Conduct of Engineering Assessment at the Pacific Northwest National Laboratory

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Office of Enterprise Assessments
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Acronyms

ASME	American Society of Mechanical Engineers
Battelle	Battelle Memorial Institute
CFR	Code of Federal Regulations
CM	Configuration Management
DOE	U.S. Department of Energy
EA	Office of Enterprise Assessments
ECN	Engineering Change Notice
F&O	Facilities & Operations
FMP	Facility Modification Permit
ITS	Issue Tracking System
NCR	Nonconformance Report
NPH	Natural Phenomena Hazards
NQA	Nuclear Quality Assurance
OFI	Opportunity for Improvement
OTS	Optional Tracking System
PNNL	Pacific Northwest National Laboratory
PNSO	Pacific Northwest Site Office
RPL	Radiochemical Processing Laboratory
SDD	System Design Description
SE	System Engineer
SSC	Structure, System, or Component
USQ	Unreviewed Safety Question

Conduct of Engineering Assessment
at the Pacific Northwest National Laboratory

Summary

Scope:
This assessment evaluated key aspects of the engineering function at Pacific Northwest National Laboratory (PNNL), including processes and procedures, technical product development, configuration management, the system engineering function, and natural phenomena hazards analyses. The primary focus was the implementation of these engineering functions at Building 325, the Hazard Category 2 Radiochemical Processing Laboratory (RPL).

Significant Results for Key Areas of Interest:
Procedures, Processes, and Technical Products
Engineering procedures/processes and a limited sample of calculations, drawings, facility modification permit packages, and other engineering documents were reviewed. The procedures and processes are adequate to support engineering functions at PNNL, with only one minor exception noted regarding the closure of unverified assumptions in calculations. The engineering products examined were generally compliant with Battelle Memorial Institute (Battelle) procedures and of good quality. The corrective action process is being applied effectively to identify, track, and correct deficiencies when they occur.

Configuration Management
The engineering role in configuration management includes developing and maintaining the technical baseline for the facility, controlling the design change process, managing engineering records, and performing self-assessments to ensure continued adequacy of performance in these areas. The technical baseline is well documented. Implementation of the design change, records management, and assessment processes is adequately rigorous to support configuration management.

System Engineering
Battelle has implemented a system engineering program at RPL that promotes the continued reliability of safety systems and is compliant with DOE Order 420.1C, *Facility Safety*, requirements. Two active safety systems observed during the review were in good condition, with no out-of-service equipment, temporary modifications, or backlog of corrective or preventive maintenance. The system engineer qualification program is detailed and thoroughly implemented.

Natural Phenomena Hazards Analysis
At the request of the Department of Energy (DOE) Pacific Northwest Site Office, EA reviewed analyses that support the design of the RPL facility for natural phenomena hazards as required by DOE Order 420.1C, Attachment 2, Chapter IV. The structural implications of those hazards were extensively analyzed and re-evaluated in 2007, using criteria current at that time. Several facility modifications resulting from that 2007 evaluation were completed in 2009. Those modifications ensured that the facility remains compliant with the relevant DOE requirements as stated in DOE-STD-1020-2012, *Natural Phenomena Hazards Analysis and Design Criteria for DOE Facilities*. The ten-year update issued in January 2019 adequately documents continued compliance.

No best practices or findings were identified during this assessment. Less significant issues were proactively entered into the Laboratory issue tracking systems by Battelle as the review progressed; therefore, no additional deficiencies were identified. Four opportunities for improvement were identified in areas where PNNL Engineering processes could be strengthened.

Follow-up Actions:
No follow-up activities are planned.

Conduct of Engineering Assessment
at the Pacific Northwest National Laboratory

1.0 PURPOSE

The U.S. Department of Energy (DOE) Office of Nuclear Safety and Environmental Assessments, within the independent Office of Enterprise Assessments (EA), performed an assessment of the conduct of engineering at the Pacific Northwest National Laboratory (PNNL). The purpose of this assessment was to evaluate the effectiveness of engineering processes and programs implemented by the facility contractor, Battelle Memorial Institute (Battelle).

EA performed this assessment from February 25 through March 14, 2019. This report discusses the scope, background, methodology, results, and conclusions of the assessment, as well as the opportunities for improvement (OFIs) identified by the assessment team.

2.0 SCOPE

This assessment evaluated key aspects of the engineering function at PNNL, including processes and procedures, technical product development, the system engineering function, configuration management (CM), and issues management within the Engineering organization. The primary focus was the implementation of these engineering functions at Building 325, the Radiochemical Processing Laboratory (RPL), which is a Hazard Category 2 facility. At the request of the Pacific Northwest Site Office (PNSO), this assessment also included examination of measures taken by the operating contractor to address natural phenomena hazards (NPH) as required by DOE Order 420.1C, *Facility Safety*, Attachment 2, Chapter IV, *Natural Phenomena Hazards Mitigation*.

This review scope was developed in cooperation with the PNSO Operations Division Director, and is in accordance with the *Plan for the Office of Enterprise Assessments Assessment of the Conduct of Engineering at the Pacific Northwest National Laboratory, February – March 2019*.

3.0 BACKGROUND

Battelle is the operating contractor for PNNL, with DOE oversight performed by PNSO, within the Office of Science. PNNL's origins date back to support of Hanford Site efforts in the 1940s. Scientists at the Laboratory now conduct research in diverse areas that include chemistry, computing, energy systems, and materials, in addition to their continuing contributions to national security. Engineering for the various facilities at PNNL is accomplished through the combination of a sitewide engineering services organization and facility-specific dedicated system engineers (SEs), with outside subcontract engineering resources available to support larger efforts as needed.

4.0 METHODOLOGY

The DOE independent oversight program is described in and governed by DOE Order 227.1A, *Independent Oversight Program*. EA implements the independent oversight program through a comprehensive set of internal protocols, operating practices, assessment guides, and process guides. Organizations and programs within DOE use varying terms to document specific assessment results. In

this report, EA uses the terms "deficiencies, findings, and opportunities for improvement" as defined in DOE Order 227.1A.

As identified in the assessment plan, this assessment considered requirements related to both conduct of engineering and NPH mitigation. The assessment team used Criteria and Review Approach Document 31-13, *Conduct of Engineering*, Revision 1, to guide this assessment.

The assessment team examined key documents, such as system descriptions, procedures, calculations, modification packages, corrective action reports, and training and qualification records. The assessment team also conducted interviews of personnel responsible for developing and executing the associated programs, and toured accessible portions of the RPL facility. The members of the assessment team, the Quality Review Board, and EA management responsible for this assessment are listed in Appendix A. A detailed list of the documents reviewed, personnel interviewed, and observations made during this assessment, relevant to the conclusions of this report, is provided in Appendix B.

EA has not conducted a recent assessment of engineering at PNNL. Therefore, there were no items for follow-up during this assessment.

5.0 RESULTS

5.1 Procedures, Processes, and Technical Products

This section discusses assessment results for the procedures and processes in place to guide the performance of engineering functions. It also discusses the quality of engineering technical products created using those processes. A limited sample of calculations, drawings, and facility modification permit (FMP) packages produced within the last two years was reviewed. PNNL is contractually committed to American Society of Mechanical Engineers (ASME) Nuclear Quality Assurance (NQA)-1-2000, *Quality Assurance Requirements for Nuclear Facility Applications*. The assessment team used that standard in conjunction with DOE requirements to form the basis for this portion of the assessment.

