Independent Oversight Appraisal of the Uranium Processing Facility Safety Basis Preliminary Safety Design Report Process at the Y-12 National Security Complex

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Acronyms

B&W Y-12	B&W Y-12 Technical Services, LLC
CD	Critical Decision
COA	Condition of Approval
CRAD	Criteria, Review and Approach Document
DAC	Design and Analysis Calculation
DNFSB	Defense Nuclear Facilities Safety Board
DOE	U. S. Department of Energy
FPS	Fire Protection System
HES	Hazard Evaluation Study
HEUMF	Highly Enriched Uranium Materials Facility
HSS	Office of Health, Safety and Security
LCO	Limiting Condition for Operation
MAQ	Maximum Anticipated Quantity
MAR	Material at Risk
NNSA	National Nuclear Security Administration
NPO	NNSA Nuclear Production Office
OFI	Opportunity for Improvement
PDSA	Preliminary Documented Safety Analysis
PFHA	Preliminary Fire Hazards Analysis
PSDR	Preliminary Safety Design Report
PSVR	Preliminary Safety Validation Report
SAC	Specific Administrative Control
SDC	Seismic Design Criteria
SDS	Safety Design Strategy
SEQ	Scenario Evaluation Question
SS	Safety Significant
SSC	Structure, System, and Component
UPF	Uranium Processing Facility

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1.0 PURPOSE

The Office of Safety and Emergency Management Evaluations, within the U.S. Department of Energy (DOE) Office of Health, Safety and Security (HSS) Office of Enforcement and Oversight (Independent Oversight), conducted an appraisal of the Uranium Processing Facility (UPF) Preliminary Safety Design Report (PSDR) and associated site office review processes. Independent Oversight assessed the progress and development of the safety basis for the UPF, which is located at the Y-12 National Security Complex in Oak Ridge, Tennessee. As part of DOE's self-regulatory framework for safety and security, DOE Order 227.1, *Independent Oversight Program*, assigns HSS responsibility for implementing an independent oversight program and requires Independent Oversight to conduct independent evaluations of safety and security. The FY 2012 omnibus appropriations (PL 112-55) provides additional requirements for independent oversight specific to the design and construction of new nuclear facilities.

In accordance with these responsibilities, Independent Oversight performs targeted oversight activities as design and construction projects progress. Independent Oversight activities are not intended to comprehensively review all aspects of the project, but to strategically focus on aspects of nuclear safety that are essential to ensuring effective protection of workers, the environment, and the public. These appraisals focus on evaluating the process of integrating nuclear safety into the facility design from the conceptual stage through the final design stage, as well as on the principal products of this process – the documented safety analysis and the technical safety requirements that constitute the safety basis of the nuclear facility. Specific appraisal areas include identification and evaluation of hazards associated with the facility; analysis of postulated accidents; and derivation and adequacy of hazard controls, particularly those associated with safety structures, systems, and components (SSCs), safety management programs, and specific administrative controls (SACs). In accordance with the requirements and processes established in DOE Order 420.1B, *Facility* Safety, DOE-STD-1189, *Integration of Safety into the Design Process*, and DOE-STD-3009, *Preparation Guide for U.S. Department of Energy Documented Safety Analyses*, review of the project's development and approval of the safety basis as documented in the Safety Design Strategy, PSDR, and Preliminary Documented Safety Analysis (PDSA) and supporting hazard analyses is a primary component of these appraisals. To the extent feasible, Independent Oversight conducts its appraisals concurrent with line management oversight assessments to maximize the effectiveness of these oversight activities and minimize the impact on project organizations.

This appraisal focused on selected aspects of the PSDR submitted to the National Nuclear Security Administration (NNSA) Production Office (NPO) for review in September 2012 and on the process implemented by NPO to review the PSDR and report its findings in the Preliminary Safety Validation Report (PSVR).

2.0 BACKGROUND

The Y-12 National Security Complex is operated for DOE by B&W Y-12 Technical Services, LLC (B&W Y-12), under the direction of the NPO, which is also responsible for contract management and oversight of the Pantex Plant in Amarillo, Texas. The Y-12 complex supports NNSA nuclear security activities by providing nuclear material processing, manufacturing, and storage operations; nuclear non-proliferation activities; and enriched uranium feedstock for the U.S. Navy.

As an integral part of its commitment to modernize the aging nuclear weapons complex, NNSA plans to build a new Uranium Processing Facility at Y-12. The UPF will provide an upgrade of aged equipment and facilities at the site, most of which are more than 60 years old and were built during World War II. Under contract to DOE/NNSA, B&W Y-12 is responsible for managing the UPF project. Within the UPF project engineering organization, there are four subcontractors managed by basic ordering agreements: Merrick & Company, Jacobs Engineering, CH2M Hill, and URS Corporation. B&W Y-12 and its subcontractors are responsible for the design and construction of the new facility, which is managed by a Federal project team under the NNSA Associate Administrator for Acquisition and Project Management.

In 2011, the UPF Federal project team received the draft PSDR from the contractor. The draft PSDR was returned to the contractor with comments. Since then, the project has completed a reaffirmation of critical decision (CD) 1 with a modified funding profile and deferment of some of the initial project scope. In July 2012, NNSA line management sponsored a technical independent project review that included, among other things, an assessment of the status of safety basis development relative to the status of the design. The NNSA line review processes led to recognition of the need for structural modifications to accommodate the footprint of the intended processes and awareness that the design was not as mature as needed to progress to a PDSA and the associated CD 3 milestone. Consequently, NNSA determined that the contractor would prepare an updated PSDR and submit it to the Federal project team for review and approval. In preparation of the updated PSDR, it was agreed between the site office and contractor that the project would not attempt to fully update the PSDR and supporting hazard analysis to the current state of design. It was further agreed that this revision of the PSDR would not address the deferred scope for the re-design of the facility footprint and any subsequent redesign. The Federal project team received the updated draft PSDR in September 2012. As the ultimate end user, NPO provided the Federal project team leader and technical staff to support a safety basis review team that reviewed the September PSDR revision 1.

