U.S. Department of Energy
Office of River Protection
P.O. Box 450, MSIN H6-60
Richland, Washington 99352

05-ESQ-078

DEC 08 2005

Mr. J. P. Henschel, Project Director
Bechtel National, Inc.
2435 Stevens Center
Richland, Washington 99352

Dear Mr. Henschel:

CONTRACT NO. DE-AC27-01RV14136 – ASSESSMENT REPORT A-05-ESQ-RPPWTP-009 – BECHTEL NATIONAL, INC. QUALITY ISSUES, FOR THE PERIOD SEPTEMBER 26 THROUGH OCTOBER 12, 2005

This letter forwards the results of the U.S. Department of Energy, Office of River Protection Assessment A-05-ESQ-RPPWTP-009, "Bechtel National, Inc. (BNI) Quality Issues," which was conducted from September 26 through October 12, 2005. The assessment evaluated a sample of recent quality issues to identify common causes or conditions that had been overlooked by BNI investigations or remained uncorrected following BNI corrective actions.

The assessment concluded most of the quality issues occurred because of nuclear safety culture weaknesses. Specific weaknesses in the safety culture identified were poor discipline in procedure compliance, ineffective training processes, weak procedures in some areas, and an inadequate "questioning attitude." BNI root cause analyses had only recently begun to recognize the cultural weaknesses causing the problems, and it was not evident during the assessment that BNI management had an adequate plan in place for creating the necessary cultural changes. The assessors identified four Findings and four Observations that resulted from the nuclear safety culture weaknesses.

Within 30 days of receipt of this letter, BNI should respond to the assessment. In addition to addressing the Findings, the response should identify in detail the actions BNI will take to correct the nuclear safety culture weaknesses. The BNI responses should include:

- The cause of the Findings;
- The corrective steps that have been taken to control or remove any adverse impact to identified noncompliance situation(s) (remedial actions), and the results achieved;
- The corrective steps that will be taken to prevent similar Findings; and
- The date when all corrective actions are completed, verified and compliance to applicable requirements is achieved.

If you have any questions, please contact me, or your staff may call Robert C. Barr, Director, Office of Environmental Safety and Quality, (509) 376-7851.

Sincerely,

Roy J. Schepens, Manager
Office of River Protection

ESQ:SAV

Attachment

cc w/attach:
G. Shell, BNI
W. R. Spezialetti, BNI

Attachment
05-ESQ-078
A-05-ESQ-RPPWTP-009

U.S. DEPARTMENT OF ENERGY
Office of River Protection
Environmental Safety and Quality

ASSESSMENT:	Bechtel National, Inc., Quality Issues
REPORT:	A-05-ESQ-RPPWTP-009
FACILITY:	Bechtel National, Inc., Hanford Waste Treatment and Immobilization Plant Project
LOCATION:	Richland, Washington
DATES:	September 26 through October 12, 2005
ASSESSORS:	Samuel A. Vega, Lead Assessor David H. Brown, Assessor
APPROVED BY:	Patrick P. Carier, Team Lead Verification and Confirmation Official

Executive Summary

From September 26 through October 12, 2005, the U.S. Department of Energy, Office of River Protection (ORP) evaluated 13 recent Bechtel National, Inc. (BNI) quality issues to identify common causes or conditions overlooked by BNI investigations, or remained uncorrected by BNI corrective actions.

The assessment identified common conditions not adequately addressed by BNI. The assessors concluded the majority of the quality issues reviewed occurred because of nuclear safety culture weaknesses. Previous ORP assessments found BNI had effective processes for investigating problems, analyzing causes, and specifying corrective actions. However, BNI root cause analyses had only recently begun to recognize the cultural weaknesses, and it was not evident BNI management had an adequate plan in place for creating the necessary cultural changes. The assessors identified four significant weaknesses in the BNI nuclear safety culture.

Weak Discipline in Procedure Compliance: The assessment found the BNI nuclear safety culture did not unambiguously require procedure compliance. As a result, errors occurred when procedures were not strictly followed by staff, workers, and management. Previous ORP assessments also identified problems with procedure noncompliance similar to the type of noncompliances with engineering that led to recent errors in the design of Analytical Laboratory structural steel.

Ineffective Training Processes: The BNI training paradigm relied heavily on required reading which was often not retained by the trainee. Had BNI measured the effectiveness of training, they would have recognized the weak knowledge that caused several of the issues reviewed. Some personnel failed to comply with procedures because they did not understand the processes they were executing. The assessors concluded training should focus more on processes rather than just procedures, so personnel understand why certain controls exist. The assessors considered properly developed training as the single area of focus to cause the greatest improvement in BNI's nuclear safety culture.

Inadequate Procedures in Some Areas: Some of the events occurred because procedures did not exist to address processes, or they failed to prohibit incorrect processes. In the absence of sound procedures, staff and managers created ad hoc processes to accomplish tasks. BNI corrected specific issues, but had not looked comprehensively for additional procedural weaknesses.

Inadequate "Questioning Attitude": When BNI and ORP personnel brought potential issues to management's attention, management's reaction was often to discount the issue. As a result, managers did not always document potential issues for resolution as required by BNI procedures. A sound nuclear safety culture rewards the discovery and reporting of errors.

The nuclear safety culture weaknesses resulted in the assessors identifying four Findings and four Observations which are presented in this report.

Table of Contents

List of Acronyms

ANSI	American National Standards Institute
ASL	Approved Suppliers List
ASME	American Society of Mechanical Engineers
BNI	Bechtel National, Inc.
CAR	Corrective Action Report
CB&I	Chicago Bridge and Iron Company N.V.
DOE	U.S. Department of Energy
Ecology	State of Washington, Department of Ecology
FCR	Field Change Request
ISMS	Integrated Safety Management System
ITS	Important to Safety
LAW	Low Activity Waste Facility
NCR	Nonconformance Report
NDE	Nondestructive Examination
NEC	National Electric Code
NTS	Price-Anderson Amendments Act Noncompliance Tracking System
NWC	Northwest Copper, Inc.
ORP	Office of River Protection
PAAA	Price-Anderson Amendments Act
PTF	Pretreatment Facility
QA	Quality Assurance
QAIS	Quality Assurance Information System
RCA	Root Cause Analysis
RCRA	Resource Conservation and Recovery Act
SCAR	Supplier Corrective Action Report
SRD	Safety Requirements Document
WTP	Waste Treatment and Immobilization Plant

Bechtel National, Inc. (BNI)
Quality Issues Assessment

Scope

From September 26 through October 12, 2005, the U.S. Department of Energy (DOE), Office of River Protection (ORP) evaluated a series of quality and safety issues at the Waste Treatment and Immobilization Plant (WTP). The purpose of the evaluation was to identify common causes or conditions that had been overlooked by BNI investigations or remained uncorrected following BNI corrective actions. The following issues were evaluated:

- Analytical Laboratory structural steel design and procurement errors;
- Melter seismic embed welding and procurement issues at the High-Level Waste Facility;
- Errors in identification of quality levels between upper and lower tier design drawings;
- Errors in the installed slope of piping between the Low-Activity Waste (LAW) Facility, the Analytical Laboratory Facility, and the Pretreatment Facility (PTF);
- Material procured from an unqualified vendor for fabrication of an evaporator and skid at the PTF;
- Inadequate control of site work by suppliers, including welding with carbon steel filler metal on the stainless steel PTF pit vessels;
- Pipe spools fabricated by commercial quality level suppliers for Important to Safety (ITS) service;
- Design drawings for a PTF ion exchange vessel inconsistent with the as-built configuration of instrument nozzles;
- Loss of material control for coaxial pipe clamshell steel;
- Failure to implement nondestructive examination (NDE) requirements as specified by the Safety Requirements Document (SRD) on a PTF tank ring fabrication;
- National Electric Code (NEC) violations in subcontractor work in the Fuel Oil Pump House (Building 81) and Fire Water Pump Houses (Buildings 84 A/B); and
- Placement of schedule 40 pipe in place of schedule 80 pipe in the north tunnel of the PTF.

After beginning the fieldwork, ORP management also requested the assessors evaluate a situation in which engineering may have specified incomplete weld inspection requirements for coaxial pipe outer shell welds.

Results

The assessors evaluated the events and found BNI had not exhibited a nuclear safety culture that placed equal value on reliable production and operational safety. Specific weaknesses in the nuclear safety culture were poor discipline in procedure compliance, ineffective training processes, weak procedures in some areas, and an inadequate "questioning attitude." BNI's processes did not consistently reward the discovery and reporting of errors. Appendix A provides analyses of each event. Topics discussed in Appendix B, including the issue of incomplete coaxial pipe welding inspections, are additional items the assessors evaluated based on interviews.

Past ORP assessments found BNI had adequate assessment and corrective action management processes; however, ORP and BNI have both identified weak follow-through on corrective actions. For example, a 2004 ORP assessment of BNI corrective action[1] found corrective actions for the dropped tools and materials events were not being implemented. When BNI reevaluated and implemented corrective actions, the frequency of dropped tools and equipment decreased.

Recent BNI root cause analyses have identified nuclear safety culture weaknesses as the root cause of continuing quality and safety issues. Despite identifying these weaknesses, the assessment team noted that BNI had not systematically identified the actions required to significantly change their nuclear safety culture.

Nuclear Safety Culture Weaknesses

The assessment team identified the following specific weaknesses in the nuclear safety culture:

Weak discipline in procedure compliance – The BNI nuclear safety culture does not unambiguously require procedure compliance. As a result, the failure of BNI personnel to follow procedures caused several of the events evaluated by the assessors. For example, engineers designing structural steel for the Analytical Laboratory facility did not follow the BNI procedure for engineering calculations and consequently made significant errors in the design. ORP found inadequate engineering calculations during earlier assessments. The errors in the design of structural steel for the Analytical Laboratory are discussed further in Appendix A of this report.

The assessors concluded management had not done all it could to create an environment that unambiguously promoted procedure compliance. For example, there was no waiver process to accommodate unique situations where verbatim compliance with a procedure was unrealistic or counterproductive.

Managers did not always follow procedures. For example, a Corrective Action Report (CAR) was not initially written to prompt the investigation of a serious electrical safety near-miss event. An electrician failed to follow BNI safety procedures and created a 240-volt, phase-to-phase arc.

[1] A-04-ESQ-RPPWTP-014, "Corrective Action Program Assessment"

While Safety Assurance eventually initiated a CAR, they initially elected not to because they considered the event was simple, and the facts were all known. However, the CAR procedure had no provisions for using these considerations to justify avoiding a CAR. In a healthy nuclear safety culture, managers must set the example of procedure compliance discipline. The failure of BNI to initiate a CAR for the electrical near-miss event is discussed further in Appendix B of this report.

BNI management has recently emphasized to staff and workers the expectation that procedures will be followed. However, this has usually taken the form of exhortations rather than instruction on how to do work correctly.

