

December 1, 2011

The Honorable Peter Winokur
Chairman
Defense Nuclear Facility Safety Board
625 Indiana Avenue, NW, Suite 700
Washington, DC 20004

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DNF SAFETY BOARD

Dear Chairman Winokur:

The Independent Safety and Quality Culture Assessment Team, formed to conduct a review of the safety culture at the Waste Treatment and Immobilization Plant, has finished its assignment. We are pleased to provide five copies of our final report, entitled "Assessment and Recommendations on Improving the Safety and Quality Culture at the Hanford Waste Treatment and Immobilization Plant," for your information.

As previously offered, the ISQCA team would be pleased to meet with you to answer questions you may have regarding the work.

Sincerely,



Dr. Nils Diaz
Vice Chair
ISQCA Team

cc: The Honorable Jessie Hill Roberson
The Honorable John E. Mansfield
The Honorable Joseph F. Bader
✓ Timothy J. Dwyer



**Assessment and Recommendations
for Improving the Safety and Quality Culture at the
Hanford Waste Treatment and Immobilization Plant**

**A Report by
Independent Safety and Quality Culture Assessment Team**

**Luis Reyes, Chairman
Nils Diaz, Vice Chairman
David Amerine Joseph Callan
Gerald Garfield Roger Mattson**

November 30, 2011

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Nils Diaz, Vice Chairman
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NOTE

The Independent Safety and Quality Culture Assessment (ISQCA) team was engaged by Bechtel National, Inc. (BNI) in response to a directive from the Secretary of Energy. The ISQCA team has maintained its independence from BNI, DOE, and all other parties, as established by the original commitment from the Secretary.

Independent Safety and Quality Culture Assessment Team


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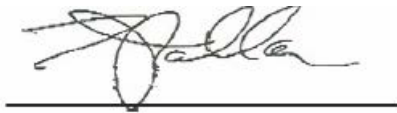
Luis Reyes

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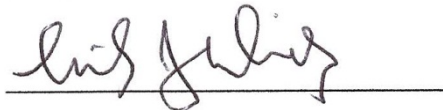
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L. Joseph Callan

Nils Diaz is the Managing Director of The ND2 Group, a nuclear energy expert and policy advisory group. He is a past Chairman of the Nuclear Regulatory Commission.



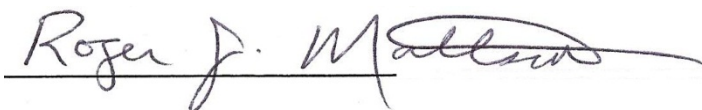
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Gerald Garfield

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Roger J. Mattson

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Preface

The importance of safety culture in planning and execution of activities of any nuclear program is now well established, as well as its relationship to the ultimate achievement of a program mission. The safety culture at the Waste Treatment and Immobilization Plant (WTP) is defined as “an organization’s values and behaviors modeled by its leaders and internalized by its members, which serve to make nuclear safety and quality the overriding priorities on the Project.” Safety culture is not a static value or behavior; on the contrary, it embodies a dynamic and consistent prioritization of safety that ensures continued improvement of the mission-critical parameters and becomes intrinsic to the discharge of all functions important to safety.

The purpose of the WTP is to fulfill the critical mission of processing, stabilizing, and immobilizing via vitrification the nuclear-weapons-related radioactive wastes stored at the Hanford Site. In glass form, the waste is stable and impervious to the environment, and its radioactivity will dissipate over hundreds to thousands of years. WTP is probably the most complex and challenging project presently under construction in the U.S., from every important viewpoint, including socio-political, financial, safety, environmental, scientific, and engineering considerations. The WTP mission is not contested; in fact, it is accepted and supported by all involved stakeholders as indispensable to the nation, the region, and the DOE establishment. However, achieving the mission within safety, schedule, and cost limitations has encountered multiple problems. The continuing efforts for mission achievement are frequently hindered by technical, budgetary, safety, and management issues, all of them significant and in need of resolution.

Issues concerning the safety culture at the WTP project have been raised for many years. With pointed clarity, the DOE Office of River Protection (ORP) stated, after a September-October 2005 review of its lead contractor on the project, Bechtel National, Inc. (BNI), that “the assessment concluded most of the quality issues occurred because of nuclear safety culture weaknesses.” A series of improvements and questions arose during the following years, culminating in multiple reviews, recommendations, and actions by both DOE and BNI.

Eventually and probably prompted by a well-publicized “whistleblower” concern and associated personnel actions, the Defense Nuclear Facilities Safety Board (DNFSB or Board) undertook a series of aggressive actions to address the potential deficiencies in the safety culture at WTP, deficiencies that could degrade the safety and quality of the project. As a result of the Board’s actions, including DNFSB Recommendation 2011-1 to the Secretary of Energy, a sequence of activities has been undertaken by DOE and BNI to address the implementation and sustainability of a suitable safety culture at WTP. These include the initiation of activities by “an independent, executive-level assessment of the project’s nuclear safety culture by a group of nuclear industry subject matter experts.” The safety and quality culture assessment, conducted at the WTP by the Independent Safety and Quality Culture Assessment (ISQCA) team from August through November 2011 and reported herein, is intended to comply with this commitment and to provide a measure of BNI’s and DOE’s effectiveness in achieving the WTP objectives within the overall safety construct required by its mission.

Acknowledgements

During the conduct of its assessment, the ISQCA team had the support and cooperation of dozens of managers and personnel from all levels of BNI, DOE, and URS. All of these individuals provided their time, information, and candid views to the ISQCA team despite constant and important competing demands for their time. The ISQCA team appreciates the commitment shown by all of these individuals to completing the WTP project in a manner that meets its mission to safely treat the tank waste.

Executive Summary

Beginning in 2009, the Defense Nuclear Facilities Safety Board (DNFSB) undertook a series of actions to address the potential deficiencies in the safety culture at WTP, deficiencies that could degrade the safety and quality of the project. As a result of the Board's actions, including DNFSB Recommendation 2011-1, dated June 9, 2011 to the Secretary of Energy, a sequence of activities has been undertaken by DOE and BNI to address the implementation and sustainability of a suitable safety culture at WTP. These activities include the initiation of "an independent, executive-level assessment of the project's nuclear safety culture by a group of nuclear industry subject matter experts," as stated by the Secretary of Energy in a letter dated, June 30, 2011. The assessment conducted at the WTP by the Independent Safety and Quality Culture Assessment (ISQCA) team and described in this report is intended to comply with the Secretary's commitment and to provide a measure of BNI's and DOE's effectiveness in achieving the WTP objectives within the safety construct required by its mission.

The history of the WTP safety and quality culture is indeed checkered and has been the subject of continuing reviews, investigations, publicity, and associated impacts on project execution. A review of the Nuclear Safety & Quality Culture (NSQC) timeline (Attachment 1) reveals the significant efforts made particularly in the last two years to establish a sound safety and quality culture at WTP; however, these efforts have not been widely disseminated outside of the project or considered to have been sufficient to overcome the continuing external concerns over the safety culture of the project and its implications on nuclear safety and radiological and environmental protection.

The findings and recommendations from the ISQCA assessment that are contained in this report are exclusively directed at issues and actions that affect the nuclear safety culture for people involved in the design, authorization, and oversight of the facility. The team's analysis of the status of industrial safety at the construction site and other project facilities suggested that DOE and BNI are making good progress in advancing the safety culture in those areas, so industrial safety was not covered in this assessment.

The Report summarizes in Part 5 a series of key safety culture themes and trends gathered from briefings and interviews conducted in Richland, WA and in Washington D.C., and a comparison of the results of a recent opinion survey of non-manual employees of WTP with the traits from a recent Policy Statement on safety culture issued by the Nuclear Regulatory Commission (NRC). The quoted themes and trends emerged from different assessment tools, and some of them are believed to have affected or are still impacting the safety and quality culture of the project. The negative trends observed by the ISQCA team may be reversed by devoting further attention to the NRC's nine traits of a positive nuclear safety culture. Those traits constitute aspirational goals that serve as a guide in the pursuit of excellence. The majority of results from the nuclear safety culture survey compare favorably to the traits in the NRC Policy Statement. The team's assessment, within the context of the NRC safety culture traits, was positive but less favorable than the survey results in a number of areas due to the team's deliberate focus on problem areas identified by the DNFSB and the team's use of current industry best practices in its assessment.

The results of the ISQCA assessment, which gives priority to conditions and actions important to safety culture over approximately the last 30 months and heavily weights present conditions, do not support DNFSB Findings 1 and 2 in Recommendation 2011-1. That is, the ISQCA team found no

widespread evidence of a chilled atmosphere adverse to safety and no widespread evidence that DOE and Contractor Management suppress technical dissent. Rather, it appears that a juxtaposition of important issues that needed timely disposition contributed to a perception of a chilled atmosphere and suppression of dissent.

The conduct of the DNFSB oversight activities, its follow-up actions, and the structure of its communications beginning in the fall of 2009, including its October 2010 public hearing on WTP safety issues and its subsequent witness tampering investigation, had the unwanted effect of instigating a series of hostile reactions and interactions that have burdened the normally constructive relationships among the Board, DOE, and its contractors.

The team found that there is no widespread reluctance on the part of DOE, URS, and BNI project personnel to raise safety and technical issues that could impact the overall safety of the project, even though there were isolated expressions to the contrary.

Although raising issues is not a problem, the timely resolution of issues stands out as a persistent and pervasive project challenge. This deficiency has been identified multiple times in the past. Unless resolved, the continuation of a pattern of delay and lack of resolution could result in important issues not being raised.

The Board correctly identified that “the tension at the WTP project organizations charged with technical issue resolution and development of safety basis scope, and those organizations charged with completing design and advancing construction, is unusually high,” and recognized its significance on the need to take remedial action to ensure a strong safety culture. It appears that a very significant contributor to this important problem is the management and performance of the Environmental and Nuclear Safety (E&NS) organization, and its direct impact on safety culture. Moreover, the failure of management to resolve the lack of alignment between Engineering and E&NS delayed the implementation of a consistent and effective safety construct. The lack of full implementation of a consistent safety analysis and matching safety oversight, to support the engineering design and construction efforts, hinders the completion of a WTP project focused on safety, quality, cost, and schedule.

Process and communication issues at WTP are found in need of improvement across the project interfaces so as to establish and sustain trust among the organizations and the employees. Communication of the resolution and closure of technical and safety issues, using effective and timely processes, has been shown to be an important issue impacting perceptions and attitudes of project personnel, and should receive increased and sustained attention from management.

In conclusion, the ISQCA team observes that ensuring the safety of the design, construction, and operation of the facilities is the only manner by which to secure cost and schedule performance.

Part 1. Introduction

Background

The Waste Treatment and Immobilization Plant (WTP) is established to fulfill the critical national mission of processing, stabilizing, and immobilizing via vitrification the nuclear-weapons-related radioactive wastes stored at the Hanford reservation. In glass form, the waste is stable and impervious to the environment, and its radioactivity will dissipate over hundreds to thousands of years. WTP is probably the most complex and challenging project presently under construction in the U.S., from every important viewpoint, including socio-political, financial, safety, environmental, scientific and engineering considerations.

One controversial issue surrounding the design, construction, and eventual operation of the WTP is the project safety culture and its impact on the project's real and perceived safety, technical performance and progress, and the capability to achieve the mission within an established overall safety construct. Recently, serious concerns have again been raised regarding the safety culture at WTP, concerns that have necessitated the strong intervention of the DOE and its contractor for the WTP, as well as a recommendation regarding the safety culture by the DNFSB.

The history of the WTP safety and quality culture is indeed checkered and has been the subject of continuing reviews, investigations, publicity, and associated impacts on project execution. A key synopsis of the history of the WTP safety culture and quality is provided in Attachment 1, NSQC History Timeline, included in this report on an optical disc. A review of that timeline reveals the significant efforts made, particularly in the last two years, to establish a sound safety and quality culture at WTP; however, these efforts have not been widely disseminated outside of the project or considered to have been sufficient to overcome the continuing external concerns over the safety culture of the project and its implications on nuclear safety and radiological and environmental protection.

Establishment of an Independent Safety and Quality Assessment of WTP

Beginning in 2009, ongoing activities and issues at DOE and WTP prompted the DNFSB to undertake a series of aggressive actions related to disposition of technical and safety issues; these actions eventually led to strong inquiries on safety culture issues and their potential impact on the protection of public health and safety. Coincident with these concerns, DOE and BNI conducted reviews in 2010 of the Nuclear Safety Culture at WTP. In October 2010, DOE's Office of Health Safety and Security (HSS) issued a report containing an Independent Review of Nuclear Safety Culture at WTP, including recommendations for its improvement.¹ In this time frame, BNI commissioned an independent consultant to perform an assessment of the Safety Conscious Work Environment (SCWE), an important aspect of Nuclear Safety Culture, within its engineering organization.² These reviews by HSS and BNI led to programmatic improvements of safety culture.

¹ Report by DOE Office of Health, Safety and Security *Independent Review of Nuclear Safety Culture at the Hanford Site Waste Treatment and Immobilization Plant Project*, dated October 25, 2010.

² Report prepared by Pillsbury, *Assessment of a Safety Conscious Work Environment at the Hanford Waste Treatment Plant*, dated November 1, 2010.

The line of inquiry into the safety culture at WTP by the Board is mostly derived from its statutory authority under 42 U.S.C. § 2286, (5) Recommendations:

“The Board shall make such recommendations to the Secretary of Energy with respect to Department of Energy defense nuclear facilities, including operations of such facilities, standards, and research needs, as the Board determines are necessary to ensure adequate protection of public health and safety.”

Exercising its responsibilities to make recommendations to the Secretary of Energy, on June 9, 2011, the Board issued its Recommendation 2011-1, *Safety Culture at the WTP*. In this recommendation the Board determined, “the prevailing safety culture at the Waste Treatment and Immobilization Plant (WTP) is flawed.”

On June 30, 2011, the Secretary of Energy responded to Recommendation 2011-1. In his letter the Secretary indicated, “DOE has developed a comprehensive action plan to address the Board’s specific recommendations to strengthen the safety culture at WTP.” The letter described a set of initial steps being taken to address the serious concerns raised regarding the WTP safety culture, including: “We will also be joining with BNI to sponsor an independent, executive-level assessment of the project’s nuclear safety culture by a group of nuclear industry subject matter experts, who have experience in INPO evaluations and/or Nuclear Regulatory Commission (NRC) inspections.”

