analysis report preceding it. Appendix A of the 325 Building DSA provides the basis for following this graded approach and includes a crosswalk between the existing DSA and 1) the provisions of 10 CFR 830, Subpart B, *Safety Basis Requirements*, and 2) the format and content guide of DOE-STD-3009-94, *Preparation Guide for U. S. Department of Energy Nonreactor Nuclear Facility Documented Safety Analyses*. The crosswalk shows that the DSA is compliant with 10 CFR 830 and that the major provisions of 3009 are addressed. The DOE safety evaluation report has approved the document as a compliant DOE-STD-3009 DSA.

The upgraded DSA will conform to the standard 17-chapter format and content (F&C) of DOE-STD-3009. This includes supplementing Chapter 4 with functional requirements, performance criteria, and system evaluation details currently residing in System Design Description (SDD) documents, and adding in a more detailed description of the safety management programs implemented at the facility.

Supplementing this F&C change is the implementation of DOE-STD-1186, *Specific Administrative Controls*, which provides for a distinct type of technical safety requirement (TSR), and Change Notice 3 of DOE-STD-3009, which supports this new Standard.

A “scoping hazards analysis” is being performed to provide insight into the type of hazardous conditions, potential accidents, and candidate hazard controls required for the mission scope. It applies proposed Control Selection Process and Criteria (Appendix B) that reduces the subjectivity of DOE-STD-3009 provisions for safety classification.

The upgraded DSA will be an essentially new document with potentially greater emphasis on facility worker safety, based on draft results of the scoping hazards analysis. Therefore, the necessary actions to close differences between the existing safety basis and current safety basis expectations consist of the following:

1. Update the 325 Building unmitigated hazard and accident analysis.
2. Apply control selection criteria of Attachment 2.
3. Revise the DSA and TSR documents to incorporate the 17-chapter F&C of DOE-STD-3009, including application of DOE-STD-1186, incorporation of selected SDD information and safety management program descriptions.

It is possible, but not anticipated, that the safety development process will identify additional needed safety SSCs. If that occurs, then the project will determine the adequacy of the identified SSCs to perform their required safety function for the extended mission. Development of the upgraded DSA will also incorporate the results of a review of new DOE safety basis related requirements (i.e. requirement

issued or reissued after development activities of the current RPL DSA began) which are documented in CRL-TECH-ESH-003.

4.2 Implementation Approach of Upgraded Safety Basis

The upgraded safety basis documentation will be prepared in parallel with maintaining the existing 325 Building safety basis documentation. The existing safety basis will be maintained in accordance with PNNL procedures, including annual updates and performance of the unreviewed safety question process. The existing 325 Building safety basis maintenance processes will support the planned facility upgrades and transition to the upgraded safety basis without interruption of operations.

It is anticipated that regulatory authority for the 325 Building is transferred to DOE-SC following approval of the 2007 annual update. Following the 2007 annual update, the next update of the safety basis will be the upgraded DSA and TSR documents submitted for review and approval in December 2008. An evaluation of readiness is planned to verify a successful transition to the upgraded 325 Building safety basis.

5.0 Activities

- Complete 325 Building SDS (subject to update)
- Complete 325 Building Natural Phenomena Hazards Assessment
- Finalize 325 Building scoping hazard analysis
- Perform 325 Building Phase I Safety System Assessment
- Perform 325 Building Phase II Safety System Assessment (if required)
- Perform evaluation of 325 Building CVS based on DNFSB 2004-2 (may be combined with Phase II assessment if applicable)
- Complete Major Modification evaluation of 325 Building upgrades
- Develop upgraded 325 Building DSA and TSR documents in parallel with maintaining the existing safety basis documentation
- Implement 325 Building facility upgrades
- Submit upgraded 325 Building DSA and TSR to DOE-SC approval authority for review and approval
- Conduct readiness review/implementation of new 325 Building safety basis

Identification of detailed project deliverables are provided by the project schedule