Ineffective training processes – The BNI nuclear safety culture does not require sufficient training to assure all processes will be executed correctly. In some of the cases evaluated by the assessors, personnel made errors because they did not adequately understand their processes. BNI usually relied on staff and workers to understand BNI processes through required reading of procedures, but this approach did not consistently provide adequate reinforcement of requirements.

The BNI training paradigm relied heavily on required reading, but required reading often results in poor retention. Also, BNI did not measure the effectiveness of training. For the engineers involved in the Analytical Laboratory structural steel event, BNI had provided little more than required reading on BNI engineering procedures and none of the required indoctrination on codes and standards. Had BNI measured the effectiveness of the indoctrination and training they provided these engineers, BNI would probably have detected the training deficiencies.

At the time of the assessment, some organizations were beginning to develop formal training on some processes where there was evidence that required reading had not adequately prepared personnel to perform their work correctly. However, this was not a company-wide change in the training paradigm. While this was a change in approach to training, the assessors found BNI had not identified all of the processes that required formal training to assure adequate performance.

In the assessors view, BNI also should have provided training that focuses on processes rather than just procedures. Several events involved inadequate understanding of the procurement process, including its rationale. For example, in the case of the supplier using carbon steel weld filler material on a stainless steel vessel, engineers contracted the supplier to work onsite when the supplier was qualified only to work at their own facility. The supplier did not have a process for controlling weld filler material away from their manufacturing facility and issued the incorrect material to welders. Adequately trained BNI engineering personnel would have understood not only that suppliers are qualified to work only at specific locations, but also why supplier qualifications are kept so narrow.

The contribution of inadequate training to quality issues is discussed further in Appendix A of this report.

Inadequate procedures in some areas – Because of a weak nuclear safety culture, managers and other personnel faced with unusual or anomalous situations created ad hoc processes outside the

bounds of procedures. While BNI has improved its procedures over the past year or two, lack of procedural direction contributed to some events.

For example, BNI did not provide personnel in engineering with adequate direction on ordering Q-level pipe spools. A written guide failed to provide personnel with adequate instructions on how to correctly order pipe spools. When Engineers ordered a large volume of pipe spools of varying quality level, they found a need to create ad hoc processes that were invisible to oversight. The result was that Q-level pipe spools were ordered from unqualified suppliers. A BNI Root Cause Analysis (RCA) identified the lack of adequate procedures. While BNI identified a lack of adequate procedures as a cause for several events, it was not clear to the assessors BNI had adequately reviewed all of their processes for similar procedural weaknesses. Problems with ordering the pipe spools are discussed further in Appendix A of this report.

Inadequate "Questioning Attitude" – The BNI nuclear safety culture does not promote a "questioning attitude" or adequately reward the discovery and reporting of errors. In some cases BNI managers did not promptly pursue potential quality issues brought to their attention. One example was where a welding engineer questioned why BNI was not performing and/or documenting some in-process weld inspections required by the specified piping code. He brought this question to his management, Field Engineering management, and Field Quality Control management, but no one initiated the required CAR. This type of management response tends to suppress a conscientious worker from raising potential safety concerns. Two months later, when an ORP inspector raised the same issue, BNI initiated a CAR and began performing and documenting the inspections required by the piping code. This issue is discussed further in Appendix B of this report.

BNI occasionally did not exhibit a "questioning attitude" when ORP Site Inspectors raise potential quality issues to BNI management. These ORP oversight personnel said that when they brought quality issues to the attention of BNI management, BNI management would sometimes discount the validity of the issue or institute limited corrective actions without appropriate investigation. The ORP Site Inspectors said that when BNI was unresponsive they would pursue issues and, if necessary, initiate ORP letters to BNI specifying a reasoned response.

Another example was when the ORP Site Inspectors recently raised an issue regarding a breakdown in the BNI welding program. After no effective response, ORP sent a letter documenting six welding issues. ORP Site Inspectors said BNI had been responsive on some of the six issues but had been unresponsive on the need to comprehensively address the causes of the poor welding program performance. BNI's unresponsiveness was a consideration in ORP's decision to initiate the letter. The breakdown in the BNI welding program is discussed in Appendix A of this report.

The ORP Site Inspectors said BNI management has been less resistant to their issues recently, but the level of responsiveness still did not reflect the questioning attitude characteristic of a healthy nuclear safety culture.

Relationship of Issues to Integrated Safety Management System (ISMS) Guiding Principles

Table 1 summarizes how weaknesses in the ISMS guiding principles caused or contributed to the issues. Table 2 summarizes the relationship between the nuclear safety culture characteristics identified by the assessment team and the issues. The two greatest areas of weakness in ISMS guiding principles were "Competence Commensurate with Responsibilities" and "Identification of Safety Standards and Priorities."

Competence Commensurate with Responsibilities – This principle requires that personnel possess the experience, knowledge, skills, and abilities that are necessary to discharge their responsibilities. The assessors found that inadequately trained personnel lacked the necessary knowledge and skills to perform their work correctly. For this reason, the assessors concluded the single greatest improvement BNI can make in improving its nuclear safety culture is in training.

Identification of Safety Standards and Requirements – Several events occurred because safety standards and requirements were not adequately identified. For example, the NDE requirements in standard American National Standards Institute (ANSI)/American Society of Mechanical Engineers (ASME) N690 were not identified in a number of jobs.

Line Management Responsible for Safety – Weakness in this area caused or contributed to several events. This took two forms; managers failing to exercise appropriate oversight of subordinates, and managers relying on oversight organizations to identify their errors. For example, when Q-level pipe spools were ordered from unqualified suppliers, managers expected downstream inspection processes to identify incorrectly ordered material. Also, BNI managers allowed the engineers who incorrectly designed the Analytical Laboratory structural steel to operate in relative isolation and with little management oversight, even though they were new to the project.

Clear Roles and Responsibilities – The assessors did not find lack of clear roles and responsibilities was a problem, provided managers, staff, and workers were adequately trained in how to do their jobs. The assessors concluded this contributed to two events, but in minor ways.

Balanced Priorities – Unbalanced priorities occur most notably when cost and schedule pressure takes priority over safety and quality. Cost and schedule pressure is present on every project and must be balanced. While hearing anecdotes about cost and schedule pressure, the assessors could confirm unbalanced priorities played a major role in only two of the events. In these cases, BNI investigations reported schedule pressure caused work to proceed outside of procedures.

Hazard Controls Tailored to Work Being Performed – The assessors concluded weakness in this area played a major role in two of the events. In meeting Resource Conservation and Recovery Act (RCRA) permit requirements, Engineering and Construction did not tailor controls to assure slope requirements for underground piping would be met. Also, before a supplier used carbon steel weld filler material on a stainless steel PTF pit vessel, Engineering and Acquisition Services failed to tailor controls adequate to assure suppliers would control the use of welding material.

Operations Authorization – The assessors did not consider weakness in this area contributed significantly to any of the events.

Table 1 – Table of Issues and ISMS Guiding Principles

1 = Major Role in Breakdown
2 = Contributing Role in Breakdown

	1 Lab Steel	2 Melter Embed	3 Quality Levels	4 Pipe Slope	5 PT Skid Procurement	6 CS Weld Rod	7 QL Spools	8 IX Nozzle Orient.	9 Clamshell Material Control	10 Vessel Support NDE	11 NEC Violations	12 Schedule 40 / 80 Pipe	13 NDE Code Compliance Clamshells
Line Management Responsible for Safety	2	2	2	2		1	2			1			
Clear Roles and Responsibilities	2												2
Competence Commensurate with Responsibilities	1	1	1			1	1	1	1	1		1	1
Balanced Priorities			1			2	1						
Identification of Safety Standards and Requirements	1	1	1	1		1			1	1	1		1
Hazard Controls Tailored to Work Being Performed			2	1		1							2
Operations Authorization											2		

Table 2 – Table of Issues and Causes

1 = Major Role in Breakdown
2 = Contributing Role in Breakdown

	1 Lab Steel	2 Melter Embed	3 Quality Levels	4 Pipe Slope	5 PT Skid Procurement	6 CS Weld Rod	7 QL Spools	8 IX Nozzle Orient.	9 Clamshell Material Control	10 Vessel Support NDE	11 NEC Violations	12 Schedule 40 / 80 Pipe	13 NDE Code Compliance Clamshells
Procedure Noncompliance	1		1				1	1	1	1		2	1
Inadequate / Weak Procedures / Process			1	1		1	1				1	1	1
Inadequate / Weak Training	1	1	1			1	1		2	2			
Inadequate / Weak “Questioning Attitude”	2		2	2		1	2		2	1	1		1

Issues / Events Key

1. Analytical Laboratory structural steel design and procurement errors.
2. Melter seismic embed welding and procurement issues.
3. Errors in identification of quality levels between upper and lower tier design drawings.
4. Errors in slope of installed piping (regulatory significance).
5. Material procured from unqualified vendor for fabrication of evaporator and skid at the PTF.
6. Inadequate control of site work by suppliers, including welding of stainless steel pipe using carbon steel filler metal on the PTF pit vessels.
7. Pipe spools fabricated by commercial quality level supplier for ITS service.
8. Design drawings for a PTF ion exchange vessel inconsistent with the as-built configuration of instrument nozzles.
9. Loss of material control for coaxial pipe clamshell steel.
10. Failure to implement NDE requirements as dictated by the SRD on PTF tank ring fabrication.
11. NEC violations in subcontractor work in the Fuel Oil Pump House (Building 81) and Fire Water Pump Houses (Buildings 84 A/B).
12. Installation of schedule 40 pipe in place of schedule 80 pipe in the north tunnel of the PTF.
13. Coaxial pipe outer shell welding NDE code compliance.

Definitions of Guiding Principles of Integrated Safety Management

Line Management Responsibility for Safety – Line management is directly responsible for the protection of the public, the workers, and the environment.

Clear Roles and Responsibilities – Clear and unambiguous lines of authority and responsibility for ensuring safety shall be established and maintained at all organizational levels within the Department and its contractors.

Competence Commensurate with Responsibilities – Personnel shall possess the experience, knowledge, skills, and abilities that are necessary to discharge their responsibilities.

Balanced Priorities – Resources shall be effectively allocated to address safety, programmatic, and operational considerations. Protecting the public, the workers, and the environment shall be a priority whenever activities are planned and performed.

Identification of Safety Standards and Requirements – Before work is performed, the associated hazards shall be evaluated and an agreed-upon set of safety standards and requirements shall be established, which, if properly implemented, will provide adequate assurance that the public, the workers, and the environment are protected from adverse consequences.

Hazard Controls Tailored to Work Being Performed – Administrative and engineering controls to prevent and mitigate hazards shall be tailored to the work being performed and associated hazards.

Operations Authorization – The conditions and requirements to be satisfied for operations to be initiated and conducted shall be clearly established and agreed-upon.

Items Opened, Closed, and Discussed

Opened – Findings

A-05-ESQ-RPPWTP-009-F01 – Procedures were not always used by BNI Personnel.

