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Performance Analysis: Issues Tracking System Data through June 2013

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Disclaimer

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Performance Analysis and Improvement Group

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1.0 Executive Summary

This report presents the results from an analysis of issues and assessments in LLNL's Issues Tracking System (ITS). The analysis is conducted to identify issues that may require additional management attention and noncompliances that may not have been previously identified that meet the threshold for reporting to the DOE Noncompliance Tracking System (NTS) or to the DOE Safeguards and Security Information Management System (SSIMS).

This report includes ITS data within the DOE Office of Enforcement regulated subjects through June 2013. The analysis in this report primarily focuses on deficiencies identified in the last twelve months.

The analysis of issues concluded that data for 17 of the 25 Office of Enforcement regulated safety/security subjects were within expected variation. The data for eight met a common test and were discussed further. Three of the eight safety subjects met an action limit and were analyzed to resolution.

Analysis of data from one of the safety subjects where a common test was met identified a potential safety related significant or programmatic (systemic) noncompliance with the LLNL work planning and control process. Additional analysis is needed to make a final determination.

Note: Since the analysis of WPC deficiencies (through June 2013) was completed, a noncompliance evaluation was also completed in November 2013 and included more recent WPC deficiencies. The analysis of ITS data through June 2013, and the results of the noncompliance evaluation completed in November 2013 led to LLNL filing a programmatic noncompliance report to the NTS in January 2014 titled, *Programmatic noncompliance with topical areas within LLNL's Work Planning and Control process.*

2.0 Introduction

The DOE Office of Enforcement expects all contractors, including LLNL, to "implement comprehensive management and independent assessments that are effective in identifying deficiencies and broader problems in safety and security programs, as well as opportunities for continuous improvement within the organization." In addition, the DOE Office of Enforcement expects that "issues management databases are used to identify adverse trends, dominant problem areas, and potential repetitive events or conditions."

LLNL has an assessment program of management and independent assessments to identify deficiencies, management issues and opportunities for improvement. Document DES-0048, *LLNL Assessment Program*, Section 3.0 discusses assessments that address the subjects regulated by DOE Rules.

LLNL has in place a process to identify, report and manage deficiencies of nuclear safety, worker safety and health (WSH), and classified information security (CIS) requirements. LLNL requires that all nuclear safety, WSH, and CIS deviations from requirements be tracked as "deficiencies" in the LLNL ITS. Individual deficiencies are analyzed for nuclear safety, WSH, and CIS noncompliances that may meet the threshold for reporting to the DOE NTS or the SSIMS. This report presents the results of the analysis of the set of issues in the ITS.

This report meets the expectations defined by the DOE Office of Enforcement to evaluate implementation of internal processes for conducting assessments to identify noncompliances, analyzing the noncompliances found in these assessments, screening and reporting noncompliances, and evaluating the data in the ITS database to identify adverse trends, dominant problem areas, and potential repetitive events or conditions.

This performance analysis is designed to answer two questions:

1. Is LLNL assessing its programs (e.g., electrical safety program) and their state of compliance? (Section 3.0)
2. What is LLNL finding in its assessments? (Sections 4.0 through 8.0)

The results from analyzing the deficiencies are presented in accordance with the two primary NTS and SSIMS reporting thresholds:

1) WSH and nuclear safety noncompliances related to certain events or conditions and

2) WSH, nuclear safety, and CIS noncompliances that are management issues.

In addition, the report analyzes WSH noncompliances to determine if any fall under the "Severity Level I Noncompliance" threshold as defined by the DOE Office of Enforcement. This threshold applies to WSH noncompliances only.

3.0 Assessments

Assessments were evaluated to assure that LLNL management assessments and independent assessments are comprehensive and effective in identifying deficiencies and broader issues in safety and security programs, and are identifying opportunities for continuous improvement within LLNL.

3.1 Assessments Conducted

During the 12-month period ending June 2013, 1,041 internal assessments were completed, a 14% reduction from the previous 12-month period. More specifically, LLNL completed 791 management observations, verifications and inspections (MOVIs), 157 management self-assessments (MSAs), 35 other internal assessments, 29 internal independent assessments (IIAs), 26 joint functional area manager (FAM)/line management assessments (JFLMAs), one readiness review. During this same 12-month period, 91 external assessments and 93 events were also completed/finalized.

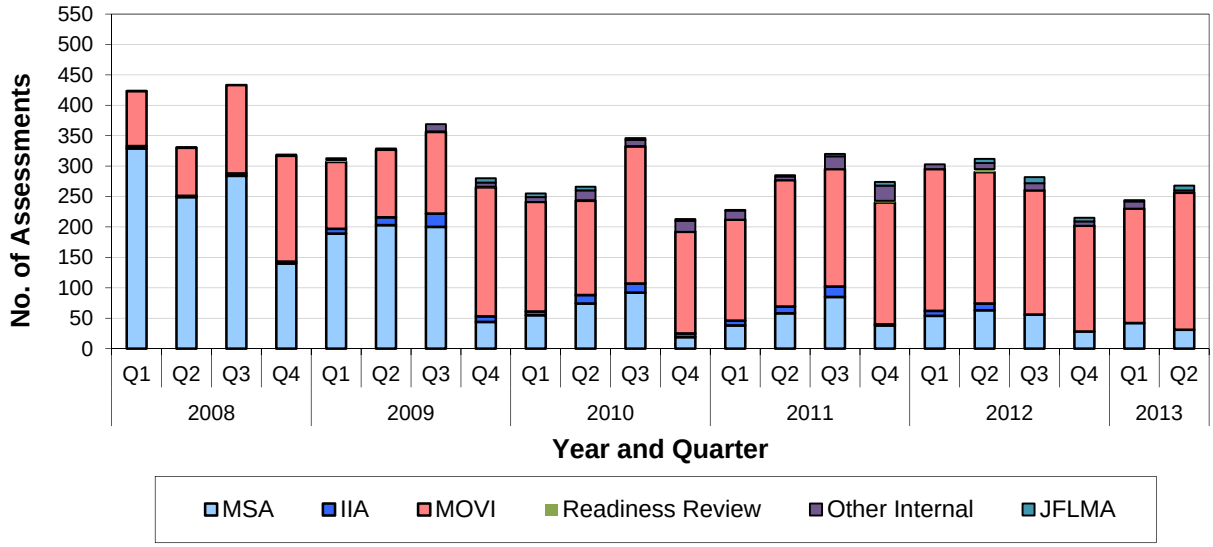


Figure 1. The number of internal assessments by type categories and quarter.

From the first to the second quarter of 2013, there was an increase in the overall number of internal assessments completed, as shown in Figure 1. Since 2009 there has been an increase in MSAs from the first to the second quarter of the year, but in 2013 there was a decrease from the first to the second quarter. Three directorates did not complete any MSAs in the second quarter of 2013 and three directorates had a decrease in the number of MSAs completed from the first to the second quarter in 2013.

A pattern exists for the number of internal assessments conducted from the beginning of 2009 through 2011; the number of internal assessments increases from the first to the third quarter of the calendar year and then decreases in the fourth quarter (Figure 1). Assessments are scheduled by fiscal year and must be completed by September 30 of each year. This pattern was discussed in detail in the previous analysis report. This pattern did not continue through the second quarter of 2012 because the number of assessments completed decreased from the first to the second quarter in 2012; however, it appears that this pattern may continue in 2013.

When evaluating the number of assessments completed each quarter using the process control chart shown in Figure 2, no action limits were recently met. The number of internal assessments has been increasing since the fourth quarter of 2012. Section 10.1 explains the common tests related to assessment data.

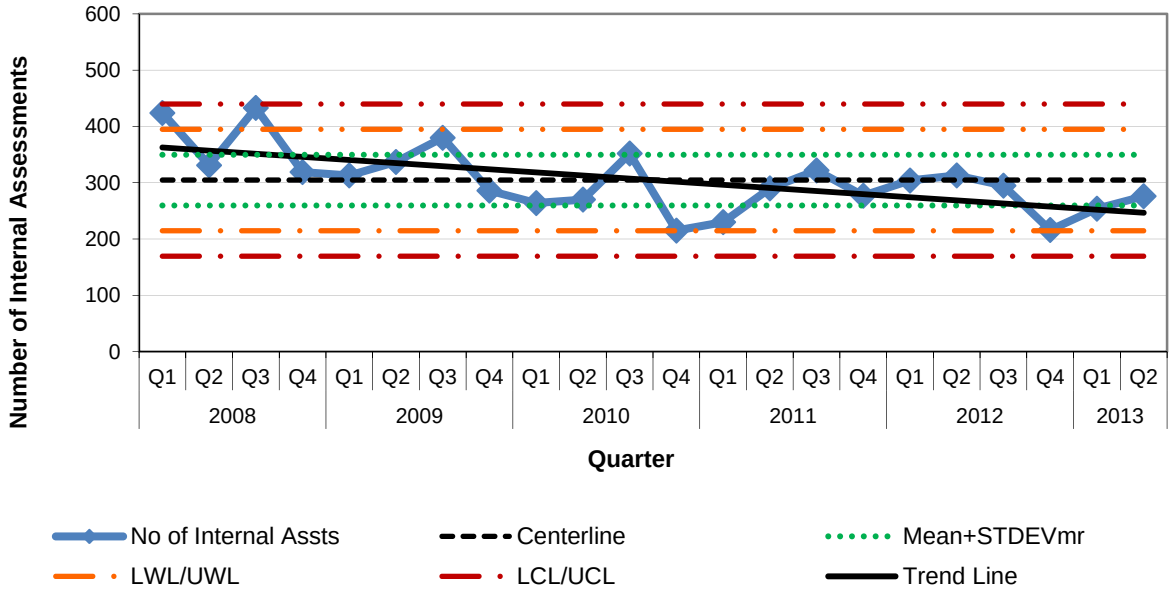


Figure 2. Frequency control chart of internal assessment data.

A statistically significant decreasing trend in the number of internal assessments entered into ITS exist (p-value < 0.01), as shown in Figure 2. The results of linear regression show that each quarter the number of assessments entered into ITS decreases by six assessments, on average. The decreasing trend from 2008 through the second quarter of 2013 can be attributed to assessment process changes and fewer unique assessments being conducted since the beginning of 2009.

This analysis concludes that the number of internal assessments decreased when comparing the recent 12-month period to the previous 12-month period. However, in comparing the most recent quarter of data analyzed to the previous quarter, the number of internal assessments increased. When evaluating the number of assessments conducted each quarter using a process control chart no action limits were met.

3.2 Assessment Effectiveness at Identifying Issues

To evaluate whether there has been a change in assessment effectiveness, issues in all functional areas from all sources were extracted from the LLNL ITS. The data showed 1,034 deficiencies with issue identification dates in July 2012 – June 2013, a 21% reduction from the previous 12-month period and 1,032 observations with issue identification dates in July 2012–June 2013, a 16% reduction from the previous 12-month period. Of the 1,034 deficiencies, 834 were designated as WSH and/or nuclear safety deficiencies, a 16% reduction from the previous 12-month period and 24 were designated as CIS, a 43%reduction from the previous 12-month period.

The number of deficiencies and observations identified each quarter has been fairly consistent since the fourth quarter of 2010 (Figure 3). There was a decrease in the number of deficiencies and observations identified from the first to the second quarter in 2013. Typically, more than half of deficiencies identified per quarter are categorized as WSH, nuclear safety, and/or CIS (Figure 3). The average number of issues identified per assessment completed in the 12-month period (July 2012–June 2013) is two, the same as the previous 12-month period, and 50% of all assessments completed in the 12-month period (July 2012–June 2013) had at least one issue. Six assessments completed in the twelve months (July 2012 – June 2013) identified more than 30 issues. One of the six assessments identified 73 issues, *The 2012 Legacy Fire Protection Re-Inspections.*

Although the number of deficiencies and observations identified each quarter has been fairly consistent since the fourth quarter of 2010 (Figure 3), a statistical test using simple linear regression concludes that the number of deficiencies and observations have a statistically significant decreasing trend over time from 2009 to the second quarter in 2013 (p-value < 0.05).

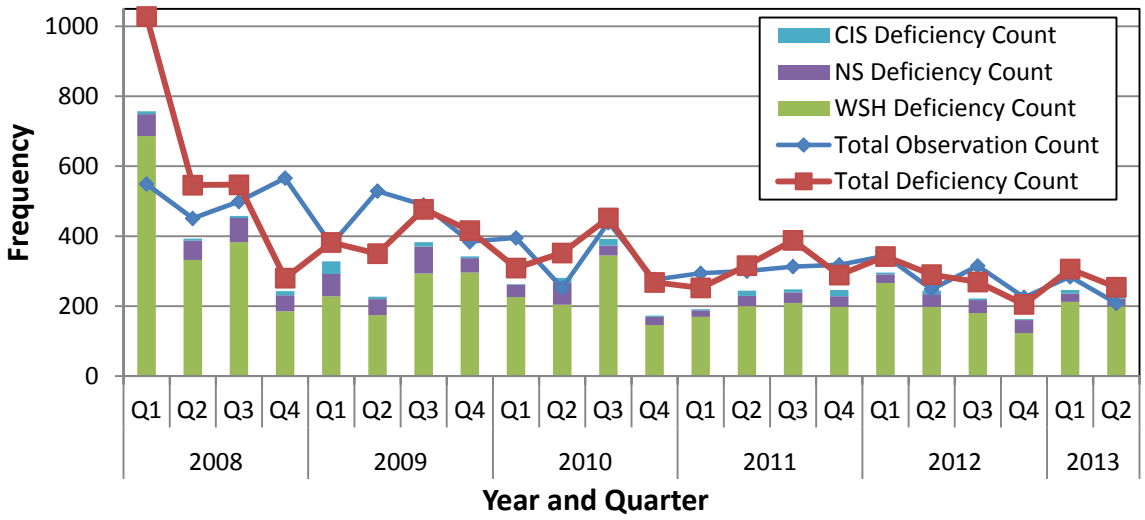


Figure 3. The number of ITS deficiencies and observations per quarter by deficiency category (WSH, nuclear safety, and CIS).

Figure 4 displays deficiencies across all functional/subject areas and highlights those related to nuclear safety (green), WSH (red), and CIS (orange). The most frequent functional/subject areas with identified deficiencies are WSH, emergency management, work planning and control, and, and safeguards and security (Figure 4). Subjects in the Office of Enforcement regulated safety and security functional areas are analyzed and the results are discussed in Sections 6.0, 7.0, and 8.0.

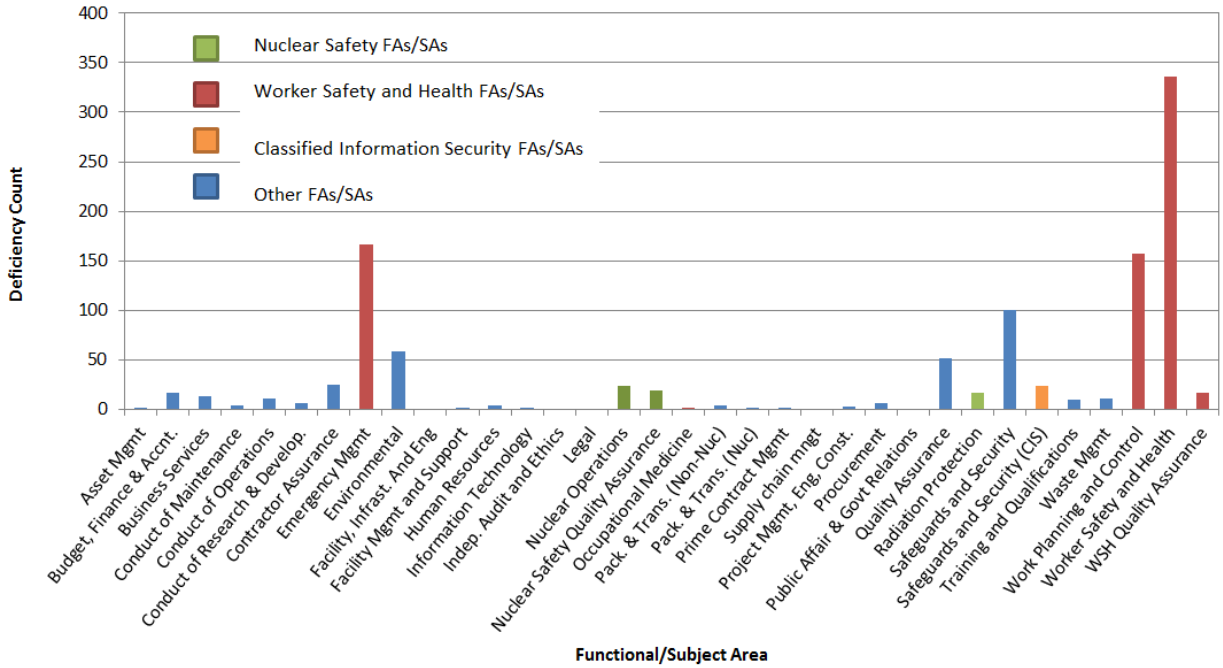


Figure 4. Number of deficiencies identified in July 2012 – June 2013 per functional/subject area.

Formal internal sources of WSH and nuclear safety deficiencies are IIAs and JFLMAs. Figure 5 displays the number of IIAs and JFLMAs performed from 2009 to 2013 (through June 2013). For the most recent four years, (2009-2013) at least one IIA or JFLMA has been completed in all of the seven regulated functional areas. In the last four years only one JFLMA was performed in the occupational medicine functional area; however, since the beginning of 2009, 10 external assessments, four MSAs, and four MOVIs within the occupational medicine functional area have been completed. Similarly for the work planning and control functional area, Figure 5 shows that only four formal assessments were performed from 2009 through June 2013. Since the beginning of 2009, 43 external assessments, 36 MSAs, and 50 MOVIs within the work planning and control functional area have been completed.

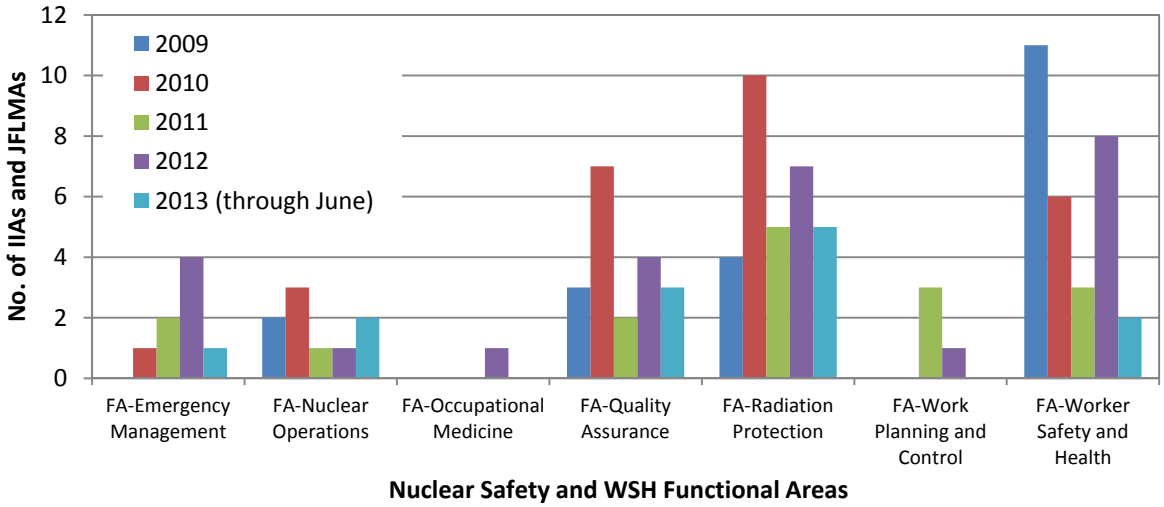


Figure 5. Number of IIAs and JFLMAs of regulated functional areas.

This analysis concludes that both the total number of deficiencies and observations decreased from the previous 12-month period. In comparing the most recent quarter of data analyzed to the previous quarter, the total number of deficiencies and observations also decreased; however, the average number of issues per assessment is the same for this 12-month period compared to the previous 12-month period. Typically more than half of deficiencies identified per quarter are categorized as WSH, nuclear safety, and/or CIS. In this 12-month period, LLNL saw an increase in the percentage of deficiencies categorized as nuclear safety and WSH. This increase may be attributed to the completion of IIAs and JFLMAs in five of the seven regulated functional areas in the first six months of 2013. For CIS deficiencies, LLNL saw a slight decrease in this 12-month period, from 3% to 2% of deficiencies categorized as CIS.

