Independent Review of
Nuclear Safety Culture
at the

Hanford Site Waste Treatment and Immobilization Plant Project

October 2010

Office of Health, Safety and Security

HSS
Office of Health, Safety and Security

Table of Contents

Abbreviations Used in This Report

ATS	*Action Tracking System*
BNI	*Bechtel National Incorporated*
CARB	*Corrective Action Review Board*
CFR	*Code of Federal Regulations*
CPR	*Construction Project Review*
CRESP	*Consortium for Risk Evaluation with Stakeholder Participation*
CY	*Calendar Year*
DNFSB	*Defense Nuclear Facilities Safety Board*
DOE	*U.S. Department of Energy*
DOE-WTP	*ORP Organizational Element with Responsibilities for the WTP Project*
DPO	*Differing Professional Opinion*
DSL	*Discipline Support Lead*
ECP	*Employee Concerns Program*
EDR	*Engineering Design Review*
EFCOG	*Energy Facility Contractors Group*
EFRT	*External Flowsheet Review Team*
EM	*DOE Office of Environmental Management*
EM-1	*Assistant Secretary for Environmental Management*
E&NS	*Environment and Nuclear Safety*
HSS	*Office of Health, Safety and Security*
INPO	*Institute for Nuclear Power Operations*
IRP	*Issue Response Plan*
IRT	*Issue Resolution Team*
ISM	*Integrated Safety Management*
MOE	*Manager of Engineering*
NSQC	*Nuclear Safety and Quality Culture*
NSQI	*Nuclear Safety and Quality Imperative*
ORP	*DOE Office of River Protection*
PIER	*Project Issue Evaluation Report*
PIRB	*Performance Improvement Review Board*
PMT	*Project Management Team*
PNNL	*Pacific Northwest National Laboratory*
QA	*Quality Assurance*
RL	*DOE Richland Operations Office*
SCWE	*Safety Conscious Work Environment*
SME	*Subject Matter Expert*
SRS	*Savannah River Site*
TIEF	*Technical Issue Evaluation Form*
TSG	*Technical Steering Group*
URS	*URS Corporation*
WTP	*Waste Treatment and Immobilization Plant*

This page intentionally left blank.

Executive Summary

The U.S. Department of Energy (DOE) Office of Health, Safety and Security (HSS) conducted an independent review of the nuclear safety culture at the Waste Treatment and Immobilization Plant (WTP) project at the Hanford Site during August and September 2010. The HSS team performed the review in response to a request in a July 30, 2010, memorandum from the Assistant Secretary for the DOE Headquarters Office of Environmental Management (EM), which referred to nuclear safety concerns raised by a contractor employee at WTP.

The WTP project – managed by Bechtel National, Incorporated (BNI) – is DOE's most technologically complex and largest capital project, and is currently in the midst of a major change from the design phase to the commissioning phase. In addition, the responsible DOE site office – Office of River Protection (ORP) – is undergoing a restructuring of the role of the Federal Project Director.

Most ORP personnel indicated their belief that the nuclear safety culture within ORP is strong and improving. Although a limited number of individuals had varying concerns, the majority of ORP personnel who were interviewed expressed positive views of the nuclear safety culture and current senior management. Nevertheless, the nature of the concerns identified by various ORP staff members indicates a continued need for management attention on improving internal communications, particularly about ongoing and upcoming changes to the ORP procedures and organizational interfaces.

Although improvements are needed in some areas, BNI and its subcontractors have established the framework for a strong nuclear safety culture at WTP. Most WTP personnel who were interviewed expressed that their managers encouraged a questioning attitude and that they were comfortable with raising safety concerns. However, some individuals within WTP believe that there is a chilled environment that discourages reporting of safety concerns, and/or are concerned about retaliation for reporting safety concerns. In a strong nuclear safety culture, any such employee concerns need to be carefully evaluated and addressed. Aspects of the BNI management systems that contributed to this situation and warrant increased and timely management attention include: (1) ensuring that management communications and actions clearly demonstrate management commitment to nuclear safety and quality and (2) ensuring that change is effectively managed as the project progresses through major stages.

ORP and BNI have multiple processes for managing nuclear safety issues. For most technical issues, these processes have been effectively implemented to address many safety issues in a transparent and well documented manner that was successful in achieving agreement on the actions needed for resolution and monitoring those actions to completion. In addition, WTP personnel have been trained on multiple options for raising nuclear safety concerns through the issues management systems and alternative mechanisms, such as the employee concerns programs and differing professional opinion program, that can be used if personnel are not satisfied that their issues are being adequately addressed through the issues management systems.

With regard to closure of technical issues, BNI has defined and, in most cases, implemented acceptable multi-level processes for ensuring the issues are evaluated and closure decisions are made by the appropriate

level of BNI and ORP management. The closure approval appropriately depends on the significance of the issue and includes appropriate closure criteria and provisions to monitor and track actions to closure. However, in the case of the closure of the issue associated with adequacy of the systems for safe mixing of materials in the process tanks (designated as M3), the issue was declared closed through a high level issue resolution process because the closure criteria for the routine process was not fully met, as shown by the need for additional testing to resolve some remaining technical questions. The HSS review determined that ORP and BNI senior management had appropriately considered residual risks, uncertainties, and differing opinions, and included appropriate provisions for further testing to resolve residual questions. However, the rationale for the decision to close the M3 issue was not effectively communicated to the BNI and ORP design and engineering organizations.

ORP and BNI have ongoing and planned efforts to improve the nuclear safety culture. As part of an EM initiative, ORP is focusing on improving mutual trust and promoting open discussions of differing opinions. Before this HSS review, BNI management recognized a need to further strengthen the nuclear safety culture at WTP and began to develop a formal plan for improving the safety culture. During this HSS review, BNI senior management identified some potential additional actions for refining and expanding the effort. Although at a preliminary stage of development, the potential actions generally correspond to the areas of weakness identified by the HSS review. However, increased attention is warranted to ensure sustainability and continuous improvement of the WTP nuclear safety and quality culture.

In light of the importance of the project and the ongoing significant changes, it is particularly important to ensure a strong safety culture where employees have confidence that safety issues can be raised with no fear of retaliation. To support the ongoing ORP and BNI initiatives, HSS has provided recommendations for consideration by ORP and BNI management in the following table.

Recommendations for Improving the Nuclear Safety Culture at WTP

1. Based on the outcome of the Federal Project Director's WTP Assessment Report, ORP should institutionalize the processes and formally define the roles and responsibilities and clarify interfaces between the WTP Federal organization and the other ORP organizations (e.g., Engineering and Nuclear Safety, Environmental Safety and Quality, and Tank Farm Project).

2. As part of the Nuclear Safety and Quality Culture (NSQC) initiative, BNI should:

   - Perform a systematic assessment of the existing processes for identifying and resolving nuclear safety issues, with particular emphasis on root cause analysis of problems involving the initial identification of issues.

   - Establish a formal change management process that identifies the actions needed to ensure that safety programs are not degraded by changes in project status or priorities.

   - Identify mechanisms to strengthen trust among the workforce and better communicate information to employees.

   - Include actions and elements in the development and implementation of the NSQC Plan to ensure that it results in sustainable and continuous improvement in the nuclear safety and quality culture at the WTP.

   - Examine all credible concerns to ensure that the nuclear safety culture does not degrade over time and to better determine the extent of the concerns.

1 Introduction

The U.S. Department of Energy (DOE) Office of Health, Safety and Security (HSS) conducted an independent review of the nuclear safety culture at the Waste Treatment and Immobilization Plant (WTP) project at the Hanford Site during August and September 2010. The HSS team performed the review in response to a request in a July 30, 2010, memorandum from the Assistant Secretary for the DOE Headquarters Office of Environmental Management (EM), which referred to nuclear safety concerns raised by a contractor employee at WTP.

Within DOE, EM has line management responsibility for most activities at the Hanford Site. At the site level, DOE line management responsibilities for the WTP project fall under the Office of River Protection (ORP). Within ORP, DOE is in the process of restructuring the organizational element that is responsible for oversight of the WTP project (this organization is referred to as DOE-WTP in this report). 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, which also has several other subcontractors and consultants.

Purpose and Scope

The purpose of this independent HSS review is to provide timely and useful information to senior Departmental managers about the management of nuclear safety concerns. The information is intended to support and facilitate EM's evaluation of the safety concerns that a contractor employee raised in a letter to the Defense Nuclear Facilities Safety Board (DNFSB), questioning the safety and reliability of the WTP.

In designing its review, the HSS team considered the fact that other organizations are also reviewing these concerns and the allegations of retaliation that were also raised in the contractor employee's letter. The DNFSB is reviewing the technical concerns raised by the employee, and EM/ORP has also tasked BNI to review the technical issues. EM has asked the DOE Inspector General to investigate the allegations of retaliation.

To complement the efforts of other organizations, the HSS team reviewed ORP and BNI nuclear safety management processes against commonly accepted models for a nuclear safety culture[1] framework. The HSS team emphasized important elements of these models that are directly applicable to the WTP's stage of development, such as leadership (organizational and human performance), conservative decision making, worker involvement, learning organization principles, change management, human performance, problem

1 While there are various safety culture models, one commonly accepted definition of a nuclear safety culture is: "an organization's values and behaviors, modeled by its leaders, and internalized by its members, that serve to make nuclear safety the overriding priority." In designing its review and interview questions, the HSS team examined the Institute for Nuclear Power Operations (INPO)/Nuclear Regulatory Commission framework and the DOE/Energy Facility Contractors Group (EFCOG) framework for a strong safety culture, which have many common focus areas and elements.

identification/resolution, and "safety conscious work environment" (SCWE) principles.[2] The HSS team placed particular emphasis on the characteristics of an effective SCWE program, such as ensuring no fear of retribution and promoting a questioning attitude. The HSS team also performed detailed reviews of selected WTP reporting and resolution processes for nuclear safety issues.

The HSS review focused on the Hanford Site organizations that are directly involved with WTP – notably ORP, which includes the ORP Federal Project Director and staff for the WTP project (i.e., DOE-WTP) and other ORP divisions providing support to DOE-WTP, and the contractors involved in WTP nuclear safety design and engineering (i.e., BNI, URS, and other subcontractors that perform design and engineering activities).

The review was led by a senior HSS manager and was performed by a team consisting of experienced HSS personnel with expertise in integrated safety management, nuclear safety, and quality assurance. To collect data, the HSS team performed structured interviews with a large sample (over 250) of ORP and BNI managers and staff (including subcontractors), with a focus on organizations that perform nuclear design and engineering activities. The interviews included questions on the major elements of the safety culture and specific questions about particularly important elements, such as willingness to raise safety issues and perceptions about retaliation. The HSS team reviewed various program documents and records, interviewed ORP and contractor management and staff about issue reporting and resolution processes, observed meetings related to issue resolution, and reviewed closure processes and packages for a sample set of technical issues.

Organization of the Report

Section 2 provides background information about the WTP, including challenging aspects of the project and a brief summary of the status of technical issues that have been raised concerning the WTP project. Sections 3 and 4 present the results of the HSS team's review of the safety culture for the WTP contractors and ORP, respectively. Section 5 presents overall conclusions and a few broad recommendations for EM/ORP and BNI consideration in their ongoing efforts to sustain and improve the nuclear safety culture at WTP.

Appendix A provides supplemental information about the review, including team composition. Appendices B and C present the results of the HSS team's review of nuclear safety issue reporting and resolution processes and management of technical issues, respectively.

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.

2 Background on Technical Issues

To provide context for considering the WTP nuclear safety culture, this section provides general information on the WTP project; the status of the project; the approach to WTP design, construction, and commissioning; and the status of various technical issues.

Purpose of the WTP Project

When complete, the WTP will be used to transform radioactive wastes into a stable glass form for disposition; the process is called vitrification. Radioactive wastes that will be processed at WTP are currently stored in underground tanks at the Hanford Site Tank Farms. The Tank Farms hold about 53 million gallons of highly radioactive and hazardous chemical waste, which are a byproduct of national defense plutonium production efforts during World War II and the Cold War era. Some of the tanks are single-wall containers that present a risk of leaking radioactive materials to the ground, where they could eventually reach the Columbia River.

Removing the radioactive materials from the tanks and processing them to a stable form is one of DOE's highest priorities and is addressed in the Hanford Federal Facility Agreement and Consent Order Tri-Party Agreement (more commonly called the Tri-Party Agreement). The Tri-Party Agreement is a comprehensive cleanup and compliance agreement among DOE, the U.S. Environmental Protection Agency, and the State of Washington Department of Ecology for achieving compliance with the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) remedial action provisions and with the Resource Conservation and Recovery Act (RCRA) treatment, storage, and disposal unit regulations and corrective action provisions. The Tri-Party Agreement establishes a legally binding cleanup plan for the site and enforceable milestones for initiating and completing specific work, including various milestones related to removing the tank wastes.

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. During earlier stages, the WTP project experienced some significant delays. For example, certain structures and components had to be strengthened to assure that the WTP would withstand a seismic event, and certain piping had to be replaced because of quality assurance deficiencies. These delays caused DOE and BNI to accelerate the remaining efforts to meet the current Tri-Party Agreement milestones. In addition, senior DOE management has placed high priority on and taken action to ensure timely completion of the WTP, such as establishing contractual incentives for contractor completion of various phases of the effort. In addition, the WTP project has been assigned a senior manager, the Federal Project Director, who reports to the ORP Site Manager and also has a reporting relation directly to the Deputy Secretary for the purpose of executive direction concerning the WTP project acquisition, financial management, and project operations. The Federal Project Director is responsible for the oversight of the Design Authority function and has full authority and responsibility to develop,

optimize, and integrate all requirements to design, commission, construct, and operate the WTP within the broad framework of policies established by the Department for safe and effective operations. BNI has also taken actions to meet milestones, such as ramping up resources, devoting extensive management attention to critical path items, and working to identify and resolve potential obstacles to meeting milestones.

