Independent Oversight
Assessment of Nuclear Safety Culture
and Management of Nuclear Safety Concerns
at the

Hanford Site Waste Treatment and Immobilization Plant

January 2012

Office of Enforcement and Oversight
Office of Health, Safety and Security
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HSS
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Abbreviations Used in This Report

BNI	*Bechtel National, Incorporated*
CFR	*Code of Federal Regulations*
DNFSB	*Defense Nuclear Facilities Safety Board*
DOE	*U.S. Department of Energy*
DOE-WTP	*DOE WTP Project Office*
DPO	*Differing Professional Opinion*
DSA	*Documented Safety Analysis*
ECP	*Employee Concerns Program*
EM	*Office of Environmental Management*
EM-1	*Assistant Secretary for Environmental Management*
E&NS	*Environmental and Nuclear Safety*
FPD	*Federal Project Director*
FRA	*Functions, Responsibilities, and Authorities*
HPA	*Human Performance Analysis Corporation*
HSS	*Office of Health, Safety and Security*
K-MR	*K-Management Resources*
LAW	*Low Activity Waste*
M3	*Pulse Jet Mixing Design Issue*
NRC	*U.S. Nuclear Regulatory Commission*
NSD	*ORP Nuclear Safety Division*
NSQC	*Nuclear Safety and Quality Culture*
NSQI	*Nuclear Safety and Quality Imperative*
ORP	*Office of River Protection*
PDSA	*Preliminary Documented Safety Analysis*
PEP	*Project Execution Plan*
PIER	*Project Issue Evaluation Report*
QA	*Quality Assurance*
RL	*Richland Operations Office*
SCWE	*Safety Conscious Work Environment*
SSC	*Structures, Systems, and Components*
URS	*URS Corporation*
WRPS	*Washington River Protection Solutions*
WTP	*Waste Treatment and Immobilization Plant*

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Executive Summary

The U.S. Department of Energy (DOE) Office of Enforcement and Oversight (Independent Oversight), within the Office of Health, Safety and Security (HSS), conducted an independent assessment of nuclear safety culture[1] and management of nuclear safety concerns at the DOE Waste Treatment and Immobilization Plant (WTP). The assessment focused on the DOE organizations with site-level line management responsibility for WTP – the Office of River Protection (ORP) and the DOE WTP Project Office (DOE-WTP) – and the site contractor – Bechtel National, Incorporated (BNI), including its subcontractors.

This assessment provides DOE management with a follow-up on the October 2010 HSS review of the WTP nuclear safety culture, including a mature and effective safety conscious work environment (SCWE).[2] It also satisfies a Secretarial commitment to the Defense Nuclear Facilities Safety Board (DNFSB) related to DNFSB Recommendation 2011-1, *Safety Culture at the Waste Treatment and Immobilization Plant*. HSS accelerated the schedule for the follow-up assessment in response to a request from the Acting Assistant Secretary for Environmental Management (EM) in an August 2011 letter, citing the serious concerns that had been raised about the safety culture at WTP. As part of a broad extent-of-condition assessment (to start following this assessment) and based on the results of this assessment, the HSS Independent Oversight team will more fully evaluate DOE Headquarters organizations to gather additional information about the role of Headquarters line management organizations in safety culture and management of safety issues at WTP.

WTP is DOE's largest ongoing design and construction project, with an estimated cost of over $12 billion and a current workforce of about 3000, and plans to transition to an operating nuclear facility in 2019.

Although WTP is not yet processing radioactive materials, WTP personnel are currently making design decisions and developing a safety basis to demonstrate that the WTP can be operated safely, and WTP personnel are also procuring, installing, and constructing systems, structures, and components that will be relied on for safe operation of an extraordinarily complex set of nuclear facilities. If these functions are not performed correctly and with high standards of quality, the safety of the WTP could be compromised during future operations by latent failures in design or safety analysis or in the installed systems, structures, and components. Therefore, a healthy nuclear safety culture, one in which employees feel empowered to raise safety questions without fear of retaliation, is essential at WTP during the current

1 While there are various safety culture models, the definition used in the Energy Facility Contractors Group report, which was accepted by the Deputy Secretary and referenced in the DOE Integrated Safety Management Guide is: An organization's values and behaviors modeled by its leaders and internalized by its members, which serve to make safe performance of work the overriding priority to protect workers, the public, and the environment.

2 A SCWE can be characterized as an environment in which employees are encouraged and are willing to raise safety concerns both to their own management and to DOE without fear of retaliation.

design and construction phase, as well as for the future operational phase. An effective nuclear safety culture is also important in light of various allegations and reviews in recent years, including a 2010 whistleblower event (questioning the safety of the design and alleging retaliation), another whistleblower revelation/event in late 2011, a subsequent allegation of retaliation by a BNI manager, and a differing professional opinion filed by an ORP staff member.

Senior DOE management has recently taken visible actions in support of a healthy safety culture. The Secretary of Energy and the Deputy Secretary of Energy issued a memorandum on December 5, 2011, on nuclear safety at DOE, which emphasized DOE expectations for a healthy safety culture. The Deputy Secretary of Energy visited WTP in July 2011 and emphasized the importance of safety, a questioning culture, and freedom to raise safety concerns without fear of retribution.

Safety Culture

To ensure a valid and effective assessment of the existing safety culture, HSS engaged external independent safety culture experts[3] with extensive experience and expertise in safety culture reviews to help plan and collect data during onsite activities (briefings, individual and focus group interviews, etc.) to supplement and complement the nuclear safety expertise of its staff. These external independent safety culture experts analyzed the data collected in accordance with established methods using a framework described by the U.S. Nuclear Regulatory Commission and provided their independent external assessment of the safety culture at WTP, which is summarized in Section 2 and provided in its entirety in the supplemental volume to this report as Appendix A. Some of the key conclusions of the report focus on the willingness of employees to raise concerns, which is an area of particular management focus in light of the 2010 whistleblower allegations, the recent DNFSB recommendation, and the Secretary's recent memorandum on nuclear safety that encourages raising issues and emphasizes that retaliation against individuals is prohibited by law and DOE policy.

While there is no fear of retaliation in the ORP (including DOE-WTP) work environment, there is a definite unwillingness and uncertainty among employees about the ability to openly challenge management decisions. There are definite perceptions that there is not an environment conducive to raising concerns or where management wants or willingly listens to concerns. Most employees also believe that constructive criticism is not encouraged.

The willingness to raise concerns and issues across the BNI organization needs to be improved to ensure that the organization is preventing events and learning from its performance. Fear of retaliation was identified in some groups as inhibiting the identification of problems. While the HSS Independent Oversight team did not hear many direct references to the 2010 whistleblower event, the event is well known among WTP personnel, and there were some indications that the whistleblower event may still be at a level of awareness that is contributing to the other indicators surrounding the reluctance to identify problems or raise concerns. Employee engagement, particularly at lower levels of the organization, would facilitate the involvement of these groups in resolving such issues and could ultimately mitigate this perception.

3 While HSS does not normally advocate the use of the term "experts" in its oversight reports, in this case, HSS engaged the services of internationally recognized experts in safety culture evaluations. Section 6 provides information about the expert qualifications of the company and individuals used by HSS to provide perspectives on the safety culture at WTP.

The organizational separation of the DOE-WTP organization from the rest of the ORP organization has created difficulties in the communication, coordination, and cohesiveness of the implementation of DOE requirements and oversight of BNI. Questions concerning how DOE-WTP is managing the project, what impact their decisions are having on the project, who is in control of the project, and ultimately who will deliver the project remain unanswered for many of ORP's employees and stakeholders.

The external independent safety culture experts determined that BNI needs to be more forthcoming in its transparency with its employees and the public for trust to improve. While BNI acknowledges that it is dealing with significant issues, various employees and stakeholders indicated that these issues are communicated in a way that diminishes their importance, contributing to a lack of trust and the perception of denial by those involved with the organization.

The external independent safety culture experts recognize that ORP and BNI are making efforts to resolve many of the technical issues that encumber the WTP Project and that these activities are taking place under intense scrutiny by numerous stakeholders and external organizations. However, more consideration of organizational and cultural considerations could facilitate the project's forward movement and make ORP's and BNI's efforts more successful. Achieving the needed changes will also depend on ORP, DOE-WTP, and BNI establishing, implementing, and expecting consistent standards and devoting more effort to behavioral change to ensure that the traits and behaviors of a healthy safety culture become the accepted way of doing business.

ORP Management of Safety Concerns

In its 2010 safety culture review report, HSS recommended that ORP "institutionalize the processes and formally define the roles and responsibilities and clarify interfaces between the WTP Federal organization and the other ORP organizations." Since then, ORP has taken several actions, including submitting a proposed revision to the WTP Project Execution Plan to DOE Headquarters in July 2011 that defined the roles and reporting relationships of DOE-WTP and ORP support organizations. The revised plan has not yet been formally approved, but most of the proposed changes to the PEP are being implemented in practice.

Some aspects of the ORP and DOE-WTP issues management processes are functioning effectively. ORP and DOE-WTP personnel have appropriate mechanisms for the Federal staff to raise safety concerns, such as the employee concerns program and differing professional opinion program. Several ORP reviews have been effective in identifying deficiencies in WTP design products and in identifying vulnerabilities that could impact the future operability of waste treatment facilities. ORP has also critically reviewed the corrective action plans proposed by BNI to address design deficiencies.

Although progress has been made, increased attention and further improvement are needed in a number of areas. Internal assessments performed by ORP quality assurance (QA) and DOE-WTP line organizations over the past two years have identified continuing weaknesses in ORP action item tracking and the management of corrective actions. A particular concern is that ORP and DOE-WTP have not established an effective approach for systematically tracking and validating corrective actions taken to enhance safety culture at the site level, therefore limiting the ability of EM or senior DOE management to ensure tracking and validation of corrective actions; tracking and validation constitute one of DOE's commitments in the June 30, 2011, letter from the Secretary of Energy to the DNFSB in which DOE

accepted DNFSB Recommendation 2011-1. Another concern is that management expectations regarding safety culture have not been formally communicated to the Federal staff through a policy statement or programmatic requirements, and safety culture training has not been provided to the staff. Improvements are also needed in the ORP Safety Management Functions, Responsibilities and Authorities (FRA), which was revised in September 2011. This document now appropriately addresses DOE-WTP but does not sufficiently define certain responsibilities and authorities, such as the organizational authority to approve documented safety analyses (DSAs).

BNI Management of Safety Concerns

BNI has taken many actions to address the specific recommendations in the 2010 HSS safety culture report. For example, BNI enhanced new employee orientation and continuing general employee training on issue identification and resolution and took several actions to improve issues management processes. However, BNI management did not adequately evaluate the significance of the collective safety culture issues documented by the DNFSB, the 2010 HSS report, BNI internal reviews, and other external assessments.

The WTP issues management processes, when implemented properly, can be effective tools for identifying and resolving safety issues. The corrective action management system uses the Project Issue Evaluation Report (PIER) form to document issues and initiate the process for evaluating, correcting, documenting, and verifying the resolution of the issues. A strength of this process is the application of PIERs to opportunities for improvement as well as violations. The Engineering Technical Issues Identification Management Guide was significantly enhanced in a March 2011 revision. The HSS Independent Oversight team's review of selected technical issues and tracking systems indicates that processes were appropriately implemented and progress is being made to resolve the numerous open technical issues, although significant work remains. If not satisfied with the issues management processes, BNI employees can report formal employee concerns to the BNI or DOE employee concerns programs, or they can use the differing professional opinion process.

However, issues are often not managed effectively to resolution at WTP because of inadequate implementation of the processes. In some cases, safety issues at WTP are not documented in the PIER system, are improperly categorized for significance, are inadequately analyzed for causes, or are not resolved with effective corrective and preventive actions. Although most investigations have been thorough, some process and implementation weaknesses were evident in the employee concerns and differing professional opinion programs. There are instances where ineffective implementation of the issues management process specifically contributed to issues with the project's safety culture. For example, WTP staff, management, and senior managers were unable to effectively execute a timely causal analysis for a PIER issued in October 2010 related to nuclear safety analysis. Senior BNI management was informed about the difficulties in completing the causal analysis and resolving this PIER before July 2011 but did not achieve resolution of the issues, and the root cause analysis was never finalized. The PIER was not resolved until BNI was prompted by formal DOE requests, which led to development of an Integrated Licensing Strategy that addresses the applicability of DOE-STD-3009-94, *Preparation Guide for U.S. Department of Energy Nonreactor Nuclear Facility Safety Analysis*. The PIER was subsequently downgraded to a Level B PIER, and a more limited apparent-cause analysis was completed and approved. Interviews with BNI staff revealed that this extended, contentious, and poorly managed

causal analysis activity resulted in strong negative feelings among personnel in several groups, and it did not result in development of a root cause analysis commensurate with the significance of the issue.

The BNI QA organization is aware of weaknesses in project corrective action management processes and has been working on various improvement actions, but actions taken to date have not been fully successful in preventing performance deficiencies. A BNI users group has identified an appropriate set of process improvements (e.g., integrating the 23 current issues management systems) that address some of the current deficiencies. However, the group recognized that process changes will have little effect on project personnel's negative perceptions of individual PIER management or the PIER process unless management devotes serious attention to addressing employee and management behaviors and cultural beliefs.

Nuclear Safety Design and Safety Basis Personnel

The information from multiple sources, including the 2010 HSS review, the recent safety culture assessment (performed by outside nuclear professionals, as directed by the Secretary's initial response to DNFSB Recommendation 2011-1, and sponsored by BNI), and the interviews and focus group data collected by the HSS Independent Oversight team during this 2011 assessment, point to safety culture issues with personnel who are directly involved in the design and engineering functions and the nuclear safety basis analysis and review functions. The HSS Independent Oversight team identified a number of specific factors that contribute to the current state of the safety culture in some groups at WTP and that need to be addressed if ORP, DOE-WTP, and BNI are to make progress in addressing the cultural issues. As examples: there are inconsistencies between contractual documents (e.g., safety basis review procedures) and regulatory requirements; and DOE-STD-3009 was not consistently applied over the years, so part of the existing safety basis documents and some aspects of the design may not comply with DOE-STD-3009 and 10 CFR 830, impacting the ability to gain approval of the final DSA. In addition, preliminary DSAs (PDSAs) are out of date, and various reviews have highlighted significant deficiencies in PDSAs and safety basis processes in general. Further, issues related to funding of DSA development have not been resolved, contributing to uncertainty in approaches and staffing for the effort.