Requirements:

a. 24590-WTP-QAM-QA-01-001, "Quality Assurance Manual," Policy Q-05.1, Section 3.1.1 states, "Activities affecting quality shall be prescribed by and performed in accordance with documented instructions, procedures, and drawings of the type appropriate to the circumstances…"

b. 24590-WTP-QAM-QA-01-001, "Quality Assurance Manual," Policy Q-05.1, Section 3.4.1 states, "All individuals at the project shall comply with the implementing documents. However, when work cannot be accomplished as described in the implementing documents, or accomplishment of such work would result in an unsafe condition or undesirable situation, the work shall not proceed. Work shall not proceed until the implementing document is changed in accordance with the appropriate procedures to reflect safe and correct work practices.

Discussion:

Contrary to this requirement, the assessors found procedural noncompliances across a range of activities and organizations, by managers, staff, and workers. Most of these were identified first by BNI, and BNI had taken steps to address them. However, the assessors considered the range and persistence of the noncompliances represented a weakness in the BNI nuclear safety culture. The following are examples of procedure noncompliances:

a. Engineers failed to follow procedures while developing the design of structural steel for the Analytical Laboratory facility. BNI documented this problem in CAR 24590-WTP-CAR-QA-05-175, Revision 0. BNI also initiated an RCA, but it was incomplete at the time of the assessment;

b. Engineers did not follow procedures when assigning quality levels in design drawings. BNI documented this problem in CAR 24590-WTP-CAR-QA-05-083, Revision 0 and RCA 24590-WTP-RCA-MGT-05-0002, Revision 0;

c. BNI inappropriately used a Material Requisition Supplement instead of a Subcontract to initiate onsite weld repair work. As a result, supplier Northwest Copper, Inc. (NWC), processes were implemented onsite that were not previously approved by BNI, NWC failed to apply adequate weld filler metal material control requirements and used carbon steel weld material on a stainless steel vessel, and BNI oversight of the weld repair activities were not engaged;

d. On September 9, 2005, an electrician caused a 240 volt phase-to-phase arc, when he violated the BNI lock and tag procedure. BNI documented this in CAR 24590-WTP-CAR-QA-05-224, Revision 0; and

e. As described in Finding A-05-ESQ-RPPWTP-009-F03, managers did not always initiate the required CAR when they identified a potential condition adverse to quality.

A-05-ESQ-RPPWTP-009-F02 – BNI did not adequately indoctrinate and train personnel to perform some activities affecting quality.

Requirements:

24590-WTP-QAM-QA-01-001, "Quality Assurance Manual," Policy Q-02.2, Section 3.2.2 states, "Personnel performing or managing activities affecting quality shall receive indoctrination in their job responsibilities … including applicable codes and standards [and] company procedures … before performing work."

Discussion:

Contrary to these requirements, personnel were not always adequately trained to perform activities affecting quality. BNI often relied on required reading and did not measure the effectiveness of training. As a result, inadequately trained personnel did not follow procedures and made errors in their work. The following are examples of inadequate indoctrination and training as well as problems caused by inadequately trained personnel:

a. Two engineers made significant errors in design calculations and design drawings for structural steel for the Analytical Laboratory. BNI documented this event in CAR 24590-WTP-CAR-QA-05-175 and initiated a RCA. Of 28 training requirements for the engineers, 25 were accomplished through required reading. Required reading often fails to provide the understanding of processes personnel need to perform their tasks correctly. Furthermore, BNI did not measure the effectiveness of the required reading training. BNI's safety envelope training failed to effectively provide the required indoctrination in the codes and standards applicable to the engineers' assignments;

b. Personnel who did not understand the procurement process made errors in contracting onsite work by suppliers. For example, they did not understand that suppliers were qualified only to work in the facilities where they had been evaluated. In one case, contracting errors with a supplier caused several significant errors, including welding on a stainless steel vessel using carbon steel weld material. BNI personnel used a Material Requisition Supplement rather than a sub-contract to obtain the supplier's onsite services, but the supplier used was not qualified to work onsite. BNI documented its investigation of this problem in RCA 24590-WTP-RCA-MGT-05-0001, Revision 0; and

c. Engineers who did not understand the applicability of a consensus standard required by the SRD failed to implement it. The engineers' lack of understanding demonstrated a breakdown in BNI's indoctrination and training processes. The standard BNI engineers failed to apply

was ANSI/ASME N690, "Nuclear Facilities; Steel Safety Related Structures for Design, Fabrication, and Erection." BNI documented their investigation of this problem in RCA 24590-WTP-RCA-ENG-05-0001, Revision 0, "Root Cause Analysis – Inconsistent Application of AISC N690 Weld Inspection Requirements."

A-05-ESQ-RPPWTP-009-F03 – BNI managers, staff, and workers were not always prompt in documenting potential conditions adverse to quality as required by the BNI Quality Assurance Manual.

Requirement:

a. 24590-WTP-QAM-QA-01-001, "Quality Assurance Manual," Policy Q-16.1, Section 3.1.1.B, states, "Conditions adverse to quality shall be identified promptly and corrected as soon as possible."

b. 24590-WTP-GPP-QA-201, Revision 14, Step 3.3.2, states, "Upon identification of a potential condition [adverse to nuclear and process safety, operations, quality, industrial safety and health, security, and the environment], initiate a CAR, documenting the condition…"

c. 24590-WTP-GPP-QA-201, Revision 14, Section 2.0, states, "This procedure also applies to issues identified by external agencies (e.g., … State of Washington …) …"

Discussion:

Contrary to this requirement, BNI did not always promptly document and resolve conditions adverse to quality. While Engineering was improving in documenting conditions in CARs, managers said personnel in the field often chose nonconformance reports, construction deficiency reports, and other vehicles to document quality issues. For conditions adverse to quality (as opposed to specific deficiencies) these vehicles do not provide corrective action process features such as extent of condition review and cause analysis. The following are examples of conditions that were not documented with the required CAR:

a. Neither Construction nor Engineering documented a State of Washington, Department of Ecology (Ecology) Notice of Concern in the required CAR. An Ecology inspection on June 22, 2004, identified a condition in which pipe slope requirements of the RCRA Part A permit were not being satisfied, but no CAR was initiated. Ecology later documented their concern in their letter, S. Dahl to R. J. Schepens, ORP, and J. P. Henschel, BNI, "Notice of Concerns for Pipe Slope Requirements for the Underground Waste Transfer Lines," dated October 22, 2004, but BNI still did not initiate a CAR.

b. Field Engineering, Field Quality Control, and Welding Engineering each failed to initiate a CAR when a potential condition adverse to quality in the inspection of coaxial transfer pipe welds was identified. These parties discussed issuing a Field Change Request instead of a CAR, but this was not done either. A welding engineer had identified a potential noncompliance with the implementation of the applicable piping construction code in

welding inspections. An evaluation by the ORP code authority subsequently found that, in fact, the code requirements were not being correctly implemented. The potential condition was identified in July 2005, but BNI did not initiate a CAR until September 29, 2005, in response to the same issue raised by an ORP Site Inspector. This was CAR 24590-WTP-CAR-QA-05-246, Revision 0.

c. Neither Construction nor Safety Assurance initiated the required CAR when an electrician's errors caused a 240-volt phase-to-phase arc. While BNI eventually added this event to an existing CAR, BNI management initially told the assessors and ORP management a CAR was not required. BNI management said a CAR was not required because the facts were known and were straightforward. However, the BNI corrective action procedure did not include an exception for these criteria. This type of response represents a weak nuclear safety culture.

d. When a DOE Site Inspector informally identified a potential condition adverse to quality in NDE inspection of a PTF tank ring beam, BNI did not promptly initiate a CAR. The inspector identified the issue to BNI in April 2005, but BNI did not act to resolve it until July 21, 2005. At that time, they identified the issue by adding it to existing CAR 24590-WTP-QA-05-024, Revision 0.

A-05-ESQ-RPPWTP-009-F04 – BNI had inadequate procedures in some areas.

Requirement:

24590-WTP-QAM-QA-01-001, "Quality Assurance Manual," Policy Q-05.1, Section 3.1.1 states, "Activities affecting quality shall be prescribed by and performed in accordance with documented instructions, procedures, and drawings of the type appropriate to the circumstances…"

Discussion:

Contrary to this requirement, BNI personnel made errors when procedures did not correctly specify how to perform some activities affecting quality. BNI identified events in which errors were caused by procedure inadequacies, and some of these are described below. While BNI has initiated corrective actions for the examples, BNI management did not have enough information to conclude there were no other activities affecting quality inadequately described in procedures.

a. Engineering personnel ordered Q-level pipe spools from unqualified vendors because the applicable engineering guide did not correctly describe the necessary process. This problem was documented in CAR 24590-WTP-CAR-QA-05-083. The causes were analyzed and documented in 24590-WTP-RCA-MGT-05-0002, Revision 0, "Root Cause Analysis for Quality Level Implementation."

b. Engineering and Acquisition Services personnel incorrectly contracted suppliers via purchase orders to work onsite who were qualified only to work in their own facilities. This led to one situation in which a supplier made serious errors in its work. The supplier, NWC, allowed a

subcontractor to use carbon steel weld filler material on a stainless steel vessel and changed the design of the same vessel without authorization. Acquisition procedures were inadequate to prevent the incorrect purchases. BNI documented its investigation of the causes of these problems in 24590-WTP-RCA-MGT-05-0001, Revision 0, "Root Cause Analysis – Controlling Site Work by Suppliers."

Opened – Observations

A-05-ESQ-RPPWTP-009-O01 – One RCA failed to adequately address significant issues.

Discussion:

While most RCAs performed by BNI comprehensively analyzed breakdowns in the quality assurance (QA) program, one missed some important issues. This was 24590-WTP-RCA-MGT-05-0001, Revision 0, "Root Cause Analysis – Controlling Site Work by Suppliers." The assessors identified the following weaknesses in the report:

- The RCA failed to investigate why welding errors occurred in December 2004 after CAR 24590-WTP-CAR-QA-04-092, Revision 0, identified in July 2004 that the supplier was not qualified to perform work onsite.

- The RCA identified a problem with weak knowledge on the part of personnel performing activities affecting quality, but it failed to investigate the training deficiencies that caused them.

A-05-ESQ-RPPWTP-009-O02 – Line organizations sometimes defer responsibility for quality to the QA organization.

Discussion:

The assessors identified a few situations in which line organizations did not fully accept responsibility for the quality of their work. Rather than assuring work was done correctly the first time, they sometimes relied on Field Quality Control, Field Engineering, and oversight organizations to identify and document adverse conditions in their work. The following are examples of situations where responsibility for achieving quality was deferred by line organizations to inspection and oversight organizations.

- During procurement of pipe spools, engineering supervision relied on shop and receiving inspection to stop commercial grade material from being used in ITS service. A BNI RCA identified and documented this issue in 24590-WTP-RCA-MGT-05-0002, Revision 0, "Root Cause Analysis for Quality Level Implementation."