Status of the WTP Project

According to information provided by ORP management, the more than $12 billion WTP project is more than half 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. Various safety analyses have been completed and approved by DOE, resulting in a facility authorization basis that provides the framework for evaluating technical issues, design changes, and construction variances.

Currently, the WTP project is transitioning from the "design/construction" phase of the project to the "construction/commissioning" phase. Although many design details remain to be finalized, DOE and BNI management have indicated that the WTP is now moving into a phase where the general design is final and the emphasis is on installation of systems and components. At a June 2010 all-hands meeting, BNI senior management emphasized that the design phase was largely over and indicated that any further design changes need to be closely scrutinized before approval.

Approach to Design, Construction, and Commissioning

Some aspects of the WTP project are different from a typical construction project, in which a facility or system design is largely finalized before the related construction begins. For the WTP project, DOE, in coordination with BNI, decided to implement an approach in which significant construction efforts are undertaken in parallel with the design efforts. DOE management determined that this approach can result in completing the effort sooner, allowing DOE to meet milestones for addressing tank waste hazards and reducing the associated environmental and safety risks of the hazardous wastes in the tank. While DOE's approach to WTP design and construction has advantages in timeliness, ORP and BNI recognize that the approach presents a number of challenges to resolving technical issues, as well as some risks to the project schedule. For example, the overlapping design and construction approach places could result in rework and delays if changes are needed in components that have already been installed or procured. Appendix C provides additional information about the challenges in resolving technical issues.

Technical Issues

During the project to date, a number of technical issues (including design questions that could impact safety) have been identified. Most notably, in 2006 a panel of experts called the External Flowsheet Review Team (EFRT) raised 28 technical issues, which are numbered M1 through M28. The Tri-Party Agreement included a provision requiring DOE to close those 28 issues. Also, DOE-WTP established a fee incentive for BNI to close the issues by the end of June 2010. With the exception of the M3 issue, DOE and BNI completed the analysis and reached agreement to close all the technical issues (based on meeting the specified closure criteria in their individual Issue Resolution Plans) well before the June 30, 2010, milestone.

The M3 issue (also referred to as the *Pulse Jet Mixing Design* issue, in some cases) addresses the adequacy of the systems for ensuring that materials in the vitrification plant are adequately mixed so that the process systems work efficiently and flammable gases do not build up or fissile material does not settle and accumulate in the bottom of vitrification plant tanks. Conditions that result from inadequate mixing

could violate the assumptions, parameters, or controls established in the WTP safety bases to prevent gas explosions/deflagrations and criticality accidents.

Although the broad M3 issue is categorized as closed, a number of related or subordinate issues have been generated to track additional actions that need to be performed to provide additional assurance or confirmation that the uncertainties in the mixing issue are sufficiently understood. As part of the closure process, BNI and ORP identified additional small-scale testing that would be performed and identified hold points in construction process to verify that the additional testing would confirm the adequacy of the design.

This page intentionally left blank.

3 WTP Contractor Nuclear Safety Culture

The HSS team reviewed the safety culture at WTP against the attributes of an effective nuclear safety culture framework, as discussed in Section 1. In evaluating the WTP safety culture, HSS considered the results of interviews with BNI and subcontractor personnel, as well as observations of meetings, reviews of program documents and records, and the results of the application of issues management processes to selected technical issues. HSS's assessment of the WTP nuclear safety culture is organized around three major elements of a nuclear safety culture: leadership (including organizational and human performance), problem identification and resolution, and SCWE. Based on the review of these three elements, the HSS team identified a few cross-cutting areas that warrant increased management attention.

Leadership

To achieve and sustain a strong nuclear safety culture, senior management must establish an organizational environment that ensures nuclear safety requirements are met (e.g., through clear policies, well defined responsibilities, and establishment of nuclear safety processes and organizational elements with responsibilities for important nuclear safety functions, such as assessments and issues management). Senior management must also establish an environment that considers human performance and must ensure that personnel at all levels of the organization – managers, supervisors, and staff – understand and accept their responsibilities for nuclear safety and recognize the importance of ensuring that nuclear safety requirements are met. To achieve this environment, senior management must demonstrate management commitment to nuclear safety, ensure personal responsibility and accountability for nuclear safety, and ensure that nuclear safety decision making is conservative and recognizes the unique risks of nuclear technologies and the requirements for rigor and formality in nuclear safety programs. As discussed below, BNI senior management has established many of the elements of an effective nuclear safety management culture at WTP, but there are gaps and aspects that warrant increased attention.

Senior BNI and subcontractor managers have communicated appropriate expectations for nuclear safety and quality through various mechanisms, such as meetings, videos, e-mails, and newsletters. Many interviewees indicated that management at all levels continuously reinforces a theme that safety is more important than schedule or budget pressures. Most aspects of responsibility and accountability for ensuring nuclear safety are well defined in various documents (e.g., position descriptions, procedures, controlled correspondence) and are communicated to and understood by WTP personnel. Personal responsibility and accountability for nuclear safety are well recognized and accepted by WTP managers and staff and are reinforced through various mechanisms (e.g., on-the-spot awards, annual performance reviews). Most interviewees indicated that they felt personally responsible for nuclear safety.

Management has established many effective processes that ensure that the priority of nuclear safety is emphasized in work processes at WTP and that nuclear safety requirements are implemented with

appropriate degrees of rigor and formality. Engineering design and procurement processes are supported by a comprehensive set of procedures, and BNI ensures that formal processes/procedures are extensively used for work activities. Various processes, such as the engineering design/review for normal work products and integrated safety management (ISM) processes for addressing nuclear design/safety issues and developing design coordination strategies, are widely used and have often proved effective in ensuring the quality of products and resolving issues. For example, BNI has well defined processes for ensuring that all proposed changes are reviewed to determine their impact on the safety basis. BNI management has established various organizational elements and processes for such functions as performing assessments, resolving employee concerns, and providing training to employees on nuclear safety requirements.

Many aspects of the BNI processes promote and ensure conservative decision making relative to nuclear safety. Interviewees consistently indicated that they would not compromise safety for production. Most interviewees indicated that the WTP approach to nuclear safety was conservative, and a few indicated that occasionally decisions were more conservative than required, such as designation of certain safety systems as safety class when safety significant would have been adequate. Many individuals indicated that their first line managers or supervisors effectively control any challenges or barriers to nuclear safety, such as schedule pressures and conflicting priorities.

Although there are many positive aspects of BNI's leadership of nuclear safety at WTP, several concerns were expressed to the HSS team. Most significantly, there are pockets of individuals within the WTP who believe that BNI management has created a "chilled" atmosphere (an environment where individuals are discouraged from raising questions or safety concerns and may fear retaliation for raising safety issues), and management actions (e.g., schedule pressures) have not consistently supported the message that safety is not to be compromised to meet schedules and cost objectives. Although a small number of individuals expressed such opinions, any indicators that individuals are concerned about the safety culture in general, and retaliation in particular, warrant management attention, including efforts to determine the extent of the concerns. The HSS team's analysis indicated that underlying weaknesses in communications and change management have contributed to the perception of a chilled atmosphere among some employees. The concerns about the chilled atmosphere, management communications, and change management are discussed further under Items for Management Attention at the end of this section.

HSS identified a few other deficient aspects of the WTP safety culture in the areas of organizational and human performance leadership that also warrant management attention. First, BNI has not institutionalized WTP nuclear safety culture expectations in a formal policy document, other than an annual correspondence document outlining WTP project management's commitment to zero tolerance for retaliation. Although BNI has provided training on aspects of nuclear safety culture in the past and most interviewees were familiar with BNI's documented expectations for a nuclear safety culture, the lack of a formal policy impedes efforts to institutionalize communications, formalize training requirements, and hold individuals accountable to an established policy. Second, responsibilities for ownership and leadership of the mechanisms to maintain a strong project nuclear safety culture have not been clearly defined. Senior management recently initiated improvements, including a plan to strengthen the nuclear safety culture (further described below) and appointment of a new champion for the new nuclear safety and quality culture effort, but the responsibilities and authorities for this individual and others who are needed to support the effort have not been formally established.

Nuclear Safety and Quality Imperative and Efforts to Strengthen the Nuclear Safety Culture. The HSS team reviewed the BNI Nuclear Safety and Quality Imperative (NSQI) and the associated actions and results. NSQI is a WTP initiative, started in 2005, to improve the safety culture at WTP. Although this initiative is in an early stage of development, the HSS team also reviewed information about the draft BNI plans to strengthen nuclear safety culture by developing and implementing a Nuclear Safety and Quality

Culture (NSQC) plan of action, which is intended to be a long-term continuing effort at WTP. HSS feedback and recommendations relative to these plans are intended to provide constructive feedback to ORP and BNI about the adequacy of planned actions to address nuclear safety culture issues at WTP.

The NSQI can be an important element of the safety culture at WTP and is an indicator of BNI management's commitment to a nuclear safety culture. BNI established its 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 include: (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. The NSQI was designed to emphasize ownership of safety/quality, a questioning attitude, communication and sharing of improvement opportunities, and procedure compliance. Specific key actions included developing a one-form issue-reporting system and a differing professional opinion process; defining, publishing, and training staff and managers on nuclear safety and quality culture attributes and processes; improving procedures and procedure compliance; developing NSQI performance metrics and indicators; and monitoring the culture through a worker survey, with an analysis and action plan for continuous improvement, and a project-wide culture assessment. Although many of the specified actions were identified as one-time events and were not required by directive or contract requirement, BNI continued to perform certain actions periodically, such as the annual employee survey (performed each year from 2005 to 2009 and planned for 2010) and the assessments of aspects of the nuclear safety culture performed in 2007 and 2008 at the direction of the Project Director. Over the past five years, BNI management has frequently communicated NSQI expectations to WTP personnel through various communication venues.

Based on the 2009 corrective action effectiveness review and the results of prior assessments, BNI has concluded that the culture of safety and quality at WTP has continuously improved since 2005 as a result of NSQI initiatives and actions. However, BNI recognizes that some aspects of the nuclear safety culture need to be strengthened as the project transitions from an engineering, procurement, and construction phase to a startup, commissioning, and operating phase. The need to strengthen the nuclear safety culture and reinforce the importance of quality and procedure compliance was also identified by an independent analysis team that was chartered by the WTP Project Manager in 2009 to examine WTP management systems, lessons learned in working through recent management and technical challenges, and impacts of the high staff turnover rate in recent years on the safety culture (e.g., many new staff have not had the level of training and indoctrination provided during the earlier stages of the NSQI).

Consequently, BNI established an NSQC working group in 2009, with representatives from many WTP organizations, to identify a set of actions that will serve as a long-term effort to sustain an effective nuclear safety culture and a strong SCWE at WTP. A draft NSQC Plan outlines a strategic approach that is consistent with the INPO and DOE/EFCOG attributes of an effective safety culture. This draft Plan establishes a set of high-level actions to strengthen and institutionalize the NSQC. The WTP Project Director serves as the overall champion in promoting the project NSQC, and the WTP Performance Excellence Council will provide oversight for implementation and monitoring of the NSQC invigoration effort. Near-term actions that were identified included: performing a gap analysis between the existing nuclear safety and quality culture and the EFCOG NSQC focus areas and attributes; developing a strategic communication plan to improve flowdown of expectations and information to workers; documenting the process for conducting and using the annual employee surveys; updating conduct-of-operations procedures; and revising the ISM process to establish an interpretive authority for nuclear safety and safety basis decisions.

During this HSS review, BNI management also commissioned an independent consultant to perform a SCWE survey of personnel within their engineering organizations and held a retreat to determine methods

for improving the safety culture at WTP. The SCWE survey was a 10 percent sampling of all BNI and URS engineering disciplines. The survey results indicated that the number of individuals interviewed during the BNI-sponsored SCWE survey who provided a negative response related to work environment attributes (e.g., willingness to raise concerns and personally targeted or observed retaliation in connection with raising concerns) was "typical of any healthy work environment." However, the negative responses need to be examined, and legitimate and critical issues need to be addressed by senior leadership. During the recent retreat, senior BNI managers reviewed the draft NSQC Plan to identify and evaluate potential enhancements and a list of additional measures to consider when enhancing the nuclear safety culture. Although the additional measures are currently at the conceptual stage, they appear to address many of the general areas needing improvement that were identified by BNI surveys and assessments and this HSS review, such as improving communication with and among workers, communicating expectations for strengthening the safety culture, and improving the employee concerns program (ECP) and differing professional opinion (DPO) processes.

Problem Identification and Resolution

A strong safety culture includes a comprehensive set of mechanisms for identifying and resolving issues and concerns, along with effective processes for assessments, application of lessons from operating experience, resolution of issues and concerns raised by employees, and corrective action management. The HSS team's review of WTP nuclear safety issue reporting and resolution processes indicates that BNI has established and implemented generally effective, formal processes for identifying, documenting, and resolving nuclear safety, quality, and technical concerns and issues raised by employees and for managing complex technical issues. However, employee interviews and HSS's assessment of these systems indicate that communicating requirements and expectations, ensuring employees' understanding of how these processes are to be used, providing timely feedback, and strengthening employees' trust in these processes need increased management attention.