4.0 Issues Evaluated for Reporting to NTS

Issues from assessment, occurrence, and analysis reports are evaluated as the reports are distributed to determine whether NTS-reportable deficiencies are being identified. From July 2012 through June 2013, 57 reports were prepared and made available and 86 issues were evaluated for noncompliance reporting. Since this section of the analysis is completed last, data through December 2013 is included in Figure 6. An additional 35 reports were made available for evaluation from July 2013–December 2013. Figure 6 shows the number of reports completed each month and subject to independent evaluation for noncompliance reporting, and the number of issues to be evaluated each month. As of the end of December 2013, 22 reports were pending a documented noncompliance evaluation, as shown in red in Figure 6. Many of these reports have been evaluated, but the documentation of the evaluation is pending entry into ITS.

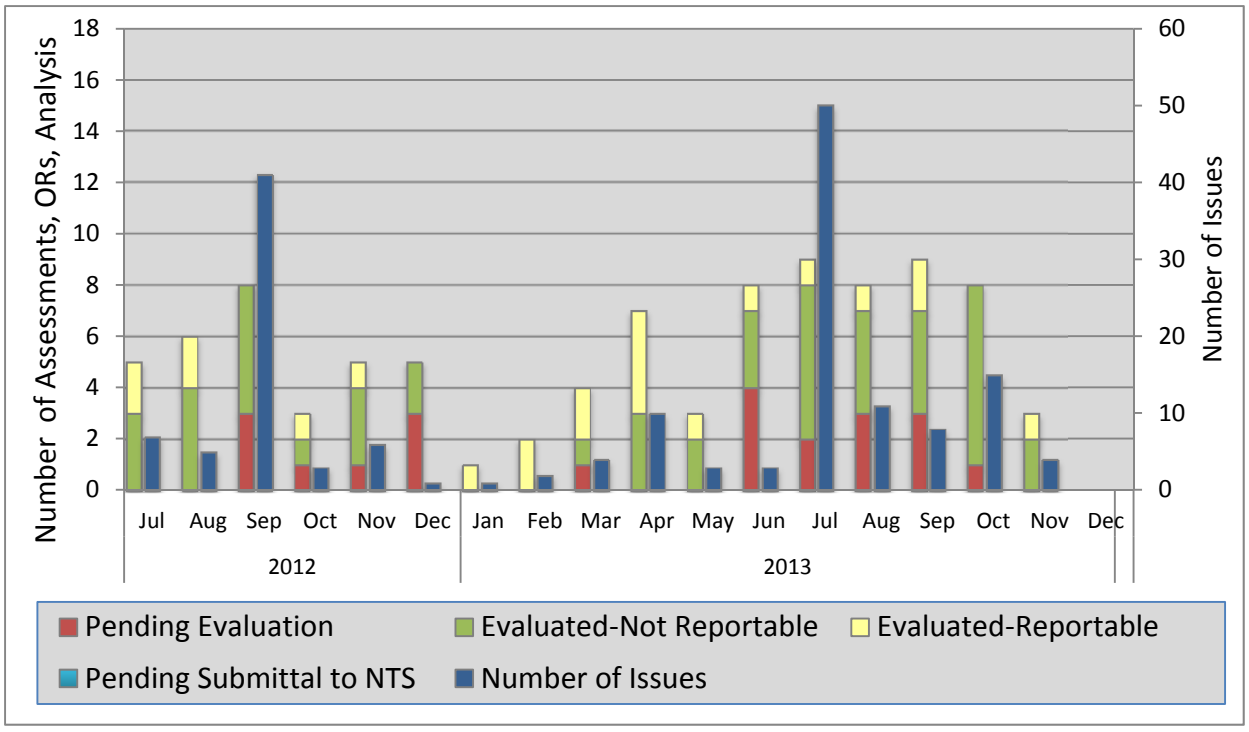


Figure 6. Assessments, final occurrence reports and analysis reports issued each month and their evaluation status.

In the 12-month period through June 2013, 69% percent of deficiencies entered into ITS were marked as WSH deficiencies, 12% were marked as nuclear safety deficiencies, and 2% were marked as CIS deficiencies. The WSH and nuclear safety percentages are an increase and the CIS percentage is a slight decrease from the previous 12-month period.

In the second quarter of 2013, the most recent quarter analyzed, 78% of deficiencies entered into ITS were marked as WSH deficiencies, 9% of deficiencies were marked as nuclear safety deficiencies, and 2% were marked as CIS deficiencies. The WSH and nuclear safety percentages increased from the previous quarter, and the CIS percentage decreased from the previous quarter, as shown in Table 1.

Table 1. ITS deficiencies entered and noncompliances reported to NTS or SSIMS.

Year	Qrt	Obs. in ITS	Defs. in ITS	WSH Noncompliances (NCs)	WSH NCs Reported to NTS	NS NCs	NS NCs Reported to NTS	CIS NCs
2011	Q1	294	252	169 (67%)	3 (2%)	19 (9%)	1 (5%)	3 (1%)
	Q2	300	316	200 (63%)	4 (2%)	29 (9%)	3 (10%)	15 (5%)
	Q3	313	388	209 (54%)	3 (1%)	30 (8%)	2 (7%)	9 (2%)
	Q4	318	289	198 (69%)	1 (1%)	30 (10%)	1 (3%)	18 (6%)
2012	Q1	344	342	266 (78%)	2 (1%)	25 (7%)	0 (0%)	5 (1%)
	Q2	248	290	198 (68%)	1 (1%)	36 (12%)	0 (0%)	10 (3%)
	Q3	315	269	180 (67%)	4 (2%)	37 (14%)	3 (8%)	5 (2%)
	Q4	225	205	123 (60%)	3 (2%)	37 (18%)	0 (0%)	3 (1%)
2013	Q1	284	306	212 (69%)	1 (< 1%)	24 (8%)	2 (8%)	10 (3%)
	Q2	208	254	199 (78%)	1 (1%)	22 (9%)	4 (18%)	6 (2%)

Note: The data in columns 6 and 8 include "combination reports" (i.e., NUC/WSH noncompliance reports as both a report for nuclear safety and a report for WSH).

Of the site-reported WSH and nuclear safety deficiencies, two percent were reported to the DOE NTS in the second quarter of 2013, similar to previous analyses where the percent reported to the DOE NTS was around two or three percent. No comparison was made between site-reported CIS and SSIMS reported CIS noncompliances.

LLNL's reporting of WSH and nuclear safety noncompliances was compared to other NNSA sites. From July 2012 through June 2013, LLNL reported the third highest number of noncompliances to the DOE NTS and LLNL had the fourth highest number of effort hours (hours worked), as shown in Figure 7. In the previous analysis LLNL had the fourth highest number of noncompliances to the DOE NTS.

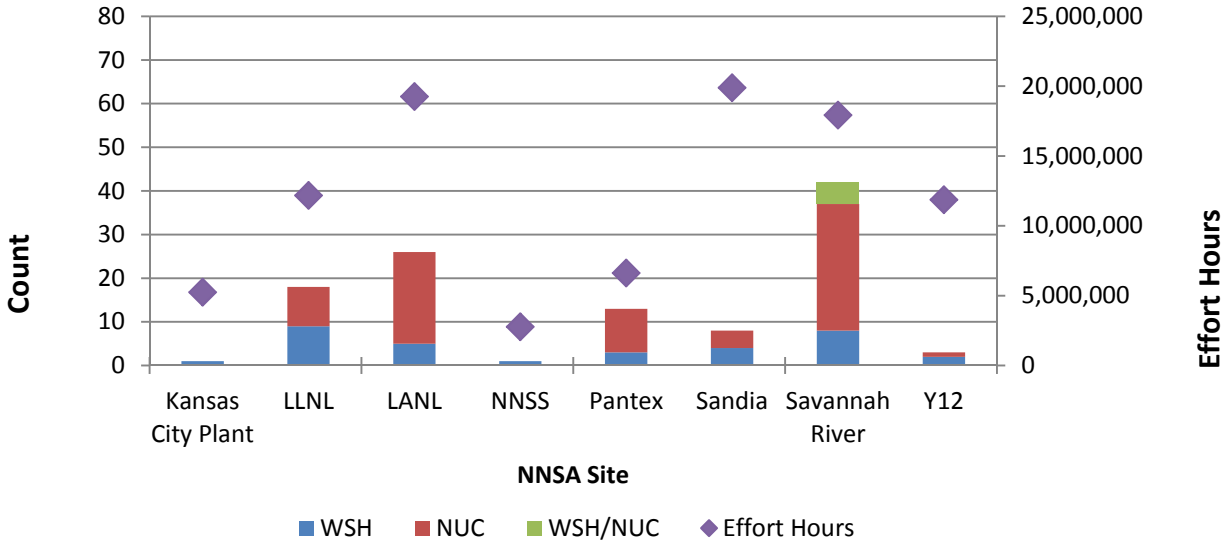


Figure 7. Noncompliances reported to the DOE NTS across NNSA sites from July 2012 through June 2013.

In comparing the number of NTS reported noncompliances among NNSA sites in the last four years, Figure 8 shows a steady decrease in the number of noncompliances reported to the DOE NTS for NNSS. Since this section of the analysis is completed last, data through December 2013 is included in Figure 8. For all other NNSA sites, including LLNL, there is no apparent trend over the last four years. LLNL, like Sandia, has seen an increase in the number of NTS reported noncompliances from 2012 to 2013 (as of December 17, 2013). However, for both LLNL and Sandia, the number of NTS reports in 2013 is less than the number reported in 2010. LANL, Kansas City Plant, Pantex, NNSS, Savannah River Site, and Y12 have seen a decrease in the number of NTS reported noncompliances from 2012 to 2013 (as of December 17, 2013).

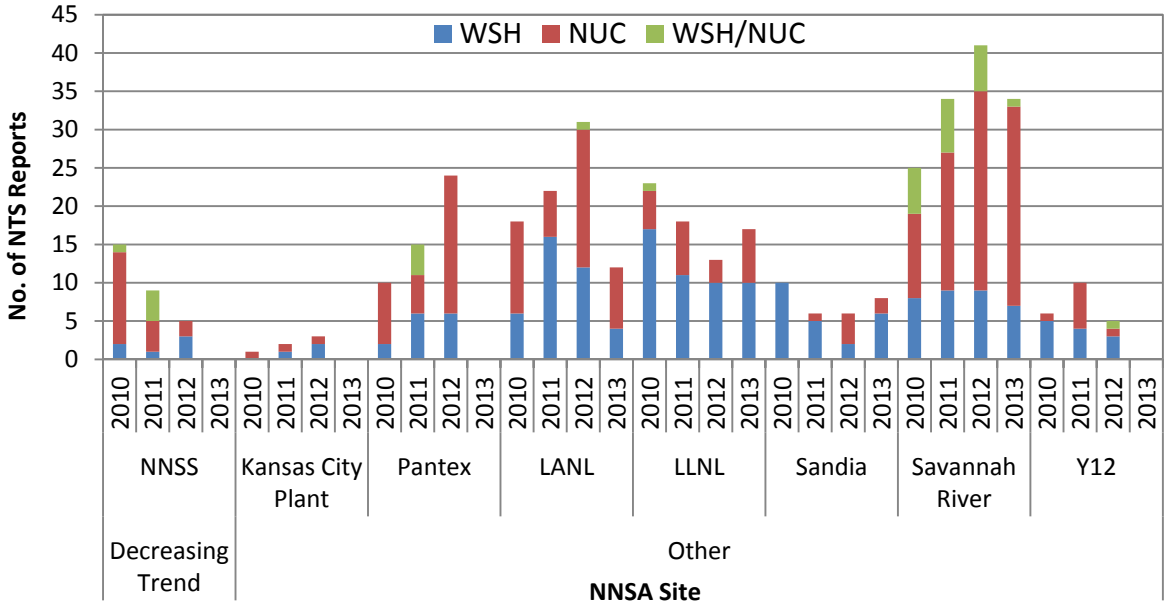


Figure 8. Noncompliances reported to the DOE NTS across NNSA sites for the last four years (as of December 17, 2013).

To summarize section 4.0, the 12-month percentage of deficiencies entered into ITS that were marked as WSH and nuclear safety increased from the previous 12-month period. The 12-month percentage of deficiencies entered into ITS that were marked as CIS decreased from the previous 12-month period. LLNL, like Sandia, showed an increase from 2012 to 2013 in the number of noncompliances reported to the DOE NTS. However, for both LLNL and Sandia, the number of NTS reports in 2013 is less than the number reported in 2010. LANL, Kansas City Plant, Pantex, NNSS, Savannah River Site, and Y12 have seen a decrease in the number of NTS reported noncompliances from 2012 to 2013 (as of December 17, 2013).

5.0 Noncompliances Related to Events or Conditions

DOE expects that noncompliances associated with certain occurrence reporting criteria be reported to the Noncompliance Tracking System (NTS), regardless of the severity of the noncompliance. LLNL uses the NTS reporting thresholds specified in the DOE *Safety and Security Enforcement Coordinator Handbook*, Tables III-1 and III-3, and described in DES-0083, *Regulatory Compliance Assurance Program for DOE Safety and Security Requirements* to determine reportability.

Occurrences are promptly reviewed for NTS-reportable worker safety and health (WSH) and nuclear safety noncompliances as they are reported into the Occurrence Reporting and Processing System (ORPS). The initial review is based on the description of the occurrence; however, after the occurrence is further characterized and analyzed for cause, additional information may be available that identifies noncompliances that should be reported. The Management Assurance System Organization works with the directorate points-of-contact (POCs) to make this determination.

5.1 Worker Safety and Health Results

LLNL submitted 53 occurrence reports to ORPS from July 1, 2012, through June 30, 2013. Seventeen occurrences submitted to ORPS were assigned a reporting criterion that satisfied the DOE Office of Enforcement WSH criteria for reporting to the DOE NTS. Each occurrence was evaluated for possible noncompliances; nine occurrences were identified as having WSH deficiencies reportable to the DOE NTS. Five occurrences revealed fall protection noncompliances and were reported into NTS as one repetitive noncompliance. Below are the nine occurrence reports that identified noncompliances reported in five NTS reports:

1. NA-LSO-LLNL-LLNL-2012-0035, *Fall Protection Near Miss During Re-roofing Project at Building 517;* NA-LSO-LLNL-LLNL-2012-0040, *Fall Protection PPE Not Worn During HVAC Repair on Trailer 5627 Roof Near Miss;* NA-LSO-LLNL-LLNL-2012-0041, *Subcontractor Fall Protection Near Miss During Building 801 Reroofing Project;* NA-LSO-LLNL-LLNL-2012-0052, *Fall Protection Near Miss During Air Conditioning Work at Building 531;* NA-LSO-LLNL-LLNL-2013-0022, *Recurring Fall Protection Near Misses.* The associated noncompliances were reported in NTS-LSO-LLNL-LLNL-2012-0008, *Repetitive instances of employees/workers not protected from a fall hazard by using appropriate fall protection*

2. NA-LSO-LLNL-LLNL-2012-0047, *Battery Failure During Compressor Start Up Causes Acid to be Splashed on Employee at Building 815.* The associated noncompliance was reported in NTS-LSO-LLNL-LLNL-2012-0012, *Exposure to battery acid.*

3. NA-LSO-LLNL-LLNL-2013-0001, *Immersion heater ejected from Building 874 fire suppression pipe during maintenance activity.* The associated noncompliance was reported in NTS-LSO-LLNL-LLNL-2013-0004, *Lockout/Tagout step omitted resulting in ejected immersion heater*

4. NA-LSO-LLNL-LLNL-2013-0005, *Three workers exposed to acid mixture at Building 827D.* The associated noncompliance was reported in NTS-LSO-LLNL-LLNL-2013-0002, *Skin Exposure to Sulfuric Acid.*

5. NA-LSO-LLNL-LLNL-2013-0014, *Fire in Building 322 Dip Tank.* The associated noncompliance was reported in NTS-LSO-LLNL-LLNL-2013-0014, *The fire hazard related to B322 dip tank operations was not properly identified, leading to a fire in B322 dip tank.*

The remaining eight occurrences did not constitute noncompliances with DOE WSH requirements or they did not warrant a noncompliance report to the DOE NTS. All of the noncompliance evaluations are documented in the LLNL ITS.

1. NA-LSO--LLNL-LLNL-2012-0034, *Custodian Trip/Fall Outside Causes Fracture to Hand,* did not constitute a noncompliance with DOE WSH requirements. This event was, neither NTS-reportable nor site-reportable. The identified cause was that the surface the employee was walking and tripped on, was slightly uneven near the water value box. OSHA 1910 Subpart D, "Walking-Working Surfaces" and ES&H Manual Document 11.2 section 15.0, "Walking and Working Surfaces" were both reviewed to determine if the uneven surface was a WSH noncompliance; the cause was not found to be out of compliance. There are no requirements in either OSHA or the ES&H Manual that are related to this cause. Also, reports from the employee and the employee's supervisor indicated that lighting was not a contributing factor.

2. NA-LSO--LLNL-LLNL-2012-0042, *Unexpected Energy Source Discovered Building 391 Electrical Panel Replacement,* did not constitute a NTS-reportable noncompliance with DOE WSH requirements. A WSH noncompliance was site-reported. The causal analysis identified the direct cause as a pre-existing legacy condition, an incorrectly wired circuit, which led to the event. It was not known when the incorrectly wired circuit was installed. It was known that LOTO was properly completed for the panel's feeder, which included the zero-energy verification step.

3. NA-LSO--LLNL-LLNL-2012-0045, *Bicycle Accident on Outer Loop Road Results in Fractured Bones,* did not constitute a NTS-reportable noncompliance with DOE WSH requirements. This issue itself, riding a bicycle in the dark without proper lighting was site reported as a WSH noncompliance.

4. NA-LSO--LLNL-LLNL-2012-0046, *Worker tripped and fractured shoulder on sidewalk near Building 314,* did not constitute a noncompliance with DOE WSH requirements. This event was neither NTS-reportable nor site-reportable. One of the identified causes was that the surface the employee tripped on was uneven due to the age and improvements/repairs that had been made to the sidewalk. OSHA 1910 Subpart D, "Walking-Working Surfaces" and ES&H Manual Document 11.2 section 15.0, "Walking and Working Surfaces" were both reviewed to determine if the uneven surface was a WSH noncompliance; the cause was not out of compliance. There are no requirements in either OSHA or the ES&H Manual that are related to this cause.

5. NA-LSO--LLNL-LLNL-2012-0054, *Pedestrian struck by vehicle in parking lot at Site 300 near Building 870,* did not constitute a noncompliance with DOE WSH requirements. The event was neither NTS-reportable nor site-reportable. LLNL determined that the speed of the car was acceptable for a parking lot. Because the employee was not crossing a street, there was no crosswalk-related noncompliance.

6. NA-LSO--LLNL-LLNL-2012-0056, *Near Miss Light Diffuser Falls in Office Area at Building 516,* did not constitute a noncompliance with DOE WSH requirements. The event was neither NTS-reportable nor site-reportable. The identified cause was that an adequate securing method was not designed for or fabricated in the assembly. The diffuser was fabricated "in-house" and adequate thought was not put into the design or fabrication. ES&H Manual Document 22.4, "Earthquakes" states, "Grills, diffusers, and lenses shall be permanently fastened to the fixture or provided with safety chains." However, ES&H Manual Document 22.4 is not a part of the LLNL WSHP, which means this issue is out of the scope of 10 CFR 851.

7. NA-LSO-LLNL-LLNL-2013-0010, *Worker slipped on ice and fractured elbow at Minot AFB,* did not constitute a noncompliance with DOE WSH requirements. The event was neither NTS-reportable nor site-reportable. This occurrence happened at a site other than LLNL. One of the identified causes was that there was nothing to call attention to the potential formation for black ice.

8. NA-LSO--LLNL-LLNL-2013-0019, *Employee sustains broken rib from bike accident,* did not constitute a noncompliance with DOE WSH requirements. This event was neither NTS-reportable nor site-reportable. The site of the accident was reviewed by a safety professional. It was the opinion of the safety professional that the configuration of the pathway at this location did not violate any federal, state or local codes, or any LLNL design standards.