Objective:
Design engineering work is performed consistent with technical standards, DOE requirements, and safety basis requirements and commitments, using approved procedures and sound engineering/scientific principles in accordance with the requirements of 10 CFR 830, Nuclear Safety Management.

Criteria:
- *Engineering procedures are in place and contain appropriate detail to control development, approval, issuance, and revision of deliverables, as well as key processes essential to the design engineering function. (10 CFR 830)*
- *Engineering procedures provide barriers against poor performance, require participation and review by appropriate organizations, and drive communication between distinct groups. Verbatim compliance is required. (10 CFR 830)*
- *Documents comprising the project technical baseline are readily identifiable and subject to appropriate control measures. System design documents and supporting documents must be identified and kept current using formal change control and work control processes. (10 CFR 830)*
- *Analyses and calculations are prepared with design inputs clearly identified and assumptions technically justified (or unverified assumptions clearly identified and tracked to resolution), prepared*

consistent with the design criteria and safety basis, and checked by a second party and verified by an independent verifier, as appropriate. (10 CFR 830)

- *Design drawings are subject to interdisciplinary review as appropriate prior to issuance, accessible and retrievable in the most current version, and in accordance with applicable design criteria and industry standards. (10 CFR 830)*
- *Internal assessments are performed on a periodic basis to examine performance with regard to procedural and programmatic requirements. Assessors are independent of the area being examined. Lessons learned are identified and communicated to engineering personnel. Identified problems are documented using the contractor assurance system and tracked to completion of corrective actions. (10 CFR 830)*
- *An effective contractor assurance process is in place wherein problems are identified and corrective actions are determined and accomplished in a timely manner. Corrective actions are effective in addressing both the extent of condition of the identified problem and recurrence control. (10 CFR 830)*

Procedures and Processes

Most engineering processes at PNNL are defined in ADM-057, *Engineering Manual*, including those for calculations, drawings, and specifications. However, where appropriate, RPL has issued facility-specific procedures that supersede ADM-057 and establish additional, more rigorous requirements. For instance, ADM-RPL-826, *Calculations*, replaces that portion of ADM-057, with compliance mandated for all engineering calculations affecting RPL.

In general, the procedures examined provide an adequate basis for completion of engineering tasks, such as the preparation and issuance of calculations and drawings for nuclear facility work. ADM-RPL-826, in particular, contains well-developed instructions for calculation preparation, including guidance for establishing design input, identifying unverified assumptions, and tracking those assumptions.

ADM-058, *Facility Modification Manual*, establishes the design change process. The assessment team found this process to be effective in most areas, as discussed in Section 5.2 below. However, the modification closure process does not contain steps to verify closure of open items that may exist in supporting documents such as calculations. Although those open items are tracked using the Optional Tracking System (OTS), which is discussed further in the issues management section on page five, no mechanism is in place to ensure closure and/or resolution of those items before the affected structure, system, or component (SSC) is placed into service following a modification. (See **OFI-Battelle-1**.) Battelle initiated OTS #05149 to track and resolve this issue.

Record of Decision documents are used to identify commitments. Owners of these documents are expected to approve the issuance of any implementing documents or procedures, thereby providing an appropriate link to ensure adequate implementation.

10 CFR 830 Subpart A, Criterion 9, states that the quality assurance program must, "Ensure managers assess their management processes and identify and correct problems that hinder the organization from achieving its objectives." Internal assessments are an effective means of ensuring consistency in the application of requirements and in maintaining procedural compliance. Battelle Engineering does not regularly perform internal assessments to gage the effectiveness of its processes or the quality of its products and services, however, Engineering is subject to periodic surveillance by quality assurance personnel.

Technical Products

Calculations
Engineering calculations are performed in accordance with ADM-RPL-826. An electronic template, ADM-RPL-826-Form-001, *Calculation Control Package*, is available to ensure that all required information is provided.

The assessment team examined ten engineering calculations. The calculations were prepared with clearly identified design inputs and sufficient explanation, detail, and clarity of approach (including references) to permit duplication by another similarly qualified individual. Results were appropriately checked/verified. The reviewed calculations were of satisfactory quality, with the following exception:

- Although ADM-RPL-826 contains adequate guidance on the documentation of unverified assumptions, the assessment team identified two calculations (S707900-CALC-002, *Floor Storage Container Hydrogen Safety Analysis*, and NS-CALC-002, *SAVY Thermal Model*) that contained unverified assumptions that were not identified as such. Battelle generated OTS #05150 to document and resolve this issue.

Drawings
Engineering drawings are produced and revised in accordance with ADM-057. The assessment team selected and reviewed 15 drawings associated with recently issued design change packages and identified no issues. In general, all drawings reviewed were in accordance with industry standards. Dimensioning was clear and legible, and auxiliary views were provided, when appropriate, for clarification. All changes were appropriately incorporated on the drawings, which were updated in a timely manner during the closure process.

Facility Modification Packages
Design changes are processed in accordance with ADM-057 and ADM-058. RPL uses several processes for implementing and controlling changes to SSCs and related documentation, including the FMP and engineering change notice (ECN). The FMP is the approval document for modifications to facilities, and the ECN is the primary method of change control when an approved FMP needs to be revised. The FMP package assembles all required project and operational documentation for readiness, turnover, and closure, including engineering deliverables, acceptance test procedures, vendor information, and new or modified equipment asset numbers.

The assessment team examined 13 FMPs to determine the effectiveness of the design change process. The packages contained references to numerous engineering products, including drawings, calculations, ECNs, and unreviewed safety question (USQ) screenings. The assessment team also interviewed several SEs who performed the FMPs, to understand their use of the process. The SEs were knowledgeable about the development of FMPs. The FMPs sampled in this assessment adequately documented the full extent of the design changes.

RPL conservatively requires that a USQ review be performed for all FMPs and ECNs. However, one of the 13 FMPs reviewed (S742217, *325RPL Mezzanine Stair Finish Work*) had a USQ number on the coversheet, and that USQ evaluation was not retrievable. RPL staff performed a comprehensive extent-of-condition review of about 1,100 documents for the referenced USQ evaluations, and identified five other similar occurrences. Battelle generated Issue Tracking System (ITS) #O-00376 and ITS #O-00377 to document and resolve this issue.

Nonconformance Reports

The assessment team reviewed the nonconformance reports (NCRs) for the last two years (32 total). Of the 32 NCRs, 12 were dispositioned "use-as-is." Of those, only one did not contain sufficient detail in the technical justification to support the disposition of use-as-is. RPL-NCR-2017-002 identified cracks in Lab 604 Glovebox 3 glass. The disposition stated, "Issue RPL-RPT-17-001, *Lab 604 Gloveboxes Broken Glass Inspection*, as the basis for accepting the windows as-is in their current state." The referenced report includes a recommendation for Lab 604 Glovebox 3, to "develop a strategy for window change-out and purchase materials to perform this job evolution in the scenario of severe window degradation or catastrophic failure of the window during operations." However, this recommendation, which forms the basis for this use-as-is disposition, was not carried out. The issue was discussed with RPL management, and issues management item OTS-05160-001 was generated to address the issue.

