



Independent Assessment of Work Planning and Control at Sandia National Laboratories – New Mexico

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Acronyms

ACGIH	American Conference of Governmental Industrial Hygienists
AHA	Activity Hazard Analysis
ALWCD	Activity-Level Work Control Document
ANSI	American National Standards Institute
CAS	Contractor Assurance System
CFR	Code of Federal Regulations
CRAD	Criteria and Review Approach Document
CSSP	Contract-specific Safety Plan
DOE	U.S. Department of Energy
EA	Office of Enterprise Assessments
ECP	Employee Concerns Program
EDM	Electrical Discharge Machine
ES&H	Environment, Safety, and Health
FY	Fiscal Year
IH	Industrial Hygiene
ISM	Integrated Safety Management
ISMS	Integrated Safety Management System
JSA	Job Safety Analysis
JSHE	Job Site Hazard Evaluation
LOTO	Lockout/Tagout
NFPA	National Fire Protection Association
NRTL	Nationally Recognized Testing Laboratory
NTESS	National Technology and Engineering Solutions of Sandia, LLC
OAA	Operational Awareness Activity
OFI	Opportunity for Improvement
OSHA	Occupational Safety and Health Administration
PHS	Primary Hazard Screen
PPE	Personal Protective Equipment
PTP	Pre-task Plan
SFO	Sandia Field Office
SME	Subject Matter Expert
SNL-NM	Sandia National Laboratories – New Mexico
SoC	Skill of the Craft
TLV	Threshold Limit Value
TQP	Technical Qualification Program
WO	Work Order
WCA	Work Control Authorization
WP&C	Work Planning and Control
WSH	Worker Safety and Health

INDEPENDENT ASSESSMENT OF WORK PLANNING AND CONTROL AT SANDIA NATIONAL LABORATORIES – NEW MEXICO

Executive Summary

The U.S. Department of Energy (DOE) Office of Enterprise Assessments (EA) conducted an independent assessment of work planning and control (WP&C) at Sandia National Laboratories – New Mexico in February 2022. This assessment evaluated National Technology and Engineering Solutions of Sandia, LLC (NTESS) WP&C processes and elements of its electrical safety program and contractor assurance system, as well as Federal oversight of WP&C by the Sandia Field Office (SFO) and the SFO employee concerns program. This assessment focused on Centers 1800 (Material, Physical and Chemical Sciences) and 4700 (Infrastructure Services).

EA identified the following strengths, including one best practice:

- The NTESS WP&C processes described in corporate-level policies and programs effectively incorporate integrated safety management system requirements at the institutional level.
- NTESS's emphasis on a critical thinking approach to WP&C at the work activity level contributes to a more effective WP&C process for identifying potential hazards associated with events that may have a low probability of occurrence but unacceptably high consequences to worker safety and health. This critical thinking approach has improved the understanding of failure modes, unacceptable consequences, and the necessary mitigation and control measures for these events. (**Best Practice**)

EA identified the following weaknesses and one finding:

- Some work control authorization (WCA) documents prepared for Center 1800 research activities did not sufficiently identify and analyze routine workplace hazards and controls (**Finding**). Some WCA documents did not meet requirements for a failure mode analysis/hazard analysis, accurately document training requirements, include all hazard controls defined in related industrial hygiene assessments, or included workers on the approved activities team list who are not qualified to perform the defined scope of work.
- Center 1800 WP&C procedures do not adequately describe how the corporate WP&C criteria are to be implemented for research activities.
- Researchers did not always ensure that laboratory-built electrical components and commercially purchased machines were subjected to a Nationally Recognized Testing Laboratory-type inspection before use.
- Maintenance workers did not accurately complete some pre-task evaluations prior to the performance of work (e.g., identification of the proper personal protective equipment for the expected arc flash hazards and steam hazards); and hazardous energy was not properly controlled in two observed work activities.
- Electrical work is inappropriately allowed to be performed as skill of the craft, without the required pre-job briefing, for all but the highest risk level activities.
- Pre-task plans at subcontracted construction worksites did not always contain documented hazards and controls and, in some cases, were not updated as required when changes occurred; construction activity work packages performed by subcontractors did not identify all hazards (i.e., caustic concrete

splashes) and required controls (i.e., eyewash station); and silica controls at two projects were not consistent with DOE and NTESS requirements.