5.2 Nuclear Safety Results

LLNL submitted 53 occurrence reports to ORPS from July 2012 to June 2013. Seventeen occurrences submitted to ORPS were assigned a reporting criterion that satisfied the DOE Office of Enforcement nuclear safety criteria for reporting to the DOE NTS. Nine of the 17 occurrences were determined to have a nuclear safety nexus (i.e., a potential to cause radiological harm) and were evaluated for noncompliances with DOE nuclear safety requirements. The following six occurrence reports were determined to have at least one associated nuclear safety noncompliance. LLNL reported the noncompliances to the NTS:

1. NA-LSO-LLNL-LLNL-2012-0030, *Degraded Safety Class Fire Barrier in Building* 332, reported that a laboratory room door was in a degraded condition because it could not be properly latched. LLNL reported the associated noncompliance, NTS—LSO-LLNL-LLNL-2012-0004, *Surveillance Requirement Violation: Degraded Safety Class Fire Barrier in Building 332*.

2. NA-LSO-LLNL-LLNL-2013-0004, *Positive USQ: MACCS2 Calculations Underestimate Waste Storage Facility Offsite Dose Consequences* reported the Potential Inadequacy in the Safety Analysis (PISA) existed regarding application of the MACCS2 dispersion code to calculate off-site radiological doses associated with postulated accidents. A subsequent Unreviewed Safety Question (USQ) evaluation determined that the discrepant condition was a positive USQ (i.e., an actual inadequacy in the safety analysis), which constituted a noncompliance with DOE nuclear safety requirements. LLNL reported the noncompliance, NTS—LSO-LLNL-LLNL-2013-0007, *MACCS2 Calculations Underestimate Waste Storage Facility Offsite Dose Consequences*.

3. NA-LSO-LLNL-LLNL-2013-0007, *Seismic Capability of Select Building 331 Exhaust Stacks and Building 332 Security Poles May Not Be Preserved in the Building 332 DSA*, reported that a PISA existed regarding the capability of select ventilation stacks and security poles, located near Building 332, to withstand a design-basis seismic event. A subsequent USQ evaluation determined that the discrepant condition was a positive USQ, which constituted a noncompliance with DOE nuclear safety requirements. LLNL reported the noncompliance, NTS—LSO-LLNL-LLNL-2013-0005, *Noncompliance with DOE Nuclear Safety Requirements for the Building 334 DSA Hazard Analysis*.

4. NA-LSO-LLNL-LLNL-2013-0012, *Description of System Boundaries of Some Safety SSCs Are Unclear in the Building 332 DSA*, reported that a PISA existed in that the description of system boundaries of some safety SSCs were unclear in the facility DSA. Specifically, some equipment in the B332 loft (i.e., equipment connected

between a glovebox in Room 1370 and the Glovebox Exhaust System, as well as an associated enclosure connected to the Room Ventilation System) was not explicitly described in the DSA as part of a safety SSC or as interfacing with the safety SSC. A subsequent USQ evaluation determined that the discrepant condition was a positive USQ, which constituted a noncompliance with DOE nuclear safety requirements. LLNL reported the noncompliance, NTS—LSO-LLNL-LLNL-2013-0006, *Building 332 DSA Does Not Adequately Describe System Boundaries of Some Safety SSCs*.

5. NA-LSO-LLNL-LLNL-2013-0018, *Some Components in the Building 332 Increment 1 RVS Exhaust Ducting May Not Meet Fire Performance Criteria*, reported that a PISA existed in that certain components in the facility Room Ventilation System (RVS) exhaust ducting might potentially degrade during an evaluation-basis room fire. Specifically, the ability to maintain structural integrity of some ducting gasket material in the RVS ducting from certain rooms with fume hoods was questioned. A subsequent USQ evaluation determined that the discrepant condition was a positive USQ, which constituted a noncompliance with DOE nuclear safety requirements. LLNL reported the noncompliance, NTS—LSO-LLNL-LLNL-2013-0007, *Building 332 DSA Does Not Explicitly Evaluate Room Ventilation System Ducting for Potential Thermal Degradation in an Evaluation Basis Room Fire.*

6. NA-LSO-LLNL-LLNL-2013-0021, *Building 332 Oxidation Furnace Pressurization Failure Mode Inconsistent with the DSA*, which reported that a PISA existed in that a pressurization failure mode inconsistent with the Building 332 DSA description existed for the Metal Conversion Glovebox (MCG) oxidation furnace in Room 1006. The MCG oxidation furnace is supplied by pressurized gas sources of up to 1000 psig. In the unmitigated case, failure of non-credited pressure control components could yield process pressures that would defeat the furnace's hydraulic seal. This potentially allows powder driven by high pressure gas pulses to be released from the furnace into the glovebox. A subsequent USQ evaluation determined that the discrepant condition was a positive USQ, which constituted a noncompliance with DOE nuclear safety requirements. LLNL reported the noncompliance, NTS—LSO-LLNL-LLNL-2013-0008, *Noncompliance Building 332 Documented Safety Analysis Did Not Evaluate Oxidation Furnace Pressurization Failure Mode.*

The remaining three occurrences did not constitute noncompliances with DOE nuclear safety requirements or they did not warrant a noncompliance report to the DOE NTS. All of the noncompliance evaluations are documented in the LLNL ITS.

1. NA-LSO--LLNL-LLNL-2012-0037, *Failed Emergency Diesel Generator Surveillance in Building 332*, reported that Emergency Diesel Generator 332GDE07 had failed its monthly surveillance test on low voltage. The other emergency diesel generator

and the emergency power system remained operable, providing backup to the generator that failed its surveillance test. The occurrence did not constitute a noncompliance with DOE nuclear safety requirements because (1) the degraded condition was discovered by LLNL personnel during a routine scheduled surveillance being performed in accordance with facility procedures and under an approved facility Work Permit; (2) the response by B332 operations personnel to the discovered condition followed facility procedures. Upon the identification of the failed surveillance, the generator was locked out of service pending repair; and (3) in accordance with facility procedures, a voltage regulator determined to be defective was replaced with a new unit. The generator was then retested and determined to meet the surveillance requirement, at which time it was returned to normal operation.

2. NA-LSO--LLNL-LLNL-2012-0053, *Failed Surveillance of a Safety Class Pressure Regulator on Fire Suppression System*, reported a failed surveillance test of the Building 332 Fire Suppression System in that the as-found output pressure of regulator PRV-1 was 72 psig instead of the required 80 psig ± 5 psig. At the time of the discovery, Building 332 Facility Operators were performing Surveillance Requirement Procedure, SRP-B332-4.3.1.g, *Semiannually, Functional Check of the Backup Nitrogen Supply System Pressure Regulating Valve (PRV-1)*. The occurrence did not constitute a noncompliance with DOE nuclear safety requirements because (1) the as-found discrepant condition was discovered by LLNL personnel during a routine scheduled surveillance being performed in accordance with facility procedures, and (2) in accordance with facility TSRs, the appropriate Limiting Condition of Operation (LCO) was entered immediately upon discovery of the discrepant condition. In accordance with facility procedures, B332 personnel replaced and tested the regulating valve, then returned the system to normal operation.
3. NA-LSO--LLNL-LLNL-2013-0023, *Performance Degradation of the Safety Class Fire Water Tank in Building 332*, reported that the Safety Class fire suppression tank, TFW-1, part of the B332 fire suppression system, was reading a head pressure of 86 psig. The allowable Technical Safety Requirements (TSR) range for this parameter is 80 psig ± 5 psig. The occurrence did not constitute a noncompliance with DOE nuclear safety requirements because (1) the as-found discrepant condition was discovered by LLNL personnel during a routine scheduled surveillance being performed in accordance with facility procedures, and (2) in accordance with facility TSRs, the appropriate LCO was entered immediately upon discovery of the discrepant condition. In accordance with facility procedures, B332 personnel restored pressure to its acceptable range by venting the tank. The regulator was exercised, diagnostics were performed, and the tank was returned to service.

The following occurrence did not immediately satisfy the Office of Enforcement criteria for reporting to the NTS, but, based on subsequent evaluations, including an extent-of-condition review and a root cause analysis, the issue was determined to be a programmatic noncompliance with DOE nuclear safety requirements that was reportable to the NTS.

1. NA-LSO-LLNL-LLNL-2012-0038, *Use of Software Not Properly Documented In Accordance With the Site Software Quality Assurance Process*, reported a PISA, namely that a specific computer code used to perform hazard analysis supporting the facility safety basis had not been subjected to appropriate software quality assurance (SQA). Subsequent evaluation determined that the discrepant condition was a positive USQ (i.e., an actual inadequacy in the Building 239 safety basis). The LLNL Quality Assurance Organization performed an extent-of-condition review that identified additional computer codes used for safety analysis that similarly had not been subjected to appropriate SQA, indicating a programmatic weakness in the LLNL Institutional Software Quality Assurance Program (ISQAP). LLNL reported a programmatic noncompliance with DOE nuclear safety requirements in NTS—LSO-LLNL-LLNL-2012-0009, *Incomplete Quality Assurance Records for Alternate Versions of DOE Toolbox Software*.

Four occurrences had a "nuclear nexus," but they were not assigned a reporting criterion that satisfied the DOE Office of Enforcement nuclear safety criteria for reporting to the DOE NTS. These four occurrences were determined to not constitute NTS-reportable noncompliances with DOE nuclear safety requirements. In one case, NA-LSO--LLNL-LLNL-2012-0043, a noncompliance existed and the noncompliance was determined to be site-reportable.

1. NA-LSO--LLNL-LLNL-2012-0039, *Management Concern: Solid State Pressure Gauge Calibration Checks in Building 331*, reported a management concern regarding calibration checks done for the solid-state differential-pressure gauges (SSGs) that are associated with the gloveboxes in the facility. Contrary to the recommendation of the gauge manufacturer (which called for a four-point calibration if the user "required" gauge calibration at all), the relevant Nuclear Materials Technology Program procedure for the calibration checks on the SSGs utilized a one-point check method, which may not capture potential drift in gauge operation. The occurrence did not constitute a noncompliance with DOE nuclear safety requirements because the gauge manufacturer left it to the user to decide if calibration was "required" and if so, only *identified*, but did not explicitly *require*, a four-point calibration method. Consequently, there was no failure to follow specific *requirements* and the reported condition – and the NMTP response to the management concern – can be considered continuous improvement of NMTP procedures.
2. NA-LSO--LLNL-LLNL-2012-0043, *Management Concern: Respirator Filter Cartridge Dislodges and Falls Off GVP Respirator Pump in Building 801A*, reported a

management concern after a worker`s GVP respirator pump filter dislodged and fell off the pump assembly. The worker did not receive any exposure to radioactive material. The reported event was determined to constitute a noncompliance with the requirements of 10 CFR 830.122(d)(1), Nuclear Safety Management, Quality Assurance Criteria, Documents and Records, owing to the identified procedural inadequacy that the process for donning the respirator lacked a requirement for a second worker to check if the respirator had been properly donned. The noncompliance was determined to be site-reportable-only.

3. NA-LSO--LLNL-LLNL-2012-0055, *Management Concern - Material Shift During Shipment Leading to Higher than Expected Surface Dose Reading on Shipping Container in Building 411*, reported the discovery that the surface radiation dose on a returned shipping container surveyed upon receipt in Building 411 exceeded the regulatory dose limit for an [DOT] Excepted package containing radioactive material. A causal analysis determined that the excess radiation dose occurred because the container in the drum had shifted during transport. The discovered condition did not constitute a noncompliance with DOE nuclear safety requirements because (1) the package (a lead pig containing the radioactive material, which was then placed in a 55-gallon drum and surrounded by hard foam) was prepared in accordance with the Integration Work Sheet (IWS) governing the work performed; (2) the package upon departure from LLNL met all pre-shipment requirements for "Radioactive Material, Excepted Package - Limited Quantity of Material," namely and solely that the contact surface dose was below regulatory limits; (3) once the package left the LLNL site, it was under control of the shipper, who decided to not survey the package upon arrival at and departure from the destination terminal; (4) upon return to LLNL, a receipt inspection of the package was performed in accordance with Laboratory procedures, at which time the contact dose reading was determined to no longer be compliant with the "excepted package – limited quantity" threshold; (5) subsequent notifications were made in accordance with Laboratory procedures; and (6) prior to returning the package to the vault for proper storage and in accordance with Laboratory procedures, LLNL personnel opened the drum and inspected its contents, then restored the internal configuration to its original pre-shipment state.
4. NA-LSO--LLNL-LLNL-2013-0011, *Power Outage at Site 300*, reported a loss of power at Site 300 from the offsite source, affecting all facilities and their normal operations. All standby generators functioned as designed and power was restored approximately two hours later. Consequently, the occurrence did not constitute a noncompliance with DOE nuclear safety requirements.

6.0 Worker Safety and Health Management Issues

Worker safety and health (WSH) includes programs in chronic beryllium disease prevention, biological safety, electrical safety, emergency preparedness, explosive safety, fire safety, occupational medicine, work planning and control, and other safety and health subjects. Data from 2005 through the second quarter in 2013 were extracted from ITS in July 2013 using the ITS Basic Issue Report.

As discussed in the sections below, the analysis for WSH identified two WSH subjects with a point above the UCL (an action limit), one WSH subject with eight points below the centerline (an action limit), and nine WSH subjects with a common test met, a point above the UWL, an increase in deficiencies in the second quarter of 2013, or a recent consecutive increase in deficiencies. Four WSH subjects were identified in previous analyses as needing follow-up analysis: fire prevention, hazard communication, general industrial hygiene, and general industrial safety.

6.1 Chronic Beryllium Disease Prevention Program (CBDPP)

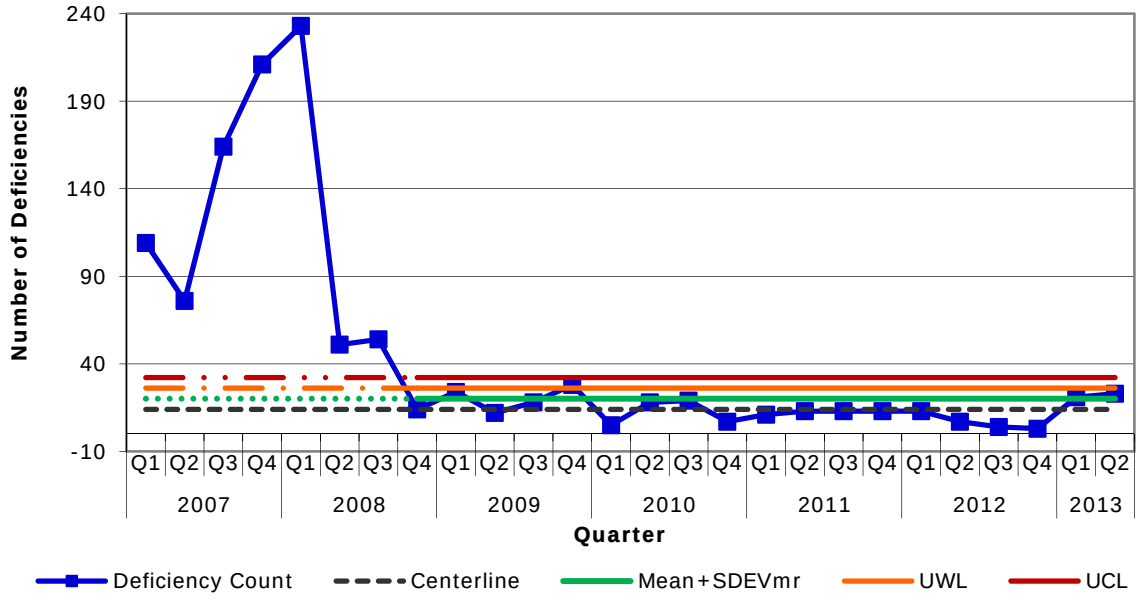
The visual analysis step did not warrant further analysis of deficiencies in ITS categorized as beryllium safety. LLNL reported a noncompliance to the DOE NTS in October 2013 title, *Repetitive noncompliance with 10 CFR 850 reporting requirements for personnel air samples less than action level.* LLNL is in the process of addressing this reported noncompliance. Since the visual analysis did not warrant further analysis, this safety subject was not discussed or analyzed further in this report.

6.2 Biological Safety

The visual analysis step did not warrant further analysis of deficiencies in ITS categorized as biological safety. Therefore, this safety subject was not discussed or analyzed further in this report.

6.3 Electrical Safety

The visual analysis step warranted further analysis of deficiencies in ITS categorized as electrical safety. Therefore, this safety subject was analyzed using a control chart (Figure 9). The control chart analysis identified a consecutive increase in electrical safety deficiencies from the fourth quarter of 2012 to the second quarter of 2013. Therefore, this safety subject is discussed further.



Note: Control Limits are based on fewer quarters than displayed

Figure 9. Frequency control chart of electrical safety deficiencies.

During the second quarter in 2013, the most recent quarter of data analyzed, there were 23 electrical safety deficiencies identified from seven different assessments. Eight of the 23 are from the Program Authority Having Jurisdiction (AHJ) JFLMA. Four of the eight deficiencies are directorate specific deficiencies needing attention in the Program AHJ database. One of the two main deficiencies from the AHJ JFLMA was reported to the DOE NTS as NTS report NTS-LSO-LLNL-LLNL-2013-0010, *A significant amount of electrical equipment is in service, but not AHJ/NRTL approved.* Thirteen of the 23 deficiencies identified in the second quarter of 2013 were from either the Facility Management Department or NIF walkabouts/walkthroughs.

During the first quarter of 2013, 19 of the 21 electrical safety deficiencies identified were from MOVIs conducted by four different directorates with 15 of the 19 deficiencies from MOVIs conducted by N&PS.

For 2012 and 2013, 74 electrical safety deficiencies were identified from a number of different categories. Twenty seven percent (27%) of the 74 deficiencies were categorized as, "Electrical wiring is installed or used improperly (e.g., multiple extension cords

connected, underrated for application, etc.)." Additional binning showed the two largest bins as related to AHJ and labeling/signage. Fifteen percent (15%) of the 74 deficiencies were AHJ-related and 12% had to do with labeling/signage. In reviewing other deficiencies identified in 2012 and 2013, there is no obvious trend. Deficiencies can be binned across at least 13 different categories.

To conclude Section 6.3, recent data within the electrical safety subject met a common test, a consecutive increase in deficiencies from the fourth quarter of 2012 to the second quarter of 2013. Fifteen percent (15%) of deficiencies identified in 2012 and 2013 were AHJ/NRTL related. LLNL submitted an NTS report in 2013 regarding equipment in service but not AHJ/NRTL approved. In reviewing other deficiencies identified in 2012 and 2013, there is no obvious trend. Therefore, it was determined that electrical safety deficiencies do not represent an additional systemic or repetitive noncompliance reportable to DOE; however, this safety subject will be analyzed in future analyses since a common test was met.

☐ Potential Significant, Systemic or Repetitive	☒ Meets Common Tests	☐ Within Expected Variation	☐ Downward Trend

6.4 Emergency Program

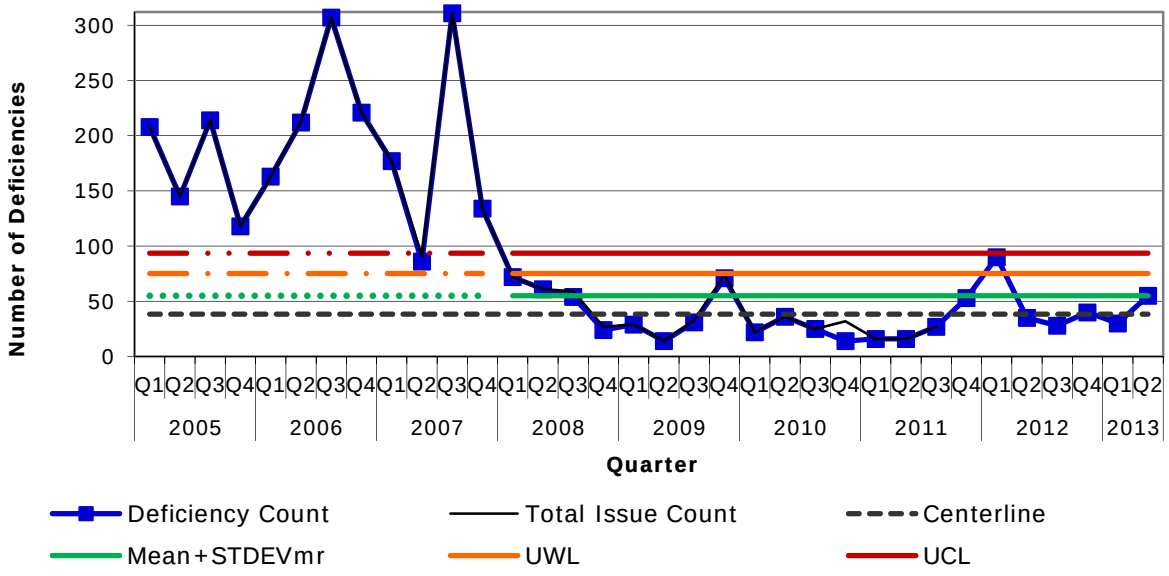
The visual analysis step did not warrant further analysis of deficiencies in ITS categorized as emergency program. Therefore, this safety subject was not discussed or analyzed further in this report.