The above factors and other conditions (e.g., limited staff experience with the DOE-STD-3009 safety analysis) have contributed to a situation where there is often severe tension and frequent animosity within and between personnel with nuclear safety design and safety basis responsibilities. Most of these individuals are in the Environmental and Nuclear Safety (E&NS) and Engineering organizations. In essence, Engineering personnel must meet aggressive milestones (e.g., completing elements of the design) to meet their performance objectives, and must demonstrate that the design will be safe (i.e., meeting the PDSA provisions), while E&NS personnel are charged with verifying that a design is safe and compliant with the PDSA before approving the submittals. With the factors described above, neither organization has performed their responsibilities effectively; technical questions and differing opinions have not been effectively resolved because the requirements are conflicting or not commonly understood, the procedures do not match the requirements, the previous analyses (e.g., PDSAs) are not reliable, and the safety basis organization is understaffed (although requisitions for new staff have recently been approved).

Most of the above factors have been in place for ten years. However, until the past few years, it appears that safety basis documents were often not reviewed by the E&NS organization and ORP against the

requirements of DOE-STD-3009. In March 2009, a new manager was brought to WTP and assigned to E&NS. This manager had experience with and an understanding of DOE-STD-3009 methodology and later changed some of the existing expectations for safety reviews of design, engineering, and environmental documents, including expectations that reviews address DOE-STD-3009 provisions or an approved alternative – a necessity if the design is ultimately to be approved for operations. However, achieving these expectations was a challenge because of many factors, including the complex and restrictive requirements for gaining DOE approval of changes to the contract that must then be reflected in E&NS implementing procedures; the inconsistencies in requirements and procedures; and inconsistent interpretation of requirements by various DOE (ORP and DOE-WTP) and BNI managers and staff. The net effect is that the recent expectations for strict conformance with DOE-STD-3009 have resulted in increased workloads, approval delays, and missed milestones, all of which have contributed to tension and animosity within the organization. The situation has become increasingly worse as the WTP design has progressed, the PDSA has become further out of date, and the delays in safety reviews of design and engineering documents have become longer. In this atmosphere, instances where individuals perceive that their concerns about design questions are not listened to, that management does not want to hear problems, that technical dissent is suppressed, and that blame is being assigned unfairly are almost inevitable (for both Engineering and E&NS staff members). The end result is that a significant number of staff either express a general reluctance to raise issues or indicate perceptions of retaliation; the situation is not consistent with a healthy safety culture. While reconciliation of design and safety basis issues is a challenge in any project in which construction and design are occurring concurrently, the problems cited (e.g., specification and communication of requirements and interpretations) have exacerbated the ongoing challenges associated with maintaining the safety bases and reconciling design changes.

Although most of the symptoms are evident within the E&NS and Engineering departments, most of the contributing factors listed above result from actions or inactions at higher levels of ORP, DOE-WTP, and BNI management. ORP, DOE-WTP, and BNI management has not achieved timely resolution of important issues, including those discussed above; in some cases, issues have remained unresolved for about ten years. Further, typically ORP, DOE-WTP, and BNI senior managers are highly experienced but do not have specific experience in applying DOE-STD-3009 nuclear safety design and safety basis processes.

In the past few months, ORP, DOE-WTP, and BNI management have begun some promising initiatives that could lead to resolution of the underlying concerns. The Independent Oversight review indicated that the current management of the E&NS organization, and certain other BNI managers, supported by some individuals within DOE-WTP, have been a focal point of change in DOE-WTP's and BNI's very recent efforts to resolve the fundamental issues that were likely to prevent or delay efforts to develop a safety basis that could be approved under applicable regulations and DOE-STD-3009. Such actions include:

- BNI recently conducted a management workshop on safety basis requirements to raise the level of management understanding of safety basis requirements and issues at WTP.
- BNI completed a gap analysis between the safety basis procedures and DOE-STD-3009 that identified the differences in the hazard analysis provisions and provides an essential baseline for action.

- In July 2011, BNI submitted a contract change request to DOE to resolve some of the discrepancies and allow revision of the E&NS implementing procedures to align them with DOE-STD-3009. As of the time of this report, DOE had not approved the contract change.

- On September 27, 2011, the DOE-WTP Federal Project Director issued a letter to the BNI WTP Project Director stating DOE's position that DOE "has not (and will not) approve an alternate methodology to meet the requirements of 10 CFR 830…"

- BNI completed a plan, called the Integrated Licensing Strategy, to develop a regulatory-compliant safety basis and submitted it to DOE on October 31, 2011. This strategy provides an approach to resolving the findings from certain other management assessments and open technical issues. However, the pertinent action due dates in the licensing strategy are based on DOE's approval of the contract change, which was submitted July 27, 2011, and has not yet been approved.

While the above actions are positive signs, some of them have not been finalized and/or are contingent on funding and the ability to attract additional personnel with the requisite skills and experience in nuclear design and safety bases. In addition, although the above actions have the potential to address the underlying problems, significant and sustained ORP, DOE-WTP, and BNI management attention will be needed to ensure that the safety culture concerns are also addressed for personnel who are involved in design and engineering functions and the nuclear safety basis analysis and approval functions.

Factors Impacting Safety Culture for Construction Activities

In addition to the broad cultural concerns identified with various ORP and BNI groups, the HSS Independent Oversight team identified some specific concerns unique to construction activities that warrant increased management attention as ORP, DOE-WTP, and BNI work to enhance the safety culture:

- **Potential for Schedule Pressure Impacts on Safety and Quality.** A significant number of crafts personnel indicated that schedule pressures and other factors (e.g., inadequate planning, frequently shifting priorities, poor communications, inadequate work packages) have resulted in instances where safety rules, procedures, and practices were not clearly communicated or were inconsistent among WTP buildings or not followed, or where work did not meet quality standards.

- **Performance Rating System.** Interviews with construction crafts personnel indicated a widespread perception that the performance rating system used for most crafts workers, which defines the ratings that are used as a major factor in decisions about promotions and reductions in force, is arbitrary and unfairly implemented in a way that inhibits or penalizes the raising of safety and quality issues. The HSS Independent Oversight team determined that most craft (including foremen and general foremen) were not aware of a Guide describing the process, and the superintendents received no formal training on rating and ranking the crafts.

- **ORP Oversight of Worker Safety.** ORP personnel indicated that the involvement of ORP subject matter specialists in oversight of worker safety at WTP, the DOE's largest construction site, is currently limited.

Conclusions

Overall, the HSS Independent Oversight team determined that most personnel at WTP believed that safety was a high priority. However, during the safety culture evaluation, a significant number of staff within ORP, DOE-WTP, and BNI expressed reluctance to raise safety or quality concerns for various reasons. Fear of retaliation was identified in some BNI groups as inhibiting the identification of problems. Employees' willingness to raise safety concerns without fear of retaliation is an essential element of a healthy safety culture, and therefore significant management attention is needed to improve the safety culture at WTP. While EM, ORP, DOE-WTP, and BNI managers espoused support for a healthy nuclear safety culture, they do not have a full appreciation of the current culture or the nature and level of effort needed to foster a healthy safety culture, including a mature and effective SCWE, and the WTP community has not been sufficiently engaged in creating a mutually shared and desired culture. In addition to the concerns about the current safety culture, the Independent Oversight team identified significant concerns about ORP, DOE-WTP, and BNI processes for nuclear design and safety basis and for managing safety issues.

HSS Independent Oversight Team Recommendations

To achieve the needed improvements, the HSS Independent Oversight team offers two sets of interrelated recommendations. The first set provides a tiered hierarchy of recommendations, from general to specific, for enhancing various aspects of the safety culture. The second set of recommendations identifies actions that should be considered by DOE organizations and BNI to enhance various other aspects of integrated safety management, focusing on nuclear design and safety basis development and safety issues management processes. DOE organizations and BNI should evaluate the results of this Independent Oversight report in their entirety, including the culture insights, identified process deficiencies, and both sets of recommendations, in accordance with established issues management processes and initiate appropriate causal analysis, corrective actions, organizational enhancements, and effectiveness reviews as appropriate.

Part 1: Recommendations for Cultivating a Healthy Safety Culture (ORP, DOE-WTP, and BNI)

DOE defines safety culture as "an organization's values and behaviors modeled by its leaders and internalized by its members, which serve to make safe performance of work the overriding priority to protect workers, the public, and the environment." A healthy safety culture is most often found within an aligned organization that has effective processes and motivated people. While WTP organizations have attempted to improve safety culture by adapting concepts and principles from external organizations, safety culture is unique in that improvement cannot be forced by discrete procedure or policy changes that are typically used for traditional technical issues. A healthy safety culture is enacted by advocating and inculcating a set of shared core values and beliefs, facilitated through continuous communication and trust building, and supported by organizational systems, with the goal of promoting collaborative human relationships that will sustain safe organizational and individual behaviors.

The overarching recommendation for improving the safety culture at WTP is:

1. **WTP needs to establish a safety culture competence commensurate in priority to science, engineering, and project management competencies.** Safety culture competence requires that organizations:[4]

    - Have a defined set of values and principles, and demonstrate behaviors, attitudes, policies, and structures that enable them to sustainably accomplish mission goals

4 Discussion of culture competence adapted from The National Center for Cultural Competence, Georgetown University Center for Child & Human Development.

- Have the capacity to (1) value diversity, (2) conduct self-assessment, (3) manage the dynamics of difference, (4) acquire and institutionalize cultural knowledge, and (5) adapt to diversity and the cultural contexts of complex and dynamic environments

- Incorporate the above in all aspects of policy-making, administration, practice, and operations, systematically involving employees, suppliers, stakeholders, and communities

- Recognize that development of cultural competence is a process that evolves over an extended period of time. Individuals and organizations are at various levels of awareness, knowledge, and skills all along the cultural competence continuum. Consequently, a specific set of actions cannot be prescribed; a collaborative effort is required to understand and enact core principles that ensure that a healthy safety culture is developed and internalized. A number of steps can be taken that will initiate the basis for the development of the WTP safety culture competence.

In support of the above overarching safety culture recommendation, the Independent Oversight team has identified the following additional recommendations as possible steps for implementing the overarching recommendation and initiating the development of cultural competence:

2. **The WTP project organizations (ORP, DOE-WTP, and BNI) need to evaluate and clearly delineate core values for moving forward. The development and definition of these values must be made with the engagement of individuals at all organizational levels across all functional groups to ensure alignment throughout the organization.** Specific actions to consider include:

   - Identifying a consensus set of values to support the safety culture the WTP community wishes to achieve. Initiate this activity with a values definition workshop engaging representatives of the collective WTP organization. The workshop should be facilitated by an external specialist with specific knowledge and experience in culture change. The output of the initial workshop should be a draft statement of values that will then be socialized with all members of the organization, leading to a formal statement of values that will be signed by senior leadership of EM, ORP, BNI, principal BNI line managers, and employee representatives to the value identification team.

   - Conducting a facilitated workshop, based on the 2020 Vision One System Strategic Plan and the Federal Project Director's 2010 report, to identify the implicit values associated with the activities outlined in those documents. The output of this workshop should be an analysis of the values implicit in those documents.

   - Conducting a comparison of the value statement and the analysis of the document values. The values in the documents need to be reconciled to ensure that the long term strategy outlined for the project is consistent with the organization's defined values. Achieving this consistency may require modification of the 2020 Vision One System Strategic Plan.

3. **ORP (including DOE-WTP) and BNI each need to develop, implement, and continuously monitor their own safety culture, including SCWE, using the organizationally defined values as the foundation.** BNI has initiated some efforts and needs to re-evaluate its program with the following considerations:

   - Short-term: Conduct further analyses from the recent 2011 safety culture survey of BNI personnel. Shortcomings were identified in the manner in which the 2011 survey results were

analyzed. Additional statistical analyses for the various groups at WTP, as well as appropriate comparative analyses between these populations, might provide insight into some of the differences between work groups in those populations.

- Long-term: A more comprehensive, ongoing, sitewide programmatic and assessment effort focused on safety culture and SCWE that includes a more reliable and validated survey, as well as additional methods that can focus on the organizational behaviors needed to promote a healthy safety culture, would be useful. This effort can be conducted as a self-assessment or an independent assessment.

- Follow-up: DOE-WTP and ORP need to follow up on the results of this assessment of its safety culture. Multiple resources are available within the DOE complex, such as the Energy Facility Contractors Group, to provide guidance on how to establish a program and conduct continuous monitoring of its organization.

4. **ORP and BNI need to develop accountability models for their organizations.** Many individuals in management and supervision do not consistently exhibit desired behaviors and are not challenged by their managers or peers. Inconsistent implementation of standards and expectations in work activities is common and may be influenced by ineffective communication and an ineffective change management process. Significant management oversight and attention are needed to implement a performance management system that establishes accountable behavior as the accepted norm. A sitewide accountability model that is consistently implemented against clearly defined standards and expectations, that recognizes and reinforces desired behaviors, and that uses effective coaching while minimizing punitive actions for undesirable behaviors is recommended.

5. **ORP and BNI can both benefit from employee engagement in many of the activities that they regularly conduct.** Engagement needs to be implemented from lower levels of the organization and can be introduced by initiating activities that are staffed with all individuals from the same working level or by introducing new employees into existing committees and meetings. Engagement is also necessary across functional groups to promote and facilitate a better understanding and development of the organization's needs and priorities.

6. **Working with ORP and DOE-WTP, BNI should enhance capabilities in behavioral sciences to assist BNI senior management in addressing problems involving organizational behaviors and interfaces.** BNI's corrective actions for past reviews often have not addressed the underlying organizational behavior and human performance factors; these actions have tended to focus on specific technical issues or very broad safety culture fixes (e.g., "train all staff"), rather than identifying the causes of the concern and focusing on the specific organizations and groups that are impacted. BNI should consider developing and adopting a strategic approach to enhance its capabilities and competencies in organization, management, and social sciences, perhaps by obtaining external support initially and building internal staffing over the longer term. Increasingly, high-hazard organizations are including specialists with advanced degrees in organizational/industrial psychology, organizational development, human factors/human performance, and related disciplines as a necessary augmentation to a strong technical staff. Such personnel, particularly those experienced with nuclear facilities or organizations, could help BNI senior management address current issues in the nuclear safety culture and proactively identify and address changes and emerging concerns. Such personnel could apply recognized tools and techniques to identify and analyze cross-cutting

issues, recurring findings, and organizational causes. These tools can also be applied to help develop and implement efforts to perform and improve risk communications, risk-informed decision making, leadership development initiatives, and self-assessments for the enhancement of the safety culture. BNI also needs to focus more on transparency with its employees and the public to enhance trust and provide confidence that issues are being addressed.

