



## The Deputy Secretary of Energy

Washington, DC 20585

June 12, 2015

The Honorable Jessie H. Roberson  
Vice Chairman  
Defense Nuclear Facilities Safety Board  
625 Indiana Avenue NW, Suite 700  
Washington, DC 20004

Dear Madam Vice Chairman:

Enclosed please find the Department of Energy Annual Report on Nuclear Criticality Safety for fiscal year 2014 which responds to the original reporting requirement as modified by former Chairman Peter S. Winokur in his letter dated October 23, 2013.

The report outlines the actions taken by the National Nuclear Security Administration (NNSA), the Office of Environmental Management (EM), and the Office of Science (SC), in the areas identified by the former Chairman. Actions include staffing, treatment of infractions and non-compliances, responses to past expert panel recommendations, overall performance, and specific expectations. Some highlights from the report are:

- DOE and NNSA offices have been working to identify the underlying reasons for recent staffing declines and have implemented corrective measures. The criticality safety staff at Los Alamos National Laboratory is now larger than at any previous time in the Laboratory's history and Y-12 has successfully stopped attrition.
- The Criticality Safety Support Group (CSSG) has been active in reviewing and advising the DOE sites. Four sites have open corrective actions relative to CSSG recommendations, including Los Alamos, Y-12, the Nevada National Security Site, and Hanford. These site offices have implemented corrective, long term, and continuous improvement plans.
- Relevant DOE sites have implemented criticality safety performance measures. Some of these measures are tied to the formal performance evaluation plan which, in turn, affects award fees. Performance measurers improve the Department's Management practices by providing information about the health and performance of criticality safety programs.

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More detailed discussions of these and other areas are provided in the enclosed report. If you have any questions or need further information, please contact Dr. Jerry McKamy, Criticality Safety Program Manager, Office of the Chief of Defense Nuclear Safety, at (301) 903-7980 for NNSA-related issues; Todd Lapointe, Director, Office of Safety Management, at (202) 586-4653 for EM-related issues; or Joe McBrearty, Deputy Director for Field Operations, Office of Science, at (202) 586-5434 for SC-related issues.

Sincerely,

A handwritten signature in black ink, reading "Elizabeth Sherwood-Randall". The signature is written in a cursive style with a long horizontal flourish at the end.

Elizabeth Sherwood-Randall

Enclosure

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# **2014 ANNUAL REPORT**

**THE DEFENSE NUCLEAR  
FACILITIES SAFETY BOARD  
JANUARY 31, 2015**

## **NUCLEAR CRITICALITY SAFETY PROGRAMS**



**NNSA**  
National Nuclear Security Administration

National Nuclear Security Administration  
United States Department of Energy  
Washington, DC 20585

**Table of Contents**

Summary ..... 3

1. Criticality Safety Staffing ..... 4

2. Infractions, Severity, and Lessons Learned ..... 7

3. Non-Compliances with Requirements ..... 9

4. Criticality Safety Support Group Recommendations ..... 10

5. Evaluation of Overall Performance ..... 11

6. Performance versus Specific Expectations ..... 11

Appendix 1: FY-2014 NNSA Annual Report on Nuclear Criticality Safety Programs.....13

    Attachment 1 Livermore Field Office ..... 14

    Attachment 2 Nevada Field Office ..... 16

    Attachment 3 Los Alamos Field Office ..... 18

    Attachment 4 Sandia Field Office ..... 21

    Attachment 5 NNSA Production Office Pantex ..... 24

    Attachment 6 NNSA Production Office Y-12 National Security Complex ..... 26

Appendix 2 Office of Science, Pacific Northwest Site Office .....31

Appendix 3 FY-2014 Office of Environmental Management Annual Report on Nuclear Criticality Safety Programs.....33

    Attachment 1 CH2M Hill Plateau Remediation Company ..... 35

    Attachment 2 Washington Closure Hanford Company ..... 37

    Attachment 3 Bechtel National, Inc. Waste Treatment and Immobilization Plant..... 39

    Attachment 4 Washington River Protection Solutions LLC, Tank Farms Operations.... 47

    Attachment 5 LATA Kentucky, Paducah, KY ..... 51

    Attachment 6 Fluor-B&W Portsmouth, Piketon, OH..... 53

    Attachment 7 B&W Conversion Services (BWCS) Paducah, KY/Portsmouth, OH..... 55

    Attachment 8 CH2M WG Idaho, LLC, Idaho Cleanup Project..... 56

    Attachment 9 Advanced Mixed Waste Treatment Project Idaho Treatment Group..... 58

    Attachment 10 URS|CH2M Hill (UCOR) ..... 61

    Attachment 11 Isotek ..... 65

    Attachment 12 Wastren Advantage Inc. .... 68

    Attachment 13 Savannah River Nuclear Solutions-Savannah River Site..... 70

    Attachment 14 Parsons ..... 73

    Attachment 15 Savannah River Remediation..... 75

## Summary

A Defense Nuclear Facilities Safety Board (DNFSB) letter dated October 23, 2013, requested that the Department of Energy (DOE) address six specific subject areas related to nuclear criticality safety in its Annual Report on Nuclear Criticality Safety (NCS) Programs. The Board's letter modifies the annual reporting requirement established for closure of DNFSB Recommendation 97-2, *Continuation of Criticality Safety at Defense Nuclear Facilities in the Department of Energy*, which requires Department of Energy to provide a report and briefing on the requested subject areas for its various nuclear criticality safety programs.

This report summarizes the detailed information provided in the NNSA, Office of Science (SC), and Office of Environmental Management (EM) reports, included as Appendices 1, 2, and 3 respectively. Appendix 1 (NNSA) has six attachments, Appendix 2 (SC) has no attachments, and Appendix 3 (EM) has 15 attachments.

There are no fissile material activities or design activities for fissile material operations underway under NNSA regulation at Savannah River. The Mixed Oxide (MOX) facility is under Nuclear Regulatory Commission (NRC) regulations and licensing. EM is responsible for the design and construction of the Salt Waste Processing Facility.

The DOE Office of Science has only one defense nuclear facility, Pacific Northwest National Laboratory's (PNNL) Radiochemical Processing Laboratory, Building 325. Oversight is provided by the Pacific Northwest Site office. PNNL applies appropriate criticality safety standards, operational performance, and analysis techniques. As shown in Appendix 2, there are no significant criticality safety issues at PNNL.

The points-of-contact for this report are Jerry Hicks, NNSA, 505-845-6287, Dr. Robert Wilson, EM, 303-236-3666, and Gerald Sauve, SC, 509-372-4083.

The DNFSB specified six areas to be addressed in this annual report. A brief summary by specified subject follows.

### **1. Contractor Criticality Safety Staffing**

Contractor criticality safety staffing levels at DOE sites fully support programmatic needs in most cases. Several sites are continuing to add staff to hedge against future staff losses, add capability, or recover from previous staff losses. These sites include the Los Alamos National Laboratory (LANL), the Y-12 National Security Site (Y-12), and the Office of River Protection. The market for criticality safety staff is still a seller's market.

### **2. Infractions, Severity, and Lessons Learned**

The numbers of criticality safety infractions vary widely from site-to-site from zero to over fifty. This variability is largely determined by the variety and pace of operations at a site. There was one infraction reported in Fiscal Year (FY)-2014 as leaving only one robust barrier to criticality in place. (See appendix 3, attachment 1)

### **3. Non-Compliances with Requirements**

The Office of Environmental Management did not find any non-compliances with applicable criticality safety standards. NNSA is aware of instances of non-compliance at two sites, which are in the process of strengthening their programs. Y-12 is addressing a firefighting issue, and LANL continues on the path to rebuilding its program.

### **4. Status of Response to Criticality Safety Support Group (CSSG) Recommendations**

Four sites have open corrective actions relative to CSSG recommendations. LANL has a long-term program improvement plan to address CSSG recommendations and other identified deficiencies. Three recommendations remain open at LANL (appendix 1, Attachment 3). Y-12 has an action plan to close findings from the fourth quarter FY-2013 review done there (appendix 1, attachment 6). The Nevada National Security Site (NNSS) has an open recommendation regarding excess reactivity controls on Godiva (Appendix 1, Attachment 2). Hanford has several open recommendations (Appendix 3, Attachments 3 and 4).

### **5. DOE Evaluation of Overall Performance**

NNSA has one site with excellent performance (Lawrence Livermore National Laboratory), four with solid performance, and one with performance that, while improving, needs significant additional improvement to meet programmatic needs (LANL). We expect the LANL program to fully mature in one to five years. Operations that are subject to readiness reviews will have adequate criticality safety bases. Full support of the desired mission may take longer. EM has one contractor with excellent performance (Oak Ridge Isotek).

### **6. Performance versus Specific Expectations**

All DOE sites with criticality safety programs have implemented criticality safety performance measures. Some of these are tied to the formal performance evaluation plan and affect award fee. Overall, these are serving management well by providing information relative to the health and performance of criticality safety programs.

A summary of the NNSA, SC, and EM detailed reports that address the six specific subject areas referenced in the DNFSB letter of October 23, 2013, follows.

#### **1. Criticality Safety Staffing**

**Current staffing levels, Department of Energy's assessment of whether staffing levels are adequate, existing plans to address staffing vacancies, and any compensatory measures taken in response to staffing shortages**

The NNSA and EM contractors in general have difficulty hiring and retaining qualified criticality safety staff. SC has had less difficulty due to a smaller and more stable workload. This includes the development path of hiring recent graduates and training them in criticality safety.

## Annual Report on DOE Nuclear Criticality Safety Programs

In the NNSA, LANL and Y-12 report shortages in staffing levels and hiring efforts underway for criticality safety staff. Livermore, Nevada, Sandia, and Pantex have sufficient staff to meet programmatic needs.

LANL is in the second year of a multi-year effort to rebuild its staff and criticality safety support capability. Experienced subcontractors are contributing to this effort. The criticality safety staff at LANL is currently larger than at any previous time in the Laboratory's history. While still relying on experienced sub-contractors, a senior experienced criticality safety engineer has joined the LANL staff. Two experienced staff members have recently joined from other laboratories.

Y-12 experienced some staff loss in FY-2012 and FY-2013, and took action to retain staff, successfully stopping the attrition. Hiring efforts are underway.

PNNL Building 325 has sufficient staff to meet programmatic needs.

All EM field sites currently report sufficient staff to meet programmatic needs. The Oak Ridge Office is monitoring the UCOR contractor for signs of needing additional staff and the Savannah River Office considers the Savannah River Nuclear Solutions contractor Criticality Safety staffing level is marginal to support programmatic needs. The Office of River Protection is monitoring the newly hired Hanford Tank Waste Treatment and Immobilization Plant (WTP) Criticality Safety staff to verify development of capability.

Table 1 below shows the contractor criticality safety staffing levels at each of the sites, and the line management assessment of whether the staffing level is adequate. Mission work has been slowed or delayed at both Y-12 and LANL operations due to previous staffing shortages.

Site	Contractor criticality safety staff, end of Fiscal Year 2014	Meets programmatic needs*
LLNL	9 technical, 2 administrative	Yes
NNSS	3 technical, 1 manager	Yes
LANL	24, (6 part time) 10 in training	No. Understaffed per staffing plan but aggressively rebuilding towards the projected need of 20.
SNL	7 (about 2 Full-time Equivalent (FTE))	Yes
Pantex	2	Yes

Annual Report on DOE Nuclear Criticality Safety Programs

Table 1: Contractor Criticality Safety Staffing		
Site	Contractor criticality safety staff, end of Fiscal Year 2014	Meets programmatic needs*
Y-12	26 FTE	No. A Shortage of ~12 FTE exists relative to identified work scope proposed in FY-2015. Y-12 is actively hiring 10 new NCS engineers, 3 have already been hired. General improvements were noted from FY-2013.
Uranium Processing Facility	5 from Y-12 prime contract 24 subcontract Approximately 25 FTE	Yes
PNNL (Office of Science)	1 Manager, 2 Criticality Safety Analysts, 2 Criticality Safety Engineer Representatives	Yes
Richland CHPRC	2 Criticality Safety Engineers, 2 Criticality Safety Engineers in training, 2 Criticality Safety Engineers contracted	Yes, but compensatory measures include additional contract and cross-trained criticality safety representative (CSR) support.
Richland WCH	2 part-time Criticality Safety Engineer/Criticality Safety Representatives (combined qualification) About 0.75 FTE	Yes
River Protection WTP (Bechtel)	1, plus 4 in training	Yes
River Protection Tank Farms (WRPS)	1 manager, 1 qualified, 1 in training	Yes
PPPO Paducah-LATAKY	0.2 FTE	Yes
PPPO Portsmouth- Fluor B&W Portsmouth (FBP)	8	Yes
PPPO BWCS	1 part-time	Yes
Idaho CH2M WG	1 manager, 1 full time, 1 part time	Yes



Annual Report on DOE Nuclear Criticality Safety Programs

Table 1: Contractor Criticality Safety Staffing		
Site	Contractor criticality safety staff, end of Fiscal Year 2014	Meets programmatic needs*
Idaho BWXT Idaho AMWTP	4 (3 FTE)	Yes
Oak Ridge UCOR	4 FTE	Yes, but DOE monitoring
Oak Ridge Isotek	2 qualified, 1 in training, 1 part time	Yes
Oak Ridge (ORO) Transuranic Waste Processing Center TWPC (WAI)	1 manager, 3 part-time	Yes
Savannah River SRNS	24 (12 fully qualified Senior Engineers; 8 fully qualified Engineers; 3 in training, 1 criticality safety technician)	Yes (Marginal)
Savannah River- Parsons	1 plus 1 part-time	Yes
Savannah River - SRR	1 plus 2 part-time, 2 in qualification	Yes
* Staff is considered sufficient if sufficient qualified staff exist to support long-term programmatic needs.		

**2. Infractions, Severity, and Lessons Learned**

**The number of criticality safety infractions, the severity of these infractions, and any lessons learned in response to significant infractions**

Infractions are graded in a similar but not identical manner across the DOE. A level 1 is usually listed as an accident, and 2 is usually a near miss. Level 3 would then be a condition with only one barrier to criticality remaining and 4 and 5 lesser issues. Some sites shift this scheme up a level, with level 1 being a near miss. Levels 4 and 5 are usually issues that should be tracked, trends followed, and recurrence prevention applied, but are not particularly severe issues.

The number of infractions at each site is given in Table 2 below.

The notable difference from last year is that several items at Los Alamos are noted as having one control parameter challenged. These were all in paused operations. This reflects increased rigor in interpreting the control sets, and more thorough knowledge of conditions in the facility. Several of these were old issues that were not known, but should have been.

For the NNSA sites, the number of process evaluations for criticality safety, also called a nuclear criticality safety evaluation (NCSE) in many places is given. The variability in the number of infractions in the Table 2 (below) is related to both the number of NCSEs in use at the site and the operational tempo.

Annual Report on DOE Nuclear Criticality Safety Programs

Table 2: Fiscal Year 2014 Infractions and Severity Across the Department of Energy Complex				
Site, Project, or Contractor	Number	No Criticality Safety Barriers Challenged	One Criticality Safety Barrier Challenged	Only One Criticality Safety Barrier Remaining
Livermore (~40 NCSEs)	1	1		
Nevada (~6 NCSEs)	1	1		
Los Alamos (~500 NCSEs)	21	13	7	
	One unauthorized operation			
Sandia (~12 NCSEs)	None			
Pantex (1 NCSE)	None			
Y-12 (~100 NCSEs)	56	54	2	
PNNL	None			
Richland - CHPRC	1			1
Richland - WCH	None			
River Protection – Tank Farms (WRPS)	1	1		
PPPO LATAKY (Paducah)	None			
PPPO - FBP (Ports)	9	9		
PPPO - BWCS (Ports)	None			
Idaho CWI	1	1		
Idaho AMWTP	5	5		
ORO - UCOR	11	11		
ORO - Isotek	1	1		
ORO - Wastren	None			
SRS Savannah River - SRNS	4	3	1	
SRS Savannah River - SRR	None			

One obvious lesson, which is not new, and is taught in the DOE criticality safety classes, is that correct application of the double contingency principle does not include acceptance of merely two barriers, and defense in depth is important.

NNSA had one infraction with a lesson learned. At Y-12, a casting furnace was loaded to mass limits without fully considering the density and metallurgy of the alloy to be cast. This resulted in a volumetric overcharge and eventual failure of the molds. Lesson: All of the process parameters, not just the traditional nuclear parameters, are important to safety.

Many of the EM sites experienced non-conformances with criticality safety related controls, but in all cases, at least one or more nuclear criticality safety parameter remained robustly controlled. However, even lower level and defense in depth non-conformances need to be investigated and corrected, as they are usually indicative of a system problem. Many of the EM sites require a root cause review for all non-conformances regardless of the level.

### **3. Non-Compliances with Requirements**

#### **Non-compliances with Department of Energy and American National Standards Institute/American Nuclear Society requirements identified during federal assessments, and any compensatory measures or corrective actions taken to address these non-compliances**

All NNSA sites and contractors use a process to ensure all American National Standards Institute/American Nuclear Society (ANSI/ANS) 8 and DOE criticality safety requirements are followed. All NNSA sites use DOE Standard DOE-STD-1158-2010, *Self-Assessment Standard for DOE Contractor Criticality Safety Programs*.

**Nevada NSTec** completed a corrective action regarding development of criticality safety evaluations per DOE-STD-3007-2007, *Guidelines for Preparing Criticality Safety Evaluations at Department of Energy Non-Reactor Nuclear Facilities*. This closed the last remaining non-compliance.