6.5 Explosive Safety

The visual analysis step did not warrant further analysis of deficiencies in ITS categorized as explosive safety. Therefore, this safety subject was not discussed or analyzed further in this report.

6.6 Fire Safety

The visual analysis step warranted further analysis of deficiencies in ITS categorized as fire safety. Therefore, this safety subject was analyzed using a control chart. The control chart analysis revealed a recent increase in fire safety deficiencies in the second quarter of 2013, a common test. Therefore, this safety subject is discussed further.



Note: Control limits are based on fewer quarters than displayed

Figure 10. Frequency control chart of fire safety deficiencies.

During the second quarter in 2013, the most recent quarter of data analyzed, there were 55 fire safety deficiencies identified from a number of different assessments; 42 of the 55 are owned by the Operations and Business (O&B) Directorate. Twenty of the 55 deficiencies were from the 2013 legacy fire protection re-inspections. Deficiencies from the 2013 legacy fire protection re-inspections are not newly identified deficient conditions; they are deficiencies that were identified in the 2007 due diligence walkdowns in preparation for contract transition. The 2007 walkdowns and due diligence inspections of LLNL facilities and operations resulted in a programmatic noncompliance report that was submitted to the DOE NTS in 2008 titled, *Fire barriers, egress/life safety and storage/handling of flammable and combustible liquids and gases deficiencies identified as pre-existing-conditions during contract transition.*

Although the programmatic noncompliance was entered into ITS, the individual deficiencies were not entered into ITS in 2007. LLNL has an agreement with LFO that all legacy deficiencies that have not been addressed would be reviewed, entered into ITS, an equivalency would be sought out or the deficiencies would be fixed or categorized as something to be fixed in the future and entered into the Condition Assessment

Information System (CAIS). The CAIS is a cost estimating tool provided by DOE for the identification and tracking of the repair costs of deferred maintenance deficiencies.

About half of the 55 deficiencies identified in the second quarter of 2013 are categorized as fire prevention and 16% are categorized as fire detection and alarms. The visual analysis of deficiencies categorized as fire prevention, and fire detection and alarms warranted further analysis. Therefore fire prevention, and fire detection and alarms deficiencies were analyzed using control charts in the sections below.

Fire Prevention

The control chart analysis (Figure 11) for fire prevention deficiencies shows a point above the UWL in the second quarter of 2013, a common test. This safety subject was also determined to need continued analysis in the previous performance analysis due to a point above the UWL in the first quarter of 2012 (the point is now slightly below the UWL). Therefore, this safety subject is analyzed and discussed further.

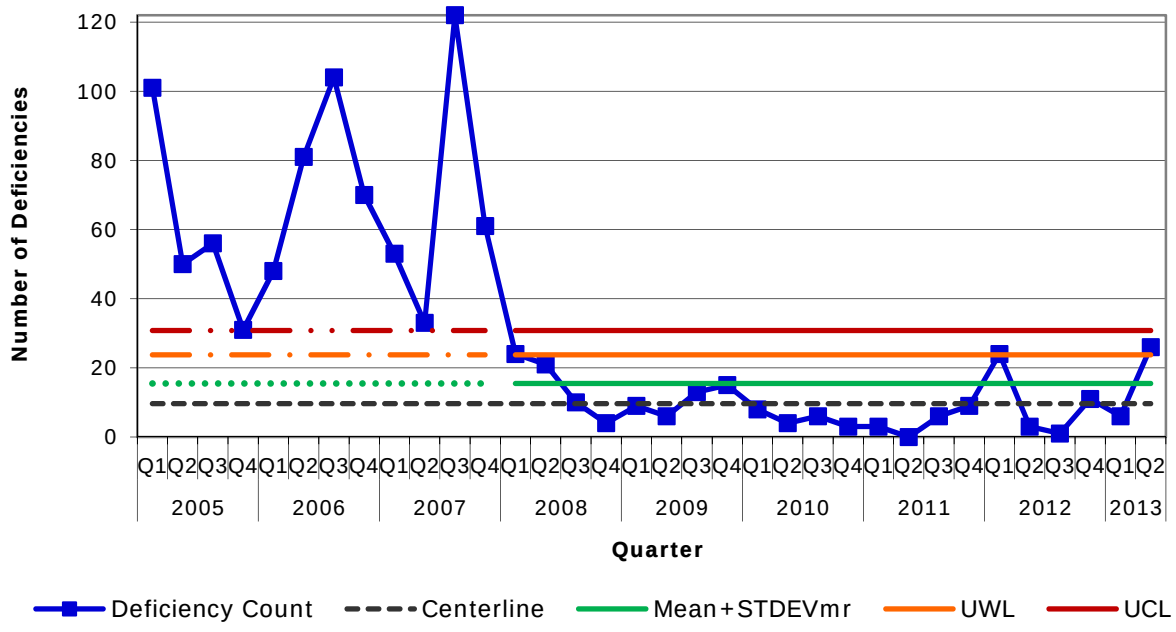


Figure 11. Frequency control chart of fire prevention deficiencies.

During the second quarter in 2013, the most recent quarter of data analyzed, there were 26 fire prevention deficiencies that caused a point to be above the UWL. The majority of the 26 deficiencies are owned by the O&B Directorate and 42% of the 26 were from the *2013 legacy fire protection re-inspections* discussed in the previous section. Seventy-three percent (73%) of the 26 fire prevention deficiencies were categorized as, "Integrity of

fire barrier and/or smoke barrier is compromised," and were within seven unique facilities.

In summary, fire prevention deficiencies met a common test, a recent point above the UWL. Steps are being taken to recertify the deficiencies and the programmatic noncompliance had been reported to NTS. Fire prevention deficiencies do not appear to represent a new systemic, repetitive, or significant noncompliance that is reportable to the DOE NTS. However, this safety subject will automatically be analyzed in future performance analyses to see if the number of fire prevention deficiencies continues to increase.

Fire Detection and Alarms

The control chart analysis (Figure 12) for fire detection and alarm deficiencies shows a point above the UCL in May 2013, an action limit. Therefore, this safety subject is analyzed to resolution.

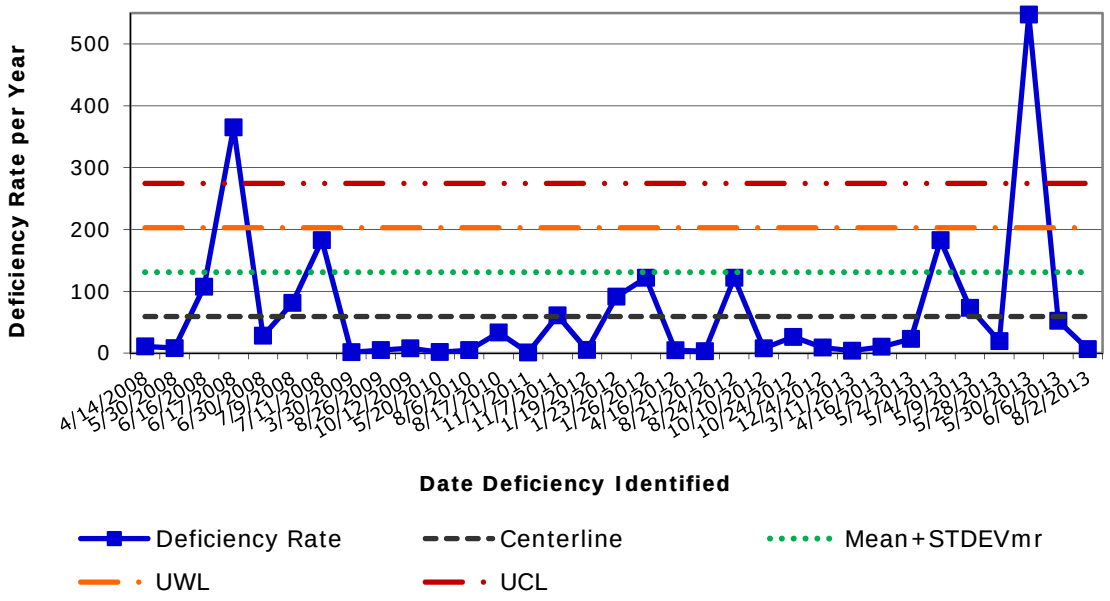


Figure 12. Deficiency rate control chart of fire detection and alarm deficiencies.

During the second quarter of 2013, nine fire detection and alarm deficiencies were identified. Four of the nine deficiencies were from the *2013 Legacy Fire Protection Re-Inspections,* two were reportable occurrences, one a below-ORPS-reportable occurrence, and the others from two different assessments. Three of the nine were related to fire dispatch not receiving an alarm; all from the High Explosives Application Facility but with three different dates for identification (5/2/13, 5/4/13, and 6/6/13). After further

review and discussion with the Fire Marshal, FAM and the Assurance Manager, it was determined that the three deficiencies related to fire dispatch not receiving an alarm were the same deficiency, with three separate entries in ITS. Two of the deficiencies were duplicated under the ITS assessment created for the occurrence, and the other deficiency was entered under a different assessment. Excluding the duplicated deficiencies in the control chart (figure not shown) did not change the results, a point remains above the UCL. However, the discussion below relates to the nine deficiencies identified in the second quarter of 2013.

Seven of the nine deficiencies from the second quarter of 2013 were identified in May 2013, more than in any other month in 2013. Four of the seven were from the *2013 Legacy Fire Protection Re-Inspections* and were identified within two days of one another, the reason for the point above the UCL. One of the four was identified on 5/28/2013 and the other three identified on 5/30/2013. The three identified on 5/30/2013 were from the same facility (Building 112) and the deficiency identified on 5/28/2013 was from Building 482. It appears that the *2013 Legacy Fire Protection Re-Inspections* were conducted on different days, and each day a different facility was assessed. The *2013 Legacy Fire Protection Re-Inspections* are discussed above at the beginning of the fire safety section. Deficiencies from these inspections are not newly identified deficiencies, but deficiencies identified during the 2007 due diligence walkthroughs. The Fire Marshal reports that the deficiencies from the re-inspections are considered minor issues.

Two of the four deficiencies from the *2013 Legacy Fire Protection Re-Inspections* are the same deficiency from the same facility, but in two different rooms, "vertical penetrations at the concrete ceiling for Inergen system pipes that are sealed with white hand towels." These penetrations were at one point sealed, but are not sealed anymore. This is not considered a significant noncompliance.

There were no other commonalities identified among the remaining fire detection and alarm deficiencies. These remaining five deficiencies are:

- A door doesn't carry a fire door rating label (B112 – re-inspection)
- Fire dispatch did not receive an alarm (HEAF - duplicated)
- Several fire dampers found inoperable (B451)
- A procedure used by a vendor was not detailed enough to prevent an inadvertent shut down of the tape libraries (B115)
- An 18" hole was noted in the ceiling at the corridor intersection outside the West entrance to Room B120 and covered at the top with plywood.

An additional fire detection and alarm deficiency was identified in the first quarter of 2013. The deficiency is described in ITS as: "Fire alarm/detection system is not properly designed and/or installed."

In summary, fire detection and alarm deficiencies met an action limit, a recent point above the UCL. The review of all deficiencies identified in 2013 determined that one deficiency, fire dispatch not receiving an alarm from HEAF, had three different entries in ITS. However, excluding two of the deficiencies from the control charts analysis did not change the results, the data point in May was still above the UCL. Although an action limit was met, the review of all deficiencies identified in 2013, excluding the two deficiencies that were duplicates, did not identify any common deficiencies nor did the deficiencies appear to be systemic.

To conclude Section 6.6, recent data within the fire safety subject met a common test, there was a recent increase in fire safety deficiencies. About half of the deficiencies identified in the second quarter of 2013 are categorized as fire prevention and 16% are categorized as fire detection and alarms; both safety subjects were analyzed using control charts.

Fire prevention deficiencies met a common test, a point above the UWL in the second quarter of 2013. Forty two percent (42%) of the data from the second quarter of 2013 were from the *2013 Legacy Fire Protection Re-Inspections.* Fire prevention deficiencies do not appear to represent a systemic, repetitive, or significant noncompliance that is reportable to the DOE NTS. Fire prevention deficiencies will be analyzed in future performance analyses to see if the number of fire prevention deficiencies continues to increase.

Fire detection and alarm deficiencies met an action limit, a point above the UCL in May 2013. During the second quarter of 2013, nine fire detection and alarm deficiencies were identified. Four of the nine deficiencies were from the *2013 Legacy Fire Protection Re-Inspections,* two were reportable occurrences, one a below-ORPS-reportable occurrence, and the others from two different assessments. Deficiencies from *the 2013 Legacy Fire Protection Re-Inspections* are not newly identified deficient conditions, they are deficiencies that were identified during the 2007 due diligence walkdowns in preparation for contract transition. A noncompliance report was submitted to the DOE NTS in 2008 titled, *Fire barriers, egress/life safety and storage/handling of flammable and combustible liquids and gases deficiencies identified as pre-existing-conditions during contract transition.* This programmatic noncompliance was a result of the fire safety deficiencies identified in the walkdowns and due diligence inspections of numerous LLNL facilities and operations.

These deficiencies were not entered into ITS in 2007. LLNL and LFO agreed that all legacy deficiencies that were not addressed since 2007 would be reviewed, entered into ITS, an equivalency would be sought out or the deficiencies would be fixed or categorized as something to be fixed in the future and entered into the Condition Assessment Information System (CAIS).

Three of the nine fire detection and alarm deficiencies identified in the second quarter of 2013 were related to fire dispatch not receiving an alarm; all from the High Explosives Application Facility but with three different identification dates (5/2/13,

5/4/13, and 6/6/13). After further review and discussion, it was determined that the three deficiencies related to fire dispatch not receiving an alarm are the same deficiency. Two fire detection and alarm deficiencies are the same deficiency from the same facility, but in two different rooms, "vertical penetrations at the concrete ceiling for Inergen system pipes that are sealed with white hand towels." These penetrations were at one point sealed, but they are not sealed anymore. This is not considered a significant noncompliance. No other commonalities exist among the remaining fire detection and alarm deficiencies and a review of the remaining deficiencies determined that none of the remaining deficiencies are significant. Fire detection and alarm deficiencies were analyzed to resolution; this analysis identified the reason for the point above the UCL and determined that a potentially reportable noncompliance does not exist.

☐ Potential Significant, Systemic or Repetitive ☒ Meets Common Tests ☐ Within Expected Variation ☐ Downward Trend

6.7 Occupational Medicine

The visual analysis step did not warrant further analysis of deficiencies in ITS categorized as occupational medicine. Therefore, this safety subject was not discussed or analyzed further in this report.

6.8 Other Industrial Hygiene

The visual analysis step did not warrant further analysis of deficiencies in ITS categorized as industrial hygiene (IH). Deficiencies categorized as hazard communication and general IH are analyzed using controls charts because common tests were met in the previous analyses.

Hazard Communication

The visual analysis step did not warrant further analysis of recent deficiencies categorized as general IH; however, this safety subject was determined to need further analysis due to an increase in deficiencies from the first to the second quarters of 2012. The current control chart analysis (Figure 13) for hazard communication deficiencies shows an increase in the number of deficiencies identified from the first quarter of 2013 to the second quarter of 2013, a common test. Although a common test was met, the data point in question in the second quarter of 2013 is below the centerline. In this case, this safety subject is discussed further.

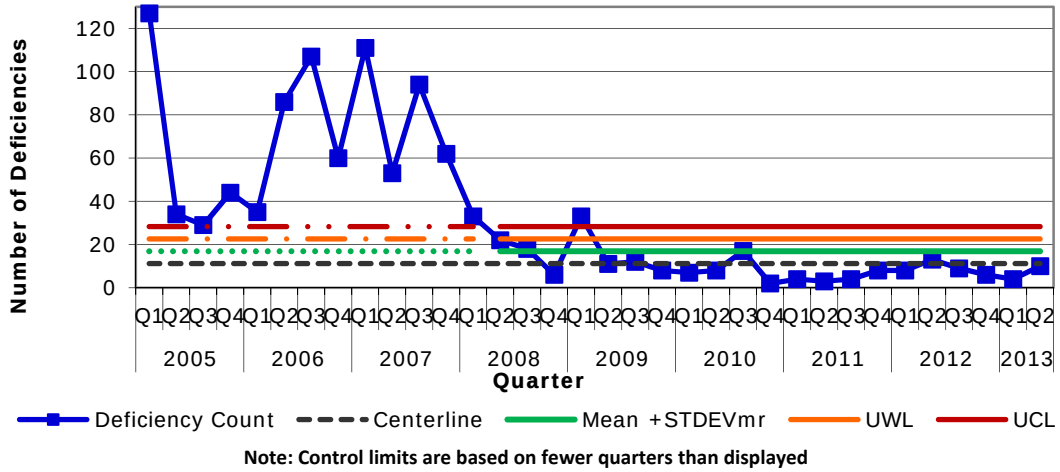


Figure 13. Frequency control chart of hazard communication deficiencies.

From the first quarter of 2013 to the second quarter of 2013, there was an increase in the number of hazard communication deficiencies identified. In the second quarter of 2013, more assessments were conducted that identified hazard communication deficiencies. During the second quarter of 2013, the most recent quarter of data analyzed, 10 hazard communication deficiencies were identified from eight different assessments, four of the eight were NIF 2013 annual walkabouts observing work addressed in separate Integration Work Sheets.

In summary, there was a recent increase in hazard communication deficiencies identified from the first quarter of 2013 to the second quarter of 2013; however, no new issues within this safety subject are reportable to the DOE Office of Enforcement as either repetitive or systemic, the hazard communication safety subject will continue to be analyzed in future analyses.

General Industrial Hygiene

The visual analysis step did not warrant further analysis of recent deficiencies categorized as general industrial hygiene; however, this safety subject was determined to need further analysis due to an increase in deficiencies from the first to the second quarters of 2012. The current control chart analysis shows that more than eight consecutive data points are below the centerline from the fourth quarter of 2010 to the second quarter of 2013, which is an action limit. This safety subject is discussed further.

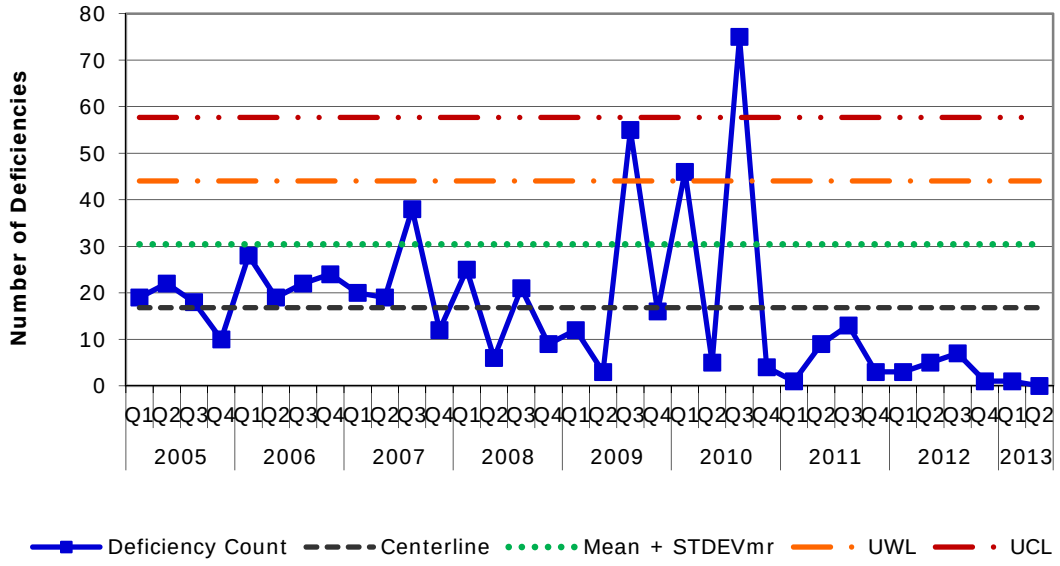


Figure 14. Frequency control chart of general industrial hygiene deficiencies.