7. **ORP, DOE-WTP, and BNI should ensure that senior managers understand the need for and direct implementation of systematic approaches to change management[5] in order to avoid or mitigate potential negative consequences resulting from significant changes in project plans, processes, and/or organization.** Specific actions to consider include:

   - Ensuring that managers with the authority to direct significant changes are trained to recognize the likelihood and nature of potential adverse consequences
   - Ensuring that managers are trained and able to develop and implement change management plans to avoid or appropriately mitigate the negative consequences of change
   - Ensuring that the authority and responsibility to direct development, approve, require implementation, and assess the effectiveness of change management plans is formally assigned
   - Applying recently-developed BNI change management guidance or other proven change management processes, preferably with the support of behavioral science personnel as recommended above, to manage the changes that will occur while resolving current problems and underlying factors in such areas as transitioning to a DOE-STD-3009 compliant hazard analysis and safety basis, revamping the design and safety basis processes, and revising the rating system for craft personnel
   - In the longer term, proactively applying change management principles to the design and development of the 2020 Vision One System for WTP Project Transition to Operations and in other aspects of the ongoing transition from design to commissioning and the eventual transition to an operating facility.

Part 2: Recommendations for Enhancing Selected Integrated Safety Management Processes

In addition to evaluating the current safety culture at WTP, the Independent Oversight team was tasked to evaluate ORP, DOE-WTP, and BNI management of safety concerns. During the course of the review, the Independent Oversight team also identified concerns about nuclear design and safety basis processes and certain other aspects of integrated safety management. The Independent Oversight team identified the following recommendations for improving various WTP processes and the primary organizations to which they apply.

5 Change management is used in the sense described in International Atomic Energy Agency publication "MANAGING CHANGE IN THE NUCLEAR INDUSTRY: THE EFFECTS ON SAFETY, INSAG-18, IAEA 2003" and in Nordic Nuclear Safety Research document "MANAGEMENT OF CHANGE IN THE NUCLEAR INDUSTRY – Evidence from maintenance reorganizations," NKS 119, March 2006.

ORP, DOE-WTP, and BNI

1. **Evaluate and address factors that adversely impact the design and safety basis processes.** ORP and BNI have recently initiated efforts that are appropriate to address many of the current concerns about the design and safety basis processes, including the recent training for managers; the September DOE-WTP letter clarifying expectations for compliance with DOE-STD-3009-94, *Preparation Guide for U.S. Department of Energy Nonreactor Nuclear Facility Safety Analysis*; and the ongoing efforts to modify the contract. However, these actions need to be systematically analyzed and managed as a part of the BNI/ORP Risk Management Plan, required by DOE Order 413.3A, *Program and Project Management for the Acquisition of Capital Assets*, to ensure that they will be effective, complete, supported by management, communicated, and universally understood and accepted by the key managers and staff. Additional actions are needed to establish effective processes for updating the PDSA and modify various safety basis procedures to ensure that they support the intended objectives.

2. **Develop and implement a strategic approach to enhance management's and the professional staff's understanding of DOE expectations for the nuclear design and safety basis processes.** Some personnel at ORP, DOE-WTP, and BNI have experience working on nuclear design and construction projects, but a significant number of managers and staff with responsibilities for the safety bases have limited previous experience with design and safety basis processes using DOE-STD-3009. This situation has contributed to problems with the nuclear design and safety basis processes (e.g., inconsistent direction and understanding of the applicable hazards analysis requirements) and culture (e.g., organizational interfaces) that have persisted for many years. The recent training/workshop efforts by E&NS management and others at WTP have helped provide BNI management with a better perspective on nuclear design and safety basis process expectations, but more such efforts are needed to ensure consistent and effective understanding of the nuclear safety design and safety basis processes at all levels of management and staff. In addition, more diligence is needed to support those managers and staff with direct responsibilities for nuclear design and safety in internalizing the expectations and lessons learned for a healthy nuclear safety culture and SCWE. ORP and BNI should develop a strategic approach to enhance staff capabilities for targeted groups of ORP and BNI management and staff (especially those with design, engineering, and safety basis responsibilities), including focused training efforts, targeted mentoring programs, increased emphasis on qualification requirements for current and future open job positions, and clear performance objectives related to nuclear safety and safety culture in organizational and individual performance evaluation processes.

Headquarters EM

3. **Finalize the WTP Project Execution Plan.** Ensure that the proposed Revision 1 to the WTP Project Execution Plan is reviewed, modified as needed, finalized, and approved in a timely manner so that ORP and DOE-WTP personnel are operating in accordance with an approved document that clearly defines expectations for ORP and DOE-WTP, including nuclear safety responsibilities and interfaces.

ORP and DOE-WTP

4. **Evaluate and address factors that may adversely impact the clarity and understanding of responsibilities and expectations for ORP staff.** Specific actions to consider include:

   - Completing changes to the BNI contract to eliminate inconsistencies and clarify DOE expectations for full compliance with DOE-STD-3009. Closely monitor BNI's implementation of this standard, and use incentive fees as appropriate to obtain the desired performance.

   - Establishing a process to ensure that Federal employee performance awards are used to encourage desired behaviors. Consider the use of an awards committee, chaired by the ORP Manager and WTP Federal Project Director, for annually setting criteria and determining awards to celebrate desired behaviors. Use performance awards to recognize Federal employees who demonstrate good safety culture.

   - Continuing the efforts to improve communications between DOE-WTP and ORP support organizations. Focus on team building to encourage working together to achieve common objectives.

   - Providing training to managers and supervisors to enhance capabilities in behavioral sciences and aid in creating and maintaining a SCWE.

   - Continuing the efforts to better define the roles and responsibilities of the Federal staff. Revise the FRA to comply with DOE Order 450.2, *Integrated Safety Management*. Consider memoranda of understanding in areas where past performance indicates the need, such as resolution of WTP operational readiness vulnerabilities identified pursuant to Washington River Protection Solutions (WRPS) Contract Line Item 3.2.

   - Establishing milestone dates and responsibility assignments for completing planned initiatives, such as SCWE training and culture surveys.

   - Re-evaluating the current level of involvement of ORP subject matter specialists in oversight of worker safety and health at WTP construction areas. Ensure that organizational responsibilities are clarified and implemented in a manner that provides for adequate ORP oversight of worker safety and health.

   - Ensuring that expectations for Federal oversight of BNI safety culture are defined and communicated, including consideration of performance measures, a process for routinely assessing the effectiveness of BNI efforts to strengthen its safety culture, and a mechanism for tracking and validating BNI actions to improve safety culture and related processes.

   - In making any changes, ensuring that the ORP group that reviews safety basis submittals maintains an appropriate degree of independence from project management priorities and schedules.

5. **Develop and implement a strategic approach to ensuring that performance incentives are aligned with nuclear safety.** In addition to considering nuclear safety requirements, the goals and performance incentives for ORP and DOE-WTP managers should explicitly consider nuclear safety, including efforts to establish a healthy nuclear safety culture. The BNI contract fee structure

should also be reevaluated to ensure that nuclear safety and quality of design and construction are appropriately weighted and promote the desired objectives. As one possible measure, progress milestones might include provisions to ensure that the design and safety bases are aligned and that the safety basis demonstrates a safe design as part of the progress payments evaluation.

6. **Apply additional Federal management attention to improve the timeliness and effectiveness of corrective actions.** Specific actions to consider include:

   - Tracking the status of assigned actions, monitoring performance, and holding Federal managers and contractors accountable when clearly-defined expectations are not met
   - Communicating to BNI and ensuring appropriate and timely resolution of the operational readiness vulnerabilities identified in 2010 and 2011 by WRPS pursuant to Contract Line Item 3.2
   - Assigning and tracking actions to address DOE commitments to the DNFSB and actions planned in response to recommendations from other external organizations
   - Assessing the WRPS issues management program with an emphasis on PIERs to determine whether issues are initiated as required, appropriate causal analysis is performed, corrective and preventive actions are appropriate, and closure is adequate and timely.

Richland Operations Office

7. **Strengthen the employee concerns program.** Ensure that RL procedural guidance is provided to adequately safeguard the confidentiality of employee concerns program participants, and also define when ORP management approval of referrals is required. Check and validate all concerns with the originator before issuing formal correspondence or referral.

BNI

8. **Strengthen the implementation of the corrective action management program.** Specific actions to consider include:

   - Conducting a comprehensive independent assessment or assessments of the implementation of the various elements of the corrective action management program (i.e., PIER initiation, significance categorization, analysis, action development, closure, and effectiveness review) to more fully characterize the nature and extent of implementation problems.
   - Reviewing and clarifying as needed the definitions and guidance for determining PIER significance levels to promote more consistent and accurate categorization.
   - Reviewing project procedures and guidance to ensure that extent-of-condition and cause evaluations are considered in resolving non-conformance reports and construction deficiency reports and that trend analyses of these documents are rigorous and comprehensive in order to ensure that the needed recurrence controls are identified and implemented.
   - Reviewing, and revising as appropriate, Trend Analysis and Reporting procedure GPP-MGT-050 to add a process for formally performing periodic project-wide trend analysis; provide more

detailed requirements and guidance on analysis and reporting processes; and require individual organizations to develop formal internal procedures detailing responsibilities, process steps, and outputs for their trending activities. Establish specific requirements for formal analysis reporting, both for individual organizations and for the project, addressing periodicity, content, format, and distribution/presentation.

- Establishing a structured, project-level, ongoing monitoring program by subject matter specialist(s) to review in-process and completed PIERs to grade their quality and provide feedback to responsible individuals, organizations, and senior management. Adjust sample size and organizational focus based on performance trends. Establish a grading system for various elements of the PIER process that will provide metrics supporting the identification of progress and areas needing greater attention.

- Evaluating current guidance and requirements for conducting root and apparent cause analysis to identify areas for simplification and remove barriers that may be adversely influencing the assignment of PIER significance levels. Consider simplifying the expectations for apparent cause analysis, and eliminate expectations for developing "judgments of need" in addition to recommended corrective/preventive actions.

- Conducting a formal root cause analysis of the problems associated with the safety basis issues described in PIER MGT-10-0999 to identify needed recurrence prevention controls.

- Including a specific Performance Improvement Review Board agenda item to identify and remove barriers to resolving and holding managers responsible for overdue critical path actions, such as the long-delayed causal analyses identified in this report.

- Ensuring that resolution of the PIER users working group's recommendations for "capturing" management and employee attention regarding issues management is assigned to the WTP Director's Office, because these issues must be owned by the complete senior leadership team.

- Specifying that the senior leadership team needs to ensure adequate resources to support timely and effective implementation of the necessary process improvements and the enhanced monitoring and mentoring activities necessary for the desired fully-effective corrective action management system.

9. **Strengthen the implementation of the BNI employee concerns program.** Include a formal second-party review of completed investigation reports to ensure that all aspects of the concerns have been identified and sufficiently addressed, that any additional issues raised during the investigation have been appropriately documented and dispositioned, and that any actions identified or taken are adequate to fully address the concerns.

10. **Strengthen the BNI differing professional opinion program.** Specific actions to consider include:

    - Reviewing and revising procedure GPP-MGT-023 to address the weaknesses identified in this report

    - Ensuring that in each case a documented review is performed to identify why lower-level formal and informal issues management processes were unable to resolve issues before they

escalated to the level of a formal differing professional opinion investigation. Establish any needed corrective actions.

11. **Strengthen the BNI management workplace visitation program.** Specific actions to consider include:

    - Reviewing GPP-MGT-062 and revising it as appropriate to address the misalignment between stated objectives and actual implementation results. Consider including some level of periodic analysis of the observation data gathered by the management walk-around teams to characterize what information and conclusions the program is providing to management regarding the project safety culture and employee performance with respect to safety, quality, compliance, and other objectives specified in the procedure. Emphasize expectations to focus on increasing direct interaction and feedback between senior management and employees and promoting management presence in the field to observe work performance and physical conditions.

    - Developing methods to ensure regular participation by all leadership team members, such as pre-assigning the membership of small teams (with target dates and locations) in an annual schedule, to facilitate schedule coordination and participation. Provide more definitive expectations for all members of the senior leadership team to routinely participate in these activities.

    - Taking action to ensure that the required formal documentation of visitation reports is completed in a timely manner, is legible, and reflects consolidated results as required by the procedure.

12. **Evaluate and address selected aspects of safety management processes governing the work of construction craft workers.** Specific actions to consider include:

    - Re-evaluating the implementation of the craft rating system to ensure that the process is perceived as fair and non-retaliatory for workers raising safety or quality concerns, including allowing workers to have more information about how the ratings were established and providing periodic feedback on their performance.

    - Investigating and addressing the view that managers allow or encourage workers to "cut corners" on worker safety and health or construction quality requirements and safety practices to meet schedules. Actions may include clarification of expectations, focused safety audits, assessment of the roles of supervisory personnel, increased management accountability, and increased efforts to solicit worker feedback on safety program implementation in a manner that allows anonymity.

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1 Introduction

The U.S. Department of Energy (DOE) Office of Enforcement and Oversight (Independent Oversight), within the Office of Health, Safety and Security (HSS), conducted an independent assessment at the DOE Waste Treatment and Immobilization Plant (WTP) to evaluate the current status of the nuclear safety culture and the effectiveness of DOE and contractor management in addressing nuclear safety[6] concerns at WTP. This assessment provides DOE management with a follow-up on the October 2010 HSS review of the WTP nuclear safety culture.

This assessment also satisfies a Secretarial commitment to the Defense Nuclear Facilities Safety Board (DNFSB) related to DNFSB Recommendation 2011-1, *Safety Culture at the Waste Treatment and Immobilization Plant*. Specifically, in a letter to the DNFSB dated June 30, 2011, the Secretary of Energy directed HSS to conduct a follow-on safety culture review at WTP as part of a broader extent-of-condition review across the DOE nuclear complex. As part of the planning for this review, DOE senior management tasked the HSS Independent Oversight team to examine the effectiveness of actions taken at WTP since the 2010 HSS report to address safety concerns. HSS accelerated the schedule for the follow-up assessment in response to a request from the Assistant Secretary for Environmental Management (EM-1) in an August 2011 letter, citing the serious concerns that had been raised about the safety culture at WTP. As part of a broader extent-of-condition assessment and based on the results of this assessment, the HSS Independent Oversight team will perform additional assessment activities at DOE Headquarters to gather additional information about the role of Headquarters line management organizations in safety culture and management of safety issues at WTP.