**Los Alamos LANL** continues to have known weaknesses in providing personnel skilled in criticality safety and operations to serve as advisors to supervisors. Additionally, several internal and external assessments over the last two years have identified weaknesses in clarity and completeness of developed controls, thoroughness of identification of abnormal conditions, and validation of criticality safety codes. These and other identified deficiencies as well as opportunities for improvement have been captured in the LANL Nuclear Criticality Safety Program (NCSP) Management Plan, a long term corrective action and continuous improvement plan, and are being corrected on a prioritized basis. Issues were also identified in the Plutonium Facility connected to conduct of operations, labeling and postings, and implementation of controls. These issues are being managed through the PF-4 Conduct of Operations Improvement Plan and resumption efforts. Operations in the Plutonium Facility were paused in June 2013, and while many operations were resumed, the majority remains paused and will be subject to Contractor and Federal Readiness Assessments in order to restart.

**Y-12** During Consolidated Nuclear Security, LLC (CNS) quarterly assessments to evaluate compliance with programmatic requirements, one finding was identified related to compliance with the DOE O 420.1C, *Facility Safety*, requirement in Attachment 2, Chapter III, section 3.g requiring the coordination of NCS guidelines for firefighting in areas within or near moderator-

controlled areas with firefighting pre-incident plans. The assessment discovered that firefighting pre-incident plans for SNM Vehicles had not been sent to the NCS organization for review and concurrence. Review of the plans revealed that NCS requirements prohibiting the use of water or foam in the vehicles' cargo area were not implemented in the pre-incident plans. Corrective actions are underway to incorporate the NCS requirements into the pre-incident plans.

**PNNL** PNNL uses a process to ensure all DOE and applicable ANSI/ANS 8 criticality safety requirements are followed. PNNL uses DOE Standard DOE-STD-1158-2010, *Self-Assessment Standard for DOE Contractor Criticality Safety Programs*.

**EM** - All EM sites and contractors use a process to ensure all ANSI/ANS 8 and DOE criticality safety requirements are followed. Most use DOE Standard DOE-STD-1158-2010, *Self-Assessment Standard for DOE Contractor Criticality Safety Programs*, on at least a three-year cycle as a tool in this process. None of the EM sites or contractors has uncovered a non-compliance with the ANS-8 standards.

#### **4. Criticality Safety Support Group Recommendations**

##### **The Department of Energy's plans to address recommendations made by the Criticality Safety Support Group, including all open recommendations from previous years**

**Nevada** The Criticality Safety Support Group (CSSG) recommended that reactivity limits for Godiva be removed, as they can only be measured after a pulse occurs. The reactivity limits specified have no impact on safety and are superfluous. These changes should be addressed in the next annual revision to the Documented Safety Analysis (DSA).

**Los Alamos** There are three open CSSG recommendations. Action has been initiated for all, but the actions are not yet complete. The recommendations and status are as follows:

- Eliminate nitric acid (fissile solution) backflow path into a non-favorable geometry that is outside the containment boundary. The engineering modifications were complete in 2013; the criticality safety evaluation of the new configuration is being finalized.
- Criticality Safety Group Staffing and attrition: This issue is being actively managed.
- Sustainable improvements in conduct of operations: This issue is being actively managed through the PF-4 Conduct of Operations Improvement Plan.

**Y-12** The CSSG issued an assessment report in early FY-2014. A number of issues were identified, and an action plan is in place. For details, please see Appendix 1, attachment 6.

**Hanford, WTP & Tank Farms** The only site-specific Criticality Safety Support Group reports and recommendations are for the Hanford Tank Farms (2009) and the Waste Treatment and Immobilization Plant (2008 and 2009). The Tank Farm contractor has completed the revised documentation recommended by the CSSG. The recommendations for the Waste Treatment Plant were largely overtaken by events and a subsequent (2013) review team, largely CSSG members, provided numerous recommendations and the issues raised are now being incorporated into a plan developed by the contractor.

## 5. Evaluation of Overall Performance

### **Department of Energy's evaluation of the contractors' performance in the functional area of criticality safety, consistent with DOE Order 226.1 B, *Implementation of Department of Energy Oversight Policy***

NNSA has one site with excellent performance, four with solid performance, and one with performance that, while improving, needs significant additional improvement to meet programmatic needs. More detail is provided in the attachments to Appendix 1.

The performance at LANL is not yet commensurate with NNSA expectations. However, significant improvement has been demonstrated. The plutonium facility remains under an operational pause that is being lifted in steps as corrective actions are implemented.

The performance at PNNL is acceptable. Details are further explained in Appendix 2.

Although most EM site contractors had performance issues, all were deemed by the department to be addressing the discrepancies. Details are further explained in attachments to Appendix 3.

## 6. Performance versus Specific Expectations

### **Department of Energy's evaluation of the contractors' success in meeting site-specific performance expectations (e.g., Performance Evaluation Plans and Performance Based Incentives) related to criticality safety**

**Livermore** The LLNL Criticality Safety continues to be above expectations with only one criticality safety infraction for the year. Additionally, LLNL continues its process of quarterly criticality safety inspections on all operations with significant quantities of fissile materials. LLNL dedicated significant personnel resources to provide LANL with criticality safety technical assistance in support of the NNSA mission. LLNL provided continued technical support to the American Nuclear Society national consensus standards effort for criticality safety. LLNL Criticality Safety also submitted for approval a revised Criticality Safety Program Description Document to reflect the revised DOE O 420.1C. This Criticality Safety Program Description Document was approved by the NNSA Livermore Field Office.

**Nevada** In coordination with LANL and LLNL, NSTec has implemented an Integrated Criticality Safety Program that supports multiple contractors at NNSS. This integration has led to an improved criticality control review process. The NSTec criticality safety program has a greatly improved field presence in support of operations.

**Los Alamos** The need for improvements in Nuclear and High Hazard Operations is reflected in the site's FY-15 Performance Evaluation Plan. This will include an evaluation of Conduct of Operations and Criticality Safety Program implementation. In addition, the plan includes specific performance expectations on successful execution of readiness assessments for paused operations. These assessments include focused review of NCSP and Conduct of Operations.

**Sandia** The federal assessments performed in FY-2014 were the four facility walkthroughs and a self-assessment of the Sandia Field Office (SFO) criticality safety oversight program using the

## Annual Report on DOE Nuclear Criticality Safety Programs

Criteria Review and Approach Documents from the NNSA Biennial Review. Since there were no deficiencies, no corrective action plans (CAPs) were required. For the four facility walkthroughs, there were several observations identified and resolved. A fifth facility walkthrough and assessment was completed for a facility that is below threshold quantities. Sandia is considering using a criticality safety index (CSI) control for staging of materials in this fifth facility. Sandia criticality safety program performance meets expectations.

***Pantex*** Performance indicators are tailored to the nature of the Pantex operations. They include staffing levels, walk downs of fissile operations by criticality staff, and management self-assessments. All of these were done as expected, and no deficiencies were found.

***Y-12*** The contractor's engineering programs (e.g., nuclear safety, criticality safety, and other related programs) continue to effectively and safely support Y-12 production schedules. The contractor continues to implement two vital improvement programs. First, the Documented Safety Analysis Improvement Plan (DSAIP) has resulted in continuous improvement of authorization packages submitted to NNSA Production Office (NPO). This has allowed NPO to review and approve authorization basis packages on a timely basis. The second initiative undertaken by CNS is the Nuclear Criticality Safety (NCS) Implementation Review Action Plan (IRAP). The NCS IRAP has completed the second phase at Y-12 and developed plans for completion of the final phase of the review in FY-2015.

However, the contractor was less than successful in some aspects of nuclear safety and engineering programs. Collectively, the noted issues indicate to the field office systemic problems in the contractor's approach to work. The overall grade was "Meets Expectations."

***PNNL*** The performance at PNNL continues to meet expectations. No reduction of award fee for criticality safety performance was made for FY-2014. Details are further explained in Appendix 2.

***EM*** - Some EM contractors have nuclear criticality safety related expectation in the contract for fee determination. These include Washington River Protection Solutions, Fluor-B&W Portsmouth, CH2M WG Idaho, Idaho treatment Group, Savannah River Nuclear Solutions and Savannah River Remediation. Some lost fee as a result. See Appendix 3 for details.

**Appendix 1: FY-2014 NNSA Annual Report on Nuclear Criticality Safety Programs**

A Defense Nuclear Facilities Safety Board (DNFSB) letter dated October 23, 2013, requested that the Department of Energy (DOE) address six specific subject areas related to nuclear criticality safety in an Annual Report on Nuclear Criticality Safety (NCS) Programs. The six areas are:

- Criticality Safety Staffing
- Non-Compliances with Requirements
- Evaluation of Overall Performance
- Infractions, Severity, and Lessons Learned
- CSSG Recommendations
- Performance Versus Specific Expectations

The following six attachments summarize these subject areas from each NNSA site, presented by site from west to east as follows:

Attachment	NNSA Office	Site
1	Livermore Field Office (NA-LL)	Lawrence Livermore National Laboratory (LLNL)
2	Nevada Field Office (NA-NV)	Nevada National Security Site (NNSS)
3	Los Alamos Field Office (NA-LA)	Los Alamos National Laboratory (LANL)
4	Sandia Field Office (NA-SN)	Sandia National Laboratories (SNL)
5	NPO	NNSA Production Office Pantex Plant (Pantex)
6	NPO	NNSA Production Office Y-12 National Security Complex (Y-12)

The Livermore Criticality Safety program continues to exceed expectations. The Lawrence Livermore National Laboratory (LLNL) Criticality Safety program was rated as Excellent for FY-2014.

**At a glance:**

Staffing:	9 technical, 2 administrative, 3 part time retirees	Meets programmatic requirements
Infractions:	1, minor	
Non-Compliances:	None	
Criticality Safety Support Group Recommendations:	None	
Overall Performance	Excellent	

**1. Criticality Safety Staffing**

Staffing of the core element of the LLNL Nuclear Criticality Safety Division (NCS) meets programmatic requirements and is relatively stable. The current core staff is comprised of eight engineers (including the division leader), one full-time computer scientist, and two administrative staff. Additionally, three retired computer scientists provide numerical methods support for the LLNL Monte-Carlo methods (funded by the Department of Energy (DOE) Nuclear Criticality Safety Program (NCSP)). All but two of the LLNL Criticality Safety engineers are qualified per the LLNL criticality safety qualification program, which satisfies DOE-STD-1135-99, *Guidance for Nuclear Criticality Safety Engineer Training and Qualification*. One of these two has nearly completed the qualification process and the other is a new hire who recently replaced an engineer who separated from LLNL to go to LANL. Additional separations are anticipated due to retirements and the division is considering hiring new entry level or mid-career individuals. The work of the engineers who have not completed the qualification process is supervised by senior engineers.

The division continues to support Superblock, Radioactive Waste Management, non-superblock programmatic operations with fissionable materials, and Transportation operations. In FY-2014, criticality safety support for Superblock and Radioactive Waste Management operations was funded at 2.3 full-time equivalents (FTEs). The NCS manager has requested that the Laboratory increase this funding level for FY-2015 to 2.5 FTEs. It should be noted that the current technical basis for criticality safety in the Superblock supports Category I operations with significant quantities of fissionable materials. Significant LLNL criticality safety resources are being dedicated to revising and streamlining the technical basis to support efficient Category III operations.

The division also continues to provide support to NNSS facilities, LLNL facilities with fissile materials that are categorized as radiological facilities, and the DOE NCSP program initiatives. During FY-2014, LLNL also provided significant engineering support to the LANL criticality safety program at the request of the LANL Director’s Office.



**Livermore Field Office**

**2. Infractions, Severity, and Lessons Learned**

There was one criticality safety infraction at LLNL in FY-2014. This involved an incorrect posting for a 20 gram metal item. This was noted in the FY-2013 report, but actually occurred in October 2014.

**3. Non-Compliances with Requirements**

There were no non-compliances with DOE or American National Standards Institute / American Nuclear Society (ANSI/ANS) standards identified during federal assessments during FY-2014.

**4. Criticality Safety Support Group Recommendations**

There are no open CSSG recommendations applicable to LLNL.

**5. Evaluation of Overall Performance**

LLNL implementation of Criticality Safety is excellent. FY-2014 contractor walkthroughs (performed quarterly), Basic Annual Reviews of all operations with significant quantities of fissionable material, and the LLNL annual assessment did not result in any significant findings. These results were consistent with LFO operational oversight for FY-2014.

**6. Performance versus Specific Expectations**

LLNL Criticality Safety continues to be above expectations with only one criticality safety infraction for the year. Additionally, LLNL continues its process of quarterly criticality safety inspections on all operations with significant quantities of fissile materials. LLNL dedicated significant personnel resources to provide LANL with criticality safety technical assistance in support of the NNSA mission. LLNL provided continued technical support to the American Nuclear Society national consensus standards effort for criticality safety. LLNL Criticality Safety also submitted for approval a revised Criticality Safety Program Description Document to reflect the revised DOE O 420.1C. This Criticality Safety Program Description Document was approved by the NNSA Livermore Field Office.

The Nevada site criticality safety program has improved in the last two years, and is now compliant.

**At a glance:**

Staffing:	2 technical, 1 manager	Meets programmatic requirements
Infractions:	1, minor	
Non-Compliances:	None	
Criticality Safety Support Group Recommendations:	The Criticality Safety Support Group recommendations for changes to the Godiva controls related to excess reactivity remain open	
Overall Performance	Performance meets expectations.	

**1. Criticality Safety Staffing**

Staffing Levels remain sufficient to support the Nevada National Security Site (NNSS). NSTec currently has 2 full time Senior NCS Engineers and a Nuclear Criticality Safety Program Manager. The NCS engineers are fully qualified per the NSTec program. The position of Criticality Safety Officer is developed but is not expected to be filled in FY15. NSTec has undertaken actions to expand NCS capability and knowledge by assigning the NCS Engineer qualification to several persons with significant Criticality Safety experience, currently working in other positions. The Nevada Field Office (NFO) is monitoring the task performance of NSTec NCS staff to verify that staffing levels remain sufficient to meet programmatic needs.

**2. Infractions, Severity, and Lessons Learned**

One NCS infraction was reported in FY-2014. The infraction involved the lack of material labels on stored fissile materials within packages. The issue was corrected and verified prior to the infraction being closed. The infraction was considered a Level 5 (Minor change from approved conditions or procedures, with no loss of any identified controls and little-to-no increase in risk of a criticality accident) per the approved program and not reportable in the Occurrence Reporting and Processing System (ORPS).

**3. Non-Compliances with Requirements**

In FY-2011, NFO assessed the NSTec level of compliance, effectiveness, and performance associated with implementation of DOE-STD-3007-2007. The results of the assessment indicate that NSTec’s Nuclear Criticality Safety Program implementation of DOE-STD-3007-2007 was unsatisfactory. NFO required NSTec to develop and submit for approval compensatory measures and a corrective action plan (CAP) to address the issues identified in the assessment report. During FY-2014, NSTec submitted NCSEs to the CSRC and had 3 approved, as required by the CAP. The CSRC review of the NCSP, focusing on DOE-STD-3007 compliance, was completed and concluded that NSTec’s program has succeeded in correcting the deficiencies noted in earlier assessments and has demonstrated capability to generate complaint NCSEs. The corrective actions and program improvements described in the CAP have been completed and NSTec has begun the process of requesting NFO concurrence on the actions and removal of the compensatory measures. This final remaining non-compliance from previous years has been closed.

#### **4. Criticality Safety Support Group Recommendations**

Recommendations from Criticality Safety Support Group Tasking 2011-05 regarding application and use of reactivity limits for Godiva are open.

#### **5. Evaluation of Overall Performance**

FY-2014 included a shadow assessment on select DOE-STD-1158 criteria with no major issues. Additionally an oversight assessment was performed in FY-2014 on the closure of a CAP for DOE-STD-3007 compliance. It was found that full DOE-STD-3007 compliance had been demonstrated. It is expected in early FY-2015, upon NFO concurrence, that the program will be fully functioning with no required compensatory measures.

#### **6. Performance versus Expectations**

There are no site-specific performance expectations associated with criticality safety in the contractor's Performance Evaluation Plan.

In coordination with LANL and LLNL, NSTec has put in place an Integrated Criticality Safety Program that supports multiple contractors at NNSS. This integration has led to an improved criticality control review process. The NSTec criticality safety program has a greatly improved field presence in support of operations. The NSTec staff has been involved in National Weapons Laboratory site visits, and the Integrated Program document has been incorporated into the site programs of NSTec, LANL, and LLNL.

Contractor performance meets expectations.

The staff at Los Alamos National Laboratory (LANL) is currently larger than at any time in the Laboratory’s history. While still relying on experienced sub-contractors, two senior experienced criticality safety engineers and a senior criticality safety advisor have joined the LANL staff.

**At a glance:**

Staffing:	Contractor:	24, (6 part time) 10 in training	Understaffed, increasing
Infractions:	Number:		21
	No Criticality Safety Control Parameters Challenged:		13
	One Criticality Safety Parameter Challenged:		7
	Only One Criticality Safety Control Parameter Remaining:		0
	One operation found without an evaluation (EWMO Source Storage and Handling)		
Non-Compliances:	<ul style="list-style-type: none"> <li>• clarity and completeness of developed controls,</li> <li>• thoroughness of identification of abnormal conditions</li> <li>• validation of criticality safety codes</li> </ul>		
Criticality Safety Support Group Recommendations:	<ul style="list-style-type: none"> <li>• Eliminate fissile solution backflow path to non-favorable geometry</li> <li>• Criticality Safety Group Staffing and attrition</li> <li>• Sustainable improvements in conduct of operations</li> </ul>		
Overall Performance	Performance is improving, but still lags expectations		

**1. Criticality Safety Staffing**

The Los Alamos National Laboratory (LANL) is entering the third year of a multi-year effort to rebuild its staff and criticality safety support capability. The criticality staff at LANL is currently larger than at any previous time in the laboratory’s history. The number of qualified full-time permanent staff has increased significantly in the last year from three to eight, but remains well short of the intended target of 20. An additional 10 full-time permanent staff are at various stages of achieving qualification.