6.0 References

1. 10 CFR 830, Nuclear Safety Management
2. CRL-INC-07-0007, 325 Building Safety System Assessment
3. CRL-INC-07-0014, Seismic and Wind Evaluation of Building 325 at Pacific Northwest National Laboratory
4. CRL-TECH-ESH-003, DOE Requirement Review – RPL Extended Mission
5. DNFSB Recommendation 2000-2, Configuration Management, Vital Safety Systems (VSS)
6. DNFSB Recommendation 2004-2, Active Confinement Systems
7. DOE O 420.1B, Facility Safety
8. DOE-STD-1186-2005, Specific Administrative Controls
9. DOE-STD-1189, Integration of Safety into the Design Process (Draft), 3/31/07
10. DOE-STD-3009-94, Preparation Guide for U. S. Department of Energy Nonreactor Nuclear Facility Documented Safety Analyses, Change Notice 3
11. PNSO 2007, Letter 07-MGR-0056, Julie K. Erickson, PNSO, to Michael Kluse, PNNL, 325 Building Defense Nuclear Facilities Safety Board Recommendation 2004-2 Assessment, dated March 21, 2007

Appendix A – Criteria for Determination of Major Modification

There are no universal criteria for determining when a facility modification should be considered to be a “major modification.” The definition of a major modification is provided by 10 CFR 830 (the Rule), Section 830.3 as the following:

“Major modification means a modification to a DOE nuclear facility that is completed on or after April 9, 2001 that substantially changes the existing safety basis for the facility.”

A major modification requires an accompanying PDSA to support it. Per Section 830.206 of the Rule,

“...the contractor responsible for a hazard category 1, 2, or 3 new DOE nuclear facility or a major modification to a hazard category 1, 2, or 3 DOE nuclear facility must:

(a) Prepare a preliminary documented safety analysis for the facility, and

(b) Obtain DOE approval of:

(1) The nuclear safety design criteria to be used in preparing the preliminary documented safety analysis unless the contractor uses the design criteria in DOE Order 420.1, Facility Safety; and

(2) The preliminary documented safety analysis before the contractor can procure materials or components or begin construction...”

Therefore, the explicit requirement for a PDSA is to document the nuclear safety design criteria to be used for the facility modification and to obtain DOE approval prior to procurement or construction. As provided by Appendix A of 10 CFR 830, Subpart B,

“A preliminary documented safety analysis can ensure that substantial costs and time are not wasted in constructing a nuclear facility that will not be acceptable to DOE. ... As a general matter, DOE does not expect preliminary documented safety analyses to be needed for activities that do not involve significant construction such as environmental restoration activities, decontamination and decommissioning activities, specific nuclear explosive operations, or transition surveillance and maintenance activities.”

The draft DOE-STD-1189 includes criteria for determining the need for a PDSA and thus the existence of a major modification. It is provided as Table A-1. The Standard states:

“In applying the PDSA Evaluation Criteria in [Table A-1] the intent is that each criterion should be assessed individually and then an integrated evaluation be performed based on the collective set of individual results. In performing this evaluation, the focus should be on the nature of the modification and its associated impact on the existing facility safety basis.”

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Table A-1. Major Modification Evaluation Criteria¹