Following the guidance established by the Secretary’s response to the Board, BNI promptly engaged a team of independent experts to conduct an in-depth review of the safety and quality culture at WTP. On August 17, 2011, BNI provided to DOE written confirmation of the formation of the ISQCA team and of its purpose, charter, and scope of work.

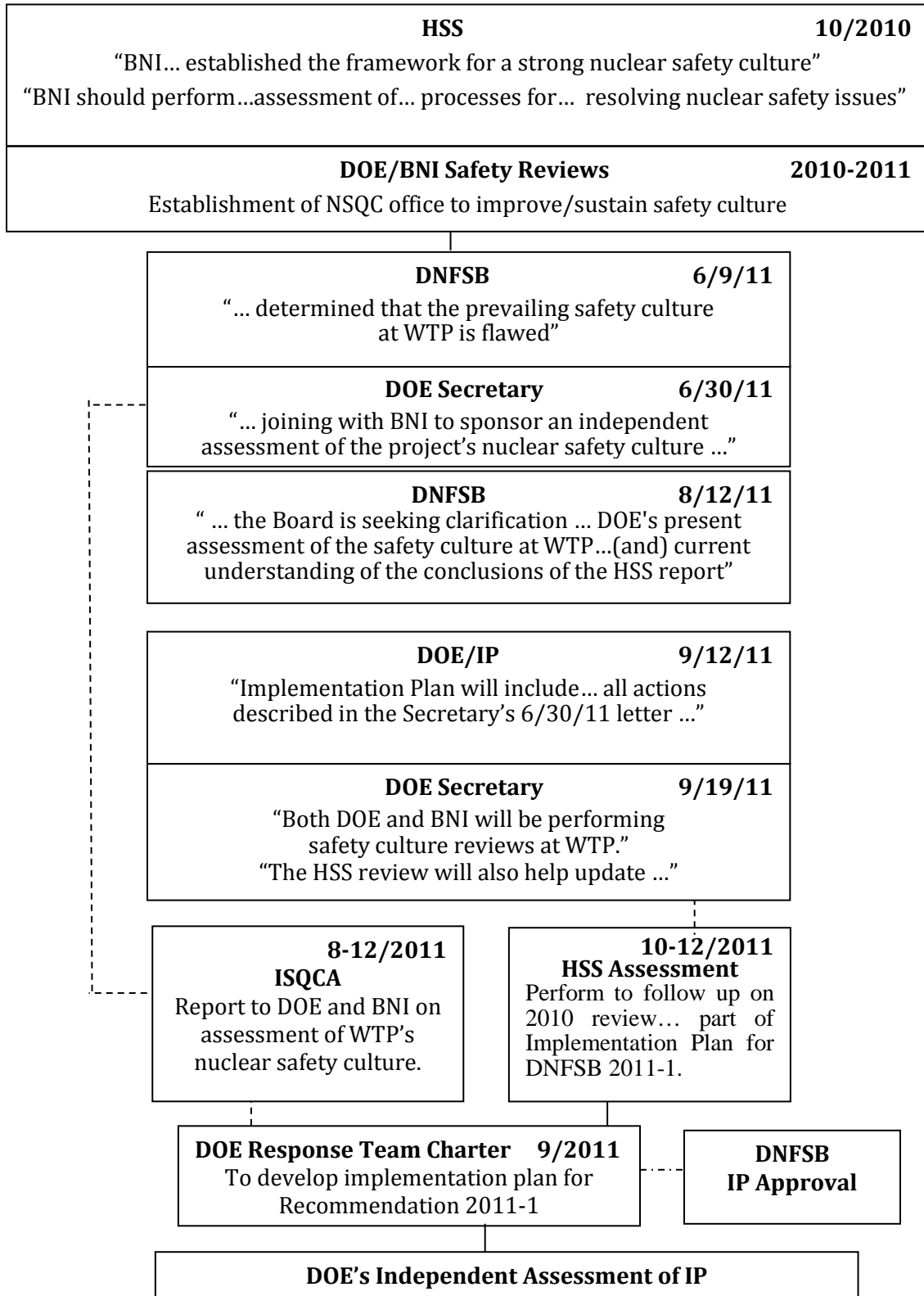
The ISQCA team started its field activities on August 3, 2011, preparing a charter and scope of work document,³ and proceeding with its implementation. On September 1, 2011, the Manager of the ORP and the WTP Federal Project Director endorsed the ISQCA team membership and its charter and supported the team’s request for visits with DOE officials at DOE offices in Washington, D.C.

On August 12, 2011 the Board requested further information from the Secretary of Energy regarding Recommendation 2011-1. The Secretary responded on September 19, 2011 to clarify the actions to be taken in response to Recommendation 2011-1, including the incorporation of efforts of the ISQCA team, as described in the following flow chart, prepared by the ISQCA team, entitled Recent Safety Culture Assessments (Primary Actions and Relationships).

³ Letter to Daniel B. Poneman and David G. Huizenga, DOE, *Independent Safety and Quality Culture Assessment (ISQCA) Team Charter and Statement of Work*, from Dale E. Knutson and Scott L. Samuelson, DOE, dated September 1, 2011.

Recent WTP Safety Culture Assessments

- Primary Actions and Relationships -



Part 2. The 2011 Independent Safety and Quality Culture Assessment

Purpose of the Assessment

In his June 30, 2011 letter to Dr. Peter Winokur, the DNFSB chair, the Secretary of Energy, Dr. Steven Chu, stated, “we recognize the need to continue improving nuclear safety at WTP and across the complex.” The Secretary outlined the initial steps for strengthening the safety culture at WTP, including tracking and validating corrective actions, an independent review by HSS of the safety culture across the entire complex of DOE facilities, training on Safety Conscious Work Environment (SCWE), and the establishment of an independent, executive-level assessment of the nuclear safety culture on the project. As described in Part 1, this last step, to which the Secretary committed, resulted in the formation of the Independent Safety and Quality Culture Assessment team.

The ISQCA team elaborated on its purpose in its Charter, which was subsequently approved by both BNI and DOE, as follows:

The ISQCA is to assess the nuclear safety and quality culture (NSQC) on the WTP project and provide the results and applicable recommendations back to the Secretary, with urgent deliberation. The ultimate purpose is to ensure that all project activities are performed with nuclear safety as the dominant design, construction, and operating requirement. This will enable the requisite safety outcomes through the consistent application of project management supported by a prevalent culture of safety.

Scope of the Assessment

The scope of the assessment is described in the Charter, as follows:

The assessment is to determine if DOE and contractor project management behaviors deter the timely reporting, acknowledgement, and ultimate resolution of technical safety concerns, and, if so, to what extent. The assessment will address whether the NSQC and other programs established and implemented at WTP measure up to the safety norms of the nuclear industry, both commercial and government, and, if not, the assessment will suggest an action plan to bring them into conformance with such norms. The assessment is to include both contractor and DOE personnel, programs, and processes.

Therefore, two specific areas of concern of the DNFSB were addressed in-depth and across pertinent levels of the DOE and contractor management and staff structures:

- To determine if a chilled atmosphere adverse to safety exists; and
- To determine if DOE and contractor management suppress technical dissent.

Concurrently, the ISQCA team examined whether there is performance excellence in three important areas directly related to the safety culture and safety implementation amongst contractor and involved DOE employees, as follows:

- To maintain and continue to improve the Project nuclear safety culture, with a strong Safety Conscious Work Environment (SCWE) program that permeates all project personnel organizations;

- To determine the present capability to disposition safety design and construction issues in a manner that preserves the integrity of the overall safety construct and the project mission; and
- To maintain and improve communication capabilities to ensure the characteristics of a strong nuclear safety culture are maintained and the disposition of safety issues is ensured.

Methodology

The ISQCA team relied on various qualifications and activities pursuant to its charter and statement of work to assess the project's safety culture, including those listed below. Selection of assessment methods was guided by current practices in the nuclear power industry.⁴

1. Direct observations, for consistency with nuclear safety culture, of personnel behavior in project meetings, at the construction site, and in presentations to the team;
2. Review of past assessments of organizational performance by DOE, BNI, and DNFSB;
3. Review of interactions among the project, the DOE, and the DNFSB staff and board, including review of the video record of the October 2010 DNFSB hearing;
4. Review of Causal Factor and Root Cause Analyses performed on the project and related to NSQC issues;
5. Analysis of results of opinion surveys, tailored by the team, of more than two thousand seven hundred and fifty project employees, including both manual and non-manual workers and managers;
6. Analysis of confidential interviews of about 90 people, including 23 DOE employees, 45 BNI employees, 16 URS employees, two senior representatives of the Washington State Department of Ecology, and several consultants to DOE. These interviews targeted controversial or high stress areas, and included people who contacted the ISQCA team privately through a special E-mail account. The interviews included present and former senior DOE officials at the Hanford Site and at DOE Headquarters.
7. Review of more than two dozen communications from project personnel and others to the DNFSB on Recommendation 2011-1. See <http://www.dnfsb.gov/board-activities/letters-and-correspondence>. Consideration was given by the team to these communications when developing its survey and interview questions;
8. Briefings by 18 project personnel on NSQC-related programs and processes;
9. Interviews of the principal author of the 2010 and 2011 Pillsbury reports;
10. A walking tour of the WTP site, including the four principal facilities;
11. Attendance at "Safety Church" on the WTP construction site where a number of construction workers and their superintendents were engaged in lessons learned activities involving safety and quality issues;
12. Review of the "Wall of Fame" in BNI's project engineering office that honors dozens of employees for their specific contributions to the safety and quality of the project;
13. Review of several hundred documents and procedures describing key NSQC-related processes. These documents were assembled in an electronic reading room;
14. Review of performance indicator and trending data related to issue identification and

⁴ *Guidance for Conducting an Independent NRC Safety Culture Assessment*, Attachment 95003.2 to U.S. NRC Inspection Procedure 95003, dated January 15, 2009. *Fostering a Strong Nuclear Safety Culture*, Nuclear Energy Institute Guideline, NEI-09-07 Rev 0, June 2009.

- resolution processes and the employee concerns programs of BNI and DOE;
15. Review of the progression of the WTP construction site from Merit to Star status in DOE's Voluntary Protection Program (VPP); and
 16. Service by one member of the ISQCA team on the Resolution Team for a Differing Professional Opinion (DPO) at BNI and as the leader of a DNFSB-approved independent review team for hydrogen in piping and ancillary vessels. Service by another member of the ISQCA team on the Review Panel for a DPO at ORP.

Part 3. Factors Affecting Nuclear Safety Culture at WTP

WTP Background

The WTP project at the DOE's Hanford Site is a massive effort to stabilize and prepare for disposal up to 56 million gallons of radioactive and hazardous wastes currently held in underground tanks. In 2000, DOE terminated an attempt to privatize the facility and consign safety oversight responsibility to the Nuclear Regulatory Commission, DOE awarded an 11 year, \$4.3 billion dollar contract to BNI to design and construct the plant. Under that contract, BNI teamed with Washington Group International, which was later acquired by URS Corporation, to bring nuclear licensing, commissioning, and operating experience to the effort.

Since the original contract, numerous problems and changes have occurred that have significantly increased the project's final cost and completion date. The changes were often done to improve the project, yet they often led to new challenges. The present cost is now projected to be about \$12.3 billion. The completion of the sequential startup schedule of the various facilities has slipped to 2019. Complicating an already complex management structure, there have been numerous DOE, BNI, and URS management changes over the ensuing eleven years; the nuclear safety culture of the project, under these various managers, has continued to be questioned throughout these years.

DOE manages the Tank Waste Project at Hanford through its Office of River Protection (ORP), which Congress directed DOE to establish in 1998 to provide better management focus to the waste disposition mission. ORP manages Hanford's tank waste through two main contracts: (1) a tank farm operations contract with a URS-led LLC whose main jobs are to maintain safe storage of the waste and to prepare it for retrieval and delivery to the WTP; and (2) an engineering, procurement, construction, and commissioning contract with BNI for the WTP, with URS as BNI's principal subcontractor.

The WTP project includes the construction of three primary processing facilities, a large analytical laboratory, and 23 supporting buildings on a 65-acre site. The three primary processing facilities are:

- The pretreatment facility, which receives the radioactive waste from the tank farms and separates it into its low-activity and high-level waste components;
- The high-level waste facility that immobilizes high-level waste for offsite disposal through a process known as vitrification, which mixes radioactive waste with molten glass; and
- The low-activity waste facility, which vitrifies the low-activity waste for onsite disposal.

DOE has followed an approach to constructing the project known as "fast-track design-build", where design, construction, and technology development occur simultaneously and where the same contractor has responsibility for both design and construction. In this approach, a significant number of design assumptions are verified after construction starts, a fact which creates cost and schedule uncertainty during both design and construction. The fast-track design-build approach requires assuming that major safety, technology, regulatory, and nuclear material acquisition uncertainties can be resolved while facilities are being constructed; these assumptions create risks that have to be resolved as construction continues, and could conflict with delayed resolution of safety issues.

The October 2010 HSS report cited above described the status of the WTP project and the important transitions that were then taking place, as follows:

“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.”

The fast-track design-build approach received the necessary approvals for the WTP project when proposed, and both design and construction are well-advanced. The implications of the project status stated by HSS and recognized by all stakeholders are broad and significant, and they obviously affect issues that could impact the project safety culture. In other words, as the threshold for raising issues becomes higher because of the project status, a common perception would be that the raising of issues is limited. However, it is now indispensable to permeate the project infrastructure with the commensurate safety culture and requisite safety requirements to enable the completion of the project.

In addition to its internal oversight functions, the DOE receives guidance and oversight from the DNFSB. The DNFSB was created by Congress in 1988 to provide an independent assessment of safety conditions and operations at defense nuclear facilities, including DOE’s Hanford Site. Furthermore, there have been numerous outside reviews of the design, construction, and management of WTP, beside those provided by the DNFSB. Attachment 2 provides the Waste Treatment Plant Timeline of External Reviews for the period June 2009 to the time of the issuance of this report. These outside reviews were commissioned by DOE or BNI and have resulted in the emergence of technical concerns that had to be resolved and that added difficulty to management of the project, impacting cost or schedule. Also, the NSQC History Timeline in Attachment 1 demonstrates the multiple issues that have been raised regarding nuclear safety culture and the various activities undertaken to resolve them.