The HSS team performed detailed reviews of two aspects of WTP nuclear safety issue reporting and resolution processes: (1) sitewide processes that employees (including ORP and contractors) can use to report issues and concerns related to nuclear safety and quality, and (2) additional technical issues management processes used by BNI organizations to meet the unique needs of the project in the areas of research, design, and engineering, as well as their application to a selected sample of technical issues. This section summarizes the results of the evaluation of the processes. More detailed information is included in Appendices B and C, and the discussion of SCWE (in the following subsection) provides additional consideration of employee perspectives on some of the reporting processes.

Identification and Resolution of Employee-Identified Issues. BNI has established and implemented formal processes for WTP employees' reporting of issues and concerns related to nuclear safety and quality and for the subsequent investigation/evaluation of these issues and concerns and identification of corrective actions and recurrence controls as appropriate. These processes are essential for establishing and maintaining a strong nuclear safety culture, including the SCWE, and include issues management systems and processes, the ECP, and the DPO process.

The WTP formal corrective action management program, as described in the project quality assurance 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. Overall, the Project Issue Evaluation Report (PIER) process provides an effective mechanism for reporting, evaluating, and resolving nuclear safety and quality issues. Mechanisms have been established to provide appropriate management oversight and engagement in the prioritization and management of documented

issues to ensure that the extent and causes of problems are rigorously evaluated, that corrective actions and recurrence controls are adequately established and rigorously implemented, and that effectiveness reviews are thorough and performed when needed. However, improvement is needed in the communication of management expectations and employees' understanding of when a PIER should be initiated instead of using a less formal identification and resolution process (e.g., discussing it with a supervisor or coworkers).

Several other formal mechanisms are available for workers on the WTP project to report and get resolution on concerns related to environment, safety, health, quality, and adverse actions related to raising concerns (i.e., harassment, intimidation, retaliation, and discrimination). Many employees have used the BNI ECP process to report concerns, with approximately 140 concerns being reported by project workers annually. As reflected in formal concerns reported to the BNI ECP and in interviews with project employees, some WTP Engineering organization personnel report instances and conditions where there is pressure, disparagement, or retaliation for raising concerns or initiating PIERs. In general, employee concerns are rigorously and conservatively investigated and resolved. Although many safety- and quality-related concerns have been reported and addressed by the ECP, improvements are needed in ensuring that appropriate corrective actions are identified, implemented (or managed in formal tracking systems), and documented in ECP case files before concern cases are considered closed.

BNI has also established the DPO process as an alternate path for resolving technical issue concerns when individuals disagree on the appropriate response to an issue. Although used only once in the past four years, the process was appropriately implemented.

In addition, the ECP staff offers exit interviews to non-manual departing employees or provides a six-question survey for departing manual employees to mail in, providing another means for employees to report safety issues and concerns and for BNI management to resolve them. However, this process is not governed by a formal procedure and has not always been consistently implemented.

Lastly, the annual employee survey provides another way for employees to express their views on nuclear safety and quality and the reporting and issues management processes discussed above. However, the requirements and management expectations for this activity have not been institutionalized in a procedure, and some WTP organizations did not follow through on the 2009 survey results, including analysis of the data and narrative commentary and identification of improvement actions.

In summary, many issues are being documented and resolved using the PIER process, and the ECP and DPO processes provide adequate mechanisms for employees to raise concerns. However, improvements are needed in some aspects of communicating expectations for use of PIERs, ensuring that case files are complete before closure, and formalizing practices in formal procedures.

Technical Issues Management Summary. BNI also maintains additional, formally defined issues management processes to efficiently meet the unique needs of project research, design, and engineering staffs for identification and resolution of technical issues. In the context of this report, technical issues include comments, issues, and questions identified and addressed in the Engineering Design Review (EDR), Action Tracking System (ATS), and Engineering Technical Issues Identification Management processes. Most research, design, and engineering staff members understand, are involved in, and/or use the EDR and ATS processes. However, familiarity with the Engineering Technical Issues Identification Management process is generally limited to the managers, supervisors, and assigned technical issue leads who are engaged in that process. As discussed below, HSS evaluated the EDR, ATS, and Engineering Technical Issues Identification Management processes, as well as the 2010 "clean-out-your-drawers" exercise and the WTP Change Authorization process.

Most of the technical issues that arise during WTP research, design, and engineering activities are routinely resolved through informal discussions with peers, leads, and supervisors or within well established internal workflow processes. In particular, many technical issues are routinely identified, tracked, and resolved within the EDR processes, encompassing checking, review, approval, and verification and re-verification activities. ATS is used as an effective and efficient process for proposing and establishing agreement on the definition of a needed action, the schedule for completion, and the responsible action manager, and for tracking the status of deliverables. Finally, the Engineering Technical Issues Identification Management process is an effective management tool that is designed and implemented as a high-threshold issues management process with the objective of achieving early alignment between BNI and ORP management on the severity of significant emerging technical issues and the path forward for their resolution.

Based on a review of documentation associated with a selected sample of technical issues, the HSS team concluded that, with one exception, WTP technical issues are efficiently and effectively managed by BNI. The HSS team also concluded that ORP's participation and oversight were appropriate. However, the HSS team observed a few problems with application of the processes to the M3 technical issue, as discussed below.

Although formal closure of the *Pulse Jet Mixing Design* issue (also referred to as the M3 issue) has been declared, and authorized by ORP based on risk acceptance, calling the issue closed appears inconsistent and confusing with reference to the documented expectations of the Engineering Technical Issues Identification Management guide (compliance with this guide is mandatory according to the applicable process). The guide indicates that technical issues may be closed *once all actions are complete or sufficiently resolved that technical uncertainty is removed, and tracking via this mechanism is no longer needed*. The guide also indicates that the technical issue may be closed, with BNI and ORP agreement, while implementation actions may be in progress *if the technical issue is essentially resolved and remaining actions are considered routine and are being tracked by other WTP tracking tools* (schedules, ATSs, PIERs, etc.). Closure of the *Pulse Jet Mixing Design* issue Cut Sheet (the document tracking the issue within the Engineering Technical Issues Identification Management process) removed it from being tracked as an individual technical issue Cut Sheet, replaced it with several new technical issue Cut Sheets, and required follow-on actions that continue to be tracked by WTP issues management processes. Although the HSS team recognizes the benefit of breaking the complex and multi-faceted *Pulse Jet Mixing Design* issue into component parts with individual resolution plans, the newly defined Cut Sheets cannot be considered routine in nature, as specified by the guide for closure of a technical issue Cut Sheet.

Further, the communications about the closure decision for the *Pulse Jet Mixing Design* issue Cut Sheet were not effective and have led to some confusion. In this instance, BNI did not ensure that the basis, benefit, and consequences of the closure of the M3 Cut Sheet, for which the associated technical risks were not fully mitigated and follow-on actions of a non-routine nature remained (e.g., further research and testing), were adequately communicated, explained, and understood by the WTP professional staff. The remaining technical issues are now being addressed in new high-priority technical issue Cut Sheets and follow-on actions.

The 2010 clean-out-your-drawers exercise resulted in identification of nine new technical issues. BNI has not performed an assessment to determine why the established technical issues management processes were not effective in achieving more timely identification and reporting of these issues.

The resolution of significant WTP technical issues frequently involves consideration of changes in project scope, cost, and/or schedule. When the implementation of the proposed change is perceived to have minimal value (a "knothole change"), authorization to proceed requires elevating the change proposal to the Project Management Team for evaluation, authorization, and control. The HSS team determined that the intent of

the WTP Change Authorization process for changes that may have limited benefit is appropriate. However, management communications to the staff through certain documents (e.g., in the Change Authorization guide), as well as management presentations encouraging "push back" and "resist change," have contributed to a situation where some members of the WTP staff perceive that the effort now required to raise and seek resolution of new technical issues discourages staff from surfacing new issues. BNI has not ensured that its communications to staff clearly indicate that the increased focus on the WTP's transition to commissioning and operations does not reduce the importance of a strong safety culture that encourages identification and reporting of all problems, issues, and concerns.

In summary, management encourages efforts to identify and resolve technical issues, and many issues have been adequately resolved through established processes. In particular, supervisor/staff interfaces and open door policies, in combination with well engrained and understood EDR processes, are well suited to efficiently manage most technical issues that arise during research, design, and engineering in-process work. The ATS process is also well suited to establish and track the status of commitments for needed actions required to support the work of researchers, designers, and engineers. The Engineering Technical Issues Identification Management process is particularly appropriate and effective in gaining early alignment between BNI and ORP on the severity of significant emerging technical issues and the path forward for their resolution. However, BNI has not been successful in explaining to the staff the basis, benefit, and consequences of closing the *Pulse Jet Mixing Design* issue and the reason why resolution of some staff-identified technical issues may not be implemented. Also, the reported reluctance of some staff members to use existing processes, such as PIERs, to identify and seek resolution of known unaddressed technical issues, as well as the identification of nine new technical issues through an informal clean-out-your-drawers exercise rather than through the established processes, warrants further WTP assessment and corrective actions to ensure that the established technical issues management processes are being used effectively by the staff to report issues.

Safety Conscious Work Environment

A SCWE is an important subset of a safety culture that focuses on the willingness of employees to identify and raise safety concerns without fear of retaliation. In an effective SCWE, avenues for raising concerns exist, employees have been trained on how to use them, employees are willing to raise concerns, trust permeates the organization, a questioning attitude is encouraged, and management is proactive in detecting/preventing retaliation. As discussed below, BNI has the elements of an effective SCWE in place. However, a small number of employees interviewed by the HSS team expressed a reluctance to raise safety concerns, and a few indicated concerns about retaliation for reporting concerns (a chilled work environment); these perceptions confirm the need to strengthen the safety culture and to determine the extent of the concerns, particularly within the design/engineering organizations.

WTP employees have multiple formal and informal avenues for reporting nuclear safety issues and concerns. Most workers use informal methods for problem/issue reporting and resolution, such as discussing them with their supervisor, coworkers, and knowledgeable individuals in other organizations, and believe these methods are effective. Most individuals stated that their work group had a good level of trust. In response to describing the meaning of a questioning attitude, most interviewees believed that they would ask questions of their supervision if needed and that anyone could raise questions openly.

If employees believe that their concerns have not been or will not be addressed through informal channels within their work groups, various formal avenues are also available to employees of BNI and its subcontractors, as well as ORP personnel. These avenues include PIERs, ECP, and DPO processes, as discussed in the previous section. These avenues have been communicated to WTP personnel through

various mechanisms, including annual and process-specific training, a website, the project newsletters, management presentations, and posters. Employees are generally aware of the processes and methods for submitting an issue or concern if needed. (See Problem Identification and Resolution, above, for further discussion of the PIERs, ECP, and DPO processes.)

Senior management has communicated its expectation that a questioning attitude is a BNI value. With a few exceptions, most individuals expressed that their managers encouraged a questioning attitude and that they were comfortable with raising safety concerns. However, a few employees expressed a concern that some managers have shifted their focus on how safety concerns are viewed. They indicated that the historical mindset was that the objective was to prove that a system design is safe to individuals who raise questions but that more recently, as schedule pressures have increased, some managers are putting the onus on individuals who raise issues to prove that the existing designs are not safe.

For the most part, workers generally believe that high quality and safety are important and expected. Many nuclear safety issues raised by WTP personnel have been documented and managed using the PIER system. WTP personnel have also used the ECP to raise various types of safety concerns (e.g., nuclear, worker safety, retaliation, and quality issues).

WTP project management annually publishes, prominently posts, and includes in the WTP newsletter a reaffirmation statement about management's commitment to zero tolerance for harassment against any employee for reporting concerns. This statement also endorses open communications and the use of the PIER and ECP processes, and it is signed by over 20 senior WTP managers.

BNI uses a number of methods to monitor and track employees' involvement in and perceptions of the safety culture. BNI compiles a monthly metric for nuclear safety and quality excellence, which is based on a compilation of SCWE inputs related to employee concerns and corrective action program performance. Although not mandated or addressed by a formal procedure, BNI has performed annual surveys since 2005 to measure the project's safety and quality culture and monitor the performance and effectiveness of the NSQI. The surveys, conducted by an independent contractor, sample a significant number of employees and gather their perceptions about nuclear safety in such areas as communication, safety, supervision/management, work environment, quality, problem solving, and effectiveness. The survey results are compiled into numerical scores that provide trends on a sitewide basis, as well as subdivided results for the various site organizations/functions and groups. The results are disseminated widely to WTP management for their consideration.

Although BNI has established an adequate framework for a SCWE and most of the WTP interviewees indicated their belief that safety concerns could be raised to management without fear of retribution, interviews revealed that there are also individuals or pockets of individuals who do not have confidence in management's commitment to nuclear safety. Some indicated a fear of retaliation, and they identified instances where individuals believed that there was poor handling of schedule pressure by supervisors or poor communication of changing expectations. (See discussions under Items for Management Attention, below.)

There are indications that a number of employees do not have confidence in use of the PIERs process or are reluctant to use it. A number of interviewees raised a concern that, in practice, PIERs are discouraged, and/or they expressed the view that management regards individuals as "trouble makers" if they file too many PIERs or file a PIER without first discussing the issue with their management. The data for PIERs indicates that the number of PIERs being generated is on a significant downward trend. Management has not adequately provided their insight to the workers on the reason for this trend. Consequently, some

believe the downward trend is due to the project approaching completion; others believe the trend reflects management's negative disposition towards PIERs.