Major Modification Evaluation Criteria		
Evaluation Criterion No.	Evaluation Criteria	Clarifying Detail / Examples
1	Add a new building or facility with a material inventory \geq HC 3 limits or increase the HC of an existing facility?	A new building may be a structure within an existing facility segment. That structure may or may not have direct process ties to the remainder of the segment / process. The requirements of DOE-STD-1027-92 shall be used in evaluating Hazard Categorization impacts.
2	Change the footprint of an existing HC 1, 2 or 3 facility with the potential to adversely impact any SC or SS safety function or associated SSC?	A change in the footprint of an existing facility requires the identification and evaluation of any potential adverse impacts on SC or SS safety functions or associated SSC (e.g., structural qualification, evacuation egress path, fire suppression spray pattern) or safety analysis assumptions. Changes that may involve adverse impacts require careful attention to maintaining adherence to applicable engineering standards and nuclear safety design criteria.
3	Change an existing process or add a new process resulting in the need for a safety basis change requiring DOE approval?	A change to an existing process may negatively affect the efficacy of an approved set of safety controls for a given event or accident. Likewise potential safety concerns associated with a new process may not be adequately addressed by the existing approved control sets. In this case, it is assumed that the existing analyses addressed the hazards associated with the new or revised process, but the specified control set(s) may no longer be valid. The evaluation of any new hazards introduced by the revised or new process should be addressed via Criterion 6
4	Utilize new technology or GFE not currently in use or not previously formally reviewed / approved by DOE for the affected facility?	This assessment should include consideration of the impact that the use of new technology (including technology scale-up issues) or GFE may have on the ability to specify the applicable nuclear safety design criteria with a high degree of certainty in the early stages of the project. Additionally, refer to GFE discussion in Section 9.3. GFE may have a technical baseline that is not directly and fully supportive of the project functional and performance requirements. An example would be employing a new technology for removal of certain nuclides from a waste stream.

¹ Excerpted from DOE-STD-1189, *Integration of Safety into the Design Process*, 3/31/07 draft

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Major Modification Evaluation Criteria		
Evaluation Criterion No.	Evaluation Criteria	Clarifying Detail / Examples
5	Create the need for new or revised Safety SSCs?	Consideration should be given to the relative complexity of the controls and the ease with which the controls can be implemented. The use of a complicated multi-channel Safety Class seismically qualified instrumented system to provide multiple interlock and alarm functions would typically pose a higher risk to the project than the use of a Safety Significant passive design feature. The degree of design and regulatory uncertainty should be addressed for this criterion for the development, review, and approval of new or revised safety analysis and attendant controls (e.g., presence of multiple regulatory/technical agencies on a single project).
6	Involve a hazard not previously evaluated in the DSA?	Hazards can include the introduction of an accident or failure mode of a different type from that previously analyzed in addition to radiological or toxicological hazards. The need to address a new hazard early in the design process may lead to some degree of uncertainty related to the proper specification of applicable nuclear safety design criteria. In such cases, this uncertainty should be addressed within this evaluation.

Appendix B – Control Selection Process and Criteria

The methodology for identifying hazards and performing hazard evaluation and selecting accidents for formal accident analysis will follow that provided by DOE-STD-3009, Change Notice 3. Quantitative accident analysis methodology is based on the provisions of DOE-STD-3009, Appendix A. This Standard also provides criteria and guidance for selection of SC and SS SSC; however, the criteria provided are ambiguous.

As a result, objective criteria are proposed for classifying SC and SS SSC (see Table B-1)²:

- 1) Appendix A of DOE-STD-3009 provides an “evaluation guideline” (EG) of 25 rem total effective dose equivalent (TEDE) and a requirement that SC SSC are to be designated to prevent or mitigate accidents that result in consequences that “challenge” the EG. This is implemented as follows:
 - At 25 rem TEDE or above SC SSC are required.
 - Between 5 rem and 25 rem TEDE, the project must evaluate the need for SC SSC and determine based on technical factors (dose estimate, frequency determination, uncertainty, sensitivity, etc.) whether SC SSC is warranted and whether DID designation is desired.
 - The EG is not “challenged” below 5 rem TEDE, and SC SSC are not required.
- 2) For SS SSC designation, a threshold radiological dose of 100 rem TEDE to the collocated worker (100 m) is established.

Consideration of SS SSC based on non-radiological exposure to hazardous material is limited to material that requires an Emergency Planning Hazards Assessment in accordance with DOE O 151.1C. [325 Building contains only laboratory quantities of non-radiological hazardous material.]

- 3) Safety significant SSC or TSR-level hazard control (e.g., specific administrative controls, Design Features, etc.) are also considered for cases judged to involve significant exposure of the facility worker to radiological or other hazardous materials based on qualitatively evaluating unmitigated consequences in terms of radiation dose, chemical exposure, or physical injury.