3.0 SCOPE

This Independent Oversight appraisal was initiated in October 2012 to coincide with NPO's review of the contractor's submittal of PSDR revision 1. The appraisal was conducted in accordance with selected sections of HSS Criteria, Review and Approach Document (CRAD) 45-55, *Review of Safety Basis Development for the Y-12 Uranium Processing Facility (UPF)*, which addresses the hazard and accident analyses, SSCs identified in the PSDR as part of the control set, and SACs associated with protection of the fundamental assumptions behind the hazard assessment (to the extent appropriate considering the status of safety basis development), such as material-at-risk (MAR) limitations. Independent Oversight conducted a "vertical slice" review – i.e., following specific aspects of the PSDR and supporting hazard analyses through the entire development process – to assess the effectiveness of the contractor's preparation process and the site office and line management review and approval process in assuring integration of safety into design. Based on the earlier draft of the PSDR, one of the primary drivers for a potential release of hazardous materials would be a fire within the facility. Consequently, the vertical slice appraisal concentrated on the hazard analysis and control sets associated with fire protection, source term segregation, and containment. This area of the appraisal drew from selected lines of inquiry from HSS CRAD 45-34, *Fire Protection*, as it applies to engineered features (SSCs) and integration of the fire hazard analysis into the design basis. Specifically, the objectives and lines of inquiry from section II: FHA/DSA Integration and section III: Engineered System Design Features for the CRAD were applied to this review. It should be noted that although the scope of this review focuses on the current state of the PSDR and the supporting hazard analysis, the observations and Opportunities for Improvements are principally directed toward assuring the later development of the PDSA is fully supported by a hazard analysis that is consistent with the maturity of the design and provides the necessary design leading safety system requirements.

4.0 RESULTS

Criterion 1: Hazards analyses are consistent with the DOE safe harbor methodologies and provide systematic and complete results for the selected hazards/accidents, consistent with the current design stage, to facilitate developing controls and their design and functional requirements.

The process for developing hazard analyses for the UPF project is guided by two procedures. The first, Y74-48-007, *Hazard Identification and Screenings to Support Development of a Hazard Evaluation Study*, contains instructions for identifying and screening the facility hazards in preparation for conducting the hazard evaluation study (HES). The second, Y74-48-008, *Hazard Evaluation Study Accident Analysis*, provides the instructions for conducting and documenting the hazard evaluation. The hazard identification and screening procedure uses input derived from the hazardous material identification process and process descriptions, which are also procedurally controlled, to identify hazardous material and energy sources. The procedure allows for the use of an iterative process, which is being appropriately applied for the UPF project. The hazardous material identification document, the process descriptions, and a suitable set of screening criteria are used to develop a composite list of hazards, including the maximum anticipated quantities (MAQs) of material, in order to identify the hazards that require further analysis. Screening criteria are consistent with the requirements of DOE-STD-1189. The MAQs are summed to obtain a maximum inventory value for the facility. The results of the screening process are documented in a design and analysis calculation (DAC) document, whose contents are specified in the procedure, and used to conduct the HES.

The HES procedure provides the basis and instructions for a systematic, qualitative approach to hazard evaluation for hazards that require additional analysis after the initial screening. The process conforms to the requirements of both DOE-STD-3009 and DOE-STD-1189 and applies to new facilities. As noted, the process can be applied iteratively as necessary to support development of the design. The hazard evaluation process is led by a team leader and a supporting team consisting of both required and recommended team members. The procedure steps, together with a set of flowcharts, provide adequate guidance for performing the analysis. Appendices provide additional guidance for identifying process parameters, initiating events, potential causes of events, estimated event frequencies, unmitigated consequences, events requiring additional analysis, and key assumptions. The analysis technique is based on the process chemical hazard analysis guidelines and uses a generic threshold analysis as the basis for judging the unmitigated consequences of postulated events. Events with consequences that are judged to meet specified criteria consistent with the standards are to be retained for further study in the accident analyses, and potential preventive and mitigative controls identified. Recommendations and key assumptions are to be identified and carried forward so that they will be protected in the continuing analysis and design. The results of the HES are documented in a DAC whose format and content are specified in a procedure appendix.

Contractor personnel developed 14 HESs (13 process evaluations and 1 for the general building) to support the design of the UPF. The initial hazard evaluations were prepared in 2008 at the 30 percent design stage. Preliminary hazard evaluations were prepared in August 2009 and approved in November 2010 to update these evaluations at what was considered to be 70 percent design. Each HES identifies the process sections that are included in the analysis (in tabular format) and contains a summary, scope and process description, methodology, recommendations, key assumptions, and references. An appendix to each HES contains a comprehensive list of the evaluated events, together with qualitative estimates of frequency, unmitigated consequences (based on assumed MAR and interim consequence calculations), and potential controls (both mitigative and preventive). A summary section provides tables to identify the events that should be carried forward to the accident analyses due to potential consequences to the public, collocated workers, or facility workers.

Independent Oversight's review of a sampling of 6 DACs for the preliminary hazard evaluations showed that the evaluations were conducted by multi-disciplinary teams that followed the process in the Y-12 procedures. Each HES contains a table with a comprehensive, detailed list of the potential "what if" events, including the postulated results, major group or parameter involved, a qualitative evaluation of the unmitigated consequences and estimated frequency, potential barriers or controls, and justification notes. Events that should be carried forward to the accident analyses, based on the estimated frequency and consequences, are identified appropriately, along with a table of potential engineering and administrative controls. Each HES indicates that recommendations have been carried over into an integrating preliminary HES; however, the integrating preliminary HES states that no recommendations were recorded and refers to another process-specific document for recommendations on good practices. Key assumptions, generally the MAR in the process, are also identified in the DACs. Although the HESs are extensive and mostly complete, they do not identify the natural phenomena events with unmitigated consequences greater than 5 Rem, which require further analysis. Since the accident analyses do not include these events, appropriate seismic design criteria (SDC) may not be identified for some SSCs that are required to prevent radiological exposures to the collocated worker for natural phenomena events. (See Section 6, **OFI-001**.)

Through Y74-48-009, B&W Y-12 has established a standard process for the systematic evaluation of scenarios carried forward from the HES. Preliminary accident analyses are implemented for new facilities and, as with the hazard evaluations, may be developed using an iterative process to support design. The stated purpose of the accident analysis is to identify administrative and engineered controls for preventing and mitigating risk from the identified hazards. The procedural steps address planning, qualitative analysis, evaluation and design basis events, quantitative analysis, classification and categorization of credited controls, analysis of SSCs and SACs, and documentation. The process involves answering a series of scenario evaluation questions (SEQs) that are applied to combined scenarios, which are grouped into similar events according to instructions in the procedure. The SEQs address radiological and non-radiological consequences that exceed comparison values, challenges to coded vessels, application of the double contingency principle, and scenarios requiring operator action. The objective of the analysis is to identify safety actions (controls) necessary to address the SEQs and establish a minimum set of credited controls. The accident analyses are also expected to identify controls credited in the HES for events carried forward for analysis. Although one of the SEQs addresses criticality controls, a separate nuclear criticality safety process is used to identify the necessary credited criticality controls.