Experienced subcontractors continue to augment the permanent staff, including several former LANL analysts. These subcontractors mentor junior staff and perform direct analyses. The hiring plan is being executed aggressively, including the recent addition of two senior analysts, a Division Leader, and a Senior Technical Advisor with extensive criticality safety experience. Significant progress was made in Criticality Safety Analyst (CSA) training and qualification in 2014. Los Alamos National Security, LLC (LANS) conducted a second Criticality Safety “Bootcamp” designed to provide the new hires with enhanced and focused academic training required for qualification as a CSA. As with the 2013 inaugural Bootcamp, this training event was successful in bringing the new hires up to speed with regard to the basics, and put them on a footing to be able to contribute to the success of the group. The CSA qualification standard was revised to include the ability to qualify CSAs-in-training on specific tasks while still pursuing full qualification. These task-specific qualifications allow the staff in training to perform duties for which they have been specifically trained in advance of full qualification. This improves the efficiency of staff utilization and allows the more senior analysts to concentrate on evaluations and mentoring. Current qualification status is included in the Table below.

Staff Numbers	Permanent	Subcontractor	Change This FY
Administrative	3	2	none
Senior Qualified Technical Staff	4 (1 Part Time)	4 (Part Time)	Increase by 4
Qualified Technical Staff	4 (1 Part Time)	2	Increase by 3
Technical Staff In Training	10	0	Increase by 6
Total Technical Staff	18	6	Increase of 13

The field office assessment of contractor staffing is that they are understaffed and underqualified, but aggressively rebuilding.

**2. Infractions, severity, and Lessons Learned**

For FY-2014, there were 36 criticality safety events, of which 15 were considered non-infractions. The 21 infractions consisted of 13 Level 5 infractions, 7 level 4 infractions, and one level 1-Non-Compliance (NC). The number of non-infractions and Level 5 and Level 4 infractions are consistent with previous history (FY-2010 through FY-2013), and are evidence of a sustained level of criticality safety for the facilities. The one level 1-NC infraction was associated with a Fissile Material Operation (FMO) being conducted with sealed sources without criticality safety guidance even though the total combined inventory exceeded the LANL Nuclear Criticality Safety Program (NCSP) threshold values for operations requiring an evaluation. Ninety seven (97) percent of Nuclear Criticality Safety (NCS) events were identified by LANL personnel, up from 80 percent in FY-2013. No significant infractions were identified that yielded noteworthy lessons learned. Several of the infractions in FY-2013 and FY-2014 illustrated known weaknesses in fissile material labeling.

**3. Non-Compliances with Requirements**

LANL continues to have known weaknesses in providing personnel skilled in criticality safety and operations to serve as advisors to supervisors. Additionally, several internal and external assessments over the last two years have identified weaknesses in clarity and completeness of developed controls, thoroughness of identification of abnormal conditions, and validation of criticality safety codes. These and other identified deficiencies as well as opportunities for improvement have been captured in the LANL NCSP Management Plan, a long term corrective action and continuous improvement plan, and are being corrected on a prioritized basis. Issues were also identified in the Plutonium Facility connected to conduct of operations, labeling and postings, and implementation of controls. These issues are being managed through the PF-4 Conduct of Operations Improvement Plan and resumption efforts. Operations in the Plutonium Facility were paused in June 2013, and while many operations were resumed, the majority remains paused and will be subject to Contractor and Federal Readiness Assessments in order to restart.

#### **4. Criticality Safety Support Group Recommendations**

There are three open CSSG recommendations. Action has been initiated for all, but the actions are not yet complete. The recommendations and status are as follows:

- Eliminate nitric acid (fissile solution) backflow path into a non-favorable geometry that is outside the containment boundary. The engineering modifications were complete in 2013; the criticality safety evaluation of the new configuration is being finalized.
- Criticality Safety Group Staffing and attrition: This issue is being actively managed.
- Sustainable improvements in conduct of operations: This issue is being actively managed through the PF-4 Conduct of Operations Improvement Plan.

#### **5. Evaluation of Overall Performance**

Overall, implementation of the LANS Criticality Safety Program continues to exhibit weaknesses in compliance with Department of Energy (DOE) Order 420.1C and national consensus standards.

Specific areas of weakness include:

- operational implementation of controls;
- posting and labeling;
- criticality safety evaluation development and control definition;
- identification of a credible upset in a suite of evaluations resulting in required compensatory measures at the safety basis level; and
- insufficient progress toward resuming paused operations at the plutonium facility resulting in the need for contractor and federal Readiness Assessments for many operations

LANS efforts to improve program performance and compliance in 2014 have included:

- aggressive efforts to meet staffing goals;
- continued execution of a robust training program for criticality safety engineers; and
- ongoing Conduct of Operations and Criticality Safety Program improvements to resume operations at the Plutonium Facility.

Plans are continuously updated and actively managed to ensure that corrective actions generate and sustain a compliant program capable of supporting safe operations. NA-LA notes that performance continues to improve as a result of these efforts, but progress has lagged expectations.

#### **6. Performance versus Specific Expectations**

The need for improvements in Nuclear and High Hazard Operations is reflected in the site's FY15 Performance Evaluation Plan. This will include an evaluation of Conduct of Operations and Criticality Safety Program implementation. In addition, the plan includes specific performance expectations on successful execution of readiness assessments for paused operations. These assessments include focused review of NCSP and Conduct of Operations.

Sandia has a stable program, focused mostly on critical experiments, fuel handling to support the annular core research reactor, and disposition of legacy items.

**At a glance:**

Staffing:	7 technical (2 Full time equivalent)	Meets programmatic requirements
Infractions:	None	
Non-Compliances:	None	
Criticality Safety Support Group Recommendations:	None	
Overall Performance	Meets expectations	

**1. Criticality Safety Staffing**

Seven SNL engineers are qualified to DOE-STD-1135-99, *Guidance for Nuclear Criticality Safety Engineer Training and Qualification*, as Nuclear Criticality Safety Engineers (CSEs). The program has been updated to address American National Standards Institute/American Nuclear Society (ANSI/ANS) 8.26, *Criticality Safety Engineer Training and Qualification Program* requirements. NCS program work is 2 full time equivalents (FTEs) in FY-2014 and is anticipated to remain at 2 FTEs for FY-2015. Staffing is sufficient to meet the level of effort for the next few years considering that SNL has now disposed of most of the fissile material and fewer analyses will be required in each of the next few years.

One concern is the number of SPR CX staff is at the minimum requirement necessary (3) to conduct operations and any future attrition would jeopardize Critical Experiment operations should the supervisor or either of the operators leave. All these activities have been under the oversight of the SFO SPR Facility Representative and SFO criticality safety point-of-contact (CRITPOC).

**2. Infractions, Severity, and Lessons Learned**

None in FY-2014.

**3. Non-Compliances with Requirements**

There were no non-compliances with DOE or American National Standards Institute / American Nuclear Society (ANSI/ANS) standards identified during federal assessments during FY-2014.

**4. Criticality Safety Support Group Recommendations**

There are no open CSSG recommendations applicable to SNL.

**5. Evaluation of Overall Performance**

NCS performance measures were established in 2006. These performance measures established metrics in:

1. Non-Conformances
2. Self-Assessments and Committees
3. Staff Responsibilities and
4. Criticality Safety Assessments

A brief status for FY-2014 follows:

#### Non-Conformances

There were no NCS ORPS reportable occurrences in the last five years for criticality safety.

#### Self-Assessments and Committees

DOE-STD-1158-2002, *Self-Assessment Standard for DOE Contractor Criticality Safety Programs*, has been used extensively to meet ANSI/ANS 8.19 requirements for self-assessments since 2009. In FY-2014, SNL planned nine DOE-STD-1158-2010 self-assessments of facilities representing all the facilities where fissile mass is greater than threshold quantities. The nine self-assessments in FY-2014 represented 100% of the facilities where fissile mass is greater than threshold quantities.

In FY-2014, the Radiological and Criticality Safety Committee (RCSC) met eight times to review criticality safety for facilities within Technical Area V (TA-V) (e.g. Annular Core Research Reactor, Sandia Pulsed Reactor, Auxiliary Hot Cell Facility), and the Sandia Nuclear Criticality Safety Committee (SNCSC) met two times to review criticality safety for facilities outside TA-V (e.g., Manzano Nuclear Facility and the High-Energy Radiation Megavolt Electron Source accelerator). Two or three qualified SNL criticality safety engineers are present at all meetings. SFO personnel have been included in the meeting notices and have attended several meetings. Meeting minutes were developed, reviewed, approved, and distributed and maintained on a server accessible to SFO. The action items are generally documented as being completed in a future set of minutes following the development of the action item.

#### Staff Responsibilities

The NCS training program is based on ANSI/ANS-8.26, *Criticality Safety Engineer Training and Qualification Program*, and an update to the CSE training program is completed. SNL has seven qualified CSEs in FY-2014. Of the seven qualified NCS engineers, six are members of safety committees that require criticality expertise. Six of the seven CSEs have participated or observed the critical experiments at SPR/CX. One of the CSEs is the lead designer and nuclear engineer for the SPR/CX experiments and five of the seven are instructors for the SPR/CX classes. Over 75 NCSEs and fifteen managers from throughout DOE have completed the training at SPR/CX.

#### Criticality Safety Assessments (CSA) (Process Evaluation for Criticality Safety)

There are eight facilities where fissile materials above threshold quantities are stored or processed. Three facilities that are for interim and long storage exclusively use a Criticality Safety Index (CSI) for their materials. Two facilities use a CSA for storing and processing materials and the three remaining facilities use a combination of CSIs and CSAs in their facilities. Prior to operations, the CSAs are developed, reviewed, and approved. There are fifteen active CSAs for SNL. To date, no CSAs have required SFO approval but almost all have been reviewed by the SFO CRITPOC.



**Sandia Field Office**

**6. Performance versus Specific Expectations**

The federal assessments performed in FY-2014 were the four facility walkthroughs and a self-assessment of the SFO criticality safety oversight program using the Criteria Review and Approach Documents from the NNSA Biennial Review. Since there were no deficiencies, no corrective action plans (CAPs) were required for the four facility walkthroughs, although there were several observations identified and resolved. A fifth facility walkthrough and assessment was completed for a facility that is below threshold quantities. Sandia is considering using a criticality safety index (CSI) control for staging of materials in this fifth facility. Sandia criticality safety program performance meets expectations. Sandia criticality safety program performance meets expectations.

The NNSA Production Office (NPO) Pantex Plant is the DOE Site for nuclear weapons dismantlement, maintenance, upgrades (e.g., life extension programs), assembly, and storage of weapons components. Pantex fissile material operations involve encapsulated weapons grade plutonium ( $^{239}\text{Pu}$ ) and highly enriched uranium ( $^{235}\text{U}$ ) components.

**At a glance:**

Staffing	2	Meets programmatic requirements
Infractions:	None	
Non-Compliances:	None	
Criticality Safety Support Group Recommendations:	None	
Overall Performance	Meets expectations	

**1. Criticality Safety Staffing**

The CNS Pantex NCS Program is currently staffed with two qualified criticality safety engineers. Two Criticality Safety Engineers are sufficient to maintain the NCS technical basis document and provide criticality safety oversight for Pantex operations. Both CNS criticality safety engineers have PhDs; one in nuclear engineering (NCS lead) and one in Chemistry. Both NCS engineers are qualified to the CNS Pantex Nuclear Criticality Safety Engineer Qualification program (which meets the requirements of DOESTD-1135-99, *Guidance for Nuclear Criticality Safety Engineer Training and Qualification*). Their workload includes collateral duties for airborne dispersion analysis of nuclear material & hazardous chemicals for design basis events. Their NCS-specific duties include facility walkdowns, personnel instruction, and Management Self-Assessments. If necessitated by operational events, additional NCS support may include using sub-contracts or getting support from other NNSA or DOE Sites. In addition, the Pantex and Y-12 consolidation under one contract is expected to yield operational efficiencies such as shared criticality safety support across the two plants. NPO has determined that the CNS Pantex Criticality Safety Program is effective and staffed to meet the needs of safe Pantex operations.

**2. Infractions, severity, and Lessons Learned**

There have been no known infractions in 22 years at Pantex.

**3. Non-Compliances with Requirements**

None identified.

**4. Criticality Safety Support Group Recommendations**

There are no open CSSG recommendations for Pantex

**5. Evaluation of Overall Performance**

FY-2014 was unique in that the M&O contractors managing the two sites changed during the fiscal year, combining into one contract under a new company. As such, two rating systems were used for the first nine months (October 2013 - June 2014) and the last three (July - September 2014) of FY-2014. NPO was the oversight body for both Y-12 and Pantex in

FY-2014 prior to the new contract. Despite these contractual changes, NPO's oversight mission did not change, nor its evaluation of the contractors in the area of NCS. NPO's fee write-up per the annual Performance Evaluation Plan included discussion of criticality safety in an objective along with nuclear safety and safety system engineering. The discussion focused on Y-12 and is given in attachment 6 to this appendix.

The overall grade was “Meets Expectations”.

## **6. Performance versus Specific Expectations**

The NPO-Pantex NCS Engineer, (dual qualified Nuclear Safety Specialist) is actively involved in reviewing CNS NCS-related work products. The NPO NCS oversight program (at Y-12) monitors CNS Pantex qualified NCS Engineer Staffing, the status of the conduct of planned facility/operations walkdowns, and shadows Contractor management self-assessments involving the CNS NCS Program. Key CNS Pantex metrics considered in this report are:

- 1) Number of qualified NCS Engineers (considered to be a leading indicator);
- 2) Status of NCS Walkdowns against the Annual Walkdown Plan (considered to be a leading indicator); and
- 3) Status of completed NCS-related Contractor Assurance System (CAS) assessments (and their results) compared to the CAS plan (considered to be a lagging indicator)

Pantex met the performance expectations in these areas in FY-2014.

NPO - Y-12 is addressing staffing issues, and has continued effort underway to improve container labeling and the process evaluations for criticality safety. Improvement from last year is evident in all three areas.

**At a glance:**

Staffing, Y-12:	26 FTE	Shortage of ~12 FTE relative to identified work scope proposed in FY-2015. Y-12 is actively hiring 10 new NCS engineers, 3 have already been hired. General improvements were noted from FY-2013.
Staffing, Uranium Processing Facility	5 from Y-12 prime contract 24 subcontract Approximately 25 FTE	Meets programmatic requirements
Infractions:	56	
Non-Compliances:	A non-compliance was identified regarding coordination of criticality safety guidance for firefighting in moderator controlled areas. Corrective actions are underway.	
Criticality Safety Support Group Recommendations:	<ul style="list-style-type: none"> <li>• The safety oversight data and issues are not in compatible formats, and are not readily searchable across disciplines. (Open, still in work)</li> <li>• Obsolete FRAM. Closed</li> <li>• Inconsistent Issue Definitions. Closed.</li> <li>• Safety impacts included in risk determinations for oversight. Closed</li> </ul>	
Overall Performance	Meets expectations	

The NPO Y-12 National Security Complex (NSC) is the DOE production site for enriched uranium (<sup>235</sup>U) fissile material operations including assembly and disassembly of weapons components, chemical recovery, casting, machining, and storage. Fissile material operations at Y-12 involve high equity solutions processing, casting, and a variety of operations dealing with various solid forms ranging from finely divided forms to large parts. Because of the variety, forms, and nature of enriched uranium materials handled at Y-12 combined with extensive administrative control and aged facilities the risk of a criticality accident is non-trivial and requires an intensive Nuclear Criticality Safety (NCS) program implementation.

**1. Criticality Safety Staffing**

The NCS organization at Y-12 supports ongoing operations in nuclear facilities, waste management facilities, onsite transportation, fissile material packaging, and projects involving technology development. An approximately 12-FTE shortage of NCS engineers exists in comparison to the identified work scope proposed for FY-2015. Y12 hired several new NCS engineers in FY-2014 and is in the process of hiring several more. Although some of the new

hires come to Y-12 with relevant experience (beyond a degree), they will require 1 to 2 years to complete the NCS qualification process before they are fully productive. While in training, there will be a demand on existing qualified personnel to support their training. The deficit between the NCS engineer work load and available personnel will exist for several more years before enough personnel can be hired and qualified.

NPO Y-12 reviews and performance feedback in FY-2014 have reported an improvement in the area of NCS staffing as compared to the previous year, which considered this a major concern. This is indicated by the implementation of retention incentives and the arrival of several new engineers. This concern is considered a pressing issue since it will impact needed NCS Program improvements, and requisite staff stability to support ongoing operations. Contractor management has demonstrated a keen interest in reversing this trend, and this issue has been identified as a top management priority for Production.