² The radiological criteria are consistent with DOE-STD-1189, *Integration of Safety into the Design Process*, Appendix A, *Safety System Design Criteria*, 3/31/07 draft.

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Table B-1. Classification of Safety Class and Safety Significant Structures, Systems, and Components (SSC)

Population at risk	Definition	SSC Classification Criteria				Related Guidance
		Evaluation Guideline or Criteria ³ (Dose in rem, TEDE)	Engineered System Classification	Admin Control Classification (if needed)	Defense In Depth	
Offsite Public (maximally exposed individual, MOI)	Site Boundary	<ul style="list-style-type: none"> • Dose > 25: SC SSC required • 25 > Dose > 5: SC SSC considered • 5 > Dose: no SC SSC 	Safety Class	Specific Administrative Control (SAC)	SS SSC SAC	DOE-STD-1186 DOE-STD-3009 DOE O 420.1B and Guides DOE-STD-1189 (draft Appendix A, 3/31/07)
Collocated Worker	100m	<ul style="list-style-type: none"> • Dose > 100 	Safety Significant	SAC	SS SSC SAC Safety Management Programs (SMP)	DOE-STD-1186 DOE O 420.1B and Guides DOE-STD-1189 (draft)
Facility Worker	In-facility boundary or worker < 100m	<ul style="list-style-type: none"> • Prompt fatality • Serious injury • Significant exposure to hazardous material 	Safety Significant	SAC, AC, or SMP	SMP	DOE-STD-1186 DOE-STD-3009 DOE O 151.1C DOE O 420.1B and Guides DOE-STD-1189 (draft)

³ Criteria provided are specific to radiological criteria. Designation of SS SSC based on public or collocated worker exposure to non-radiological hazardous material is applicable but not anticipated based on the laboratory quantities of non-radiological hazardous material contained by 325 Building.

Attachment 1 – Phase I Criteria, Review, and Approach Document

[Adapted from <http://www.deprep.org/vss/review.asp>]

Use the Review Approach below to assess each 325 Building active safety system against the criteria provided. This assessment is intended to be conducted at the **system level**, and is only intended to consider **existing** information and processes (i.e., completion of the assessment does not require development of new or additional information). Where the requested information does not exist or is incomplete, the Review Information may be supplemented by related information, interviews and/or walkdowns. Sufficient information documenting the Review Approach should be retrievable for demonstrating the quality of the assessment and to support the conclusions reached, but do not submit the information with this form.

System:

System Classification:

System Safety Function (list):

OBJECTIVE

This safety system is operational and personnel and processes are in place that ensure its continued operational readiness.

Criteria and Discussion of Results

1. **Safety functions are defined and understood by responsible line managers, and supporting information/documentation is available and adequate. System testing is adequate to ensure operability.** (See Review Approach items 1, 2, 3 and 7)

Discussion of Results - (List information/documentation that was unavailable or inadequate. Indicate whether the criterion was met.)

2. **The backlog for surveillances, tests, inspections, maintenance, repair, upgrades, or other work on the system is managed and kept to an appropriate minimum.** (See Review Approach item 6)

Discussion of Results - (Provide a discussion indicating whether the criterion was met.)

3. **Configuration Management and Maintenance programs effectively ensure operational availability of the system.** (See Review Approach items 5, 8 and 9)

Discussion of Results - (Address the maintenance program, work control, change control, document control, and assessments of the system. Include the identification and maintenance of system requirements and their associated basis information. Indicate whether responsibility for operational readiness of this system is formally assigned.)

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4. **The system is operable and available to fulfill its safety function when required.** (See Review Approach items 4 and 10)

Discussion of Results - (Provide a discussion indicating whether the criterion was met.)

Conclusion - (Summarize the results of the review and state whether the Objective was met. Identify any systemic, recurring, or significant issues or trends which require corrective action.)