The evaluation and design basis events section in the preliminary accident analysis applies to events that are rated moderate or high in the HES. Events that could potentially cause serious injury to facility workers are also addressed. Per procedure, the accident analysis team leader selects the most limiting scenarios for each type of event for analysis, in order to arrive at a scenario that will yield a bounding set of controls for all similar events. The procedure also specifies that analysis of natural phenomena to identify SSCs with performance categories that should be credited. This includes identifying performance characteristics for SSCs that may interact or interface with other credited SSCs. Quantitative analysis is performed for high and moderate consequence events, beginning with the MAR from the HES and using conservative values for the source term calculation. The result of the calculated source term is compared to the threshold quantities contained in DAC-EF-801768-A025, *Y-12 Generic Threshold Analysis for Use with DOE-STD-1189*, to determine whether detailed quantitative analysis is required; if required, this analysis is performed and documented separately. Two appendices provide guidance for selecting controls and conducting the analysis of the SSCs and SACs to verify their ability to support the required safety function. SACs are to be identified for administrative controls that perform actions that would be safety functions. Administrative controls that are identified as initial conditions and make it unnecessary to identify a safety SSC are also considered for designation as SACs (for example, inventory limits ensuring that MAR is below thresholds). The procedure also specifies that SSCs (such as monitoring equipment) that support an SAC be designated according to the safety function provided by the SAC.

Credited SSCs are identified and their functional classification is determined using procedure Y74-48-006, *System Functional Classification and Natural Phenomena Performance Criteria*.

During review of Y74-48-009, Independent Oversight noted that the instructions for responding to the SEQs provided in Appendix C of the procedure specify that the purpose of the fifth question is to identify initial conditions to "ensure normal operations are conducted within the assumptions made in the accident analysis." The instructions also state that the purpose of question six is to "identify any actions necessary during an event to ensure control area habitability by limiting the control area to the same requirements applicable to the public." Although review of the preliminary accident analyses (discussed further below) revealed that the teams often address the operators' preventive actions in response to question five, the procedural instructions (particularly the restriction of question six to the operators' mitigative actions) do not lead directly to a systematic examination of operator actions that are required to prevent an event. (See Section 6, **OFI-002**.)

Independent Oversight also noted that some of the DACs for consequence analysis will be revised based on recent changes to the parameters and refined distribution modeling used to calculate the release source term limits for some materials. However, the changes to the calculations are not expected to significantly impact the identification and selection of most safety basis hazard controls.

Y74-48-006 supports the safety basis hazard control process by providing instructions for determining the preliminary safety classification and natural phenomena performance criteria for facility SSCs. The procedure provides criteria for evaluating the safety classification using a top-to-bottom format, with the classification assigned based on the first criterion met. SSCs may be designated safety class based on estimated consequences to the public, safety significant (SS) for protection of the public from chemical hazards (or defense-in-depth for radiological hazards), and SS for protection of collocated workers from radiological or chemical hazards or for protection of facility workers from prompt fatality or serious injury. The designation is preliminary, and the results of the process are to be confirmed following final approval of the HES and accident analyses. Criteria for determining the performance criteria for seismic events and other natural phenomena are also provided, including an appendix that ties SDC to the criteria in DOE-STD-1189. The procedure also requires that SSCs be analyzed for adverse interactions with other SSCs (two-over-one) before final classification. Functional classifications are to be documented following the procedure for safety analyses and calculations.

Independent Oversight also reviewed 10 of the 14 preliminary accident analyses that were prepared for the processes and general building functions. The second revisions of these preliminary analyses were based on the preliminary design reflected in the process and instrumentation drawings (P&IDs) revision D/E and were completed and approved in September 2012. The contents of the accident analyses appropriately include the scope of the review (typically a list of the analyzed process sections), a process description, a summary of the HES results, qualitative analysis, and event analysis using the six SEQs. The documents also discuss the design basis accidents selected for the process. It was noted that nuclear criticality safety controls are not part of the accident analyses for specific processes. Criticality safety hazards analysis and the associated control sets are determined using the criticality safety analysis process and defined in separate documents. Consequently, these performance and design requirements may not be integrated and translated to the design and procurement engineers responsible for specific systems or processes, unless they are carefully integrated with the PDSA. Facility-level controls are addressed in DAC-EF-801768-A042, *Preliminary Accident Analysis for UPF General Building (U)*. For the SEQs, the data provided in the accident analyses includes whether the SEQ applies to the worker (facility), onsite (collocated worker), or offsite (public); the safety actions and controls; comments for all the questions; and comments addressing general statements of the identified safety function. Final sections of the reports discuss the functional classification and seismic performance of the credited SSCs, tables of "credited" engineered controls, and tables of programmatic and/or administrative controls. The table of

engineered controls in each report identifies the safety function, functional requirements, supporting SSCs and performance criteria for each selected control. Finally, another table lists the "key assumptions" associated with the accident analyses; most, if not all, are based on calculations in DAC-EF-801768-A024, *Consequence Calculations for the Uranium Processing Facility*. It should be noted that DAC-EF-801768-A024 will need to be revised based on recent commitments addressing material release distribution modeling. These will impact the potential critical values for some materials, as well as determination of the allowed MAR. The MAR quantity is a key assumption for all or nearly all the processes. The analyses are mostly complete, although the table of administrative controls does not currently identify all the necessary SACs. The functional classification and seismic performance section also does not discuss seismic interactions between SSCs, as required by the procedure. Also, the two-over-one criteria is not addressed as a system-specific design requirement. (See Section 6, **OFI-003**.)

Criterion 2: The basis for the design, functional, and performance requirements of selected safety SSCs to prevent or mitigate the postulated accidents is adequately defined and described.

As described above, Independent Oversight reviewed a sample of preliminary HESs and accident analyses and followed the identification of safety basis hazard controls, safety functions, and performance criteria from these documents into the PSDR. The processes selected for review included assembly, disassembly, machining, turnings cleaning and conversion, chemical recovery, and enriched uranium purification and metal production.