Issues Management Within Engineering

PNNL uses OTS to track closure of minor issues, including procedure revisions. The separate ITS is used for more significant issues. These processes allow personnel at any level of the organization to identify issues, and apply a graded approach to drive the performance of extent-of-condition reviews, causal analysis, and effectiveness evaluations.

A limited review of three ITS items and seven OTS items indicated that OTS and ITS are being used effectively to document and resolve engineering issues. Planned corrective actions are adequate to resolve the issues identified and were accomplished in a timely manner. This conclusion was reinforced during the assessment process as Battelle created four new OTS items and two new ITS items to track and resolve issues raised by the assessment team. Those tracking numbers are referenced where appropriate in this report.

Procedures, Processes, and Technical Products Conclusions

The Engineering procedures and processes reviewed were adequate to support engineering functions at PNNL, with only one minor exception noted regarding the closure of unverified assumptions in calculations. The engineering products examined were generally compliant with the Battelle procedures and of good quality. The corrective action process is being applied effectively to identify, track, and correct deficiencies when they occur. Issues identified during this assessment were documented appropriately in OTS or ITS for resolution.

5.2 Configuration Management

The engineering role in CM includes functions associated with creating and maintaining the technical baseline for the facility, controlling the design change process, managing engineering records, and performing self-critical assessments to ensure continued adequacy of performance in these areas. Guidance for these functions is included in DOE-STD-1073-2016, *Configuration Management*, and DOE Order 420.1C.

Objective:

A documented configuration management program has been established and implemented in accordance with DOE Order 420.1 that ensures consistency among system requirements and performance criteria, system documentation, and physical configuration of the systems within the scope of the program.

Criteria:

- *Design input and output documents are appropriately established. Requirements from upper tier documents are appropriately incorporated into successor (or lower tier) documents. System design*

basis documents are kept current using formal change control and work control processes. (DOE-STD-1073-2016)

- *A design change process is in place to ensure that all documents affected by a change, both predecessor and successor, are identified and revised as part of the change process; that changes are reviewed by all potentially affected disciplines and organizations; and that extant changes against technical documents are tracked from initial issuance until incorporation in an approved revision. (DOE-STD-1073-2016)*
- *A records management system has been implemented to provide accessibility to engineering documents using a process that defaults to the most recent revision; tracks unincorporated changes outstanding against issued documents; and limits outstanding changes against engineering documents, such as drawings, to avoid negative impacts from excessive change paper and difficulties in determining the current design configuration. (DOE-STD-1073-2016)*

The Battelle CM program is adequately described in FO-CM-PLN-001, *Configuration Management Plan*. Appendices A and B of FO-CM-PLN-001 appropriately provide document crosswalks that outline how Facilities & Operations (F&O) organization procedures and processes implement both DOE-STD-1073-2016 and ASME NQA-1 2000 CM requirements. Overall, responsibility for implementation and oversight of CM rests with the Operational Systems Directorate Chief Engineer.

Technical Baseline

The technical baseline for RPL is adequately documented and maintained in various documents, including safety basis documents, drawings, and the master equipment list. ADM-057 adequately addresses development and documentation of the technical baseline. ADM-069, *Equipment Categorization and Drawing Requirements*, adequately describes a systematic approach for assigning equipment categories and defines two categories for drawings (key and operational) based on importance to the facility.

Design Change Control

ADM-057 and ADM-058 define the design change control process, as discussed in Section 5.1. Both procedures are adequate in this regard. Changes are appropriately reviewed by all potentially affected disciplines and organizations, such as training, document control, safety basis, fire protection, operations, and maintenance. Section 5.1 documents the assessment team's review of a sample of design change packages. Overall, implementation of the design change process at RPL is adequate.

SEs are the sole source of information on impacted documents when their assigned system is affected by a planned design change. Design Engineering looks to the SEs to identify all impacted documents, such as calculations and drawings. Input provided by the SE is not otherwise checked or validated. This reliance on the SE creates a single failure point and introduces the risk of not identifying all impacted documents, with commensurate implications for the CM process. For example, in developing the design change documentation for FMP S768351 in 2017, the former SE did not identify 325RPL-CAS-RPT-002, which develops information that is used in the RPL documented safety analysis, as an impacted document; therefore, it was not updated appropriately during that modification. This omission was identified by the current SE for the system in January 2019, and measures were initiated to correct the issue. The assessment team identified an additional document listed in the criticality alarm system, a system design description (SDD) that is also affected by FMP S768351. The document, 325RPL-CRAL-A1-101, *Criticality Alarm System (CAS) Detector Coverage Zone Plans*, must be revised as a successor activity to the revision of 325RPL-CAS-RPT-002. Battelle generated OTS #05152-001 to document and resolve this issue. (See **OFI-Battelle-2**.)

Document Control

ADM-001, *Document Management*, and ADM-002, *F&O Records Management*, adequately address the basic records management functions necessary to CM. Vault, the F&O document management system, is used to manage in-process records, such as open FMPs, procedures, and drawings. Once finalized, electronic records are automatically sent to PNNL's electronic records management system (eRecords) for storage. The assessment team noted the following positive attributes:

- Accessing engineering documents defaults to the most recent (current) version.
- Locating vendor information received during the process of designing and implementing a design change does not require knowledge of the FMP number.
- Revisions to key and operational drawings occur in a timely manner (no later than 30 days after completion of construction, as required by ADM-058-Form 02, *FMP Form*, and ADM-058-Form 04, *Facility Modification Permit Instructions*), which helps to prevent the accumulation of unincorporated changes against drawings.
- Issuing one FMP closure package, which contains all the documentation associated with that FMP as well as a Facility Review Board close-out approval signature block, reflects a rigorous process for FMP close out.

However, drawing changes and sketches created to support open FMPs do not show up in the document control process as planned changes to the affected documents. These changes exist solely in the FMP until the modification process is field-complete, and the affected documents are "checked out" in Vault for updating during the FMP closure process. Other users accessing the affected documents from Vault or eRecords will remain unaware that the documents have outstanding changes in process. This approach introduces a small but concrete risk of impact to other ongoing work in the facility. (See **OFI-Battelle-3**.)

Assessments

RPL relies partly on the SE function to assess CM. The physical configuration of RPL systems is validated by walkdowns and periodic system assessments performed by SEs. A sample of internal assessments of design change control and document control processes, as performed by F&O and Quality Assurance, was adequately introspective. These internal assessments contributed to the creation of the Facility Management Improvement Initiative Plan in October 2018. This plan is a proactive approach to strengthen configuration and control of organizational processes. A full management assessment (Assessment #AST-01777) of CM is planned for the spring of 2019.

Configuration Management Conclusions

The technical baseline is well documented and meets DOE expectations. Overall, implementation of the design change and records management processes is adequately rigorous to ensure that CM is maintained. Self-critical assessments are performed to ensure continued adequacy of performance in these areas.

5.3 System Engineering

This section discusses the RPL cognizant system engineer program (hereafter referred to as the SE program). DOE Order 420.1C requires that facility contractors at Hazard Category 1, 2, and 3 facilities implement a cognizant system engineer program for all safety-related systems and designated defense-in-depth systems.