## **2. Infractions, Severity, and Lessons Learned**

Y-12 did not have any NCS occurrences in the Nuclear Criticality Safety (3C) group. However, there were several occurrences reported under other criteria that were related to NCS. There were two Potential Inadequacies of the Safety Analysis (PISAs) filed in FY-2014 related to NCS; one resulted in a positive Unreviewed Safety Question Determination (USQD) and one negative. The one with a positive USQD (3B-I) was filed in August 2014 and involved the discovery of an error in an engineering analysis used to determine a required response time for a vacuum system active design feature control. The active design feature is designed to sense water and fissile material in a trap and de-energize the vacuum producer before material could overflow the trap and collect in the unfavorable geometry vacuum producer. The error is believed to result in an implemented response time that is greater than the time to overflow the trap and allow material to transfer downstream toward the vacuum producer. The issue is still being evaluated while the vacuum system remains out of service.

The PISA with a negative USQD (3B-3) involved a discrepancy between a Criticality Control Review document and the facility Documented Safety Analysis (DSA). The discrepancy is a control regarding fissile material containers selected for elevation into the DSA but the control had been inadvertently omitted from the facility's DSA. Even though the control was not identified in the DSA, the control was still implemented per the requirements of the Y-12 NCS program.

There were two occurrences related to equipment items with NCS design feature requirements that were confirmed to have suspect/counterfeit fasteners (4C-1). In October of 2013, a 4C-1 occurrence was filed that involved dollies (rolling carts) used to handle and store fissile material and that were confirmed to have suspect/ counterfeit bolts. Some dollies were also discovered to have missing bolts or incorrectly installed bolts. Although there were issues with the bolts, the dollies met the applicable NCS design feature requirements. The extent of condition review from the issue with the dollies led to a separate 4C-1 occurrence in December 2013 involving the discovery of suspect/counterfeit bolts in birdcages used to handle and store fissile material. As was the case with the dollies, the birdcages were compliant with the applicable NCS design feature requirements.

There were two management concern occurrences (10-2) filed in FY-2014 that are related to NCS. One occurrence involved an unsuccessful casting of uranium alloy feed. The material being cast was primarily low uranium content aluminum alloy. The material was loaded into two furnaces for concurrent operation. After lowering one casting stack from a furnace, the crucible split into two halves while cooling. Within minutes, the crucible continued to deteriorate, the uranium-alloy material in the crucible continued to react, and the crucible and its contents progressively crumbled and fell into the spill ring and furnace bowl. Similar issues were noted in a second casting stack although not quite to the extent of the first. Administrative control was established and an NCS deficiency was filed.

The second management concern involved an issue related to controlling the evacuation boundary around a nuclear facility during a power outage that affected the facility's Criticality Accident Alarm System (CAAS). A limiting condition of operation (LCO) was entered that required suspending fissile material handling activities and establishing a restricted access area around the facility that includes an area near a security post serving the Y-12 protected area. During the time when the restricted area was established, a person who needed to exit the protected area was escorted into the restricted area by someone wearing a Personal Radiation Detection Instruments (PRDI). The Technical Safety Requirement (TSR) conditions that allow personnel with PRDIs to enter the restricted area only apply to personnel involved in certain specified activities that do not include people exiting the protected area.

### **3. Non-Compliances with Requirements**

During CNS quarterly assessments to evaluate compliance with programmatic requirements, one finding was identified related to compliance with the DOE O 420.1C requirement in Attachment 2, Chapter III, section 3.g requiring the coordination of NCS guidelines for firefighting in areas within or near moderator-controlled areas with firefighting pre-incident plans. The assessment discovered that firefighting pre-incident plans for SNM Vehicles had not been sent to the NCS organization for review and concurrence. Review of the plans revealed that NCS requirements prohibiting the use of water or foam in the vehicles' cargo area were not implemented in the pre-incident plans. Corrective actions are underway to incorporate the NCS requirements into the pre-incident plans.

### **4. Criticality Safety Support Group Recommendations**

The DOE Criticality Safety Support Group (CSSG) completed tasking 2013-04 on October 11, 2013. The purpose of the review was twofold; to assess the status of NCS control implementation at Y-12 and to review the NPO's oversight program. The CSSG review resulted in finding eight contractor Performance Problems. The contractor responded with a formal corrective action plan on December 5, 2013, and accomplished the items that were within their scope by the end of the fiscal year.

One Finding, two Performance Problems, and three Recommendations were made for NPO. The issues and plans to address them are below.

- The safety oversight data and issues are not in compatible formats, and are not readily searchable across disciplines.

- This issue has been brought up by other parties including the CDNS. Resolution of this issue is tied to development of the new CNS issues management and tracking system, upon which the NPO system will be based.
- The NPO FRAM references the NNSA FRAM that was cancelled before the NPO FRAM was issued.
  - NPO issued a new FRAM (NPO-2.2.2.1) September 9, 2014, that resolves this issue.
- The definitions for the various types of issues in NPO-3.4.1.2.1, Rev. 0, NS&E Issues Evaluation and Management Process are inconsistent with those in NPO-3.4.1.1, Rev. 0, NPO Oversight Process.
  - The NPO level Oversight procedure and policy were revised to resolve this issue.
- Safety impacts should be formally included in the risk determinations for oversight in the NPO oversight process document.
  - The NPO Oversight Planning Process, documented in NPO-3.1.2 was updated on 10/28/14. The risk ranking process includes safety as part of the analysis.
- It is recommended that NPO consider basing the next official staffing analysis on detailed resource requirements for the work required by the safety oversight procedures, with input from senior safety staff.
  - This was also an issue brought up by the CDNS. Actions taken by NPO-10 specifically include a staffing analysis (NPO-10-NSE-10-7-2014). Based on the newly directed NNSA staffing allowances, NPO management is developing an NPO-wide staffing analysis.
- NPO should consider sending the facility representatives to the DOE criticality safety managers' hands-on training class. This should be repeated every few years commensurate with the criticality risk in the areas the FRs support. Note: The NPO FR Qualification Standard includes elements of criticality safety appropriate to the job tasks.
  - NPO continues to evaluate our training requirements, including enhancement of technical skills as we finalize our processes and procedures. This recommendation is still open.

## 5. Evaluation of Overall Performance

FY-2014 was unique in that the M&O contractors managing the two sites changed during the fiscal year, combining into one contract under a new company. As such, two rating systems were used for the first nine months (October 2013 - June 2014) and the last three (July - September 2014) of FY-2014. NPO was the oversight body for both Y-12 and Pantex in FY-2014 prior to the new contract. Despite these contractual changes, NPO's oversight mission did not change, nor its evaluation of the contractors in the area of NCS. NPO's fee write-up per the annual Performance Evaluation Plan included discussion of criticality safety in an objective along with nuclear safety and safety system engineering. The discussion is given below.

Objective SSO-4.2: Successfully execute the nuclear safety, criticality safety, safety system engineering, and other related engineering programs while demonstrating continuous improvement in quality, efficiency, and effectiveness.

The contractor's engineering programs (e.g., nuclear safety, criticality safety, and other related programs) continue to effectively support Y-12 production schedules. The contractor continues to implement two vital improvement programs. First, the Documented Safety Analysis (DSA)

Improvement Plan (DSAIP) has resulted in continuous improvement of authorization packages submitted to NPO. This has allowed NPO to review and approve authorization basis packages on a timely basis. The second initiative undertaken by CNS is the Nuclear Criticality Safety (NCS) Implementation Review Action Plan (IRAP). The NCS IRAP has completed the second phase (i.e., NCS evaluations in Group B) at Y-12, and developed plans for completion of the final phase of the review (i.e., Group C evaluations) in FY-2015.

However, the contractor was less than successful in aspects of nuclear safety and engineering programs. Examples include:

- two pellets of highly enriched uranium oxide were found misplaced in a processing area in Building 9212;
- a bag containing an enriched uranium metal plate was found in Building 9212 in an unauthorized storage area;
- challenges in appropriate staffing of nuclear safety staff;
- comprehensive analysis of issues (extent of condition) reviews to prevent reoccurrence (reference QIMM report);
- timeliness of evaluating potential nuclear safety issues (e.g., “kneeling man” and casting crucibles);
- DAC calculations to support Y-12 operations;
- skull burner;
- glove box fire; and
- grading of NCS infractions.

When taken collectively, all of these issues point to systemic problems in the contractor’s approach to work. The overall grade was “Meets Expectations”.

## **6. Performance versus Specific Expectations**

The NNSA performance evaluation process no longer includes performance-based incentives (PBI’s). Y-12 NCS compliance is evaluated in the performance evaluation plan as detailed in the previous section. Performance meets expectations.



**Appendix 2 Office of Science, Pacific Northwest Site Office**

Summary Table:

Contractor Staffing:	2 senior criticality safety analysts, 2 criticality safety engineers	Meets programmatic requirements
Infractions:	None	
Non-Compliances:	None	
Criticality Safety Support Group Recommendations:	None	
Overall Performance	Meets expectations	

**1. Criticality Safety Staffing**

Pacific Northwest National Laboratory's (PNNL) current staffing levels are sufficient to meet programmatic needs based on DOE's review of the criticality safety program description conducted in Fiscal Year 2014 and PNNL's performance. PNNL maintains a staffing of one program manager, two senior criticality safety analysts, and two criticality safety engineers (representatives). PNNL's succession planning includes training one additional criticality safety analyst as backup capability.

**2. Infractions, Severity, and Lessons Learned**

There were no criticality safety infractions for PNNL in Fiscal Year 2014.

**3. Non-Compliances with Requirements**

An assessment performed for PNSO by nuclear criticality safety staff from EM Headquarters verified the effectiveness of PNNL nuclear criticality safety practices with respect to DOE Orders and the applicable ANSI/ANS standards. No specific instances of failure to meet ANSI/ANS requirements were identified. However, weaknesses were found in policies, administrative procedures, and implementing procedures that need to be improved to ensure that ANS requirements will consistently and effectively be implemented. The weaknesses are symptomatic of a lack of maturity and do not indicate a need for compensatory measures. A corrective action plan will be submitted by PNNL to address the weaknesses.

**4. Criticality Safety Support Group Recommendations**

No CSSG Recommendations were specific to PNNL.

**5. Evaluation of Overall Performance**

The Pacific Northwest Site Office (PNSO) (or PNNL) has determined that PNNL's criticality safety performance is satisfactory based on an established schedule of assessments that is consistent with DOE Order 226.1B. Day-to-day oversight is performed by the PNSO Facility Representative. PNSO performs oversight of PNNL relative to the safety basis. Reviews of Criticality Safety Program related documents are performed by Larry Berg from EM Headquarters. Additionally, the Hanford Site emergency management team evaluated the FY-2014 PNNL criticality response with injury exercise and provided an overall grade of satisfactory. Consistent with the goals of Recommendation 2014-1, *Emergency Preparedness*

*and Response*, a table top Hanford Site exercise was conducted, focusing on a severe event involving multiple facilities, including the 325 Building.

## **6. Performance versus Specific Expectations**

There are no site-specific performance expectations (e.g., Performance Evaluation Plans and Performance Based Incentives) related to criticality safety for PNNL. Day-to-day performance monitoring and assessments are used to determine if any site-specific performance expectations may be needed. At this time, PNNL's criticality safety program has maintained satisfactory performance. General performance based incentives for safety exist and are applied through contract performance evaluations.

PNSO evaluates the contractor's performance in meeting expectations using the Office of Science Performance Evaluation and Measurement Plan. There are no stated expectations specific either to the PNNL or to criticality safety. The contractor's performance is rated for compliance with all applicable rules, orders, and standards. Non-compliances are identified in assessments and oversight activities, evaluated, and reflected in performance scores. No significant failures to meet performance expectations were identified in FY-2014 and no reduction of award fee for criticality safety performance was made. PNNL's criticality safety program has maintained satisfactory performance throughout FY-2014.

### **Appendix 3 FY-2014 Office of Environmental Management Annual Report on Nuclear Criticality Safety Programs**

A Defense Nuclear Facilities Safety Board (DNFSB) letter dated October 23, 2013, requested that the Department of Energy (DOE) address six specific subject areas related to nuclear criticality safety in an Annual Report on Nuclear Criticality Safety (NCS) Programs. The six areas are:

- Criticality Safety Staffing
- Non-Compliances with Requirements
- Evaluation of Overall Performance
- Infractions, Severity, and Lessons Learned
- CSSG Recommendations
- Performance Versus Specific Expectations

#### **1. Criticality Safety Staffing**

All EM field sites currently report sufficient staff to meet programmatic needs. The Oak Ridge Office is monitoring the UCOR contractor for signs of needing additional staff and the Savannah River Office considers the Savannah River Nuclear Solutions contractor Criticality Safety staff is marginally sufficient staff to meet programmatic needs. The Office of River Protection is monitoring the newly hired Hanford Tank Waste Treatment and Immobilization Plant Criticality Safety staff to verify development of capability.

#### **2. Infractions, Severity, and Lessons Learned**

Many of the EM sites experienced non-conformances with criticality safety related controls but none saw a level with the significance of reducing the protection approved in the safety basis to a single credible barrier. Nevertheless, even lower level and defense-in-depth non-conformances need to be investigated and corrected, as they are usually indicative of a system problem. Many of our sites require a root cause review for all non-conformances regardless of the level.

One contractor discovered a credited glovebox drain to be covered. Another contractor had a faulty program description. One contractor had an error caused by a faulty assumption about the fissile material distribution in a container and another contractor discovered an erroneous calculation of a safety margin. One site office determined that the practice of affixing the grating over some fuel racks did not meet the assumption in the safety basis.

#### **3. Non-Compliances with Requirements**

All EM site offices and contractors use a process to ensure all ANSI/ANS 8 and DOE criticality safety requirements are followed. Most use DOE Standard 1158-2010 on at least a three year cycle as a tool in this process. None of our site offices or contractors has uncovered a Standard non-compliance.

#### **4. Criticality Safety Support Group Recommendations**

The only site-specific Criticality Safety Support Group reports and Recommendations are for the Hanford Tank Farms (2009) and the Waste Treatment Plant (2008 and 2009). The Tank Farm contractor has completed the revised documentation recommended by the CSSG. The Recommendations for the Waste Treatment Plant were largely overtaken by events and a subsequent (2013) review team, largely CSSG members, provided numerous Recommendations and the issues raised are now being incorporated into a plan developed by the contractor.

#### **5. Evaluation of Overall Performance**

Although most site contractors had performance issues, all were deemed by the department to be addressing the discrepancies. See the attachments for details.

#### **6. Performance versus Specific Expectations**

Some contractors have nuclear criticality safety related expectation in the contract for fee determination. These include Washington River Protection Solutions, Fluor-B&W Portsmouth, CH2M WG Idaho, Idaho treatment Group, Savannah River Nuclear Solutions and Savannah River Remediation. Some lost fee as a result. See attachments for details.

All EM sites use metrics as part of the NCS program oversight program. As a result of a recent ANS session on metrics, DOE sites staffs are better communicating on choice of metrics and are focusing on maximizing the utility of metrics. Typical increased focus at EM sites is on assessments, staff training and qualification, quality of evaluations, and operational performance.

A detailed report of the fifteen EM contractors follows.

**At a glance:**

Contractor Staffing:	2 Criticality Safety Engineers, 2 Criticality Safety Engineers in training, 2 Criticality Safety Engineers contracted	Sufficient to meet programmatic needs but comp measures include additional contract and cross-trained criticality safety representative (CSR) support.
Infractions:	1, Only one control remained	
Non-Compliances:	None	
Criticality Safety Support Group Recommendations:	None	
Overall Performance	Meets expectations	

**1. Criticality Safety Staffing**

CH2M Hill Plateau Remediation Company (CHPRC) currently maintains a Criticality Safety organization composed of a Central Organization and staff matrixed to three major projects on site. The Central CHPRC organization consists of a Criticality Safety Manager and Criticality Safety Lead (neither are full time positions). The matrixed organization consists of two Criticality Engineers (CSE) with 2 CSEs being trained and two Criticality Safety Representatives (CSR).

Management	CSE	CSE (Training)	CSE (Contract)	CSR	Comp Measures
Manager Lead	2	2	2	3	<ul style="list-style-type: none"> <li>Contracted Criticality Safety support.</li> <li>Cross trained CSEs or CSRs for work at multiple facilities.</li> </ul>

**2. Infractions, Severity, and Lessons Learned**

CH2M Hill experienced one non-conformance this period.

Description	Severity	Lessons Learned
Criticality Safety Drain Obstructed by size reduction waste in 236-Z.	SC-2	LL-2014-PFP-0009 Dated 6/23/2014

This nonconformance involved the discovery of a pile of size reduction waste that was piled up against the outlet of a criticality drain pipe, located in the Maintenance Cell of 236-Z (PRF) at PFP and was characterized as SC-2. The blockage resulted from activities that size-reduced pencil tanks in the maintenance cell, without disposing of wastes as they were generated. The criticality drain was classified as safety significant at the time of the occurrence, due to its importance to upstream gallery glovebox operations. The lessons learned were documented in LL-2014-PFP-0009 Dated 6/23/2014.

The immediate action was taken to unblock the drain and remove the waste accumulations, and post an additional sign to remind workers not to block the criticality drain outlet. Subsequent to this incident, the D&D work in the gallery gloveboxes was completed, the CPS for gallery

glovebox work was cancelled, and the criticality drain was removed from the safety equipment list. There are no more active credited criticality drains at the PFP complex.

### **3. Non-Compliances with Requirements**

There were no non-compliances with DOE or American National Standards Institute/American Nuclear Society (ANSI/ANS) standards identified during FY-2014.

### **4. Criticality Safety Support Group Recommendations**

There are no open CSSG Recommendations specific to CH2M Hill operations.

### **5. Evaluation of Overall Performance**

Based upon the current evaluation program, DOE-Richland Operations (RL) evaluates CHPRC's performance in the functional area of criticality safety as Satisfactory.

### **6. Performance versus Specific Expectations**

There are currently no site-specific CS program performance expectations for CHPRC.