Review Approach (Sufficient information documenting the Review Approach should be retrievable for demonstrating the quality of the assessment and to support the conclusions reached, but do not submit the information with this form.)

1. Using the DOE-approved facility safety analysis (i.e., SAR, BIO, etc.), identify: a) the system safety function(s); b) the normal, abnormal, and accident conditions under which the system is intended to perform its safety function(s); and c) relevant system functional requirements and performance criteria.
2. Identify the acceptance criteria from the surveillance tests used to verify that the system is capable of accomplishing its safety function(s). Review the acceptance criteria against the function(s), conditions, requirements, and performance criteria identified in Question 1 above.
3. At what frequency are the tests identified in Question 2 above performed? Determine whether these tests and inspections are required by Technical Safety Requirements, Operational Safety Requirements (OSRs), or other Authorization Basis or Authorization Agreement requirements.
4. For each of the past three years: a) identify the number of times that the system has failed to meet its test acceptance criteria; b) identify the number of times that the system has failed in response to facility operating conditions (i.e., failed on demand); and c) estimate the percentage of time that the system was not capable of accomplishing its safety function(s) when required to be operable.
5. Identify formally scheduled activities, in addition to those addressed in item 2 above, that are intended to help ensure reliable performance of the system. Include preventive maintenance, walkdowns, inspections, and assessments as appropriate.
6. Identify the current backlog for the system for items such as preventive maintenance, corrective maintenance, modifications, surveillances, tests, inspections, and corrective actions.
7. Are drawings that document the system configuration available? If so, identify the types of drawings (e.g., piping and instrumentation diagrams, electrical one-line, wiring, or schematic diagrams, installation drawings).
8. Review the application of processes used to ensure that work on the system and changes to the system are properly controlled (i.e., formally reviewed, approved, implemented, tested, USQ review performed if required, documents updated, and work/change accepted).

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9. Determine whether the procedures identified in items 2 and 5 above, and the drawings identified in item 7 above, are controlled under a formal document control process, and indicate whether the process requires that documents be updated as necessary to maintain their accuracy.

10. Identify any systems and equipment (e.g., electric power, instrument or control air, diesel fuel transfer, vacuum, heat tracing, etc.) that directly support the operation of the vital safety system being assessed (i.e., where the support systems/equipment are essential for the safety system to perform its safety functions) that are not included within the defined system boundary.

Attachment 2 – Phase II Criteria, Review, and Approach Document

[adapted from VSS Phase II Assessment Reports at <http://www.deprep.org/vss/review.asp>]

The objectives for Phase II assessments are as follows:

- Obtain the appropriate information where necessary to fully understand and characterize safety system operability/reliability issues, problems, or concerns identified during the Phase I assessments,
- Determine the associated causes, and
- Determine corrective measures for restoring safety system operability/reliability to acceptable levels and ensuring these levels are maintained on a continuing basis.

Criteria for Initiating Phase 2 Assessments

Phase II assessments will be conducted where the Phase I results indicate a problem exists that appears significant on a site level, facility level, system level (either generic, or site or facility specific), or operability/reliability attribute level, and where the appropriate facility, laboratory, and DOE managers agree that there is sufficient potential safety benefit (i.e., “value added”) to be gained from performing the assessment.

A significant problem is indicated when it is clear to responsible management that a safety system operability/reliability problem exists, *and* the extent of the problem is unclear or unknown. The Phase II assessments in these cases would be expected to clearly define and describe the extent of the problem, identify the causes, and determine the corrective actions required for resolution to restore confidence in safety system operability/reliability.

The following prerequisites should be met as a minimum before specific sites, facilities, systems, and/or operability/reliability attributes are considered as potential candidates for Phase II assessments:

- the safety system(s) involved must be classified as either Safety Class or Safety Significant
- a significant problem, issue, or concern that brings into question the operability/reliability of a safety system is determined to exist,
- the extent of the problem, issue, or concern is unclear or unknown and can not be resolved through simple corrective actions, and
- the appropriate facility, laboratory, and DOE managers agree that a Phase II assessment has value added and should be performed.