Objective:
A cognizant system engineer (CSE) program has been implemented in accordance with the requirements of DOE Order 420.1B or 420.1C, as applicable, to ensure continued operational readiness of identified systems to meet their safety functional requirements and performance criteria.

Criteria:
Refer to the applicable revision of DOE Order 420.1 for specific requirements based on contract provisions for the facility under review.

- *CSEs have been designated, trained, and qualified (for safety class and safety significant systems, as a minimum) in accordance with DOE requirements.*
- *CSEs are involved in developing and maintaining System Design Descriptions (SDDs). SDDs identify the requirements associated with the facility's safety SSCs, explain the technical bases for the requirements, and describe the features of the system design provided to meet those requirements.*
- *At operating facilities, system assessments are performed on a periodic basis examining:*
  - *Analysis of system reliability, operability, and material condition*
  - *Operating status of the system; ability to perform design and safety functions*
  - *Physical configuration as compared to system documentation*
  - *System and component performance relative to established criteria.*

Battelle has implemented an SE program at RPL, which is described in ADM-RPL-901, *System Engineer Program Description*. SEs have been appropriately assigned and designated by the Building Manager. The assessment team verified that all identified systems have been properly assigned an SE. In addition, a backup SE is also assigned for each system, ensuring that coverage is maintained during periods when the primary SE is unavailable. The responsibilities listed in ADM-RPL-901 are extensive and include operational readiness, CM, assessing system status and performance, and support for Operations and Maintenance. All of these areas are compliant with DOE Order 420.1C.

In the areas of Operations and Maintenance support, the RPL SE responsibilities go well beyond support, into areas that are traditionally responsibilities of those organizations. For example, the SEs are responsible for planning and executing maintenance as the point of contact for their assigned systems. While this level of support for maintenance is not typical for most SEs across the DOE complex, the assessment team concluded that this responsibility does not prevent accomplishment of the SE duties contained in DOE Order 420.1C, due to the low number of planned maintenance work packages conducted annually (i.e., five to six work packages per SE annually). RPL SEs are also responsible for taking systems out of service and tagging them; this is typically an operator responsibility, but at RPL has been assigned to the SE who reports to the Building Manager. Based on the condition and health of observed systems in the field, these activities are not adversely affecting the reliability of RPL safety systems. For example, there was no out-of-service equipment for the active safety systems observed during the assessment. In addition, all equipment requiring calibration was up to date, there was no backlog in corrective or preventive maintenance, and no temporary modifications existed.

Training

The RPL SE qualification program is defined and implemented through Course 1915, *RPL System Engineer Training Package*. The qualification program reflects a systematic approach to training (consistent with DOE Order 426.2, *Personnel Selection, Training, Qualification and Certification Requirements for DOE Nuclear Facilities*) and is detailed and comprehensive, with one exception. Because the qualification is generic to all SEs at RPL, the SE qualification program covers all systems to a general level. It does not address two of the qualification elements listed in DOE Order 420.1C.

Specifically, DOE Order 420.1C, Attachment 2, Chapter V, *Cognizant System Engineer Program*, Sections 3.e(3) and (7) state the following:

> Qualification requirements must include knowledge of:
>
> (3) codes and standards applicable to assigned systems;
>
> (7) vendor manuals, product warnings, and updates related to assigned systems, available (in print or online).

The SE qualification program does not cover codes and standards, vendor manuals, product warnings, and updates for assigned systems. Following discussions with the assessment team, RPL management initiated an action in the issues management system (OTS-05137-001) to address this issue.

The SEs interviewed and observed during system walkdowns were knowledgeable of their assigned systems, and all training records were up to date. During the walkdown of the fire suppression system, the SE pointed out two recent nonconforming items that were discovered during facility inspections by that individual. The conditions have been corrected. In addition, of the 32 NCRs generated during the last 2 years, 8 were identified through SE activities.

System Design Descriptions

SDD documents are used at RPL as a mechanism to document the features and critical characteristics of systems that perform a safety function. SEs at RPL are directly assigned responsibility for the content of SDDs for their assigned systems. The assessment team reviewed the SDDs for all safety systems and determined that each one identifies system requirements and associated bases, safety function requirements, safety system SSCs, and boundaries and interfaces associated with the systems. The technical basis for each system is clearly described in acceptable detail, including how the system design requirements for that system are met. The SDDs for the safety-related fire suppression system, criticality alarm system, and glovebox systems are up to date and included in the CM program for RPL. No issues were identified. However, the four remaining SDDs (three for the hot cells and one for the exhaust ventilation system) are not current, having last been issued in the 2012-2014 timeframe, and at least one of these SDDs was not updated to reflect a system modification. As repositories of essential information on these systems, the SDDs are a significant resource for the SEs, especially during periods of personnel turnover, and should be updated on a regular basis. (See **OFI-Battelle-4**.)

System Health

Battelle has established requirements for periodic assessments under the scope of DOE Order 420.1C (i.e., active safety systems), including preparation of a monthly system health checklist. This checklist is prepared by the SE for the Building Manager. The checklist identifies system status, loss of availability during the period (if applicable), corrective and preventive maintenance, and status of any modifications. Based on review of a sample of checklists, the assessment team determined that the monthly checklists effectively document system status.

In addition to the monthly system checklists, periodic system assessments are prepared by the SE and approved by the Building Manager. The assessments are performed on a frequency based on how much the system has undergone change. For example, the last criticality alarm system periodic assessment was in 2016 (OPSA-CAS-001-2016). An additional neutron detector is being installed in March 2019. This change has prompted a new system assessment, which was underway during this EA assessment. The system assessments sampled during this review were thorough and, together with the monthly system checklists, meet the criteria for periodic assessments defined in DOE Order 420.1C.

System Engineering Conclusions

Battelle has implemented an SE program at RPL that promotes the continued reliability of safety systems so that they will perform intended safety functions when required. Two of the active safety systems were observed during walkdowns with SEs and were in good condition with no out-of-service equipment, temporary modifications, or backlog of corrective or preventive maintenance. The SEs are knowledgeable and are assigned by management to all active and passive safety systems, as well as defense-in-depth systems. The SE qualification program is detailed, thoroughly implemented, and consistent with a systematic approach to training. One weakness in the SE qualification process was noted related to the lack of inclusion of vendor information and codes and standards for assigned systems.

5.4 Natural Phenomena Hazards Analyses

At the request of PNSO, the assessment team reviewed analyses that support the design of the RPL facility for NPH as required by DOE Order 420.1C, Attachment 2, Chapter IV.

Objective:
Facilities must be designed, constructed, maintained, and operated to ensure the SSCs will be able to perform their intended safety functions effectively under the combined effects of NPH and normal loads defined in the applicable building codes contained in facilities' codes of record.