The WTP project is influenced by socio-political, financial, safety, environmental, scientific, and engineering factors. Among these factors is the added complexity brought by the need to satisfy the Tri-Party Agreement (TPA), signed on May 15, 1989 among DOE, EPA, and the State of Washington’s Department of Ecology. The TPA is a comprehensive compliance agreement establishing key milestones and other expectations for the WTP that DOE has agreed to meet. See <http://www.hanford.gov/page.cfm/TriParty>.

The ISQCA team notes that every major construction project moves through phases of design, construction, and commissioning to finally reach operations. However, the abundance of stakeholders and the plethora of reviews associated with WTP are extraordinary even among projects in the DOE complex. In addition to adding to the workload and cost, these various demands create stress for management and personnel of both DOE and BNI; they also probably contribute to delays in the resolution of issues and thereby impact safety culture. The extensive duration of the WTP project has also affected safety culture and contributed to management stress. From the aspect of safety and quality culture, the staff turnover and the large number of people who come to the project without a nuclear background make it more challenging to ensure that everyone commits to the safety standards and expectations in a project of the nature of WTP.

Contractual and Regulatory Relationships between DOE and BNI

The contractual and regulatory relationships between DOE and BNI are complex and have varied significantly over the past few years. This section briefly describes factors associated with these relationships that add complexity to the project and that could affect the sustainability and strengthening of its safety culture.

The design of WTP began in the 1990s under a privatization approach DOE undertook in a contract with British Nuclear Fuels, Limited (BNFL) that would have produced a commercial facility regulated by the NRC. In May 2000, DOE terminated the BNFL contract and decided to construct the WTP as a government-owned facility using a cost-plus-incentive fee contract. That contract was awarded to BNI in December 2000 and added complexities to project execution, including the fast-track design-build approach and the division of responsibilities between BNI and URS. It was also decided at the time that regulatory oversight would revert to DOE, without NRC assistance.

Since March 2010, there have been other significant changes in the organization of the DOE management at WTP. On May 24, 2010, Secretary of Energy Chu announced that the DOE was taking steps to strengthen project management at the WTP. As part of this initiative, an experienced manager was selected from Pacific Northwest National Laboratory to serve as the Federal Project Director for the project. The FPD now reports directly to the Deputy Secretary on his charter of responsibilities, while safety and other oversight duties for WTP are provided by ORP and the headquarters Office of Environmental Management. The current ORP Manager has been in office since April 2011, after significant turnover in that position between August 2010 and April 2011.

The Department has not provided consistent and final guidance with respect to establishing the overall safety construct for the project. For example, in 2002, DNFSB Chairman John Conway wrote to Jesse Roberson, DOE's Assistant Secretary for Environmental Management, to identify deficiencies in the safety basis for WTP that included nonconformance with DOE Standard 3009 and several other issues.⁵ From 2002 to 2011, there has been a series of DOE actions to establish stable guidance for the safety basis documentation required for the WTP project, increasingly focusing on 10 CFR 830 requirements and DOE Standard (STD) 3009. These efforts resulted in incorporation of elements of DOE STD 3009 into the Safety Requirements Document (SRD), rather than a complete direct implementation of STD 3009. Finally, in 2011, DOE's FPD wrote to BNI expressing concern "with the lack of progress in delivering an integrated plan that maintains nuclear safety licensing activities of the WTP in accord with the Code of Federal Regulation...10 CFR 830."⁶ The letter went on to recount that DOE Standard 3009 was to be used in such a plan, saying, "DOE has maintained a steady dialogue with BNI senior executives regarding the expectations of maintaining integrated performance between engineering and nuclear safety." The letter harkened back to the Conway letter to Roberson, saying, "DOE wants to avoid the possible repetition of issues identified in the November 2, 2002 DNFSB letter...". The FPD gave BNI one month to develop a "plan to resolve the 'integrated WTP licensing strategy.'" On October 31, 2011, BNI responded to

⁵ Letter to the Honorable Jesse Hill Roberson, Assistant Secretary for Environmental Management, DOE, from John T. Conway, Chairman, Defense Nuclear Facilities Safety Board, November 4, 2002.

⁶ Letter to Mr. F. M. Russo, WTP Project Director, BNI, *Contract No. DE-AC27-01RV14136 -- Department of Energy Concerns, Licensing Approach for Waste Treatment and Immobilization Plant (WTP)*, from DOE Federal Project Director Dale E. Knutson, dated September 27, 2011.

the FPD's request for a plan, including information to address "Alignment concerns between Engineering and E&NS [and] Construction Project Review team recommendations for impacting the safety basis..."⁷ It appears to the ISQCA team from these exchanges of correspondence and other information gathered in the course of its assessment that fundamental issues regarding the overall safety construct for WTP have remained unresolved for more than nine years. Such a lack of certainty in the safety construct for any nuclear facility would have implications for safety culture.

Development of BNI's NSQC Programs

BNI has undertaken numerous programs to foster nuclear safety and quality culture on the WTP project. The following sections briefly summarize the most important of these programs.

1. Nuclear Safety and Quality Culture Plan

In an assessment done in the fall of 2005,⁸ DOE identified four significant weaknesses in the BNI safety culture, as follows:

- Weak discipline in procedure compliance;
- Ineffective training processes;
- Inadequate procedures in some areas; and
- Inadequate questioning attitude.

As a result, BNI implemented a Nuclear Safety and Quality Culture Change Initiative for the project through a Nuclear Safety and Quality Imperative (NSQI) that became the focus of WTP management from 2005 to 2009.⁹ The goal was to create and sustain an open and trusting environment at WTP, focusing on corrections for the four identified weaknesses. In 2009, a Common Cause Evaluation (CCE)¹⁰ was conducted by BNI to address the following questions:

- Is WTP structured for success;
- Does the culture support effective issue management;
- Are safety, quality, schedule, and cost commitments balanced; and
- Is there open and honest communication?

The CCE report provided mixed results and led to a recommendation to reenergize the NSQI, particularly focused on quality and new employees. BNI decided that this re-emphasis would use the EFCOG/DOE ISMS Task Team Report,¹¹ particularly the attributes addressing foundations of

⁷ Letter to Mr. D. E. Knutson, FPD, *Contract No. DE-AC27-01RV14136 -- BNI Response for Licensing approach Plan*, from R. W. Bradford, BNI, WTP Deputy Project Director, dated October 31, 2011.

⁸ DOE letter forwarding *Quality Issues for the Period September 26 through October 12, 2005*, CCN 133613, dated December 8, 2005

⁹ BNI letter transmitting *Hanford Waste Treatment and Immobilization Plant (WTP) Nuclear Safety and Quality Culture Change Initiative Status Report*, dated February 7, 2006.

¹⁰ BNI report by Lester Hurt, et al., *WTP Management Systems Common Cause Evaluation*, Document 24590-WTP-RPT-MGT-09-017, Rev 0, dated December 17, 2009.

¹¹ Report by *EFCOG-DOE ISMS Safety Culture Task Team*, dated April 16, 2009.

leadership, employee/worker engagement, and organizational learning.

In the year after the CCE was completed, HSS and Pillsbury performed the external assessments of WTP safety culture cited above. Their reports suggested that improvements were needed and should be incorporated into the Nuclear Safety and Quality Culture (NSQC) Plan that the project was developing. The NSQC Plan was issued in October, 2010 and revised in January, 2011.¹² It included, among other things, upgrading the training on NSQC, improving communications on NSQC expectations, and establishing an executive position with responsibility for overseeing NSQC.

A gap assessment (to find the difference between safety culture reality and expectations on the WTP project) was done in May, 2011, and the results were generally favorable.¹³ However, the assessment found there were “pockets” of dissatisfaction with problem identification and issue resolution, with about 10% of the respondents unsatisfied with their ability to raise issues without retribution, compared to the usual smaller target percentage in this area. Inefficiencies in the PIER system (a principal component of the corrective action program on the WTP project), the use of caustic emails, and conflict resolution issues were also cited.

The NSQC Plan was revised, and Revision 2 was issued August 23, 2011, during the ISQCA team’s review. The focus of that revision was on improving the PIER system and teamwork. In addition, the WTP project is implementing current industry guidance in a 2009 report by the Nuclear Energy Institute, NEI 09-07, “Fostering a Strong Nuclear Safety Culture,” cited above, which is tailored to the EFCOG/DOE ISMS Model.

2. Actions Taken on the Project to Address Safety Culture

Over time, BNI has taken various actions to address safety culture. These include:

- All hands meetings;
- Stand downs;
- NSQI training;
- Revisions to training of engineers;
- Restructuring the corrective action program;
- Supervisor and management training; and
- Development of NSQI metrics.

The recent (September 15, 2011) issuance of a WTP Safety and Quality Procedure¹⁴ was intended by BNI to capture in one place all the programs and policies directed at supporting a SCWE. Furthermore, a management policy addressing issues and corrective action programs has recently been issued, effective November 21, 2011, which includes a directive to evaluate issues and

¹² BNI document 24590-WTP-PL-MGT-10-0001, Rev 0, *Nuclear Safety and Quality Culture Plan*, Frank Russo, et al., dated October 10, 2010; BNI document 24590-WTP-PL-MGT-10-0001, Rev 1, *Nuclear Safety and Quality Culture Plan*, Frank Russo, et al., dated January 20, 2011.

¹³ WTP Sponsored Assessment Report 24590-WTP-SAA-MGT-11-0001, Rev 0, *Nuclear Safety and Quality Culture (NSQC) Gap Assessment*, Mike Coyle, et al., dated May 10, 2011.

¹⁴ BNI Procedure, 24590-WTP-GPP-MGT-061, Rev. 0, *WTP Nuclear Safety and Quality Culture*, dated September 15, 2011.

recommended improvements impartially without prejudice regarding the source of the issue.¹⁵

3. Corrective Action Program

Corrective action programs of the type now routinely in use in operating nuclear power plants have not yet been fully deployed on nuclear construction projects, such as the WTP. However, the corrective action program on the WTP project has many of the features expected on high performing nuclear power plants. The corrective action program at WTP is made up of several different reporting mechanisms depending on the origin or status of the issue under consideration. The basic reporting tool is the Problem Identification and Evaluation Report (PIER), and there are other documents that can be used, such as the Technical Issue Evaluation Form (TIEF), the Action Tracking System (ATS), or the Technical Issues Summary Sheets. The project tracks corrective action closure using performance metrics that are widely used by the commercial nuclear industry.

Representatives of BNI stressed to the ISQCA team that project “staff are free to issue PIERs for any problem but not every concern is managed through a PIER.” BNI and URS issue about 44 PIERs a month, with most being prioritized as category D, the lowest category. At the current time there are fewer than two dozen category A PIERs in an unresolved status.¹⁶ The times to closure of the items in the corrective action program are tracked and managed by the project. Nevertheless, some of the most difficult issues (e.g., HPAV and Non-Newtonian Vessel mixing) have been open for a long time. Presently, a series of coordinated actions is being taken to significantly improve the timely disposition and closure of issues incorporated into the corrective action program.

4. Surveys

Surveys can be a useful tool for measuring the pulse of an organization on any particular topic. There have been a number of WTP employee surveys; in each instance, BNI has published the survey results and taken actions commensurate with those results. The initial baseline survey was in 2005, and a NSQC-focused survey was performed in 2006. Follow-up surveys were conducted in 2007, 2008, and 2009, with results of the surveys posted on the ECP webpage. Action plans were developed for the specific functional areas and tracked by the ECP. Another opinion survey was conducted in August-September 2011, with questions provided by the ISQCA team. The analyzed results of this last survey are provided within the context of the ISQCA assessment in Part 5 of this report. Although the results of these surveys have tended to plateau over time, for the most part they show a continuing positive trend. The action plans associated with the various surveys have received attention and appear to have benefited the safety culture.

5. The 2011 Safety Culture Opinion Survey

A safety culture opinion survey was completed in the fall of 2011. The ISQCA team selected the survey questions, with substantial changes made from previous surveys, to focus the questions on safety and quality issues and to enhance responsiveness by reducing the number of questions. Two

¹⁵ BNI Policy, 24590-WTP-G63-MGT-015, Rev. 0, *Issues and Corrective Action Management Policy*, effective November 21, 2001.

¹⁶ “Engineering Quality and Issue Management,” David Pisarcik, BNI Engineering Requirements Manager, September 26, 2011.

survey instruments (one for non-manual and the other for manual employees on the WTP project) were developed specifically for this assessment, and the survey was conducted by K-Management Resources (K-MR). The demographic variables and processes were modeled after previous WTP surveys. Each survey tool had twenty-eight items, grouped into four categories. The data were collected for four demographics for each survey instrument. However, there were differences in the questions asked in the two survey instruments. The number of respondents in the manual survey was 1177, and 1569 employees responded to the non-manual survey. The total number of respondents was roughly 80% of the total employee population.

A K-MR representative discussed the report with the ISQCA team. He broke the report into its two main parts, non-manual and manual, and provided his interpretation of the results. He used bar charting of the results to help explain his conclusions. BNI subsequently brought in Pillsbury to evaluate the survey results to determine what those results mean with respect to the health of the safety culture at WTP. The ISQCA team was also briefed on Pillsbury's report and conclusions.

General

In light of the number of surveys the WTP workforce has been given and the number of assessments that have been done on the culture at WTP, the participation level in the 2011 opinion survey was good. Pillsbury interpreted the results overall to be positive with respect to the safety culture. In general, the survey instruments indicated workers at WTP are not afraid to raise issues and are mostly engaged in the safety consciousness of the workplace. The construction workforce is especially focused on issues centered on industrial safety, which can be more easily and timely addressed than the safety construct for the operating plant, which is the primary focus for non-manual employees.