WTP personnel rarely use the DPO process to elevate concerns about nuclear safety. Only one DPO has been filed at WTP in the four years since the DPO process was established. Some managers and staff indicated that the DPO process is rarely used for nuclear safety issues because there is confidence in the ability to raise issues in meetings and other informal processes. However, a few interviewees stated that although they would try to resolve issues with their managers, they would drop an issue if they felt pushback rather than use DPO or ECP processes, because of fear of losing their jobs. Although there are differing perspectives within WTP about the reasons for the rare use of the DPO process, interviews revealed that while some WTP staff and managers disagree, sometimes strongly, with some management decisions on technical grounds, they did not file a DPO; this situation indicates that the DPO process may be underutilized because management is not encouraging its use or because WTP staff may be reluctant to use the DPO option.

Items for Management Attention

Chilled Work Environment. Some individuals within WTP believe that BNI management has created a "chilled" atmosphere that discourages individuals from reporting safety concerns. Further, some individuals expressed their belief that individuals who raise safety concerns could be subject to retaliation, including the threat of losing their jobs. One of the most significant concerns was subtle retaliation – i.e., that individuals who raise safety issues would not be selected for new assignments as their current assignments are completed. In construction projects with various phases, such as WTP, it is inevitable that many construction, engineering, and design jobs will end as various activities are completed and, over the long term, overall employment will decrease significantly as the labor-intensive design, engineering, and construction tasks end and the facility transitions to startup and testing mode and eventually to operations. In such an environment, job security is a concern for many individuals, and more of the workforce is feeling vulnerable to layoffs. In this environment, a significant number of employees are understandably concerned that a reputation as a "trouble maker" could adversely impact their opportunities for continued or future employment. In addition, several interviewees, including senior staff and managers, indicated that the situation surrounding the individual who raised concerns to the DNFSB (prompting the request by EM to perform this review) contributed to a chilling effect that may reduce their willingness to raise technical or safety issues. While some organizations had a higher fraction of personnel with concerns than others, the concerns about a chilled environment were not limited to a single organizational element or job category.

Management Communication of and Commitment to Nuclear Safety and Quality Expectations. While senior management has expressed support for nuclear safety, some individuals at WTP have the perception that management communications about expectations for nuclear safety and quality have not been consistent. This situation has contributed to unhealthy tensions and erosion of confidence on the part of some WTP personnel and organizations. Most managers are accessible and engaged, but ECP cases and a number of interviews showed that individual supervisors or managers have not always "walked the talk" with regard to surfacing, documenting, and resolving issues. Individuals cited instances where managers or supervisors told staff not to write a PIER unless the issue is cleared with them first, where there was retaliation or perceived retaliation for raising issues (e.g., the individual who raised the concern was given the additional assignment of resolving it), and where managers and company lawyers inappropriately attempted to change issued documents to put the company in a more favorable light. Several individuals also indicated that although senior management expressed the position that nuclear safety and quality would not be sacrificed to meet schedule and cost objectives, in the lower tiers of supervision/management, in practice, the emphasis on schedule and cost is more important; these individuals cite examples of pressure

to produce work products (e.g., drawings) on accelerated schedules or with deficiencies (e.g., missing information) to meet production needs or construction milestones. A few individuals also indicated that excessive overtime and schedule pressure left employees without the time or energy for the questioning attitude that is part of a strong safety culture. In addition, management has not been consistently effective in explaining decisions in a manner that fosters continued confidence among the workforce. For example, even though a formal risk management process is in place, technical decisions on major issues (e.g., the M3 issue) have not been well communicated or justified to all stakeholders and/or staff with differing opinions. Similarly, a number of staff members indicated that the situation involving the contractor employee who raised concerns was not handled properly and sent the wrong message to the staff about the ability to raise safety concerns without fear of retribution.

Managing Major Project Change. The senior management message from a June 2010 all-hands meeting contributed to uncertainty among staff members and was not effective in ensuring that staff members understand management expectations as the project transitions to the commissioning phase. Most interviewees stated that they would not compromise safety for production and did not believe the message was intended to stymie changes necessitated by valid safety concerns, but simply to focus on doing what is necessary to successfully complete the project safely. However, several interviewees were confused by the message and believed that senior management indicated that BNI management is accepting some compromise in nuclear safety in order to finish plant construction on time. Although several middle managers and supervisors have attempted to interpret the senior management message and better explain expectations to their staff, these efforts have been limited and had mixed success. An underlying concern is that senior management did not have an effective approach for ensuring the understanding and support of lower tier managers and supervisors regarding the expectations and how they would translate into actions and priorities at the staff level. Management communications to the staff in the Change Authorization guide and management presentations encouraging "push back" and "resist change" on the design have also not been well communicated and have resulted in a perception that management is discouraging individuals from raising new technical issues that could be important to safety.

Sustainability and Continuous Improvement of the WTP Nuclear Safety and Quality Culture. Many actions and initiatives were taken to implement the NSQI following identification of weaknesses in the NSQC at WTP in 2005. Subsequent employee survey and self-assessment results have identified improvements and given consistently high scores for characteristics of a strong NSQC and SCWE. However, recent events, surveys and assessments, employee concerns, and narrative responses to employee surveys indicate some remaining weaknesses in the project's safety and quality culture, specifically related to issues of trust and perceptions of the freedom and encouragement to identify concerns and issues without fear of retribution. Because of the relatively high turnover in project staff (from entry level personnel to senior managers) since 2005, many at WTP were not involved in or aware of the issues prompting the NSQI efforts or appreciative of the need to sustain some of the resulting improvement activities. The NSQI actions and initiatives have not been fully effective in ensuring a strong and continuously improving safety and quality culture, and some of the actions have not been maintained or implemented consistently or with sufficient rigor.

4 ORP Nuclear Safety Culture

The HSS team reviewed the ORP safety culture against the attributes of an effective nuclear safety culture framework, as discussed in Section 1. In evaluating the ORP safety culture, HSS considered the results of interviews with BNI and subcontractor personnel, as well as observations of meetings, reviews of program documents and records, and the results of the application of issues management processes to selected technical issues. HSS's assessment of the ORP nuclear safety culture is organized around three major elements of a nuclear safety culture: leadership (including organizational and human performance), problem identification and resolution, and SCWE.

At the time of this review, ORP was undergoing a significant restructuring at the direction of the Secretary of Energy and the Assistant Secretary for Environmental Management (EM-1) to strengthen project management of WTP. When fully implemented, the restructuring will result in a significant degree of organizational separation of the ORP staff with responsibility for WTP (e.g., mission, function, roles and responsibilities, and authorities) from the other ORP staff (e.g., those responsible for tank farm operations and support functions). As part of the restructuring of ORP, the Federal Project Director is redefining the roles and responsibilities of the Federal staff assigned to the WTP project (designated as DOE-WTP) and relocating them to buildings closer to their BNI counterparts. DOE-WTP will continue to coordinate with and rely on other ORP staff for support in some key areas, such as safety basis reviews, quality assurance programs, and approval and interpretation of nuclear safety standards and requirements.

The Federal Project Director is the key Departmental individual responsible for providing oversight of the design authority functions and the daily operations/construction management of WTP. As part of the ongoing transition in the role of DOE-WTP, the Federal Project Director has the responsibility to define the framework for DOE-WTP operations, including defining the interfaces between the various other ORP organizations and developing WTP-specific procedures and protocols. Because of the uniqueness and complexity of this project, DOE utilized the Intergovernmental Personnel Assignment Agreement process to draw talent and resources from across DOE to search for and select the new Federal Project Director, who was announced on May 31, 2010. The Federal Project Director reports to the Manager of the Office of River Protection and also has direct access to the Deputy Secretary of Energy for the purpose of executive direction of WTP project acquisition, financial management, and project operations, and to facilitate timely action and resolution of challenges and initiatives.

Leadership

The HSS review indicates that ORP management has promoted a strong and mature nuclear safety culture within the ORP organization. Senior ORP management has consistently demonstrated its commitment to nuclear safety through its communications with the staff and other actions, such as recruiting and retaining staff members with the requisite nuclear safety expertise. Nuclear safety policies and procedures are in

place and expectations are further communicated and reinforced through various means, such as meetings, all-hands, small gatherings, or one-on-one encounters between managers or between managers and staff. During interviews, many individuals specifically cited senior management over the past few years as having significantly enhanced the nuclear safety culture at ORP.

Managers and staff understand that they are personally accountable and responsible for safety and are actively engaged in work planning and identification and resolution of safety issues through various means, such as regular meetings and participation on Integrated Project Teams. ORP management has also ensured that managers and staff spend considerable time in the field and are actively engaged in safety management. Senior leadership demonstrated strong commitment to safety and was regularly visible and actively engaged in the field. A high degree of teamwork and mutual respect and trust among the ORP teams was evident.

ORP is also working on EM initiatives to further improve the nuclear safety culture. EM has established an annual process for performing a Federal Staff Safety Culture Survey, as part of the EM Strategic Plan for implementing a "Roadmap" to achieve excellence. The survey is based on the INPO Nuclear Safety Culture Model and contains 25 questions exploring different elements of safety culture, including personnel responsibility and accountability, management engagement, performance monitoring through multiple means, no fear of retribution, and trust. The 2010 survey was sent to 134 individuals (managers and staff) within EM, and the response rate was over 40 percent. The overall survey results were positive; however, there was a high number of neutral responses for some questions. EM Headquarters has planned a follow-up to better understand the degree of engagement of the ORP workforce and to make improvements in the survey questions for 2011. Based on the 2010 safety culture survey, EM-1 has directed all sites, including ORP, to focus on a few aspects of the nuclear safety culture, including efforts to establish mutual trust and promote discussions of differing opinions. The areas of focus selected by EM are appropriate and consistent with those identified during this HSS review.

Problem Identification and Resolution

ORP has established ECP (with concerns submitted by ORP personnel managed by the DOE Richland Operations Office) and DPO programs that provide adequate opportunities for ORP personnel to submit concerns or differing opinions, if they believe that there is a need to do so. Although ORP staff have not used these mechanisms for nuclear safety issues, interviews indicated that essentially all ORP staff believed that they were able to express their views on nuclear safety within existing formal and informal processes and that the ECP or DPO processes could be used if needed, with no fear of retribution for raising nuclear safety issues.

ORP management and staff have been actively involved in all of the major risk management decisions at the WTP. HSS's interviews and observations of an Issue Resolution Team meeting on the resolution of an important technical issue demonstrated that ORP personnel actively participated in the discussions, that the differing positions and viewpoints were clearly presented and openly discussed, and that the resolution process was professional and transparent. ORP senior management was instrumental in arranging for technical reviews by independent experts, including the Consortium for Risk Evaluation with Stakeholder Participation (CRESP) and a team from the Savannah River Site (SRS). With the exception of one aspect of the M3 issue, all of the major issues have reached full concurrence of the Technical Steering Group and a broad consensus for resolution within the project; ORP, DOE-WTP, and BNI leadership and technical reviews/input contributed to this achievement.

ORP made a risk-based management decision on the required portions of the M3 issue when a full consensus was not readily reached through a formal technical issue evaluation process. In making this decision, ORP managers reviewed the technical issues, the remaining uncertainties, the plans for additional

testing, and differing/dissenting analysis and opinions, as confirmed by interviews conducted by the HSS team. ORP also considered the program risks (e.g., implications of DOE not meeting legally mandated milestones) and the safety and environmental risks associated with possible delays in removing hazardous material from the waste tanks. Interviews confirmed that ORP managers placed high importance on nuclear safety risks in the decision process; they determined that the expected risks were within the bounds of the approved nuclear facility safety basis and that measures (e.g., design changes and rework) could be taken if further information (e.g., from analysis, testing, or experience with simulants) indicated that nuclear safety risks would be higher than they are currently evaluated to be through the safety analysis process. ORP managers required additional testing to support the M3 closure decision and demonstrated that they fully understand that if future analysis (e.g., testing or operating experience with simulants) indicates a need to make substantive design changes, the cost and schedule impacts of rework could be higher than they would be earlier in the process.

While HSS makes no judgments on the technical aspects (e.g., adequacy of flow dynamic models) of the ORP decision on M3, HSS's review confirms that ORP made their decisions with an understanding of the residual risks, uncertainties, and differing opinions on the importance of the uncertainties with respect to plant operability and safety. In addition, in making their decision, ORP had the benefit of some external reviews (e.g., reviews by CRESP and a team from the SRS), and the Central Technical Authority/Chief, Nuclear Safety has regularly monitored nuclear safety issues at WTP.

Safety Conscious Work Environment

Many ORP staff members expressed confidence that management made risk-informed and conservative decisions regarding safety issues and established an environment that encourages open discussion where safety issues could be raised without fear of retribution. Over the last several years, ORP management has become more active in promoting a questioning attitude and seeking resolution of longstanding legacy issues.

Although the overall nuclear safety management culture at ORP is positive, deficiencies were identified during discussions with a small number of interviewees. There were some isolated disagreements with decisions about the resolution of technical issues and a perceived management resistance to discussing certain design changes. Some ORP personnel expressed concerns about the ongoing office restructuring and realignments. They had some concerns regarding the potential for degraded communications within the WTP oversight support groups (e.g., nuclear safety authorization basis personnel) and had questions about the applicability of existing ORP procedures. In addition, some staff indicated that they did not understand and had not been informed about expectations for the new roles and responsibilities and the new interfaces between DOE-WTP and support organizations within ORP. At the time of this HSS review, the Federal Project Director was nearing completion of the WTP Assessment Report for the Secretary of Energy to include the Federal Project Director's initial findings and recommendations to ensure project success. The assessment addresses the current state of the project's development and organizational structure and provide recommendations for changes to achieve a smooth transition from construction to commissioning and hot operations.