- A Level 2 CAR addressing the event in which schedule 40, rather than schedule 80, pipe was placed in the PTF North Tunnel did not address the process failure that caused the nonconforming condition. This was CAR 24590-WTP-CAR-QA-012, Revision 0, which

only identified emphasizing in-process surveillance as a corrective action. It identified "human error" as a cause, but did not identify the cause of the human error. For example, human error resulting from inadequate knowledge would lead to a different corrective action than an error resulting from a poorly planned installation process.

A-05-ESQ-RPPWTP-009-O03 – BNI should consider developing a waiver process.

Discussion:

In a few situations evaluated by this assessment, BNI personnel chose to deviate from procedures because they believed they were in unique situations not adequately addressed by BNI procedures. BNI did not have a waiver process for procedures, although this is common among other DOE contractors. A waiver process allows one-time deviations from procedures to accommodate unique or unanticipated circumstances. The assessors consider a waiver process is consistent with a strong nuclear safety culture, because it provides an alternative to violating procedures when personnel believe waiting to change a procedure for a unique situation is unreasonable. It is also a strong indication from management that they consider procedure compliance, even if through a waiver, a requirement. While waivers are vulnerable to abuse, setting an appropriately high approval level usually prevents abuse.

A-05-ESQ-RPPWTP-009-O04 – BNI should consider modifying the Quality Assurance Information System (QAIS) database to retain a record of superseded actions and entries.

Discussion:

During the assessment fieldwork, the assessors had difficulty reconstructing some events because information no longer existed in the QAIS database. The QAIS database holds, for example, all of the CAR system data. The assessors found when information in a CAR is superseded, the superseded information is lost. The assessors consider modifying the database to retain this information could aid future RCA and assessment teams who must reconstruct event histories. Sometimes intermediate information in CARs plays a role in events.

Closed

None.

Discussed

None.

Signatures

Samuel A. Vega,
Assessment Team Leader

Patrick P. Carier,
Verification and Confirmation Team Leader

Appendix A
Analysis of Selected Issues

Analytical Laboratory Structural Steel Design and Procurement Errors

Issue:

BNI procured structural steel for the Analytical Laboratory facility that did not conform to the design criteria and the specified codes.

How and When Discovered:

In early July 2005, a new Engineering supervisor was evaluating a vendor's request to modify the design of some structural steel for the Analytical Laboratory facility. The supervisor identified significant errors in the original design. He reported them to Engineering management who evaluated the scope of the issue. On July 13, 2005, Engineering Management placed a hold on further Analytical Laboratory structural design work and on steel shipments.

BNI Response:

BNI investigated the event and found two engineers made calculation errors, provided calculations that did not match drawings, and issued drawings with steel details that did not conform to design criteria and specified codes. BNI issued a CAR[2] and initiated a RCA. The RCA was not complete at the time of the assessment. BNI management relieved the engineers involved of all duties on the project, and the cognizant supervisor resigned.

BNI initially judged the problem was peculiar to the work of the two engineers and the supervisor involved. Among other things, the initial investigation found the engineers had not followed the BNI engineering calculations procedure[3] and did not correctly apply code requirements. BNI checked for errors and made corrections in other work by these individuals. When issued, the RCA report may provide a wider extent of condition analysis and commensurate corrective actions.

ORP Analysis:

The assessors reviewed the engineers' training records and found BNI did not effectively provide the indoctrination in codes and standards required by the BNI Quality Assurance Manual[4]. The assessors also found the majority of the training was required reading. For example, BNI assigned one of the engineers 28 specific training items, but 25 of these were required reading. BNI provided only three formal classroom training courses to the engineers: Hanford General Employee Training, "As Low as Reasonably Achievable" design, and QA Program Overview. In a documented interview conducted by a BNI investigator one of the engineers stated he did not receive any on-the-job training regarding the codes applicable to the WTP. BNI managers

[2] 24590-WTP-CAR-QA-05-175, Rev. 0
[3] 24590-WTP-3DP-G04B-00037, "Engineering Calculations Procedure," Rev. 8
[4] 24590-WTP-QAM-01-001, Rev. 6, "Quality Assurance Manual," Policy Q-02.2, section 3.2.2

said that because the engineers involved were experienced and were licensed as professional engineers, they should have required relatively little indoctrination and training. The BNI manager's response also is an example of a weak nuclear safety culture. Being a professional engineer is only one component required to perform high quality work. Expert knowledge of local work practices and processes are others.

An earlier RCA[5] conducted after the engineering errors were made but before they were discovered identified the problem of a weak technical training program for engineers, particularly in training on the application of codes and standards specific to the WTP. The assessors considered the causes identified in that RCA contributed to these engineering errors.

BNI did not provide the means for the engineers to become fully acclimated to the WTP engineering environment. The engineers were on the WTP project for only a year but were allowed to work in relative isolation during that time. Management placed reliance on their experience and did not provide adequate supervision. For example, the approval of their work did not involve a comprehensive technical review.

ORP found earlier noncompliances with the requirements for controlling, documenting, and implementing design calculations. While BNI reported these were resolved, errors have recurred. An example is ORP Inspection Report IR-01-009, "Design Process Assessment." Findings from this inspection were resolved, but the current problem of errors in Analytical Laboratory structural steel design is one of several examples of recurrence of the earlier Findings.

ORP Event Conclusions:

This occurrence is symptomatic of a weak nuclear safety culture in Engineering. Training, indoctrination, and oversight were inadequate.

Even experienced engineers new to the WTP project require indoctrination on which codes and standards to apply along with application peculiarities specific to the WTP. BNI provided nearly all technical training through required reading, but this was ineffective. BNI did not measure the effectiveness of the training to assure the engineers understood which codes and standards to apply and how to implement them on the WTP.

BNI did not provide adequate supervision. The engineers only checked each other's work, and their work was approved by their supervisor without a serious technical review.

While BNI acted promptly to stop further questionable work, the RCA was slow. The issue was identified in early July 2005, but the RCA was incomplete in mid-October 2005. When an event occurs, management needs prompt feedback to prevent further errors and noncompliances.

Corrective actions from earlier ORP and BNI assessments failed to prevent this event.

[5] 24590-WTP-RCA-ENG-05-0001, Rev. 0, "Root Cause Analysis – Inconsistent Application of AISC N690 Weld Inspection Requirements"

Melter Seismic Embed NDE Issues

Issue:

BNI procured melter seismic embeds for which welding NDE was not correctly performed.

How and When Discovered:

On February 2, 2005, while performing an extent-of-condition review for incorrect application of the NDE requirements of standard ANSI/ASME N690[6] BNI found they had not specified the NDE requirements of N690 to the melter seismic embed vendor. BNI conducted the review as a result of an RCA[7] for similar problems. N690 is a technical standard required by ORP for ITS work on the WTP.

BNI Response:

The BNI RCA identified causes that included lack of understanding of N690, lack of oversight, and an inconsistent application of N690 within Engineering. Corrective actions from the RCA were awareness training on standards and additional oversight. BNI also checked for other standards, codes, and code editions that might be overlooked by engineers. Corrective action from the RCA added a new requirement to explicitly identify critical welds to assure NDE requirements from specified codes and standards are correctly identified. At the time of the assessment fieldwork BNI was still determining the extent of the condition.

The BNI RCA also identified an earlier instance of failure to implement N690 requirements occurring in 2003. BNI had documented this in a CAR[8], but the corrective actions failed to prevent recurrence.

The seismic embeds were corrected using a nonconformance report (NCR) and a CAR[9]. The equipment was fabricated by ABW Technologies, Inc., but the error was in the BNI specification.

ORP Analysis:

The BNI RCA for N690 implementation found BNI had not assured engineers were adequately indoctrinated and trained in the codes and standards to apply to the WTP design. The melter seismic embed NDE issue was an additional example of failure to implement the requirements of N690. Not only were indoctrination and training inadequate, but BNI had not made the standard itself readily available to engineers who were required to refer to it.

BNI appropriately looked for other standards, codes, and code editions that might be overlooked by engineers.

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[6] ANSI/ASIC N690, "Nuclear Facilities; Steel Safety Related Structures for Design, Fabrication, and Erection."
[7] 24590-WTP-RCA-ENG-05-0001, Rev. 0, "Root Cause Analysis – Inconsistent Application of AISC N690 Weld Inspection Requirements"
[8] 24590-WTP-QA-CAR-03-162, Rev. 0
[9] 24590-WTP-QA-CAR-05-024, Rev. 0

The BNI corrective action system failed to assure corrective action effectiveness for the 2003 CAR that identified failures in implementation of N690.

ORP Event Conclusions:

This occurrence is symptomatic of a weak nuclear safety culture in Engineering. Engineering did not systematically assure engineers understood what unusual codes, code editions, or code requirements were to be applied to the WTP. The BNI Quality Assurance Manual[10] required BNI to indoctrinate personnel in code requirements, but BNI's training and indoctrination process for engineers was inadequate. Also, BNI's management and independent assessment processes failed to recognize engineers were not being adequately indoctrinated with respect to the application of the correct codes and standards.

Recurrence of failures to implement N690 after the 2003 CAR corrective actions indicates weakness in the corrective action system, at least during the 2003-2004 timeframe.

Errors in Identification of Quality Levels between Upper and Lower Tier Design Drawings

Issue:

Engineering issued drawings with incorrect quality level assignments.

How and When Discovered:

On May 13, 2005, BNI identified an adverse trend in that 13 CARs issued between March and May 2005 documented errors in quality level assignments.

BNI Response:

A BNI RCA[11] investigated the issue, identifying as a root cause that the engineering culture did not emphasize verbatim compliance with procedures. The RCA said BNI engineers came from various industry backgrounds, and many engineers had never been exposed to a culture emphasizing verbatim compliance to procedures. As a contributing cause, the RCA identified weaknesses in how BNI engineering procedures correlate quality levels between upper and lower tier drawings.

The RCA found that engineers issued lower tier drawings knowing the quality level assignments conflicted with those in upper-tier drawings. Because of schedule considerations, engineers did not change the upper tier drawings to reconcile the differences as required by engineering procedures[12,13,14]. The RCA also found the procedure specifying the control of upper tier

[10] 24590-WTP-QAM-01-001, Rev. 6, "Quality Assurance Manual," Policy Q-02.2, section 3.2.2
[11] 24590-WTP-RCA-MGT-05-0002, Rev. 0, "Root Cause Analysis for Quality Level Implementation"
[12] 24590-WTP-3DP-G04T-00905, "Determination of Quality Levels"
[13] 24590-WTP-3DP-G04T-00901, "Design Change Control"
[14] 24590-WTP-3DP-G04B-00046, "Engineering Drawings"

drawings was not sufficiently prescriptive. BNI reported this issue in a Price-Anderson Amendments Act (PAAA) noncompliance report[15].

The RCA recommended several actions to convey and reinforce management expectations for procedure compliance. The RCA's actions were incomplete at the time of the assessment, so the assessment team could not evaluate their effectiveness.

The BNI RCA also recommended specific process changes to increase control of quality level assignments in drawings, including the use of a checklist. It also recommended new procurement and receiving controls to assure non-Q-level material would not be accepted in place of Q-level material.