While SFO has established a generally comprehensive, integrated process for Federal oversight, EA identified the following weaknesses in SFO oversight and its employee concerns program (ECP):

- SFO does not have a unified approach for documenting issues identified during oversight activities, and data is maintained in multiple locations, making trending and analysis of NTESS performance difficult.
- Employee concern case files are not documented in sufficient detail, supporting documents are not maintained, and the final dispositions of cases were not communicated. SFO is overdue for conducting biennial self-assessments of its ECP and assessments of the NTESS ECP.

In summary, NTESS has a corporate WP&C framework that is well documented with program plans and detailed implementing procedures, and SFO has established a generally comprehensive, integrated process for Federal line oversight. However, EA observed instances of inadequate detail in Center 1800 procedures and WCA documents, as well as instances of inadequate implementation of hazard identification and controls in Center 4700. Until the concerns identified in this report are addressed or effective mitigations are put in place, potential vulnerabilities in the safe implementation of work will persist.

INDEPENDENT ASSESSMENT OF WORK PLANNING AND CONTROL AT SANDIA NATIONAL LABORATORIES – NEW MEXICO

1.0 INTRODUCTION

The U.S. Department of Energy (DOE) Office of Worker Safety and Health Assessments, within the independent Office of Enterprise Assessments (EA), conducted an assessment of work planning and control (WP&C) at Sandia National Laboratories – New Mexico (SNL-NM), which is managed by National Technology and Engineering Solutions of Sandia, LLC (NTESS). EA conducted the onsite portions of this assessment February 7-10 and 22-25, 2022. This assessment was conducted within the broader context of ongoing assessments of WP&C implementation with a focus on electrical safety.

Consistent with the *Plan for the Independent Assessment of Work Planning and Control at the Sandia National Laboratories, January 2022*, this assessment evaluated the effectiveness of the implementation of the integrated safety management (ISM) core functions (define the scope of work, identify and analyze hazards, identify and implement controls, perform work safely within controls, and provide feedback and make improvements) for activity-level work. This assessment also evaluated elements of the electrical safety program, the flowdown of construction safety requirements to subcontractors, the contractor assurance system (CAS), and the oversight of WP&C provided by the National Nuclear Security Administration Sandia Field Office (SFO). The SFO employee concerns program (ECP) was also evaluated.

NTESS manages SNL-NM under the direction and oversight of SFO. SNL-NM consists of 11 divisions. This WP&C assessment focused on Division 1000 (Advanced Science and Technology) and Division 4000 (Infrastructure Operations). These two divisions each consist of several centers and a number of departments within each center. For Division 1000, EA focused on Center 1800 (Material, Physical and Chemical Sciences), which is one of six Division 1000 centers. For Division 4000, EA focused on two of three departments within Center 4700 (Infrastructure Services): the centralized maintenance department, which manages construction activities (hereafter referred to as Center 4700 - Maintenance), and the project department (hereafter referred to as Center 4700 - Projects).

2.0 METHODOLOGY

The DOE independent oversight program is described in and governed by DOE Order 227.1A, *Independent Oversight Program*, which is implemented through a comprehensive set of internal protocols, operating practices, assessment guides, and process guides. This report uses the terms “best practices, deficiencies, findings, and opportunities for improvement (OFIs)” as defined in the order.

As identified in the assessment plan, this assessment considered objectives and criteria from DOE Guide 226.1-2A, *Federal Line Management Oversight of Department of Energy Nuclear Facilities*, Appendix D: *Activity Level Work Planning and Control Criterion Review and Approach Documents with Lines of Inquiry*. EA used elements of Criteria and Review Approach Document (CRAD) EA-30-07, Rev. 0, *Federal Line Management Oversight Processes*, to collect and analyze data on SFO oversight activities related to WP&C. EA also used objectives and criteria from EA CRAD 32-03, Rev. 1, *Industrial Hygiene Program*, and CRAD EA-30-01, Rev. 1, *Contractor Assurance System*.