Some of the concerns expressed by ORP personnel can be attributed to ongoing changes in the status of the project and ORP organization. The transition to the construction/commissioning phase of the project and the perception by some of an increased management emphasis on schedule and milestones and management resistance to discussing design change concerns may be discouraging some staff members from raising additional issues about aspects of the design that are considered to be finalized because they may adversely affect cost and/or schedule. The recent restructuring and organizational changes within ORP have also

contributed to uncertainty about expectations for use of existing ORP processes by the DOE-WTP and interfaces between DOE-WTP and with other ORP organizational elements. While ORP management has stressed open communications and the transition plan is still under development, increased management focus on timely communications about planned actions relative to the organizational restructuring and reemphasis of the overriding priority of safety are warranted to prevent concerns among some staff members or to ensure that affected staff members understand and accept their roles and responsibilities.

Overall, although a small number of individuals had varying concerns, the majority of ORP personnel who were interviewed expressed positive views of the nuclear safety culture and current senior management. Based on the information collected and analyzed during this review, the HSS team concluded that overall nuclear safety culture at ORP is positive and improving. Nevertheless, the nature of the concerns identified by various ORP staff members indicates a continued need for management attention to communication, particularly about ongoing and upcoming changes.

5 Conclusions and Recommendations

The HSS review indicated that ORP has developed appropriate expectations and most of the ORP staff believed that ORP management has promoted a strong nuclear safety culture that encourages raising safety issues with no fear of retribution. However, some ORP staff members indicated that they had concerns with some aspects of management decisions on technical issues and clarity of roles and responsibilities and organizational interfaces as the ORP organization is restructured. These concerns indicate a continued need for management attention to communications, particularly about ongoing and upcoming changes in the ORP organizational interfaces and procedures.

Although improvements are needed in some areas, BNI and its subcontractors have established the framework for a strong nuclear safety culture at WTP. However, a number of individuals have lost confidence in management support for safety, believe there is a chilled environment that discourages reporting of safety concerns, and/or are concerned about retaliation for reporting safety concerns. These concerns are not isolated and warrant timely management attention, including additional efforts to determine the extent of the concerns. Before this HSS review, BNI management recognized a need to strengthen the nuclear safety culture at WTP and began to develop a more formal NSQC Plan. During this HSS review, BNI senior management identified some potential additional actions for refining and expanding the effort. Although at a preliminary stage of development, the potential actions generally correspond to the areas of weakness identified by the HSS review and other mechanisms.

ORP and BNI have multiple processes for managing nuclear safety issues. These processes have been effectively implemented to address many safety issues in a transparent and well-documented manner that was successful in achieving agreement, in most cases, on the actions needed for resolution and monitoring those actions to completion. The M3 issue was also managed in accordance with rigorous processes; however, one process deficiency was identified in that the M3 Cut Sheet was closed although the closure criteria were not fully met. In addition, the closure declaration included additional technical issues to be resolved; there were and may continue to be differing professional opinions about certain aspects of this technical issue and the adequacy of the path forward. Nevertheless, ORP and BNI appropriately considered residual risks, uncertainties, and differing opinions when making the decision to declare the M3 issue closed, with provisions for additional testing. The processes applied by ORP and BNI were effective in identifying the remaining needed actions and identifying hold points to make further management decisions, depending on testing results.

The intent of this HSS review is to provide line management with constructive information. To this end, the HSS team identified the following recommendations for consideration by ORP and BNI management.

Office of River Protection

1. **Based on the outcome of the Federal Project Director's WTP Assessment Report, institutionalize the processes and formally define the interfaces between the WTP Federal organization and the other ORP organizations (e.g., Engineering and Nuclear Safety, Environmental Safety and Quality, and Tank Farm Project).** In this effort, particular focus is warranted on clearly defining and communicating the roles and responsibilities of and expectations for all ORP organizations and clarifying the distinction between WTP procedures and processes and those of other ORP organizations with regard to and responsibilities for development, review, approval, and implementation. ORP should also accelerate the efforts to address the EM-1 directed ORP actions on safety culture elements.

Bechtel National Incorporated

1. **As part of the Nuclear Safety and Quality Culture initiative, perform a systematic assessment of the existing processes for identifying and resolving nuclear safety issues, with particular emphasis on root cause analysis of problems involving the initial identification of issues.** BNI has many different issues management processes that follow the same general steps of issue identification/entry into a formal process, screening, evaluation, development of actions, tracking and monitoring, and effectiveness verification. Some specific concerns about individual processes need attention, but once an issue is identified and entered into one of the WTP issues management process, the processes appear to work well to achieve resolution and track progress to completion. However, a number of concerns were evident with respect to the identification and entry step in multiple processes, including the lack of minimum management expectations for when to use the processes, a reluctance to enter issues into PIERs and to use the DPO process, the use of less formal means that bypass important analysis and trending functions, and concerns among a subset of employees that management is discouraging individuals from raising issues. A formal causal analysis of these factors, considering cultural issues as well as the adequacy of guidance, training, and procedures, could provide a needed baseline for determining how to modify site processes to improve the identification of safety issues for evaluation and resolution.

2. **As part of the ongoing effort to strengthen the safety culture, establish a formal change management process that identifies the actions needed to ensure that safety programs are not degraded by changes in project status or priorities.** Change management is a proven management technique for systematically evaluating the impact of planned changes, taking actions to minimize the negative impacts of change (e.g., revising procedures, providing needed training), and proactively communicating with employees to alleviate concerns and encourage understanding and acceptance of changes and management decisions. Some of the concerns identified during this review could have been precluded by a more systematic approach to change management that considers needs and concerns at all levels of the organization.

3. **As part of the ongoing effort to strengthen the safety culture, identify mechanisms to strengthen trust among the workforce and better communicate information to employees.** Management attention is needed to address the pockets of employees who perceive a chilled environment. A major focus of the effort should be the belief among some employees that job security is enhanced by not reporting safety issues. BNI needs to establish a formal company policy addressing all aspects of nuclear safety culture and train or retrain supervision and management at all levels (including work group leads) on fostering and maintaining a SCWE. BNI also needs to ensure that its communications to staff clearly indicate that the increased focus on WTP's transition to commissioning and operations does not reduce the importance of a strong safety culture that encourages identification and reporting

of all problems, issues, and concerns. Improved processes are also needed to provide feedback to professional staff on the status of technical issues, including planned follow-on actions (e.g., further research and testing) and, in some cases, the reasons why some technical issues may not be implemented (e.g., because the benefits of implementation are not sufficient to outweigh the impact on project cost, schedule, and scope). BNI should also consider increasing efforts to positively reinforce reporting of safety issues (e.g., recognition of individuals who raise safety issues) and increasing efforts by BNI senior management to meet with staff to discuss misperceptions.

4. **Include actions and elements in the development and implementation of the NSQC Plan to ensure that it results in sustainable and continuous improvement in the nuclear safety and quality culture at the WTP.** A structured analysis is needed to identify why the actions and initiatives for implementing the WTP NSQI have not been fully effective or consistently maintained or implemented. A structured analysis is also needed to identify causal factors contributing to any deficiencies and weaknesses identified in recent or planned culture surveys, assessments, or gap analyses, as well as effective actions for addressing these causal factors. Where appropriate, formal project policies and procedures, processes, controls, and other initiative elements need to be established as part of the improvement plan to ensure continuity and consistency. BNI also needs to examine all credible concerns to ensure that the nuclear safety culture does not degrade over time and to better determine the extent of the concerns.

This page intentionally left blank.

Appendix A
Supplemental Information

Dates of Review

Scoping/Planning Visit	August 9-13, 2010
Onsite Data Collection	August 23 – September 3, 2010
Offsite Analysis of Data and Development of Results	September 3-20, 2010
Onsite Discussion of Results and Observations	September 20-24, 2010

Management

Glenn S. Podonsky, Chief Health, Safety and Security Officer
William A. Eckroade, Deputy Chief for Operations, Office of Health, Safety and Security
Patricia Worthington, Director, Office of Health and Safety, HSS
John S. Boulden III, Acting Director, Office of Independent Oversight and Office of Enforcement, HSS

Quality Review Board

William Eckroade	John Boulden	Thomas Staker
George Armstrong	Michael Kilpatrick	

Review Team

Patricia Worthington, Team Leader
William Miller, Deputy Team Leader

Vic Crawford	Jim Coaxum	Ali Ghovanlou
Marvin Mielke	Shiv Seth	Robert Compton
Al Gibson	Joe Lischinsky	Tim Martin
Ed Stafford	Ed Greenman	Mario Vigliani

Administrative Support

Mary Anne Sirk
Tom Davis

This page intentionally left blank.

Appendix B
WTP Nuclear Safety Issue Reporting and Resolution Processes

Over the life of the project, senior U.S. Department of Energy (DOE) and prime contractor management at the Waste Treatment and Immobilization Plant (WTP) have communicated their expectations for establishing and maintaining a safety-conscious work environment, including the resolution of nuclear safety and quality issues and concerns identified by their employees and subcontractors. A 2005 assessment by the Office of River Protection (ORP) identified a weak safety and quality culture on the project, and the contractor subsequently established the WTP Nuclear Safety and Quality Imperative and the associated actions. Since then, management communications on this topic have increased in number and specificity. Management has communicated its expectation that all employees identify safety and quality issues to supervision or subject matter experts (SMEs) or through more formal issues management systems in various ways: numerous publications in the project newsletter *WTP Today*; management presentations at meetings attended by employees; announcements on the WTP websites; new employee orientation, as well as initial and refresher general employee training; topical training on employee concerns, ethics, and issues management for supervisors, managers, and employees; and requirements and processes detailed in site policies, procedures, and program descriptions. Bechtel National Incorporated (BNI) and ORP have established and implemented several formal processes that allow employees working on the WTP project to report issues and concerns related to nuclear safety and quality; for investigating/evaluating these issues and concerns; and for identifying corrective actions and recurrence controls as appropriate. These processes include employee concerns programs (ECPs), differing professional opinion (DPO) processes, and issues management systems.

BNI Processes

Employee Concerns Reporting and Resolution. BNI has established an ECP that is generally adequate and formal (i.e., governed by a written procedure). The procedure details the BNI policy and requirements and the process steps for filing, prioritizing, processing, and investigating concerns; it also addresses confidentiality, training, posters, and hotline access. The ECP is advertised to employees on posters mounted on bulletin boards throughout project facilities and is introduced during new and returning employee orientation, in periodic articles in the project newsletter, and on a BNI intranet webpage. The ECP officer and the construction ECP lead also make periodic presentations to workers in small groups. An orientation presentation on the ECP for new non-manual employees (i.e., employees who perform work activities typical of office work, such as preparation of drawings, rather than manual labor or crafts activities) that was observed by the DOE Office of Health, Safety and Security (HSS) team was effective in providing appropriate information to the audience. The ECP office conducts annual assessments of subcontractors' ECPs as specified in DOE Order 442.1A, *Department of Energy Employee Concerns Program*, and conducts an annual program self-assessment.

Many employees have used the BNI ECP process to report concerns. Over 70 concerns were reported to the BNI ECP office in the first nine months of calendar year (CY) 2010, and over 100 concerns were reported in both CY 2008 and CY 2009. In addition, 140 concerns from BNI employees were reported to the ORP concerns program in CY 2008-2010 (some of which were transferred to BNI for resolution). Most of these concerns were from craft persons at the construction site or marshalling yard, but approximately 20 percent were reported by project engineering or support staff in Richland facilities and at satellite engineering support offices.

The team selected a sample of ten case files for concerns reported in 2008-2010 involving engineering or quality organization personnel to evaluate the characterization of the types of concerns and the implementation of the program. Several of these engineering and quality assurance (QA) related allegations were substantiated, several were partially substantiated, and some were not investigated due to confidentiality issues. These reported concerns identified such issues as supervisory and management pressure, belittling, or retaliation for writing project issue evaluation reports (PIERs); management attempts to revise approved QA records (i.e., a PIER root cause analysis and a Price-Anderson Amendments Act reportability assessment form); and harassment because the group had reported low scores for employee morale in the annual employee survey. (Although individual survey answers are anonymous, results are collected and trended for organizations and provided to management for action as needed.) The case files that were examined were generally complete and well organized. They typically contained concern statements/summaries, contact and event logs, investigation summaries, substantiation determinations, and communication of decisions to the concerned individual. Investigations were generally thorough and well documented. Where appropriate, efforts were made to extend investigations to address the potential for a "chilling effect" on employees. In one case where a "chilled" work environment was determined to exist, a follow-up evaluation of conditions was made by the ECP staff approximately six months later; there were some inadequacies in this evaluation, as discussed below.