Currently, WTP is in the design and construction phase, with the plan of transitioning to an operating nuclear facility in 2019. Although WTP is not yet processing radioactive materials, WTP personnel are currently making design decisions and developing a safety basis to demonstrate that WTP can be operated safely, and WTP personnel are also procuring, installing, and constructing structures, systems, and components (SSCs) that will be relied on for safe operation of an extraordinarily complex set of nuclear facilities. If these functions are not performed correctly and with high standards of quality, the safety of the WTP could be compromised during future operations by latent failures in design or safety analysis or in the installed SSCs. Therefore, a healthy safety culture, one in which employees feel empowered to raise safety questions without fear of retaliation, is essential at WTP.

Senior DOE management has recently taken visible actions in support of a strong safety culture. The Secretary of Energy and the Deputy Secretary of Energy issued a memorandum on December 5, 2011,

6 The term "nuclear safety" includes the quality of design, engineering, and construction of nuclear facilities at WTP.

on nuclear safety at DOE, which emphasized DOE expectations for a healthy safety culture. The Deputy Secretary of Energy visited WTP in July 2011 and emphasized the importance of safety, a questioning culture, and freedom to raise safety concerns without fear of retribution.

As the Independent Oversight team was completing its review of WTP, DOE issued its DOE Implementation Plan for DNFSB Recommendation 2011-1 (dated December 27, 2011). Among other things, the Implementation Plan identifies needed improvements in translating DOE's high level policy expectation for a healthy safety culture into detailed guidance for implementing that expectation. Although not a focus of this progress assessment, the results of this Independent Oversight assessment confirm the need for better definition and communication of expectations for actions needed to ensure a healthy safety culture for both DOE organizations and contractors.

1.1 Background

WTP Organizations

Within DOE, the Headquarters Office of Environmental Management (EM) has line management responsibility for WTP and most other activities at the Hanford Site. At the site level, DOE line management responsibilities for WTP have been assigned to the DOE Office of River Protection (ORP). The DOE Richland Operations Office (RL) and ORP have a joint employee concerns program (ECP), which encompasses the Hanford Site, and is administered by RL.

Formal assignment of responsibility for WTP activities remains with ORP. However, in practice, the DOE WTP Project Office (DOE-WTP) has been established to oversee most WTP activities and provide line management direction to the WTP contractor. DOE-WTP was reorganized in late 2010 (at about the same time HSS conducted its 2010 review) to provide more organizational focus on WTP and independence within ORP. It is now an organizational element within ORP and is led by the DOE WTP Federal Project Director (FPD). FPD and DOE-WTP responsibilities and interfaces are defined in a revision to the Project Execution Plan (PEP), but the revision has not yet been formally approved. In practice, the FPD has been implementing the draft revised PEP, which has the project functionally reporting directly to EM-1 as the Program Secretarial Office, with a direct line of communication to the Deputy Secretary of Energy as the Acquisition Executive. With this arrangement, DOE-WTP currently functions largely autonomously within ORP at the direction of FPD.

DOE-WTP personnel carry out most onsite DOE line management responsibilities for WTP, but certain important safety-related functions are performed by ORP. Most significantly, a nuclear safety organizational element within ORP has primary responsibility for reviewing and approving contractor submittals for nuclear safety basis documents and related analyses. Because DOE-WTP's activities are largely autonomous, Independent Oversight strived to be specific in distinguishing DOE-WTP activities from those performed by other elements of ORP.

Under contract to DOE, Bechtel National, Incorporated (BNI) is designing and coordinating the construction of the WTP. URS Corporation is a major subcontractor to BNI and performs a significant fraction of the design and safety basis work. BNI intends BNI and URS personnel to work closely together, and in practice BNI and URS personnel are intermingled. For example, BNI personnel may

work in an organization with a URS supervisor, or vice versa. BNI also has several other subcontractors and consultants at the WTP.

WTP Functions and Status

The WTP will be used to transform radioactive wastes into a stable glass form for disposition, using a process called vitrification. About 56 million gallons of highly radioactive and hazardous chemical and radioactive wastes are currently stored in underground tanks at the Hanford Site. Some of the tanks are single-wall containers that present a risk of leaking radioactive materials into the ground, where they could eventually reach the Columbia River. Removing the radioactive materials from the tanks and processing them into a stable form is one of DOE's highest priorities and is required by the Hanford Federal Facility Agreement and Consent Order Tri-Party Agreement (more commonly called the Tri-Party Agreement). Timely completion of the WTP project is an essential element of DOE's approach to meeting the Tri-Party Agreement milestones and addressing legacy tank waste hazards.

Located on the Hanford Site in southeastern Washington State, WTP is DOE's largest ongoing construction project, with an estimated cost of over $12 billion and a current workforce of about 3000. According to information provided by the BNI website, the WTP project is more than 60 percent complete, design of the plant will be complete by 2013, construction will be complete in 2016, and all facilities and systems will be fully operational and begin the process of vitrifying tank waste by 2019. Recent DOE project reviews, however, indicate that the WTP project is likely to incur further delays and cost increases of $800-900 million, partly because of identified technical issues and uncertainties.

For the WTP project, DOE decided to implement a "design-build" approach in which significant construction efforts are undertaken in parallel with the design efforts. The goal of this approach was to complete the WTP sooner, thus allowing DOE to meet milestones for addressing tank waste hazards and reducing the environmental and safety risks associated with the hazardous wastes in the tank.

Background on Nuclear Safety Issues

Since work began on the WTP in the late 1990s, a number of nuclear safety issues have had a direct or indirect impact on the nuclear safety culture. The following brief summary of some of the most important issues – identified during contractor assessments and during reviews by DOE organizations (including ORP and HSS) and non-DOE organizations, such as the DNFSB – provides context for understanding the results of this assessment.

In the mid-2000s, certain structures and components had to be strengthened to ensure that WTP met seismic standards, and certain piping had to be replaced because of quality assurance (QA) deficiencies. These delays contributed to cost increases for the project and caused DOE and BNI to accelerate the remaining efforts in an attempt to meet the Tri-Party Agreement milestones.

HSS enforcement activities identified concerns about safety-related design and quality functions, dating back to 2002, that are documented in three enforcement actions and one consent order. These enforcement activities identified non-compliances in various aspects of design, procurement, and QA of components important to nuclear safety; examples include failure to adhere to design codes documented in facility safety requirements, failure to follow requirements, inconsistent design and procurement specifications, failure to use appropriate suppliers, failure to correct deficient conditions, and failure to identify discrepancies between procurement specifications and authorization bases. The HSS enforcement

documents also cited contributing factors that raised questions about the safety culture at BNI, such as procurement decisions that were driven by cost and schedule rather than giving priority to nuclear quality requirements, and staff who lacked sufficient experience to properly consider nuclear quality in making project decisions.

A number of identified technical issues (including design questions that could impact safety) have taken considerable effort to address, and some are still being evaluated. Most notably, in 2006, an external panel identified 28 technical issues involving the WTP design. By the time of the 2010 HSS review of the safety culture, DOE and BNI had completed the analysis and closed 27 of the 28 technical issues. The remaining issue, referred to as the M3 issue or the *Pulse Jet Mixing Design* issue, addressed the adequacy of the systems that ensure adequate mixing of materials in the Pre-Treatment Building of the WTP, both to promote efficient operations and to prevent buildup of flammable gases or accumulation of fissile material in the bottom of tanks. Inadequate mixing could violate the assumptions, parameters, or controls that the WTP safety bases have established to prevent gas explosions/deflagrations and criticality accidents. Although the broad M3 issue was categorized as closed, a number of related or subordinate issues were developed and tracked to provide additional assurance or confirmation that the uncertainties in the mixing issue are sufficiently understood.

In 2010, BNI and ORP identified additional small-scale testing to gather data about the mixing process. They also specified hold points in the construction process to examine the test results to determine whether the additional testing would confirm the adequacy of the design. Subsequently, in response to DNFSB concerns and internal DOE discussions, WTP personnel made some design changes and developed a plan for large-scale testing of the pre-treatment mixing systems.

One ORP engineer has filed a differing professional opinion (DPO) that documents concerns about the technical issues and related management decisions. The DPO indicated that the initial test results raise additional concerns about the viability and safety of the mixing system design. One specific concern raised in the DPO is that the system changes that are designed to enhance mixing could have the undesired side effect of increasing the erosion rate within the mixing system, which could cause premature failure of components and/or other difficulties in demonstrating the safety of the system.

While aware of the technical uncertainties and recognizing the possibility that their decisions could result in significant rework, DOE-WTP and BNI recently decided to proceed with certain activities, such as welding heads on vessels. Some staff and external organizations have cited this decision as an indicator that management places priority on schedule over safety. DOE-WTP and BNI managers, however, have indicated that such decisions will not compromise safety (e.g., if testing and analysis demonstrate that the system cannot be shown to be safe, they will take the necessary actions, including significant redesign and rework) and that the recent decisions were made based on an informed perspective on project risks, schedules, and costs. However, DOE-WTP and BNI management did not effectively communicate to stakeholders the rationale for this decision, nor did management communicate the fact that the action was reversible if ongoing analysis concluded that the design needed to be modified.

Background on Safety Culture Issues and Initiatives

BNI, in coordination with ORP and DOE-WTP, has a longstanding effort to establish and sustain an effective safety culture. BNI established its Nuclear Safety and Quality Imperative (NSQI) in response to a 2005 ORP assessment that identified a number of systemic weaknesses in the WTP project and

concluded that the underlying cause was a "less than adequate nuclear safety and quality culture." Major focus areas of the NSQI included: (1) development and implementation or improvement of project systems, especially for procedures and procedure compliance and the management of issues and concerns; and (2) communication efforts on the importance of various aspects of a nuclear safety and quality culture. In the 2005-2010 time frame, BNI performed a number of assessments of the safety culture and an annual employee survey.

In 2009, based on a review of prior assessments and corrective actions, BNI concluded that the culture of safety and quality at WTP had improved as a result of NSQI initiatives and actions. However, BNI also concluded that aspects of the nuclear safety culture needed to be strengthened as the project was transitioning from the engineering, procurement, and construction phase to the startup, commissioning, and operating phase. Consequently, BNI established a Nuclear Safety and Quality Culture (NSQC) working group in early 2010, with representatives from many WTP organizations, to identify a set of actions to achieve and sustain an effective nuclear safety culture and a strong, safety conscious work environment (SCWE) at WTP. These actions were in various stages of development and implementation at the time of the HSS review in 2010.

In 2010, a URS contractor employee raised several concerns in a letter to the DNFSB, questioning the safety and reliability of the WTP. This whistleblower letter prompted EM-1 to ask HSS to review the nuclear safety culture at WTP. The 2010 HSS independent review identified a number of concerns, including pockets[7] of individuals within the WTP who believed that BNI management had created a "chilled" atmosphere (an environment that discourages questions or safety concerns and promotes fear of retaliation for raising safety issues), as well as some deficiencies in processes for managing safety issues. After the 2010 review, EM Headquarters management accepted the HSS report and directed BNI to address the recommendations. ORP and BNI developed corrective actions that were intended to address the HSS recommendations and integrated the corrective actions into their NSQC improvement initiatives.

In 2011, DNFSB Recommendation 2011-1 identified weaknesses in the nuclear safety culture at WTP and recommended that management "Assert federal control at the highest level and direct, track, and validate the specific corrective actions to be taken to establish a strong safety culture within the WTP Project consistent with DOE Policy 420.1 in both the contractor and federal workforces."

DOE accepted the recommendation and exchanged letters with the DNFSB to clarify the intent of the recommendation. DOE is working on a formal implementation plan, and the Secretary's direction that HSS perform this Independent Oversight review is part of the response actions.

DOE's initial response to DNFSB Recommendation 2011-1 (transmitted in a June 30, 2011, letter to the DNFSB from the Secretary of Energy) also committed that DOE and BNI would jointly sponsor an "executive-level assessment of the project's nuclear safety culture" to be conducted by a group of experienced nuclear industry subject matter professionals. Subsequently, the DNFSB and others raised questions about the independence of a team that would be sponsored by BNI. In a September 19, 2011, follow-up letter to the DNFSB, DOE indicated that it would "monitor and cooperate with – but not partner in – the BNI review" and would gauge the validity of the BNI process and examine the results

7 In the context of the 2010 HSS review, "pockets" referred to groups within the organization that had significant numbers of personnel who expressed concerns to the extent that HSS believed that the concerns were not isolated and warranted significant management attention.

for relevant findings. In the same letter, DOE indicated that HSS would perform an independent, DOE-directed assessment of the status of the nuclear safety culture at WTP.

The DOE-directed, BNI-sponsored team of nuclear safety professionals completed its activities and reported its review results in a report dated November 30, 2011, which was provided to DOE and BNI.

In November 2011, a URS manager filed a complaint with the Department of Labor, alleging retaliation for trying to adhere to safety requirements and for providing testimony contrary to DOE positions at a DNFSB public meeting.

The WTP project is experiencing budget uncertainty and reductions in staffing. Schedule and cost pressures and uncertainties impact workers' job security, attitudes, and anxiety level. These conditions need to be factored into the evaluation of the current safety culture.

1.2 Scope and Methodology

This Independent Oversight assessment covers the DOE and contractor organizations at the Hanford Site that have responsibilities for WTP activities. Within DOE, the focus was on ORP and DOE-WTP. The HSS Independent Oversight team also examined the relevant programs managed by RL (e.g., the ECP). The review of BNI included its primary subcontractor, URS. The assessment was led by an experienced HSS manager. Onsite data collection was conducted primarily by HSS staff, with support from an external independent specialist in group dynamics and focus groups.

In designing and conducting this 2011 assessment, the HSS Independent Oversight team considered the results and scope of the 2010 HSS review, which determined that problems with the safety culture were not widespread but that there were significant pockets of personnel that had concerns about retaliation and suppression of safety issues. In this 2011 review, the HSS Independent Oversight team devoted particular attention to those pockets – most notably those in the Environmental and Nuclear Safety (E&NS) and Engineering organizations – including examining the cultural perceptions of individuals in these organizations in light of the complex technical issues and safety basis framework. Considering the advice of the external independent safety culture experts and other factors, the Independent Oversight team decided to include all site personnel in the scope of the safety culture assessment.