Non-Manual Results

The statistical analysis conducted on the survey responses separated the results into four categories; of these, the Safety and Quality Effectiveness category scored highest and the handling of Issues, Suggestions, and Concerns category scored lowest. Of the various non-manual groups, the two scoring lowest in overall confidence in the safety culture were the Nuclear Safety & Plant Engineering (which contains the E&NS organization) and Quality Assurance (QA). These results correlate well with what the ISQCA team learned from its confidential interviews. The low scores in the area of Quality Assurance (and Subcontracts, which also scored low) are not unanticipated given the nature of their mission in the organization. That is not to say, however, that their low scores should be ignored. Pillsbury reported that there were seven areas of potential strengths and two areas of potential opportunities for improvement indicated by the 2011 survey of non-manual employees.

Manual Results

For this group, Pillsbury cited seven areas of potential strengths and four areas where there was potential room for improvement. In the manual group survey, the Safety and Quality Effectiveness category again scored highest, and the (handling) of Issues, Suggestions, and Concerns category scored lowest. Among the facilities, the Pretreatment Facility scored lowest in its trust of the nuclear safety culture, and among the crafts, the Operating Engineers scored safety culture the lowest, with the Teamsters and the Electricians close behind. One observation is that the large turnover in manual employees can affect their understanding of the safety culture expectations.

Also, the presence of more than one union on site can have an impact on confidence in the safety culture and management's allegiance to it.

The team observes that BNI management has already addressed the results of the 2011 survey in its communications to the workforce.

6. *Employee Concerns Program (ECP)*

The ECP provides all employees and contractors an avenue to raise concerns that is an alternative to their management chain. The ECP on the WTP project has most of the tools typically used in the nuclear industry, including procedures and personnel for conducting investigations, a "Rapid Response" approach, and utilization of Subject Matter Experts to review technical issues when appropriate. The program incorporates regular feedback to the concerned individuals and to management. It has confidentiality and anonymity features as well. Data provided to the ISQCA team by the ECP manager indicate that from 2005 through the present time, 186 concerns have been initiated with the ECP, 94 by engineering personnel. Of these, 121 were deemed by the manager to be NSQC related, and eight of those were substantiated. Of the concerns that were NSQC related, 28 alleged harassment, intimidation, retaliation, or discrimination (HIRD); three of the HIRD allegations were substantiated.¹⁷

The ISQCA team found indications that the ECP program at BNI is in need of enhancement, to match and support the improvement initiatives on the nuclear safety and quality culture program of WTP, such as ensuring that employees are fully cognizant of the implementation of an openness-to-all issues policy, as well as improving the confidence that employees have in the program.

7. *Differing Professional Opinion (DPO)*

The WTP has a program for raising, addressing, and resolving DPOs, an important tool for a technically complex project with major safety implications. As is typical, the process is used sparingly, but it retains its high importance; less than a handful of DPOs have been registered with the project in the past several years. Most of these were resolved in favor of the people who raised the differing opinions; for example, the most recent DPO involving AC power reliability was resolved in favor of the originator but required significant tenacity and perseverance on his part.

DOE Programs for Concern Resolution

1. *ECP and DPO Programs in the DOE Oversight Organizations*

The Richland Office (RL) of DOE is responsible for oversight of the Hanford Site. It administers both the ECP and DPO programs that are applied to the ORP. As with the BNI programs mentioned above, most of the usual features are in place. However, in interviewing DOE employees, the ISQCA team formed the opinion that there is a lack of confidence in the efficacy of the programs. Issues take a long time to be resolved, and some employees look upon the resolutions as lacking

¹⁷ "Engineering Concerns Filed with BNI ECP," Ron Benedict, Employee Concerns Program Manager, September 2011.

objectivity. The recent DPO on Non-Newtonian tank mixing is a good example of the process requiring unusual tenacity and fortitude by the submitter, with the resolution agreeing with key recommendations of the submitter.

Part 4. The Defense Nuclear Facilities Safety Board and WTP

Role of the DNFSB

Congress created the DNFSB in 1988 to identify the nature and consequences of potential threats to public health and safety at the DOE's defense nuclear facilities. Under its enabling statute, 42 U.S.C. § 2286 *et seq.*, the DNFSB provides independent oversight of all programs and operations impacting public health and safety at DOE's defense nuclear facilities, including DOE's Hanford Site. The DNFSB evaluates DOE's activities at its defense nuclear facilities in the context of Integrated Safety Management (ISM).¹⁸

Among the powers provided to the DNFSB in its oversight role with DOE, pursuant to its enabling statute, are powers to: (1) review and evaluate the content and implementation of the standards relating to the design, construction, operation, and decommissioning of defense nuclear facilities of the Department of Energy (including all applicable Department of Energy orders, regulations, and requirements) at each DOE defense nuclear facility; (2) conduct investigations of any event or practice at a DOE defense nuclear facility which the DNFSB determines has adversely affected, or may adversely affect, public health and safety;¹⁹ and (3) make recommendations to the Secretary of Energy that the DNFSB determines are necessary to ensure adequate protection of public health and safety. The Secretary of Energy may accept or reject any such recommendation (or part of any such recommendation).²⁰

In a report on the DNFSB, the Federal Research Division of the Library of Congress stated, "the enabling statute of the DNFSB that emerged from Congress in late 1988 embodied...the development of a consultative, non-adversarial relationship between the Board and DOE."²¹ Most of the history of that relationship has affirmed this statement; i.e., the relationship between the DNFSB and DOE has been constructive and has led to significant design and safety-related improvements at DOE's defense nuclear facilities. However, recently there has been a marked change in the nature and tone of communications among the DNFSB, DOE, and its contractor on matters concerning the WTP, and the relationship has become more adversarial. These recent interactions have increased tensions among DNFSB, DOE, and BNI.

¹⁸ Five basic tenets of ISM: (1) define the scope of work; (2) analyze the hazards; (3) develop and implement hazard controls; (4) perform work within controls; and (5) provide feedback and continuous improvement. See DOE Policy 450.4, *Safety Management System Policy*.

¹⁹ Investigatory powers include: (1) conducting public hearings; (2) issuing subpoenas for the attendance of witnesses and production of evidence; (3) formally requesting information or establishing reporting requirements; (4) stationing on-site resident inspectors; and (5) conducting special studies.

²⁰ 42 U.S.C. § 2286c (b)(1).

²¹ *Defense Nuclear Facilities Safety Board: The First Twenty Years*, A Report Prepared by the Federal Research Division, Library of Congress under an Interagency Agreement with the Defense Nuclear Facilities Safety Board, September 2009, p. 67.

DNFSB's Interactions with WTP

Beginning in late 2008, DOE began to revise the WTP design basis, including proposing changes to the facility's safety approach. During this time, the DOE's Office of River Protection (ORP) assembled a team to evaluate the potential for using a reduced radiological material-at-risk (MAR) inventory in the safety analysis and design of the WTP.²² The Department has stated that the MAR previously used for the WTP was based "on a hypothetical 'Super Tank' concept that assumed the simultaneous presence in the waste of the worst characteristics permitted by the WTP Contract even though such a waste stream did not exist at the Tank Farms."²³ Although DOE has conceded that "Super Tank" MAR may have been necessary at the conceptual design stage for the WTP, it explains that "carrying its excessive conservatism through the preliminary design process was judged to be diverting design attention from the real issues posed by the waste that would be received."²⁴ In November 2009, using a revised MAR and a new analytic methodology, DOE approved a new design and safety control strategy for the WTP.

It was during this period that the DNFSB began to raise a number of questions and concerns regarding DOE's modified design and safety strategy. In a 2010 quarterly report to Congress,²⁵ the DNFSB explained:

"The DNFSB has endeavored to work with and advise DOE on potential safety issues associated with these proposals. The DNFSB made its reviews a priority so issues would be resolved expeditiously (with minimal cost and schedule impact to the project). However, DOE has continued to approve changes related to the classification and design of safety-related systems and components without fully resolving key technical issues, preferring to grant conditional approval in areas involving significant technical uncertainty. DOE-ORP's revised approach is more complex and less conservative than the original design approach, and is heavily reliant on the engineering judgment of BNI."

In its April 15, 2010 quarterly report to Congress, the DNFSB expressed various technical concerns related to changes to the design of the WTP that were approved by ORP. For one, the DNFSB expressed continued concern that the WTP project should not proceed towards implementing a revised safety design (resulting from the reduced material-at-risk) "without full consideration of the need to protect the facility's workers." The April 15, 2010 report to Congress also noted, "In an

²² Hanford Site Rep Weekly Reports to the Technical Director of the Defense Nuclear Facilities Safety Board, *Hanford Activity Report for the Week Ending January 9, 2009*.

²³ DOE Letter to the DNFSB, *Responses to Questions from August 6, 2010, Board Letter regarding Plans and Processes for the WTP at the Hanford Site*, dated September 8, 2010.

²⁴ *Id.*

²⁵ Defense Nuclear Facilities Safety Board's Quarterly Report to Congress, dated April 15, 2010. The House Conference Report 109-702 on the National Defense Authorization Act for Fiscal Year 2007 (H.R. 5122) directed the Defense Nuclear Facilities Safety Board to provide quarterly reports on the status of significant unresolved technical differences between the Board and DOE on issues concerning the design and construction of DOE's defense nuclear facilities. Although this requirement has been removed, the DNFSB has continued to provide such reports, "as the Board believes these reports provide an appropriate means to keep all parties apprised of the Board's concerns with new designs for DOE defense nuclear facilities." See U.S. Congress, House of Representatives, Committee on Appropriations, *Nuclear Weapons Complex*, statement by DNFSB Chairman Eggenberger, March 17, 2009, p. 5.

effort to resolve...technical issues [surrounding hydrogen in piping and ancillary vessels (HPAV)], the Board suggested that DOE undertake a comprehensive, independent, expert-based review of the safety design strategy for control of hydrogen in pipes, similar in scope to the external flow sheet review completed in 2006.” The HPAV review has been underway since that time. In this report to Congress, the DNFSB also referenced its January 6, 2010 letter to DOE concerning technical issues related to pulse jet mixing. In that letter, the DNFSB stated that after reviewing the design and testing of the pulse jet mixing technology to be employed at the WTP, it found deficiencies in the functional requirements for mixing and transport systems. The DNFSB determined, “as currently designed, the pulse jet mixers lack sufficient power to adequately mix and transport the most rapidly settling particles expected to be present in the Hanford waste inventory.”

Shortly after expressing these concerns, the DNFSB, in a letter dated May 5, 2010, raised additional concerns related to the revised safety design strategy for the WTP. The DNFSB stated that it observed quality assurance problems with aspects of the HPAV experimental test program. The DNFSB requested a written response from DOE that would address the quality assurance and safety concerns with the HPAV design, “including flow down of quality assurance requirements to subcontractors and more rigorous application of consensus quality standards (i.e., ASME NQA-1 Code and Standards Committee) to contractor and subcontractor quality assurance programs.” Although technical projects are underway to resolve these concerns, such disagreements over the revised safety design strategy have increased tension among the DNFSB, DOE, and BNI.

Subsequently, on May 21, 2010, the DNFSB raised additional concerns in a letter to DOE questioning DOE’s “revised WTP transport analysis (of a radioactive plume) which used the default transport value for dry deposition velocity (1 cm/sec).” The DNFSB argued that this value is not a reasonably conservative parameter for dry deposition velocity. The DNFSB reiterated these concerns in its August 26, 2010 letter to DOE, which included the DNFSB’s Staff Issue Report on this issue.

The DNFSB’s continued concerns on a variety of issues related to the WTP project led to the DNFSB publishing a Sunshine Act Notice in July 2010 announcing an October 7-8, 2010 public hearing to address safety-related aspects of the design and construction of the WTP project at the Hanford Site (among the DNFSB’s authorities for interacting with the DOE is the power to conduct public hearings). Several days after publication of this notice, in a July 27, 2010 letter addressed to David Walker, President of BNI, the DNFSB informed BNI that it was conducting an investigation on health and safety concerns described in a letter the DNFSB received from Dr. Walter Tamosaitis, former Deputy Chief Process Engineer and Research and Technology Manager at the WTP project. Dr. Tamosaitis alleged that he was removed from the WTP project after he raised safety concerns with project management.

On August 6, 2010, the DNFSB sent DOE a set of 23 multi-part questions in advance of the public meeting and hearing.²⁶ In a September 8, 2010 letter, DOE provided the DNFSB with a 209-page written response to these questions. During this time, the DNFSB also sent a number of Requests for Appearance to individuals requesting their participation at the October 7-8, 2010 public meeting and hearing.

²⁶ DNFSB Letter to DOE, *Board Request for DOE Responses to Enclosed Questions, for the Public Meeting and Hearing of October 7-8, 2010*, dated August 6, 2010.

A summary of the DNFSB interactions with BNI and DOE regarding WTP, for the period July 2009-October 2011 is shown on Attachment 3.

October 2010 Hearing

On October 7-8, 2010, the DNFSB held a public hearing and meeting in Kennewick, WA, concerning safety-related aspects of the design and construction of the WTP. The hearing record included DOE's written responses to the DNFSB's questions set forth in its August 6, 2010 letter. Technical issues addressed at this hearing included: (1) changes in safety-related design criteria resulting from modification of the material-at-risk; (2) changes in design strategy to address hydrogen in pipes and ancillary vessels; (3) criticality safety concerns and other safety-related risks for the pulse jet mixing system; (4) reclassification of safety-related systems, structures, and components; and (5) safety-related design aspects of new facilities or modifications of existing facilities needed to deliver high-level waste feed.²⁷

Post-Hearing Alignment between DNFSB and DOE

After a contentious public meeting and hearing, the DNFSB continued its investigation into the safety design strategy and operations of the WTP. One particular session of the October hearing had focused on evaluating the WTP's pulse jet mixing (PJM) system. In response to the written answers provided by DOE to address concerns related to the PJM system, the DNFSB approved Recommendation 2010-2, dated December 17, 2010, *Pulse Jet Mixing at the Waste Treatment and Immobilization Plant*. The DNFSB believed that DOE's answers were insufficient and that schedules for addressing most of the recommendations from the Consortium for Risk Evaluation and Stakeholder Participation (CRESP) had not yet been established. In Recommendation 2010-2, the DNFSB stated that "the testing and analysis completed to date have been insufficient to establish, with confidence, that the pulse jet mixing and transfer will perform adequately at full scale." The DNFSB recommended that DOE address unresolved technical concerns regarding the WTP's PJM system.