In the second quarter of 2013, the most recent quarter of data analyzed, no general industrial hygiene deficiencies were identified. Simple linear regression shows that there was no statistically significant decreasing *trend in general industrial hygiene deficiencies identified per quarter (p-value > 0.05). No new noncompliance within this safety subject is reportable to the DOE Office of Enforcement as either repetitive or systemic.*

To conclude Section 6.8, recent data within the industrial hygiene safety subject met a common test, specifically hazard communication data. General industrial hygiene deficiencies were analyzed in this analysis due to a common test met in the previous analysis; however, there were no general industrial hygiene deficiencies identified in the second quarter of 2013. It was determined that hazard communication deficiencies will continue to be analyzed in future analyses. No new issues within industrial hygiene are reportable to the DOE Office of Enforcement as either repetitive or systemic.

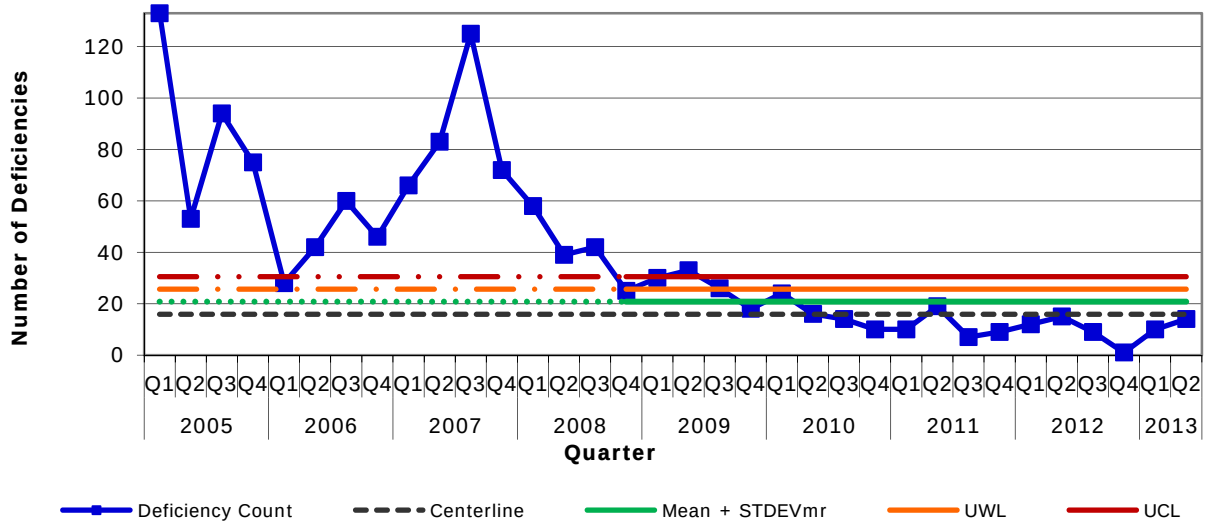
☐ Potential Significant, Systemic or Repetitive ☒ Meets Common Tests ☐ Within Expected Variation ☐ Downward Trend

6.9 Other Industrial Safety

The visual analysis step warranted further analysis of deficiencies in ITS categorized as the industrial safety, specifically those categorized as general IS, ladder safety, and seismic safety. Therefore, these safety subjects were analyzed using control charts in the following sections.

General Industrial Safety

The control chart analysis (Figure 15) for general industrial safety deficiencies shows a consecutive increase in the number of deficiencies identified from the fourth quarter of 2012 to the second quarter of 2013, a common test. Also, this safety subject was determined to need continued analysis in the last analyses due to an increase in deficiencies from the third quarter of 2011 to the second quarter of 2012. Therefore, this safety subject is discussed further.



Note: Control limits are based on fewer quarters than displayed

Figure 15. Frequency control chart of general industrial safety deficiencies.

During the second quarter of 2013, the most recent quarter of data analyzed, 14 general industrial safety deficiencies were identified; five of the 14 were from an O&B walkthrough and three were identified during the investigations of injuries/illnesses. The 14 industrial safety deficiencies fell into six categories, housekeeping (5), signage/labeling (3), ergo evaluations (3), stairs (1), repetitive motion (1) and storage of florescent lighting (1).

From the fourth quarter in 2012 to the second quarter in 2013, there were increases in the number of general industrial safety deficiencies identified, from one deficiency identified in the fourth quarter of 2012 to 14 deficiencies identified in the second quarter of 2013. Although there was a recent consecutive increase in industrial safety

deficiencies, all data points since the second quarter of 2011 are below the centerline. In reviewing the recent industrial safety deficiencies identified in 2013, there is no obvious systemic or repetitive noncompliance. Therefore, this safety subject is not discussed further.

In summary, there is a consecutive increase in general industrial safety deficiencies identified from the fourth quarter of 2012 to the second quarter of 2013; however, this pattern is below the centerline and is not of concern at this time. Although no new issues within this safety subject are reportable to the DOE Office of Enforcement as either repetitive or systemic, the general industrial safety subject will continue to be analyzed in future analyses.

Ladder safety

The control chart analysis (Figure 16) for ladder safety deficiencies shows a consecutive increase in the number of deficiencies identified from the fourth quarter of 2012 to the second quarter of 2013, a common test. Therefore, this safety subject is discussed further.

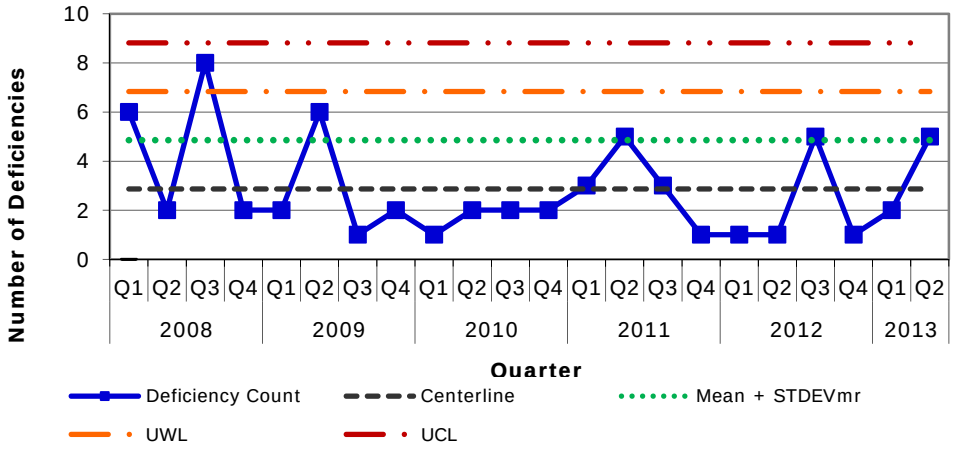


Figure 16. Frequency control chart of ladder safety deficiencies.

During the second quarter of 2013, the most recent quarter of data analyzed, five ladder safety deficiencies were identified; three of the five are owned by O&B.

From the fourth quarter of 2012 to the second quarter of 2013, there were increases in the number of ladder safety deficiencies identified, from one deficiency identified in the fourth quarter of 2012 to five deficiencies identified in the second quarter of 2013. Four of the seven identified in the first and second quarters of 2013 are categorized as, "Portable ladder and/or step stool is not inspected, stored, and/or maintained as required." Specifically, the four deficiencies relate to two step-stools missing the rubber gasket, storage of a ladder and a ladder needing to be restrained. These four deficiencies are owned by three directorates, Computations (COMP), Engineering (ENG), and NIF

and Photon Sciences (NIF&PS). There is no concern with ladder safety deficiencies at this time; however, ladder safety deficiencies will be analyzed in the next performance analysis to see if the increase in deficiencies continues over the next quarters.

In summary, there is a consecutive increase in ladder safety deficiencies identified from the fourth quarter of 2012 to the second quarter of 2013. Although no new issues within this safety subject are reportable to the DOE Office of Enforcement as either repetitive or systemic, the ladder safety subject will be analyzed in future analyses to see if the increase in deficiencies continues.

Seismic safety

The control chart analysis (Figure 17) for seismic safety deficiencies shows a data point close to the UWL in the first quarter of 2013. Although this is not a common test, this safety subject is discussed further.

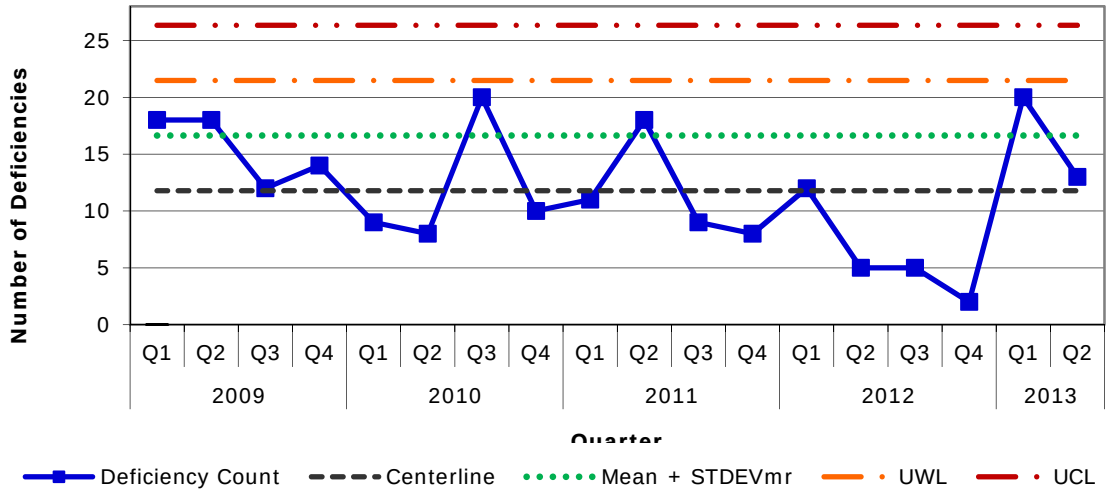


Figure 17. Frequency control chart of seismic safety deficiencies.

During the second quarter of 2013, the most recent quarter of data analyzed, 13 seismic safety deficiencies were identified; eight of them owned by N&PS and 10 of the 13 categorized as, "Item stored above workstations that are >5' in height are not seismically secured to walls or floors and/or do not have material restraints as necessary." During the first quarter of 2013, the data point close to the UWL, 20 seismic safety deficiencies were identified. Seventeen of the 20 were categorized as, "Item stored above workstations that are >5' in height are not seismically secured to walls or floors and/or do not have material restraints as necessary." Eight of the 20 were identified from NIF 2013 walkabouts from different IWSs, and three were identified from ENG walkthroughs.

In summary, a data point was close the UWL in the first quarter of 2013; this is not a common test. No new issues within this safety subject are reportable to the DOE Office of Enforcement as either repetitive or systemic.

To conclude Section 6.9, recent data within the industrial safety subject met a common test, specifically general industrial safety and ladder safety. It was determined that deficiencies categorized as general industrial safety and ladder safety will continue to be analyzed in future analyses, but no new issues within IS are reportable to the DOE Office of Enforcement as either repetitive or systemic.

☐ Potential Significant, Systemic or Repetitive ☒ Meets Common Tests ☐ Within Expected Variation ☐ Downward Trend

6.10 Work Planning and Control

Work planning and control (WPC) was established as a new functional area in March 2013 This functional area will be analyzed as new section under the WSH section 6.0 of this report. All WPC deficiencies are considered WSH deficiencies and will be analyzed accordingly.

The visual analysis step warranted further analysis of WPC deficiencies. Therefore, this safety subject was analyzed using a control chart.

Figure 18 shows four recent points above the UCL, action limits. Therefore, this safety area was analyzed to resolution. Figure 18 also shows an increase in WPC observations from early 2008 through early 2012. The observations identified will also be analyzed and reviewed to determine if WPC issues are being properly categorized by issue type.

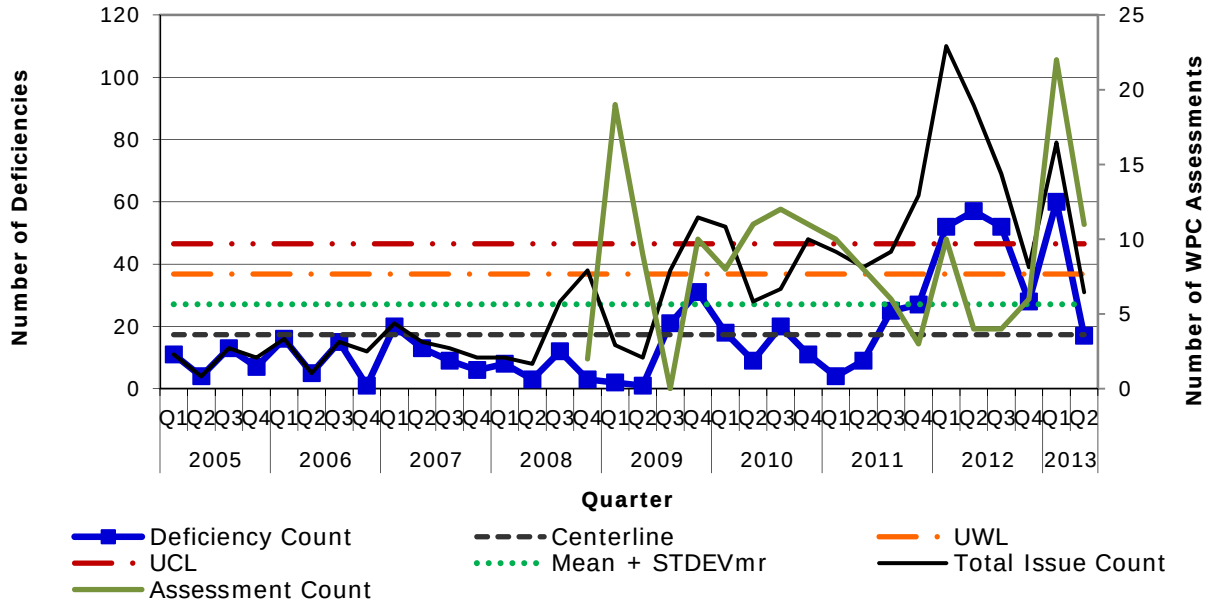


Figure 18. Frequency control chart of work planning and control deficiencies.

Many WPC deficiencies are categorized by compliance code as, "Worker are not adequately trained and qualified to perform work tasks assigned, or have not read and signed the IWS." Eighty percent (80%) of deficiencies in 2013 and 66% of deficiencies in 2012 were categorized as the stated compliance code. Most (94% in both 2012 and 2013) of the WPC deficiencies related to training and signing of IWSs are owned by the Global Security directorate.

Figure 18 was re-created excluding the deficiencies categorized as training and signing of IWSs (Figure 19) to determine if other WPC areas needed further attention. Without the training related deficiencies in Figure 19, no points were above the UCL and no action limits were met.

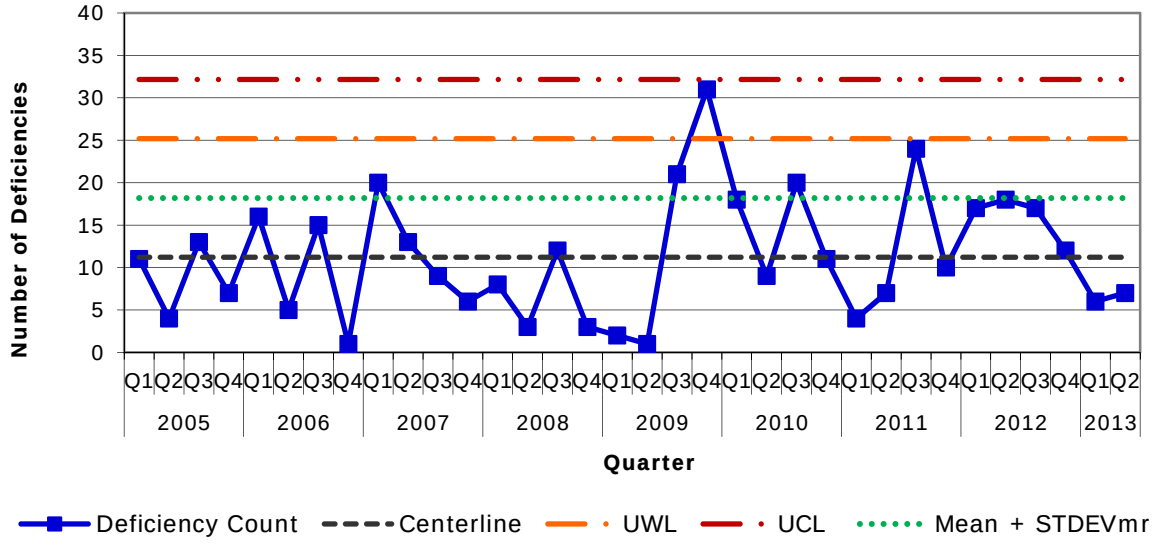


Figure 19. Frequency control chart of work planning and control deficiencies excluding training/IWS sign-off deficiencies.

WPC issues categorized as observations were reviewed because there appeared to be an increase in WPC observations from early 2008 through early 2012 (Figure 18). In many cases, there was not enough information in the ITS description to determine the proper issue type. Table 2 below provides a summary of the WPC observations reviewed for the last three years through June 2013. Although the percentage of observations mis-categorized in 2013 appears low, it is suspected that if the WPC JFLMA completed in 2013 was entered into ITS at the time of the data pull, this percentage would be higher.

Table 2. Results of WPC observations review

Year	Total Number of WPC observations	Observations that should be Deficiencies
2011	39	16 (41%)
2012	53	16 (30%)
2013 (through June)	20	1 (5%)

By including observations that should be deficiencies in the control chart for WPC deficiencies, a point is above the UWL in the first quarter of 2012, a common test, and another point is at the UWL in the third quarter of 2011. Therefore, this safety subject is analyzed further.

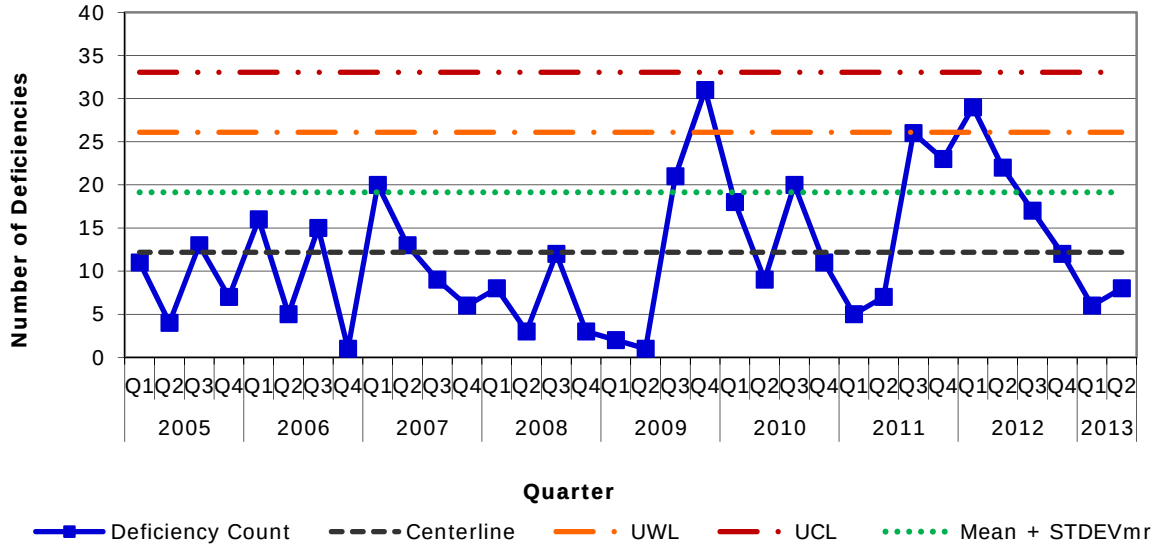


Figure 20. Frequency control chart of work planning and control deficiencies including deficiencies categorized as observations.