The Independent Oversight team also designed its evaluation to encompass the impacts of the 2010 whistleblower event. Specifically, the focus groups and interviews were performed in a manner that allowed individuals to raise issues that were significant to them. For instances where individuals raised the issue of the 2010 whistleblower event or related concerns, the Independent Oversight team prepared questions designed to probe the concerns to develop a better understanding of the perceptions of the workforce.

In accordance with the Secretary of Energy's direction, the scope of the Independent Oversight review included two major areas:

- **Evaluation of the Current Nuclear Safety Culture at WTP.** The safety culture assessment data was analyzed by external independent safety culture experts. This analysis is summarized in Section 2, and the detailed results are presented in the supplemental volume of this report (Appendix A).

- **Management of Safety Concerns.** The HSS Independent Oversight team's assessment of ORP's (including DOE-WTP's) management of safety issues is summarized in Section 3, with additional details provided in the supplemental volume of this report (Appendix B). The HSS Independent Oversight team's assessment of BNI's management of safety issues is summarized in Section 4, with additional details provided in the supplemental volume of this report (Appendix C).

As the assessment progressed, the HSS Independent Oversight team evaluated information from various sources, including the external evaluation of safety culture (i.e., the effort directed by the Secretary, sponsored by BNI, and documented in a report dated November 30, 2011); the identified technical issues, issues management processes, and corrective actions; document reviews; interviews; and observations of various site activities (e.g., safety meetings). The Independent Oversight evaluation determined that there are continuing concerns about the safety culture at WTP and identified a number of factors that contribute to the continuing concerns, as discussed in Section 5. Recommendations that identify potential methods for enhancing the safety culture and that target the factors that are impeding effective resolution of safety concerns at WTP are provided in the front of this report, immediately after the Executive Summary.

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2 Current Safety Culture

This section summarizes the results of an evaluation of the existing safety culture at the WTP. To ensure a valid and effective assessment of the existing safety culture, HSS sponsored external independent safety culture experts to analyze various sources of data and perform the independent evaluation.

2.1 Background

Before starting the assessment, HSS enhanced its capability to assess safety culture processes and capability, through consultation with the U.S. Nuclear Regulatory Commission (NRC), several nuclear power generating utilities, and associated support organizations to benchmark their processes. Recognizing that it has significant expertise in nuclear safety and issue management but limited on-staff expertise in systematic application of behavioral science-based methodologies for performing safety culture assessments, the Independent Oversight team added an HSS human performance specialist as an advisor to the team. HSS also contracted with an external professional sociologist with a strong background in both organizational research and design and group dynamics to provide support on training and data collection and contracted with an external company that specializes in human performance analysis.

The external company that specializes in human performance analysis – Human Performance Analysis Corporation (HPA) – provided its two principals to help design the approach for data collection, analyze the data, and independently evaluate the safety culture. Both of the individuals have extensive experience in the development and application of safety culture assessment methodologies used by commercial nuclear and other industries. The credentials of the company and its principals are provided in Section 6.

With the guidance of the external independent safety culture experts, the Independent Oversight team selected a methodology for the assessment that provides an objective and systematic measurement of the organizational behaviors that impact safety performance, using multiple data collection tools to assess organizational behaviors. These tools include functional analysis, semi-structured focus group and individual interviews, observations, and behavioral anchored rating scales. The Independent Oversight team also arranged for the external independent safety culture experts to conduct a culture survey for ORP (including DOE-WTP) personnel[8] using commonly used survey tools and techniques. The culture survey was conducted and analyzed by the HPA external independent safety culture experts.

8 The Independent Oversight safety culture survey tool was limited to Federal personnel in order to avoid overlap and confusion with a parallel survey administered to contractor personnel in the same time frame. The survey for contractor personnel was sponsored by BNI, performed by a survey organization, analyzed and reported by a law firm (Pillsbury) under contract to BNI, and used as an input for the BNI-sponsored quality culture review.

The external independent safety culture experts trained HSS staff on applying the data collection techniques and conducting focus group interviews. In addition, the external professional sociologist provided training, both before and during data gathering activities, and supported data collection efforts by facilitating focus group interviews and using a structured approach to record and analyze data.

The HPA safety culture experts were tasked to analyze the data collected during the functional analysis, interviews, focus groups, and observations conducted by the external independent safety culture experts and HSS staff along with the safety culture survey implemented by the external independent safety culture experts in accordance with their established methodology. The safety culture evaluation by the external independent safety culture experts is summarized in the remainder of this section and provided in its entirety in the supplemental volume of this report as Appendix A. The recommendations by the external independent safety culture experts are included in the recommendations following the Executive Summary of this report.

2.2 Scope and Methods

The population addressed in the evaluation included all employees, both Federal and contractor, in ORP, DOE-WTP, and BNI. The evaluation was conducted from September through November 2011. The primary objective of the evaluation was to provide information regarding the status of the safety culture at WTP project. The applied framework was the one recently described by the NRC. The evaluation was conducted using the same methodology that aligns with the current NRC procedures for independent safety culture assessment. Positive observations and areas in need of attention with respect to the traits necessary for a healthy safety culture are presented. Conclusions regarding the information collected on the safety culture traits are also presented to facilitate the identification of improvement strategies. Finally, recommendations are provided for some initial steps that the external independent safety culture experts believe are necessary to effectively implement and execute the actions that will result in improved safe and reliable performance.

The safety culture components important for the existence of a healthy safety culture within a nuclear facility have been identified (INSAG-15, 2002; Institute of Nuclear Power Operations Principles for a Strong Nuclear Safety Culture, 2004; NRC Inspection Manual 0305, 2006). The NRC and its stakeholders have recently agreed upon nine traits that are viewed as necessary in promoting a positive safety culture. These include: leadership safety values and actions, problem identification and resolution, personal accountability, work processes, continuous learning, environment for raising concerns, effective safety communication, respectful work environment, and questioning attitude. Particular behaviors and attitudes have been identified to evaluate the extent to which the organization has attained these traits.

While the methodology used in this evaluation was based upon work originally developed with the support of the NRC to assess the influence of organization and management on safety performance, the methodology has also been effectively implemented in non-nuclear organizations, such as mining, health care, research, engineering, and transportation. The methodology entails collecting a variety of information that is largely based upon the perceptions of the individuals in an organization, as well as conducting observations of individuals performing work activities. Perceptions are often reality when it comes to influencing behavior and understanding basic assumptions. Therefore, the data collected regarding individuals' perceptions are critical to this type of evaluation.

The external independent safety culture experts recognize that ORP and BNI are making efforts to resolve many of the technical issues that are encumbering the WTP project. These activities are taking place under intense scrutiny by numerous stakeholders and external organizations. However, the lack of consideration of organizational and cultural considerations will not facilitate the project's forward movement or make ORP's and BNI's efforts as successful as they could be. The external independent safety culture expert's independent analysis offers the following conclusions that will provide insight into some of the difficulties the WTP project may be encountering.

2.3 ORP (including DOE-WTP)

ORP is perceived by many to have a strong focus on nuclear safety. While many interviewees indicated that their line management was supportive of their challenging conditions and activities, the Independent Oversight team concluded that there is a lack of full engagement on the part of ORP senior management in the area of safety culture. There is a perception that the value of safety is sometimes degraded in the presence of schedule and cost pressures. ORP senior management has not addressed delays in the implementation of the corrective actions from the previous HSS assessment as well as from the DNFSB Recommendation. In addition, ORP management has not provided clear direction to ORP staff on the importance and implementation of safety culture into their oversight activities.

The organizational separation of the DOE-WTP organization from the rest of the ORP organization has created difficulties in the communication, coordination, and cohesiveness of the implementation of DOE standards and oversight of BNI. Questions concerning how DOE-WTP is managing the project, what impact their decisions are having on the project, who is in control of the project, and ultimately who will deliver the project remain unanswered for many of ORP's employees and stakeholders.

While the external independent safety culture experts determined that there is no fear of retaliation in the ORP work environment, there is a strong indication of an unwillingness and uncertainty among ORP staff about the ability to openly challenge management decisions. There are definite perceptions that the ORP work environment is not conducive to raising concerns or whether management wants to or willingly listens to concerns. Most ORP staff members also strongly believe that constructive criticism is not encouraged.

2.4 BNI

The external independent safety culture experts recognize that BNI has recently initiated several activities designed to enhance safety culture across the organization. However, the external independent safety culture experts identified significant cultural differences within the BNI organization that will inhibit the success of these activities if they are not appropriately addressed. These differences were identified in groups in both the "Manual" and "Non-Manual" worker populations. The differences are predicated upon the groups' perceptions and priorities around the value the organization places on safety. If BNI is to succeed in implementing some of its initiatives involving the enhancement of safety culture, it must first acknowledge these organizational safety culture differences and work toward having all groups, on all organizational levels, share the same values and perceptions.

The external independent safety culture experts determined that there is a lack of consistency in the behavior of BNI's supervisory and management personnel. This behavior has resulted in the inconsistent

implementation of the desired expectations and standards across the BNI organization. The external independent safety culture experts identified informality with respect to the expectations used in determining the behavior that supervision and management must model for their staff and the methods that are employed to hold all employees accountable for the desired behaviors. Clear and consistent communication of standards and expectations is needed across the BNI organization.

The external independent safety culture experts observed that the BNI organization has become very adept in portraying itself in the most favorable position possible. This is a behavior learned and reinforced given the circumstances (numerous external stakeholder expectations) that it has to confront on a regular basis. While the organization does not deny that it is dealing with significant issues, it handles the communication of these issues in such a way as to diminish their importance. This behavior is not lost on BNI's employees or stakeholders and may be contributing to a lack of trust and the perception of denial by those involved with the organization. The external independent safety culture experts determined that BNI needs to be more forthcoming and transparent with its employees and the public if trust is to improve and if its legitimate efforts are to be successful.

The external independent safety culture experts determined that there is some reluctance to raise concerns and issues across the BNI organization. Fear of retaliation was identified in some groups as inhibiting the identification of problems. Employee engagement in decision making, development of policies and procedures, and the implementation of practices and standards, particularly at lower levels of the organization, would facilitate the involvement of these groups in resolving issues and ultimately mitigating this perception.

The events involving the URS contractor employee/whistleblower who sent a letter to the DNFSB in 2010 are well publicized nationally and are well known to most WTP personnel. The aftermath of the events subsequent to the URS contractor employee's letter to the DNFSB is still evident. Some interviewees indicated that the events around the 2010 whistleblower incident were still on their minds and made subtle reference to the potential for similar consequences as a potential inhibitor to their raising concerns. In addition, some BNI personnel indicated that information regarding the decisions and status of the whistleblower event have been lacking. While employees made few direct references to the whistleblower event, there were some indications that it may still be at a level of awareness that contributes to the hesitancy to challenge management decisions and the belief that management does not want to hear problems or concerns.

2.5 WTP Project

The external independent safety culture experts identified two conclusions, applicable to both ORP (including DOE-WTP) and BNI, that are impacting the safety culture at WTP:

The external independent safety culture experts believe that a potential conflict for WTP is the different perceptions of the role of safety in a research/design project as compared to a construction project as compared to a production project. These perceptions set up the priorities of schedule, cost, and safety differently and may be contributing to some of the organizational issues. WTP needs to establish, implement, and expect the same standards and behaviors for safety, regardless of the phase of the project.

The external independent safety culture experts identified that all organizations involved at WTP have adopted a procedural approach to dealing with safety, and especially safety culture. The behaviors and traits important for a healthy safety culture will not be effective until they are internalized by the members of the organization. More effort is needed in behavioral change to ensure that these traits become the accepted way of doing business.

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3 ORP Management of Safety Concerns

The Independent Oversight team's evaluation of ORP's management of safety concerns focused on the effectiveness of actions implemented by ORP and DOE-WTP to improve safety culture since the 2010 HSS independent assessment of safety culture. Accordingly, the Independent Oversight team examined the actions taken by ORP and DOE-WTP to address the specific HSS 2010 recommendations and to enhance the safety culture. The Independent Oversight team also reviewed the effectiveness of various ORP issues management processes to determine whether the improvement actions have been effective and whether the processes are currently effective in improving the safety culture. Additional details are provided as Appendix B in the supplemental volume of this report.

3.1 Corrective Actions for the 2010 HSS Review

In its 2010 safety culture review report, HSS recommended that ORP "institutionalize the processes and formally define the roles and responsibilities and clarify interfaces between the WTP Federal organization and the other ORP organizations."

Since that time, DOE has made progress in establishing an effective DOE-WTP project organization. ORP has taken steps to better define roles and responsibilities and to strengthen interfaces between DOE-WTP and the rest of the ORP staff. For example, new positions have been established in DOE-WTP to facilitate liaison with ORP support organizations. Most ORP staff members who were interviewed by the Independent Oversight team said that communications between the DOE-WTP organization and supporting ORP organizations had improved but were not yet fully effective.

A proposed revision to the WTP PEP has been prepared and was submitted to EM for approval in July 2011. The revised PEP describes roles and responsibilities for the current DOE-WTP and ORP support organizations. In the revised PEP, both the WTP FPD and the ORP Manager report to EM-1. The proposed plan specifies a direct line of communication from the FPD to the Deputy Secretary and assigns a support role to the staff of the ORP Manager. Most of the proposed changes to the PEP are being implemented in practice, even though they have not yet been approved.

The ORP Safety Management Functions, Responsibilities and Authorities (FRA) was revised in September 2011 to include functions, responsibilities, and authorities for the line management of ORP, including DOE-WTP. The FRA does not fully comply with DOE Order 450.2, *Integrated Safety Management*, in that it does not describe the organization and management structure, does not consistently identify who within the organization has responsibility to perform the functions, and does

not specify the authorities delegated to responsible organizational elements. For example, the FRA identifies the ORP Nuclear Safety Division (NSD) as the position responsible for safety and hazards analyses, but it does not specify whether NSD has authority to approve or disapprove documented safety analyses (DSAs). Formal agreements, such as memoranda of understanding or interface agreements, have not been established to clarify shared responsibilities.

While the above steps were partially responsive to HSS recommendations, continued management attention is needed to better define roles and responsibilities, improve communications, and approve the PEP.