Criteria:
The NPH analysis supporting design and construction of facilities and safety SSCs must be documented and include evaluation of:

- *Potential damage to and failure of safety SSCs resulting from both direct and indirect NPH events*
- *Common cause/effect and interactions resulting from failures of other nearby facilities or other SSCs in the same facility caused by or induced by an NPH event. (DOE Order 420.1C, Attachment 2, Chapter IV, Section 3.c)*
- *Existing facility or site NPH assessments must be reviewed at least once every ten years and whenever significant changes in NPH data, criteria, and assessment methods warrant updating the assessments. (DOE Order 420.1C, Attachment 2, Chapter IV, Section 3.d)*

Battelle is contractually committed to compliance with DOE-STD-1020-2012, *Natural Phenomena Hazards Analysis and Design Criteria for DOE Facilities*. RPL has been evaluated against the NPH criteria summarized in Table 1.1 of PNNL-DSA-325, *325 Building Radiochemical Processing Laboratory Documented Safety Analysis*, using Performance Category 2 criteria per DOE-STD-1021-93, *Natural Phenomena Hazards Performance Categorization Guidelines for Structures, Systems, and Components*, and Seismic Design Category 2 per DOE-STD-1020-2002, *Natural Phenomena Hazards Design and Evaluation Criteria for DOE Facilities*.

The assessment team examined analytical efforts documented in 06348011-002, *Seismic and Wind Evaluation of Building 325 at Pacific Northwest National Laboratory*, which was performed by a third-party contractor in mid-2007 and focused on analyzing the RPL structure for loads imposed by NPH events. This detailed re-evaluation applied current wind loading effects and seismic accelerations to the building structure, determined worst-case load scenarios, and identified several areas within the facility where structural upgrades were recommended. The analysis then underwent a detailed peer review by Lawrence Livermore National Laboratory, and all comments were resolved. Modifications to the structure were completed in 2009. This evaluation process was performed using guidance from DOE-STD-1020-2002, but is generally compliant with Section 9.0 of DOE-STD-1020-2012.

The evaluation was, in part, based on a list of assumptions that were documented in Section 9.1.4 of 06348011-002. Those assumptions were addressed and resolved/validated as documented in Table 2-1 of 063480105-001, *Building 325 Seismic/Wind Upgrades*, in December 2007. That document also provides a detailed list of the building modifications/upgrades subsequently made to address the recommendations from the seismic evaluation. A walkdown of accessible areas where those modifications were accomplished did not identify any issues.

As required by DOE-STD-1020-2012, Battelle performed a subsequent ten-year re-evaluation that was documented in Revision 2 of TPD-006, *Review of Facility Natural Phenomena Hazard Assessments*, and issued in January 2019. TPD-006 documents compliance of PNNL facilities with DOE-STD-1020-2012 requirements, in part based on the 2007 re-evaluation discussed above. In the absence of new major modifications, that re-evaluation of RPL remains adequate to establish compliance of that facility with DOE requirements in this area.

Natural Phenomena Hazards Analyses Conclusions

The RPL documented safety analysis documents consideration of applicable NPHs for that facility. Structural implications of those hazards were updated and re-evaluated in 2007, leading to facility modifications that were completed in 2009. Those modifications ensured that the facility remains compliant with the relevant DOE requirements. The ten-year update issued in January 2019 adequately documents continued compliance.

6.0 FINDINGS

The assessment team did not identify any findings or deficiencies during this assessment.

7.0 OPPORTUNITIES FOR IMPROVEMENT

The assessment team identified some OFIs to assist cognizant managers in improving programs and operations. While OFIs may identify potential solutions to findings and deficiencies identified in appraisal reports, they may also address other conditions observed during the appraisal process. EA offers these OFIs only as recommendations for line management consideration; they do not require formal resolution by management through a corrective action process and are not intended to be prescriptive or mandatory. Rather, they are suggestions that may assist site management in implementing best practices or provide potential solutions to issues identified during the assessment.

Battelle Memorial Institute:

OFI-Battelle-1: Consider revising the FMP process to require closure of any calculation unverified assumptions and any other open items affecting the scope of a modification prior to placing that modification into service.

OFI-Battelle-2: Consider revising ADM-058 to require that the identification of impacted documents (documents that are affected by a planned design change) be independently verified by another SE prior to issuance of the modification permit.

OFI-Battelle-3: Consider revising the FMP process and/or document control process to provide automated notification to potential users when stored documents are affected by an in-process design modification.

OFI-Battelle-4: Consider updating the SDDs for non-safety significant systems more frequently to enhance their effectiveness as information repositories and training tools for the SEs.

Appendix A
Supplemental Information

Dates of Assessment

Onsite Assessment: February 25-28 and March 11-14, 2019

Office of Enterprise Assessments (EA) Management

Nathan H. Martin, Director, Office of Enterprise Assessments
John S. Boulden III, Acting Deputy Director, Office of Enterprise Assessments
Thomas R. Staker, Director, Office of Environment, Safety and Health Assessments
C.E. (Gene) Carpenter, Jr., Director, Office of Nuclear Safety and Environmental Assessments
Kevin G. Kilp, Director, Office of Worker Safety and Health Assessments
Gerald M. McAteer, Director, Office of Emergency Management Assessments

Quality Review Board

John S. Boulden III
Steven C. Simonson
Michael A. Kilpatrick

EA Site Lead for PNNL

Jeff Snook

EA Assessors

Charles R. Allen – Lead
Glenn W. Morris
Maureen Zelinsky
Joseph C. Grice (Observer)

Appendix B
Key Documents Reviewed, Interviews, and Observations

Documents Reviewed

0634801.12-S-003, *Seismic and Wind Evaluation of Building 325 at Pacific Northwest National Laboratory*, Revision 0, 9/6/2007
06348011-002, *Seismic and Wind Evaluation of Building 325 at Pacific Northwest National Laboratory*, Revision 1, 7/2/2007
063480105-001, *Building 325 Seismic/Wind Upgrades*, Revision 0, 12/28/2007
48343-WO92-TRPT-003, *Life Extension and Modernization Evaluation to Retain the Radiochemical Processing Laboratory (RPL) Building 325 PNNL Facilities Beyond 2026*, Revision 2, 6/5/2013
5722627-CALC-02, *Shielded Enclosure Stability Evaluation*, Revision 0, 12/6/2016
ADM-001, *Document Management*, Revision 18, 3/21/2018
ADM-002, *F&O Records Management*, Revision 1, 3/21/2018
ADM-057, *Engineering Manual*, Revision 1, 5/10/2018
ADM-057-PG-01, *Engineering Design Standard*, Revision 2.1, 2/12/2016
ADM-058, *Facility Modification Manual*, Revision 13, 8/31/2018
ADM-058-Form 02, *FMP Form*, 7/10/2018
ADM-058-Form 04, *Facility Modification Permit Instructions*, Revision 1, 8/31/2018
ADM-058-PG-01, *Facility Review Board (FRB) Process Guide*, Revision 0, 8/31/2018
ADM-069, *Equipment Categorization and Drawing Requirements*, Revision 9, 5/10/2018
ADM-081, *Equipment Out-of-Service Guidance*, Revision 3, 1/29/16
ADM-900, *Readiness to Start or Restart Facilities, Facility Modifications, or Projects*, Revision 5.1, 5/31/2017
ADM-CM-055-PG-06, *Design Development*, Revision 4, 7/12/2018
ADM-RPL-601, *Operational Readiness Review Procedure*, Revision 2.1, 9/30/2013
ADM-RPL-607, *Periodic System Assessments*, Revision 7, 5/10/18
ADM-RPL-815, *Control of Nonconforming Items*, Revision 10, 5/10/18
ADM-RPL-816, *RPL Corrective Action Reports*, Revision 5, 4/24/2017
ADM-RPL-825, *Control of Acquired Design Analyses Software*, Revision 0.1, 8/31/2017
ADM-RPL-826, *Calculations*, Revision 0, 9/11/2017
ADM-RPL-826, *Calculations*, Revision 1, 1/31/2019
ADM-RPL-826-Form-001, *Calculation Control Package*, Revision 1, 1/31/2019
ADM-RPL-901, *System Engineer Program Description*, Revision 8, 5/10/18
ADM-RPL-902, *RPL Systematic Approach to Training*, Revision 5, 9/12/18
ADM-RPL-905, *RPL Training Plan*, Revision 5, 8/23/18
ASMT-01441 *Conduct of Engineering Self-Assessment Report*
ASMT-01441 *Conduct of Engineering Self-Assessment Report Issue Reconciliation*
Course 1915 – *RPL System Engineer Training Package*, Revision 12, 4/24/2017
Drawing G0-001, *General Title Sheet*, Revision 0
Drawing G0-002, *General Specification*, Revision 0
Drawing E1-101, *Room 409 Demolition and Glovebox Installation*, Revision 0
Drawing H-3-305241, Sheet 1, *Electrical E-Lights & Exit Signs 1ST FL-Area 9E, 9W*, Revision 3, 2/2018
Drawing H-3-307593, *HVAC Exhaust Duct Work Basement Plan*, Revision 9
Drawing H-3-308430, Sheet 1, *Fire Suppression Piping 1ST Floor Area 9E, 9W*, Revision 10, 6/21/2018
Drawing H-3-311129, Sheets 1-3, *Glovebox Room 48 HVE-1093-GB*, Revision 3, 8/2017
Drawing H-3-311340, Sheets 1-3, *Glovebox Lab 419 HVE-GB-1084*, Revision 8, 8/2017
Drawing H-3-314977, Sheet 3, *Electrical Fire Alarm System 1ST Fl Plan & Det*, Revision 12, 2/8/2019
Drawing H-3-314977, Sheet 5, *Electrical Fire Alarm System Schedules*, Revision 12, 2/8/2019
Drawing H-3-314977, Sheet 14, *Electrical Fire Alarm System Modules Wiring Diagrams*, Revision 12,