The Phase II assessments should be graded to focus on those areas requiring clarification, understanding, and corrective action, and to avoid unnecessary repeat of Phase I assessment or other efforts.

Criteria and Approach for Phase II Assessments

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The *Criteria and Approach* is divided into topical areas: (1) safety function definition, (2) configuration management, (3) system maintenance, and (4) system surveillance and testing. Each of these topical areas includes the following:

- *Objective* describes the intent that the topical area should contribute to assessment of the safety system
- *Criteria* suggest characteristics of a safety system that should be verified
- *Approach* suggests collection of information needed to assess the condition of the safety system according to the criteria. The items in the *Approach* section are to guide the assessment team; however, the assessment team may choose to select another approach to meet assessment-specific needs.

For each topical area, the criteria and approach items are numbered for later reference. The items under the *Approach* subsection are numbered such that the items can be readily linked back to the most applicable criterion (e.g., item number 2-1 under the Approach is most directly linked to Criterion 2). However, the evaluation of each criterion should consider all relevant information collected during the assessment (not only information related to the linked items).

The 2000-2 Phase I assessment or other reviews of the safety system being assessed may satisfy some of the objectives and criteria that follow. Previous reviews may also contain information relevant to this assessment, which can be cited and used in this assessment. In such situations, this assessment should be limited to objectives and criteria not covered in previous assessments and should not unnecessarily duplicate previous assessments.

Safety Function Definition

Objective:

Safety basis-related technical, functional, and performance requirements for the safety system are identified/defined in appropriate safety documents.

Criteria:

Safety basis documents identify and describe 1) the safety system safety functions and the safety functions of any essential supporting systems, and 2) the system requirements and performance criteria that the safety system must meet to accomplish its safety functions.

Approach:

Review the appropriate safety basis documents, such as the documented safety analysis, technical safety requirements, safety evaluation reports, and hazards and accident analyses, to determine if the definition/description of the safety system safety functions includes:

- The specific role of the system in detecting, preventing, or mitigating analyzed events
- The associated conditions and assumptions concerning system performance
- Requirements and performance criteria for the system and its active components, including essential supporting systems, for normal, abnormal, and accident conditions relied upon in the hazard or accident analysis.

Configuration Management

Objective:

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

Criteria:

1. Changes to safety 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. Limited 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 system safety basis requirements, documents, and installed components conform to the approved safety basis (safety envelope) for the facility, and the appropriate change approval authority is determined using the Unreviewed Safety Question (USQ) process.
4. Facility procedures ensure that changes to the system safety basis requirements, documents, and installed components are adequately integrated and coordinated with those organizations affected by the change.

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5. Software used in safety system instrumentation and control (I&C) components that perform functions important to safety is subject to a software quality process consistent with 10 CFR 830, Subpart A, *Quality Assurance Requirements*.

Approach:

- 1-1 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:
- SSCs and documents affected by the change are identified
 - Changes are accurately described, reviewed and approved as appropriate
 - Installation instructions, post-modification testing instructions and acceptance criteria for turnover to facility operations are specified, and
 - Important documents affected by the change (e.g., operating and test procedures, Master Equipment List, etc.) are revised in a timely manner.
- 1-2 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.
- 2-1 Walkdown selected safety system components and compare the actual physical configuration of these components to system documents such as design basis and safety/authorization basis documents, system design descriptions, and system drawings such as piping and instrumentation diagrams. Identify any temporary changes, or configuration discrepancies that call into question (1) the operability or reliability of the system or (2) the adequacy of the change control or document control processes, including drawing revision, applied to the system.
- 3-1 Review documentation, such as change travelers and changes packages, and interview individuals responsible for processing selected changes made to the system requirements, installed equipment, and associated documents. Determine whether:
- 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
 - The USQ process (i.e., USQ screens and USQ safety evaluations/ determinations) is being appropriately used
- 4-1 Determine whether engineering (including the design authority and technical disciplines for process control, electrical, mechanical, chemical, HVAC, nuclear, criticality, structural, etc.), operations, and maintenance organizations are made aware of safety 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.
- 5-1 For software used by safety system I&C components, request the facility staff to identify:
- The applicable software quality assurance requirements,