ORP Analysis:

Engineers made errors when they did not follow procedures. They created ad hoc processes in order to deal with emerging barriers, in part because adequate procedures did not exist for some activities. However, the nuclear safety culture in engineering did not adequately emphasize procedure compliance.

ORP Event Conclusions:

This event is symptomatic of a weak nuclear safety culture in Engineering. The culture did not assure engineers would follow the procedural requirements to align quality levels between drawing tiers. Also, the governing procedures did not adequately describe some of the processes. As a result, engineers devised their own ad hoc processes.

The RCA reflected an emerging recognition within BNI of the need for significant improvement in the nuclear safety culture. However, the corrective actions did not reflect the extent of the initiatives and changes required to achieve the necessary culture change.

Errors in Slope of Installed Piping

Issue:

BNI installed piping runs from the LAW building and the Analytical Laboratory facility to the PTF that did not conform to the slope requirements in the WTP RCRA Part A permit.

How and When Discovered:

BNI's third-party inspection contractor, Caliber Inspection, identified inadequately sloped piping runs in late May 2004, and BNI documented this on May 24, 2004, in an NCR[16]. On June 22, 2004, Ecology conducted an onsite inspection in which they identified issues that some piping

[15] NTS-RP--BNRP-RRPWTP-2005-0003, "Application of Appropriate Quality Levels"
[16] 24590-WTP-NCR-CON-04-0105, Rev. 1

was buried before slope was verified, that slope requirements were not met for some pipe runs, and that the condition was not reported to Ecology within the required five days of discovery.

BNI Response:

BNI did not document a reaction to the Ecology findings until October 12, 2004, when Ecology transmitted a Notice of Concern[17] to BNI and ORP regarding the potential issue that BNI was not satisfying regulatory pipe slope requirements. On October 27, 2004, BNI issued an Occurrence Reporting and Processing System report[18] identifying the Ecology Notice of Concern. However, BNI did not issue the CAR required for issues identified by regulatory agencies[19].

Engineering initiated a Level 1 CAR[20] regarding a pipe slope issue on October 12, 2004. This was one of several Level 1 and 2 CARs documenting specific pipe slope issues, but the assessors did not see any CAR addressing the general problem that regulatory slope requirements and inspection requirements were not being satisfied.

BNI and ORP subsequently met and corresponded with Ecology, resolving their issues. However, BNI found consistently meeting slope requirements for underground lines was technically challenging. In September 2005, Engineering issued a management assessment[21] describing a system for assuring pipe slope requirements would be met. This was the culmination of considerable engineering effort to define and implement processes to reconcile conflicting requirements among piping runs. Among other things, the management assessment recommended changes to the design guides to assure pipe slope values are accurately developed and correctly specified.

ORP Analysis:

BNI Engineering did not anticipate how difficult it would be for the craft to achieve the specified slope. The craft applied tolerances allowed by the piping installation specification, but these sometimes failed to achieve the slope specified in the installation drawings as well as permitting documents. It was Inspection, rather than the craft, who found slope requirements on the drawings were not met.

When the problem was identified in May 2004, BNI did not initiate a CAR to address the full extent of the problem. Again, when BNI received the Ecology letter, they did not initiate the required CAR.

[17] Washington State Department of Ecology letter from S. Dahl to R. J. Schepens, ORP, and J. P. Henschel, BNI, "Notice of Concern for Pipe Slope Requirements for the Underground Waste Transfer Lines," dated October 22, 2004

[18] RP-- BNRP-RPPWTP-2004-0024, "Ecology Notice of Concern on Waste Transfer Line Slopes"

[19] 24590-WTP-GPP-QA-201, Rev. 13, "Corrective Action," section 2.0

[20] 24590-WTP-CAR-QA-04-178, Rev. 0

[21] 24590-WTP-MAR-ENG-05-0011, Rev. 0

ORP Event Conclusions:

This event is symptomatic of a weak nuclear safety culture in Engineering and Construction in that the extent of the issue was not promptly documented in a CAR when it was recognized. Also, they did not follow the procedure requiring a CAR for issues identified by regulatory agencies.

While Engineering could have anticipated the problems the craft would have in achieving the slope requirements in drawings, this did not represent a programmatic breakdown.

Material Procured from an Unqualified Vendor for Fabrication of Evaporator and Skid at the Pretreatment Building

Issue:

A BNI supplier used an unqualified sub-tier supplier to provide ITS equipment.

How and When Discovered:

During a supplier audit of U. S. Tool and Die, Inc., BNI found U. S. Tool and Die was using material from unqualified suppliers for Q-level items it was providing to Framatome, ANP. Framatome supplied Q-level equipment to BNI using products from U. S. Tool and Die. BNI was performing the audit jointly with Framatome as part of supplier oversight activities for establishing a separate direct contract with U. S. Tool and Die to provide other Q-level items. The audit was conducted jointly between Framatome and BNI because both had separate contracts with U. S. Tool and Die to provide Q-level items.

BNI Response:

The BNI supplier corrective action report (SCAR)[22] stopped all shipments from Framatome to the WTP. BNI also documented the event in a PAAA noncompliance tracking system (NTS) report[23]. The BNI SCAR required Framatome to conduct a formal RCA, but the results were not available at the time of the assessment fieldwork.

[22] 24590-WTP-SCAR-QA-05-101, Rev. 0
[23] NTS-RP-- BNRP- RRPWTP-2005-0005, "Failure of a WTP Supplier to Control a Sub-Tier Supplier"

ORP Analysis:

Framatome, a BNI Q-level supplier, subcontracted fabrication work to U. S. Tool and Die, Inc., who used material from suppliers that were not qualified to supply them. BNI qualified Framatome, but Framatome did not properly qualify its supplier. At the time of the assessment fieldwork, Framatome was working to deliver a formal RCA to BNI.

ORP Event Conclusions:

Framatome is a nuclear industry leader with a good reputation, so this occurrence was surprising. Framatome had been evaluated by BNI Supplier Quality and was on the BNI approved suppliers list. The assessors considered BNI was properly addressing the issue and did not consider this represented a breakdown in the BNI QA program.

Welding of Stainless Steel Using Carbon Steel Filler Metal on the PTF Pit Vessels

Issue:

A supplier used carbon steel weld filler material on a stainless steel vessel.

How and When Discovered:

Chicago Bridge and Iron Company N.V., (CB&I), a sub-contractor to a BNI suppler used incorrect weld material on a stainless steel PTF pit vessel. This was in December 2004, more than five months after the problem of uncontrolled on-sight work by suppliers was documented in a CAR[24] (CAR-04-092, July 12, 2004). This issue resurfaced when BNI had inappropriately used a Material Requisition Supplement to obtain the services of the vessel supplier, NWC to perform onsite repairs of welds on the PTF pit vessels. NWC used CB&I to perform the weld repairs because BNI had previously qualified CB&I to perform other welding work onsite. However, portions of this new work (repairing the welds and controlling the weld wire) were performed using NWC process procedures which were never reviewed and approved by BNI to be used onsite. The arrangement was ad hoc and poorly organized, resulting in loss of control of welding filler metal.

BNI Response:

The BNI RCA[25] found that inadequate procedures allowed personnel to use an incorrect contracting method (Material Requisition Supplement rather than a subcontract) to make repairs to the PTF pit vessels.

Prior to CAR 04-092, Engineering had only authorized work for the NDE inspections of some welds. Without informing QA, BNI Engineering informally authorized the supplier's sub-contractor to cut some lifting lugs off one of the vessels (a design change). This prompted CAR

[24] 24590-WTP-CAR-QA-04-092, Rev. 0
[25] 24590-WTP-RCA-MGT-05-0001, Rev. 0, "Root Cause Analysis – Controlling Site Work by Suppliers"

04-092, documenting Engineering had contracted work by an incorrect method. Again, a Material Requisition Supplement was inappropriately used to initiate weld repairs on the PTF pit vessels instead of a subcontract which resulted in work performed using processes not previously evaluated and approve by BNI. BNI told the assessors they believed a September 2004 e-mail message from Acquisition Services[26] should have prevented any further work without a contract for the services of evaluated and qualified suppliers.

When the problem of the incorrect weld rod was identified in December 2004, BNI issued a Management Suspension of Work order[27], a new CAR[28], and a SCAR[29].

The RCA stated there were no training gaps and did not recommend training as a corrective action. However, it identified less than adequate knowledge of work processes for controlling onsite work and insufficient knowledge of the approved suppliers list (ASL) as causes.

BNI elevated CAR 04-092 to Level 4 (requiring an RCA) when the event was found to be reportable into the PAAA NTS system on February 22, 2005.

Following this event, BNI changed the corrective action process to improve monitoring and control of noncompliant conditions. It was changed to require all corrective actions to be completed in less than 90 days (unless extended by senior management) and allow independent closure of individual corrective actions. The purpose of this change was to provide QA with more timely monitoring of corrective actions. QA considered more timely status of resolution on the CAR 04-092 corrective actions would have led them to detect that the Acquisition Services e-mail had not prevented continuation of work under a purchase order.

ORP Analysis:

BNI's RCA correctly identified that procedures failed to prevent personnel from obtaining the services of suppliers to make onsite repairs to equipment. While the supplier was the original fabricator of the equipment, BNI did not qualify them to work onsite. Had personnel understood the restrictions of the ASL, they would have used a subcontract to obtain Northwest Copper's services. This would have, in turn, required qualifying Northwest Copper and its sub-contractors to perform the work onsite, including qualifying their local weld filler material control process.

CAR 04-092, initiated in July 2004, failed to prevent continuation of uncontrolled and, eventually, inadequate work. It did not assure work was proceeding in the context of correct procurement procedures, or that the sub-contractors' activities were reconciled with the ASL. The corrective action process did not stop work by unqualified suppliers working outside the procedural framework. Despite the belief of some BNI personnel to the contrary, the assessors consider the e-mail from Acquisition Services provided little force for instituting control over ongoing work.

[26] BNI e-mail message from Kevin M Chalmers to Thomas Boggess, et al, "FW: CAR04-092 (Proposed Corrective Action Plan)," CCN 109206, dated September 3, 2004
[27] 24590-WTP-SOW-MGT-04-0002
[28] 24590-WTP-CAR-QA-04-240, Rev. 0
[29] 24590-WTP-SCAR-QA-04-137

The RCA also failed to address training inadequacies. It identified knowledge inadequacies as a contributing cause, but did not acknowledge the role of training in assuring personnel were knowledgeable. The BNI training paradigm relied heavily on required reading, but personnel required more formalized training to understand their role in the entire acquisition process. The RCA did not recognize the significance of the training failure because it was framed in the context of the BNI training paradigm.

ORP Event Conclusions:

This occurrence is symptomatic of a weak nuclear safety culture in Construction, Engineering, QA, and Acquisition Services. BNI did not adequately train personnel to understand the acquisition process. Adequately trained personnel would have understood the location-specific nature of ASL listings. This allowed BNI and subcontractor personnel to use an approach to contracting and work processes that lacked adequate controls to assure the quality of the work. Also, procedures were inadequate to assure personnel understood the limitations regarding where evaluated suppliers were permitted to work.