3.2 Processes for Managing Issues

RL and ORP have established appropriate mechanisms for the Federal staff to raise safety concerns, but these mechanisms have seldom been used. Most Federal staff members said that they would have no reservations about raising concerns to their supervisors and no reservations about using those mechanisms. However, a significant number of ORP staff indicated a reluctance to raise safety concerns.

ORP reviews have been effective in identifying deficiencies in WTP design products and in identifying vulnerabilities that could impact the future operability of waste treatment facilities. However, correcting these deficiencies has been problematic. Many of the corrective action plans proposed by BNI to address design deficiencies have been judged inadequate by DOE-WTP, and certain operability vulnerabilities identified by DOE-WTP sponsored reviews have not been addressed in a timely manner. Internal assessments performed by ORP QA and DOE-WTP line organizations over the past two years have identified continuing weaknesses in ORP action item tracking and the management of corrective actions.

The Independent Oversight team was provided no evidence of systematic or formal Federal actions to track or validate corrective actions taken to strengthen safety culture at the site level, limiting the ability of EM or senior DOE management to ensure timely and effective tracking and validation of corrective actions. This tracking and validation constitute one of DOE's commitments in the June 30, 2011, letter from the Secretary of Energy to the DNFSB in which DOE accepted DNFSB Recommendation 2011-1.

Senior ORP and DOE-WTP managers consistently said that safety was their overriding priority and that they had taken steps to convey this message to their staffs. They require that each ORP meeting begins with a safety message, and they emphasize the importance of safety during all-hands meetings. However, some middle managers and staff members said that senior management placed a higher priority on cost and schedule than on safety, and some management actions have contributed to this view. Certain management actions and communication weakness suggest the priority of schedule and cost or raise questions about management priorities among the staff members. For example, the basis for a decision approving the welding of heads on certain vessels was not effectively communicated to Federal or BNI staffs, causing some staff members to conclude that project management had compromised safety in order to meet cost and schedule objectives. The decision to weld the heads was opposed by a DPO, a union grievance, and a stop-work order.

BNI has taken a number of actions to strengthen its safety culture, but most of these actions appear to have been prompted by DNFSB comments and HSS reviews and enforcement actions, rather than by proactive efforts on the part of ORP or DOE-WTP. At the time of this Independent Oversight review,

management expectations regarding safety culture had not been formally communicated to the Federal staff through a policy statement or programmatic requirements, and safety culture training had not been provided to the staff. DOE-WTP had not established a program for periodically monitoring safety culture and providing feedback to management. Additional Federal leadership and actions are needed to strengthen the safety culture within ORP and BNI, including formalizing roles and responsibilities of Federal employees, ensuring that management actions and communications demonstrate the stated priority of safety, and ensuring that factors that could deter Federal staff from raising safety issues are addressed.

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4 BNI Management of Safety Concerns

The Independent Oversight team's evaluation of BNI's management of safety concerns focused on the effectiveness of actions implemented by BNI to improve safety culture since the 2010 HSS independent assessment of safety culture. Accordingly, the Independent Oversight team examined the actions taken by BNI to address the specific HSS 2010 recommendations and to enhance the safety culture. HSS also reviewed the effectiveness of various ORP issues management processes to determine whether the improvement actions have been effective and whether the processes are currently effective. The supplemental volume of this report (Appendix C) provides additional details.

4.1 Corrective Actions for the 2010 HSS Review

The Independent Oversight team reviewed the status, adequacy, and effectiveness of actions identified, taken, and planned to address the recommendations identified in the HSS 2010 safety culture review at WTP. The recommendations addressed the four broad areas of issues management, change management, safety culture improvements to address the groups of employees who perceive a chilled environment, and measures to continuously improve the safety culture. BNI responded to the 2010 HSS report and recommendations in December 2010 and provided the team with a status of BNI commitments to address the recommendations in August 2011.

Recommendation #1, Issues Management

BNI management has identified and has implemented or is implementing many actions to address weaknesses in project issues management, including addressing issues identification and management processes in an NSQC gap assessment and employee survey, a focused process review by a Project Issue Evaluation Report (PIER) users group with associated improvement recommendations, and enhanced new employee orientation and continuing general employee training on issue identification and resolution. BNI has devoted significant effort and made progress in addressing Recommendation #1. However, the Independent Oversight team determined that PIERs written to address this recommendation were given a lower significance designation than warranted for this issue, obviating BNI requirements for performing cause and extent-of-condition reviews and identifying recurrence control actions. Further, the specified actions taken for several of the PIERs addressing this recommendation were insufficiently comprehensive and/or were inappropriately closed (e.g., issue on unclear interface between PIER and other systems is not clearly closed, with actions related only to trend analysis). Many of the actions to address the 2010 HSS concerns about the implementation of BNI processes for identifying and resolving nuclear safety concerns are either only recently implemented or not yet implemented, and it is too early to determine their effectiveness. In addition, the Independent Oversight team identified many PIER

process implementation deficiencies (e.g., institutional trend analysis not addressed) that do not appear to be specifically or adequately addressed by the corrective actions and recommendations identified to date. Continued and focused senior management attention is needed to address these issues.

Recommendation #2, Change Management

The WTP change management program and procedure requirements, when effectively and appropriately implemented, provide assurance that approved changes will not degrade nuclear safety SSCs. However, additional effort is planned and needed to enhance BNI change management planning processes in order to ensure avoidance or appropriate mitigation of potential negative impacts of changes in project plans, procedures, schedules, organizations, and responsibilities on nuclear safety culture.

Recommendation #3, Safety Culture Improvements to Address the Pockets of Employees who Perceive a Chilled Environment

Many avenues of communication have been established. Several initiatives, including small group meetings with the WTP FPD and small group meetings with the BNI Manager of Engineering, were recently initiated. BNI also provided additional training to employees on safety culture issues and established a management walk-around program. However, based on the feedback from interviews, the effort to strengthen trust among the workforce is not fully effective in some organizations, and BNI management has not made sufficient efforts to identify the groups of workers who have specific concerns and to identify and address the specific concerns and the underlying factors. In addition, based on interviews with employees, training has not been sufficient, and there is limited appreciation of what a nuclear safety culture is, especially among employees who had not worked at a nuclear facility before working at WTP.

Recommendation #4, Measures to Continuously Improve the Safety Culture

BNI provided training in response to this recommendation and performed a gap analysis indicating that the NSQC effort was sufficient to improve the safety culture. The Independent Oversight team considers that the gap analysis review was insufficiently rigorous in that it did not include any direct evaluation of any performance evidence and did not adequately address the indicators of less-than-adequate safety culture performance that are evident in the results of previous surveys and other data.

Overall, BNI has taken many actions to address the specific recommendations in the 2010 HSS safety culture report. However, BNI management did not sufficiently or accurately evaluate the significance of the collective safety culture weaknesses, deficiencies, and concerns documented by the DNFSB, the 2010 HSS report, BNI internal reviews, and other external assessments. This shortcoming was reflected in assigning the lowest significance level to the PIERs that were used to evaluate and manage the HSS recommendations. Further, weaknesses in developing corrective actions for some of the recommendations, specified actions that were later deemed unnecessary or less rigorous than required, and less than fully effective implementation of some actions have limited the progress in improving the WTP nuclear safety and quality culture.

4.2 Processes for Managing Issues

The Independent Oversight team evaluated the adequacy and effectiveness of the primary programs BNI uses at WTP to document, evaluate, and resolve safety issues, including processes and implementation.

Programs that were evaluated included corrective action management, engineering technical issues management, the BNI ECP, and the DPO program.

Corrective Action Management

The WTP issues management processes, when implemented properly, can be effective tools for identifying and resolving safety issues. The WTP formal corrective action management system, as described in the project QA manual and the contractor assurance system description, is required to be used to manage adverse conditions, as well as other unwanted or unplanned issues and recommendations and suggestions for improvement. The corrective action management system uses the PIER form to document issues and initiate the process for evaluating, correcting, documenting, and verifying the resolution of the issues. A strength of this process is the use of PIERs to formally document, disposition, and track resolution of opportunities for improvement in addition to violations. Many PIERs are written at WTP, providing for formal documentation, review, and resolution of issues. Approximately 100 PIERs were written per month in the past year. WTP's formal trend analysis and reporting procedure specifies that selected organizations will periodically identify, collect, review, and analyze data for their organizations to identify trends. Trending is performed by a number of organizations as required.

However, inadequate implementation of the requirements of these processes can damage the nuclear safety culture at WTP because issues are often not managed effectively to resolution. In some cases, safety issues at WTP are not documented in the PIER system, are improperly categorized for significance, are inadequately analyzed for causes, or are not resolved with effective corrective and preventive actions. There are instances where ineffective implementation of the issues management process specifically contributed to negative effects on the project's safety culture. For example, WTP staff, management, and senior managers were unable to effectively execute a timely root cause analysis for a PIER issued in October 2010 related to nuclear safety analysis. Senior management was made aware of the difficulties in completing the causal analysis and resolving this PIER no later than July 2011, but management was not effective in resolving the issues and the root cause analysis was not finalized. The final resolution of this PIER was driven by formal DOE requests and BNI's provision of a formal licensing strategy that addresses the applicability of DOE-STD-3009-94. Because consensus agreement on the root cause could not be achieved and there was pressure from DOE to take actions, the PIER was subsequently downgraded to a Level B PIER, a more limited apparent-cause analysis was completed and approved, and corrective actions were identified. Interviews with BNI staff revealed that this extended, contentious, and poorly managed causal analysis activity resulted in strong negative feelings among and between Engineering, E&NS, and QA personnel, and it did not result in development of a root cause analysis commensurate with the significance of the issue. This issue is a significant contributor to the current nuclear safety culture problems at WTP, discussed in Section 5. Although this issue was discussed in a November 2011 Performance Improvement Review Board meeting, where it was suggested that a lesson learned might be appropriate, no definite actions or responsibilities were identified. A rigorous root cause analysis is warranted to identify and establish recurrence control actions that will address the fundamental problems contributing to this PIER and the substantial difficulties and delays in completing the causal analysis and resolving this issue.

The BNI QA organization is aware of weaknesses in project corrective action management processes and has been working on various improvement actions. These include several ongoing efforts, including a "six sigma" group and a PIER users group. The actions taken to date have resulted in process improvements, but they have not been fully successful in preventing performance deficiencies.

The PIER users group has identified an appropriate set of process improvements (e.g., integrating the 23 current issues management systems) but recognized that process changes will have little effect on project personnel's negative perceptions of individual PIER management or the PIER process unless management devotes serious attention to addressing employee and management behaviors and cultural beliefs. While the recommendations are appropriate and have the potential to strengthen project issues management, especially with regard to the need to modify behaviors and cultural weaknesses, they do not specifically address the implementation deficiencies identified during this review.

Engineering Technical Issues Management

The Engineering Technical Issues Identification Management Guide was significantly enhanced in a March 2011 revision. The revised Guide clarifies applicability and expectations.

An HSS review of BNI Engineering activities in 2008 identified a concern that the WTP design did not provide adequate mitigation for potential volcanic eruption ash fall from the nearby Cascade Mountain Range. The Independent Oversight team reviewed documentation associated with the closure status of this issue to follow up on this concern and to evaluate the effectiveness of the Guide process. In reviewing the issue, BNI appropriately determined that the original proposed strategy (requiring replacement of approximately 7000 filters within a 24-hour period) was not feasible. The revised, optimized, and agreed strategy requires bringing the facilities to a safe configuration during a two-hour warning period after a volcanic eruption (e.g., shutting down certain processes) and adding or modifying various filtration and ventilation equipment. For this issue, the Guide process was effectively followed, and a path forward is in place and scheduled to occur in 2012.

Consistent with the revision of the Engineering Technical Issues Identification Management Guide, Engineering appropriately consolidated the list of technical issues identified in the 2009 and 2010 "Clean Out the Drawers" initiative and ensured that the status of each was being tracked in an appropriate formal or informal process. The Independent Oversight team also reviewed the October 2011 WTP Technical Issues Summary Table for open technical issues (included in Technical Issue Evaluation Forms and Cut Sheets). These processes were appropriately implemented, and progress is being made to resolve the numerous open technical issues, although significant work remains.

BNI Employee Concerns Program

The Independent Oversight team reviewed current process documents and a sample of case files for BNI employee concerns that were filed with the BNI, ORP, and RL ECPs and were closed after October 2010. In the past year, approximately 100 WTP workers have reported formal concerns to the BNI, ORP, or RL concerns programs, including construction craft, technical, and administrative staff. Many of the concerned individuals reported multiple concerns, all of which were investigated/resolved individually by the concerns program staff. The continuing reports of formal employee concern cases show that many WTP employees feel free to report their concerns, as well as reflecting continuing worker perceptions of a less-than-adequate safety culture. Most investigations were generally thorough and reflect significant effort by ECP investigators to communicate and establish a positive working relationship with the concerned individuals to draw out as much information as possible and communicate investigation status. The BNI ECP has established a formal exit interview process to solicit safety concerns from departing employees that is more formal and specific than typical concerns programs.

While the investigations that were conducted were generally thorough, in a number of the ECP case files reviewed, the investigations were not sufficiently comprehensive. For example, a BNI ECP case that identified peripheral safety issues was closed based on an e-mail from the superintendent stating that he had talked with his foremen, heard that they were unaware of any problems, and told them he expected procedures to be followed. These actions were insufficient to definitively establish whether the expressed concerns were accurate or to identify the extent of condition. The failure to address all aspects of the case or to fully address emergent issues can damage the credibility of the program with concerned individuals, who may conclude that the ECP process is ineffective or biased. Also, formal BNI ECP communications of resolutions to the concerned individuals did not address any recourse for the concerned individual if he/she did not agree with the resolution; the ECP manager took action to improve this situation during this Independent Oversight assessment by changing the standard template for responses.

Differing Professional Opinion Program

Two DPO cases have been filed since the 2010 HSS review. Both were decided in favor of the initiator. The investigations and case files were generally well documented and involved independent personnel with nuclear safety qualification and experience who evaluated the facts of the competing positions and made appropriate recommendations for resolution.