In the first quarter of 2012, the quarter with a point above the UWL, 29 deficiencies were identified and are from the assessments listed in Table 3. Approximately half of the 29 deficiencies fall within three areas of WPC: work scope, task description, and hazards and controls. Five of the 29 deficiencies are related to a scope clarification needed or an overly broad scope; all five are owned by Physical and Life Sciences (PLS). Five of the 29 deficiencies are related to a task description clarification needed or a missing task; four are owned by PLS and one is owned by Weapons and Complex Integration (WCI). Four of the 29 deficiencies are related to hazards/controls not included or specified; the four are owned by PLS, WCI, and NIF&PS.

Table 3. Source of WPC Deficiencies from the first quarter of 2012.

Assessment	Number of Deficiencies
PLS Work Control Work Scope Review	10
Work Authorization Release (WCI) - 33156	8
Occurrence Report/Injury or Illness	5
NIF Walkabouts	2
Hazard Identification (WCI) - 33155	2
Assessment of SO IWSs – 33093	2
Total	**29**

The *PLS Work Control Work Scope Review* assessment completed in May 2012 identified the following: "guidance from Document 2.2 of the ES&H Manual, "Institution-Wide Work Planning and Control Process" regarding the definition of a work scope and task description is not always being followed. While the interpretation of an adequate work scope or task description is somewhat subjective, there are elements and aspects in the document that are not present in the PLS work scope or task description sections. However, these elements are found in other sections of the documents and the necessary information needed to allow workers to understand controls and identify scope boundaries and key limits is present."

The data reviewed in this analysis (through June 2013) suggests that a possible significant or systemic WPC noncompliance exist in three areas of WPC. Further review of more recent WPC data is warranted to determine if a systemic noncompliance reportable to the DOE Office of Enforcement exists.

To conclude Section 6.10, recent data within the WPC functional area, even when excluding training/IWS sign-off deficiencies, met a common test, an increase in deficiencies for the most recent quarter of data analyzed, the second quarter of 2013. Also, an increase in observations prompted a review of recent observations to determine if deficiencies are being mis-categorized as observations. This was found to be the case in 2011 and 2012 and suspected in 2013. By including deficiencies mis-categorized as observations in the control chart analysis, common tests were met, a point about the UWL in the first quarter of 2012 and an increase in deficiencies in the most recent quarter of data analyzed, the second quarter of 2013. The deficiencies reviewed in this analysis (through June 2013) suggest that a possible significant or systemic WPC noncompliance exist in the areas of work scope, task description, and hazards and controls. Further review of more recent WPC data, including the results of a recent JFLMA completed in late 2013, is warranted to determine if a systemic noncompliance reportable to the DOE Office of Enforcement exists.

Note: Since this analysis of WPC deficiencies identified through June 2013 was completed, a noncompliance evaluation was completed in November 2013 and the evaluation included more recent WPC deficiencies. The analysis of ITS data through June 2013, and the results of the noncompliance evaluation completed in November 2013, led to LLNL filing a programmatic noncompliance report to the NTS in January 2014 titled, *Programmatic noncompliance with topical areas within LLNL's Work Planning and Control process.*

☒ Potential Significant, Systemic or Repetitive ☒ Meets Common Tests ☐ Within Expected Variation ☐ Downward Trend

6.11 "Severity Level I" Noncompliances

The WSH "Severity Level I," NTS reporting threshold, previous called the "Other Significant Condition," is defined as "a condition or hazard that has the potential to cause death or serious physical harm (injury or illness)." This reporting threshold would include, at a minimum, significant noncompliances with high relative risk, as defined in DES-0083, *Regulatory Compliance Assurance Program for DOE Safety and Security Requirements*. These deficiencies are identified in ITS as having an issue significance level of one, but could also be an issue with an issue significance level of two.

Two methods were used to review ITS data for deficiencies that may have met the "Severity Level I" NTS reporting threshold:

1. A review of all issue significance level one and two deficiencies with identification dates starting in November 2012 through December 2013
2. A review of all deficiencies with compliance codes that suggests an issue significance level of one, but the significance level was downgraded

There were no issue significance level one deficiencies identified between November 2012 and December 2013; there were 13 issue significant level two deficiencies identified during this time period. Twelve of the 13 were either reported to the DOE NTS or were from a security incident/assessment. The remaining issue was categorized as an on-site nuclear packaging issue. Therefore, it is out of the purview of WSH.

Since the third quarter of 2012, there were 16 deficiencies assigned a compliance code with a suggested issue significance level of one that was downgraded to another issue significance level. Three of the 16 deficiencies were already reported to the DOE NTS and two of the 16 were deficiencies associated with occurrences that had been evaluated for noncompliances. The other 11 deficiencies are identified in Table 4 and were evaluated by the Performance Analysis and Improvement Group (PAIG) of the Management Assurance System Organization for reporting to the DOE NTS.

Table 4. Deficiencies downgraded from an issue significant one from November 2012 through December 2013

Seq.	Issue Sub-Topic	Deficiency Description from ITS
1.	Electrical Safety	Multi-outlet strip permanently mounted on wall is missing
2.	Ladders/ Scaffolding	Wooden ladder has damage to footing. Rubber feet are damaged and a screw is pulled away from footing. Ladder was immediately taken out of service.
3.	Ladders/Scaffolding	Remove ladder
4.	Ladders/Scaffolding	Buildup of foreign material on rungs and side rails.
5.	Ladders/Scaffolding	Vertical pipe near bottom rung is an obstruction and impedes on the 7" clearance requirement

Seq.	Issue Sub-Topic	Deficiency Description from ITS
6.	Ladders/Scaffolding	Roof hatch required special instruction and multiple hand operations to open and close
7.	Laser	Laser eyewear did not completely cover corresponding wavelength and OD requirements for lasers listed in laser table. Additional Information provided by SME: The lasers with eyewear that did not provide coverage were not in use
8.	Laser	Beam shutter interlock is not properly functioning as the shutter is staying closed. Additional Information provided by SME: This is not a safety issue because the shutter "failed safe" as designed.
9.	Laser	East side of lab missing laser crash button. Additional Information provided by SME: There is no requirement stated for the number of "crash-buttons" required. Lab management asked for another crash button for ease of shutting the laser down if the worker was over in that part of the lab.
10.	Laser	It was discovered that the camera cover (integrated into the laser shielding) was not secured (needs to be affixed so removal cannot occur without tools). Laser work has not been performed recently, and the laser power supply was not connected. In order to continue with Class 1 laser controls, control of the plug must be maintained, which means the cabinet must be secured when the operator leaves the room. IWS to be updated with language on LOTO (cord and plug) when camera housing needs to be removed. Additional Information provided by SME: The operations was not active at the time. The issue was discovered during shutdown/maintenance.
11.	Machinery and Power Tools	5 gal mastic pail mixer has unguarded moving parts without warning signs or barriers.

The deficiencies from Table 4 were reviewed to determine if any of these deficiencies should be issue significant one deficiencies and thus reportable to the DOE NTS. All deficiencies, except for the laser safety deficiencies, were determined by the PAIG to not meet the threshold for reporting to the DOE NTS as a "Severity Level I" noncompliance. The laser safety SME was consulted on the four deficiencies from Table 4 related to lasers. The SMEs review concluded that none of the laser safety deficiencies from Table 4 met the threshold for reporting to the DOE NTS as a "Severity Level I" noncompliance.

7.0 Nuclear Safety Management Issues

Nuclear safety includes safety programs in nuclear operations (criticality safety, safety basis, and system engineering), nuclear packaging and transportation, quality assurance, work planning and control, and radiation protection. Data from 2005 through June 2013 were extracted from the Issues Tracking System (ITS) in August 2013 using the ITS Basic Issue Report. Three nuclear safety subjects, nuclear operations (specifically safety basis, analysis, design and documentation), nuclear quality assurance, and radiation protection, were identified in the previous analysis as needing follow-up analysis. Based on the frequency of deficiencies by functional area in the most recent quarters, two nuclear-related functional areas warranted a control chart analysis based on the visual analysis step.

As discussed in the sections below, the analysis for nuclear safety deficiencies identified two subjects with a consecutive increase in deficiencies and one subject with increased deficiencies in the second quarter of 2013, the most recent quarter of data analyzed.

7.1 Nuclear Operations

The visual analysis step did not warrant further analysis using a control chart of deficiencies in ITS categorized as the nuclear operations functional area. This functional area was determined to need continued analysis in the previous performance analysis due to an increase in deficiencies from the first to the second quarter in 2012. Therefore, this safety subject was analyzed using a control chart.

The control chart analysis of nuclear operations deficiencies (see Figure 21) shows a consecutive increase in deficiencies from the third quarter of 2012 to the first quarter of 2013, a common test. Therefore, this functional area is analyzed further.

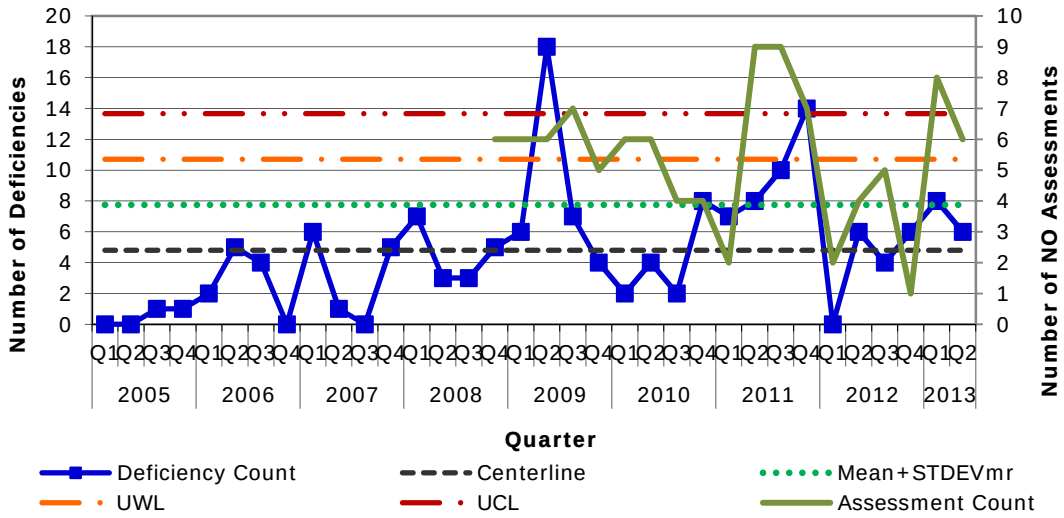


Figure 21. Frequency control chart of nuclear operations deficiencies.

During the second quarter of 2013, the most recent quarter of data analyzed, six nuclear operation deficiencies were identified, as shown in Figure 21. All six nuclear operation deficiencies are from four unique occurrences, one occurrence has three deficiencies associated with it. Three of the four occurrences had nuclear safety noncompliances associated with them and the nuclear safety noncompliances were reported to the DOE NTS as three separate noncompliance reports.

From the third quarter in 2012 to the first quarter in 2013, there was a slight increase in nuclear operations deficiencies from six identified in the fourth quarter of 2012 and eight identified in the first quarter of 2013. None of the data points in Figure 21 are above the UWL. Over the two quarters, the fourth quarter of 2012 and the first quarter of 2013, 14 deficiencies were identified. Four of the 14 were deficiencies from occurrences and three deficiencies were identified through the LFO Periodic Issues Report. The 14 deficiencies are from eight different subtopical areas and 10 different compliance codes. There doesn't appear to be any common deficiencies. However, the safety basis subject was determined to need continued analysis in the previous performance analysis due to an increase in deficiencies from the first to the second quarter in 2012 (Figure 22). Therefore, this safety subject is discussed further.

Safety Basis, Analysis, Design, and Documentation

In this analysis, compared to the previous analysis, the control chart shows no increase in deficiencies from the first to the second quarter of 2012. This implies that since the previous analysis, the deficiency identification date was changed or the deficiency was deleted or re-categorized. No recent common tests were met. However, there was an apparent increasing trend from the second quarter in 2012 to the second quarter in 2013. Therefore, this safety subject is discussed further.

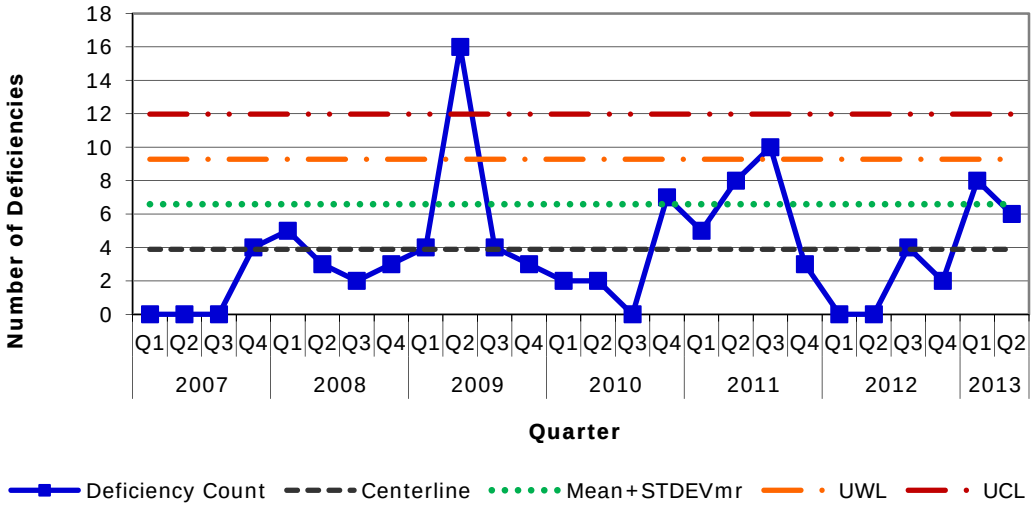


Figure 22. Frequency control chart of safety basis, analysis, design, and documentation deficiencies.

It appears that the apparent increasing trend from the second quarter of 2012 through the second quarter of 2013 is due to an increase in deficiencies identified from occurrences. The increase in deficiencies identified from occurrences in 2013 is similar to the number of deficiencies identified from occurrences in 2011. In 2011, 19 of the 26 deficiencies were from occurrences and two of the 19 deficiencies were NTS reported noncompliances. In 2012, there were fewer deficiencies from occurrences, only four of the six deficiencies, and none of these deficiencies were reported to the DOE NTS. There were also fewer deficiencies identified in 2012, six compared to 26 in 2011. In 2013, nine of the 14 deficiencies were from positive unreviewed safety question (USQ) occurrences and all of the nine deficiencies were NTS reported noncompliances. The nine deficiencies from positive USQ related occurrences are from six unique occurrences listed in Table 5. Also listed in Table 5 is the positive USQ occurrence from 2014. These occurrences and their associated nuclear safety noncompliances were reviewed for a potential repetitive or programmatic noncompliance with nuclear safety requirements. Although all noncompliances are from the same type of occurrence and a number of them relate to the Building 332 Documented Safety Analysis (DSA), the subject of the positive USQ is different in every case, as listed in the subject column of Table 5. Also, the noncompliances for two of the positive USQ occurrences (2013-0018 and 2013-0021) were identified during our processes to evaluate a new installation or modification of equipment built years ago. Therefore, the noncompliances listed in Table 5 are not considered repetitive or programmatic.

Table 5. Positive USQ occurrences and associated noncompliances form 2013 and 2014.

Report No.	Occurrence Title	Subject	Reported Noncompliances
NA--LSO-LLNL-LLNL-2013-0004	Positive USQ: MACCS2 Calculations Underestimate Waste Storage Facility Offsite Dose Consequences	Application of system software dispersion code to calculate off-site doses.	Using the code system software Type B output is not consistent with the methodology specified in DOE-STD-3009 and in U.S. Nuclear Regulatory Commission Regulatory Guide, to calculate offsite dose consequences from postulated accidents. A misunderstanding of the software code dose output capabilities resulted in non-conservative dose values referenced in the Waste Storage Facility DSA.
NA--LSO-LLNL-LLNL-2013-0007	Seismic capability of select Building 331 exhaust stacks and Building 332 security poles may not be preserved in the Building 332 DSA	Exhaust stacks and security poles	The current B332 DSA does not explicitly evaluate the B331 stacks and interior security poles falling on some nearby B332 Safety-SSCs in an evaluation basis seismic event. The B332 DSA did not explicitly discuss the possibility that the subject stacks/poles would fall on some nearby Safety-SSC in B332.
NA--LSO-LLNL-LLNL-	Description of system boundaries of some safety SSCs are unclear	Equipment connected between a	The B332 DSA is not detailed enough in the description of interfaces and connections to some safety SSCs in the loft.

Report No.	Occurrence Title	Subject	Reported Noncompliances
2013-0012	in the Building 332 DSA	glovebox and the Glovebox Exhaust System, as well as an associated enclosure connected to the Room Ventilation System	
NA--LSO-LLNL-LLNL-2013-0018	Some components in the Building 332 Increment 1 RVS exhaust ducting may not meet fire performance criteria	Room Ventilation System exhaust ducting	The current DSA for B332 does not adequately identify and analyze hazards in that the DSA does not explicitly evaluate the potential for thermal degradation of the RVS exhaust ducting in the facility loft during an Evaluation Basis Room Fire The B332 DSA does not adequately describe the performance of the RVS exhaust ducting in regard to the evaluation basis room fire event.
NA--LSO-LLNL-LLNL-2013-0021	Building 332 oxidation furnace pressurization failure mode inconsistent with the DSA	Metal Conversion Glovebox oxidation furnace	The current DSA for B332 does not adequately identify and analyze hazards in that the DSA does not include a full evaluation of the MCG oxidation furnace pressurization failure mode.
NA--LSO-LLNL-LLNL-2014-0003	Safety Basis Calculation for Building 332 Fire Suppression System Tank Has Non-Conservative Omission	Fire Suppression System Tank	A calculation that supports the safety basis was identified as having a non-conservative omission. The calculation omitted a potential flow path and thus may under-predict flow rate and over-predict duration.

To conclude Section 7.1, recent data within the nuclear operations functional area met a common test, a consecutive increase in deficiencies from the third quarter of 2012 to the first quarter of 2013. There is also an apparent increase in safety basis deficiencies from the second quarter of 2012 to the second quarter of 2013. The current analysis determined that neither a programmatic or repetitive noncompliance exists. However, because a common test was met, the nuclear operations safety subject will continue to be analyzed in future performance analyses.

☐ Potential Significant, Systemic or Repetitive ☒ Meets Common Tests ☐ Within Expected Variation ☐ Downward Trend

7.2 Packaging and Transportation (Nuclear)

The visual analysis step did not warrant further analysis of deficiencies in ITS categorized as nuclear packaging and transportation. Therefore, this safety subject was not discussed or analyzed further in this report.