The corrective action process was not adequate to stop work by suppliers not qualified to work onsite, prevent work from proceeding beyond the bounds of the compensatory measures, or prevent the use of incorrect weld filler metal.

The RCA was weak in that it failed to determine the cause of the failure of the corrective action process to stop or otherwise control inadequate work. It also failed to identify the training inadequacy. The assessors considered these important issues, although similar RCA weaknesses were not evident in other RCAs the assessors reviewed.

Pipe Spools Fabricated by Commercial Quality Level Suppliers for Q-Level Service

Issue:

Engineering obtained Q-level pipe spools from non-Q qualified supplier. This occurred when a large number of orders for Q-level pipe spools were placed in a short period of time.

How and When Discovered:

In March 2005 an Engineering management assessment identified anomalies in pipe spool quality levels. Further investigation found 1,572 items with incorrect quality levels.

BNI Response:

The BNI RCA[30] found a written guide provided inadequate direction for personnel choosing suppliers from which to order pipe spools. Also, procedures did not adequately address correlation of quality levels. Personnel were left to determine how to manage a large volume of orders with inadequate technical direction and oversight.

[30] 24590-WTP-RCA-MGT-05-0002, Rev. 0, "Root Cause Analysis for Quality Level Implementation"

The RCA found engineering personnel were creating ad hoc processes to compensate for inadequate procedures to get them through the procurements. The RCA recommended specific process changes to increase control, e.g., a new checklist. It also recommended new procurement and receiving controls to assure non-Q material is not accepted in place of Q material.

ORP Analysis:

With the high volume of orders the probability of error was high, but procedures were weak. BNI's process did not provide adequate control, and there was inadequate oversight of the work.

When personnel had difficulty managing the work within the procedures, they created ad hoc systems to supplement the written guide. Engineering supervision and management assumed that downstream processes (e.g., receiving inspection, shop inspections) would catch any errors.

ORP Event Conclusions:

This occurrence is symptomatic of a weak nuclear safety culture in Engineering. Engineering had not established processes that were sufficiently robust to handle the volume of these procurements. Also, management oversight of the process was inadequate to provide timely information to management that the process was failing. When personnel executing processes or their managers recognize procedures are inadequate, a healthy nuclear safety culture would require work to stop and procedures be corrected before continuing work.

A feature of a sound nuclear safety culture is an expectation that work will be done correctly without reliance on inspections to identify and prevent errors. In this case, managers were incorrectly depending on future inspections to catch Engineering's errors.

Design Drawings for a PTF Ion Exchange Vessel Were Inconsistent with the As-Built Configuration of Instrument Nozzles

Issue:

Instrument nozzles on the ion exchange vessel were different than described in the final drawing.

How and When Discovered:

Problems with the vessel instrument nozzles were documented in a nonconformance report[31] by a field quality control inspector on June 30, 2005. However, the inspector was referring to the purchase order drawing rather than the as-built fabrication drawing and erroneously reported an error in the nozzle orientation. Engineering subsequently identified a nonconformance in nozzle heights when resolving the nonconformance report.

[31] 24590-WTP-NCR-CON-05-0254, Rev. 0

BNI Response:

A BNI CAR[32] documented that Engineering had not followed design control and procurement procedures in 2003 when they authorized changes to the vessel design. The BNI investigation found the supplier, Harris Thermal, Inc., fabricated the cesium ion exchange vessel in accordance with a fabrication drawing incorporating design changes informally approved by BNI Engineering. During fabrication, engineers informally approved design changes, but Engineering never formalized the changes through the contractual design control process. This process is specified in BNI procedures. The vessel was fabricated in 2003 but was not shipped to the site until 16 months later (December 2004). In the meantime, the BNI engineers involved in the informal communications with the supplier left BNI.

The BNI investigation found the design changes included substituting a level instrument with a different nozzle orientation. The final drawing of the vessel submitted by the supplier to BNI correctly showed the new nozzle orientation, but it did not agree with the as-built lengths of the nozzles. (BNI subsequently accommodated the differing lengths by adjusting field-runs of connecting piping.)

A misunderstanding regarding an issue with nozzle orientation began when BNI performed a comparison of the vessel to the original proposal drawing. The personnel performing the comparison did not know the design had changed, and they did not use the final drawing submitted by Harris Thermal. As a result they incorrectly reported there were errors in the nozzle orientation.

In May 2004, a routine audit of Harris Thermal found significant deficiencies in the Harris Thermal QA program, and BNI issued a SCAR[33]. This was after the vessel was fabricated, but before it was shipped. When problems with the vessel were subsequently identified, BNI concluded they were caused by the same programmatic deficiencies identified by the BNI supplier audit. BNI did not issue an additional SCAR, because they considered the circumstances of the drawing error were captured in the scope of the earlier audit SCAR.

BNI identified the problem of the informal design changes approximately two years after the design changes were made. BNI's corrective actions identified three subsequent training activities[34] for engineers stressing the use of BNI's formal process for transmitting design changes to suppliers. BNI concluded these actions were adequate to prevent recurrence. The assessment team did not identify other examples of this specific type of problem.

ORP Analysis:

BNI engineers did not follow procedures in 2003 when they made changes to the design of the vessel. As a result, some design changes were not formally authorized, but these were not directly related to the NCR. While the engineers were no longer employed by BNI, BNI continues to experience problems with procedure noncompliances in Engineering.

[32] 24590-WTP-CAR-QA-05-177, Rev. 0
[33] 24590-WTP-SCAR-QA-04-042, Rev. 0
[34] CCN 125976, CCN 116407, and CCN 118310

The nozzle issue attracted attention primarily because of the misunderstanding about nozzle orientation.

BNI did not identify corrective actions for the causes of this event, because they believed that they were addressed by corrective actions for other events. However, BNI has since identified more problems with procedure compliance and inadequate procedures in Engineering. BNI did not identify why the engineers did not comply with the design control process, so the assessors could not determine if this was, for example, a training deficiency.

ORP Event Conclusions:

The vessel nozzle problem attracted attention because of a misunderstanding. However, the informal design change correspondence with the supplier reflected a weak nuclear safety culture in Engineering. While the informal correspondence occurred in 2003, weak procedure compliance has persisted, indicating earlier corrective actions were ineffective. BNI CARs and RCAs continued to identify poor procedure compliance discipline.

In cases like this one it is difficult to discern how much of the weak procedure compliance is due to poor procedure compliance discipline and how much is due to inadequate training. Both must be addressed to repair the nuclear safety culture.

Loss of Material Control for Coaxial Pipe Clamshell Steel

Issue:

Coaxial piping was fabricated, placed, and buried using unauthorized material.

How and When Discovered:

In July 2005, a BNI inspector found the material used in the fabrication of some coaxial piping could not be verified. He documented the deficiency in a CAR[35]. The extent of condition analysis for the CAR found anomalies with about 20 joints in coaxial piping. The piping was non-ITS and was associated with the Analytical Laboratory facility.

BNI Response:

In addition to the CAR, BNI initiated a construction deficiency. They stopped the work and evaluated the completed work. The BNI CAR investigation found craft and Field Engineering did not properly document material substitutions while completing joints in the outer shell of coaxial piping. While the piping was non-Q, BNI was still required to document material traceability. In three cases BNI could not account for source of the material they had used in the piping shells. It was necessary for them to dig up these joints and replace the shell segments with the proper material.

[35] 24590-WTP-CAR-QA-05-163, Rev. 0

Craft, supervision, and field engineers were verbally reminded of material control requirements and piping field engineers were reinstructed in the requirements for verification and documentation of material. BNI changed the piping fabrication and installation specification[36] to clarify the requirements for material substitutions in non-Q work.

ORP Analysis:

Neither the craft nor Field Engineering followed the requirements for control of the material. This was because their understanding of control requirements for non-Q material was weak. BNI managers said their evaluation concluded workers did not understand the requirements because training was weak.

Craft and Field Engineering personnel involved in this event had been required to familiarize themselves with the BNI procedures on their own, and BNI's initial corrective action focused on verbally reminding personnel of requirements. Later, BNI recognized this as a weakness and began preparing formal training for field engineers, quality control inspectors, and some craft. At the time of the assessment fieldwork this training was still in development.

ORP Event Conclusions:

This occurrence is symptomatic of a weak nuclear safety culture in Construction and Field Engineering. While this was non-ITS work, other runs of the same piping (not yet installed) were ITS. Craft and Field Engineering personnel did not understand the requirements for material traceability in non-ITS piping. In a sound nuclear safety culture, personnel understand procedures and comply with them. Management provides appropriately formal training in their tasks to assure they understand the processes for which they are responsible.

BNI management recognized belatedly their need for a new approach to training. At the time of the assessment BNI was developing new training, but it was narrowly focused.

Failure to Implement NDE Requirements as Dictated by the SRD on the PTF Tank Ring Fabrication

Issue:

BNI did not identify the correct NDE requirements for PTF tank ring beam welds.

[36] 24590-WTP-3PN-PS02-00057, "Addition Material Change Requirements"

How and When Discovered:

An ORP Site Inspector identified this issue informally to BNI in April 2005, but BNI did not initially respond. When the ORP Site Inspector continued to pursue the issue, BNI convened a meeting on July 21, 2005, to document the issue and a plan for resolution.

BNI Response:

BNI Engineering, Construction, Field Engineering, and QA representatives met with the ORP Site Inspector on July 21, 2005. They explained that when responsibility for the design of tank ring beams was transferred from the structural discipline to the mechanical discipline, mechanical discipline engineers changed the design of some welds. However, they failed to recognize and apply the NDE requirements of N690 to the welds.

BNI added this issue to the existing CAR[37] addressing failures in application of ANSI/ASME N690[38] NDE requirements. They considered this was another example of failure to apply the requirements of N690 that were addressed previously in an RCA[39]. BNI considered the programmatic causes were addressed in the CAR and RCA, and specific issues with the tank ring beam welds were addressed through a series of NCRs.

ORP Analysis:

When the ORP Site Inspector raised the issue, Engineering was slow to respond. Positive action did not begin for several months.

As discussed in "Melter Seismic Embed Welding and Procurement Issues," above, BNI did not apply the requirements of standard N690 in a number of places where it was required. BNI management did not train or indoctrinate many engineers on applying the standard on the WTP, nor did they assure that its requirements were uniformly implemented.

ORP Event Conclusions:

This occurrence is symptomatic of a weak nuclear safety culture in Engineering. BNI Engineering was slow to respond to the ORP Site Inspector's concern, reflecting lack of a "questioning attitude." Also, BNI Engineering was not assuring all engineers were adequately indoctrinated on which and how codes and standards were to be applied to the WTP design. Adequate indoctrination and training is an important feature of a nuclear safety culture.