2/8/2019
Drawing H-3-316054, *HVAC Exhaust 1-Line Diagram*, Revision 8
Drawing H-3-316061, *Exhaust/Supply 1-Line BSMT Plan*, Revision 4
Drawing H-3-52814, Sheet 1, *Elec Neutron Sensitive Criticality Alarm System First Floor Plan*, Revision 8, 3/29/2018
Drawing H-3-52814, Sheet 2, *Elec Neutron Sensitive Criticality Alarm System First Floor Plan*, Revision 6, 3/29/2018
Drawing M1-101, *Mechanical HVAC Demolition and Remodel Plan*, Revision 0
ECN 01 to S707900-FMP-02, *325 Inventory Increase*, 1/11/2018
ECN 02 to S707900-FMP-02, *325 Inventory Increase*, 1/29/2018
ECN 03 to S707900-FMP-02, *325 Inventory Increase*, 4/2/2018
ECN 04 to S707900-FMP-02, *325 Safeguards Upgrade Inventory Increase*, 8/19/2018
ECN 05 to S707900-FMP-02, *RPL Room 50 Safeguards Upgrade*, 10/2/2018
ECN 07 to S707900-FMP-02, *325RPL Safeguards Upgrade Inventory Increase*, 10/2/2018
ECN 08 to S707900-FMP-02, *325RPL Safeguards Upgrade Inventory Increase*, 1/3/2019
ECN 09 to S707900-FMP-02, *325RPL Safeguards Upgrade Inventory Increase*, 12/13/2018
ECN 10 to S707900-FMP-02, *325RPL Safeguards Upgrade Inventory Increase*, 1/24/2019
ECN 01 to S768230-FMP-03, *RPL Room 48 Ventilated Enclosure*, 2/21/2018
ECN 02 to S768230-FMP-03, *RPL Room 48 Ventilated Enclosure*, 3/21/2018
ECN 01 to S770246-FMP-01, *RPL Lab 406 Glovebox Removal*, 9/20/2018
ECN 02 to S770246-FMP-01, *RPL Lab 406 Glovebox Removal*, 11/5/2018
ECN 03 to S770246-FMP-01, *RPL Lab 406 Glovebox Removal*, 1/8/2019
ECN 01 to S775092-FMP-01, *RPL Room 48 Fume Hood Installation*, 10/31/2018
ECN S747480, *Move Glovebox from Room 201 to Room 409*, Revision 0, 9/6/2018
EDP S707900-03, *RPL Inventory Increase*, Revision 0, 5/1/2017
EDP S768230-01, *Room 48 Benchtop Confinement/Double Sided Fume Hood*, Revision 0, 9/1/2017
EDP S768230-02, *Add a ventilated gas bottle enclosure to room 414*, Revision 0, 11/13/2017
EDP S768230-03, *RPL Room 48 Saw Enclosure*, Revision 0, 1/8/2018
EDP S770246-01, *RPL Lab 406 Glovebox Removal*, Revision 0, 4/26/2018
EDP S775092-01, *RPL – Lab 48 Fume Hood Installation*, Revision 0, 3/30/2018
EDP S776324-01, *325RPL CAS coverage room 97*, Revision 0, 8/23/2018
EDP S781329-01, *Rm 91 Benchtop Confinement Removal and PE560 Disposal*, Revision 0, 9/21/2018
Expert USQD RPL-2016-310E, FMPs *Involving Replacement of Installation of New Heat/Smoke Detectors at the RPL*, Revision 0, 2/7/2017
Expert USQD RPL-2018-034E, *Service Request S747480, Move Glovebox HVE-98-GB from Room 201 to Room 409*, Revision 0, 2/12/2018
Expert USQD RPL-2018-034E, *Service Request S747480, Move Glovebox HVE-98-GB from Room 201 to Room 409*, Revision 1, 2/21/2018
FO-ASMT-17-01, *Records Recovery Assessment of Corrective Action Closure Self-Assessment,* 6/13/2017
FO-ASMT-18-01, *Effectiveness Review Report for Issue E-00855, Management Concern Regarding Facility Operations Record Management System*, 7/25/2018
FO-CM-PLN-001, *Configuration Management Plan*, Revision 0, 5/9/2018
ITS A-01822, *Final Design Inspection Criteria*, 9/21/2017
ITS A-01934, *Lack of Evidence of CMP or QAP for Planned Engineering Projects*, 3/21/2018
ITS A-01935, *Lack of Objective Evidence of WSS for 325RPL Engineering Work*, 3/21/2018
ITS A-01956, *NUC-MOP-ASMT-18-007-Conduct of Engineering ASMT AST-01441- Finding 1*, 7/12/2018
Memorandum, *ADM-RPL-901 System Engineer Program Description System Engineer Assignments, 10/23RPL Systems engineer (SE) Qualification Card,* 10/23/2018
NS-CALC-001, *In-floor Storage Containment H2 Generation*, Revision 2, 11/16/2017