7.3 Quality Assurance (Nuclear)

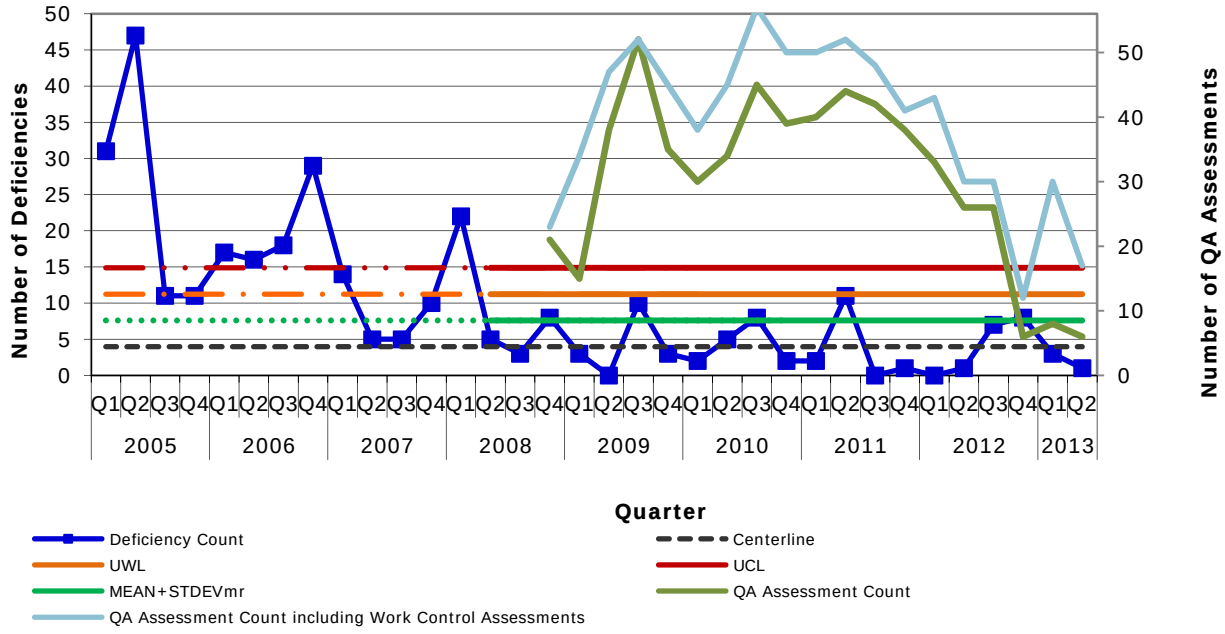
Quality assurance (QA) deficiencies that are nuclear safety related are identified in ITS by (1) a "Yes" answer to the nuclear safety question at the ITS issue level and (2) assignment to the QA functional area. Since 2005, there have been 3,662 deficiencies categorized as QA, with 319 (9%) related to nuclear safety based on answers to the nuclear safety question in ITS. Recently the functional area of work planning and control (WPC) was added to the functional area list and pull down menu in ITS. Deficiencies previous categorized within the QA functional area under the work control topical area have now been moved under the WPC functional area, the reason there are fewer QA deficiencies compared to the previous analysis.

The majority of nuclear-safety-related QA deficiencies since 2005 fall within two of the ten criteria of the QA Order (DOE O 414.1) and the QA Rule (10 CFR 830, Subpart A): 49% in Criterion 4 (Management/Documents and Records), and 22% in Criterion 2 (Management/Personnel Training and Qualification).

The visual analysis step did not warrant further analysis using a control chart of deficiencies identified in ITS as related to nuclear safety QA. This safety subject was determined to need continued analysis in the previous performance analysis due to an increase in deficiencies from the first to the second quarter in 2012. Therefore, this functional area was analyzed using a control chart.

No common tests were met in the control chart analysis in Figure 23. The control chart shows a decrease in nuclear safety QA deficiencies from the fourth quarter in 2012 to the second quarter in 2013 where only one nuclear safety QA deficiency was identified. Therefore, deficiencies within this safety subject were not discussed further.

Figure 23 shows a decrease in QA-related assessments since the second quarter of 2011. It was possible that the decrease could be attributed to the breakout of work control from the QA functional area to the new WPC functional area. However, WPC assessments were included in the count of QA-related assessments (Figure 23) and there is still a decrease in assessments from the second quarter in 2011 to the fourth quarter in 2012.



Note: Control Limits are based on fewer quarters than displayed

Figure 23. Frequency control chart of nuclear safety quality assurance data.

To conclude Section 7.3, no common tests were met and recent data is considered to be within expected variation.

☐ Potential Significant, Systemic or Repetitive ☐ Meets Common Tests ☒ Within Expected Variation ☐ Downward Trend

7.4 Work Planning and Control (Nuclear Safety)

Recently, the functional area of work planning and control (WPC) was added to the functional area list and pull down menu in ITS. Deficiencies previous categorized within the QA functional area under the work control topical area have been moved under the WPC functional area. WPC deficiencies that are nuclear safety related are identified in ITS by (1) a "Yes" answer to the nuclear safety question at the ITS issue level and (2) assignment to the WPC functional area. Since 2005, there have been 593 deficiencies categorized as WPC, with 63 (11%) related to nuclear safety based on answers to the nuclear safety question in ITS.

The visual analysis step prompted further analysis of deficiencies in ITS categorized as nuclear safety WPC. The control chart, Figure 24, shows a point above the UCL in the second quarter of 2012 where 13 WPC nuclear safety deficiencies were identified. However, these are the same 13 deficiencies discussed in the previous analysis report of data through June 2012 (Section 7.3) that used be categorized under the QA functional area, and are now under the WPC functional area. Therefore, additional discussion about these 13 deficiencies is not warranted.

Since the second quarter of 2012, there has been a decrease in WPC nuclear safety deficiencies. However, there was a recent increase in WPC nuclear safety deficiencies in the first quarter of 2013, a common test. Therefore, this safety subject is discussed further.

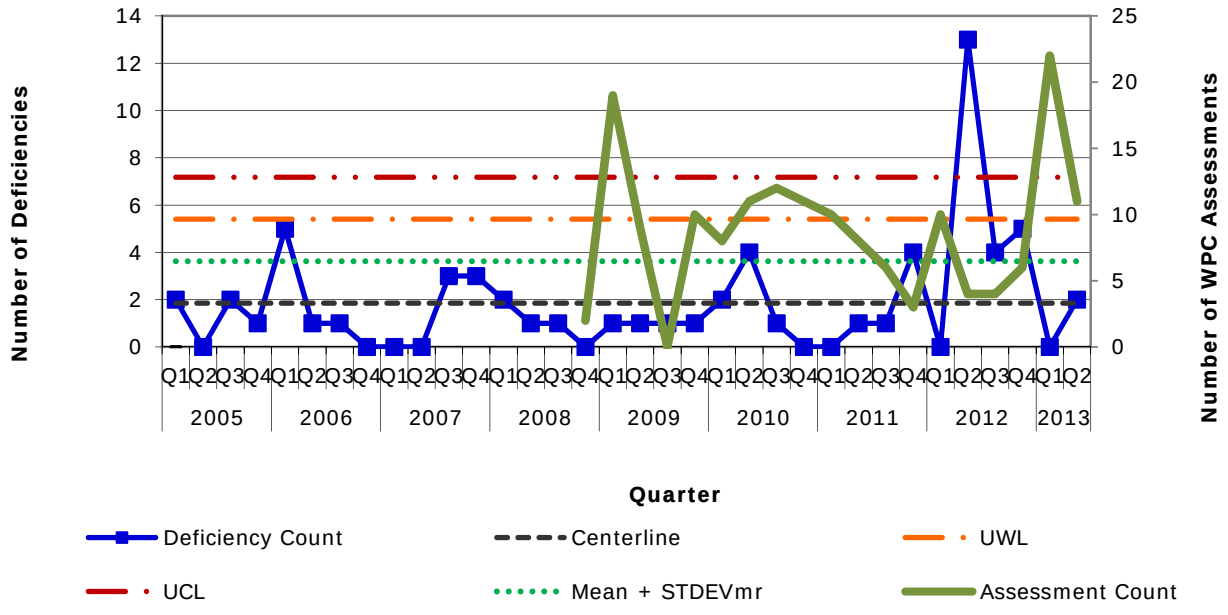


Figure 24. Frequency control chart of nuclear safety work planning and control.

During the second quarter of 2013, the most recent quarter of data analyzed, there were two nuclear safety WPC deficiencies identified from two different assessments. One deficiency was from an event that did not require reporting to ORPS. One deficiency was an employee had not completed all required training in an IWS and the other was an IWS had not been updated to include the installation and operations of a x-ray fluorescence unit. Question: This adds up to 3 deficiencies?

To conclude Section 7.4, a recent common test was met, an increase in the most recent quarter of data analyzed. Therefore, this safety subject will continue to be analyzed in future performance analyses.

☐ Potential Significant, Systemic or Repetitive	☒ Meets Common Tests	☐ Within Expected Variation	☐ Downward Trend

7.5 Radiation Protection

The visual analysis step did warrant further analysis of deficiencies in ITS categorized as radiation protection. This functional area was also determined in the previous analysis to need continued analysis due to an increase in deficiencies from the first to the second quarter in 2012. Therefore, this functional area was analyzed using a control chart.

There was an increase in radiation protection deficiencies from the fourth quarter in 2012 to the second quarter in 2013, Figure 25. Therefore, this safety subject is discussed further.

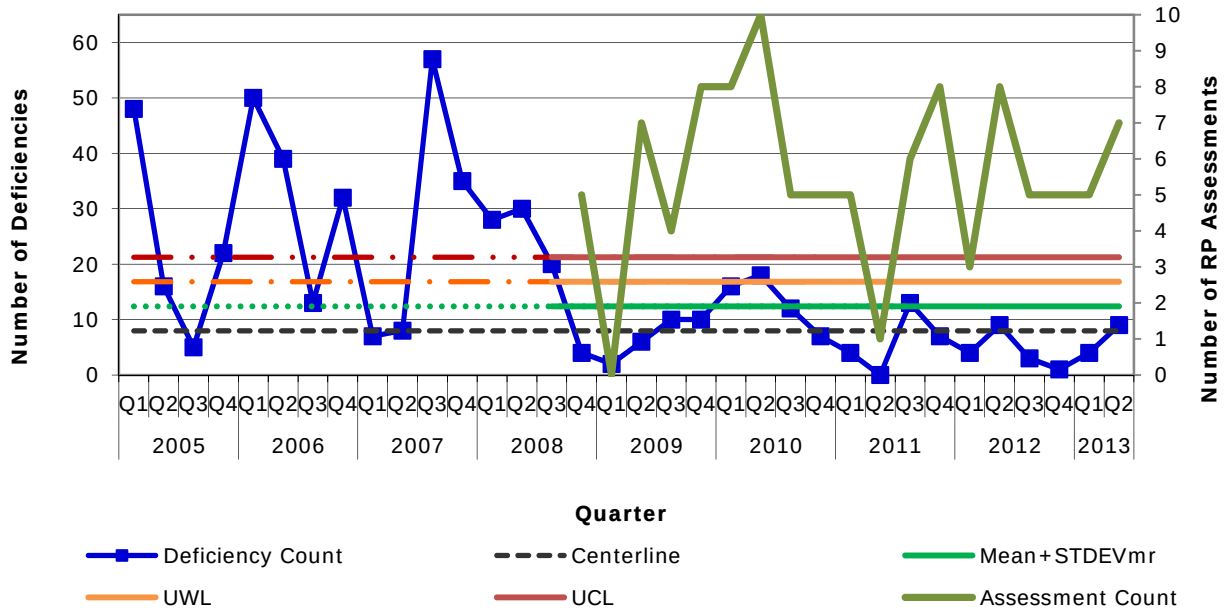


Figure 25. Frequency control chart of radiation protection data.

During the second quarter of 2013, the most recent quarter of data analyzed, there were nine radiation protection deficiencies identified from six different assessments, with four of the nine from radiation protection assessments in the Physical and Life Sciences (PLS) directorate. The nine deficiencies are categorized under six different subtopics and eight different compliance codes. There doesn't appear to be any commonalities of concern.

To conclude Section 7.5, a recent common test was met, an increase in radiation protection deficiencies from the fourth quarter in 2012 to the second quarter in 2013. Therefore, this safety subject will continue to be analyzed in future performance analyses to see if the increase in deficiencies continues.

☐ Potential Significant, Systemic or Repetitive ☒ Meets Common Tests ☐ Within Expected Variation ☐ Downward Trend

8.0 Classified Information Security Management Issues

LLNL safeguards and security issues tracked in the Issues Tracking System (ITS) are analyzed to identify programmatic or repetitive issues that may require additional management attention. Emphasis is placed on issues related to classified information security (CIS) within two functional areas, cyber security and safeguards and security.

Cyber security was established as a new functional area in March 2013. This functional area was previously analyzed under the safeguards and security functional area. Cyber security will continue to be analyzed under section 8.0 of this report. Issues within the cyber security functional area are categorized into one of four topics when they are entered into ITS. The topics are cyber security operations, cyber security program management, cyber security technical, and telecom security. These topics are further categorized into subtopics. Issues related to CIS are required to have the CIS question marked "Yes" at the issue level in ITS.

Issues within the safeguards and security functional area are categorized into one of eight topics when they are entered into ITS. The topics are program management and support, protective force, physical protection, information protection, personnel security, unclassified visits and assignments, nuclear materials control and accountability, and identifying classified information. These topics are further categorized into subtopics. Issues related to CIS are required to have the CIS question marked "Yes" at the issue level in ITS.

Data from 2007 through the second quarter of 2013 were extracted from ITS in August 2013 using the ITS Basic Issue Report. Issues identified by security incidents are reflected in the ITS data from February 2010.

As discussed in the sections below and shown in Figure 26, the analysis of CIS deficiencies did not identify any security subjects meeting a recent common test. Two topics were further analyzed using a control chart, one topic in the cyber security functional area and one in the safeguards and security functional area. Although common tests were identified for these two subjects in previous analyses, no recent common tests were met.

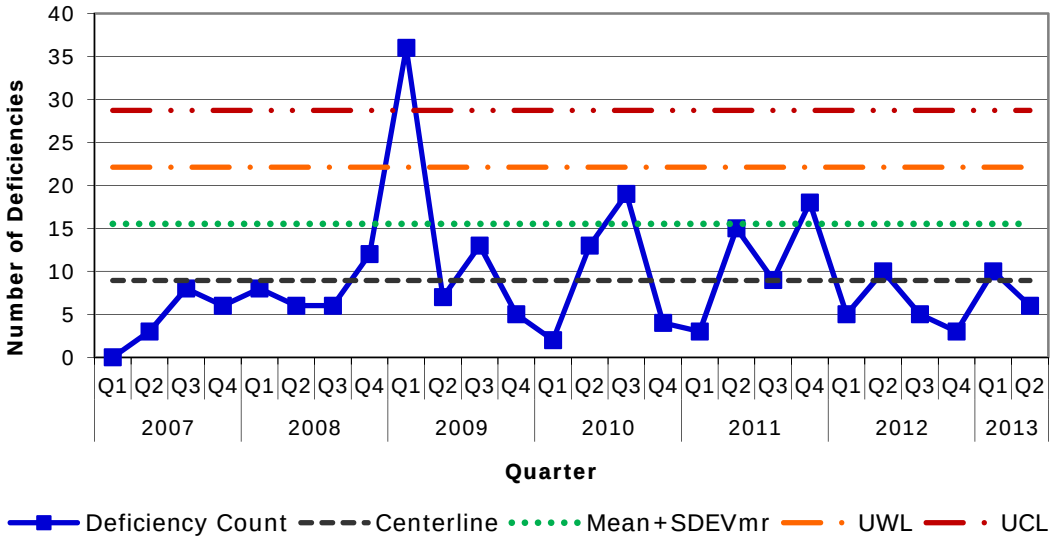


Figure 26. Frequency control chart of safeguards and security (CIS) deficiencies.

In the second quarter of 2013, the most recent quarter of data analyzed, six CIS deficiencies were identified in ITS compared to 10 CIS deficiencies in the first quarter of 2013, a decrease in deficiencies from the first to the second quarter. Deficiencies identified in the second quarter of 2013 were categorized as information protection, identifying classified information, and physical protection. All topical areas are discussed in the sections below.

8.1 Cyber Security

The visual analysis step did not warrant further analysis of deficiencies categorized as cyber security in ITS. In the previous analysis this topic was determined to need continued analysis due to a point above the UWL in the fourth quarter of 2011. Therefore, cyber security was analyzed using a control chart. In the control chart (Figure 27) no common tests were met. Since the fourth quarter of 2011, the number of CIS cyber security deficiencies decreased until the first quarter of 2013. However, in 2013, there was a slight increase in the first quarter and then no deficiencies identified in the second quarter. Therefore, this security topic is not discussed further.

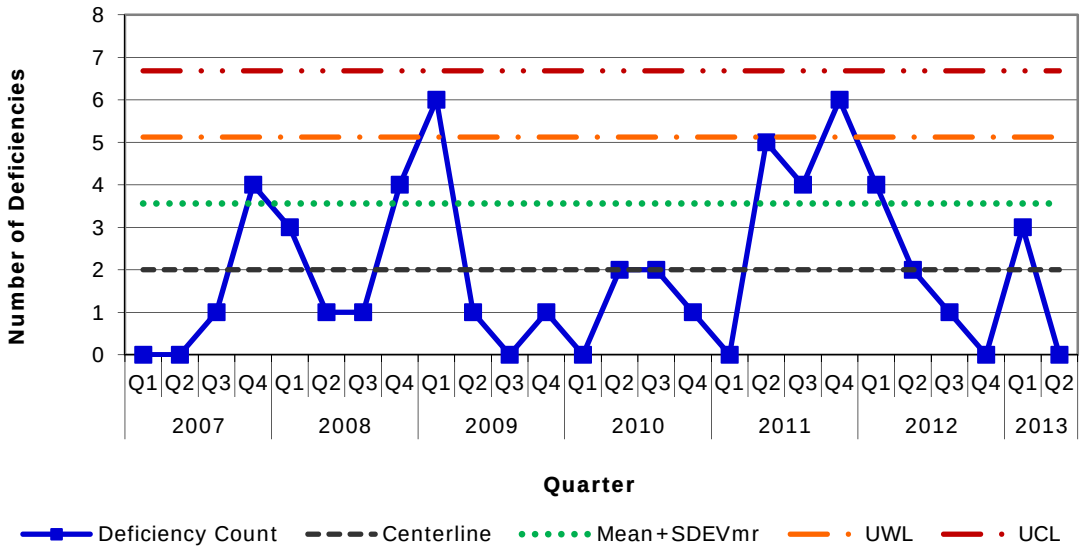


Figure 27. Frequency control chart of CIS cyber security deficiencies.

Because no recent common tests were met, deficiencies within this security subject are considered to be within expected variation and this security subject will not automatically be analyzed in future performance analyses.

☐ Potential Significant, Programmatic or Repetitive ☐ Meets Common Tests ☒ Within Expected Variation ☐ Downward Trend

8.2 Identifying Classified Information

The visual analysis step did not warrant further analysis of deficiencies categorized as identifying classified information. Therefore, this safeguards and security subject was not discussed or analyzed further in this report.

8.3 Information Protection

The visual analysis step did not warrant further analysis of CIS information protection deficiencies identified in 2013. In the previous analysis this topic was determined to need continued analysis due to an increase in deficiencies from the first to the second quarter of 2012. Therefore, this security subject was analyzed using a control chart. In the control chart (Figure 28) no common tests were met. In the second quarter of 2013, three CIS information protection deficiencies were identified, representing a decrease from the first quarter in 2013. Since no common tests were met, this security topic is not discussed further.

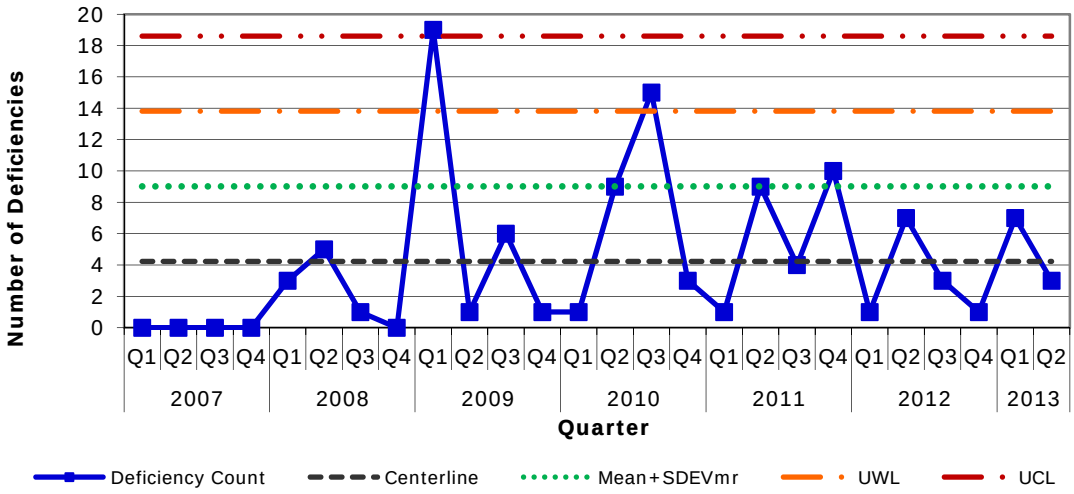


Figure 28. Frequency control chart of CIS information protection deficiencies.