[37] 24590-WTP-CAR-QA-05-024, Rev. 0
[38] ANSI/ASIC N690, "Nuclear Facilities; Steel Safety Related Structures for Design, Fabrication, and Erection."
[39] 24590-WTP-RCA-ENG-05-0001, Rev. 0, "Root Cause Analysis – Inconsistent Application of AISC N690 Weld Inspection Requirements"

NEC Violations in Subcontractor Work in the Fuel Oil Pump House (Building 81) and Fire Water Pump Houses (Buildings 84 A/B)

Issue:

Electrical work performed by a subcontractor did not conform to the NEC.

How and When Discovered:

On March 14, 2005 an ORP inspector identified numerous NEC code violations in the work of a subcontractor[40]. This occurred during an ORP inspection that ORP inspectors incorrectly believed followed the BNI final walk-down of the electrical systems. Due to a misunderstanding, ORP actually conducted the inspection before BNI's final electrical inspection. The four small buildings, including electrical installations, were fabricated offsite and were then relocated to permanent locations onsite. The equipment was non-ITS.

BNI Response:

BNI called the subcontractor back in to correct the deficiencies. At the time of the fieldwork for this assessment, ORP was in the process of re-inspecting the corrected deficiencies.

ORP Analysis:

The ORP inspectors and ORP Site Inspectors said these issues were representative of pervasive NEC code violations in subcontractor work. However, the vast majority of other violations identified by ORP personnel were with temporary equipment. Very little permanent electrical work had been performed at this stage of the project, but the amount of permanent electrical work being performed was increasing steadily.

The ORP inspector said most of the deficiencies identified in this inspection would probably have been identified in the BNI walk-down inspection that should have preceded the ORP inspection. However, these problems support the contention of the ORP Site Inspectors that NEC code violations are pervasive in the work of subcontractors. The assessors agreed with the ORP Site Inspectors that there was little evidence BNI was willing to aggressively address this problem.

ORP Event Conclusions:

The assessment team concluded that weak oversight of subcontractor electrical work reflected nuclear safety culture weaknesses in Construction. While this was non-ITS work, NEC code violations have significant industrial safety implications. The safety implications exist whether the equipment is temporary or permanent.

[40] ORP Inspection Note A-05-AMWTP-RPPWTP-001-105

Installation of Schedule 40 Pipe in Place of Schedule 80 Pipe in the North Tunnel of the Pretreatment Facility

Issue:

BNI craft began installing a pipe run with schedule 40 pipe instead of the specified schedule 80 pipe.

How and When Discovered:

In February 2004, an NDE inspector noted the wrong size pipe in a radiograph he was examining. The craft was welding lengths of pipe together for a pipe run in the north tunnel of the PTF.

BNI Response:

The work was still in process when the problem was found, but BNI was surprised that the work proceeded as far as it had. Missed opportunities to identify the error included traceability verification, clean check, weld fit-up, and visual weld examination. However, this was the first inspection in the process where the inspection could not be performed correctly without detecting the error.

The CAR questioned whether inspections should be re-sequenced to detect this type of problem earlier, but this was not addressed in the corrective actions.

BNI did not generate a nonconformance report, because fabrication was still in process. BNI said they checked for similar conditions in other work.

The BNI CAR[41] attributed the cause to "human error." Field Engineers were briefed on the problem and the need for attention to detail during surveillances. There was no documented corrective action regarding how to prevent recurrence of the error; the corrective actions focused only on detection of similar errors after they occur.

ORP Analysis:

This error was detected when the craft reached the first inspection of the process (radiography) where the inspection would have necessarily identified the error. Therefore, the assessment team found it difficult to assign this occurrence special significance. However, because the error was not noticed during several other inspections and surveillances, it suggests a level of inattentiveness among craft and Field Engineering, even though verification of piping size was not a criterion of the other inspections.

"Human error" is not a useful cause categorization and did not reflect a "questioning attitude." Also, the CAR should have focused first on preventing recurrence of the error, then on error detection. Instead, the corrective actions addressed only error detection.

[41] 24590-WTP-QA-CAR-04-012, Rev. 0

ORP Event Conclusions:

The identification of "human error" as a cause reflects a weak nuclear safety culture. A questioning attitude would prompt managers to ask why the human error occurred. For example, human error occurring due to inadequate training would lead to different corrective action than human error caused by a technically accurate but confusing procedure.

A strong nuclear safety culture emphasizes doing work correctly rather than catching errors after they occur. While error detection is vitally important, the first priority should always be error prevention.

Appendix B
Analysis of Other Issues

Weak Responsiveness to ORP Site Inspector Issues

Issue:

BNI management was sometimes unresponsive to ORP Site Inspector issues.

Discussion:

ORP Site Inspectors told the assessors that when they raised quality issues with BNI management, BNI was often initially unresponsive or would focus only on example conditions. While ORP Site Inspectors believe this is less a problem now than in the past, they said convincing BNI management of the validity of their issues was sometimes difficult. In some cases, ORP Site Inspectors initiated letters to BNI to document issues, because BNI management had been unwilling to fully acknowledge their validity or significance.

For example, the ORP Site Inspectors recently raised an issue regarding a breakdown in the BNI welding program. Although BNI managers agreed with some specific issues, the ORP Site Inspectors found BNI management was reluctant to address underlying causes of these problems. Because of this, ORP documented in a letter six issues supporting the concern. ORP Site Inspectors said BNI had been responsive on some of the six issues but had been unresponsive on the need to comprehensively address the causes of the poor welding program performance. BNI's unresponsiveness was a consideration in ORP's decision to initiate the letter.

ORP Analysis:

The ORP Site Inspectors provided several examples of issues they identified, but where BNI was unwilling or slow to fully address underlying causes. This indicated the lack of a "questioning attitude." When BNI is unresponsive on an issue the ORP Site Inspectors consider important to safety and quality, they must initiate letters to force a BNI response.

ORP Conclusion:

This condition is symptomatic of a weak nuclear safety culture in Construction and Field Engineering. If these organizations possessed a stronger "questioning attitude" they would respond promptly and consistently to issues raised by the ORP Site Inspector and others. This does not mean that BNI management would blindly accept issues without validation, but it does mean they would promptly and appropriately investigate the issues.

Failure to Resolve Coaxial Pipe Welding Inspection Issue

Issue:

BNI did not promptly resolve a significant question regarding the weld inspection process for coaxial piping.

Discussion:

In July 2005, a welding engineer raised a question with Field Engineering and Quality Control regarding how code requirements for in-process inspections of outer coaxial pipe welds were satisfied. The welding engineer said he was concerned that code requirements for specific inspections were not performed and/or documented in accordance with the specified piping code[42]. The issue required prompt resolution because installed piping was to be buried in earth or concrete. The issue was not documented until September 29, 2005, after an ORP inspector raised the same issue. Field Quality Control then issued a CAR[43] and an NCR[44].

BNI personnel involved in the issue said that when the welding engineer first raised the issue there was a verbal agreement that a field change request (FCR) would be an appropriate vehicle for achieving resolution. However, the involved individuals provided different understandings regarding who would initiate the FCR. No one documented a commitment to initiate the FCR, and none was written. The individuals involved in the conclusion said they understood someone else had the action to initiate the next step toward resolution.

The ORP inspector's question prompted a meeting between ORP and BNI on October 13, 2004, concluding that a 5% sample of the coaxial pipe welds required documented inspection of all seven inspection attributes specified in the code. This was consistent with the welding engineer's original question.

ORP Analysis:

Field Quality Control and Field Engineering management said they did not immediately initiate a CAR because they did not believe the issue was a nonconforming condition. They discussed this with the BNI code authority and concluded the approach to inspection they were following satisfied the code requirement. Specifically, in a required sample of welds, it was not necessary to inspect all seven code inspection criteria[45] for each of the sample welds, and it was not necessary to specifically document some of the inspections. The inspection criteria could be distributed over a wider sample of welds, and some inspections could be performed on a surveillance basis.

A CAR would have been an appropriate vehicle for documenting the issue, but an FCR would also have brought the issue to a conclusion had one been written. It was not clear why there was

[42] ASME B31.3, "Process Piping"
[43] 24590-WTP-CAR-QA-05-246, Rev. 0
[44] 24590-WTP-NCR-05-0312, Rev. 0
[45] ASME B31.3, "Process Piping," section 344.7.1

confusion about who had action to document the issue, but all parties allowed work to proceed without initiating a resolution process.

Even after the assessment fieldwork was completed some BNI personnel still considered the code requirement was ambiguous, so that BNI's original inspection practice was appropriate. It is ORP's position that the code is clear, and BNI should have understood it from the outset of the work.

ORP Conclusion:

This issue is symptomatic of a weak nuclear safety culture in Field Engineering, Welding Engineering, and Field Quality Control. A "questioning attitude" would have encouraged promptly documenting the potential condition adverse to quality to obtain speedy resolution.

However, promptly documenting and resolving the issue did not mean it would have necessarily led to the correct resolution, since the BNI code authority considered the existing inspection practice was correct. At the time of the assessment fieldwork, BNI required further work to determine why code authorities in BNI and ORP had such different interpretations of the code.

Welding Program Issues

Issue:

There were weaknesses in the BNI welding program.

Discussion:

A recent ORP letter to BNI[46] identified a concern with a decline in quality associated with WTP welding and inspection. The letter cited six examples of degraded quality, including technical errors in procedures, loss of material control, and incorrectly identified drawings. Also, BNI had incorrectly relied on the wrong standard to justify acceptance of some weldments. BNI was applying the acceptance criteria of Electric Power Research Institute, Palo Alto, CA. NP-5380[47] instead of American Welding Society D1.1[48] which was inconsistent with the requirements of the WTP SRD.

As discussed in Appendix A of this report, the ORP Site Inspectors initiated the ORP letter because they did not believe informal dialog with BNI led to resolution of the issues.

[46] ORP letter from Roy J. Schepens to J. P. Henschel, BNI, "Waste Treatment and Immobilization Plant Weld Program Concerns," 05-WTP-172, dated August 10, 2005
[47] Electric Power Research Institute NP-5380, "Visual Weld Acceptance Criteria," September 1987
[48] American Welding Society, "Structural Welding Code – Steel"

ORP Analysis:

The ORP letter documents weakness in the BNI welding program. BNI should have recognized and acted on the weaknesses before being prompted by ORP.

ORP Conclusion:

This condition is symptomatic of a weak nuclear safety culture in Construction, Engineering, and Field Engineering. BNI should have identified and corrected the issues themselves. Because of a weak "questioning attitude," BNI managers did not respond promptly when ORP Site Inspectors initially brought some of the issues to their attention. Seeking expedience, BNI selected inappropriate standards to justify accepting welds without assuring the criteria were consistent with the SRD. Even when this issue was identified earlier in a ORP Site Inspector surveillance report[49], BNI did not acknowledge and correct the problem. Some issues in the ORP letter also represent recurrence of document control problems previously thought to have been corrected.

A disciplined document control process is a necessary element of a sound nuclear safety culture. BNI previously experienced document control problems associated with rebar placement and piping installation work packages[50]. In the case of rebar, document control problems caused a series of errors in rebar placement. While, corrective actions for these errors were complete and were believed to be effective, the errors recurred in this case. The assessors could not determine if this was a new problem, or if it resulted from ineffective corrective action from the earlier problems.