NS-CALC-002, *SAVY Thermal Model*, Revision 3, 6/20/2018
OPSA-FSS-001-2018, *325RPL Radiochemical Processing Laboratory Fire Suppression System Riser 6 Pipe Failure*, Revision 0, July 2018
OPSA-FSS-002-2018, *Assessment to Accept the As-Is Condition of Torqued Fasteners of Second Floor Fire Suppression System Hangers and Supports*, Revision 0, October 2018
OSI-ASMT-17-03, *Facility Modification Permit – Document Center Job and Task Analysis Informal Assessment (AST: 01116)*, 11/2017
OSI-ASMT-17-04, *Facility Modification Permit – Chief Engineer Job and Task Analysis Informal Assessment (AST: 01137)*, 11/2017
OSI-ASMT-17-05, *Facility Modification Permit – "Other Key Roles" Job and Task Analysis Informal Assessment (AST: 01138)*, 11/2017
OSI-PLAN-003, *Facility Management Improvement Initiative Plan*, Revision 0, 10/2018
OTS-04127, *QA Requirements Identified in Specification*, 5/16/2017
OTS-04636, *References in 325RPL QAPD*, 3/22/2018
OTS-04637, *Date of Revision on Engineering Documents*, 3/22/2018
OTS-04638, *Quality is not a Required Reviewer on CAT 1 or CAT 2D Design Documents*, 3/22/2018
OTS-04640, *Safety Class*, 3/23/2018
OTS-04643, *Incomplete Records in HPRM*, 3/23/2018
OTS-04644, *Records Not In HPRM*, 3/23/2018
PNNL-DSA-325, *325 Building Radiochemical Processing Laboratory Documented Safety Analysis*, Revision 11, 11/20/2018
RPL-CAS-SDD, *325RPL Building Criticality Alarm System – System Design Description*, Revision 7, December 2018
RPL-EVS-SDD, *325 Building Exhaust Ventilation System Design Description*, Revision 0, October 2014
RPL-FSS-SDD, *325RPL Building Fire Suppression System Design Description*, Revision 3, August 2018
RPL-NCR-2017-001, *Part Number for Material Ordered Does Not Match Part Number on Material Received*, 2/7/2017
RPL-NCR-2017-002, *Lab 604 Gloveboxes Broken Window Panes*, 2/20/2017
RPL-NCR-2017-003, *Receipt Inspection of LANCS Bag Out Bags*, 2/21/2017
RPL-NCR-2017-004, *FSS Riser 2 Piping not Installed Above Bridge Crane Support Beam*, 4/24/2017
RPL-NCR-2017-005, *Riser 6 Air Maintenance Device*, 5/22/2017
RPL-NCR-2017-006, *Imperfections in Edges of Glass Panels*, 5/27/2017
RPL-NCR-2017-007, *Dedication Testing of CAS Howlers*, 5/31/2017
RPL-NCR-2017-008, *Dedication Testing of CAS Howlers*, 5/31/2017
RPL-NCR-2017-009, *Torque Wrench Model Number Does Not Match Calibration Certificate*, 6/6/2017
RPL-NCR-2017-010, *Torque Wrench Used Outside of Torque Value Range*, 10/10/2018
RPL-NCR-2017-011, *FSS Riser 2 Sprinkler Location in Room 95*, 8/3/2017
RPL-NCR-2017-012, *Ratchet Tie-Down Strap Assembly Containing S/CI Fasteners*, 8/3/2017
RPL-NCR-2017-013, *Manufacturer Date not Identified on Battery*, 8/3/2017
RPL-NCR-2017-014, *Issues Identified on Three Separate Sprinklers Supplied by Riser 1*, 8/31/2017
RPL-NCR-2017-015, *Paint on Sprinkler Deflector*, 8/31/17
RPL-NCR-2017-016, *2017 Floor Level Fire Suppression System Issue Associated with SR S768313C*, 8/31/2017
RPL-NCR-2017-017, *325RPL Replace Fire Riser #3 HDPE Pipe Fittings*, 9/20/2017
RPL-NCR-2017-018, *325RPL Water Supply Enclosure Concrete Pad Out of Specifications*, 11/3/2017
RPL-NCR-2017-019, *Small Leak Developed at Fitting After Completion of the 2-hour Leak Test at Fitting*, 11/6/2017
RPL-NCR-2017-020, *Roof Panels of Water Supply Enclosure are not Installed per S718319-A5-101*, 11/13/2017
RPL-NCR-2017-021, *Wall Panels of Water Supply Enclosure Not Installed per S718319-A5-101*, 11/13/2017

RPL-NCR-2017-022, *Height of Pipe Connection and Stands Do Not Comply with Design*, 11/27/2017
RPL-NCR-2017-023, *Asphalt Placement not in Compliance with the Weather Limitations of WSDOT M41-10*, 6/11/2018
RPL-NCR-2017-024, *Small Leak Identified in HLRF A-Cell South Face Window*, 12/15/2017
RPL-NCR-2018-001, *CRAL-54-HW Failure*, 3/22/2018
RPL-NCR-2018-002, *Testing of CAS K1/K3 Relays*, 4/30/2018
RPL-NCR-2018-003, *Fire Suppression System Riser 6 Inspection and Testing*, 5/29/2018
RPL-NCR-2018-005, *Riser 3 Main Drain Valve Leak*, 8/3/2018
RPL-NCR-2018-007, *Pre-Heat and Re-Heat Pump Flow Set Point*, 8/18/2018
RPL-NCR-2018-009, *HLRF A-Cell North & South Window Oil Change*, 9/4/2018
RPL-NCR-2018-008, *Riser 6 Received Supplier Parts*, 8/17/2018
RPL-NCR-2018-011, *Room 50 Temporary Column Placement*, 12/26/2018
RPL-PLN-801, *RPL Quality Assurance Program Description (QAPD)*, Revision 8, 7/10/2018
RPL-RPT-14-008, *Radiochemical Processing Laboratory (RPL) 325 Building Seismic Hazard Analysis Review*, Revision 0, 7/2/2014
RPL-RPT-17-001, *Lab 604 Gloveboxes Broken Glass Inspection*, Revision 0, 2/22/2017
RPL-RPT-17-002, *Evaluation of Fire Suppression System Sprinklers Partially Obstructed by Large Ventilation Ducts*, Revision 0, February 2017
RPL-RPT-17-003, *Assessment of Localized Corrosion Product Formation on Fire Suppression Piping*, Revision 0, June 2017
RPL-RPT-17-007, *Functional Design Criteria HLRF In-Cell Criticality Alarm System (HICAS)*, Revision 0, 4/19/2017
RPL-RPT-17-010, *Review the 2017 Edition of NFPA 25 to Compare Code Requirements to Existing Inspection, Testing and Maintenance Procedures in Use at the 325RPL*, Revision 0, July 2017
RPL-RPT-17-013, *Detailed Preventive Maintenance Procedure Review Following NFPA 25 2017 Update: A Comparison of Testing Requirements between 2014 and 2017 Editions*, Revision 1, 12/8/2017
RPL-RPT-18-006, *Evaluate Glove Box HVE-98-GB Move from Room 201 to Lab 409*, Revision 0, February 2018
RPL-RPT-18-008, *Evaluation of W200 Style Contactor Failures in the Electrical Distribution System*, Revision 0, April 2018
RPL-RPT-18-009, *Square D Safety Switch Recall Assessment for 325RPL*, Revision 0, June 2018
RPL-RPT-18-011, *Evaluation of Engineering Documentation for 325RPL Lab 48 Modifications Project Closeout and Opportunities for Improvements*, Revision 0, October 2018
RPL-SDD-GBS, *325RPL Gloveboxes-System Design Description*, Revision 6, December 2018
RPL-SDD-HC-HLRF, *325-Building HLRF Hot Cell System Design Description*, Revision 0, September 2012
RPL-SDD-HCM, *325-Building Modular Hot Cell*, Revision 4, May 2012
RPL-SDD-HC-SAL, *325-Building SAL Hot Cell System Design Description*, Revision 0, January 2013
RPL-SUR-17-002, *Nuclear Maintenance Management Program Section 3.9, Procurement*, Revision 1, 6/01/2017
RPL-SUR-17-003, *Nuclear Maintenance Management Program Section 3.11, Suspect/Counterfeit Items*, Revision 1, 6/01/2017
RPL-SUR-17-005, *325 RPL Inspection Process*, Revision 1, 9/21/2017
RPL-SUR-18-002, *Design Control for the 325 Radiochemical Processing Laboratory*, Revision 1, 3/28/2018
RPL-SUR-18-005, *Implementation of 325 RPL Quality Assurance Test Control Requirements*, Revision 1, 9/11/2018
S707900-CALC-001, *RPL Safeguards Limits: Project Calculations*, Revision 0, 10/2017
S707900-CALC-002, *Floor Storage Container Hydrogen Safety Analysis*, Revision 1, 1/5/2018
S707900-CALC-003, *RPL Safeguards Limits: FSC Structural Calculations*, Revision 1, 2/2018
S707900-CALC-04, *RPL Safeguards Limits: Jib Crane Installation*, Revision 0, 10/2017