Then, as part of its ongoing review and investigation of the WTP project, the DNFSB decided to conduct a full investigation into "whether there was any attempt by DOE or its contractors to inappropriately change testimony presented to (or to retaliate against witnesses for their testimony before) the DNFSB in its October hearing on the WTP facility." The DNFSB essentially accused DOE and BNI of witness tampering. Concerned that testimony at the public hearing may have been improperly influenced, the DNFSB subpoenaed a number of officials from DOE, BNI, and URS, seeking information related to those concerns. It is the sense of the ISQCA team that this investigation led to a further deterioration of the working relationship among DNFSB, DOE, and BNI.

The DOE's counsel, in response, expressed concerns regarding the DNFSB's authority to conduct such an investigation (arguing that such an investigation is outside the DNFSB's jurisdiction and expertise) and offered to work with the DNFSB's legal counsel to mitigate the Board's concerns. As stated in a February 11, 2011 letter to the DNFSB, the DOE explained that such offers were repeatedly rebuffed by the DNFSB's legal counsel. In light of the concerns (legal and otherwise) with the DNFSB's intention to carry out such an investigation, DOE asked the DNFSB to immediately

²⁷ *Id.*

cease its witness tampering investigation, and if not, to report the matter to the DOE's Inspector General. After reviewing DOE's request to cease its investigation in this matter, the DNFSB (in a letter dated February 16, 2011) stated that its investigation into whether the DOE may have improperly influenced information provided at the October 2010 public hearing was consistent with the DNFSB's statutory authority under 42 U.S.C. § 2286a (a)(2).²⁸

Such exchanges between the DNFSB and DOE on these matters further detracted from an atmosphere of consultation and trust. Instead, these interactions resulted in a new pattern of adversarial, litigious behavior, which caused further strain in the relationship among the DNFSB, DOE, and BNI.

On April 5, 2011, DNFSB Chairman, Dr. Peter Winokur, testified to the Congressional Subcommittee on Strategic Forces. He explained that DOE needed to preserve a robust system of nuclear safety directives, given the fact that DOE had recently pursued several initiatives "to rapidly reduce the scope and impact of the directives system." He stated that "it is essential that the senior leadership of DOE ensure that the margin of safety embodied in DOE's directives is maintained or increased, or many years of progress in development and refinement of the directives system could be undone." Concerning the DNFSB's safety-related issues with the WTP project, Chairman Winokur testified that the DNFSB remained concerned that some changes to the design of the WTP facility are being implemented before outstanding technical issues are resolved and that these issues require prompt resolution.

In a letter dated April 5, 2011, the same day as Chairman Winokur's testimony to Congress, the DNFSB expressed further concerns to DOE with the WTP project. In that letter, the DNFSB stated that the WTP's methodology for assessing dose consequences from pressurized spray leaks involving radioactive liquids is not reasonably conservative. The DNFSB determined that "safety-class structures, systems, or components may be required to mitigate accident scenarios involving spray leaks in the hot cell region of the WTP." In this letter, the DNFSB also requested that DOE provide a report to the Board that describes an approach for performing a reasonably conservative, well-formulated spray leak analysis. Then, on May 5, 2011, the DNFSB requested an additional report from DOE. In that letter, the DNFSB stated that the "operation and maintenance of independent protection layers should be included in the facility safety basis" and requested that DOE provide the DNFSB with "planned improvements to address shortcomings in BNI's hazard analysis process."

As described in this section, the recent interactions and communications among DNFSB, DOE, and BNI regarding the WTP have become increasingly adversarial. On February 22, 2011, Board member Larry W. Brown resigned from the DNFSB. In a May 20, 2011 letter addressed to the Secretary of Energy and to the Chairman of the DNFSB, he described more generally the recent decline of the working relationship between the DNFSB and the DOE. "I have been deeply discouraged by the deterioration of the consultative relationship between the DOE and the DNFSB; it is well known. This is an unfortunate departure from past practice."

Amidst the growing tension between these two organizations, the DNFSB, as a result of its investigation, determined that the "prevailing safety culture at the WTP is flawed." Therefore, on

²⁸ Pursuant to 42 U.S.C. § 2286a (a)(2), "the Board shall investigate any event or practice at a Department of Energy defense nuclear facility which the DNFSB determines has adversely affected, or may adversely affect, public health and safety."

June 09, 2011, the DNFSB approved Recommendation 2011-1, *Safety Culture at the Waste Treatment and Immobilization Plant*.

At this time, after numerous exchanges between DOE and the Board concerning Recommendation 2011-1, an Implementation Plan to address the Board recommendation is being developed by DOE, concurrently with the finalization of reports on the ISQCA and HSS assessments of safety culture.

Part 5. Key Safety Culture Themes and Trends at WTP

Introduction

The ISQCA team delved into a correlated series of issues and information sources over a period of about three months. During this assessment, repeated themes and trends emerged that have affected or are still impacting the safety and quality culture of the project. The following sections summarize the themes that emerged from documentation; the 2011 Opinion Survey results (as analyzed by Pillsbury); communications among DOE, project employees and DNFSB; live presentations; attendance at routine management and personnel meetings; requested or volunteered interviews; or discussions with project stakeholders. Obviously, there is not 100% agreement among project personnel on any specific issue, and the ISQCA team's findings and recommendations, included in Part 6 of this report, represent a value judgment on the overall importance of issues that it believes need to be considered and acted upon.

The ISQCA team also reviewed public correspondence to the Board regarding Recommendation 2011-1. The Board issued the recommendation on June 9, 2011. Its website contains 31 communications from public entities and private citizens between June 18 and November 3, 2011. These communications were sent by 23 individuals and two organizations (some communicated more than once). The 23 individuals fell in the following categories: six were currently or formerly employed on the WTP project, five were current or former employees of the Tank Farm contractor, two had academic interest in the site, and ten claimed no connection with or knowledge of the site. The two organizations that commented were Hanford Challenge and the Oregon Hanford Cleanup Board. Of the six individuals with direct knowledge of the status of the safety culture on the WTP project, one did not identify his/her capacity, one was an electrical craftsman at the construction site, and four were part of the design effort. The ISQCA team interviewed several of the individuals who gave comments to the Board, including Dr. Walter Tamosaitis. The statements made by these individuals in their interviews were consistent with what they wrote to the Board.

Two separate categories of themes and trends related to the safety culture at WTP are discussed in the sections that follow. First, the key safety culture themes that emerged during the assessment are listed. These themes are presented without comments to provide direct feedback from observations by personnel in the problem-target areas that the team selected for in-depth assessment. They are significant because of the direct knowledge of the individuals of issues important to the project safety culture. The themes that arose from the ISQCA target population are supported by the statistically significant results of the opinion survey. The survey results are provided in the following section, utilizing a summary comparison of the WTP safety culture performance, as measured by the 2011 opinion survey results and analyzed by Pillsbury, with the corresponding expectations stated by the NRC safety culture traits.

Key Safety Culture Themes

The team found that a representative sample of statements or responses to questions ascertained from the sources listed above provides a direct, unvarnished indication of principal themes revealed during its assessment. The grouping of statements is not arbitrary but follows the lines of inquiry generally used in the team's confidential interviews. The lines of inquiry were based on Recommendation 2011-1 and then on the results of the first round of interviews of a selected group of BNI, URS, and DOE managers. The lines of inquiry focused attention on a correlated series of

potential problem areas, which became a roadmap for additional interviews, briefings, and analysis. These efforts led to the recognition of themes and trends.

Statements within quotes in the following sections come from interviews or official presentations, while the words in parenthetical italics are added for clarity. Statements without quotes are taken directly from interview responses but are not direct quotes. A number of very specific statements have not been included to avoid the potential disclosure of identities.

In the themes that follow, the team has chosen statements representative of what it learned from the interview process or official presentations. The team has chosen to limit the number of comments presented in each theme so as to not bias the reader by the number of statements.

General Comments on WTP Safety Culture

- “No lack of safety culture – only personality clashes and communication issues.”
- “We need to have [a] process to distinguish genuine safety issues (*from technical and construction issues*).”
- “The Safety Culture is not broken but people do not understand what a nuclear safety issue really is.”
- ...but from an insider perspective, (*interviewee*) believes the safety culture is healthy.
- The Safety Culture is generally good but waxes and wanes as a function of many things, including Tri Party Agreement (TPA), contract changes or emphasis, management changes....
- “(*Our*) leadership has a deep sense of safety culture. We are not cutting corners.”
- BNI is a construction company; (*it*) doesn’t understand nuclear safety.
- Nuclear safety needs to remain (*an*) independent function and that is why it stayed at ORP.
- “I don’t think anyone here is not concerned with safety; it’s just not their priority due to cost and schedule pressure.”
- ECP responses seen as “fluff answers or platitudes.” ECP needs strengthening.
- “The NSQC indoctrination effort is not very effective.”
- “NSQC is what we do every day. It didn’t start with 2011-1.”
- “We are schedule driven, but safety of the public and the workers is paramount.”
- 2011-1 helped to push NSQC to the forefront but (*NSQC is*) hampered by no feedback to people.

Theme 1: “It takes too long to resolve technical issues”

- Takes too long to resolve technical issues. Several took more than a year to resolve.
- Never been in a project that takes so long to resolve issues.
- The reason for untimely feedback on issue resolution is the volume of issues, and no one appreciates that.
- “Cost and schedule pressures preclude fixing known issues.”
- “The problem is more with issue resolution than issue identification.”
- Need new process for resolving safety issues (*timely*).
- There should be accountability in the budget system (*EVMS*) of time spent on PIERS items.
- No record of (*consistent*) disposition of issues affecting safety and quality.
- “We are our own worst enemy in getting back to issue identifiers.”
- “The PIER process is ineffective – it relies too much on agreement between the PIER initiator and the responsible manager before the PIER is initiated.”

- Recommend implementing nuclear safety plan that meets throughput (*assume safety is dominant criterion*). There should be a system for identifying how issues are resolved and management should not be able to simply close issues without justification or without informing the originator.

Theme 2: "There is no chilling atmosphere at WTP"

- "Would not characterize WTP as having a chilled atmosphere, but working through some of the issues has been hard."
- WTP project is a very charged environment with a lot at stake. There is intense cost and schedule pressure on the project, but safety culture behavior is not unusual.
- Did not agree with the DNFSB assessment of a chilled environment at WTP. Everyone is encouraged to bring up issues and there are multiple venues to do so. DNFSB staff is not communicating as well as they once did.
- Have not experienced or seen evidence of a chilled environment. People bring concerns even after the Walter Tamosaitis publicity. (*There is*) no suppression of technical issues. Multiple avenues to raise concerns.
- Disagrees that there is a chilled environment because the project is open to lots of external oversight.
- No chilled atmosphere, can raise safety issues, but need to defend well when impacting cost/schedule.
- No chilled atmosphere for this organization, no suppression of technical dissent. After Walter Tamosaitis's removal, people wonder.

Theme 3: "There is a chilling atmosphere at WTP"

- (*The statement*) "the science is over... had a chilling effect."
- "The statement made by Winokur at the October meeting was the most chilling experience of my career. It sent the message that E&NS was not to be disagreed with."
- (*Existence of a*) "chilled environment as stated by DNFSB: Correct statement."
- (*The Walter Tamosaitis*) removal had a chilling effect: "it could happen to me."
- Chilled environment: agree with existence of chilled environment; big problems with bringing the issues out and with resolving the issue.
- "I was chilled by the DNFSB treatment of...and (*others*) during the hearing in Richland in October 2010."

Theme 4: "There is no suppression of technical dissent"

- "I have seen no evidence of suppression of technical dissent; on the contrary, people bring up tough issues and grapple with them openly. I have heard no one say anything to the contrary."
- "There is no suppression of technical issues; approaches can be different and still valid."
- Suppression of technical dissent: absolutely not. Issues not held back but solutions take longer than some people would like.
- "Technical issues are out in the open on the project, but people sometimes do not like how the issues are closed."
- No fear of retaliation for raising issues. If there is a true technical issue, it will not be quashed, but you will have to push for your position. No evidence of suppression.

- “There is no suppression of technical dissent. Safety issues impacting cost and schedule will be challenged but accepted if proven.”
- “Nothing is buried, issues are all public information, but closing issues is not focused until the end.”

Theme 5: “Technical dissent is suppressed by...”

- Suppression of technical dissent: unless something is huge, nothing is going to change.
- Suppression of technical dissent: yes, and many issues are not brought out. However, interviewee sees good changes by present top management and hopes for stability in ORP.
- “Issues are not raised because it is now painful, takes too long to place in process and to follow through: you have to demonstrate that you are right against a done thing.”
- “I have no fear of bringing up issues to BNI management but do not feel the same way about URS.”
- “When you raise technical issues, they retaliate” (*This individual stated s/he had escalated a technical issue at multiple levels of the organization and their recommended design change was adopted.*)
- “The problems are so pervasive that they may create an environment that discourages bad news being brought forward.”

Theme 6: “Problems between Engineering and Environmental and Nuclear Safety”

- “The disconnect between Engineering and E&NS, (*is*) mostly due to the (*fast track*) design-build approach.”
- Need better alignment between E&NS and Engineering. Would like to get better definition of long term funding for the project.
- “BNI doesn’t have a culture that embraces technical excellence.”
- A group that conflicts with engineering design is believed to impact cost and schedule.
- E&NS creates a perception that there are NSQC concerns.
- “E&NS has high caliber people working in a terrifying situation. People are stressed by the chaos in that organization...”
- There needs to be a better leadership model to bring engineering and nuclear safety together rather than by precipitating crisis.
- “The scope of design and licensing is BNI’s but the management of nuclear safety is URS, and there is a significant disconnect between BNI and URS.”
- Personalities should not stand in the way of justified engineering decisions.
- ... no one has done a good job of separating personnel actions from technical activity.
- “Safety analysis is beat down by Engineering.”
- “Our organization (*E&NS*) is now paralyzed, so Engineering bypasses E&NS and waits to get caught.”

Theme 7: “DOE management issues”

- “Recommend separation of the roles of line management and safety, with an independent organization responsible for safety.”
- DOE does not have the people or the ability to manage the people; (*you*) have to understand the technical issue first.
- “DOE has a split-personality: owner and regulator.”