Notwithstanding the positive attributes of the processes and management of concerns by BNI, the HSS team identified some deficiencies in the investigation and closure of six of the ten case files reviewed. Of greatest concern was that the corrective actions planned or taken to address the issues raised by substantiated or partially substantiated concerns were not usually documented in the case files or were incompletely documented. DOE Order 442.1A defines closure as "necessary corrective actions have been identified (e.g., issuance of a non-conformance report); the office responsible for taking the corrective action has accepted jurisdiction over the matter; and the resolution has been documented in a formal tracking system, necessary corrective actions have been identified, and implementation/jurisdiction of the corrective actions has been identified." The BNI procedure paraphrases the closure criteria from DOE Order 442.1A and defines "resolution" of a concern as a process of verifying the concern and "identifying the facts that aid in establishing plans to correct identified deficiencies." However, it does not specifically define closure and does not require closure information in the file on corrective actions taken. Ensuring that appropriate corrective and preventive actions have been implemented or identified in formal issues management systems before closure is required to maintain the integrity and reputation of the ECP. The template for the investigation report does provide a field and examples for documenting the corrective actions taken; establishing plans to correct identified deficiencies; and identifying corrective action vehicles, tracking systems and numbers, and responsible organizations for ensuring that actions are completed. In some cases the ECP used, and sometimes documented the use of, an internal tracking system for corrective actions cited by responsible managers or actions that needed to be performed by the ECP. However, in general, for the cases reviewed by HSS, specific actions identified by responsible managers were not specified in the case files, and the methods for documenting and tracking completion of these actions were not documented. However, in some cases files, the only actions identified were investigative actions taken or being tracked by the ECP; the specific institutional or organizational actions to address the concerns were not identified in these instances.

Other identified deficiencies included insufficient evidence to support a "not substantiated" resolution, incomplete details on important investigation elements, exit interview documents referenced but not included in case files, and closure of a chilled work environment condition with a follow-up analysis that did not adequately address lingering work environment issues. In the reanalysis of the chilled work environment, the ECP investigation concluded that a chilled environment no longer existed, but the report reflected that three of eight employees interviewed, one of whom was a new employee, still had negative feelings about

the corrective actions taken (e.g., the responsible manager got promoted out of the organization), ongoing events, and conditions (e.g., the original issue, related to a canceled PIER, still existed). Interviewees noted that it was still not clear when a PIER can be written. One of the eight selected for an interview refused to participate, citing a continuing bad environment. After discussion of these issues with the HSS team, the ECP manager added memoranda to several files clarifying actions and providing more detail on the management of these cases. However, these clarifying comments did not fully address the deficiencies identified.

BNI DPO Process. The BNI DPO process provides an alternate path for resolving technical issue concerns when individuals and BNI management disagree on the appropriate response to the issue. The BNI Project Manager has sole discretion to make the final determination as to whether the issue will be addressed in the DPO process. The process requires the DPO Coordinator to ensure that the normal review process has been attempted before processing the DPO form, including at least one formal meeting between the parties and their management, and that all DPOs are documented in PIERs. Confidentiality is not provided during the DPO process or required by DOE Manual 442.1-1, *Differing Professional Opinions Manual for Technical Issues Involving Environment, Safety, and Health*. A DPO Resolution Team, composed of at least two technically qualified members with no prior involvement in the decisions concerning the issue, is formed to examine the issue. (As an option, an independent third party can be called, depending on the issue.) The DPO Resolution Team prepares for and attends the DPO Review Board meeting for presentations by the issue originator; the originator's SME, if any; and the SME representing the differing opinion on the issue. The DPO Review Board reviews the DPO Resolution Team's response, determines whether any additional actions are warranted to close the DPO, and either makes recommendations for appeals filed by the issue originator or renders a final decision. The decision reached by the DPO Review Board is considered final by BNI management.

Only one formal DPO has been submitted. In 2007, an engineer filed a DPO case related to the use of gravity settling, rather than ultrafiltration, in the pretreatment facility. The DPO Resolution Team concluded that the proposed design alternative was without merit. The HSS team examined the case file for this DPO, including the investigation report by the independent investigation team of SMEs and disposition by DOE Headquarters, and determined that the DPO procedure had been implemented appropriately and the investigation was thorough and well documented.

One-time familiarization reading of the DPO procedure is part of the qualification training plan for newly hired technical staff in the Engineering organization, and required reading of this procedure and any revisions is in the qualification plans for Engineering supervisors and managers.

BNI Exit Interviews. Although there is no regulatory, contractual, or BNI policy driver for this activity, the ECP staff offers exit interviews to non-manual departing employees or provides a six-question survey for departing manual employees to mail in, providing another means for employees to report safety issues and concerns and for BNI management to resolve them. This process is not governed by a formal procedure, but a brief desk instruction describes the purpose as a means to "help reinforce the Nuclear Safety Quality Culture at the WTP" and provides interview and mail survey questions. Interview/survey questions include whether the employee had any environment, safety, health, or quality concerns that had not been addressed and whether supervisors properly addressed concerns when raised. The ECP performs approximately five interviews a month with non-manual employees and estimates that 12 to 15 percent of manual employees return the survey form. The ECP officer stated that new cases are opened when concerns are expressed during an interview; during the previous quarter, eight new ECP cases were opened from 137 ECP exit interviews. However, several case files mentioned allegations of safety issues raised during exit interviews for which there was insufficient documentation of resolution, indicating inconsistent implementation of this policy.

BNI PIERs. 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. The PIER process provides a worker feedback mechanism to report issues or recommendations without having to establish significance or identify the appropriate communication or resolution process; the worker only has to describe the issue.

PIERs can be written anonymously or initiators can request confidentiality, resulting in restricted distribution of initiator information. Approximately two percent of the 2300 PIERs written between March 2009 and September 2010 had anonymous initiators; a total of eight PIERs were written by engineering personnel in 2008, 2009, and 2010. Since March 23, 2009, approximately two percent of PIER initiators requested confidentiality.

PIERs are managed through a graded process based on the significance of the issue. Four significance categories are assigned, ranging from high significance (Level A), to analysis and action required (Level B), to "broke/fix" (Level C), to recommendations and opportunities for improvement (Level D). A PIER review committee of managers from various project organizations, chaired by the site Corrective Action Manager, meets daily to screen new PIERs for initial significance categorization, assigns the responsible organization/manager, and reviews Action Tracking System (ATS) entries to ensure that adverse conditions are documented as PIERs. A review committee meeting observed by the HSS team reflected conservative and active engagement by members in evaluating PIERs for initial significance categorization and in reviewing ATS items to determine whether a PIER should be initiated. If issues are not adequately described on the PIER form, they are returned to the initiator for clarification to ensure effective resolution of the condition.

BNI has established several other panels that provide oversight and evaluation of PIERs management. The Performance Improvement Review Board (PIRB) is a chartered panel that is designed to provide senior management oversight of the WTP corrective action program through review and concurrence with root cause analyses, monitoring of response to and management of significance Level A PIERs, evaluation of corrective action effectiveness of Level A PIERs and selected Level B PIERs, review of apparent-cause analyses and extent-of-condition determination for selected PIERs, and review of quarterly project trends (non-financial). It also serves as a forum for resolving organizational conflicts and resource constraints. The PIRB is sponsored by the Project Director, chaired by the Project Manager, facilitated by the site Corrective Action Manager, and populated by senior managers (12 designated positions). Board activities and decisions are documented in meeting minutes. Additional actions for presenters or the board are logged, assigned to owners, and monitored/tracked to completion. The HSS team observed a PIRB meeting and reviewed minutes from previous board meetings. Managers were engaged and knowledgeable of the issues, asked appropriate questions about aspects of the issue being addressed, and made appropriate decisions to ensure a rigorous evaluation and resolution of significant nuclear safety and technical issues.

The Engineering organization has established a Corrective Action Review Board (CARB) as an enhancement to the BNI corrective action management process for Level A, B, and C PIERs generated by engineering personnel. The purpose, detailed in an Engineering Guide for corrective action management, trending, and effectiveness review, is to ensure that Engineering manages the corrective action process effectively and efficiently. The CARB membership consists of discipline support leads (DSLs), the Engineering Processes Manager, and representatives from production Engineering and Materials Engineering as applicable. The DSL responsible for a PIER being reviewed presents a summary of the issue and the results of a planning worksheet (for Level A and B PIERs), prepared by the responsible manager and responsible employee, that includes determination of adequate description, assignment, and needed immediate/compensatory actions,

and also summarizes the investigation, extent of condition, apparent cause, proposed actions, lessons learned, planned closure dates, and selected error precursors for trending. The CARB review addresses the adequacy of immediate/compensatory actions, causal analysis, extent-of-condition analysis, corrective/preventive actions, and effectiveness review decision. Each area and the overall quality are scored as effective, partially effective, or not effective.

In a review of previous CARB meeting minutes and observations of a CARB meeting by the HSS team, DSL peers were engaged, asked appropriate questions, and made appropriate recommendations. Additional or revised actions determined during the review were identified and logged for tracking. The result of this oversight process is a more rigorous and effective management of issues. However, the HSS team found that the guidance document is not aligned with the actual practice of the CARB. The Engineering Guide states that the primary focus is PIERs (Levels A, B, and C) that are expected to exceed 160 job-hours of corrective or remedial actions to resolve – a focus on schedule/production rather than on the quality of the work, regardless of time or cost. In actuality, Level A PIERs are not reviewed because they are addressed by the PIRB, and all Level B PIERs are reviewed regardless of predicted man-hours.

BNI provides employees with a variety of training on the PIER process. The PIER process is introduced during the new/returning employee orientation. The review team observed an orientation session for non-manual employees and noted that the PIER process was only briefly introduced, with no adequate description of the purpose, process, or context for the use of this issues management system. In addition, approximately 1750 non-construction employees and subcontractor personnel in five different qualification plans have completed a computer-based training course for PIER initiators on the corrective action management system procedure. Personnel who are considered "expert" and routine users of the PIER system with specific responsibilities for PIER management elements (e.g., causal analysts, corrective action program staff, and PIER Review Committee and PIRB members) receive additional specific training on multiple corrective action management procedures. The PIER process is also briefly addressed in two training modules of the Hanford general employee training. The QA module only identifies a management responsibility to implement the WTP corrective action management procedure and does not address the use of PIERs by other employees. The Nuclear Safety and Quality Culture module specifies an expectation for employees to submit a PIER if an issue has not been satisfactorily answered by other means, but does not cite the procedure or any other details. The BNI corrective action management procedure is a required-reading qualification component for engineers and designers, including supervisors and managers. PIERs are also routinely discussed in monthly Engineering and Quality presentations in all Engineering groups.

The site QA and Engineering Assurance organizations have conducted self-assessments of the corrective action program and implementation for the site and the Engineering organization, respectively. The self-assessments conducted in 2009 were appropriately comprehensive and rigorous. Both identified several deficiencies in implementation and generated PIERs and ATS items to address the identified issues. The Engineering Assurance organization also performs trend analyses of Level A, B, and C PIERs and issues quarterly reports as required by project procedure to identify monitoring, emergent, or adverse trends (actions are required to be taken for the latter two trend categories). PIERs are evaluated for trends in raw numbers, process codes (e.g., software, drawings, and calculations), and failure mechanisms (causes). The HSS team reviewed completed reports and determined that issues were appropriately analyzed.

The number of PIERs has been declining in the past two years. In CY 2008, approximately 2400 PIERs were issued, in CY 2009 approximately 1900 were issued, and in the first eight months of CY 2010 fewer than 900 have been issued. Projecting the same rate for all of CY 2010 would result in 55 percent fewer PIERs in 2010 than in 2008. Similarly, the projected number of Level B adverse condition reports would decline from 229 in 2008 to 45 in 2010.

Overall, the BNI PIER corrective action management processes provide an effective mechanism for reporting, evaluating, and resolving nuclear safety and quality issues. The review committee, PIRB, and CARB processes are effective management tools that enhance the management and oversight of nuclear safety and technical issues to ensure that the extent and causes of problems are rigorously evaluated, that corrective actions and recurrence controls are adequately established and rigorously implemented, and that effectiveness reviews are thorough and performed when needed. BNI Engineering organization personnel report elements of pressure, disparagement, or retaliation for raising concerns or initiating PIERs. Although many issues are being documented and resolved using the PIER process, improvement is needed in the communication of requirements and expectations and employees' understanding of when a PIER should be initiated instead of a less formal identification and resolution process (e.g., discussing it with a supervisor or coworkers).

ORP Processes

ORP has established a formal ECP (i.e., governed by a comprehensive and well written procedure) that processes concerns raised by ORP contractors. Although not specifically stated in the ORP procedure, ORP has a formal memorandum of agreement with the Richland Operations Office (RL) specifying that concerns raised by ORP employees are processed through the RL ECP office and in accordance with the RL procedure. In CY 2008, BNI personnel reported 32 concerns to ORP, 60 were reported in CY 2009, and 51 had been reported in the first eight months of CY 2010. Most of these concerns were from craft workers at the WTP construction site. Some concerns were transferred or referred to the BNI ECP.

The HSS team reviewed case files for nine concerns. Several cases were adequately investigated and documented, several cases were not investigated by the ORP ECP for a variety of reasons (e.g., a union grievance had been filed on the issue in one case, and another was referred to human resources as an equal employment opportunity issue), and one case was transferred to BNI for disposition. A transferred concern does not require feedback on resolution to the ORP ECP office.

Several deficiencies were identified in the reviewed case files. Two cases involving allegations of retaliation were closed because more than 90 days had passed since the retaliation took place. The "whistleblower" rule, 10 CFR 708, does have a statute of limitations of 90 days, but these cases were not filed with DOE under 10 CFR 708 and the ORP ECP procedure does not have such a limitation. One of the cases (retaliation for writing PIERs) was closed as "documentation only," with no investigation or justification for closure. After questioning, the ECP manager found additional correspondence indicating that the case was closed based on the delay in reporting. One file on a concern that was detailed in a letter, perhaps from an external organization, contained no details about the concern and did not include the letter or the chronological log that was started three months after the concern was received and the case file initiated.