S707900-CALC-05, *325 RPL Room 50 Temporary Structural Support*, Revision 0, 10/2018
S707900-FMP-02, Revision 0, 8/31/2017
S707900-RPT-002, *RPL Safeguards Limits Project – Hydrogen Mixing in Floor Storage Container*, Revision 0, 2/2018
S747480-CALC-01, *RPL Room 201 Glovebox Move to Room 409*, Revision 1, 3/15/2018
S747480-EDP-01, *Move Glovebox form RM 201 to RM 409*, Revision 2, 2/16/2018
S760698-ENG-001, *Options Analysis/Functional Design Criteria Development: RPL Glovebox Glass Reinforcement*, Revision 0, 2/2017
S760698-ENG-002, *RPL Glovebox Secondary Glass Pane Analysis*, Revision 0, 3/24/2017
S760698-FMP-01, *S760698 Facility Modification Permit (FMP) Closure Package – Provide Secondary Glass Window for Lab 48 and 419 Gloveboxes*, Revision 0, 6/2018
S762232-FMP-01, *S762232 Facility Modification Permit (FMP) Closure Package – Add a New Criticality Alarm Howler in Room 525*, Revision 0, 1/2019
S766402-FMP-01, *S766402 Facility Modification Permit (FMP) Closure Package – Repair Small Portion of Roof at Dock*, Revision 0, 8/2018
S768230-ATP-001, *Acceptance Test Procedure: 325RPL Room 48 Saw Ventilated Enclosure*, Revision 0, 5/2018
S768230-ATP-002, *Acceptance Test Procedure: 325RPL Room 48 VIM Ventilated Enclosure*, Revision 0, 6/2018
S768230-ATP-001, *Acceptance Test Procedure: 325RPL Room 48 Saw Ventilated Enclosure*, Revision 0, May 2018
S768230-ATP-002, *Acceptance Test Procedure: 325RPL Room 48 VIM Ventilated Enclosure*, Revision 0, June 2018
S768230-CALC-001, *325-Room 48 Ventilated Enclosure*, Revision 0, 1/25/2018
S768230-FMP-01, Revision 0, 8/1/2017
S768230-FMP-02, Revision 0, 11/13/2017
S768230-FMP-03, Revision 0, 1/10/2018
S770246-CALC-01, *Lab 406 Glovebox Exo-Skeleton Structural Calc*, Revision 0, 5/2/2018
S770246-FMP-01, Revision 0, 6/8/2018
S775092-CALC-001, *325 – Room 48 Fume Hood Installation*, Revision 0, 4/24/2018
S775092-FMP-01, Revision 0, 5/7/2018
S776324-FMP-01, Revision 0, 8/24/2018
S781329-FMP-01, Revision 0, 9/21/2018
SES RPL-2017-240S, *FMP S768230 – Demolish and dispose of the Room 48 Benchtop Confinement/Double Sided Fume Hood*, 11/2/2017
SES RPL-2018-082S, *Engineering Change Notice 01 to S766402-EDP01-FMP01, 325(RPL) Roof Repairs*, 3/29/2018
SES RPL-2018-153S, *S775092-FMP01 & JPP S775092 RPL Lab 48 Fume Hood Installation*, 6/28/2018
System Health Report Checklist (10)
System Engineer Qualification Cards – completed (7)
TPD-006, *Review of Facility Natural Phenomena Hazard Assessments*, Revision 2, 1/28/2019
USQD RPL-2017-111D, *Service Request S760698, Lab 48 and 419 Glovebox Window Covers*, 5/22/2017
USQD RPL-2017-341D, *S768351-FMP-01, JPP-S768351A and JPP-S768351C, add a CAS Detector in HRLF*, Revision 0, 1/8/2018
USQD RPL-2017-343D, *FMP S762232: 325RPL CAS Coverage Rooms 525 and 427 and Associated ECN and JPP*, 12/12/2017
USQD RPL-2018-013D, *Service Request S707900, 325RPL Room 50 Inventory Increase Project*, Revision 0, 5/29/2018
USQD RPL-2018-013D, *Service Request S707900, 325RPL Room 50 Inventory Increase Project*, Revision 1, 9/10/2018
USQD RPL-2018-013D, *Service Request S707900, 325RPL Room 50 Inventory Increase Project*,

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USQD RPL-2018-013D, *Service Request S707900, 325RPL Room 50 Inventory Increase Project*, Revision 3, 12/18/2018
USQD RPL-2018-169D, *S770246-FMP-01: Room 406 Glovebox Removal*, 7/18/2018
USQS RPL-2018-218S, *FMP S776324: 325RPL CAS coverage room 97*, 8/30/2018
USQS RPL-2018-265S, *Rm 91 Benchtop Confinement Removal and PE560 Disposal*, 9/28/2018

Interviews

- PNNL Chief Engineer
- PNNL Engineering Manager
- PNNL Operations Support & Integration Manager
- PNSO Nuclear Safety Officer
- PNSO Facility Representative for RPL
- PNSO Radiological Protection Manager
- PNSO Technical Specialist
- RPL Building Manager
- RPL Manager
- RPL Nuclear Training Specialist
- RPL Quality Assurance Engineer
- RPL Support Manager
- Safety Basis Engineer
- System Engineers (3)
- RPL Training Manager
- RPL Work Control Manager
- Engineer, Fluid and Computational Engineering

Observations

- RPL Facility Tour/Walkdown
- Walkdown of the Fire Suppression System with the System Engineer
- Walkdown of the Criticality Alarm System with the System Engineer