RL utilizes the following local performance metrics in evaluating contractor performance in the functional area of Criticality Safety:

Metric	Overall Program Performance
Assessment, Surveillance and OA reports,	Satisfactory
Occurrence Reports,	Satisfactory
Stop Light Charts	Satisfactory
Contractor Metrics	Satisfactory

**At a glance:**

Contractor Staffing:	2 part-time Criticality Safety Engineer/Criticality Safety Representatives (combined qualification) About 0.75 FTE	Meets programmatic requirements
Infractions:	None	
Non-Compliances:	None	
Criticality Safety Support Group Recommendations:	None	
Overall Performance	Meets expectations	

**1. Criticality Safety Staffing**

The Washington Closure Hanford Company (WCH) staffing needs reflect operations which have no projects with criticality controls due to limited fissionable material inventory and the nature of the work (burial ground remediation, waste site remediation, building demolition). DOE-RL agrees the staffing is sufficient to meet programmatic needs.

Manager	CSE	CSE (Train)	CSE (Contracted)	CSR	Comp Measures
0	2	0	0	0	None.

**2. Infractions, Severity, and Lessons Learned**

There have been no criticality safety non-conformances involving WCH operations;

**3. Non-Compliances with Requirements**

There have been no con-compliances with industry or DOE criticality safety standards

**4. 4 Criticality Safety Support Group Recommendations**

There are no CSSG recommendations specific to WCH operations.

**5. Evaluation of Overall Performance**

Based upon the current evaluation program, RL evaluates WCH's performance in the functional area of criticality safety as Satisfactory.

**6. Performance versus Specific Expectations**

There are currently no site-specific CS program performance expectations for WCH.

RL utilizes the following local performance metrics in evaluating contractor performance in the functional area of Criticality Safety:

Metric	Overall Program Performance
Assessment, Surveillance and OA reports,	Satisfactory
Occurrence Reports,	N/A
Stop Light Charts	Satisfactory
Contractor Metrics	Satisfactory



**At a glance:**

Contractor Staffing:	1 qualified, 4 in training	Meets programmatic requirements
Infractions:	Not Applicable, not operational	
Non-Compliances:	None	
Criticality Safety Support Group Recommendations:	Multiple recommendations.	
Overall Performance	Improvements needed	

**1. Criticality Safety Staffing**

Bechtel National, Inc. (BNI), the contractor responsible for construction of the Waste Treatment and Immobilization Plant (WTP), recently rebuilt their staff and presently retains one qualified criticality safety engineer and four criticality engineers-in-training, two of which hold PhDs in nuclear engineering. Additionally, a lead nuclear criticality safety engineer has been assigned to provide coordination and technical direction to the team. The Nuclear Criticality Safety Team reports to the safety analysis manager that is part of the reconfigured Nuclear Safety Engineering organization. ORP considers this staffing level sufficient and is waiting to review the staff work products to assess how they are developing.

A planned update and rewrite of the Preliminary Criticality Safety Evaluation Report (CSER) has been consolidated into a single effort managed as a project and entitled, “T2 Plan for Resolution of Criticality Technical Issues.” This effort will require additional support and expertise to augment the present BNI staff. As stated in FY-2013, this expertise will need to evaluate areas such as hydrodynamics, plutonium chemistry based on the presence of plutonium oxide (Pu oxide) in the tank farms waste as well as a revised hazards analysis.

**2. Infractions, Severity, and Lessons Learned**

WTP is not an operating facility. A nonconformance or occurrence reporting process for criticality safety is not yet in place.

**3. Non-Compliances with Requirements**

There were no instances of non-compliance with Standards.

**4. Criticality Safety Support Group Recommendations**

DOE Criticality Safety Support Group (CSSG) assessments of the WTP Criticality Safety Program were conducted in 2008 and 2009. Notably, the Criticality Safety Support Group assessment recommendations and areas for improvement were incorporated into the Conditions of Approvals (COA) written in the ORP safety evaluation report. Progress on closure of the COAs has slowed due to several technical challenges (e.g., presence of Pu oxide particles greater than 10 microns, preferential settling of heavy Pu oxide particles in WTP process vessels, and pulse jet mixer design issues to ensure adequate vessel bottom clearing requiring the need for a hydrodynamics study of heavy particle preferential settling and segregation), which have caused a revision to the preliminary CSER to be delayed until after September 2015 for development of several engineering studies specific to criticality safety that will support a revision to the

preliminary CSER. The current WTP facility-wide CSER will be revised to evaluate specific processes such as high solids vessels in Pretreatment Facility (High-Level Waste Lag Storage and Feed Blending Process System (HLP), Ultrafiltration Process System (UFP), and Plant Wash and Disposal System (PWD)), High-Level Waste Facility, Low-Activity Waste Facility (LAW), and balance of Pre-Treatment Facility (PT). Closure of these outstanding issues has been included as a committed activity in the “T2 Plan for Resolution of Criticality Technical Issues” with a due date of September 2015. Key deliverables due at the completion of this effort include:

- Fluid Dynamics Study: This study will summarize the recommendations of the fluid dynamics expert group. The study will mathematically evaluate the settling of fissile material and absorbers in addition to evaluating the physics of particle dynamics in WTP process vessels.
- Chemistry Study: This study will serve as the technical basis document supporting the criticality safety evaluations.
- Criticality Safety Hazards Assessment: A comprehensive hazards assessment will be conducted covering relevant WTP Pretreatment Facility operations where co-precipitated and particulate plutonium larger than 10 microns may be processed.
- Criticality Safety Calculations: Any calculations required to support development of the criticality safety evaluation will be included as a separate report.
- Criticality Safety Strategy and Controls Report: This report will document recommended controls and strategies to prevent criticalities in processes involving the presence of high density particulate plutonium.
- Criticality Safety Evaluation Engineering Study for High-Level Waste Lag Storage and Feed Blending Process, Ultrafiltration, and Plant Wash and Disposal: This study will document criticality safety hazards evaluated for High-Level Waste Lag Storage and Feed Blending Process, Ultrafiltration, and Plant Wash and Disposal relative to high solids waste streams and co-precipitated and particulate plutonium larger than 10 microns may be processed. The study will document recommended criticality safety controls.

In December 2012 an Independent Review Team (IRT), consisting largely of CSSG members, was established by the previous Secretary of Energy and tasked with making specific recommendations for resolution of criticality safety issues associated with high-solids waste streams in the Pretreatment Facility. The IRT reviewed the WTP preliminary CSER and its supporting documents and identified the following areas of concern:

- The hazard assessment supporting the preliminary CSER had not fully addressed possible upset conditions or recent discoveries of non-co-precipitated plutonium in the tank farms.
- The calculational basis for assessing the risk of the non-co-precipitated plutonium was not part of the CSER.

- The technical basis for settling characteristics of the plutonium material and the nuclear poisons was not adequate.

In order to deal with each of these areas of concern, the IRT chartered the following tasks, but was only able to accomplish the first two tasks by the time of this report's completion:

- A criticality safety hazard review was performed of the current design of WTP to assess areas for additional criticality safety controls not previously identified and to determine if there were parameters that could be controlled.
- Computational calculations were performed as part of a parametric study to determine plutonium mass loading to achieve critical configurations in WTP process vessels.
- A task description and statement of work are provided in the CSER to substantiate a technical basis for assumptions on settling characteristics of plutonium and iron and other selected absorbers in actual tank farm materials.

In the CSER, the IRT recommended that the WTP contractor:

- Use the information and recommendations of the report to develop a revised criticality safety basis for WTP.
- Proceed with the settling test in order to evaluate a major unresolved criticality safety issue.
- Ensure that an adequate sampling capability is available so that the WTP waste acceptance criteria for fissile-to-metal loading ratios is met before waste is accepted at the Pretreatment Facility.
- Proceed with further criticality safety analysis using the recommendations provided in the WTP criticality hazard review (Appendix A).
- Perform an integrated project review of the process vessel heel management system and locations for deployment throughout the Pretreatment Facility.
- Develop a testing strategy to establish hydrodynamic equivalence as a viable control strategy including associated waste acceptance criteria testing requirements.
- Establish a protocol for developing a defense of limited fissile mass for a given scenario or plant process/location/vessel using probabilistic risk assessment and/or event trees.
- Review and confirm that the scope of the (to be developed) WTP chemistry report includes information to support assumptions in the hazard review related to the impact of acid, caustic, and water additions on the potential to segregate fissile material and absorbers as well as the mechanical integrity of co-precipitated solids under pulse jet mixer operation.

- Identify specific actions to maintain the evaluation of criticality safety hazards current with evolving changes in plant design.
- Identify and establish configuration control linking the technical basis documents to the criticality hazard review and CSER documents to support any key assumptions.

Completion of the above identified technical studies is required to address IRT recommendations. These recommendations have been incorporated into ORP and BNI long-term plans and are reflected in the recently developed, “T2 Plan for Resolution of Criticality Technical Issues.” Testing is the only recommendation not included in the “T2 Plan for Resolution of Criticality Technical Issues” and will be addressed based on the Fluid Dynamics Expert Review Team’s recommendations regarding testing.

The contractor continues to use Monte Carlo N-Particle (MCNP) modeling and is actively updating criticality calculations previously performed using an earlier version of Monte Carlo N-Particle. As of October 1, 2014, BNI has completed the first of several hazards analysis meetings, and has drafted a three-phased chemistry study, which evaluates the chemical processes of importance to uranium and plutonium in tank wastes. BNI has initiated a fluid dynamics study and is actively working on contracts for three fluid dynamics experts. As the fluid dynamics study will benefit both tank farms and WTP, a contract modification has been initiated, which will fund tank farms participation in those studies for future implementation during waste retrieval.

There were no formal assessments of the contractor criticality safety programs conducted during FY-2014. ORP conducts assessments of the criticality safety programs on an as-needed basis because WTP is not an operating facility. The WTP contractor has submitted a revised WTP criticality safety program description document in FY-2013 to ORP for approval as required by DOE O 420.1B, *Facility Safety*. ORP evaluated the program description documented and approved it. The document has now been implemented in the BNI program.

## **5. Evaluation of Overall Performance**

In 2009, the ORP federal CSE conducted a review of the WTP CSER and issued a safety evaluation report conditionally approving the document with nine conditions of acceptance (COA). One of the COAs has been closed. Five of the COAs pertain to the Preliminary Documented Safety Analysis, while the remaining three will require resolution by the time the Documented Safety Analysis is finalized. ORP is working closely with the contractor and is tracking these issues.

As reported for fiscal year (FY) 2013, the WTP Project has not advanced to the point where performance metrics specific to operations have been implemented. The project overall is approximately at 69 percent completion. Performance metrics specific to the performance of criticality safety evaluations, training, and qualification of contractor criticality safety staff, management assessment, periodic inspections, and identification and resolution of problems in criticality safety will be implemented prior to operational readiness reviews of affected WTP facilities.

When operational, the WTP Project expects to have technical safety requirement level criticality safety controls, additional evaluations, and implementation programs. Criticality safety considerations are being included in the facility design. A preliminary criticality safety evaluation addressing the process flow, process chemistry, and safety of operations has been developed, but needs to be updated with process design changes. Facility designs have incorporated these basic control concepts.

A significant lesson learned from ORP oversight to date is that federal CSEs and federal WTP engineering division staff personnel must be actively involved with the contractor design changes and how they can affect the CSER. Also, closer coordination between ORP and WTP contractor NCS staff is necessary in order to properly review and assess design changes that potentially affect criticality safety. ORP conducts joint monthly interface meetings with BNI and Washington River Protection Solutions LLC criticality safety. These meetings are also attended by One System (tank farms and WTP interface) managers and engineers. These meetings have proven invaluable in enabling a constructive team approach to address criticality safety issues at both tank farms and WTP. ORP is meeting biweekly with interface meetings between BNI and One System related to the T2 plan to resolve criticality safety technical issues.

As reported last year, technical issues and questions remain involving the mixing of the Pretreatment Facility waste feed receipt process vessels using pulse jet mixers. These technical issues involve questions associated with the following:

- Sample non-representativeness;
- Effect of co-precipitated plutonium and metal absorber agglomerations;
- Effects of gravity segregation and preferential settling of heavy particles such as Pu oxides;
- Solids accumulation in process vessels;
- Particle size distribution.

These issues are being addressed as part of the technical issue resolution plans for Mixing (T4) and Criticality (T2).

In February 2011, Washington River Protection Solutions LLC, the contractor operating for the tank farms, declared a potential inadequacy in safety analysis associated with the presence of large, dense Pu oxide particles previously unidentified in tank wastes. There has been limited progress in resolving this issue since initially reported in 2012. As described in this report, progress in revising the WTP CSER is contingent upon resolving the above technical issues and full-scale mixing studies. These issues are summarized as follows:

- Mixing studies conducted by BNI indicated that large dense particles (greater than 10 micron and greater than 8 g/cc) will not remain suspended in the current design of non-Newtonian process vessels.

- A study commissioned by BNI and released in January 2013 concluded that there was a possibility for Pu oxide and metal particles of larger than 10 micron equivalent spherical diameter and with densities exceeding 8 g/cc to be present in significant quantities in tank farm wastes destined for processing within WTP.
- Washington River Protection Solutions LLC determined that this issue affected tank farms operations (e.g., mixing, waste transfer) and waste disturbing activities involving waste tanks with significant quantities of Pu oxides were placed on hold. These large dense particles are of concern for tank farms operations principally because they do not form agglomerations with credited neutron poisons (i.e., iron, chromium, and nickel) as assumed in the current CSER and where preferential settling could occur during mixing or waste retrieval operations.
- In 2011, a review team composed of URS Corporation personnel was assembled and chartered to evaluate the extent of the problem and confirm or dismiss the conclusions of the earlier WTP report. The resultant report, RPP-RPT-50941, *Review of Plutonium Oxide Receipts into Hanford Tank Farms*, reviewed all processes that sent large, dense plutonium-bearing particles to the tank farms. This team concluded that:
  - Approximately 100 kg of plutonium (all forms) was sent to tank farms from various facilities, of which up to 30 kg were dense Pu oxides or metal fines greater than 10 microns in equivalent spherical diameter.
  - Sixteen tanks received this waste: Eight received greater than 750 grams and eight received less than 400 grams.
  - The review team was able to verify that the earlier study was correct and conservative with regard to the conclusions on possible inventories of Pu oxides and metal fines.

Because these results will directly impact the operation of the Pretreatment Facility, resolution of the technical issues associated with the presence of large quantities of previously unanticipated forms of plutonium will either require significant changes to the criticality safety strategy for WTP operations and a significant revision to the WTP preliminary CSER or require restriction of the waste tanks for WTP processing until more information is available to assess criticality safety implications to WTP operations. The impact to WTP operations and criticality safety is being evaluated as part of the T2 work by BNI.

In the past few years, reviews of the preliminary criticality safety control strategy at WTP have been performed by various external groups, such as the Consortium for Risk Evaluation with Stakeholder Participation, Criticality Safety Support Group, and Defense Nuclear Facilities Safety Board. These reviews have provided a range of expert input that typically includes further perspective on issues needing to be addressed in the final criticality safety evaluations. Response to the review comments will be documented as part of hazards analyses supporting the revision of the current preliminary CSER. The reviews provide important information to be considered if additional criticality control strategies are needed and if additional facility design changes to be evaluated in hazards analyses and control selection processes are needed.

## **6. Performance versus Specific Expectations**

Metrics are used to evaluate criticality safety performance, as provided by DOE EM:

- Timely identification and resolution of non-conformances (leading indicator);
- Progress towards program improvement milestones (leading indicator);
- Type of assessment findings (leading indicator);
- Type of non-conformances (leading indicator);
- Number of repeated non-conformances (lagging indicator);
- Timely performance of required assessments (lagging indicator);
- Number and type of U.S. Department of Energy comments on contractor safety evaluations and the quality of these evaluations (lagging indicator);
- Number of assessment findings (lagging indicator);
- Number of non-conformances (lagging indicator).

Judgment is used in combining each metric into an overall measure of performance. Changes to these metrics are infrequent, although they will be reexamined as the mission needs change and the tanks farms add waste feed preparation and delivery operations to the currently authorized storage and retrieval operations. Metrics are reviewed by U.S. Department of Energy criticality staff after identification of a nonconformance or after issuance of an assessment or criticality safety evaluation.

Any identified weaknesses or trends identified by Department of Energy criticality staff are immediately communicated to the contractor. This communication may be formal or informal depending on the severity of the issue. For example, a review of a draft criticality safety evaluation report identified a weak technical justification for the resultant conclusions. This was judged to be sufficient to be transmitted formally, requiring a formal response. These metrics are considered in federal staff attendance at monthly criticality safety staff meetings with the contractors, in quarterly contractor performance evaluations, and in year-end award fee determinations. Criticality safety performance is considered in the evaluation of the contractor's nuclear safety performance.

ORP will conduct criticality safety assessments only on an as-needed basis. Closure of the open assessment findings and numerous open conditions of approval associated with the CSER are being tracked to closure by the Nuclear Safety Division. No formal assessments of the contractor criticality safety program were conducted this fiscal year.

Appendix 3 Environmental Management Annual Report on Nuclear Criticality Safety Programs  
Attachment 3 **Bechtel National, Inc. Waste Treatment and Immobilization Plant**

As discussed previously, an unresolved issue with the presence of Pu oxides in the tank farms waste solids requires specific technical studies. First is the study of the hydrodynamics of large, high-density particles. This study will be conducted by BNI and will be reviewed by external fluid dynamics experts. Second is a contractor report that addresses the chemistry processes in the Pretreatment Facility from a criticality safety perspective, this will also be reviewed by external plutonium chemistry experts. As these studies are drafted, the hazards review/analysis has commenced to support the criticality safety evaluation engineering study for High-Level Waste Lag Storage and Feed Blending Process, Ultrafiltration, and Plant Wash and Disposal. This information will be used subsequently to revise the preliminary CSER.