- “DOE supports the Integrated Safety Management System (ISMS) to assess safety culture and to improve/sustain the safety culture. (However) DOE and many of its managers have no systematic training on safety culture.”
- DOE’s current organizational structure for oversight of the WTP is unhealthy because there are no safety checks and balances in the reporting arrangement from the Federal Project Director to the Deputy Secretary.
- “DOE may be asking too much of BNI in resolving all technical issues at this time.”
- In general, DOE/EM has a strong safety culture, but the construct of oversight of the WTP project is causing consternation.
- The current state of diminished DOE regulatory oversight of the project probably contributes to the decline in the Board’s trust of DOE.
- DOE and BNI need to understand that words are not enough.
- Improve integration between the tank farm and the WTP.

Theme 8: “DNFSB is creating a chilling effect over WTP”

- The DNFSB is creating a chilled environment; people (*are*) afraid their statements will be used against them or their management.
- (*Should*) solve animosity between DNFSB and DOE, driven by both (*sides*). The DNFSB and DOE lawyers view their role as litigation.
- “(*Interviewee*) feels that sometimes confused messages are sent to the DNFSB which causes them to react negatively.”
- “The DNFSB is dictating solutions and intimidating those who disagree.”
- “DNFSB feels we are not embracing conservatism.”
- “Standards are being ratcheted by the DNFSB staff.”
- The DNFSB situation needs to be addressed, not exacerbated.
- DNFSB is creating hostile environment; NRC always gave us adequate time to respond and treated us with respect.
- DNFSB process is not the right way to do business; no factual accuracy review, no courtesy. Process (*being followed*) is fatiguing not chilling.
- “The (*DOE/BNI*) relationship with the DNFSB has created the most poisonous atmosphere I have ever experienced; it has been mutually created.”
- This person is offended by the DNFSB letter because it insults the integrity of the people working at WTP and their courage in bringing up issues.
- “The Board’s implication that DOE would knowingly use false numbers in the safety basis for the WTP was absurd.”
- The origin of the current difficulties in the relationship between the project and the Board appears to be the change in the MAR.
- Working in a hostile environment after the October 2010 DNFSB hearing.
- “ISM communications are different when DNFSB staff are present.”

Theme 9: “Need to improve communications at WTP”

- Management’s failure to explain the reassignment of Walter Tamosaitis led to speculation.
- Management has to communicate much better during the (*issue*) resolution process.
- (*What should be done?*) “Improve communications.”
- Management has done a poor job of communicating on the Walter Tamosaitis issues.

- This person has received no explanation of the removal of Walter Tamosaitis and only knows from the press that apparently it was for raising (*safety*) issues.
- Improve information pathways up to management.
- This situation (*at E&NS*) makes it hard for interviewee to communicate to engineering the need to not sacrifice long-term operations priorities for near term production priorities.

Theme 10: "Organizational and Management Problems"

- High stress impacts the effectiveness of organization and personnel.
- "People think WTP is just a big chemical plant; an understanding of its nuclear aspects is needed."
- "The technical problems at WTP stem from the (*fast track*) design-build contract, too much emphasis on the nuclear nature of the plant, and not enough attention on the chemical nature of the plant."
- Too many reviews ongoing all the time; project leadership not fully focused because of reviews.
- "(I) see the project as unique in that it raises issues that are very difficult to answer, and that there is stress because of this."
- Empower and hold people accountable to bring solutions when they bring issues.
- People are concerned about future staff reduction milestones.
- "... and the Project should stop doing things that impede the ability to process the material in the tanks, which is where the real safety threat resides."
- Problems with flowing down requirements (PDSA).
- Decision-making is very centralized and the way people are rewarded contributes to the centralization.
- Defensiveness and resistance to feedback (*have*) improved but are still occurring at reduced frequency.
- "There is a lack of clarity as to who is the design authority for WTP."

Comparison of WTP Opinion Survey Results to NRC Safety Culture Traits

The letter from the Secretary of Energy of June 30, 2011, responding to Recommendation 2011-1, *Safety Culture at the Waste Treatment and Immobilization Plant*, cited that the specific criteria for assessing nuclear safety culture will include the existing requirements for the Integrated Safety Management System and the safety culture principles from INPO and NRC.

An opinion survey was conducted in August-September 2011 for the entire workforce at WTP, as described in Part 3, above. That survey focused on the nuclear safety culture of the project. The questions employed in the survey were drafted by the ISQCA team; the survey was conducted by K-MR and Pillsbury, an experienced firm in this area, analyzed the statistical results. Pillsbury's survey results were recently made public by BNI.

The traits embodied in the safety culture principles of NRC, the results of the 2011 opinion survey for non-manual employees, and the team's direct observations are combined in the analysis presented in the following paragraphs.

- Consistent with INPO guidance and DNFSB Recommendation 2011-1, control of safety culture should reside at the highest level of the organization. At that level, executives should direct,

track, and validate the specific corrective action to be taken to establish a strong safety culture in both contractor and federal workforces.

- It is also the responsibility of the oversight organizations (DOE and DNFSB in this case) to ensure strong safety culture programs are maintained.
- The NRC identified nine traits of a positive nuclear safety culture in its Final Safety Culture Policy Statement in 2010. The NRC-identified traits constitute aspirational goals that serve to guide the pursuit of excellence in safety culture.
- The NRC traits are stated below, along with NRC's definition of each trait, in italics, with the following added information:
 - Recounting of the results of the non-manual employee opinion survey conducted in the fall of 2011 to compare WTP performance for each of the NRC traits.
 - Pillsbury report insights, when provided, on the relative performance of WTP compared to an NRC trait. Pillsbury's approach to the analysis of the survey results included consideration of the variance from the statistical mean to indicate which results provided evidence of potential strength or potential weakness. Pillsbury also looked at variation of survey responses among organizational units.
 - Finally, the team provides additional insights from its assessment for each of the traits.

1. Leadership Safety Values and Actions: *Leaders demonstrate a commitment to safety in their decisions and behaviors.*

Opinion survey question 3: "We have a strong nuclear safety culture at WTP" received a 4.29 out of 5.00 in the survey. This score is above the mean. Pillsbury did not interpret this result.

Opinion survey question 5: "WTP management is committed to safety and quality" received a 4.35 out of 5.00 in the survey. Pillsbury interpreted this result to indicate a positive aspect of the WTP work environment.

The team has observed instances where upper managers did not demonstrate appropriate sensitivity to the impact of their statements and actions on the safety culture. However, the team has observed that BNI leaders have initiated actions to address this shortcoming and demonstrate their commitment to safety.

2. Problem Identification and Resolution: *Issues potentially impacting safety are promptly identified, fully evaluated, and promptly addressed and corrected commensurate with their significance.*

Opinion survey question 15: "Issues take too long to get resolved at WTP" received a 2.39 out of 5.00 in the survey. The scoring has been reversed to indicate a negative outcome. This result is the lowest score in the survey. Pillsbury interpreted this result to mean that this is the greatest issue of concern at WTP.

The team drew a similar conclusion in its assessment, as reflected in Part 6, Finding 2. Furthermore, the team notes the potential for this characteristic to discourage individuals from raising issues due to the individual burden associated with the lack of responsiveness from the system.

3. Personal Accountability: *All individuals take personal responsibility for safety.*

Opinion survey question 28: “Never pressured to take short cuts or make misleading statements when it comes to safety” received a 4.47 out of 5.00 in the survey. Pillsbury interpreted this result to indicate a positive aspect of the WTP work environment.

The conclusion of the team’s assessment of this area parallels the conclusion of Pillsbury.

4. Work Processes: *The processes for planning and controlling work activities are implemented so that safety is maintained.*

Opinion survey question 10: “Safety and quality come ahead of cost and schedule on this project” received a score of 3.87 out of 5.00 in the survey which is below the mean. Pillsbury identified this area for potential improvement in three departments (Nuclear Safety & Plant Engineering; Startup & Completion; and Safety, Quality & Operations).

Opinion survey question 18: “When we raise issues about adequacy of compliance with safety requirements or nuclear safety standards, our questions are answered appropriately and changes made when needed” received a 3.95 out of 5.00 in the survey, a result that is below the mean of 4.04.

Opinion survey question 21: “WTP processes for raising technical, safety or quality issues or concerns are effective” received a score of 3.86 out of 5.00, a result that is below the mean.

Opinion survey question 27: “Members of my work group are held accountable for following procedures” received a 4.38 out of 5.00 in the survey. Pillsbury interpreted this result to indicate a positive aspect of the WTP work environment.

The team found that there is room for improvement in the corrective action program and the interaction between organizations.

5. Continuous Learning: *Opportunities to learn about ways to ensure safety are sought out and implemented.*

Opinion survey question 8: “I get the information and training I need to do my job effectively” received a 3.91 out of 5.00 in the survey, which is below the mean.

Continuous learning is reflected in the corrective action program at a nuclear construction site and is part of the Integrated Safety Management System at a DOE facility. The team observed BNI had reasonable programs for root cause and extent of condition assessments as part of its corrective action program. However, the program does not consistently evaluate the effectiveness of corrective actions in preventing recurrence of deficiencies, as required.

6. Environment for Raising Concerns: *A safety conscious work environment is maintained where personnel feel free to raise safety concerns without fear of retaliation, intimidation, harassment or discrimination.*

Opinion survey question 1: “I have confidence in the ways available (other than my immediate supervisor) to raise technical, safety or quality concerns” received a score of 4.29 out of 5.00 on the survey, which is above the mean.

Opinion survey question 4: “Identifying and addressing technical, quality or safety issues is a routine part of my job” received a score of 4.35 out of 5.00 on the survey. Pillsbury interpreted this result to indicate a positive aspect of the WTP work environment.

Opinion survey question 6: “I am confident that the zero tolerance policy against retaliation at WTP is enforced” received a score of 3.87 out of 5.00 on the survey, which is below the mean.

Opinion survey question 7: “Management has discouraged me from making suggestions to improve safety or quality” received a score of 4.23 out of 5.00 on the survey, which is above the mean. The scoring has been reversed to indicate a positive outcome.

Opinion survey question 11: “I would bring a concern to Human Resources or Employee Concerns Program (ECP) if I needed to” received a score of 4.14 out of 5.00 on the survey, which is above the mean.

Opinion survey question 12: “Issues I raise get the appropriate level of attention” received a score of 3.86 out of 5.00 on the survey, which is below the mean.

Opinion survey question 23: “I take action when I see potentially unsafe or poor quality practices or products” received a score of 4.51 out of 5.00 on the survey. Pillsbury interpreted this result to indicate a positive aspect of the WTP work environment.

Opinion survey question 24: “Management suppresses technical dissent at WTP” received a score of 3.61 out of 5.00 on the survey, which is below the mean. Pillsbury identified this area for potential improvement in three departments (Nuclear Safety & Plant Engineering; Subcontractors; and Safety, Quality & Operations).

Opinion survey question 25: “Members of my work group are willing to identify errors, deficiencies or potentially unsafe or poor quality conditions” received a score of 4.44 out of 5.00 on the survey. Pillsbury interpreted this result to indicate a positive aspect of the WTP work environment.

The team’s assessment of WTP status in this area is described in Part 6, Finding 1.

7. *Effective Safety Communications:* *Communications maintain a focus on safety.*

Opinion survey question 2: “We have effective communication in our workgroup” received a score of 4.07 out of 5.00 on the survey, which is approximately the mean.

The team’s assessment of WTP status in this area is described in Part 6, Finding 4.

8. *Respectful Work Environment:* *Trust and respect permeate the organization.*

Opinion survey question 13: “I believe there is trust and respect on this project” received a score of 3.73 out of 5.00 on the survey, which is below the mean.

Opinion survey question 17: “I trust my immediate supervisor” received a score of 4.32 out of 5.00 on the survey, which is well above the mean.

Opinion survey question 19: “There is cooperation among the various departments on this project” received a score of 3.39 out of 5.00 on the survey, which is the second lowest score in the non-manual opinion survey.

Opinion survey question 22: “WTP employees are treated fairly and consistently” received a score of 3.71 out of 5.00 on the survey, which is below the mean. Pillsbury identified three departments (Nuclear Safety & Plant Engineering; Business Services; and Procurement & Subcontracts) as having the potential for improvement in this area.

Opinion survey question 26: “We have high level of teamwork in my workgroup” received a score of 4.23 out of 5.00 on the survey, which is above the mean.

The team’s assessment of WTP status in this area is described in Part 6, Finding 3.

9. Questioning Attitude: *Individuals avoid complacency and continually challenge existing conditions and activities in order to identify discrepancies that might result in error or inappropriate.*

Opinion survey question 9: “My immediate supervisor listens to employees, encourages a questioning attitude and puts a high priority on quality through his/her actions” received a score of 4.30 out of 5.00 on the survey, which is above the mean.

Opinion survey question 16: “WTP managers/supervisors communicate and respond to employee questions in an open and honest manner” received a score of 3.82 out of 5.00 on the survey, which is below the mean.

Opinion survey question 20: “WTP management encourages a questioning attitude” received a score of 4.17 out of 5.00 on the survey, which is above the mean.

The team’s assessment of WTP status in this area is described in Part 6, Finding 1.

Part 6. Findings and Recommendations

Introduction

The U.S. Nuclear Regulatory Commission issued its Final Safety Culture Policy Statement in 2010, after many years of endeavoring to establish a well-balanced framework that would “set forth its expectation that individuals and organizations performing or overseeing regulated activities establish and maintain a positive safety culture commensurate with the safety and security significance of their activities and the nature and complexity of their organizations and functions.” The NRC policy statement resulted from the intensive and broad involvement of Government, industry, and stakeholders, including the Institute of Nuclear Power Operations (INPO), and is considered by many, including DOE, as defining the cornerstones of nuclear safety culture. The team examined WTP performance relative to the NRC’s nine traits of a safety culture in Part 5 of this report.

The ISQCA team believes that the importance of maintaining a WTP safety culture, in a manner commensurate with the safety significance of the design, construction, and operation of its facilities, is unsurpassed by any other nuclear facility in this country. Furthermore, the nature and complexity of the organizations and functions managing the WTP mission and those exercising oversight also point out the necessity of establishing safety as the primary driver of project execution, aided and supported by a strong and growing safety culture and a matching SCWE. In fact, after deliberating on the project and its safety history, the ISQCA team believes that ensuring the safety of the design, construction, and operation of the facilities is the only manner by which to secure cost and schedule performance.