EA observed the planning and implementation of work activities in three primary areas: (1) Center 1800 research activities, (2) Center 4700 maintenance activities, and (3) Center 4700 projects activities. EA examined key activity-level work control documents (ALWCDs), such as WP&C plans and procedures,

job hazard analyses, work orders (WOs), manuals, analyses, and policies. EA also interviewed key personnel responsible for developing and executing the associated programs, observed 52 onsite work activities (including a sample of 14 research activities within seven of the 20 Center 1800 departments), and walked down relevant portions of specific facilities. Follow-on discussions among EA, SFO, and NTESS were conducted to clarify and resolve issues. The members of the assessment team, the Quality Review Board, and management responsible for this assessment are listed in appendix A.

EA previously assessed WP&C at SNL-NM, as documented in *Office of Enterprise Assessments Targeted Review of Work Planning and Control at the Sandia National Laboratories, November 2014*. This current EA assessment examined the completion and effectiveness of corrective actions for the one finding cited in the previous assessment (SNL-FINDING-01). Results of the corrective action assessment are discussed in section 3.7 of this report.

3.0 RESULTS

The objective of this assessment was to verify that NTESS manages and performs work in accordance with a documented safety management system that (1) defines the scope of work; (2) identifies and analyzes hazards associated with the work; (3) develops and implements hazard controls; (4) performs work within controls; and (5) provides feedback on the adequacy of controls and continues to improve safety management, all in accordance with the DOE requirements for an integrated safety management system (ISMS), as defined in DOE Policy 450.4A, *Integrated Safety Management Policy*, and 48 CFR 970.5223-1(c), *Integration of Environment, Safety, and Health into Work Planning and Execution*.

3.1 Work Planning and Control Institutional Programs

The objective of this portion of the assessment was to verify that NTESS has established WP&C processes at the institutional level and at the organizational level for Centers 1800 and 4700 - Maintenance.

3.1.1 NTESS Institutional Level

NTESS has established an effective sitewide WP&C institutional program. The NTESS WP&C institutional program is adequately documented in GN470115, *Work Planning and Control*; ESH001.1, *Integrate ES&H [Environment, Safety, and Health] into Work Planning and Execution*; and PG470252, *Integrated Safety Management System Description*. These documents effectively implement the guiding principles and core functions of ISM as defined in DOE Policy 450.4A and describe minimum requirements for all NTESS organizations. GN470115 appropriately requires all NTESS organizations to develop and approve documents describing how WP&C institutional criteria will be implemented. The NTESS WP&C institutional program allows each NTESS organization flexibility to tailor its work processes within this framework. WP&C processes used by different NTESS organizations at the site are properly coordinated using a multi-organizational work agreement to ensure the seamless integration of work performed by co-located workers.

In addition, PG470252, section 3.3.4, establishes six overarching principles on which the NTESS WP&C institutional program is based: implement a safe-by-design intent; understand the technical basis of the operation; identify and control energy sources; define unacceptable consequences; take a risk assessment approach; and use a positive verification process to ensure that the specified controls are in place. These principles are effectively applied via a “critical thinking” approach to ensure the most effective identification and control of potential hazards. The application of critical thinking results in a department’s manager’s formal, documented “safety case” that describes how the overarching principles

and system hazards and controls are addressed, and the basis for accepting the residual risk remaining after the application of hazard controls. EA considers NTESS's emphasis on the critical thinking approach as fundamental to WP&C to be a **Best Practice** because it encourages the work staff to focus on identifying unacceptable consequences when performing work by taking a risk assessment approach to planning and implementing work. Further, this practice has led to a broader identification and understanding of failure modes, unacceptable consequences, mitigation and control measures, and the definition of acceptable risks.