**At a glance:**

Contractor Staffing:	1 manager, 1 qualified, 1 in training	Meets programmatic requirements
Infractions:	1, plus several programmatic improvement issues	
Non-Compliances:	None	
Criticality Safety Support Group Recommendations:	None	
Overall Performance	Meets expectations	

**1. Criticality Safety Staffing**

Washington River Protection Solutions LLC (WRPS) employs one nuclear safety manager responsible for criticality safety, one qualified Criticality Safety Engineer (CSE), one CSE in training, and three qualified Criticality Safety Representatives. Staffing appears to be sufficient to meet the current mission needs; however, monitoring by the ORP will be continued through periodic assessments to ensure that sufficient CSE support is available when needed.

**2. Infractions, Severity, and Lessons Learned**

Consistent with previous years, periodic contractor inspections, assessments, etc., have identified minor observations related to programmatic improvement that have resulted in the generation of Performance Evaluation Reports. Issues identified include:

- Program documentation and maintenance
- Training/qualification.

Trends are rolled up and reported to senior management semiannually. In addition to these programmatic improvements, one criticality nonconformance involved the use of the cone penetrometer without prior authorization of the CSR. The criticality program related Problem Evaluation Report (PER) action items associated with the cone penetrometer use have been closed; however, one related PER action item to review the Process Hazards Analysis process interface remains open with a commitment date for closure of 12/16/2014. All other PERs that remain open are related to the update of training to implement the new CSER or to add a reference to a Tank Operations Contractor procedure outlining which other procedures require CSR review prior to modification. The PERs related to training include the update of the annual training class, integration of 222 S Laboratory personnel with the same training as other WRPS personnel and update of both the CSR and CSE qualification cards to reflect the revised CSER and to ensure compliance with the applicable American Nuclear Society/American National Standards Institute and U.S. Department of Energy requirements.

**3. Non-Compliances with Requirements**

There were no instances of non-compliance with Standards.

**4. Criticality Safety Support Group Recommendations**

ORP conducts reviews of the WRPS criticality safety management self assessment and reviews the quarterly facility inspections. Because of infrequent changes to the CSER, ORP has raised concerns whether the existing technical bases developed many years ago for the CSER were

considered adequate. As a result, ORP requested the U.S. Department of Energy Criticality Safety Steering Group (CSSG) to assess the technical bases of the tank farms CSP. The CSSG reviewed the WRPS CSP in December 2009. The CSSG review uncovered no underlying safety issues; however, several recommendations and areas for improvement were identified. These recommendations or areas for improvement were included in a plan for CSP improvements submitted by WRPS to ORP in July 2010. The scope of these improvements was approved by ORP in 2011. WRPS has completed the major program upgrades as identified in the approved plan for CSP improvements. Program upgrades completed to date include the revision of the CSP to include a new program document that was reviewed and approved by ORP and corresponding revisions to the lower tier implementing procedures.

## **5. Evaluation of Overall Performance**

Tank farms NCS is based upon preserving the form and distribution of the fissile bearing waste; and maintaining the total fissile inventory below one-half minimum critical mass in the 222-S Laboratory. The scope of routine waste operations (e.g., storage, transfer, sampling, surveillance, evaporation, etc.) was incorporated into the NCS basis when it was developed. Therefore, the waste storage mission yielded little chance of nonconformance with established limits and controls.

The addition of waste retrieval activities and the design of new waste treatment processes have made it necessary to update and broaden the scope of the tank farms NCS program. This in turn, has provided an expanded opportunity for identifying process improvements and application of past lessons learned. The CSER will be revised as necessary as these new activities are implemented in tank farms operations.

The tank farm contractor's NCS performance is measured through assessments, quarterly inspections, and close interaction between the criticality safety representative (CSR) and operations personnel shown as follows:

- Perform regular management self-assessment of NCS program implementation. Washington River Protection Solutions LLC (WRPS) conducted a management assessment of their criticality safety program (CSP) in March 2014. The assessment concluded that the NCS program was adequate and met applicable requirements. The U.S. Department of Energy, Office of River Protection (ORP) last conducted an overall assessment of the Tank Operations Contractor NCS program in August 2012 and issued three findings and four observations. Because of the delays in completion and implementation of the contractor's new criticality safety evaluation report (CSER), the planned assessment in 2014 has been delayed, and will be conducted in 2015.
- Qualified criticality safety engineers (CSE) and criticality safety representatives using DOE-STD-1135-99, *Guidance for Nuclear Criticality Safety Engineer Training and Qualification* as a guide. Presently all Tank Operations Contractor criticality safety staff working in facilities and preparing evaluations are qualified to the standard.

- Frequent interaction of the CSRs with operations staff in operating facilities. Facility CSPs emphasize participation of the CSR in facility walkdowns, job planning, pre-job briefs, and interactions with operations.
- Frequent interaction of the CSRs with process engineering staff. In accordance with the requirements of WRPS waste compatibility assessment procedure HNF-SD-WM-OCD-015, *Tank Farms Waste Transfer Compatibility Program*, CSRs review waste compatibility assessments prior to waste transfers into the tank farm facilities from interfacing facilities, retrievals from tanks containing particulate PuO<sub>2</sub>, and for waste transfers where the waste stream contains more than 1.03 wt.% enriched <sup>235</sup>U. These evaluations by the CSR ensure that the pH, the fissile material concentration, and the amount of insoluble neutron absorbers in waste receipts and transfers are controlled to ensure the margin of sub-criticality is maintained via the form and distribution of the waste.
- Perform quarterly criticality safety inspections of fissionable material storage areas/arrays and laboratory areas.

WRPS tracks criticality safety issues through the Problem Evaluation Request (PER) system. Any identified issues or deficiencies are documented in a PER. PERs are entered into a corrective action management system for tracking and trending. Nine PERs in criticality safety were identified in 2014, and nine were identified in 2013. Most were low-level concerns or opportunities for improvement, and were closed through the PER process. Only five PERs remain open, related to training program upgrades to implement the newly approved CSER or to a missing reference in a procedure outlining which other procedures require CSR review.

## **6. Performance versus Specific Expectations**

The following metrics provided by DOE EM are used to evaluate criticality safety performance:

- Timely identification and resolution of non-conformances (leading indicator);
- Progress towards program improvement milestones (leading indicator);
- Type of assessment findings (leading indicator);
- Type of non-conformances (leading indicator);
- Number of repeated non-conformances (lagging indicator);
- Timely performance of required assessments (lagging indicator);
- Number and type of U.S. Department of Energy comments on contractor safety evaluations and the quality of these evaluations (lagging indicator);
- Number of assessment findings (lagging indicator);
- Number of non-conformances (lagging indicator).

Judgment is used in combining each metric into an overall measure of performance. Changes to these metrics are infrequent, although they will be reexamined as the mission needs change and the tanks farms add waste feed preparation and delivery operations to the currently authorized storage and retrieval operations. Metrics are reviewed by U.S. Department of Energy criticality staff after identification of a nonconformance or after issuance of an assessment or criticality safety evaluation.

Any identified weaknesses or trends identified by the U.S. Department of Energy criticality staff are immediately communicated to the contractor. This communication may be formal or informal depending on the severity of the issue. For example, a review of a draft criticality safety evaluation report identified a weak technical justification for the resultant conclusions. This was judged to be sufficient to be transmitted formally, requiring a formal response. These metrics are considered in federal staff attendance at monthly criticality safety staff meetings with the contractors, in quarterly contractor performance evaluations, and in year-end award fee determinations. Criticality safety performance is considered in the evaluation of the contractor's nuclear safety performance.

**At a glance:**

Contractor Staffing:	0.2 FTE	Meets programmatic requirements
Infractions:	None	
Non-Compliances:	None	
Criticality Safety Support Group Recommendations:	None	
Overall Performance	Meets expectations	

**1. Criticality Safety Staffing**

Los Alamos Technical Associates Environmental Services of Kentucky, LLC (LATA Kentucky) has several storage Nuclear Criticality Safety (NCS) evaluations for stable, limited storage arrays. The D&D and shipment efforts have reduced the fissile material in the Department of Energy (DOE)-regulated portion of the Paducah Gaseous Diffusion Plant to almost nil. As a result, only one part-time LATA Kentucky NCS Engineer is needed to provide NCS oversight (equaling to about one day per week) to ensure NCS compliance at the plant.

**2. Infractions, Severity, and Lessons Learned**

LATA Kentucky has had no criticality safety infractions or non-compliances for three years. This is due to the small amount of fissile inventory within facilities operated by LATA Kentucky. Therefore, there were no lessons learned issued.

**3. Non-Compliances with Requirements**

There are no NCS non-compliances with DOE or ANSI/ANS requirements at facilities operated by LATA Kentucky, although there are DOE-approved exceptions and clarifications to DOE and ANSI/ANS requirements included in the LATA Kentucky NCS Program Description Document.

**4. Criticality Safety Support Group Recommendations**

No Criticality Safety Support Group recommendations are specific to LATA Kentucky.

**5. Evaluation of Overall Performance**

DOE oversight reviews of the LATA Kentucky NCS program are performed each year as a part of the annual Safety Basis update process. Performance is acceptable.

**6. Performance versus Specific Expectations**

There were no specific NCS-related performance goals in the Performance Evaluation Plan or Performance Based Incentives.

A formal set of performance metrics is used to track the LATA Kentucky NCS program implementation at Paducah, which includes the number of Anomalous Condition Reports (ACRs), the amount of field time for NCS engineers, continuing education of NCS engineers, and, number of surveillances, assessments, and lessons learned. LATA Kentucky NCS provides the information in quarterly NCS metrics reports to their Management and to DOE PPPO.

Appendix 3 Environmental Management Annual Report on Nuclear Criticality Safety Programs  
Attachment 5 **LATA Kentucky, Paducah, KY**

These metrics are not used in fee determination; DOE-PPPO rates LATA Kentucky NCS performance acceptable in meeting each of these metrics.

**At a glance:**

Contractor Staffing:	8	Meets programmatic requirements
Infractions:	9 (conflicts with text; deviations are not counted as infractions if two or more barriers are maintained.)	
Non-Compliances:	None	
Criticality Safety Support Group Recommendations:	None	
Overall Performance	Meets expectations	

**1. Criticality Safety Staffing**

Fluor-B&W Portsmouth (FBP) has approximately 8 full time equivalents (FTEs) Nuclear Criticality Security (NCS) staff (FBP employees and subcontractors) in the NCS Organization, more than half are qualified as Sr. NCS Engineers. This meets the needs of the present scope of operations at the plant as reviewed by Department of Energy (DOE). Subcontractors under contract to FBP could provide additional resources if any of the present staff leave or if scope at the site increases requiring additional NCS support and oversight. DOE is monitoring the FBP NCS staffing regularly to ensure that NCS support is available when needed.

**2. Infractions, Severity, and Lessons Learned**

There were nine Anomalous Condition Reports (local term for infractions at former diffusion plant sites) generated in FY-2014 in PORTS FBP facilities; none were infractions as two or more barriers to criticality were maintained in all of the non-compliances. Four of the nine were administrative spacing violations where the as-found spacing was slightly less than the required spacing. Two ACRs involved potential loss of moderation control and two were due to changed configuration. All nine were discovered by operational personnel. The additional training and non-scheduled walkthroughs performed by NCS in FY-2014 had a positive impact on criticality safety of operations and the reduced number of anomalous conditions.

A lesson learned was issued to ensure that procedures that contain NCS controls are not issued prior to the NCSE effective date.

**3. Non-Compliances with Requirements**

There are no NCS non-compliances with DOE or ANSI/ANS requirements at facilities operated by FBP, although there are DOE-approved exceptions and clarifications to DOE and ANSI/ANS requirements included in the FBP NCS Program Description Document.

**4. Criticality Safety Support Group Recommendations**

No Criticality Safety Support Group (CSSG) recommendations are specific to FBP.

**5. Evaluation of Overall Performance**

PPPO-M-420.1-3, Safety Systems Oversight Plan establishes and implements PPPO oversight programs and processes to meet the requirements of DOE O 226.1B and the PPPO Oversight Program (PPPO-M-226.1-2). DOE oversight reviews of the FBP NCS program are performed each year through NCS assessments, periodic walkdowns, corrective action close-out reviews,

NCS document reviews, periodic meetings, regularly scheduled teleconferences, and as a part of the annual Safety Basis update process.

The FBP Nuclear Criticality Safety organization performs well and requires little Government intervention. The NCS organization supports D&D activities by completing its required actions in a timely manner. Documents are provided to DOE for review and comment prior to final submission, generally with sufficient time for DOE review. Performance is acceptable.

## **6. Performance versus Specific Expectations**

The "award fee evaluation process" is part of the contract management process. DOE oversight staff provides a subjective review of the contractor's safety management program. The overall evaluation of FBP's performance in the area of Nuclear Criticality Safety is that the organization performs well with little Government intervention. The NCS organization supports D&D activities by completing its required actions in a timely manner. Documents are provided to DOE for review and comment prior to final submission, generally with sufficient time for DOE review.

A formal set of performance metrics is used to track FBP NCS program implementation for both the former uranium enrichment facilities (FUEF) and non-FUEF facilities. FBP NCS maintains a schedule of walkthroughs and tracks open items. The number of Anomalous Condition Reports (ACRs) and NCS-related Problem Reports are tracked and trended. Additionally, field support time, continuing education, assessments and reviews, and lessons learned are tracked. FBP NCS provides this information in quarterly NCS metrics reports to their Management and to DOE PPPO.

These metrics are not used in fee determination; DOE-PPPO rates FBP NCS performance acceptable in meeting each of these metrics



**At a glance:**

Contractor Staffing:	1 part-time	Meets programmatic requirements
Infractions:	None	
Non-Compliances:	None	
Criticality Safety Support Group Recommendations:	None	
Overall Performance	Meets expectations	

**1. Criticality Safety Staffing**

Babcock & Wilcox Conversion Services (BWCS) has some UF<sub>6</sub> cylinders in particular cylinder yards that have greater than 1.0 wt. % <sup>235</sup>U that are covered by Nuclear Criticality Safety (NCS) evaluations. The BWCS operations only process material ≤ 1.0 wt. % <sup>235</sup>U and therefore, the only requirement is to ensure that no cylinder is brought to the processing areas that exceeds this limit. As a result, only one part-time NCS Engineer is needed to provide NCS oversight to ensure NCS compliance at both plants. Department of Energy (DOE) oversight is also minimal and is provided by the Nuclear Safety Oversight Lead and the Safety Systems Oversight Engineer, as required. There are no vacancies or shortages.

**2. Infractions, Severity, and Lessons Learned**

BWCS has had no criticality safety infractions or non-compliances at either plant since beginning operations in 2012. This is due to the limited number of fissile UF<sub>6</sub> cylinders and the processing of only non-fissile material within facilities operated by BWCS. Therefore, there are no new lessons learned.

**3. Non-Compliances with Requirements**

There are no NCS non-compliances with DOE or ANSI/ANS requirements at facilities operated by BWCS except for those DOE-approved exceptions and clarifications to DOE and ANSI/ANS requirements included in the BWCS NCS Program Description Document.

**4. Criticality Safety Support Group Recommendations**

No Criticality Safety Support Group recommendations are specific to BWCS.

**5. Evaluation of Overall Performance**

DOE oversight reviews of the BWCS NCS program are performed each year as a part of the annual Safety Basis update process. The performance is satisfactory.

**6. Performance versus Specific Expectations**

There were no specific NCS-related performance goals in the Performance Evaluation Plan or Performance Based Incentives.

**At a glance:**

Contractor Staffing:	1 manager, 1 full time, 1 part time	Meets programmatic requirements
Infractions:	1	
Non-Compliances:	None	
Criticality Safety Support Group Recommendations:	None	
Overall Performance	Meets expectations	

**1. Criticality Safety Staffing**

The Idaho Cleanup Project CH2M WG Idaho, LLC (CWI) Criticality Safety Program has one full time criticality safety engineer, one full time subcontract criticality safety engineer, and one full time criticality safety manager. All three employees are fully qualified as criticality safety engineers. Staffing levels are sufficient to meet programmatic needs. There are no plans for compensatory measures.

DOE line management determined that the contractor had sufficient staff to meet programmatic needs for FY-2014 activities.

**2. Infractions, Severity, and Lessons Learned**

One infraction occurred during FY-2014. An error was detected in a legacy MCNP input deck that was used to model the Irradiated Fuel Storage Facility. The error was detected as a result of the criticality safety engineer modeling the entire fuel storage array filled with a specific fuel type. The reactivity effect of correcting the error was very small. The lesson learned was to be vigilant in verifying input files used to model fissile materials.

**3. Non-Compliances with Requirements**

No non-compliances with DOE or ANSI/ANS standards have been identified.

**4. Criticality Safety Support Group Recommendations**

No open recommendations from the CSSG for this contractor.

**5. Evaluation of Overall Performance**

The contractor has a criticality safety program that is rated as effective.

**6. Performance versus Specific Expectations**

The contractor is meeting performance expectations.

The measures given below are used to evaluate performance.

1. The Nuclear Safety Severity Index (NSSI) is an index of severity of ORPS reports related to TSR violations, criticality safety events, or degradation of SSCs. The 12-month average shows a negative trend and is above the set goal. Several recent Technical Safety

Requirement violations at the Idaho Waste Treatment Unit unrelated to nuclear criticality safety have caused this negative trend.