The following ISQCA findings and recommendations, representing a value judgment on the information received and analyzed, are arranged to first address the issues raised by DNFSB in Recommendation 2011-1, and then other key issues identified during the assessment, in no particular order.

The team’s analysis of the status of industrial safety at the construction site and other project facilities identified no significant current concerns regarding the safety culture in that area. Furthermore, the Board’s issues in Recommendation 2011-1 and the associated actions by the Secretary of Energy are focused on the safety of the design and integrated licensing strategy (overall safety construct) for the project. Therefore, these findings and recommendations are exclusively directed at issues and actions that affect the nuclear safety culture for people involved in the design, authorization, and oversight of the WTP.

Finding 1: - No Widespread Evidence of a Chilled Atmosphere Adverse to Safety - No Widespread Evidence that DOE and Contractor Management Suppress Technical Dissent

Supporting Statements

- The team found, in general, there is no reluctance on the part of DOE, URS, and BNI project personnel to raising safety and technical issues that could impact the overall safety of the project, even though there were isolated expressions to the contrary.

- The ISQCA was keenly focused throughout its assessment on Findings 1 and 2 of DNFSB Recommendation 2011-1. The results of this assessment, which gives priority to conditions and actions important to safety culture over approximately the last 30 months and heavily weights present conditions, do not support the DNFSB Findings 1 and 2.
- However, it is important to provide the proper context and framework for the ISQCA findings, as follows:
 - The DNFSB actions that began in the fall of 2009 to address practices and events at WTP that may adversely affect public health and safety, including aggressively pursuing the importance of maintaining a strong safety culture, have positively contributed to improvements in the accountability for the safety framework and the safety culture at both DOE and its contractors for the WTP project.
 - Isolated but well-identified legacy and technical issues with safety significance were not timely managed and efficiently resolved and have contributed to the real or perceived “failed safety culture” encountered by DNFSB. Moreover, it appears that a juxtaposition of important issues that needed timely disposition contributed to what appeared to be a flawed safety culture, and resulted in the Board actions described in Part 4 of this report. These matters are discussed in more detail in Finding 2, below.
 - The safety significant issues included deposition velocity, potential criticality events, hydrogen in piping and ancillary vessels (HPAV), and the vessel mixing issues, all of them not timely and visibly resolved and, therefore, with serious implications to the overall safety basis of the design, and by attribution, safety culture.
 - The Walter Tamosaitis event has been a major disruption to WTP and to what appeared to be an improving nuclear safety and quality culture. This continuing issue, with a potential for a chilling impact, was exacerbated by the failure of management to timely explain the basis for its actions.
 - The conduct of the DNFSB investigations, its follow-up actions, and the structure of its communications beginning in the fall of 2009, including the October 2010 public hearing on WTP safety issues and subsequent witness tampering investigation, had the unwanted effect of instigating a series of hostile reactions and interactions that have burdened the normally constructive relationships among the Board, DOE, and its contractors.
 - The Board correctly identified that “the tension at the WTP project organizations charged with technical issue resolution and development of safety basis scope, and those organizations charged with completing design and advancing construction, is unusually high,” and recognized its significance on the need to take remedial action to ensure a strong safety culture. However, as discussed more fully in Finding 3 below, it appears that a very significant contributor to this important problem is the management and performance of the E&NS organization, and its direct impact on safety culture.

Recommendations

- Implement an improved nuclear safety culture that is strong, visible, reliable, and forward-looking across all the organizational structures of WTP, in a manner consistent with the mission and with safety being the dominant criterion intrinsic to the discharge of design, construction, and operation activities.
- Implement a program to address and formally resolve, in a timely manner, isolated cases that could lead to a chilled environment adverse to safety.

Finding 2: Lack of Effective and Timely Disposition of Technical and Safety Issues

Supporting Statements

- The ISQCA team, after analyzing multiple inputs to the assessment’s deliberative process, determined that the lack of effective and timely disposition of technical and safety issues, large and small, was and is a major contributor to the real and perceived problems with the WTP project execution, and strongly affects its safety culture.
 - The issue of timely resolution of issues is not new and has been identified multiple times; it stands out as a persistent and pervasive project issue. Early in the assessment, this issue became the subject of focused attention by the ISQCA team.
 - It might appear contradictory to separate timely disposition of technical and safety issues from Finding 1 above, but in the particular case of WTP, this separation adds clarity to the resolution of both findings.
 - Many technical or safety issues, whether new or recurrent, are raised to management via one or more of the multiple tools available, but many are not resolved in a timely manner and frequently lack adequate feedback during or even after resolution. This appears to be an endemic problem that has existed for years and has contributed to the impression that management is mostly focused on cost and schedule. The ISQCA team believes the WTP management is focused on the mission and uses cost and schedule as enabling factors, without visibly and consistently making nuclear safety the dominant criterion in its decision-making process.
- Schedule is a very important factor for WTP; it is often the key factor cited for compliance with the Tri-Party Agreement because of the urgency of the safety mission connected with tank waste stabilization and disposal. Cost is also very important because the project has to be funded to go forward. However, safety should rule in nuclear projects; cost and schedule have to be established as dependent on the overall safety of design, construction, and operation.
- The ISQCA team is convinced that effective integrated safety management, used with consistent safety oversight, is the enabling factor for mission accomplishment.
- Several attempts have been made to collect and review technical or safety significant issues previously raised at WTP but not acted upon. For example, the 2009 and 2010 “empty-your-drawers” exercises helped to elevate technical issues for increased attention. A continuation of efforts to improve capture and resolution of raised issues has been recommended by several parties.
- Management had not, until recently, taken the effective steps necessary to eliminate or minimize the impression resulting from the lack of closure of unresolved issues. There are now comprehensive actions being taken to address these deficiencies, such as the formation of a dedicated tank team to resolve mixing issues.
- Significant and visible safety issues are eventually resolved at WTP, as evidenced by the resolution of the complex DPOs recently closed, but the process is frequently slow, and requires persistent advocacy and endurance by the proponent.
- The combination of the above factors discourages some people from raising technical issues. However, the critical safety issues are well-known in the project and openly discussed, and as stated by the majority of project participants, there is no doubt that new ones would be raised if needed.
- Lower importance technical issues are often rated against a high threshold, which is apparently often based on cost and schedule considerations. Related safety considerations might be

considered as already resolved or being resolved; however, the screening process needs decision-making consistent with safety and project priorities and must create the assurance that management has time and interest to consider the issues. Unless resolved, the continuation of a pattern of delay and lack of resolution could result in important issues not being raised.

- Therefore, it is apparent that the process to timely disposition the critical safety issues and other technical issues that are raised during the safety review of this fast-track design-build project has not been effectively and consistently executed.

Recommendations

- BNI should establish an effective, visible, and consistently implemented process for the timely disposition of safety and technical issues in a manner commensurate with the safety significance of the activity, including capturing, tracking, managing, providing suitable feedback, communicating, and establishing closure actions. This process should include conflict resolution.
- BNI should implement a simple-to-follow corrective action program matching the above program for timely disposition of issues and the demands of the project, with periodic feedback mechanisms and accountability to a designated project executive.

Finding 3: Safety Construct Implementation does not Support Project Schedule

Supporting Statements

- For a significant period of time DOE has not provided consistent and final guidance with respect to establishing the project's overall safety construct (safety basis).
- Although management appears to have devoted much time and effort in ensuring the continuing progress needed to achieve the mission, it has not taken the steps necessary to assure the timely implementation of the adequate safety basis process to enable completion of the project on schedule.
- Presently, the lack of full implementation of a consistent safety analysis and matching safety oversight, to support the engineering design and construction efforts, appears to be in conflict with the completion of a WTP project focused on safety, quality, cost, and schedule.
- Key contributors to the issue described above are the management and performance of the E&NS organization and the failure of management to resolve the lack of alignment between Engineering and E&NS. These factors delayed the implementation of a consistent and effective safety construct that would serve to ensure protection of the public and the environment.
- The lack of resolution of the safety construct for WTP led to a letter from the FPD to BNI, dated September 27, 2011, stating DOE's expectations for maintaining integrated performance between Engineering and Nuclear Safety. The FPD also expressed the alignment of DOE's expectations with the recent Construction Project Review (CPR) recommendations for completion of hazard analyses, design configuration, and operational safety basis.
- It is apparent that both DOE and its contractor are committed to the overall safety mission of WTP. For example, this commitment is visible and accounted for in the construction project, where industrial safety is intrinsic to the workers' and management's activities. Another example is the efforts of project management to institute a Nuclear Safety and Quality Culture Plan. However, this commitment has not been systematically incorporated into the everyday nuclear safety processes for the design, construction, operation, and oversight of WTP, with the assurance that those processes will be implemented in a manner commensurate with their safety significance.

Recommendations

- Nuclear safety must permeate all the project structures and enable project execution with sound cost and schedule goals. As a result, mission critical parameters will show continuous improvement and the project nuclear safety culture will be dominant and visible.
- A management directive regarding the dominance of the overall safety construct for this fast-track design-build project is needed, including the associated impact on project execution and safety. The directive should be well communicated externally and internally, to promote the understanding of how safety design issues and safety oversight are being integrated into project execution.
- The Department and BNI should implement specific project management oversight processes to fully align nuclear safety with project execution.
- The DOE must formally establish responsibility for the final design assurance and safety oversight over the entire project.
- The Department and BNI should implement SCWE training for all project participants.
- The Department and BNI should implement ECP enhancements to increase effectiveness of and confidence in these programs.
- The Department should establish “project accountability oversight” within DOE to screen and judiciously limit the number of external reviews on the project to those that are jurisdictional or deemed essential for project execution and safety.

Finding 4: Communications not Fully Supportive of Safety Culture

Supporting Statements

- High performing organizations capable of making timely decisions have well established and effective lines of vertical and horizontal communication.
- Process and communication issues at WTP are in need of improvement across project interfaces so as to establish and sustain trust among the organizations and the employees.
- The lack of pertinent information on the overall process surrounding the Walter Tamosaitis case, influenced by the legal proceedings, created a significant need for specific communication to project personnel and the public.
- Communication of the resolution and closure of technical and safety issues, using effective and timely processes, has been shown to be an important issue impacting perceptions and attitudes of project personnel.

Recommendations

- The Department and BNI should improve communications with stakeholders and the public to establish better understanding of project issues, ongoing safety issues and their resolution, the status of safety culture, and its commitment to accomplish the mission within a well-articulated, overall safety construct.
- The Department and BNI should establish safety management and safety culture indoctrination and training at every level of the project such that a common language and common objectives are achieved.
- BNI should establish a communication program dedicated to identifying, tracking, and determining resolution of every issue in its corrective action program, thereby ensuring responsive and timely communication to issue originators during the process.

Overall Conclusions

Pursuant to its Charter, the ISQCA team assessed the nuclear safety and quality culture on the WTP project, including the specific areas listed below. In these areas, the team found:

No widespread evidence of a chilled atmosphere adverse to safety;

No widespread evidence that DOE and contractor management suppress technical dissent;

That the majority of results from the nuclear safety culture survey compared favorably to the traits in the NRC Policy Statement, although the team's assessment was less favorable in some respects due to its deliberate focus on problem areas;

A lack of effective and timely disposition of technical and safety issues;

That overall safety construct implementation does not support the project schedule;

A lack of systematic integration of safety and design indicates a less than adequate safety construct and has itself negatively impacted the WTP safety culture; and

That improved communications across project interfaces and improved issue resolution tools are needed to support safety culture.

Moreover, the team found that the conduct of the DNFSB oversight activities, its follow-up actions, and the structure of its communications beginning in the fall of 2009, including the October 2010 public hearing on WTP safety issues and subsequent witness tampering investigation, had the unwanted effect of instigating a series of hostile reactions and interactions that have burdened the normally constructive relationships among the Board, DOE, and its contractors.

In conclusion, the ISQCA team observes that ensuring the safety of the design, construction, and operation of the facilities is the only manner by which to secure cost and schedule performance. There are improvements required, as documented above, to ensure this philosophy dominates the WTP Project.

Attachments

Note: The attachments listed below are only available on the optical disc included with the hard copy of the report and the electronic copy posted to the publically-accessed ISQCAT.com website.