Independent Oversight found that in most cases, the results of the preliminary hazard and accident analyses, along with the system classification and functional analyses, were adequately documented in the PSDR and translated appropriately into safety functions, functional criteria, and in most instances, performance criteria. As noted by both the NPO safety basis review team and Independent Oversight, the safety functions, functional criteria, and performance requirements are not yet fully developed at this stage of the project's design (as discussed further below). Site and facility information in the PSDR was complete and available to support ongoing design of safety SSCs; however, the facility is undergoing re-design to ensure that it is large enough to accommodate the required SSCs. This ongoing re-design of the facility footprint (referred to as the "Fit Study") will likely impact at least some of the facility's important safety systems, such as the fire suppression and sprinkler water supply system. The functional classification of most SSCs is consistent with the procedural requirements based on an assessment of the unmitigated consequence analysis. Controls identified in the hazard and accident analyses are accurately carried forward into the PSDR; however, in at least a few instances, MAR controls that were established through recent analyses and documented in the PSDR are not reflected in the underlying hazard and accident analysis documents. General requirements for the SSCs (such as single-point failure and safe failure modes) are specified. Applicable codes and standards have also been identified, but Independent Oversight did not fully review this aspect of the PSDR.

Although the PSDR provides a basis for the design, functional and performance requirements for most of the safety-related SSCs, the NPO safety basis review team and Independent Oversight reviewers identified some weaknesses, as discussed further below. The PSDR lags the project's design status and does not provide a complete definition of the design requirements for all the facility's SSCs. For example, the system-level functional and performance requirements for some SSCs are not always specified (though they may be in development), particularly for support systems, such as the electrical power systems supporting SS SSCs. Also, the PSDR does not provide a comprehensive discussion of the defense-in-depth requirements for the SSCs, and as noted by the NPO safety basis review team, the criticality safety functions require additional analysis. DOE-STD-1189 considers the PSDR to be an evolutionary document that provides a foundation for defining the safety-related design requirements and specifications that must be documented in the PDSA and protected throughout the design, procurement, and construction phases of the project. (See Section 6, **OFI-004**.)

Independent Oversight's review of PSDR revision 1 identified a number of opportunities for improvement to support the ongoing design effort. Independent Oversight provided draft comments to the NPO safety basis review team and discussed them with some members of both the NPO safety basis review team and the contractor's safety organization. Several of Independent Oversight's comments addressed subjects that had been raised previously by the site office safety basis review team during its review of revision 0. Additionally, several of the issues that Independent Oversight identified had been raised in overlapping comments from the site office review team for revision 1. These included:

- Incomplete discussion of the risks and risk mitigation strategies
- Shortcomings in the system level descriptions of safety system support functions, system interactions, and potential failure modes, interlocks, and defense-in-depth
- Lagging development of the preliminary fire hazards analysis (PFHA) to support the PSDR and design

Additional Independent Oversight comments on the PSDR concern the need to:

- Include the safety functions related to seismic interaction in the PSDR and the safety design requirements, particularly those related to two-over-one interactions with safety-related SSCs
- Further evaluate the classification of certain glovebox inerting systems
- Completely document HESs for the 15 MeV x-ray units and any safety-related design requirements
- Clearly describe the controls for "red oil" explosions and appropriately identify the controls that will be SS or defense-in-depth
- Address whether internal flooding has been adequately analyzed to support assumptions in the criticality studies and whether related controls have been appropriately included in the PSDR documented design requirements.

Independent Oversight provided the comments on the PSDR to NPO by separate transmittal. (See Section 6, **OFI-005**.)

Project risks related to safety and associated risk mitigation strategies were not fully incorporated in the PSDR, leading to some uncertainty about the project's processes for ensuring that the final design provides adequately for the identified safety SSCs, their support systems, and safety functions. It will be necessary to carefully manage the design specifications to accommodate the changes resulting from ongoing analysis efforts, re-design, and follow-up actions in response to the PSVR. (See Section 6, **OFI-006**.)

Criterion 3: The functional and performance requirements and the basis for the design associated with fire protection control strategies, source term segregation and containment, and active SSCs are adequately defined, described, and classified.

The content of the PSDR is based on preliminary design input and is intended to evolve to produce the PDSA during the final design phase. Independent Oversight reviewed the functional and performance requirements for the fire protection control strategies that dictate the basis for the system design. During the course of the review, several factors influenced the review of the adequacy of selected fire protection control set strategies. First, a significant revision to the Preliminary Fire Hazard Analysis (PFHA) was issued during the review of the PSDR, the contents of which require review for consistency. Second, the project staff recognized that the UPF building structure could require significant changes that would involve raising the building height and/or changing the building footprint (the Fit Study); the resulting facility reconfiguration will dictate changes to the PSDR as reviewed. Third, DOE Order 420.1C, *Facility Safety*, along with DOE-STD-1066, *Fire Protection*, were formally revised and issued, and they

could affect the design and performance requirements of the fire protection control set as described in the PSDR reviewed by Independent Oversight. Adoption of the new order is to be based on the current level of design maturity as prescribed in DOE Order 420.1C, paragraph 3.c. (9), *Equivalencies and Exemptions*. Independent Oversight's analysis and observations were influenced by these factors. (See Section 6, **OFI-007**.)

With regard to review of safety SSCs, Independent Oversight focused primarily on the fire protection control strategies necessary to prevent and/or mitigate the consequences of postulated accidents at UPF. The fire protection control set consists primarily of a combination of SS and industry-standard fire protection systems and features, including fire-rated, passive fire barriers; active and passive confinement systems; automatic and manual fire detection and alarm systems; active and manual fire suppression systems; and redundant, automatic fire water supply systems. The UPF fire protection water supply consists of a non-SS potable water loop around the UPF building fed from two 2-million-gallon elevated supply tanks that provide water to the Y-12 complex and a SS SDC-3 fire water tank that receives make-up water from the potable water loop. The SS fire water tank is currently defined as requiring a 300,000 gallon water capacity. The tank will be a shared resource for the Highly Enriched Uranium Materials Facility (HEUMF) and UPF. The piping will be arranged to allow HEUMF only the top half of the tank, thereby ensuring UPF a dedicated water supply. The fire protection system (FPS) pressure will be enhanced using two fire pumps: one non-safety electric motor-driven pump and one SS diesel engine-driven fire pump. The electric pump will take suction from the potable water loop and is considered the primary water supply for UPF. The diesel-driven fire pump will be considered the back-up water supply and takes suction from the SS fire water tank.