Because no recent common tests were met, deficiencies within this security subject are considered to be within expected variation and this security subject will not automatically be analyzed in future performance analyses.

☐ Potential Significant, Programmatic or Repetitive ☐ Meets Common Tests ☒ Within Expected Variation ☐ Downward Trend

8.4 Nuclear Materials Control & Accountability

The visual analysis step did not warrant further analysis using a control chart of nuclear materials control and accountability deficiencies. Therefore, this safeguards and security topic was not discussed or analyzed further.

8.5 Personnel Security Program

The visual analysis step did not warrant further analysis using a control chart of personnel security program deficiencies. Therefore, this safeguards and security subject was not discussed or analyzed further.

8.6 Physical Protection

The visual analysis step did not warrant further analysis using a control chart of deficiencies categorized as physical protection. Therefore, this safeguards and security topic was not discussed or analyzed further.

8.7 Program Management and Support

The visual analysis step did not warrant further analysis of deficiencies categorized as program management and support. Therefore, this safeguards and security topic was not discussed or analyzed further.

8.8 Protective Force

The visual analysis step did not warrant further analysis using a control chart of deficiencies categorized as protective force. Therefore, this safeguards and security topic was not discussed or analyzed further.

8.9 Unclassified Visits & Assignments by Foreign Nationals

The visual analysis step did not warrant further analysis of deficiencies categorized as unclassified visits and assignments by foreign nationals. Therefore, this safeguards and security topic was not discussed or analyzed further.

To conclude Section 8.0, no recent common tests were met within the cyber security or the safeguards and security functional areas, specifically related to CIS deficiencies.

9.0 Conclusion

ITS issues identified from July 2012 through June 2013, were analyzed focusing on identifying issues that may require additional management attention and noncompliances that meet the threshold for reporting to the DOE NTS or to the DOE SSIMS.

The analysis concluded that data for 17 of the 25 Office of Enforcement regulated safety and security subjects were within expected variation. These subjects are shown in green in Table 6. The data for eight of the 25 safety and security subjects, shown in yellow and red in Table 6, met a common test or an action limit. All eight regulated safety and security subjects that met a common test are discussed in this report and will be monitored over future quarters. Data for three of the eight regulated safety and security subjects met an action limit, a point above the Upper Control Limit (UCL) or eight consecutive points below the centerline. Data within these three subjects were analyzed further to resolution to determine if a repetitive or programmatic (i.e., systemic) noncompliance exists that warrants a noncompliance report to DOE. The data for one WSH subject is identified as a potential repetitive or programmatic noncompliance (shown in red in Table 6); additional analysis is needed to make a final determination.

Table 6. Summary of safety and security subjects regulated by the DOE Office of Enforcement.

Worker Safety and Health Management Issues	
	Beryllium
	Biological Safety
	Electrical Safety
	Emergency Program
	Explosive Safety
	Fire Safety
	Occupational Medicine
	Other Industrial Hygiene
	Other Industrial Safety
	Work Planning and Control
	Severity Level I Noncompliances
Nuclear Safety Management Issues	
	Nuclear Operations
	Packaging and Transportation (Nuclear)
	Quality Assurance (Nuclear)
	Work Planning and Control
	Radiation Protection

Classified Information Security Management Issues	
	Cyber Security
	Identifying Classified Information
	Information Protection
	Nuclear Materials Control & Accountability
	Personnel Security Program
	Physical Protection
	Program Management and Support
	Protective Force
	Unclassified Visits & Assignments By Foreign Nationals

Legend	
	Data within this subject was within expected variation or there was a decreasing trend in the data
	Data within this subject met a common test and will be analyzed in future performance analyses
	Data within this subject met a common test and might represents a significant, systemic, or repetitive noncompliance reportable to DOE

The three Office of Enforcement regulated safety subjects with data meeting an action limit in the control chart analysis were, fire safety, industrial hygiene, and work planning and control (WPC).

The fire safety deficiencies that caused a point to be above the UCL were fire detection and alarm deficiencies identified in May 2013. In May 2013, seven fire detection and alarm deficiencies were identified, a higher number of fire detection and alarm deficiencies than any other month in 2013. Four of the seven were from the *2013 Legacy Fire Protection Re-Inspections* and were identified within two days of one another, the reason for the point above the UCL. Deficiencies from these inspections are not newly identified deficiencies, but deficiencies identified in the 2007 due diligence walkthroughs in preparation for contract transition. The Fire Marshal determined that these deficiencies are considered minor issues.

General industrial hygiene deficiencies met an action limit because more than eight consecutive data points are below the centerline from the fourth quarter in 2010 to the second quarter in 2013. This type of action limit does not typically warrant any concern of a programmatic or repetitive noncompliance.

A review of WPC deficiencies identified a potential significant or systemic noncompliance. By including deficiencies mis-categorized as observations in the control chart analysis for WPC, common tests were met, a point above the UWL in the first

quarter of 2012 and an increase in deficiencies in the most recent quarter of data analyzed, the second quarter of 2013. Twenty nine WPC deficiencies were identified in the quarter with a point above the UWL. The data reviewed in this analysis (through June 2013) suggests that possible significant or systemic WPC deficiencies from three topical areas exist. Further review of more recent WPC data is warranted to determine if a systemic noncompliance reportable to the DOE Office of Enforcement exists.

Recommendation: *Analyze work planning and control deficiencies in more detail to determine if a significant or programmatic noncompliance exists that may be reportable to NTS.*

Note: Since this analysis of WPC deficiencies identified through June 2013 was completed, a noncompliance evaluation was completed in November 2013 and the evaluation included more recent WPC deficiencies. The analysis of ITS data through June 2013, and the results of the noncompliance evaluation completed in November 2013, led to LLNL filing a programmatic noncompliance report to the NTS in January 2014 titled, *Programmatic noncompliance with topical areas within LLNL's Work Planning and Control process.*

The analysis identified seven regulated safety subjects that will be monitored over future quarters:

- Electrical Safety (Section 6.3)
- Fire Safety (Section 6.6)
- Other Industrial Hygiene (Section 6.8)
- Other Industrial Safety (Section 6.9)
- Nuclear Operations (7.1)
- Work Planning and Control (Nuclear Safety) (7.4)
- Radiation Protection (Section 7.5)

No issues were determined to meet the WSH "Severity Level I" threshold for reporting to the DOE NTS. There were no issue significance level one deficiencies identified between October 2012 and December 2013. Twelve of the 13 issue significance level two deficiencies were either reported to the DOE NTS or were from a security incident/assessment. The remaining issue was out of the purview of worker safety and health.

Since the third quarter of 2012, there were 16 deficiencies assigned a compliance code with a suggested issue significance level of one that was downgraded to another issue significance level. Three of the 16 deficiencies were already reported to the DOE NTS. The other 13 deficiencies were evaluated for reporting to the DOE NTS and all were determined to not meet the threshold for reporting to the DOE NTS as a "Severity Level I" noncompliance.

10.0 Methods

10.1 Method for Analyzing Assessments

Internal assessments at LLNL include Internal Independent Assessments (IIAs) chartered by the Director's Office; management self-assessments chartered by either the functional area managers, the principal associate director, or the associate director; and management observations, verifications, and inspections (MOVIs). DOE and regulatory agencies conduct external assessments. The results of internal and external assessments are entered into the LLNL Issues Tracking System (ITS). In addition, deficiencies, observations, and corrective actions identified during the analysis of events (e.g., illnesses/injuries and occurrences) are also entered into ITS.

Data on assessments conducted from 2005 through 2010 was extracted in February 2011 using the ITS Mega Report; duplicate values were deleted. The ITS Mega Report includes all assessments performed, whether or not the assessment resulted in an issue (i.e., deficiency or observation). The ITS allows the user to categorize assessments by type. For this analysis, the ITS assessment types were binned into the following nine assessing categories:

- "Event" includes assessment types event-illness/injury case analysis report, event-occurrence event-below occurrence reporting process system (ORPS) (site) reportable and security incident.
- "External" includes assessment types external-Livermore site office (LSO) monthly assessment or periodic issues reports, external-LSO surveillance and external-other.
- "Internal Independent" includes assessment types internal independent, independent audit and oversight department audit, and LLNL parent org functional management assessment.
- "Joint FAM/Line" includes assessment type joint FAM/Line.
- "Management Self" includes assessment type management self.
- "MOVI" includes assessment types management observation, verification or inspection.
- "Other External" includes the combination of assessment type other and assessments performed by external assessors.
- "Other Internal" includes the combination of assessment type other and assessments performed by internal assessors.
- "Quick ITS" includes assessment type quick ITS.
- "Readiness Review" includes assessment type readiness review.

The data was reviewed to determine if the frequency or categories of assessments (above) changed comparing recently collected data to data collected since 2005. Process control charts for individual measurements were produced to look at variations of internal assessment data. The process control chart can be considered a way of

performing a statistical test to determine whether the process under study is in a state of control. One control chart was used to analyze variation within internal assessment data, referred to as a frequency control chart. The frequency control chart in this case plots the internal assessment frequency over time (i.e., quarters).

The control chart provides a means to evaluate and compare the number of assessments over time to the following seven key elements:

1. Centerline: the average number of assessments over the time period (mean)
2. One standard deviation: one times the average moving range divided by a constant with value 1.128 above the mean
3. One standard deviation: one times the average moving range divided by a constant with value 1.128 below the mean
4. Upper Warning Limit (UWL): two times the average moving range divided by a constant with value 1.128 above the mean
5. Upper Control Limit (UCL): three times the average moving range divided by a constant with value 1.128 above the mean
6. Lower Warning Limit (LWL): two times the average moving range divided by a constant with value 1.128 below the mean
7. Lower Control Limit (LCL): three times the average moving range divided by a constant with value 1.128 below the mean

The key element, the UCL, is a common calculation for control charts. Ideally, the majority of data would lie within the UCL and the LCL.

The moving range is defined as $|x_i-x_{i-1}|$, where x is the number of internal assessments for a specific quarter. The moving range can also be defined as the absolute difference between two successive data points, in this case quarterly assessment counts. The constant discussed above, referred to as d_2 in the *Introduction to Statistical Quality Control* (Montgomery, 1997) is defined as the mean of the distribution of the relative range and is used in calculating the estimate of the standard deviation, which is defined as the average moving range divided by this constant (d_2). The value of d_2 ranges anywhere from 1.128 to 3.931, depending on how many observations are in each sample. The moving range is used instead of the range because each data point in the control charts used in this analysis is based on individual counts and not a sample average. Because the moving range is calculated using two successive data points, our value of n is two (n=2). Therefore, the value of d_2 is defined as 1.128 in Table VI in the *Introduction to Statistical Quality Control*.

We look within the process control charts for special causes of variation, which can be found by using common tests. The common tests (below) are called action limits, as listed in the *Introduction to Statistical Quality Control*:

1. One data point falling above the UCL or below the LCL

2. Two (or three) out of three points in a row are more than the UWL from the mean or are less than the LWL from the mean in the same direction
3. Four out of five points in a row are more than one standard deviation from the mean in the same direction
4. Eight consecutive points plot on one side of the centerline

Theoretically, if a process is "in-control" then none of the data points meet the requirements of an action limit. If an action limit is met, the assessment data is analyzed further.

10.2 Method for Analyzing for Management Issues

Management issue noncompliances are defined as repetitive noncompliances, programmatic (i.e., systemic) issues, and intentional violations or misrepresentations. One goal of analyzing Issues Tracking System (ITS) data is to look for a possible programmatic noncompliance by reviewing deficiencies within the same safety or security subject. Second, the analysis may identify a previously overlooked repetition of the same type of deficiency. A programmatic problem generally involves some weakness in administrative or management controls or their implementation, to such a degree that a broader management or process control problem exists. A repetitive problem is generally two or more different events that involve substantially similar conditions, locations, equipment, or individuals. Repetitive problems tend to be narrower in scope than programmatic problems. The ITS issue analysis included a three-step process of 1) looking at the data as a whole to identify visual variations; 2) performing statistical tests of the sets of data gleaned from the first step; and 3) evaluating the sets of data gleaned from the second step by reviewing the context of the noncompliances, such as discovery method, location in terms of facility, the compliance code, and the description of the noncompliance.

The process for analyzing ITS data was to first, visually review the deficiencies by quarter, looking for groupings with large numbers of deficiencies, observed changes in the number of deficiencies, or other observations that look different from what is expected. Then, if the numbers appeared to be of interest, create a process control chart for individual measurements for the safety subjects within the functional areas related to worker safety and health (WSH) and nuclear safety and the security subjects within the safeguards and security functional area. The control charts utilize the "Individual-X/MR" method, described in Introduction to Statistical Quality Control.
A process control chart can be considered a way of performing a statistical test to determine whether the process is in a state of control. Frequency control charts were used to look at variations of issues within safety and security subjects. These control charts plot the deficiency frequency and sometimes the observation frequency per quarter along with the number of assessments within a quarter for a particular safety or security subject. The number of assessments, which in previous analyses was included

in the control chart, is not plotted prior to the fourth quarter of 2008 because the functional area for assessments became a required field in ITS as of the fourth quarter of 2008.
Along with the frequency of deficiencies, these control charts consist of four key elements:

- Centerline: the average number of deficiencies over the time period (mean)
- One Standard Deviation: one times the average moving range divided by a constant with value 1.128 above the mean
- Upper warning limit (UWL): two times the average moving range divided by a constant with value 1.128 above the mean
- Upper Control-limit (UCL): three times the average moving range divided by a constant with value 1.128 above the mean

Two other key elements, which are typically part of a process control chart, are not shown in the control charts in this analysis. These two elements are the Lower Warning Limit (LWL) and the Lower Control Limit (LCL). The LWL is two times the average moving range divided by a constant with value 1.128 below the mean. The LCL is three times the average moving range divided by a constant with value 1.128 below the mean. These elements have not been incorporated in the control charts because the number of deficiencies per quarter cannot be below one or zero, and in many cases the LWL and LCL would have been below one or zero had it been incorporated in the control charts.

The key element, the UCL, is a common calculation for control charts. Ideally, the majority of data would lie within the UCL and the LCL.

The moving range is defined as $|x_i - x_{i-1}|$, where x is the number of deficiencies (and sometimes observations) for a specific quarter. The moving range can also be defined as the absolute difference between two successive data points, in this case quarterly assessment counts. The constant discussed above, referred to as d2 in Introduction to Statistical Quality Control, is defined as the mean of the distribution of the relative range and is used in calculating the estimate of the standard deviation, which is defined as the average moving range divided by this constant (d2). The value of d2 ranges anywhere from 1.128 to 3.931 depending on how many observations are in each sample. The moving range is used instead of the range because each data point in the control charts used in this analysis is based on individual counts and not a sample average. Because the moving range is calculated using two successive data points, our value of n is two (n=2). Therefore, the value of d2 is defined as 1.128 in Table VI in Introduction to Statistical Quality Control.

In many cases, the control limits were adjusted and calculated for fewer quarters than what is displayed on the control chart in order to emphasize the more recent data,

which often produces tighter control limits. If this adjustment was done for a control chart, it is noted on the bottom of the chart.

If there was a rare incidence of deficiencies within a subject, then the frequency of deficiencies was converted to a rate of deficiencies per year, and this rate was used as each data point on the control chart. The centerline becomes the average rate of deficiencies per year, but the formula for calculating the UCL and UWL does not change. This control chart is referred to as the deficiency rate per year control chart. Note that the x-axis becomes the date, not the quarter, the deficiency was identified. We look within the process control charts for special causes of variation, which can be found by using common tests. The common tests (below) are called action limits, as listed in the Introduction to Statistical Quality Control:

- One data point falling above the UCL or below the LCL
- Two (or three) out of three points in a row are more than UWL from the mean in the same direction
- Four out of five points in a row are more than one standard deviation from the mean in the same direction
- Eight consecutive points plot on one side of the centerline

Theoretically, if a process is "in-control," then none of the data points meet the requirements of an action limit. If an action limit is met, a more detailed examination of the specific deficiencies will occur in order to determine if repetitive, programmatic, or systemic weaknesses exist that may be reportable to the DOE Noncompliance Tracking System (NTS). If data within a subject meets an action limit, but has already been reported to NTS, further explanation will not be provided. The following four other common tests are used, but are not considered action limits:

- One data point above the UWL
- Single increase in data points for the quarter in question
- Recent increasing trend for more than one quarter
- An unusual or nonrandom pattern in the data

Some of the common tests described above are more conservative than the typical set of decision rules listed in Introduction to Statistical Quality Control. These non-typical common tests are meant to detect subjects that should be analyzed using control charts in future performance analyses to watch for potential nonrandom patterns.

- One standard deviation: one times the average moving range divided by a constant with value 1.128 below the mean
- Upper Warning Limit (UWL): two times the average moving range divided by a constant with value 1.128 above the mean
- Upper Control Limit (UCL): three times the average moving range divided by a constant with value 1.128 above the mean

- Lower Warning Limit (LWL): two times the average moving range divided by a constant with value 1.128 below the mean
- Lower Control Limit (LCL): three times the average moving range divided by a constant with value 1.128 below the mean

The key element, the UCL, is a common calculation for control charts. Ideally, the majority of data would lie within the UCL and the LCL.
The moving range is defined as |xi-xi-1|, where x is the number of internal assessments for a specific quarter. The moving range can also be defined as the absolute difference between two successive data points, in this case quarterly assessment counts. The constant discussed above, referred to as d2 in the Introduction to Statistical Quality Control (Montgomery, 1997) is defined as the mean of the distribution of the relative range and is used in calculating the estimate of the standard deviation, which is defined as the average moving range divided by this constant (d2). The value of d2 ranges anywhere from 1.128 to 3.931, depending on how many observations are in each sample. The moving range is used instead of the range because each data point in the control charts used in this analysis is based on individual counts and not a sample average. Because the moving range is calculated using two successive data points, our value of n is two (n=2). Therefore, the value of d2 is defined as 1.128 in Table VI in the Introduction to Statistical Quality Control.

We look within the process control charts for special causes of variation, which can be found by using common tests. The common tests (below) are called action limits, as listed in the Introduction to Statistical Quality Control:

- One data point falling above the UCL or below the LCL
- Two (or three) out of three points in a row are more than UWL from the mean in the same direction
- Four out of five points in a row are more than one standard deviation from the mean in the same direction
- Eight consecutive points plot on one side of the centerline

Theoretically, if a process is “in-control” then none of the data points meet the requirements of an action limit. If an action limit is met, the assessment data is analyzed further.

11.0 Definitions

Correlation: The strength of the linear relation between two quantitative variables (e.g., observations and deficiencies).

Correlation Coefficient (Rho): A number between -1 and 1 that measures the degree to which two variables are linearly related. If there is perfect linear relationship with positive slope between the two variables, we have a correlation coefficient of 1; if there is positive correlation, whenever one variable has a high (low) value, so does the other. If there is a perfect linear relationship with negative slope between the two variables, we have a correlation coefficient of -1; if there is negative correlation, whenever one variable has a high (low) value, the other has a low (high) value. A correlation coefficient of 0 means that there is no linear relationship between the variables.

Correlation Test (Pearson): The statistical significance of *r* is tested using a t-test. The hypotheses for this test are:

H_0: rho = 0
H_a: rho <> 0

A low p-value for this test (less than 0.05, for example) means that there is evidence to reject the null hypothesis in favor of the alternative hypothesis, or that there is a statistically significant relationship between the two variables.

P-value: The probability of wrongly rejecting the null hypothesis if it is in fact true. Examples of null hypotheses used in this analysis:

H_0: The process is in a state of control
H_0: rho (correlation coefficient) = 0

Simple Linear Regression: Simple linear regression aims to find a linear relationship between a response variable and a possible predictor variable by the method of least squares and production of a regression equation. A regression equation allows us to express the relationship between two variables algebraically. It indicates the nature of the relationship between two variables. In particular, it indicates the extent to which you can predict a variable by knowing another, or the extent to which variables are associated with one another.

Standard deviation: A way to measure how far the observations are from their mean. It is also referred to as a measure of spread.

State of Control: The extent of variation of the output of the process does not exceed that which is expected on the basis of the natural statistical variability of the process. None of the data points fall outside of the Upper or Lower Control Limits.

Statistically Significant: The probability (usually less than 5 percent or less than a p-value of 0.05) that a finding or result is caused by something other than just chance.

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