1. NSQC History Timeline, 2000-2011 (disc)

2. Waste Treatment Plant Timeline of External Reviews, 2009 - 2011 (disc)

A. 2009-2010

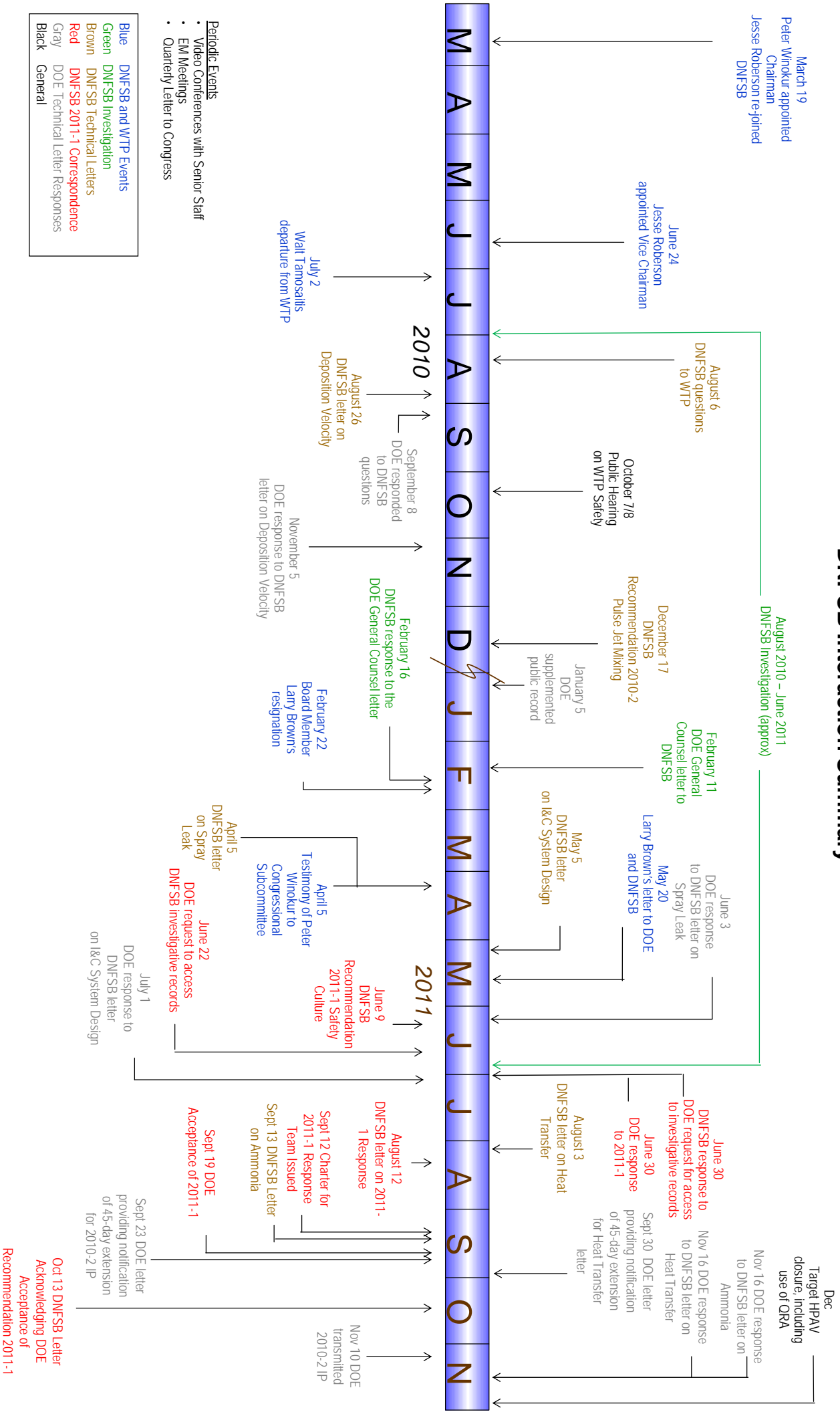
B. 2010-2011

3. DNFSB Interaction Summary (disc)

Acronyms

AEC – Atomic Energy Commission
ATS – Action Tracking System
BNI – Bechtel National, Inc.
BNFL – British Nuclear Fuels, Limited
CCE – Common Cause Evaluation
CRESP – Consortium for Risk Evaluation and Stakeholder Participation
DNFSB – Defense Nuclear Facilities Safety Board
DOE – Department of Energy
DOE/EM – Department of Energy, Environmental Management
DPO – Differing Professional Opinion
E&NS – Environmental & Nuclear Safety
ECP – Employee Concerns Program
EFCOG – Energy Facility Contractors Group
EPA – Environmental Protection Agency
FPD – Federal Project Director
HPAV – Hydrogen in Piping and Ancillary Vessels
HSS – Department of Energy, Office of Health, Safety and Security
INPO – Institute of Nuclear Power Operations
IP – Implementation Plan
ISM – Integrated Safety Management
ISMS – Integrated Safety Management System
ISQCA – Independent Safety and Quality Culture Assessment
K-MR – K-Management Resources
MAR – Material-At-Risk
NRC – Nuclear Regulatory Commission
NSQC – Nuclear Safety and Quality Culture
NSQI – Nuclear Safety and Quality Imperative
ORP – Department of Energy, Office of River Protection
PDSA – Preliminary Design Safety Analysis
PIER – Project Issues Evaluation Report
PJM – Pulse Jet Mixing
QA – Quality Assurance
RL – Department of Energy, Richland Operations Office
SCWE – Safety Conscious Work Environment
SRD – Safety Requirements Document
TIEF – Technical Issue Evaluation Form
TPA – Tri-Party Agreement
VPP – DOE's Voluntary Protection Program
WTP – Waste Treatment and Immobilization Plant

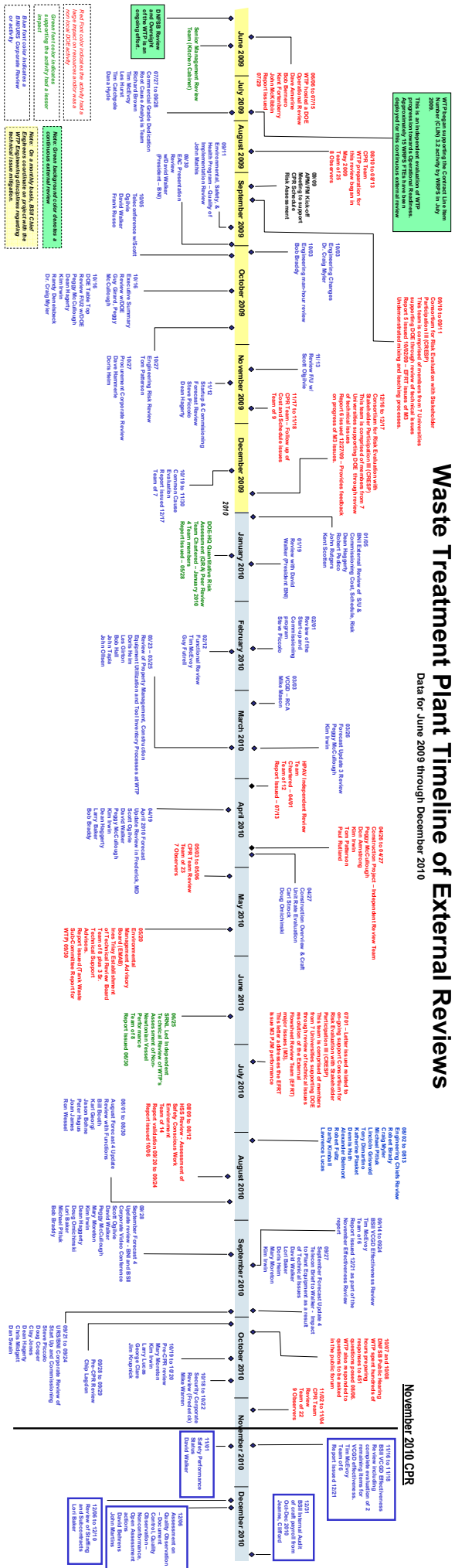
DNFSB Interaction Summary



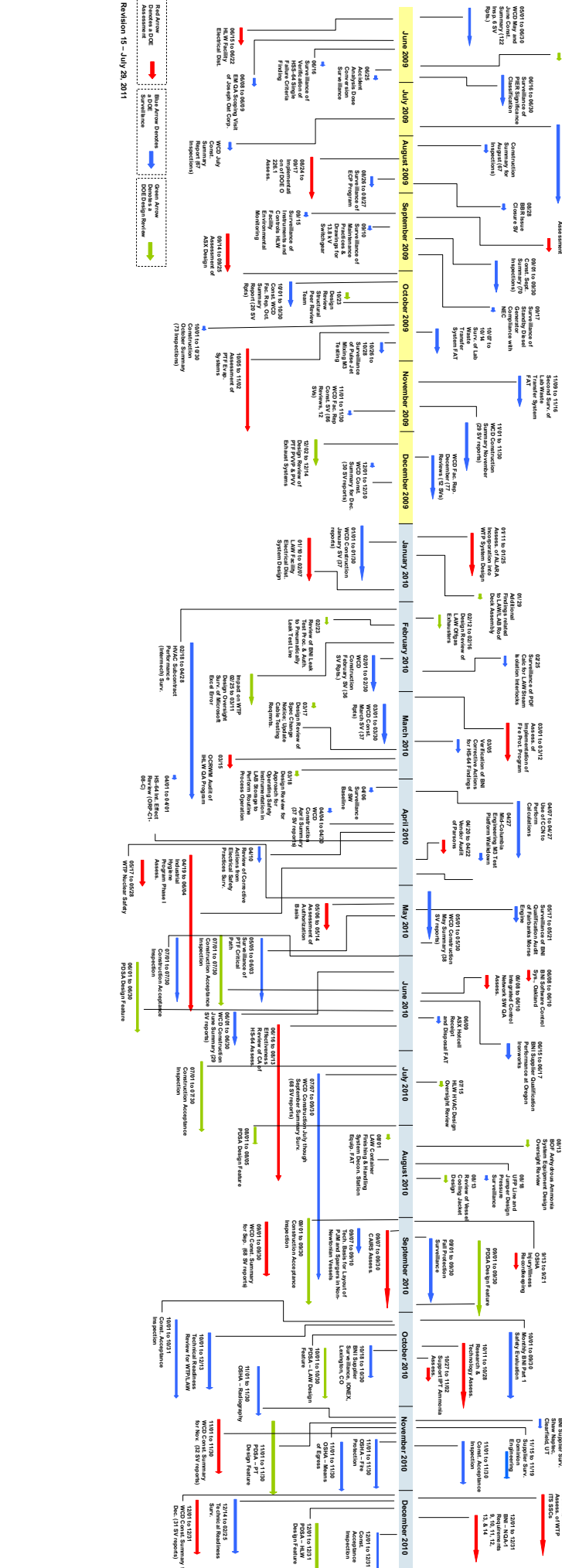
- Periodic Events
- Video Conferences with Senior Staff
 - EM Meetings
 - Quarterly Letter to Congress
- | | |
|-------|--------------------------------|
| Blue | DNFSB and WTP Events |
| Green | DNFSB Investigation |
| Brown | DNFSB Technical Letters |
| Red | DNFSB 2011-1 Correspondence |
| Gray | DOE Technical Letter Responses |
| Black | General |

Waste Treatment Plant Timeline of External Reviews

Data for June 2009 through December 2010



Department of Energy Assessments, Surveillances, and Design Reviews

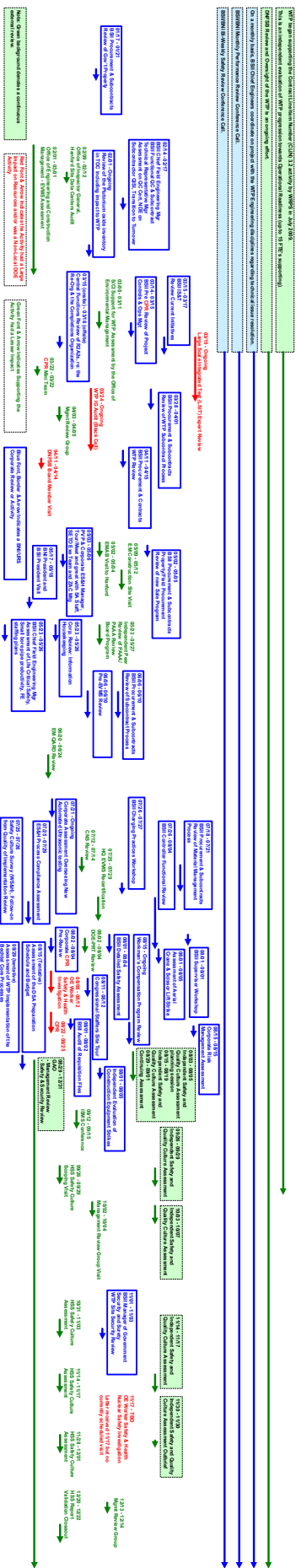


Revision 15 - July 29, 2011

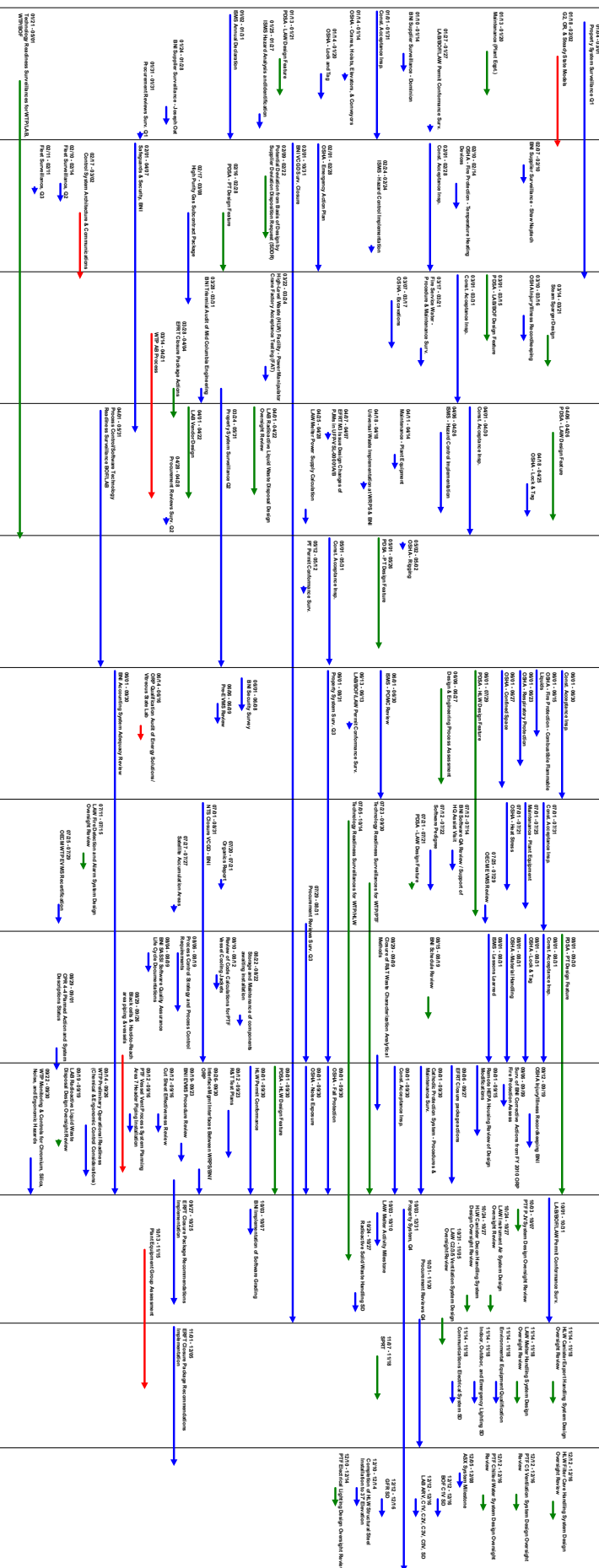
EM, DNFSB, & BN/URS Corporate Reviews & Assessments

Waste Treatment Plant Timeline of External Reviews

Data for January 2011 through December 2011



Department of Energy Assessments, Surveillances, and Design Reviews



November 22, 2011
Revision 23