The SS fire protection control set as described is basically consistent with the logic presented in the PSDR, hazard and accident analyses, and other supporting documents. The functional safety classifications of SSCs are largely consistent with unmitigated accident consequences, but some exceptions were identified. The glovebox inerting systems are not identified as part of the fire protection control set; the inerting systems are not classified as SS but as defense-in-depth, and functional requirements and performance criteria are not described in the PSDR. The PFHA and the SDS document state that inert gas systems are provided for gloveboxes that contain materials capable of self-ignition or materials with deflagration potential, as well as for gloveboxes where criticality safety concerns mandate no sprinklers. For the sprinkler system control to be effective, a fire in the glovebox must compromise the glovebox integrity and spread to the area outside the glovebox. Therefore, unmitigated consequences of a glovebox incipient-fire scenario and impact to the facility worker should be analyzed and applicable glovebox inerting systems classified accordingly. If the inerting system is not credited as a preventive control, it would be assumed to be inoperable and deflagrations or incipient fires would challenge the glovebox integrity; the FPS control is ineffective until the fire spreads outside the glovebox. This condition is contrary to DOE-STD-3009 and the SDS (RP-FS-801768-A003), which prescribes preventive controls before mitigation and safety-engineered controls before administrative controls. (See Section 6, **OFI-008**.)

In most cases, the PSDR clearly identifies functional requirements and performance requirements of credited SSCs. However, Independent Oversight identified some SSCs that were not completely addressed. For example, the SS pump house, which houses the SS diesel pump that draws water from the SS fire water tank, is not identified as a safety SSC, and its performance and design criteria are not identified; further, the PSDR identifies natural phenomena hazards for all buildings to support the design at UPF, except for this pump house. Additionally, freeze protection for the fire water supply tank is not completely addressed in the performance requirements in the PSDR, contrary to the PFHA requirement stating that the water storage tank will be protected from freezing, in accordance with National Fire Protection Association (NFPA) 22 requirements, by insulation and a water recirculation system. The PFHA notes that the pump house will be protected by a permanent heater unit and a room low-

temperature alarm as required by NFPA 22, Section 16.1.2.2, and the *Implementation Plan for DNFSB* 2008-1. The PSDR performance requirements should specify these criteria. The project has chosen to rely on, and only credit, the low-temperature alarm. This current control strategy relies on an administrative control rather than on engineered controls as prescribed by DOE-STD-3009 and the project's SDS. Contrary to requirements, the freeze protection systems and electric power for the freeze protection system components are not classified at the same level as the safety sprinkler system. (See Section 6, **OFI-009**.)

Additionally, the PSDR identifies SSCs of lesser seismic design criteria that will be located near the FPS. For example, the active confinement ventilation systems are designed to SDC-1 criteria, with Zone 1B designed to SDC-2 criteria. The FPS is designed to SDC-3 criteria. The performance criteria for the confinement systems and other potential sources in the process and utility systems do not specify that two-over-one system interaction criteria shall be met so as not to adversely impact the FPS safety function. Two-over-one system interaction performance criteria are not uniquely identified in the safety basis for relevant systems, and this design performance requirement is not in the relevant sections and listed in the appropriate tables in the PSDR. (See Section 6, **OFI-003**.)

In some cases, safety system boundaries are not clearly identified in the PSDR. For example, the UPF sprinkler water supply system is designed to meet SDC-3, Limit State D seismic criteria. The HEUMF diesel-driven fire pump draws water from the UPF water supply tank, and since the HEUMF fire protection system is designed to SDC-1 (Performance Category-1) criteria, seismic isolation is necessary – but is not specified – between the differing seismic design boundaries for the UPF facility's FPS interface. Portions of the HEUMF FPS will be required to be SDC-3 in order to avoid an adverse interaction. Additionally, system boundaries are not clearly identified for the FPS, the sprinkler water supply system, and the SS UPF diesel pump and supply tank. (See Section 6, **OFI-010**.)

Some safety SSCs identified in the PSDR rely on support systems not classified as safety related to perform or maintain safety functions, and in some cases these interfacing systems could affect the performance of safety SSCs. For example, the backup power supplies to several safety related process and support system circuits and interlocks are not classified as SS. Also, the PSDR does not address the electrical power requirements for the Safety Detection and Response System and the SS SSCs in the process systems and does not discuss instrumentation and control interfaces between the Safety Detection and Response System and the safety-related functions in the process systems. Further, the PSDR does not comprehensively identify backup or stand-by power requirements and capability for all the systems. Similarly, other system backup power requirements that would be necessary after an earthquake, such as confinement system exhaust to maintain negative pressure in gloveboxes, are not adequately addressed. Although not required by the current FPS safety classification, provision of SS power to the FPS electric motor-driven booster pump would provide a robust design to meet the project's commitment to apply single-failure criteria to achieve sufficient reliability. The PDSA should clearly document the power needs and backup capabilities for all required or credited systems. (See Section 6, **OFI-009**.)

In another case, the description of the HEUMF and UPF diesel-driven fire pumps in the PFHA is not consistent with the description in the PSDR. The PFHA states that each SS UPF and HEUMF diesel-driven fire pump is required to supply 1500 gallons per minute at 95 pounds per square inch and that the design provides for the HEUMF diesel fire pump to serve in a redundant fashion, with provisions for accommodating emergency hose usage. It further states that if the UPF pump fails, the HEUMF pump can be redirected to serve either facility or UPF alone, until the UPF pump can be returned to service. The PSDR does not discuss this scenario and does not recognize the fact that the tank volume dedicated to the HEUMF pump (top part of tank) would have to supply both facilities. (See Section 6, **OFI-011**.)

Criterion 4: The SACs are adequate to prevent or mitigate the hazards/accidents for which they were identified, and the safety document satisfactorily provides the rationale and basis for determining the safety SACs and their required functions.

The PSDR includes eight SACs, which generally are limits on MAR or material form. These SACs are included in Chapter 4 of the PSDR, and the safety functions, functional requirements, and performance requirements are identified. Considering the current status of the design, relatively few SACs, other than those related to protection of the MAR and MAQ assumptions have been developed. Supporting limiting conditions for operation (LCOs), technical safety requirements (TSRs), and measurement and safety related support programs have not yet been fully described. Given the early stage of maturity of design, Independent Oversight did not perform a detailed review of the SACs in the PSDR; additional SACs and LCOs will need to be developed to support the design as part of the PDSA.

Criterion 5: Implementation of site office procedures and processes leads to an effective review, which includes an appropriate degree of rigor, resolution of identified issues, and proper documentation. The PSVR provides adequate justification that the commitments made in the PSDR and design documents would result in a final design that could be approved for operation without major changes.