2. The Criticality Safety Adversity Index (CSAI) monitors criticality safety non-compliances as a weighted average based on the severity of the noncompliance. All non-compliances are trended from the most minor program noncompliance up to loss of protection such that only one barrier remains. The 12-month average shows a negative trend and is slightly above the set goal. No common causes identified at this time. Causes include poor equipment design, inadequate implementation, and human failure.
3. The Corrective Action Effectiveness Index (CAEI) evaluates for recurring or repeat issues, quality of corrective actions, and timeliness of corrective actions. The 12-month average is within set goals.
4. The Assessment Effectiveness Index (AEI) is an index that evaluates the timely completion of assessments, sources of issues (assessment, external, or event), and quality of assessments performed. The 12-month average is within set goals.
5. The Procedure Compliance Element Index (PCI) is an index that measures the number of procedure violations entered into ICARE during the month. The 12-month average is within set goals.

Semiannually metrics are reviewed with senior management (e.g., the executive safety review board) to determine program performance. Trends and issues are identified and discussed and corrective actions identified during these reviews. Since other safety management programs (such as conduct of operations, maintenance, fire protection, and configuration management) could affect criticality safety, they have metrics as well which are also reviewed with the ESRB. Improvement actions are identified and tracked at ESRB meetings.

**At a glance:**

Contractor Staffing:	4 (3 FTE)	Meets programmatic requirements
Infractions:	5	
Non-Compliances:	None	
Criticality Safety Support Group Recommendations:	None	
Overall Performance	Meets expectations	

**1. Criticality Safety Staffing**

In FY-2014, Advanced Mixed Waste Treatment Project (AMWTP) Nuclear Criticality Safety (NCS) staffing was three full-time AMWTP employees (two criticality safety officers and one qualified criticality safety engineer). One of the criticality safety officers left AMWTP during the year and this position has not been filled as of the end of the fiscal year. In addition, AMWTP employs three criticality safety engineers on a subcontracted basis (sharing 80 hours per week).

DOE-ID line management determined that the contractor had sufficient staff to meet programmatic needs for FY-2014 activities.

**2. Infractions, Severity, and Lessons Learned**

There was one Technical Safety Requirement (TSR) violation and one Potential Inadequacy of the Safety Analysis (PISA) related to nuclear criticality safety during FY-2014. There were three criticality deficiencies during FY-2014.

- June 19, 2014 Criticality Deficiency Management Concern  
 ORPS Report: EM-ID--ITG-AMWTF-2014-007, Preventive Maintenance Not Completed within Scheduled Periodicity. This resulted in Lessons Learned 2014-ID-AMWTP-013, Failure to Meet Criticality Working Requirement due to Poor Turnover of Equipment:
- June 18, 2014 Potential Inadequacy of the Safety Analysis (PISA)  
 ORPS Report: EM-ID--ITG-AMWTF-2014-0006, New Information Indicates Criticality Safety Analysis for Storage of Overmass Waste Containers May Be Inadequate
- June 15, 2014 Criticality Deficiency  
 An M-III bin created from the Remote Handled Transuranic (RH TRU) project was received from CWI without a Fissile Gram Equivalent (FGE) value and was not placed in an Isolation Storage Area (ISA) or immediately assayed upon arrival at AMWTP.
- March 5, 2014 Technical Safety Requirement (TSR) Violation  
 ORPS Report: EM-ID--ITG-AMWTF-2014-0001, *Barcode Label Technical Safety Requirement Surveillance Requirement Not Performed Correctly*. A TSR violation was declared after personnel discovered that a 55-gal waste drum destined for compaction had a bar code label identification number that did not match the other six that were affixed to the

drum. This resulted in Lessons Learned 2014-ID-AMWTP-007, *Evaluate/Mitigate Human Factors when performing Critical Work Barcode Label TSR Surveillance Requirement Not Performed Correctly*.

- February 6, 2014 Criticality Deficiency-Spacing within the ISA in WMF-634 between a box and a drum did not meet the 6-foot requirement (they were located 5 foot 9 inches from each other).

### **3. Non-Compliances with Requirements**

No non-compliances with DOE or ANSI/ANS standards have been identified.

### **4. Criticality Safety Support Group Recommendations**

No open recommendations from the CSSG for this contractor.

### **5. Evaluation of Overall Performance**

The contractor has a criticality safety program that is rated as effective.

### **6. Performance versus Specific Expectations**

The contractor is meeting performance expectations.

Advanced Mixed Waste Treatment Project (AMWTP) continues to track and trend all events and deficiencies that impact or potentially impact nuclear criticality safety (NCS), regardless of severity. This tracking and trending utilizes AMWTP's formal issues tracking system, TrackWise, and is included in the AMWTP self-assessment of the NCS program.

In addition, AMWTP utilizes a lagging indicator metric, Nuclear Safety Index (NSI), for NCS issues. This metric is reported in the Safety Performance Objectives, Measures, and Commitments (SPOMC) report. The NSI is under the annual goal for the year but a technical Safety Requirement violation relating to barcode double verification caused the metric to be above zero.

The Corrective Action Effectiveness Index (CAEI) measures the timeliness and effectiveness of corrective-action implementation to prevent the recurrence of issues and events. This metric is reported in the SPOMC report. This metric is under the annual goal.

The Assessment Effectiveness Index (AEI) measures the effectiveness of management assessments and worker feedback in identifying issues. The index includes completion of scheduled management assessments; evaluation of assigned risk levels for scheduled management assessments; and evaluation of sources of TrackWise issues relative to management assessments, worker feedback, and external assessments. This metric is reported in the SPOMC report. This metric is under the annual goal.

The ISMS Work Control Performance Index (WCPI) is an index of severity and weighting factors that measures work performed in accordance with the AMWTP work control system and involves an ISMS work-control breakdown that results in an ORPS-reportable event and non-

Appendix 3 Environmental Management Annual Report on Nuclear Criticality Safety Programs  
Attachment 9 **Advanced Mixed Waste Treatment Project Idaho Treatment Group**

reportable events. This metric is reported in the SPOMC report. This metric is under the annual goal.

Metrics are reviewed monthly by Operations Management, Quality Assurance, and Nuclear Safety/Criticality Safety management. Trends are identified, and Corrective Action reports (CARs) are initiated and tracked through the plant action tracking system (TrackWise™). Significant issues rise to the level of ORPS reportability.

**At a glance:**

Contractor Staffing:	4 FTE	Meets programmatic requirements but DOE monitoring
Infractions:	11	
Non-Compliances:	None	
Criticality Safety Support Group Recommendations:	None	
Overall Performance	Meets expectations	

**1. Criticality Safety Staffing**

The URS|CH2M Hill (UCOR) NCS program currently has four FTEs, including the NCS Manager. In addition to the full time staff, other NCS engineers currently qualified under the UCOR NCS Program can be made available as needed. The DOE NCS oversight continues to monitor the contractor’s staffing level for adequacy. The UCOR Criticality Safety Officers are not included in the total FTE count but are vital to the UCOR NCS Program as applied specifically to the Deactivation & Decommissioning (D&D) Project. The DOE NCS oversight will continue to observe the criticality safety officer (CSO) staffing levels for adequacy, as well. DOE-OR determined that the staffing level is sufficient to meet the needs of the current work plan.

**2. Infractions, Severity, and Lessons Learned**

On average, less than one new ACR occurred per month (11 ACRs during FY-2014). Severity levels are assigned to each ACR, on a scale of 1 to 5, with 1 being the most severe (the occurrence of an actual criticality) and 5 being the least severe (e.g., administrative errors that do not result in non-compliance with any implemented NCS controls). There were 3 Level 5 ACRs, and 8 Level 4 ACRs in FY-2014.

The average time to close ACRs has remained about the same as FY-2013 and over half of ACRs in FY-2014 were closed within 10 days. Three ACRs, one of which actually was discovered in FY-2013, but did not close until FY-2014, were open longer than 30 days, with the longest being 204 days.

All ACRs are tracked and trended internally by the UCOR corrective action management tracking system, as required by the NCS program. All Level 1, 2, and 3 ACRs are also tracked through the Occurrence Reporting system, which is independent of the NCS Program.

Three causes were identified in several of the ACRs involving inattention to detail, legacy discovery, and inadequate NCSE implementation. The UCOR NCS staff, working in conjunction with Work Control, developed a new method of distributing procedures to the field for work. Prior to a procedure being released to work crews, NCS staff verifies the appropriate evaluations and its controls are fully implemented, instead of relying on work crews to contact NCS staff for approval prior to work.

The UCOR ACRs are tabulated below:

ACR #	Subject	Severity Level
ACR-ET-14-0008	During the performance of an annual assessment, it was noted that several personnel involved in bottle handling had expired training in the bottle storage evaluation. As a follow up, the supervisor noted that, in addition to the above deficiency, several personnel involved in equipment moving had expired training involving that NCSE (NCSE-ET-K25-1618).	5
ACR-ET-14-0006	Five gallon bucket of unknown Radioactive Material discovered in BNG Legacy Array of 55-gallon drums and ST90 Boxes	4
ACR-ET-14-0005	Five gallon bucket of oil/water mixture discovered under Lube Oil Tank in Vault 32A in area posted as Monolith Disassembly Area	4
ACR-ET-14-0004	G17 Valve mining operation did not follow order prescribed in evaluation for single parameter activity	4
ACR-ET-14-0003	Procedure WP 3085 used in field prior to receiving pre-requisite signatures from CSO for proper NCSD/E implementation (all NCSDs/Es are properly implemented)	5
ACR-ET-13-0029	Procedure PROC-KD-9019 R. 11 used in field prior to receiving pre-requisite signatures from CSO for proper NCSE implementation (all NCSEs are properly implemented)	5
ACR-ET-13-0028	Upon cutting coils on the high mass converter for mining, liquid was discovered in the line. Also, upon inspection of the bell housing, its configuration does not match that described in NCSE-ET-K25-1640.	4
ACR-ET-13-0026	Trap being mined contains an oily residue.	4
ACR-ET-13-0025	Bottles staged in non-destructive assay (NDA) shop awaiting NDA without required attendance.	4
ACR-ET-13-0023	Water was discovered in the cooler section of a converter during segmentation. Approximately one gallon of water was collected in a safe geometry pan, but there is a likelihood more water is contained in the converter.	4
ACR-ET-13-0022	A coolant line in an intercell cooler being mined was breached and approximately one gallon of coolant leaked from the cooler.	4

### 3. Non-Compliances with Requirements

There were no non-compliances with either DOE or ANSI/ANS standards requirements identified during Federal assessments in FY-2014.

### 4. Criticality Safety Support Group Recommendations

There are no open CSSG recommendations applicable to Oak Ridge Environmental Management (OREM) sites.



## 5. Evaluation of Overall Performance

Contractor performance has met expectations. The number of ACRs experienced in FY-2014 is lower than the number experienced in FY-2013. With the exception of one ACR (open for more than 200 days), expedient and appropriate actions were taken in response to the ACRs; including changing procedures and training personnel to lower the likelihood of repeat issues.

The ACR open the longest was discovered in FY-2013 and involved equipment that was assayed and discovered to contain more fissile material as holdup than any evaluation current at that time. This equipment was located in the K-27 Facility. The static conditions of the equipment were determined to be safe in the ACR report, but a formal evaluation was not performed immediately, as NCS resources were dedicated to finish the work scope associated with the K-25 demolition.

Demolition of the K-25 Facility was completed in FY-2014 and work is proceeding on the analysis for the K-27 Facility to ready it for demolition. NCS staffing levels are sufficient to meet programmatic needs, and the NCS staff (including CSOs) spends an appropriate amount of time in the field supporting fissile material operations.

## 6. Performance versus Specific Expectations

NCS performance is included in the UCOR Performance Evaluation Measurement Plan as part of the overall worker safety and health measure, but there are no performance-based incentives or performance evaluations directly related to NCS. The contractor is satisfactorily meeting the performance expectations.

Unweighted, individual metrics are used to assist in evaluation of performance. The individual metrics provide a means to make qualitative determinations of the contractor's overall performance. The metrics used are:

**Anomalous Conditions** - This metric data includes the number of new and total ACRs by Project Organization, ACR severity levels (Levels 1-5, with 5 being the least severe), the severity level of all open ACRs by Project, the age of all open ACRs by Project, and the ACR Primary Causes. An increase in the number of lower severity level ACRs is a leading indicator that more severe non-compliances may be expected to occur. A number of ACRs with similar causes is a lagging indicator of potential issues within conduct of operations or other supporting safety management programs. Timely closure of ACRs (as reflected by the age of all open ACRs) is a leading indicator of project management and operations attention to NCS.

**NCS Field Time and Continuing Education** - This metric is the average number of field hours for each of the engineers in the NCS Organization, and the total accumulated number of hours of continuing education amongst all engineers. These metrics are leading indicators of project management support of the NCS program, by encouraging NCS engineer presence in the field and continuing education/professional development of the NCS staff.

**Surveillances** - This metric measures timely performance of required NCS surveillances. The number of findings/anomalous conditions discovered during performance of the surveillances (if any) is also reported. This metric is a lagging indicator of issues that affect the NCS program

(e.g., discovery of pre-existing non-conformances, management inattention to the NCS program causing overdue surveillances, etc.).

The UCOR metrics are routinely monitored by the DOE field office. The metrics are informally analyzed to determine where program improvements may be warranted. None of the metrics are used in fee determination. No adverse programmatic trends, or programmatic strengths or weaknesses, were identified during this reporting period. As a result, no improvement actions have been directed. The metrics are rarely changed, as they have proven effective in monitoring the quality and health of the NCS program.

**At a glance:**

Contractor Staffing:	2 qualified, 1 in training, 1 part time	Meets programmatic requirements
Infractions:	1	
Non-Compliances:	None	
Criticality Safety Support Group Recommendations:	None	
Overall Performance	Excellent	

**1. Criticality Safety Staffing**

Isotek has enhanced its posture with regard to Nuclear Criticality Safety (NCS) staffing as it prepares to begin design work for dissolving, down-blending, and disposing of <sup>233</sup>U materials. The staff currently consists of a Lead NCS Engineer (Senior NCS Engineer), one full-time qualified Senior NCS Engineer, a second full-time qualified NCS Engineer, and a third newly-hired full-time individual who is in the process of qualification. A fourth, part-time Senior NCS Engineer is currently under contract as-needed to provide peer review of NCS documentation.

This level of staffing permits full-time site operations support by a qualified NCS Engineer. The newly-hired individual will attain qualification in time to fully support design activities for dissolution, down-blending, and disposal of fissile materials. Isotek has taken aggressive action to continue its support of day-to-day activities and to prepare for new work scope with a qualified staff and OREM considers the staffing sufficient to meet programmatic needs.

**2. Infractions, Severity, and Lessons Learned**

One Level 5 NCS nonconformance has been issued by the NCS Staff this FY resulting from field surveillance. This is the only NCS nonconformance issued in FY-2014.

Isotek assigns cause codes and tracks identified non-conformances via its Condition Reporting Procedure. Trending is conducted and reported accordingly. All NCS non-conformances are included in this process. There have been an insufficient number of NCS-related issues identified during the reporting period to establish trends or indications.

The nonconformance was discovered to be an incorrect re-inspection date applied to a status tag on NCS-credited equipment. The tag indicated the re-inspection was scheduled for a year in the future, when the actual re-inspection date being tracked by the Engineering organization was only 6 months into the future. The date on the tag does not cause re-inspection; rather it is an indication of status. The re-inspection is driven by maintenance software. This is a low-level nonconformance, since the equipment inspection was not past due and the tag does not cause the re-inspection.

**3. Non-Compliances with Requirements**

There were no non-compliances with either DOE or ANSI/ANS standards requirements identified during Federal assessments in FY-2014.

#### **4. Criticality Safety Support Group Recommendations**

There are no open CSSG recommendations applicable to OREM sites.

#### **5. Evaluation of Overall Performance**

Contractor performance has been exceptional. The Isotek NCS Program remains fully capable of supporting fissile material handling activities. NCSEs are current, rigorously maintained, and frequently evaluated against operating activities to ensure that the full set of normal and abnormal conditions have been analyzed. NCS limits and controls are thorough, well-understood, and effectively implemented to maintain the likelihood of inadvertent criticality “not credible”.

Isotek has added NCS engineers to the staff in preparation for increased work scope related to design work for dissolving, down-blending, and disposing of  $^{233}\text{U}$  materials. Management is supportive of the additions to the NCS staff, and supportive of the qualification process.

NCS procedures are periodically reviewed, and recent revisions have been proactively made in an effort to make programmatic improvements. Surveillances and assessments are performed frequently to maintain awareness of field conditions. Operators are knowledgeable of NCS Controls and appropriate emphasis is provided by Senior Management as evidenced by the few, and low-level significance of NCS-related anomalous conditions.

#### **6. Performance versus Specific Expectations**

There are no performance expectations (e.g., Performance Evaluation Plans and Performance Based Incentives) directly related to criticality safety.