A procedure describes the DPO process expectations. However, deficiencies in the DPO procedure and the implementation of the process were identified. For example, the revised procedure does not describe, in the text or the process flow chart, the documentation and management of any issues and associated corrective actions or recurrence controls resulting from the DPO resolution (i.e., document and manage as a PIER). Also, deficiencies in the application of the DPO process included providing insufficient analysis of the reasons why prior issue resolution methods were ineffective in resolving the issue, documenting corrective actions in the wrong system (a commitment tracking system rather than the PIER system), and incorrectly categorizing corrective actions in the PIER system (resulting in a lower priority than warranted and thus obviating requirements for analysis of causal factors).

DOE-Directed, BNI-Sponsored Safety Culture Assessment

As discussed in Section 1, DOE directed and BNI sponsored a review of the WTP nuclear safety culture by a group of nuclear industry subject matter professionals. The BNI-sponsored safety culture assessment team consisted of six well qualified individuals with extensive executive-level experience in nuclear facilities and nuclear safety, which conducted its review from August through November 2011 and provided its results in a report dated November 30, 2011. In a related effort, BNI initiated a safety culture survey. Conducted in August 2011, the BNI safety culture survey used questions developed by the BNI-sponsored team and was administered by K-Management Resources (K-MR), an organization that performs surveys. The results were analyzed by Pillsbury Winthrop Shaw Pittman LLP (Pillsbury), a law firm whose services to BNI have included evaluations of previous culture surveys and conduct of safety culture interviews in August 2010. Pillsbury's analysis of the survey results were documented in a report issued in November 2011. The BNI-sponsored team reviewed the BNI survey results and the Pillsbury report and incorporated the results in its evaluation of the safety culture in its report dated November 30, 2011. The Independent Oversight team reviewed the survey, the Pillsbury analysis, and the BNI-sponsored safety culture assessment team report; a brief summary of the Independent Oversight perspectives on these efforts is provided below.

The BNI safety culture survey was an extensive effort that provided valuable insights. The detailed data tables provide information about the perspectives of various BNI and URS organizational elements, which identified significant variation in perspectives among various groups at WTP. However, the Independent Oversight team identified several concerns about the survey methodology, statistical approaches, and analysis methodologies. For example, bounding numbers were used inconsistently and were applied in a manner that made it relatively easy to identify an item as an area of strength and relatively difficult to identify an item as an area for improvement. More consistent application of the bounding numbers would have resulted in fewer areas of strength and more potential areas for improvement; in one instance, the lax application of bounding numbers resulted in the report identifying six areas of strength and three areas of weakness, whereas a strict application would identify only three areas of strength and six areas of weakness. The HSS-sponsored external safety culture experts provided a set of specific concerns about the survey approach and methodologies to BNI and Pillsbury personnel during the assessment and validated the concerns.

The DOE-directed, BNI-sponsored safety culture assessment team report provides the perceptions and interpretation of a group of senior management-level professionals with considerable experience in nuclear safety and operations. They primarily used document reviews and interviews that targeted knowledgeable individuals and key managers and a limited number of random employees to collect data, rather than a systematic sampling of the WTP population using formal safety culture inspection protocols (such as focus groups of individuals representing the various groups at WTP). Nevertheless, the report provides useful insights about the nuclear safety culture of ORP, DOE-WTP, and BNI, and many of the results are broadly similar to results of the 2010 HSS review and this 2011 Independent Oversight assessment. For example, all of these efforts determined that some individuals were reluctant to raise safety concerns and problems regarding the processes for reviews of nuclear designs and safety basis documents. However, the BNI-sponsored safety culture assessment report and this Independent Oversight assessment have differences in scope and methods, and, in a few important areas, have differing perspectives and conclusions. Some of the more important areas where the BNI-sponsored team report and this Independent Oversight progress assessment reached somewhat differing conclusions include:

- **The degree to which there is a chilled atmosphere.** The BNI-sponsored safety culture assessment report concluded that there was no widespread evidence of a chilled atmosphere and that reluctance to raise safety and technical issues was isolated (which was clarified in a December 1, 2011, teleconference as a very small number or handful of BNI personnel). The Independent Oversight team determined that concerns about the safety culture, while not necessarily widespread, are not isolated to a small number of individuals and are prevalent enough, particularly in certain groups, to warrant significant and timely management actions.

- **The role of the E&NS organization in the current problems with nuclear design and safety bases processes.** The BNI-sponsored safety culture assessment team and the Independent Oversight team both identified the safety basis as one of the most important problems impacting the safety culture and that management's failure to resolve the alignment between the Engineering and E&NS organizations was one of the most significant contributors to this problem. The BNI-sponsored safety culture assessment report focuses on "management and performance of the E&NS organization" as a key contributor to the problem. The Independent Oversight team has different perspectives on the most important causal factors. This Independent Oversight review indicates that the current management of the E&NS organization, along with certain DOE-WTP and BNI managers, has been active in the recent efforts to resolve the fundamental

issues that were likely to prevent or delay efforts to develop a safety basis that could be approved under current standards (e.g., hazard assessments that meet DOE-STD-3009-94, and provision of resources needed to perform safety basis activities). While there are some concerns about management style and performance problems (e.g., delays in approvals) within the current E&NS organization, this Independent Oversight review indicates that the more fundamental problems affecting E&NS performance result from ineffective communications, inaction, and ineffective direction in a number of areas (e.g., lack of timely decisions on and communication of applicable requirements) by more senior BNI and ORP/DOE-WTP management over the past years.

- **Adequacy of the safety culture with respect to construction work.** Based on their analysis of the status of industrial safety at the construction site and other data, the BNI-sponsored safety culture assessment team determined that there were no significant concerns about industrial safety at the construction site and that ORP and BNI were making good progress in advancing the industrial safety culture. Accordingly, the BNI-sponsored safety culture assessment team decided not to further discuss the safety culture for manual workers (e.g., construction workers) in its report. The Independent Oversight team's progress assessment results, which included extensive focus group interviews with construction superintendents and the construction craft, foremen, and general foremen, indicate that the safety culture for construction work and industrial safety warrants increased attention in a number of areas. Also, the Independent Oversight team's review of the detailed results of the 2011 BNI survey (administered by K-MR) identifies some potential concerns with respect to crafts workers. For example, 48 percent of the responding electricians disagreed or strongly disagreed with a statement on the K-MR survey stating "I am confident that the 'zero tolerance' policy against retaliation at WTP is enforced."

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5 Factors Affecting the Safety Culture

Based on the review of data from multiple sources, the Independent Oversight team identified two areas for further analysis of factors that contribute to the observed weaknesses in the safety culture: the nuclear safety construct[9] and construction activities.

5.1 Nuclear Design and Safety Basis Processes

The information from multiple sources, including the 2010 HSS review, the November 2011 BNI-sponsored team report, and the interviews and focus group data collected by the Independent Oversight team during this 2011 assessment, point to problems with the nuclear safety construct. These problems impact the efforts to achieve a positive safety culture, particularly for BNI, ORP, and DOE-WTP personnel who are directly involved in the interfaces between design and engineering functions and the nuclear safety basis analysis and approval functions. The Independent Oversight team identified a number of specific factors that contribute to the current degraded safety culture in some groups at WTP; ORP, DOE-WTP, and BNI need to address these factors as part of the effort to address the cultural issues. The factors discussed here, many of which are interrelated, need to be evaluated and addressed both individually and collectively by WTP line management.

Longstanding and Continuing Inconsistencies in Contractual Requirements

Clearly defined requirements are a prerequisite to an effective nuclear safety construct, including development of a safe design and adequate safety basis; if requirements are not clearly understood, problems in safety basis reviews are inevitable. Currently, there are some important inconsistencies and deficiencies in the Safety Requirements Document, which is a part of the contract that defines the safety requirements applicable to WTP that complement the applicable regulatory requirements (e.g., 10 CFR 830). Specifically, the Safety Requirements Document identifies certain safety basis procedures that include requirements that are inconsistent with regulatory requirements, as described below. Additionally, because certain procedures (e.g., safety basis review procedures) are included in the Safety Requirements Document, they cannot be changed without a DOE safety evaluation review and approval (a process that typically takes six months).

Deficiencies in the contract date back to the initial contract between DOE and BNI in the late 1990s, when DOE and BNI believed that WTP would be licensed by the NRC, a strategy that was later abandoned.

9 As used in this report, the "nuclear safety construct" refers to the spectrum of nuclear safety requirements and processes, including design processes and safety basis processes, that have the ultimate goal of ensuring a safe design, DOE approval of the safety bases, and DOE authorization to operate.

In addition, the original contract predated the issuance of 10 CFR 830 (final rule issued in 2001), which contained new requirements for safety bases. Among other things, 10 CFR 830 requires contractors to obtain approval from DOE for the methodology used to prepare the DSA for nuclear facilities unless the contractor uses DOE-STD-3009-94, *Preparation Guide for U.S. Department of Energy Nonreactor Nuclear Facility Safety Analysis*. However, the contract Safety Requirements Documents included some requirements that were directly in conflict with DOE-STD-3009, as discussed under the next factor. During the 2002 time frame, reviews by DNFSB and others indicated problems with the requirements and safety basis procedures; however, actions at that time were not effective for long-term resolution of the problems. In the past two years, other events (e.g., assigning a manager for the E&NS organization who was experienced in DOE-STD-3009 and recognized the procedure inadequacies) and various internal and external assessments highlighted the conflicting requirements and prompted action.

In 2011, BNI took actions that have the potential to lead to resolution, including a gap analysis between the Safety Requirements Document safety basis procedures and DOE-STD-3009. In July 2011, BNI submitted a contract change request to DOE to resolve some of the discrepancies and allow revision of the E&NS implementing procedures to align them with DOE-STD-3009. As of the time of this report, DOE had not approved the contract change. Interviews indicated that the reasons for delaying approval were influenced by budget constraints. Further, the proposed change does not resolve the discrepancies in the safety basis requirements in other standards of the contract, namely standard 7 and standard 10. Although actions to resolve this concern are now under way, the inconsistent requirements have been a source of conflict between the Engineering and E&NS organizations, and within the E&NS organization, particularly in the past two years. E&NS management has attempted to meet the more stringent standards of DOE-STD-3009 in order to achieve eventual approval of the safety basis, even though they cannot change the procedures until the contract modification is approved (discussed further below).

DOE and BNI Communications about the Applicability of DOE-STD-3009

Ineffective DOE and BNI communications about DOE-STD-3009 resulted in conflicting views about its applicability, exacerbating the above concern. In September 2001, BNI asked DOE to allow BNI to use the DOE-STD-3009 format for the authorization basis documents, but stated that they were not requesting relief from the approved authorization basis document methodology requirements as documented in the Safety Requirements Document or other requirements that were in place at that time. According to corroborating interviews during this Independent Oversight assessment, BNI believed at that time that the safety basis documentation would be developed under the NRC methodology established in the Safety Requirements Document (since much work had already been done using this method), but that the results would be published in the format of DOE-STD-3009. According to interviews and later correspondence, there was much disagreement, both within BNI and DOE and between BNI and DOE, about whether DOE-STD-3009 fully applied. Some individuals, both within BNI and DOE, believed that the change notice constituted approval from DOE to use the NRC methodology specified in the Safety Requirements Document while using the DOE-STD-3009 format, but others within both BNI and DOE believed that the methodologies in DOE-STD-3009 fully applied because DOE never issued a formal approval letter for the alternate approach.

In the 2002 time frame, a DNFSB review identified a concern that the BNI methodologies and safety documents did not meet DOE-STD-3009 provisions. Among other things, the DOE response informed the DNFSB that "DOE-STD-3009-94, Change Notice 2, is not included in the contract and is not required during this phase of the project. However, DOE has attempted to remain consistent with this guidance,

where appropriate for a new construction facility, and with a view to its eventual use for the Documented Safety Analysis for the facility." This language further complicated BNI's and ORP's understanding of the applicability of DOE-STD-3009 in that the meaning and intent of the statements "attempted to remain consistent with this guidance" and "with a view to its eventual use for the Documented Safety Analysis" were never formally communicated to BNI.

An August 2011 DOE construction project review recognized the disagreement about DOE-STD-3009 applicability within BNI and recommended resolving the internal BNI conflict regarding the applicability of DOE-STD-3009, as well as the applicability of 10 CFR 830 to commissioning and testing. On September 27, 2011, the DOE-WTP FPD issued a letter to the BNI WTP Project Director (Letter 11-WTP-35, *Contract No.DE-AC27-01RV14136 – Department of Energy Concerns, Licensing Approach for Waste Treatment and Immobilization Plant*) stating DOE's position on DOE-STD-3009. The FPD stated, "DOE has not (and will not) approve an alternate methodology to meet the requirements of 10 CFR 830…" The FPD also stated that "DOE wants to avoid the possible repetition of issues identified in the November 4, 2002, DNFSB letter…. Actions taken several years ago to address DNFSB's concerns should have effectively addressed the process and organizational interfaces that develop and deliver the engineering and safety basis documents for the project." Although it appears clear in this letter that DOE's intent is to have WTP fully comply with DOE-STD-3009, it was apparent from several interviews during the week of November 28, 2011, that this information has not been well communicated within either organization (neither DOE nor BNI), and misunderstandings of the applicability of DOE-STD-3009 persist within both organizations.

The resolution of the applicability of DOE-STD-3009 has had wide-ranging impacts that have not yet been fully evaluated. In June 2011, BNI E&NS performed a gap analysis to determine the gaps between DOE-STD-3009 and existing BNI E&NS procedures dealing with safety basis requirements. The items below summarize key requirements of DOE-STD-3009 that are not addressed in existing BNI procedures:

- There are no criteria/requirements for the evaluation of "other hazardous conditions." Chemicals have been routinely screened as "not a concern" using the "extremely hazardous quantities" thresholds.
- There are no criteria/requirements for evaluating impacts to the environment.
- Defense-in-depth criteria/requirements are inconsistent with DOE-STD-3009; BNI criteria are consequence-based, contrary to the guidelines in DOE-STD-3009 for hierarchy of controls.
- There are no requirements for protecting inputs and assumptions in technical safety requirements, if required.
- The criteria/requirements for selecting controls and developing accident analyses are incomplete. Inaccurate use of the terms "prevent" and "mitigate" in BNI procedures has led to the safety basis documents containing no mitigated accident scenarios.
- There are no criteria/requirements for addressing beyond design basis events.
- Accident binning is based on accident consequences rather than accident type (e.g., fires, spills, explosions).

- There are no criteria/requirements for establishing performance criteria for credited safety SSCs.
- There are no criteria/requirements for establishing system boundaries/interface points for credited safety SSCs.