ORP employees have reported only three concerns to the RL ECP since 2002, none of them involving employees in technical, quality, or safety-related positions or involving nuclear safety or quality issues. ORP employees can also use the RL DPO process, but no cases have been filed.

Appendix C
Technical Issues Management

Staff training, procedures, guides, and various correspondence encourage the Waste Treatment and Immobilization Plant (WTP) project staff to identify and report issues to promote early resolution. The Project Issue Evaluation Report (PIER) process, as discussed in Appendix B, provides the means to report issues or recommendations without first having to establish the significance level or identify the appropriate communication or resolution process. Bechtel National Incorporated (BNI) also maintains additional formally defined issues management processes to efficiently meet the unique needs of project research, design, and engineering staffs for identification and resolution of technical issues. In the context of this report, technical issues include comments, issues, and questions identified and addressed in the Engineering Design Review (EDR), Action Tracking System (ATS), and Engineering Technical Issues Identification Management processes, which are further discussed in this appendix. Although most research, design and engineering staffs understand, are involved in, and/or use the EDR and ATS processes, understanding and use of the Engineering Technical Issues Identification Management process is generally limited to managers, supervisors, and assigned technical issue leads. The HSS team also reviewed the "clean-out-your-drawers" exercise and the Change Control Program and Change Authorization Guides.

Background. While DOE's approach to WTP design and construction has advantages in timeliness, the Office of River Protection (ORP) and BNI recognize that the approach presents a number of challenges to resolving technical issues that warrant continued attention as the project moves to completion:

- **The need for processing unique materials makes the WTP systems design and engineering complex and technically challenging.** Consequently, WTP processes are subject to many variables and uncertainties that have posed challenges to issue resolution. While many of the complex chemical and physical processes have been tested on smaller scales, they has not been implemented on a large scale, and there is uncertainty about the behavior of the materials and the functionality of the equipment in the various process steps in full scale operations. This uncertainty is further complicated by the fact that the composition of the tank waste feed materials varies considerably and the materials are not homogeneous. Because of these factors, it has often been difficult or time consuming to fully determine and demonstrate whether a technical issue with possible safety implications (e.g., the effectiveness of mixing) has been sufficiently resolved.

- **The overlapping design and construction approach places some constraints on design changes.** At this stage of the construction, various structures, materials, and components have been installed, and various others have been designed, ordered, or in storage. In some cases, components were procured before the design was completed. The concurrent design, review, and testing efforts have and may continue to produce information that may suggest possible modifications or improvements in final design and installed components, or that raises additional questions about the functionality of final designs or installed components. There are recognized risks with the approach (e.g., some required modifications may not be accommodated if identified too late, or only accomplished with major cost increases and schedule delays). At the current stage of progress, BNI has declared many aspects of the design to be final and the U.S. Department of Energy (DOE) has accepted the design, so design changes will be adopted only if there is a convincing need, as determined by a formal design change process.

As a result of such factors, various professionals working on the WTP project have residual questions and differing opinions about decisions that have been made and the importance of various technical questions

and issues, the need for and priority or rigor of additional study and analysis, the adequacy of the information available for making decisions, and the balancing of project risks. In such an environment, it is particularly important to ensure that the safety culture encourages individuals to raise safety issues and ensures that issues are properly evaluated and resolved. It is also important to recognize the importance of effective risk management and communication processes that inform individuals about the rationale for decisions and strive to achieve their acceptance, and to inform them about the formal process for raising differing professional opinions when disagreements remain.

EDR Processes. Many technical issues that arise during WTP design and engineering activities are routinely resolved through informal discussions with peers and supervisors or within well established internal design and engineering workflow processes. In particular, technical issues are routinely identified, tracked, and resolved during EDR processes encompassing checking, review, approval, and verification and re-verification activities. The EDR processes engage the Environment and Nuclear Safety (E&NS) organization for assessment of the design from the standpoint of nuclear and environmental acceptability. While the issues are being addressed as in-progress work, they are specifically exempted from the need to develop PIERs. The supporting WTP design and engineering procedures and guides included appropriate management expectations for effective technical issue management.

ATS Process. The ATS process is used to propose and establish agreement on the definition of a needed action, the schedule for completion, and the responsible action manager, and to track the status of deliverables. ATS is frequently used to track longer-term planned actions or implementation of commitments to completion. If there is doubt as to what is to be done, who is to do it, and whether or not it fits in the ATS or PIERs, the ATS procedure directs reporting in the PIER system. The ATS process does not apply to identification of unresolved issues, recommendations, deficiencies, hardware non-conformances, or conditions adverse to quality. ATS items frequently constitute required follow-on activities in the management of technical issues that are cited as bases for closing a technical issue before all aspects of resolution are completed. The Office of Health, Safety and Security (HSS) review of the ATS procedure and several issues currently in ATS indicated that the process is well integrated and effective for scheduling and tracking completion of well defined deliverables.

Engineering Technical Issues Identification Management Processes. The Engineering Technical Issues Identification Management process is designed and implemented as a high-threshold issues management process with the objectives of achieving early alignment between BNI and ORP management on the severity of significant emerging technical issues and the path forward for their resolution. This agreement process is intended to ensure that senior BNI and DOE management priority is focused on the most significant technical issues that may require their involvement for timely and effective resolution. The reporting and processing of technical issues within this process is well defined. The Engineering Manager or the Discipline Production Engineering Manager is required to identify emerging significant technical issue(s) to the Manager of Engineering (MOE) and, if agreed, assign a BNI Technical Issue Lead to document the issue on a Technical Issue Evaluation Form (TIEF); rank the issue priority High, Medium, or Low; and present the issue to BNI management for review. High and selected Medium priority technical issues (selected by the MOE) are proposed as Technical Issue Summary Sheets (routinely referred to as "Cut Sheets") and presented to ORP for review. If ORP agrees with the proposed Cut Sheet priority, technical scope, and path forward, ORP assigns an ORP Technical Issue Lead to work with the BNI counterpart to oversee and periodically check the status of resolution. ORP also reviews all Medium priority TIEFs and may request development of a Cut Sheet for any technical issue that was not proposed by BNI for that status.

The Engineering Technical Issues Identification Management guide indicates that once a Technical Issue Summary Sheet (Cut Sheet) is prepared for an issue, the TIEF is superseded. In practice, significant research, design, or engineering technical issues are identified and monitored either on a "Technical Issue

Watch List," TIEF, or Cut Sheet, depending on the significance of the issue. However, the terms "Cut Sheet" and "Technical Issue Watch List" are not defined in the Engineering Technical Issues Identification Management guide, and some thresholds are not defined (e.g., binning and resolution tracked as Low priority TIEFs rather than Technical Issue Watch List issues, or Technical Issue Watch List issues rather than individual Engineering organization "punch list" issues or Level 4 schedule items).

The management of technical issues that may be associated with environmental or nuclear safety risks are subject to additional WTP controls, such as the E&NS screening process, that are not addressed in the Engineering Technical Issues Identification Management guide or in this assessment. However, if the technical issue could significantly affect existing design, project schedule, and/or cost, the Engineering Technical Issues Identification Management guide requires the issue to also be screened for incorporation into the project risk register. Technical issues that qualify for tracking on the project risk register require development of a risk handling plan; definition of the potential Worst, Most Likely, and Best case impacts; and status tracking. Technical issues that do not qualify for risk register tracking, but are still considered sufficiently important to monitor internally to ensure that the likelihood of occurrence does not increase, are entered into the risk management system as "Risk Management Watch List" items, which do not require risk handling or impact definitions but are periodically reviewed for indicators of increasing importance to risk.

ORP implements effective oversight of WTP design and technical issue resolution processes through assigned ORP Technical Issue Leads for individual Cut Sheets and through Safety System Oversight Engineer and Facility Representative involvement in assessments, surveillances, and independent design reviews. Required BNI responses to findings and selected observations identified through ORP oversight activities are effectively tracked in the ORP Action Reporting System (OARS). ORP is also effectively involved in WTP technical issue management through assigning technical issue leads, tracking Cut Sheet status, concurring in the proposed technical issue closure, and planning closure effectiveness reviews. When issues cannot be efficiently resolved at lower levels of the organization, they are addressed jointly by the ORP organizational element with responsibilities for oversight of the WTP project (DOE-WTP) and BNI through the Issue Resolution Team (IRT), which is co-chaired by the WTP Project Directors and has equal membership of ORP and BNI technical staff.

Based on a May 2010 Construction Project Review Team recommendation, the Engineering Technical Issues Identification Management guide was recently revised to require an effectiveness review of all closed technical issues tracked by Cut Sheets within three months of their closure unless the BNI/MOE, with concurrence of the ORP Engineering Division Director, determines that such a review is not necessary.

HSS reviewed the Engineering Technical Issues Identification Management guide and various documentation, correspondence, ATS items, PIERs, and closure effectiveness reviews associated with the issues identified below under Technical Issue Resolution and Closure Analysis. The HSS team concluded that the Engineering Technical Issues Identification Management process is clearly effective in focusing both BNI and ORP management attention and oversight on significant open technical issues. The guide-defined process was also found to appropriately support development and implementation tracking of effective plans for closure of research, design, and engineering technical issues.

BNI is currently revising the Engineering Technical Issues Identification Management guide. The HSS team recommends that the revision define the "Cut Sheet" and "Watch List" terms; define the thresholds for identifying a technical issue as a Cut Sheet, TIEF, Watch List issue, individual engineering organization "punch list" issue, or Level 4 schedule item; define the role of the IRT; and establish the basis for superseding a technical issue to encompass certain situations (such as that encountered in closing the *Pulse Jet Mixing Design* issue with a new status term other than "closure"). Further, the team recommends that BNI clarify

and formalize the relationship and distinction between the project corrective action management system (PIERs) and technical issues management processes.

External Flowsheet Review Team (EFRT) Report (March 2006). ORP directed the project to convene an EFRT to support submission of their annual report to Congress on completion costs and throughput in light of observed escalations of costs for proposed changes. The EFRT identified 28 technical issues and provided recommendations and potential solutions for resolving each of the identified issues. BNI subsequently developed detailed Issue Response Plans (IRPs), which were reviewed and concurred with by ORP and BNI technical and project management and a lead EFRT member. The IRPs describe the scope of the evaluation and closure criteria for each of the EFRT recommendations. As allowed for other technical issues, closure of EFRT issues is permitted with descriptions of residual risks and defined and formally tracked follow-on actions. Concurrence that an issue is closed requires the same level of approval as the IRP. Closure of each of the 28 EFRT issues requires approval by a Technical Steering Group (TSG) that is composed of representatives from BNI, ORP, and Pacific Northwest National Laboratory (PNNL). All 28 EFRT issues are now closed.

Technical Issue Resolution and Closure Analysis. The HSS team reviewed documentation and correspondence associated with three closed Cut Sheets, one open Cut Sheet, one high priority TIEF (superseded by an associated Cut Sheet), and one low priority TIEF (that was appropriately not upgraded to the status of a Cut Sheet), as well as the Cut Sheet for EFRT issue M3. The sole purpose of the review was to verify the technical issue management processes specified for identification, tracking, evaluation, closure, follow-on, and effectiveness review were appropriately implemented. The HSS team did not attempt to validate the technical adequacy of analysis and resolution of the underlying technical issues. The specific results for each item reviewed by the HSS team are as follows:

- Cut Sheet "Technical Issue 2008-0018: Undemonstrated Leaching Process (PEP)" accurately summarized the issue and the WTP Issue Resolution Plan; appropriately referenced the Technology Steering Group - Issue Closure Record, EFRT Issue M12 - Undemonstrated Leaching Processes that detailed the basis for closure of each of the IRP seven closure criteria; listed the five follow-on action recommendations; and included the signatures of the assigned BNI and ORP Technical Issue Leads. Documentation that was reviewed by HSS also confirmed that the five activities specified for issue resolution on the Cut Sheet were appropriate and had been completed. Additional reviews of the M12 Closure Follow-on ATS were also verified to be consistent with the TSG recommendations. Given the level of oversight and closure concurrences, BNI and DOE/ORP determined that a separate Cut Sheet closure effectiveness review was not required, as is allowed by the Engineering Technical Issues Identification Management guide.

- Cut Sheet "Technical Issue 2008-0024: Steam Sparging" accurately summarized the issue, the activities required for resolution, and the references documenting activity completion. The overall unmitigated risk to cost and schedule was assessed to be moderate, and the risk sheet included a risk handling plan requiring the approval of a TREND (a local term for a change in the project cost or schedule) to support a contract for material corrosion testing, and the definition of potential strategies for Best, Most Likely, and Worst Case scenarios. Reviewed documentation confirmed that the 14 activities specified for issue resolution were appropriate and had been completed. The BNI and ORP Technical Issue Leads signed the Cut Sheet. Additional review of follow-on actions confirmed that the basis for closure of the 14 activities required for issue resolution was documented, that material corrosion testing was in progress, and that an ATS item required that the Steam Sparger Heating process be incorporated in the next update of the Ultrafiltration System Description. A related ATS item directed an "Effectiveness Review of Cut Sheet 2008-0024 Closure." The resulting self-assessment met the minimum lines of inquiry specified by the process guide, conformed to the

methodology specified by the responsible Discipline Production Engineering Manager, and confirmed that the issue was effectively closed with defined follow-on actions. For example, because aerosol impacts on system equipment from all sources are being evaluated in Cut Sheet 2010-0001, "PVP and PVV System Upgrades," alignment between ORP and BNI with regard to the Cut Sheet 2008-0024 evaluation of the potential for generation of excessive foaming from air purging and steam spargers was noted in the self-assessment as an action to be accomplished during management of that Cut Sheet.