Unweighted, individual metrics are used to assist in evaluation of performance. The individual metrics provide a means to make qualitative determinations of the contractor’s overall performance. The metrics used are:

- **Number and Severity Level (Levels 1-5, with 5 being the least severe) of NCS Non-conformances** - An increase in the number of lower severity level NCS non-conformances is a leading indicator that more severe non-compliances may be expected to occur.
- **Days to Closure of NCS Non-conformances** - Timely closure of NCS non-conformances is a leading indicator of project management and operations attention to NCS.
- **Self-Reporting of NCS Non-conformances** - NCS non-conformances self-reported by Operations is a leading indicator of Operations understanding of NCS requirements, and attention given to the NCS program.
- **Number and scope of NCS Operational Surveillances.**
- **Number of overdue Nuclear Criticality Safety Evaluation Annual Operational Reviews.**
- **Number of NCS Program Assessments.**

**Isotek**

- Along with the surveillance and assessment results metrics discussed below, these metrics provide a lagging indicator of issues that affect the NCS program (e.g., management inattention to the NCS program causing overdue surveillances).
- **Severity of issues identified during surveillances (findings or observations).**
- **Number of findings from surveillances.**
- **Severity of issues from assessments (findings/observations/recommendations).**
- **Number of findings from assessments.**

Along with the NCS surveillance and assessment metrics discussed above, these metrics provide a lagging indicator of issues that affect the NCS program (e.g., discovery of preexisting non-conformances).

- **Number of qualified NCS Engineers.**
- **Requalification status of NCS Engineers (professional development).**
- **Participation on ANSI/ANS Standards Working Groups.**

These metrics provide a leading indicator of project management support of the NCS program, by ensuring adequate staffing levels and encouraging continuing education/professional development of the NCS staff.

The Isotek metrics are routinely monitored by the DOE field office. The metrics are informally analyzed to determine where program improvements may be warranted. None of the metrics are used in fee determination. No adverse programmatic trends, or programmatic strengths or weaknesses, were identified during this reporting period. As a result, no improvement actions have been directed.

In addition to the listed metrics above, Isotek is in the process of defining additional NCS Program metrics to be taken for the coming FY. The new metrics will measure performance of operational and administrative activities at a more in-depth level. The new metrics will provide management with leading indicators of issues that could, if not addressed, result in NCS non-conformances. The intent of this effort is to drive program enhancements in all project areas that could affect NCS.

**At a glance:**

Contractor Staffing:	1 Manager, 3 part time	Meets programmatic requirements
Infractions:	None	
Non-Compliances:	None	
Criticality Safety Support Group Recommendations:	None	
Overall Performance	Meets expectations	

**1. Criticality Safety Staffing**

Wastren Advantage Inc. (WAI) retains its NCS staff under a subcontract arrangement, including the NCS Manager and NCS Engineers. Presently, the staff consists of 3 fully qualified NCS Engineers that report to the NCS Manager. All positions are part-time and the availability of 3 highly experienced NCS Engineers permits flexibility to cover all facility needs. The staffing level is considered sufficient for the workload and OREM has no concerns in this area.

**2. Infractions, Severity, and Lessons Learned**

There have been no NCS-related infractions at the TRU Waste Processing Center (TWPC) during this reporting period. Site-level requirements for inventory control on each waste container processed at the facility minimize the likelihood of NCS-related storage and handling failures. No issues have been identified as part of day-to-day operations, nor as a result of annual reviews of NCS Evaluations or management assessments.

**3. Non-Compliances with Requirements**

There were no non-compliances with either DOE or ANSI/ANS standards requirements identified during Federal assessments in FY-2014.

**4. Criticality Safety Support Group Recommendations**

There are no open CSSG recommendations applicable to OREM sites.

**5. Evaluation of Overall Performance**

The WAI NCS Program is adequately scoped and implemented at the TWPC. The contractor maintains awareness of the need for NCS organization input to operating activities and appropriately executes the NCS Program.

**6. Performance versus Specific Expectations**

There are no performance expectations (e.g., Performance Evaluation Plans and Performance Based Incentives) directly related to criticality safety.

The metrics that are tracked for the NCS Program at TWPC are those associated with Anomalous Condition Reports (ACRs). ACRs are tracked according to cause and days to closure. Tracking based on cause helps identify weak areas in the program, and tracking days to closure measures management attention to resolving NCS issues.

Occurrences of NCS anomalous conditions at WAI have been extremely infrequent. None were identified during this reporting period. Therefore, no trending analysis can be done. Also, no programmatic strengths or weaknesses were identified during this reporting period, and no improvement actions have been directed. The metrics are rarely changed, as they have proven effective in monitoring the quality and health of the graded approach NCS program. The NCS metrics are not used in fee determination.

**At a glance:**

Contractor Staffing:	24 (12 Senior Engineers; 8 qualified Engineers; 3 in training, 1 criticality safety technician)	Meeting programmatic requirements but may be marginal
Infractions:	4	
Non-Compliances:	None	
Criticality Safety Support Group Recommendations:	None	
Overall Performance	Meets expectations	

**1. Criticality Safety Staffing**

Savannah River Nuclear Solutions (SRNS) manages the majority of DOE-EM facilities at Savannah River, and is responsible for development and maintenance of a comprehensive criticality safety program. SRNS has established and maintains the Criticality Safety Program Description Document (CSPDD) as well as an ANS-8.26 and DOE-STD-1135 compliant criticality safety (CS) engineer qualification program.

SRNS accomplishes its portion of the Savannah River mission using a total of 24 staff members with various levels of knowledge/qualifications. The staff consists of 12 fully qualified Senior CS Engineers, 8 fully qualified CS Engineers, 3 staff members currently working to complete the CS Engineer qualification, and a CS Technician who serves as a qualified assessor. Most of the qualified Senior CS and CS engineers are also qualified as CS Officers in one or more of the facilities. One of the staff members currently working to complete CS Engineer qualification is a subcontract employee. The FY-2014 staff level represents a net increase of two over the FY-2013 staff level.

SRNS considers the current staffing level to be marginally sufficient for the currently anticipated work scope with very little capacity to accommodate unforeseen work. Additionally, a significant number of SRNS criticality safety staff members are retirement eligible or will be within the near future. Efforts to acquire additional staff members are on-going and a program to incentivize the staff to achieve further qualifications has been established.

The adequacy of the SRNS criticality safety staffing level is routinely discussed at monthly DOE-SR/Contractor CSP interface meetings. While DOE-SR recognizes that SRNS criticality safety resources are below desired levels, lack of facility criticality safety support resources has not yet been identified as a contributor to inadequate nuclear criticality safety evaluation or failure to fulfill operations support functions. It has been noted that potential loss of senior criticality safety resources has the potential to result in diminished prioritization of some functions related to the criticality safety program, furthermore, that the average age of existing criticality safety staff represents a vulnerability for additional loss, potentially impacting both program and facility functions. This situation is being monitored by DOE-SR criticality safety staff.



## **2. Infractions, Severity, and Lessons Learned**

A total of four criticality safety related ORPS reportable events occurred during FY-2014, in three Savannah River facilities. No common factors were identified among the events so no broadly applicable lessons learned were developed.

An L-Area Disassembly Basin ORPS 3C3 event involved several rack grating covers that were found to have been closed in a manner inconsistent with design specifications. It appears that surveillance following pre-2013 inspection/verification rack access failed to detect the improper closure.

Identification of a discrepancy between H Canyon evaluated dissolver insert dimensions and corresponding “as-built” dimensions resulted in an event that was initially classified in ORPS as 3B2 and subsequently upgraded to 3B1.

Unclear specification of an H Canyon fissile mass limit was classified initially as a 3B2 event and subsequently downgraded to an ORPS 3B3 event.

Discovery of an unanalyzed particulate trap in an SRNL drain line, initially classified as a 3B2 event, was also subsequently downgraded to an ORPS 3B3 event.

A potential criticality accident was never approached for any of these events because of the presence of multiple additional controls.

## **3. Non-Compliances with Requirements**

Non-compliance with DOE and ANSI/ANS requirements were primarily noted during federal assessment of criticality safety evaluation and authorization basis documents. Identified deficiencies were typically resolved through document revision prior to implementation. Two non-compliances requiring more substantial response were identified. In one case, documented criticality safety related ORPS guidance was found to be inconsistent with DOE O 232.2, *Occurrence Reporting and Processing of Operations Information*, and revision of the guidance was required. In the second case, criticality safety evaluation technical reviewer qualification requirements were found to be inadequate. As of the end of FY-2014, determination of appropriate corrective actions was on hold pending response to formal ANS clarification request.

## **4. Criticality Safety Support Group Recommendations**

No SRS specific CSSG recommendations were issued during FY-2014 and no recommendations remain open from previous years.

## **5. Evaluation of Overall Performance**

Savannah River contractor criticality safety performance is evaluated through review of criticality safety evaluations and related safety basis documents, consideration of contractor self-assessment processes and results, and performance of operational awareness activities. The evaluation process is supported through regular interface with contractor criticality safety program management and staff that includes review of criticality safety performance metric data.

Overall, SRNS criticality safety performance during FY-2014 was found to be satisfactory. Nuclear criticality safety evaluations were found to be generally adequate. DOE-SR identified areas of concern were limited and SRNS was found to be appropriately responsive. Regular assessment of facilities containing fissile mass in excess of threshold quantities was conducted by criticality safety program and facility staff in reasonable accord with a well-defined assessment plan. Operational awareness activities conducted at SRNS managed facilities did not identify any additional significant issues.

## **6. Performance versus Specific Expectations**

At SRS, the Performance Evaluation Management Plan establishes both general (subjective) and specific expectations whereby DOE assesses contractor criticality safety performance during evaluation, handling, storage, surveillance, transportation, and disposition of fissile bearing materials. Subjective performance assessment is typically provided throughout the contract period as part of monthly feedback meetings and reports. Criticality safety is addressed subjectively as part of overall technical performance, which also includes Conduct of Operations, Radiological Safety, and Nuclear Safety. Specific expectations are defined through performance-based incentives (PBIs) which, less frequently, address particular aspects of criticality safety performance (e.g., nuclear criticality safety evaluation, identification of criticality safety controls, and criticality safety conduct in operations).

The subjective evaluation of SRNS technical performance in the area of criticality safety was judged to be strong in FY-2014. Several SRNS PBIs were defined in the FY-2014 Performance Evaluation Plan that relate specifically to criticality safety. Satisfactory performance of H-Canyon waste minimization activities involving the revision sump flush program related to the criticality safety program resulted in full incentive award. Fee determination was in progress at the end of FY-2014 for development of the criticality safety limits needed to support HFIR receipt and dissolution and revision of the H Canyon contingency analysis required to support Canadian liquids processing.

Collection and evaluation of non-conformance and issue tracking data related to criticality safety, begun in FY-2013, was expanded in FY-2014 with the inclusion of data from criticality safety assessments, criticality safety training and qualification records, and document review databases. Leading and lagging indicators provide insight into the adequacy of criticality safety assessment performance, criticality safety evaluation, and criticality safety performance in facility operations, as well as criticality safety staff training, qualification and continuing education. Continued metrics development effort is planned for FY-2015 to optimize data collection and presentation and to formalize the process of data interpretation.

While none of the criticality safety performance metrics are directly utilized to support fee determination, the data is used to inform the criticality safety performance evaluation process, supplementing the conclusions drawn during assessments of criticality safety documents and activities. Although FY-2014 metrics effort was primarily focused on protocol development, early data interpretation efforts supported broad conclusions regarding aspects of criticality safety program health.

**At a glance:**

Contractor Staffing:	1 plus 1 part-time	Meets programmatic requirements
Infractions:	Not applicable, not operational	
Non-Compliances:	None	
Criticality Safety Support Group Recommendations:	None	
Overall Performance	Meets expectations	

**1. Criticality Safety Staffing**

Parsons is responsible for the design and construction of the Salt Waste Processing Facility. The project is in the construction phase with criticality safety evaluation ongoing.

Parsons accomplishes this portion of the Savannah River mission using one full time engineer and one part time engineer, both of whom are qualified as Senior Criticality Safety Engineers in accordance with DOE-STD-1135. DOE-SR concurs with the Parson’s conclusion that this staffing level is sufficient for the scope of work.

**2. Infractions, Severity, and Lessons Learned**

The SWPF is not yet operational. There were no criticality safety infractions during FY-2014.

**3. Non-Compliances with Requirements**

The SWPF is not yet operational and thus, had no ORPS events related to criticality safety during FY-2014.

**4. Criticality Safety Support Group Recommendations**

No SRS-specific CSSG recommendations were issued during FY-2014 and no recommendations remain open from previous years.

**5. Evaluation of Overall Performance**

Parson’s criticality safety performance is evaluated primarily through review of the SWPF Criticality Safety Program Description Document, the Preliminary Documented Safety Analysis (PDSA), and nuclear criticality safety evaluations. The evaluation process is supported through periodic communication with Parson’s criticality safety engineers and program management. Adequate criticality safety performance was confirmed during FY-2014 through review of NCSE and technical reference documents.

**6. Performance versus Specific Expectations**

At SRS, the Performance Evaluation Management Plan establishes both general (subjective) and specific expectations whereby DOE assesses contractor criticality safety performance during evaluation, handling, storage, surveillance, transportation, and disposition of fissile bearing materials. Subjective performance assessment is typically provided throughout the contract period as part of monthly feedback meetings and reports while specific expectations are defined through performance based incentives (PBIs) which, less frequently, address particular aspects of

**Parsons**

criticality safety performance (e.g., nuclear criticality safety evaluation, identification of criticality safety controls, criticality safety conduct in operations). As SWPF is a construction-phase project, no criticality safety related PBIs were defined for FY-2014.

**At a glance:**

Contractor Staffing:	1 plus 2 part-time, 2 in qualification	Meets programmatic requirements
Infractions:	None	
Non-Compliances:	1 regarding basis for criticality control designation	
Criticality Safety Support Group Recommendations:	None	
Overall Performance	Meets expectations	

**1. Criticality Safety Staffing**

Savannah River Remediation (SRR) is responsible for the operation of waste processing related facilities at SRS, including the Defense Waste Processing Facility (DWPF), Concentration, Storage and Tank Facilities (CSTF), and Saltstone Facility. SRR utilizes the Criticality Safety Program Description Document as well as the criticality safety (CS) engineer qualification program (compliant with both ANS-8.26 and DOE-STD-1135) maintained by Savannah River Nuclear Solutions (SRNS).

During FY-2014, SRR accomplished its portion of the Savannah River mission with a staff of three senior criticality safety engineers, all qualified in accordance with DOE-STD-1135. Two of the three SCSEs are retirees who provide part time support. In anticipation of the future unavailability of those resources, one additional SRR engineer is in the process of CSE qualification and another individual with CSE experience from non-SRS DOE facilities is in the process of SCSE qualification. The current criticality safety staff level is considered sufficient to meet programmatic needs by both SRR and DOE-SR.

**2. Infractions, Severity, and Lessons Learned**

No criticality safety related ORPS reportable events occurred in SRR facilities during FY-2014.

**3. Non-Compliances with Requirements**

Non-compliance with DOE and ANSI/ANS requirements were primarily noted during federal assessment of criticality safety evaluation and authorization basis documents. Identified deficiencies were typically resolved through document revision prior to implementation. One such case occurred during FY-2014 which involved a failure to provide adequate technical basis to support criticality control designation. Resolution required the recognition that an existing Specific Administrative Control in the DWPF DSA/TSR applies to criticality safety as well as other hazards.

**4. Criticality Safety Support Group Recommendations**

No SRS specific CSSG recommendations were issued during FY-2014 and no recommendations remain open from previous years.

**5. Performance versus Specific Expectations**

Savannah River contractor criticality safety performance is evaluated through review of criticality safety evaluations and related safety basis documents, consideration of the contractor

self assessment process and results, and performance of operational awareness activities. The evaluation process is supported through regular interface with contractor criticality safety program staff.

Overall, SRR criticality safety performance during FY-2014 was found to be satisfactory. Nuclear criticality safety evaluations were found to be adequate. Regular assessment of facilities containing fissile mass in excess of threshold quantities was conducted by criticality safety staff in reasonable accord with a well-defined assessment plan. Operational awareness activities conducted at SRR managed facilities identified no areas of concern.

## **6. Performance versus Specific Expectations**

At SRS, the Performance Evaluation Management Plan establishes both general (subjective) and specific expectations whereby DOE assesses contractor criticality safety performance. Subjective performance assessment is typically provided throughout the contract period as part of monthly feedback meetings and reports. Criticality safety is addressed subjectively as part of overall Program Management performance incentive which includes cross cutting areas such as safety, use of trained and qualified personnel, and continuous improvement. Specific expectations are defined through performance based incentives (PBIs) which, less frequently, address particular aspects of criticality safety performance (e.g., nuclear criticality safety evaluation, identification, and implementation of criticality safety controls).

The subjective evaluation of SRR criticality safety performance, which is encompassed under the general Program Management performance incentive, was judged to be satisfactory during FY-2014. SRR was generally found to perform adequately in criticality safety specific activity assessments as communicated through monthly feedback. There were no PBIs defined in the SRR FY-2014 Performance Evaluation Management Plan that related explicitly to criticality safety and no award fee reduction resulted from performance within the SRR criticality safety functional area.

Collection and evaluation of non conformance and issue tracking data related to criticality safety, begun in FY-2013 by SRNS and expanded in FY-2014 to include data from criticality safety assessments, criticality safety training and qualification records, and document review databases, was adapted by SRR in late FY-2014 to reflect the corresponding criticality hazard of waste processing operations. The reduced set of leading and lagging indicators addresses criticality safety assessment performance, criticality safety evaluation, and criticality safety performance in facility operations, as well as criticality safety staff training, qualification and continuing education. Continued SRR metrics development activity is planned for FY-2015 to coordinate with SRNS in further optimization of data collection, presentation, and interpretation.

SRR metrics development occurred very late in FY-2014 and thus did not contribute significantly to the performance evaluation process. It is anticipated that, in the future, the data will be used to inform the criticality safety performance evaluation process, supplementing the conclusions drawn during assessments of criticality safety documents and activities.