Failures by Managers to Follow Procedures

Issue:

Managers sometimes do not follow procedures.

Discussion:

When faced with unusual situations, managers sometimes resort to ad hoc processes rather than assuring they are following procedures. The assessors identified several instances where managers did not follow procedures.

- In July 2005 a welding engineer identified a question for Welding Engineering, Field Quality Control, and Field Engineering managers that welds on coaxial pipe were not being inspected as required by the applicable code[51]. The managers involved did not assure a CAR was initiated for this as a potential condition adverse to quality or otherwise assure the issue was documented for resolution. This issue is discussed under the heading, "Failure to Resolve

[49] ORP letter from Roy J. Schepens to J. P. Henschel, "Inspection Report A-05-AMWTP-RPPWTP-002 – On-Location Inspection Report for the Period April 1, 2005, Through June 30, 2005," 05-WTP-132, July 13, 2005
[50] ORP assessment report A-04-ESQ-RPP-WTP-002, "Control of Documents and Records"
[51] ASME B31.3, "Process Piping," section 344.7.1

Coaxial Pipe Welding Inspection Issue," above. When BNI did document and resolve the problem with ORP, ORP found BNI's inspection process did not conform to code requirements.

- In July 2004, QA issued a CAR[52] documenting that suppliers were working onsite without being evaluated and qualified for working outside their own facilities. Engineering, Procurement, and Construction management had established ad hoc processes to allow the suppliers to continue work. However, the ad hoc processes did not provide the supplier evaluation required by BNI procedures to allow the suppliers to perform work outside their facilities. As a result, the work was inadequately controlled leading to significant defective work. This problem is discussed in Appendix A, under "Welding of Stainless Steel Using Carbon Steel Filler Metal on the Pretreatment Facility Pit Vessels."

- On September 29, 2005, a BNI electrician was involved in a near miss to a serious industrial accident, when a series of procedure noncompliances and errors caused a 480 volt phase-to-phase arc. Neither BNI Construction nor Safety Assurance documented this event in a CAR. The BNI corrective action procedure[53] specified that industrial safety events were to be documented in CARs. When the assessors brought this to the attention of BNI Safety Assurance Management, they initially said they did not believe issuing a CAR was necessary. This was because the facts were simple and well understood, but their statement was inconsistent with the requirements of the BNI corrective action procedure. Later, Safety Assurance added this event to an existing CAR[54] that documented a series of industrial accident near-misses that occurred the preceding week.

- A BNI assessment[55] appeared to identify inadequacies in the BNI design verification process, but the issues were not resolved in accordance with the BNI assessment and corrective action procedures. For example, no CAR was issued to document potential conditions adverse to quality implied or stated in the report. The CAR procedure states that potential conditions adverse to quality are to be documented in CARs and be subsequently evaluated for validity[56].

  BNI managers stated that the consultant tasked to lead the assessment refused to follow the BNI assessment and corrective action procedures for documenting the issues. As a result, the report was largely ambiguous and contained misleading statements. Rather than extract the issues from the text and tabulate them for resolution, BNI Engineering issued a path forward document to identify Engineering's actions to resolve recommendations in the report text. BNI managers said they were frustrated by the consultant's intransigence, and considered their approach to have been their most reasonable option. However, this approach did not address the apparently significant conditions adverse to quality discussed in the report. BNI Engineering and QA Managers said they had evaluated the conditions informally and

[52] 24590-WTP-CAR-QA-04-092, Rev. 0
[53] 24590-WTP-GPP-QA-201, Rev. 11, "Corrective Action," section 3.1 and Appendix 1, "Examples of Level 3 or 4 significant conditions adverse to IS&H for which corrective actions shall be documented," second bullet
[54] 24590-WTP-CAR-QA-05-224, Rev. 0
[55] BNI Engineering memorandum from M. A. deLamare to D. J. Pisarcik, "Submittal of Independent Design Verification Assessment," CCN116525, March 18, 2005
[56] 24590-WTP-GPP-QA-201, Rev. 11, "Corrective Action," section 3.2.1.8

determined that none were valid. Therefore, they considered further documentation was unnecessary.

ORP Analysis:

The assessment identified several situations in which managers created ad hoc processes for unusual or anomalous situations. In the case of suppliers working onsite by purchase order, the ad hoc process in effect waived the requirement to formally evaluate and qualify the supplier.

In the cases of failure to initiate CARs for the industrial safety event and the design verification management assessment, managers incorrectly rationalized why they were within the intent of the corrective action procedure without initiating CARs.

ORP Conclusion:

This issue represents a weak nuclear safety culture in BNI. When managers encounter unusual or anomalous situations they sometimes create ad hoc processes rather than see how they can resolve the situation within the context of their procedures.

The example situations indicate weakness in procedure compliance discipline. In a healthy nuclear safety culture, managers set an example for staff and workers by adhering diligently to all procedures. When procedures cannot be followed as written, the process is stopped until the procedure is changed. In some organizations, a formal waiver process allows creation of temporary processes for situations where a procedure cannot be followed, but a procedure change is inappropriate. (High level approval of waivers discourages abuse of the waiver process.) A formal waiver process is consistent with a nuclear safety culture, although it is not a necessary attribute. BNI did not have a formal waiver process.

While blind compliance to procedures can create new problems and inefficiencies, a complex project requires a serious discipline about procedure compliance. This discipline is not reflected in these events.

Appendix C
Personnel Interviewed

S. Akerman, Supplier Quality
J. P. Betts, Project Manager
M.R. Braccia, Engineering
D. J. Canazaro, Supplier Quality
R. D. Crisp, Quality Assurance
M. A. Ehlinger, Quality Assurance
M. D. Ensminger, Field Quality Control
B. G. Erlandson, Environmental Permits
M. D. Evarts, ORP Site Inspection
B. A. Harkins, ORP Site Inspection
D. O. Henry, Quality Assurance
M. W. Hoffman, Engineering
T. J. Hughes, Engineering
D. E. Kammenzind, Quality Assurance
J. W. McCormick-Barger, ORP Site Inspection
D. G. McKenzie, Operations and Support Integration
T. Minor, Field Engineering
C. F. Mitchell, Engineering
D. J. Pisarcik, Engineering
M. D. Robertson, Employee Concerns Program
G. T. Shell, Quality Assurance
S. H. Shyu, Quality Assurance
J. L. Smith, Supplier Quality
T. C. Stewart, Employee Concerns Program
D. O. Wallace, ORP Site Inspection

Appendix D
Documents Reviewed

Corrective Action Reports and Supplier Corrective Action Reports

- 24590-WTO-QA-CAR-03-162, Rev. 0
- 24590-WTP-CAR-QA-04-012, Rev. 0
- 24590-WTP-SCAR-QA-04-042, Rev. 0
- 24590-WTP-CAR-QA-04-092, Rev. 0
- 24590-WTP-CAR-QA-04-178, Rev. 0
- 24590-WTP-SCAR-QA-04-137
- 24590-WTP-CAR-QA-04-240, Rev. 0
- 24590-WTO-QA-CAR-05-024, Rev. 0
- 24590-WTP-SCAR-QA-05-101, Rev. 0
- 24590-WTP-CAR-QA-05-163, Rev. 0
- 24590-WTP-CAR-QA-05-175, Rev. 0
- 24590-WTP-CAR-QA-05-177, Rev. 0
- 24590-WTP-CAR-QA-05-224, Rev. 0
- 24590-WTP-CAR-QA-05-246, Rev. 0

Nonconformance Reports

- 24590-WTP-NCR-CON-04-0105, Rev. 1
- 24590-WTP-NCR-CON-05-0254, Rev. 0
- 24590-WTP-NCR-CON-05-0312, Rev. 0

BNI Manuals and Procedures

- 24590-WTP-3DP-G04B-00037, Rev. 8 “Engineering Calculations Procedure”
- 24590-WTP-QAM-01-001, Rev. 6, “Quality Assurance Manual”
- 24590-WTP-3DP-G04T-00905, “Determination of Quality Levels”
- 24590-WTP-3DP-G04T-00901, “Design Change Control”
- 24590-WTP-3DP-G04B-00046, “Engineering Drawings”
- 24590-WTP-GPP-QA-201, Rev. 11 and 13, “Corrective Action”
- 24590-WTP-3PN-PS02-00057, Rev. 0 “Addition Material Change Requirements”

Correspondence

- BNI e-mail message from Kevin M Chalmers to Thomas Boggess, et al, “FW: CAR04-092 (Proposed Corrective Action Plan),” CCN 109206, dated September 3, 2004
- Washington State Department of Ecology letter from S. Dahl to R. J. Schepens, ORP, and J. P. Henschel, BNI, “Notice of Concern for Pipe Slope Requirements for the Underground Waste Transfer Lines,” dated October 22, 2004
- BNI Engineering memorandum from M. A. deLamare to D. J. Pisarcik, “Submittal of Independent Design Verification Assessment,” CCN116525, March 18, 2005
- ORP letter from Roy J. Schepens to J. P. Henschel, BNI, “Waste Treatment and Immobilization Plant Weld Program Concerns,” 05-WTP-172, dated August 10, 2005

BNI Assessment Reports

- 24590-WTP-MAR-ENG-05-0011, Rev. 0

Root Cause Analyses

- 24590-WTP-RCA-ENG-05-0001, Rev. 0, "Root Cause Analysis – Inconsistent Application of AISC N690 Weld Inspection Requirements"
- 24590-WTP-RCA-ENG-05-0001, Rev. 0, "Root Cause Analysis – Inconsistent Application of AISC N690 Weld Inspection Requirements"
- 24590-WTP-RCA-MGT-05-0002, Rev. 0, "Root Cause Analysis for Quality Level Implementation"
- 24590-WTP-RCA-MGT-05-0001, Rev. 0, "Root Cause Analysis – Controlling Site Work by Suppliers"

PAAA Noncompliance Tracking System Reports and ORPS Reports

- NTS-RP--BNRP-RRPWTP-2005-0003, "Application of Appropriate Quality Levels"
- RP-- BNRP-RPPWTP-2004-0024, "Ecology Notice of Concern on Waste Transfer Line Slopes"
- NTS-RP-- BNRP- RRPWTP-2005-0005, "Failure of a WTP Supplier to Control a Sub-Tier Supplier"

ORP Assessments

- ORP Inspection Note A-05-AMWTP-RPPWTP-001-105
- ORP Assessment Report A-04-ESQ-RPP-WTP-002, "Control of Documents and Records"
- ORP letter from Roy J. Schepens to J. P. Henschel, "Inspection Report A-05-AMWTP-RPPWTP-002 – On-Location Inspection Report for the Period April 1, 2005, Through June 30, 2005," 05-WTP-132, July 13, 2005
- A-04-ESQ-RPPWTP-014, "Corrective Action Program Assessment"

Miscellaneous

- 24590-WTP-SOW-MGT-04-0002 (Management Suspension of Work)