3.1.2 Center 1800

Center 1800 has established a generally effective WP&C process for research activities. The NTESS WP&C institutional program is implemented in Center 1800 work activities by CP 1800-WPC01, *Center 1800 Work Planning and Control Process*, and supporting documents (e.g., guidance documents and templates) that collectively provide the framework to develop a work control authorization (WCA) document (the primary ALWCD). CP 1800-WPC01 also appropriately requires the WCA document to be supplemented by operating procedures and bounded by a primary hazard screen (PHS) and an industrial hygiene (IH) exposure assessment. The WCA document is an effective mechanism for identifying critical work tasks (tasks with the greatest hazards) and potential adverse consequences, documenting related lessons learned, prescribing mentoring requirements, and presenting a safety case (the department manager's description of the most significant risks and justification that the identified hazard controls adequately mitigate the risk). CP 1800-WPC01 appropriately requires NTESS IH subject matter experts (SMEs) to prepare an IH exposure assessment for each research laboratory; the IH exposure assessment serves as the certified workplace hazard assessment for personal protective equipment (PPE) as required by Occupational Safety and Health Administration (OSHA) 29 CFR 1910.132 and the expectations of 10 CFR 851.

While Center 1800's WP&C process has a number of positive attributes, CP 1800-WPC01 (the Center 1800 WP&C document intended to implement the institutional WP&C process defined in GN470155) does not adequately describe how all GN470155 WP&C institutional criteria will be implemented for activity level work performed in Center 1800. (See **Deficiency D-NTESS-1.**) GN470115, section 1.2 requires each organization's WP&C implementation documents, such as CP 1800-WPC01, to demonstrate effective implementation of the WP&C criteria described in GN470115. However, CP 1800-WPC01 does not define the purpose and limitations of a WCA document or describe the work authorization process or the meaning of an "approved" WCA document as required by GN470115. Requirements for documenting required training in a WCA document are unclear. Key terms used in a WCA document, such as a "critical job task," are not defined, and the relationship between laboratory-level ES&H documents (e.g., PHS and the IH exposure assessment) and WCA documents is not explained in CP1800-WP-01. The mechanism for feedback and continuous improvement at the activity level is undefined in CP1800-WP-01. This lack of detail in CP 1800-WPC01 contributed to incomplete WCA document content and inadequate implementation of the institutional WP&C program as described in section 3.2.1 of this report.

3.1.3 Center 4700 - Maintenance

Center 4700 - Maintenance has established a generally effective WP&C process. The institutional WP&C program, GN470115, is implemented by PCD-059, *Maintenance Work Planning and Control*, WI-025, *Facilities Maintenance Safety Case Overview*, and a supporting suite of WP&C documents that collectively provide appropriate requirements specific to maintenance activities. The processes of planning, job hazard identification, walkdowns (involving workers, supervisors, and SMEs), and hazard analysis are adequately described.

WI-025 defines an adequate maintenance work risk model that correlates the work risk (derived from a risk matrix that relates consequence and probability) with the level of rigor (derived from a table that identifies general hazard level descriptions for specific hazard types). WI-025 also identifies 22 safety cases (standard descriptions of common hazards like hoisting and rigging, control of hazardous energy, and fall protection) that identify the residual risk level remaining after implementation of controls, and justify why the residual risk is acceptable. Fourteen of the 22 Center 4700 - Maintenance safety cases were reviewed and adequately demonstrated implementation of the risk model, clearly identifying an initial risk level (1 to 4, with 1 being the highest risk) for specific types of maintenance work hazards with identified controls and a mitigated risk level resulting from the applied controls.

PCD-059 and WI-025 together provide a generally effective process for developing WOs. Appendix A of PCD-059 identifies specific criteria for designating the level of rigor (low, medium, and high) for all relevant types of maintenance work. Table 2-1 of WI-025 adequately correlates the rigor and risk level resulting in a defined WO work approval level and the need (or not) for a pre-job/post-job briefing. Skill of the craft (SoC) work activities and controls are adequately described in job safety analysis (JSA) documents for each craft, which are used for low-risk activity-level work instructions. SoC work involves activities and controls that craft personnel perform per their training, without supplemental direction in work instructions. JSA documents also adequately describe tasks that are common to every craft.