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- The software quality assurance standards/controls applied to software development, procurement, acceptance, and testing
 - The basis for acceptance of these standards/controls as providing adequate assurance that the software is acceptable for performing its associated safety functions
- 5-2 Review software quality assurance requirements, procedures, and records. Determine whether:
- Software quality assurance documentation exists for software in use
 - Configuration management procedures exist for updates, changes, and version control of software and related documentation such as software design documents and a list of software configuration items installed on computer-based components
 - An appropriate degree of independence exists between those responsible for software development and quality assurance functions
 - A process is in place and used to identify, evaluate, and resolve operational problems that are attributable to software
- 5-3 Interview facility engineering and operations staff to determine their awareness of software quality assurance requirements for system software under their cognizance.

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System Maintenance

Objective:

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

Criteria:

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

Approach:

- 1-1 Verify that maintenance for the safety system satisfies system requirements and performance criteria in safety basis documents or other local maintenance requirements.
[NOTE] The following approach statements 1-2 and 1-3 need to be reviewed only once for common site or facility-specific implementation of maintenance management processes or programs.
- 1-2 Evaluate maintenance of aging safety 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
- 1-3 Determine whether maintenance source documents such as vendor manuals, industry standards, DOE Orders, and other requirements are used as technical bases for development of system maintenance work packages.
- 2-1 Verify that the system is inspected periodically according to maintenance requirements.
- 2-2 On a sample basis, perform a walkdown inspection of the system with emphasis on the material condition of installed equipment, components, and operating conditions. Identify and document any observed conditions that could challenge the ability of the safety system to perform its safety function (e.g., leaks, cracks, deterioration, or other degraded or abnormal conditions). Determine whether observed deficiencies have been identified and addressed in a facility condition assessment or deficiency tracking system.
- 2-3 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.

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- 2-4 Review the procedure and process for performing walk downs of the system. Verify through manager and worker interviews that personnel performing walk downs understand operational features, safety requirements and performance criteria for the system.

System Surveillance and Testing

Objective:

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

Criteria:

1. Requirements for surveillance and testing are adequate for demonstrating overall system reliability and operability, and are linked to the technical safety basis.
2. Surveillance and test procedures confirm that key operating parameters for the overall system and its major components are maintained within operating limits.
3. Instrumentation and measurement and test equipment for the safety system are calibrated and maintained.

Approach:

- 1-1 Identify the acceptance criteria from the surveillance test procedures used to verify that the safety system is capable of performing its safety functions. Compare the acceptance criteria with the safety functions, functional requirements, performance criteria, assumptions and operating characteristics discussed in safety documents. Verify that there is a clear linkage between the test acceptance criteria and the safety documentation, and that the acceptance criteria are capable of confirming that safety/operability requirements are satisfied.
- 2-1 Review surveillance and testing procedures for the system's major components. Review a sample of the test results. Perform a walkthrough of the surveillance test procedure with appropriate facility personnel and verify:
 - Validity of test results
 - System performance meets system requirements
 - Performance criteria are appropriate for current facility mission life-cycle
 - Parameters that demonstrate compliance with the safety requirements can be measured
 - Test personnel are knowledgeable and able to satisfactorily perform the test
 - The procedure cites applicable Technical Safety Requirements/Limiting Conditions for Operation
 - Limits, precautions, system and test prerequisite conditions, data required, and acceptance criteria are included
 - Appropriate data recording provisions are included or referenced and are used to record results
 - The procedure includes provisions for listing discrepancies
 - The procedure requires timely notification of facility management about any failure or discrepancy that could impact operability
 - Appropriate personnel reviewed the test results and took appropriate action
- 3-1 For the surveillance and test procedures and records reviewed, determine whether the test equipment used for testing was calibrated.