Although DOE has very recently clarified its position and indicated that BNI must fully comply with DOE-STD-3009, some safety basis analyses and design reviews over the past ten years were performed against procedures that do not fully meet all DOE-STD-3009 requirements. As a result, the existing safety bases documents and some aspects of the design may later be found to not comply with DOE-STD-3009 and 10 CFR 830, impacting the ability to gain approval of the safety basis for hot operation (the final DSAs). The impacts of this issue on design, cost, and budget have not been fully analyzed, but some ORP, DOE-WTP, and BNI personnel indicated a potentially large impact that may require redesign of some systems, further stressing the Engineering and E&NS organizations.

Inadequacies in the Current PDSA and Safety Basis Process

The original safety analysis report and preliminary safety evaluations were developed in accordance with NRC standards. With the issuance of 10 CFR 830, BNI was required to develop individual facility preliminary DSAs (PDSAs) to supersede the WTP initial safety analysis report and preliminary safety analysis reports. The PDSAs are the authorization basis documents for authorizing procurement and construction of the facilities and serve as the primary safety basis documents until the final DSAs are approved for hot operations. Over the years, processes to keep the PDSAs current have not been effective, and the PDSA is out of date, a situation that is getting worse.

Various internal WTP reviews have highlighted significant deficiencies in PDSAs and safety basis processes in general. A September 2010 PIER described an inconsistency in that the Pre-Treatment Facility PDSA fire barrier design feature requirements for fire barriers had not been incorporated into the plant design. In June 2011, E&NS issued the results of a management assessment that focused on the Low Activity Waste (LAW) Facility PDSA and concluded that comprehensive corrective actions would be necessary to achieve a "licensable" DSA for the LAW Facility; since the findings apply equally to the other WTP facilities, the corrective actions should be structured and implemented to address all WTP facilities. Another review led to a November 2011 decision to suspend design, procurement, or installation of several key systems (e.g., safety systems required for ash fall events). The resolution of these issues involves bringing the design and safety bases into alignment.

Insufficient Planning and Management Support for Developing the Safety Bases

Developing a compliant safety basis for a facility as large and complex as the WTP is a massive effort. Historical experience with other large efforts shows that the cost for a major DSA is on the order of $20 million, and WTP needs to develop five major DSAs. According to a BNI presentation for an August 2011 construction project review, the current budget calls for funding for completion of all five DSAs at a level of less than $4 million, which appears to be less than 10 percent of the amount needed (based on historical experience with development of safety basis documents). Some personnel at WTP indicated that the gap occurred because DOE never fully budgeted or provided the appropriate funds for a DOE-approved safety basis, and others indicated that BNI significantly underestimated the cost of developing DSAs. In addition, as discussed previously, DOE has not provided a concise and unambiguous set of requirements and expectations for the safety basis effort, and BNI has not provided adequate resources and organizational leadership to ensure that the expectations for the WTP safety basis are fully defined and supported by all organizations.

Some senior DOE and BNI managers have begun to recognize the likelihood of a large budget gap for the DSA effort, but the magnitude of the gap seems not to have been evaluated and widely understood within WTP. Also, during interviews with the Independent Oversight team, some ORP and BNI personnel indicated that DOE had been reluctant to ask Congress for additional funding because of previous budget cap commitments to keep the cost of the WTP below the current cap (about $12 billion). Some personnel at WTP indicate that reluctance to request funding has contributed to delays in approving the contract modification discussed above, since the contract modification would involve a cost adjustment. Subsequently, other BNI personnel indicated that funding the safety basis effort was within the contingency funds and would not cause costs to exceed the cap. At this time, the safety basis effort is significantly underfunded, and no plan for resolving the issue has been finalized.

Tension between E&NS and Engineering

In March 2009, a manager experienced in DOE-STD-3009 methodology was brought to WTP and assigned to E&NS. Before this manager was assigned, it appears that safety basis documents were reviewed and approved by the E&NS organization and ORP based on contract requirements that did not meet requirements of DOE-STD-3009. The current E&NS manager has been active in setting expectations for safety reviews of design, engineering, and environmental documents that are consistent with DOE-STD-3009 expectations. However, formalizing the DOE-STD-3009 expectations in E&NS implementing procedures was hindered by the complex and restrictive Safety Requirements Document that was not consistent with DOE-STD-3009, and the time consuming requirement for DOE approval of changes to the Safety Requirements Document and revision of the E&NS procedures that must reflect the revised requirements of the Safety Requirements Document. Consequently, these expectations were communicated through less-formal channels, such as verbal or e-mail instructions to the staff. These expectations significantly increased the workload of the E&NS staff and delayed E&NS safety review and approval of documents from other organizations. Because these delays could not be attributed to requirements in the BNI procedures (which do not meet DOE-STD-3009) and caused Engineering milestones to be missed (sometimes impacting performance appraisals), hard feelings ensued. Engineering organizations felt that the new approach, along with the resulting delays, was unwarranted and placed blame directly on the E&NS department. Additionally, some E&NS staff felt pressure from E&NS management and design and engineering organizations, and they resented the lack of a procedural basis for the additional safety review requirements and workload. Over the last two years, WTP design has progressed, but the PDSA has become further out of date, and delays in safety reviews of design and engineering documents have worsened. The animosity between some groups (e.g., Engineering) and managers and the entire E&NS group has become severe. A contributing factor is that much of the existing E&NS safety review staff and engineering staff has limited experience with the DOE-STD-3009 safety analysis format.

This Independent Oversight review indicated that the current management of the E&NS organization and certain other BNI managers, supported by some individuals within DOE-WTP, have been active in DOE-WTP's and BNI's very recent efforts to resolve the fundamental issues that were likely to prevent or delay efforts to develop a safety basis that could be approved under applicable regulations and DOE-STD-3009. Although most of the symptoms are evident within the E&NS and Engineering departments, most of the contributing factors listed above result from actions or inactions at higher levels of ORP, DOE-WTP, and BNI management. While the Independent Oversight team determined that senior managers are supportive of safety in general, ORP, DOE-WTP, and BNI management has not achieved timely resolution of important issues, including those discussed above, in some cases for

about ten years. Further, typically ORP, DOE-WTP, and BNI senior managers are highly experienced but do not have specific experience in applying DOE-STD-3009 nuclear safety design and safety basis processes.

In the past few months, ORP, DOE-WTP, and BNI management have begun some promising initiatives that could lead to resolution of the underlying concerns:

- BNI recently conducted a management workshop on safety basis requirements to raise the level of management understanding of safety basis requirements and issues at WTP.
- BNI completed a gap analysis between the safety basis procedures and DOE-STD-3009 that identified the differences in the hazard analysis provisions and provides an essential baseline for action.
- In July 2011, BNI submitted a contract change request to DOE to resolve some of the discrepancies and allow revision of the E&NS implementing procedures to align them with DOE-STD-3009. As of the time of this report, DOE had not approved the contract change.
- On September 27, 2011, the DOE-WTP FPD issued a letter to the BNI WTP Project Director stating DOE's position that DOE-STD-3009 "has not (and will not) approve an alternate methodology to meet the requirements of 10 CFR 830…"
- In response to a finding in the August 2011 construction project review, BNI completed a plan, called the Integrated Licensing Strategy, to develop a regulatory-compliant safety basis and submitted it to DOE on October 31, 2011. This strategy provides an approach to resolving the findings from certain other management assessments and open technical issues. However, the pertinent action due dates in the licensing strategy are based on DOE's approval of the contract change, which was submitted July 27, 2011, and has not yet been approved.

While these actions are positive signs, some of them are not finalized and/or are contingent on funding and the ability to attract additional personnel with the requisite skills and experience in nuclear design and safety bases. In addition, although the above actions have the potential to address the underlying problems, significant and sustained ORP, DOE-WTP, and BNI management attention will be needed to ensure that the safety culture concerns are also addressed for personnel who are involved in design and engineering functions and the nuclear safety basis analysis and approval functions.

5.2 Construction Activities

Information collected through Independent Oversight team interviews, focus groups, and document reviews confirms that many construction personnel believe that the Hanford Site and/or WTP are among the safest places they have ever worked. However, many crafts workers identified concerns about safety culture, including mistrust of the construction superintendents; frustration with inconsistent disciplinary actions and the craft rating system; fear of retaliation for raising safety issues; inconsistent application and communication of rules and procedures among WTP buildings; and inadequate planning, scheduling, and coordination of work. Although not highlighted in the Pillsbury report, the BNI safety survey (administered by K-MR) responses to certain questions revealed strong concerns among the construction craft. In many respects, the concerns raised by construction craft personnel are similar to

those expressed by other groups at WTP, as discussed in Section 2 and in the supplemental volume of this report (Appendix A). However, the Independent Oversight team identified three areas with concerns unique to construction activities: the potential for impacts on safety and quality, the rating system, and ORP oversight of worker safety. These areas warrant increased management attention.

Potential for Schedule Pressure to Impact Safety and Quality

A significant number of crafts personnel indicated that schedule pressures and other factors (e.g., inadequate planning, frequently shifting priorities, poor communications, inadequate work packages) have resulted in instances where safety rules, procedures, and practices were not followed. The crafts recognize that procedures and work packages must be followed verbatim, but believe that supervisors do not always support that requirement in work judged to have a high priority. For example, following procedures verbatim could take too long and cause delays for other crafts. Due to production pressures, some foremen make compromises or ask the crafts to decide for themselves (and take the risk of violating procedures). BNI, DOE-WTP, and ORP management should evaluate these concerns to determine their validity and extent. In addition to the safety risks to workers, compromising procedures and rules could impact the quality of construction and installation of safety grade SSCs. Crafts personnel described a few instances where safety grade structures or components (e.g., electrical cable trays) may not have been installed correctly because of schedule pressures, poor planning, or inadequate work packages (e.g., needed parts not available). BNI, DOE-WTP, and ORP management should evaluate work practices, QA processes, and communication and understanding of expectations to ensure that safety and quality are not compromised by schedule pressures or insufficient management expectations, controls, and oversight.

Performance Rating System

Interviews with construction crafts personnel indicated widespread dissatisfaction with the rating system used for most crafts workers, which defines the ratings that are used as a major factor in decisions about promotions and reductions in force. The perception that the rating system is arbitrary and unfairly implemented in a way that inhibits or penalizes the raising of safety and quality issues is a particularly important factor in many craft workers' views of the safety culture. The Independent Oversight team's focus group discussions related to the ratings indicates that construction superintendents consider the BNI performance rating system to be complex but more effective than the previous seniority system. Craft personnel are rated primarily by their superintendents based on input from foremen and general foremen on three broad factors (safety, job knowledge, and initiative). However, crafts workers, foremen, and general foremen strongly and almost universally believe that the crafts rating and ranking system is poor, inconsistent, and unfair; they cite several concerns about inconsistent application, insufficient input from the persons most knowledgeable of the workers' performance, and insufficient communication of the reasons for ratings. The Independent Oversight team determined that although BNI has a guide (WTP Craft Employee Evaluation Guide) describing the rating system, most craft, including foremen and general foremen, are not aware of it, and the superintendents receive no formal training on rating and ranking the crafts.

ORP Oversight of Worker Safety

ORP and DOE-WTP oversight of functional areas, such as industrial safety, industrial hygiene, and radiation protection, warrants attention. Some ORP personnel indicated that the only Federal presence performing oversight of worker safety at WTP facilities is the Facility Representatives, and that ORP safety subject matter specialists did not regularly communicate with the DOE-WTP Facility Representatives. Several ORP safety subject matter specialists indicated that they had not been to the

WTP site for months because they were not welcome by the DOE-WTP team; were not involved in safety functions they had previously performed (e.g., review of the worker safety and health plan); and were not involved in reviewing, and sometimes were not formally made aware of, significant safety events at WTP (e.g., the steel girder drop). Conversely, a DOE-WTP manager with responsibility for oversight of construction has indicated that attempts have been made to engage ORP subject matter specialists and that the amount of oversight by subject matter specialists at WTP had been low for some time and was not impacted by the de facto separation of DOE-WTP from the rest of ORP. The apparently limited involvement of subject matter specialists in Federal oversight of worker safety at a major construction site warrants timely management evaluation and attention.

6 Supplemental Information

Dates of Review

Scoping/Planning Visit:	September 26-30, 2011	
Onsite Data Collection:	October 10-14, 2011	October 31-November 4, 2011
	November 14-18, 2011	November 28-December 2, 2011
Validation and Briefing	December 20-22, 2011	

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Expertise and Credentials of the Independent Safety Culture Experts

Human Performance Analysis Corporation (HPA) is one of the leading consulting groups working to assist organizations in **performance improvement** through the understanding and leveraging of the individual, process, and organizational behaviors necessary to facilitate safe operating performance.

The HPA team is composed of experts in **organization and management, safety culture,** and **human performance analysis**. HPA has decades of experience working across numerous different industries where high safety performance is required, both in the United States and abroad.

HPA provides performance improvement services to public and private sector clients conducting safety-sensitive operations across a wide range of industries including nuclear, healthcare, mining, research, engineering, transportation, and energy.

The principals are:

Sonja B. Haber, Ph.D. Dr. Haber has been conducting work in the area of human performance analysis for over 30 years. She has been involved in the evaluation and intervention of human performance strategies in various applications, including nuclear facilities. For the last 23 years, Dr. Haber's work has focused on improving human performance within organizations that must operate with a high degree of reliability. She has been extensively involved in conducting fieldwork for various international agencies in efforts related to enhancing human performance. Her work has also included cross-cultural analysis of organizational issues in the areas of safety culture and management and supervisory skills. Most recently, Dr. Haber has been conducting safety culture evaluations in various organizations; providing consultation in organizational interventions including leadership and management training, enhanced communication, and observational skills training; and working toward the development of performance measures for organization and management processes.

Deborah A. Shurberg, Ph.D. Dr. Shurberg's primary interests lie in the development and implementation of methodological tools useful for the analysis and improvement of organizational functioning and in the assessment and evaluation of human resource practices critical to effective organizational performance. In particular, her work focuses on improving human performance within organizations that must function with a high degree of reliability and the assessment and improvement of organizational behaviors that impact safety culture. Dr. Shurberg has extensive experience across a variety of industries and countries, providing support in the diagnosis of organizational and management strengths and areas in need of improvement. She has significant experience in the development and implementation of intervention strategies within the nuclear industry, particularly on human-performance related topics including communication skills, observational skills, and management and supervisory skills.

More information can be found at: http://hpacorp.com/