However, contrary to GN470115, section 3.2.1, Center 4700 supplemental documents contain three weaknesses that limit the ability to produce clear definition of hazards. (See **Deficiency D-NTESS-2**.) Hazards must be clearly defined to ensure that the appropriate rigor and risk level are identified and documented for each medium- and/or low-rigor work activity. Weaknesses include:

- PCD-059 limits the risk discussion of pressurized systems to steam, omitting other types of pressurized systems (fire hydrants, hydraulic systems, and compressed gases) that are used for medium-rigor work. This omission impedes planners from consistently determining risk and rigor levels during work planning involving pressurized systems.
- WI-025, Table 2-1, inappropriately allows higher-risk work (risk levels 1 and 2) to be performed as SoC. This table implies that SoC-type work can be conducted without the special WO hazard analysis required for task-level planning as shown in PCD-059, figure 3.2.
- WI-009A, *Routine Hazards and Controls Associated with Maintenance Activities*, inappropriately includes “critical lifts” as a routine hazard applicable to all craft resulting in “critical lifts” relying solely on SoC controls, contrary to the requirements of PCD-059, Appendix A. Treating critical lifts as SoC work increases the risk of personal injury.

Work Planning and Control Institutional Programs Conclusions

NTESS has established an effective sitewide WP&C institutional program, as well as generally effective WP&C processes at the organizational level for Center 1800 and Center 4700 - Maintenance. The WP&C institutional program adequately implements the DOE-approved ISMS, providing flexibility for NTESS organizations to tailor their implementing approach within the institutional framework. NTESS’s emphasis on the critical thinking approach for analyzing hazards as fundamental to WP&C is cited as a Best Practice. Center 1800 and Center 4700 - Maintenance have generally adequate WP&C processes within the WP&C institutional program. However, the Center 1800 WP&C process does not adequately describe how WP&C institutional criteria are to be implemented for research activities. Further, EA identified weaknesses in the Center 4700 - Maintenance WP&C process in the areas of hazardous energy controls and inappropriately broad application of, or reliance on SoC.

3.2 Work Planning and Control Implementation

The objective of this portion of the assessment was to assess NTESS's implementation of its WP&C institutional program in Center 1800 and Center 4700 - Maintenance.

3.2.1 Center 1800

The objective of this portion of the assessment was to evaluate the implementation of WP&C in Center 1800 through defining the scope of work, identifying and analyzing hazards, developing and implementing hazard controls, and performing work within controls.

Defining the Scope of Work

All 14 of the reviewed WCA documents provided a detailed scope of activity and critical job tasks, sufficient to enable the identification of hazards and controls associated with the research activity. In addition, six of the 14 observed research activity WCA documents were supplemented by one or more operating procedures, providing even greater work scope detail.

Identifying and Analyzing Hazards Associated with the Work

Center 1800 personnel effectively identify and analyze low probability/unacceptably high consequence research-related hazards (see Best Practice) but are not as effective in identifying and analyzing all routine industrial hazards and performing failure modes/hazards analyses. The 14 reviewed WCA documents adequately documented potential failures and unacceptable consequences associated with the research experiment, in accordance with GN470115, section 3.2, and included a safety case. However, contrary to GN470115, section 3.2.1, EA identified the following four WCA documents in which routine industrial hazards (i.e., higher probability of occurrence and lower but unacceptable consequence hazards) and controls were not identified and/or sufficiently analyzed. (See **Finding F-NTESS-1.**) Inadequate hazard identification and control of all worker hazards can result in increased risk of injury or illness to workers.

- Hazards and controls for precision machining tools were not fully identified and analyzed as required by 10 CFR 851 required health and safety standards (i.e., OSHA 29 CFR 1910). The Meso Manufacturing machine shop includes a variety of machines, such as lathes, drills, sheers, and electrical discharge machines (EDMs). The Vertical Mill rotary hazard was not properly guarded, and employee interviews revealed that not everyone had a clear understanding of the requirement for the chip guard. The EDM observed by EA was not evaluated for guarding, and the EDM and other machines in the shop were not adequately assessed for all energy isolation tasks, such as cleaning and set-up. This resulted in employees performing activities without using lockout procedures for the control of hazardous energy. Further, there are no machine-specific lockout/tagout (LOTO) procedures for any of the machines in the shop, and there is no record of the training conducted for authorized, affected, and other personnel. NTESS ES&H management was notified of these concerns by EA team management and NTESS initiated interim corrective actions to ensure worker safety.
- Hazards and controls associated with cutting, grinding, and polishing some toxic metals were not fully identified and analyzed. Specifically, the hazards and controls of working with cadmium or lead samples are not described in the associated WCA document for the Metallography Laboratory in Building 701 Lab 1327B (Department 1831).