YSO-5.20, *Review of Safety Basis Documentation*, establishes appropriate instructions for performing and documenting the technical review of safety basis documents for Y-12 facilities. The latest revision incorporates changes to address DOE-STD-1189 and DOE-STD-1104, as well as DOE Order 413.3. The Site Office Manager (NPO Manager) is designated the Safety Basis Approval Authority and is responsible, among other things, for the independence of the review team from the line management of the facility or preparation of the documents being reviewed. The Assistant Manager for Engineering, Safety, and Environment has overall responsibility for the review and acts as the contracting officer's representative in this area. The procedure identifies the responsibilities of the review team leader and reviewers, including preparation of safety evaluation reports and safety validation reports, as appropriate. The procedure also addresses the responsibilities of the Federal project director, who reviews and concurs on the PSVR for the PSDR. The procedure's General Guidance section addresses the purpose, scope, and timing of the preliminary safety documents, including the SDS and PSDR. The procedure provides general guidance for the team members on approaching the review; for example, safety system oversight engineers focus on systems and processes, and Facility Representatives focus on operational concerns. Detailed instructions provide adequate guidance for conducting and documenting the review, including evaluation and consolidation of identified issues. Attachments provide additional instructions for preparing the safety validation report and describe how to manage issues identified during the review, recording significant or important issues or document enhancements on a comment form that generally follows the approach in DOE-STD-1104. Conditions of approval (COAs) are to be tracked in Pegasus, the site office corrective action management and tracking system. The procedure also provides standard formats for the review plan and the safety report. Overall, the guidance in Attachment 3 of the procedure provides a sound approach for classifying and documenting issues. One expectation is to accept the results of previous reviews unless "clear and significant deficiencies" are identified. Independent Oversight noted that the procedure has not been updated to reflect the reorganization of the site office and transition to the NPO. (See Section 6, **OFI-012**.)

Revision 0 of the PSDR was submitted for review in July 2011. The UPF Federal project team provided draft comments to B&W Y-12 in November 2011 and final comments in January 2012. Revision 0 received a large number of "significant" and "important" comments, requiring a revision to the PSDR. The site office and the contractor reviewed the comments and agreed on the specific comments that would be addressed in revision 1. Revision 1 of the PSDR, which incorporates the resolution of those

comments, was submitted for review in September 2011, along with a comment resolution matrix from the contractor that outlined the resolution of those comments affected by the revision.

NPO developed a review plan, *The National Nuclear Security Administration Production Office (NPO) Y-12 Uranium Processing Facility Preliminary Safety Design Report Rev. 1 Review Plan*, to govern the conduct of the PSDR review and preparation of the PSVR. The scope of the PSDR review included the supporting documents and comment incorporation since the initial submittal, and reviewers were directed to focus on the "significant" issues and changes from revision 0. The plan outlined the potential decision options regarding the PSVR as one of the following:

- A - Approve the PSDR with or without COAs.
- B - Significant issues can be resolved with document change notices to the PSDR, with a single PSVR to address the revision and the change notices.
- C - Significant issues exist, warranting a full revision of the PDSR document before approval.

The plan addressed the need to modify the schedule for the PSVR based on whether decision A, B, or C was reached. The team of independent, qualified reviewers, primarily from the NPO Y-12 office, included a number of members who had participated in the review of revision 0 of the PSDR and thus retained significant continuity in evaluating the effectiveness of B&W Y-12 actions to address the original set of comments.

Independent Oversight concluded that the scope of the review, which was based on the results of the review of the PSDR revision 0 and the continuity of the review team members, was adequate for the review of the revised PSDR. The review plan included an approach that specified what would be assessed and the assessment methods. The plan also adequately addressed review and closure of previously identified issues in the PSDR submittal. For the most part, team members were appropriately independent of the project line management.

In the PSVR, the NPO review team concluded that the PSDR warranted approval and identified eleven conditions for proceeding to the next stage of the design. These conditions, which are expected to require some refinement of the safety basis hazard controls, include:

- Improvement of the nuclear criticality analyses
- Revision of the SDS to be consistent with the PSDR approach to control schemes to protect workers from explosions
- Revision of the PFHA to evaluate large building fires
- Modification of some safety controls and/or functional requirements
- Resolution of the currently identified design and operational improvements in the PSDR.

The NPO review team also noted that the system evaluation section for the identified controls was not as mature as the design and concluded that in many cases the interface design "still needs to be evaluated." The PSVR appropriately identifies those conditions that are to be addressed through revision of the SDS (by May 31, 2013) and those to be included in the PDSA.

Independent Oversight's discussions with some of the review team members and review of the final PSVR and review team comments showed that the review was conducted in accordance with the review plan. The results of the review are properly described in the PSVR, and the conclusions are supported by the discussion in the report. The degree of rigor applied to the review was appropriate, and overall the identified issues are properly categorized using the site criteria. Team members' comments demonstrated their technical expertise and qualifications for the assigned areas of review. As noted above, the NPO

review team concluded that the additional actions/commitments identified in the PSVR, together with those in the PSDR and design documents, would result in a final design (and a constructed facility) that could be approved for operation without major changes.

5.0 CONCLUSIONS

B&W Y-12 has established and implemented processes for conducting hazard and accident analyses and for preparing the PSDR. For the most part, these processes appropriately incorporate safe harbor methodologies for conducting the analyses and translating the results into a set of safety basis hazard controls. The PSDR follows the format provided in the standard and adequately describes the facility and the planned processes. Hazard controls are identified, and most are described in a level of detail sufficient to support ongoing design activities.

Nonetheless, additional studies and hazard analyses that must be completed or updated are not fully identified in the PSDR. The modifications to the facility footprint to accommodate the intended processes will result in additional changes to some SSC and SAC requirements and specifications. Deferment of scope with the modified funding profile will also impact the design and some aspects of the hazard control requirements. Inconsistencies were identified in the PSDR document in that some sections appropriately incorporated changes resulting from update of some analyses and calculations, but other sections failed to incorporate those same changes, which will need to be included in the PDSA.

NPO has procedures in place that provide adequate instruction to guide the review process for the PSDR and other safety basis documents. The NPO safety basis review team completed a review of the PSDR following an appropriately detailed plan. The PSVR adequately describes the results of the review and provides sufficient documentation to support its conclusions. As noted in the PSVR, the PSDR – which is intended to define leading design requirements – has a number of weaknesses that must be addressed in the near future to ensure that safety functions are sufficiently integrated into the facility's design. Specifically, the NPO review team recommended approval of the PSDR and identified eleven conditions that must be met before proceeding to the next stage of design.