- Cut Sheet "Technical Issue 2009-0008: LAW Melter Feed Vessel (LFP) High Temperature" accurately summarized the issue and defined appropriate activities required for issue resolution. The overall unmitigated risk to cost and schedule was assessed to be moderate. The risk sheet included a risk handling plan requiring evaluation of alternatives for resolving a vessel temperature problem; approval of a TREND to support the least costly, technically acceptable alternative; and definition of potential strategies for Best, Most Likely and Worst Case scenarios. Documentation reviewed by HSS confirmed that the seven activities specified for issue resolution were appropriate and had been completed. The BNI and ORP Technical Issue Leads signed the Cut Sheet. A related ATS item directed an "Effectiveness Review of Cut Sheet 2009-0008 Closure." The resulting self-assessment met the minimum lines of inquiry specified by the process guide, conformed to the methodology specified by the responsible Discipline Production Engineering Manager, and confirmed that the issue was effectively closed with defined follow-on actions.

- Cut Sheet "Technical Issue 2010-0001: PVP and PVV System Upgrade" accurately summarized the issue and defined appropriate activities required for issue resolution. The overall unmitigated risk to cost and schedule was assessed to be moderate. The risk sheet included a risk handling plan requiring development of a cost estimate and planning and equipment installation to upgrade the safety systems from passive to active to maintain a negative pressure in the non-Newtonian vessels during all normal and accident conditions, including loss of site power or a seismic design basis earthquake event. The activities required for issue resolution were appropriately defined, and the Cut Sheet was signed by the BNI and ORP Technical Issue Leads. At the end of the onsite review, the Cut Sheet was still appropriately open with forecasted completion of required activities for closure extending into February 2011 with some listed as "To Be Determined."

- TIEF-0023, "Potential Changes in Evaluation Guidelines for Dimethyl Mercury" was determined to have a High priority level based on difficulty and technical impact, signed by the MOE and ORP/Federal Project Director Engineering Manager, and superseded by Cut Sheet "Technical Issue 2009-0023: Changes in Regulatory Requirements Related to Dimethyl Mercury Emissions." The resulting Cut Sheet appropriately summarized the issue, referenced the DOE risk sheet, identified activities required for resolution, discussed the status and forecast for activities, and was signed by the BNI and ORP Technical Issue Leads.

- TIEF-0022, "Open Technical Issue: Evaluate Mercury/DMHg Concentrations Against Current WTP Limits for Worker Exposure and Public Exposure" required updating existing correspondence addressing evaluation of exposure limits to a formal engineering calculation subject to formal review and approval; defined the path forward, action milestones, and responsibilities; was ranked as low priority based on no technical impact and low difficulty; and was only signed by the MOE, as required. As a Low priority TIEF, it was appropriately not elevated to Cut Sheet status and thus does not require alignment between BNI and ORP senior management.

Based on review of the correspondence and documentation associated with the above technical issues, the HSS team concluded that the Engineering Technical Issues Identification Management process is effective

in focusing BNI and ORP management attention and oversight on significant open technical issues, and in developing and tracking implementation of effective plans for closure of research, design, and engineering technical issues. Further, the team's review identified no violations of the Engineering Technical Issues Identification Management process and verified that its implementation for the above technical issues selected for review was robust and that issue closures were defensible. However, the HSS team further evaluated the closure of M3 and noted that closure of M3 is inconsistent among the different issues management processes in terms of the nature of follow-on actions. Closure of the of the *Pulse Jet Mixing Design* issue Cut Sheet (EFRT issue M3) is discussed further below.

Analysis of Closure of Technical Issue M3. BNI's Engineering Technical Issues Identification Management guide indicates that technical issues may be closed *once all actions are complete or sufficiently resolved that technical uncertainty is removed, and tracking via this mechanism is no longer needed.* The guide also indicates that: *Although implementation actions may still be in progress, if the technical issue is essentially resolved and remaining actions are considered routine and are being tracked by other WTP tracking tools* (schedules, ATS items, PIERs, etc.), then, with agreement from the MOE (all TIEFs) and DOE (for issues that are jointly tracked by the Technical Issue Summary Sheets), the technical issue may be closed.

In the case of an EFRT issue, which is also identified as a Cut Sheet, the issue is normally closed when its resolution satisfies both the closure criteria specified in its IRP and the closure criteria specified in the Engineering Technical Issues Identification Management process. The guidance on closure of technical issues requires that the TIEF/Cut Sheet be updated with a statement summarizing what was done to close the technical issue or why the issue is considered closed. The HSS review of the closure of EFRT issue M12 and selected TIEF/Cut-Sheet issues (discussed above) indicates that the process for closure of issues and definition of required follow-on actions as described by the guide was appropriately implemented.

For some complex, multi-faceted technical issues, the resolution effort may require breaking the parent technical issue into its component technical issues. These resultant technical issues may be Cut Sheets, TIEFs, or Technical Issue Watch List issues, which would be tracked within the Engineering Technical Issues Identification Management process, and/or follow-on actions that would be tracked in ATS, PIERs, schedules, etc. In some cases, the follow-on actions required to resolve resultant technical issues involve consideration of several technical questions and performance of further activities that may not be routine and/or for which the outcome is uncertain; further actions in this category could include additional research and testing efforts where the outcome is uncertain, or may be based on plant processes that are still under design and involve uncertain aspects. In such cases, declaring the complex, multi-faceted parent technical issue "closed" could be confusing, since the original issue has not yet been resolved but is only superseded by multiple progeny technical issues or follow-on actions, each to be tracked and resolved with its own set of required actions and uncertainty of success.

The adequacy of required follow-on actions to finally bring a technical issue to full closure may also be open to question. For example, the recent technical issue "closure" of the *Pulse Jet Mixing Design* issue (EFRT issue M3) clearly recognizes a remaining BNI/DOE concern about mixing in certain specific non-Newtonian vessels. BNI and ORP also acknowledge that small-scale testing may not fully mitigate the remaining project cost, schedule and scope risks. The questions underlying these issues are complex; they relate to whether the complex physical phenomena are adequately modeled, appropriately scaled, and sufficiently benchmarked and tested. Currently available assessment information and planned testing may still not be adequate to resolve the concerns. The directed action addressing these concerns is to clearly define any information gaps, complete a risk assessment, and establish a path forward. The resolution may entail platform and laboratory testing to support gap closure, validation of input assumptions, and prototypic performance demonstrations. A new Cut Sheet, Technical Issue 2010-0004 on the Implementation of Non-Newtonian Vessel Closure Package Recommendations, has been established. Further, the "closure" process

for the *Pulse Jet Mixing Design* issue and the 2009 and 2010 clean-out-your-drawers exercises (discussed below), resulted in definition of two additional technical issue Cut Sheets relating to final resolution of the *Pulse Jet Mixing Design* issue.

Thus, although the required follow-on actions and project cost, schedule, and scope risks are being tracked, reviewed, and well managed, the remaining actions related to final closure of the *Pulse Jet Mixing Design* issue are not of a routine nature, and technical uncertainty still remains. In this case, ORP and BNI made a project risk-based management decision to "close" the *Pulse Jet Mixing Design* issue with defined follow-on actions, without actually resolving all technical aspects of the issue and the remaining uncertainties of success. The updated Cut Sheet for the *Pulse Jet Mixing Design* includes a summary statement of how the issue was closed and includes references to multiple closure packages, as required. However, calling the issue "closed" appears inconsistent with the documented expectations of the Engineering Technical Issues Identification Management guide.

A key aspect of the residual concerns among some individuals surrounding closure of the *Pulse Jet Mixing Design* issue is that the definition of "closure" varies significantly between that represented by the closure of the *Pulse Jet Mixing Design* issue and the customary understanding of the term, which is closely approximated by the closure of ATS items and PIERs. This varying use of the term "closure" makes it difficult to understand the true status of the closure of technical issues by external stakeholders and others, thereby challenging project status transparency. "Closure" of the *Pulse Jet Mixing Design* issue removed the original broad technical issue from Cut Sheet status and redefined the status of some of the open technical issues underlying the original issue. Further, some of the follow-on actions to resolve the underlying technical issues have become redefined as Cut Sheet issues themselves, which are not routine tasks as expected in implementing the Engineering Technical Issues Identification Management guide process. Other engineering technical issues are declared closed when the technical issue is sufficiently resolved that technical uncertainty is removed, and the remaining actions are routine and tracked. PIERs or ATS issues are closed upon completion of all required corrective actions or required actions, respectively.

Clean-Out-Your-Drawers Exercise. The May 2010 Construction Project Review (CPR) report noted that "During 2009, there was a clean out your drawers initiative wherein BNI leadership instructed the engineering staff to surface any lingering issues that they have identified but not yet resolved. The objective is to quantify open technical issues to ensure they are appropriately assessed, quantified, and captured in the engineering work plan." The May 2010 CPR recommendation 3.2 stated that "Prior to July 30, 2010, the project team should repeat the targeted drive to force the formal identification of any known technical issues."

The MOE directed her staff by e-mail to review the technical issues list posted on the WTP intranet for completeness; to identify needed additions; to engage all engineers in their discipline to bring hidden issues to light; to start the process immediately; and to screen new technical issues to determine which will be tracked as Technical Issue Watch List issues, TIEFs, or Cut Sheets. A subsequent WTP Project Technical Director e-mail indicated that there would be a joint review of any new issues to assure integration between the engineering disciplines. The clean-out-your-drawers exercise was not otherwise formally defined. Through this effort, 89 potential new WTP technical issues were identified and categorized during a joint BNI research, design, and engineering disciplines meeting. ORP also independently identified 29 potential new technical issues. A subsequent joint BNI and ORP meeting pared the joint list to nine new Technical Issue Watch List items; some adjustment of that number is possible upon completion of additional planned reviews. Many of the remaining proposed new technical issues were reported as being worked on or being followed in other processes.

BNI also solicited PNNL's identification of new technical issues, and PNNL responded as requested. By the time the HSS team completed onsite data collection activities, BNI had not completed their review of

PNNL's response or discussed their assessments and plans for resolution and tracking of PNNL-identified vulnerabilities.

The HSS team recognizes that a periodic clean-out-your-drawers exercise can be an effective mechanism for enhancing confidence that the list of open significant technical issues is known and is being appropriately processed, and for assessing the effectiveness of existing institutional processes for surfacing and managing significant technical issues. However, the effectiveness of this process may have been limited because it was not defined in a procedure or guide, and thus BNI should consider formally defining and periodically scheduling a clean-out-your-drawers process. In addition, the clean-out-your-drawers exercise identified nine new significant technical issues that were not previously surfaced by the established technical issue identification and management processes.

Change Control Program and Change Authorization Guides. The resolution of significant WTP technical issues frequently involves consideration of change in project scope, cost, and/or schedule. WTP management's recent emphasis on project completion has increased the recognition that some proposed changes may impact cost and schedule without commensurate benefit to safety, quality, and functionality. Therefore, management has reinforced the expectation that changes need to be evaluated, authorized, and controlled at the right level of the organization. As the need for change is identified, the WTP staff is expected to discuss proposed changes with line management, which is responsible for evaluating and controlling changes through the normal Change Control process. The Change Control guide implements a disciplined process to ensure that the scope, schedule, and cost baselines are accurate, up to date, and capable of providing meaningful data and information for the project.

The purpose of the Change Authorization guide is to ensure that those changes or actions that may fall into the category of potential limited return to the customer and WTP, while increasing cost, are evaluated by senior management before implementation. The guide is focused on evaluating, authorizing, and controlling so called "knothole changes." A knothole change is a change that has been challenged regarding the value of implementation, necessitating elevation of the change proposal to the Project Management Team (PMT) for evaluation, authorization, and control. BNI encourages the staff to identify potentially needed knothole changes for evaluation, particularly if adhering to the status quo may deny the opportunity for significant benefit to safety, cost, and/or schedule.

PMT members are responsible for determining whether a proposed change is a knothole change. When a knothole change is identified, the change initiator is responsible for outlining the change justification by answering the specified "10 Hard Questions"; answering the guide's specified contractual and compliance questions associated with the proposed change; identifying an implementation strategy demonstrating how coordination, consequences, impacts, and timing issues are addressed; and submitting the change proposal to the PMT for consideration. The PMT (with Executive Review Board, IRT, or subject matter expert input, as appropriate) determines and documents their decisions on proposed knothole changes and ensures that follow-up or implementation tracking actions are captured.

The HSS team determined that the intent of the WTP Change Authorization process for changes that may have limited benefit is appropriate, and formal justification and senior management involvement are warranted. However, management communications to the staff in the Change Authorization guide, and in "sound bite quality" pronouncements by management encouraging "push back" and "resist change," have contributed to some members of the WTP staff perceiving that the effort now required to raise and seek resolution of new technical issues is a disincentive to surfacing those issues. BNI should ensure that its communications to staff clearly indicate that the increased focus on WTP transition to commissioning and operations does not reduce the importance of a strong safety culture that encourages identification and reporting of all problems, issues, and concerns.