Independent Oversight concurs with the overall conclusion of the NPO safety basis review team and acknowledges the decision to move toward completing the PDSA subject to specific conditions for proceeding to the next stage of design. The resolution of the conditions will require continued management attention to ensure that they are resolved in a timely, effective manner. Clear definition of the safety functions and performance requirements of SSCs is a fundamental starting point for project development and for integration of safety into the design. Currently, the PSDR and supporting hazard analysis sometimes do not appropriately lead the design specification, thereby complicating the identification of design requirements and translation of those requirements into design criteria and specifications. The completion of outstanding analyses and actions to address the conditions in the PSVR should be carefully managed so that safety classification, functional requirements, and performance criteria for all safety systems are fully and clearly specified. The configuration management processes associated with the design requirements should protect the functional requirements and performance criteria and ensure accurate transmittal to the project's engineers throughout the design, procurement, and construction phases of the project. It will be beneficial to establish a mechanism to track and manage minor revisions or change notices to supporting hazards analysis and safety basis configuration as the PDSA is developed and approved. An integrated schedule that clearly sequences facility and SSC performance requirements with other aspects of the design, defines deliverables, and designates interim reviews and approvals as the safety analyses and design progress toward the PDSA and CD 3 would be useful. It is important that the project address all the deficiencies noted in the review of the PSDR; provide timely, accurate updates to the nuclear safety design requirements; and achieve full maturity of

design requirements in the PDSA to integrate safety into design before CD 3 approval.

6.0 OPPORTUNITIES FOR IMPROVEMENT

During the review, Independent Oversight identified several issues, which are characterized as OFIs. According to Independent Oversight protocols, OFIs "are suggestions offered by the Independent Oversight appraisal team that may assist line management in identifying options and potential solutions to various issues identified during the conduct of the appraisal." OFIs are not mandatory and do not require formal resolution by management through the corrective action process, but should be evaluated and resolved in accordance with NPO processes.

The OFIs identified during the review are annotated in the report by number following the paragraph in which they are discussed (for example, OFI-001).

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OFI-001: To ensure that natural phenomena performance criteria are accurately assessed for SSCs that provide preventive or mitigative safety functions, ensure that natural phenomena events with estimated doses to collocated workers greater than 5 Rem are carried forward from the HES into the accident analysis.

OFI-002: To identify operator actions that are required for prevention of events with unmitigated consequences exceeding the evaluation guidelines, consider revising the accident analysis procedure to include an evaluation of the operators' preventive actions (along with mitigative actions).

OFI-003: To integrate safety with design, clearly specify the requirements of the two-over-one criteria related to seismic interaction of lower categorized systems with safety SSCs, and protect those requirements throughout the design, acquisition, and construction phases of the project. Clearly state these requirements for each system in appropriate design documents and subsequently in the PDSA.

OFI-004: To ensure that the PDSA serves as design leading safety requirements documents and to support the integration of safety into design, open actions and the conditions for proceeding with the next stage of design should be carefully managed so that the safety classification, functional requirements, and performance criteria for all facility SSCs are protected throughout the design, acquisition, and construction phases of the project and are clearly articulated and incorporated in the PDSA.

OFI-005: Evaluate the open comments from the HSS independent reviews of the PSDR and ensure that each one is managed in interim documentation, supporting hazard analyses, and associated design requirements documents, and satisfactorily addressed before approval of the PDSA. (Note: HSS comments were provided to NPO via a separate transmittal)

OFI-006: To ensure that open items that could affect safety basis hazard controls are tracked to closure and that changes in design requirements are provided to the design team in a timely manner, continue to identify issues requiring tracking, initiate necessary changes to the safety design requirements, and post these changes to the design requirements DAC.

OFI-007: Consider adopting the newly revised order DOE Order 420.1C, *Facility Safety*, and the associated standard, DOE-STD-1066, *Fire Protection*, on a timely basis since safety must be integrated into the design early and throughout the design process consistent with DOE-STD-1189.

OFI-008: Evaluate whether to classify certain glovebox inerting systems and the supporting instrumentation and controls as SS as part of the fire prevention strategy.

OFI-009: Continue to evaluate the support systems necessary for the function of SS SSCs and identify them as SS, when appropriate. Identify the resulting design and performance requirements in the design requirements documents and PDSA to ensure protection throughout the design, acquisition, and construction phases of the project.

OFI-010: Clearly define the system boundaries and interfaces of safety SSC to ensure proper classification of supporting or interfaced and segregating components.

OFI-011: Review the PFHA and PSDR for consistency and ensure that PFHA development is synchronized with safety basis development (PDSA and later DSA) so that the documented safety controls and interfacing systems identified in both documents have been considered and are consistent in the final safety basis documents.

NNSA Production Office

OFI-012: Update YSO procedures (5.20 and others) to address the reorganization of the site office and the revised roles, responsibilities, accountabilities, and authorities.

7.0 ITEMS FOR FOLLOW-UP

As noted by the NPO safety basis review team that prepared the COAs for the PSVR, significant open items remain in the PSDR and supporting documents that reflect the current uncertainty or lack of maturity of the design. Also, some comments identified as significant or important during the review of PSDR revision 0 and carried through to revision 1 remain open and require resolution, as well as open items and analyses identified in the PSDR. Careful management of these open items necessitates a comprehensive system for tracking and addressing these issues, along with a process (directed by the integrated project team) for detailed technical review and approved disposition of these issues. The NPO safety basis team should establish and maintain a schedule for reviewing and commenting on the resolution of these issues and ensuring that they are appropriately translated into the draft PDSA. The PSDR is intended to be an evolutionary document that leads the maturity of the design until the PDSA is reached. Independent Oversight will monitor the process by which the open items are managed and addressed in order to verify that modifications to the PSDR, supporting documents, and associated design requirements documents are made in a timely manner to support design activities and approval of the PDSA.

Independent Oversight will also continue to actively track the developments and perform intermediate reviews as appropriate to monitor progress. Follow-up activities may include monitoring and review of some of the following:

- Resolution of the planned actions and future improvements and conditions for proceeding with the next stage of design
- Resolution of Independent Oversight's comments on the PSDR
- Review and revision of the PFHA and resulting modifications to the PSDR and supporting documentation
- Project design criteria and configuration management of the design criteria documents during the interim period to approval of the PDSA

- Review of the translation of PSDR and design criteria requirements into preliminary engineering design output documents prior to CD 2 approval
- Integration of quality assurance and quality control activities into the design, procurement, and construction processes.

Appendix A
Supplemental Information

Dates of Review

Onsite Review: October 15-19, 2012
October 22-26, 2012
December 4-5, 2012

Office of Health, Safety and Security Management

Glenn S. Podonsky, Chief Health, Safety and Security Officer
William A. Eckroade, Principal Deputy Chief for Mission Support Operations
John S. Boulden III, Director, Office of Enforcement and Oversight
Thomas R. Staker, Deputy Director for Oversight
William E. Miller, Deputy Director, Office of Safety and Emergency Management Evaluations

Quality Review Board

William Eckroade
John Boulden
Thomas Staker
William Miller
Michael Kilpatrick
George Armstrong
Robert Nelson

Independent Oversight Site Lead

Timothy Mengers

Independent Oversight Reviewers

Timothy Mengers – Lead
David Odland
Joseph Panchison

Appendix B
Documents Reviewed and Meetings/Interviews

Documents Reviewed

- DAC-EF-801768-A014, Preliminary Hazard Evaluation Study for Turnings Cleaning and Conversion (U), Rev. 0, 11/10
- DAC-EF-801768-A015, Preliminary Hazard Evaluation Study for Special Oxide Production (U), Rev. 0, 11/10
- DAC-EF-801768-A020, Preliminary Hazard Evaluation Study for Chemical Recovery (U), Rev. 0, 11/10
- DAC-EF-801768-A021, Preliminary Hazard Evaluation Study for EUPMP (U), Rev. 0, 11/10
- DAC-EF-801768-A022, Preliminary Hazard Evaluation Study for SDOR (U), Rev. 0, 11/10
- DAC-EF-801768-A024, Consequence Calculations for the Uranium Processing Facility (U), Rev. 0, 3/10
- DAC-EF-801768-A024, Consequence Calculations for the Uranium Processing Facility, Rev. 0, 3/10
- DAC-EF-801768-A028, Integrating Preliminary Hazard Evaluation Study for UPF (U), Rev. 0, 11/10
- DAC-EF-801768-A029, Preliminary Accident Analysis for Assembly (U), Rev. 2, 9/12
- DAC-EF-801768-A030, Preliminary Accident Analysis for Disassembly (U), Rev. 2, 9/12
- DAC-EF-801768-A032, Preliminary Accident Analysis for Machining (U), Rev. 2, 9/12
- DAC-EF-801768-A033, Preliminary Accident Analysis for Turnings Cleaning and Conversion (U), Rev. 2, 9/12
- DAC-EF-801768-A034, Preliminary Accident Analysis for Special Oxide Production (U), Rev. 2, 9/12
- DAC-EF-801768-A036, Preliminary Accident Analysis for Casting (U), Rev. 2, 9/12
- DAC-EF-801768-A037, Preliminary Accident Analysis for Rolling and Forming (U), Rev. 2, 9/12
- DAC-EF-801768-A039, Preliminary Accident Analysis for Chemical Recovery (U), Rev. 2, 9/12
- DAC-EF-801768-A040, Preliminary Accident Analysis for EUPMP (U), Rev. 2, 9/12
- DAC-EF-801768-A041, Preliminary Accident Analysis for SDOR (U), Rev. 2, 9/12
- DAC-EF-801768-A046, Calculation of the Maximum Possible Fire Loss (U),Rev.0, 6/11
- DAC-EZ-801768-A094, UPF Fire Main System Design and Hydraulic Analysis for the East Riser Supplied by the Diesel Fire Water Pump (U), Rev. A, 10/09
- DAC-F000Y12-F-0005, Technical Basis for Atmospheric Dispersion Using MACCS2, Rev. 0, 2/12
- DAC-FS-900000-A020, ICRP72 Dose Conversion Factors for Selected Isotopes (U), Rev. 0, 4/07
- DAC-FS-900000-A025, Y-12 Generic Threshold Analysis for Use with DOE-STD-1189, Rev. 5, 5/12
- DE-PE-801768-A025, UPF Fire Protection Design Criteria (U), Rev. 3, 12/11
- DE-PE-801768-A036, UPF Fire Protection Services Design Criteria (U), Rev. 3, 12/11
- FH-EF-801768-A001, Preliminary Fire Hazard Analysis of Building 9226, Uranium Processing Facility, Rev. 1, 6/11
- FH-EF-801768-A001, Preliminary Fire Hazard Analysis of Building 9226, Uranium Processing Facility, Rev. 2, 10/12
- National Nuclear Security Administration Production Office (NPO) Y-12 Uranium Processing Facility Preliminary Safety Design Report Rev. 1 Review Plan, 9/12
- OT-EF-801768-A001, Y-12 Site Office Comments on the Uranium Processing Facility Preliminary Safety Design Report (U), Rev. 0, 9/12
- RP-EF-801768-A003, Post-Seismic Evaluation Report (O), Rev 0, 1/11
- RP-EF-801768-A004, Preliminary Safety Design Report for the Uranium Processing Facility (U), Rev. 1, 9/12

- RP-EZ-801768-A007, Fire Protection Methods in Uranium Processing Facility Gloveboxes (U), Rev. 0, 6/11
- RP-EN-801768-A008, Criticality Review Report for the UPF, Rev. 0, 6/11
- RP-EZ-801768-A018, Fire Assessment Guidance for NCS Credited Components (U), Rev. 0, 8/12
- RP-EZ-801768-A022, Post-Seismic Fire and Sprinkler Head Operation (U), Rev. 0 8/12
- RP-EZ-801768-A023, UPF Construction and Fire Barriers (U), Rev. 0, 8/12
- RP-FS-801768-A003, Safety Design Strategy for the Uranium Processing Facility (O), Rev. 4, 6/11
- Technical Independent Project Review (TIPR) Final Report Uranium Processing Facility (UPF) Y-12 National Security Complex (Y-12) June 18-22, 2012, 9/12
- Y/FSD-17, Y-12 National Security Complex Safety Analysis Report, Rev. 6, 10/10
- Y74-48-006, System Functional Classification and Natural Phenomena Performance Criteria, 1/20/11
- Y74-48-007, Hazard Identification and Screening to Support Development of a Hazard Evaluation Study, 1/10/12
- Y74-48-008, Hazard Evaluation Study, 1/10/12
- Y74-48-009, Accident Analysis, 1/10/12
- Y75-121, Radiation Generating Devices, 12/10
- YSO-5.20, Review of Safety Basis Documentation, Rev. 6, 9/10
- YSO-5.20-6.2.2.2, Review and Comment Resolution Sheet, 3/09

Meetings/Interviews

- NPO Safety Basis Review Team Members
- B&W Y-12 Nuclear Safety Personnel