- The WCA document for *Etching Standard Practices* identifies hazards associated with acid mixing in a critical job task but does not describe the work steps, hazards or hazard controls associated with the use or application of etchant solutions to metallographic samples via immersion, swab, and electrolytic etching, which is the stated scope of the activity in the WCA.
- The WCA document for *Thermal Processing, Soldering and Aging*, involving the benchtop use of small quantities of molten lead-based solder, does not address the potential hazards and controls of working with this type of solder, even though such hazards and controls are discussed in the IH exposure assessment for this laboratory. The WCA document instead references the *Chemical Processing* WCA document for chemical hazards, which does not describe hazards and controls related to molten lead-based solder.

Furthermore, contrary to GN470115, section 3.2.3, and PG470252, section 3.3.4, none of the 14 reviewed WCA documents met all institutional requirements for a failure mode/hazard analysis. (See **Deficiency D-NTESS-3**.) The reviewed WCA documents contained failure mode analyses but did not use a “recognized technical standard appropriate to the task” (e.g., what-if methodology) or address all seven required elements of a failure mode/hazard analysis (e.g., unacceptable consequences, single point failures, and residual risks). Incomplete failure mode/hazard analyses can result in missed adverse consequences and mitigating controls.

Developing and Implementing Hazard Controls

For most of the 14 observed Center 1800 research activities, hazard controls were generally well developed and adequately documented in the associated WCA document. For each critical job task identified in a WCA document, the WCA document detailed the “engineered and administrative controls to mitigate hazards associated with the task.” Most failure mode analyses identified mitigation measures. All safety cases included one or more of the most significant hazard control measures associated with the activity. All WCA documents included a *Training for this Activity* section that identifies a core set of four training courses required of any Center 1800 research activity and several additional training courses selected by the work planner and/or research department manager. However, EA identified the following two weaknesses:

- Contrary to the NTESS Center 1800 WP&C process (CP 1800-WPC01, *WCA Tool*, Step 11), six of the 14 reviewed WCA documents did not adequately identify all training requirements for the work scope defined in the WCA documents. (See **Deficiency D-NTESS-4**.) The training section of these WCA documents did not include all applicable PHS courses (as determined by the research department manager) for the work scope. In addition, the operating procedures for several observed experiments identified training requirements that were not included in the training section of the WCA documents. Incomplete training requirements in work documents can result in inadequately trained workers and increased risk to worker safety.
- Contrary to IH PG-01-02, *Strategy for Managing and Assessing Occupational Exposures*, the hazard controls (e.g., PPE) identified in five of 14 IH exposure assessments were not incorporated into the associated WCA documents. (See **Deficiency D-NTESS-5**.) An IH exposure assessment is prepared for each Center 1800 laboratory and typically identifies hazard controls. In some cases, these hazard controls were not included in the WCA document because, as indicated in interviews, it is not clear which section(s) of the IH exposure assessment (which typically bounds multiple WCA documents) apply to a specific WCA. For example, research activities in the Corrosion Laboratory are described in six WCA documents, which are bounded by one IH exposure assessment, but there is no direct correlation between the WCA documents and the IH exposure assessment. In another case, hazard controls from the IH exposure assessment were not included in the WCA document because the IH exposure assessment is outdated with respect to equipment or process changes in the laboratory. For

example, the IH exposure assessment for the Meso Manufacturing machine shop defines hazards and controls (e.g., local exhaust, PPE) for EDMs that were removed from the machine shop almost a decade ago and replaced with newer EDMs with different hazards requiring different controls. (See OFI-NTESS-1.)

Performing Work Within Controls

Center 1800 personnel generally performed observed work within identified controls. The interviewed research staff members, technologists, and research department managers were knowledgeable of the experiments and associated hazards and controls. Research department managers are dedicated to ensuring that research staff implement controls identified in WCA documents. All observed research work was performed safely and without incident.

As required by CP 1800-WPC01 and the associated WCA Tool, each Center 1800 WCA document includes a list of “activity team” workers for whom the “primary decision maker” (i.e., the research department manager) has attested that “all workers, 1800 and matrixed have been identified,” and that the “certification of skills, experience and training required to execute the work has been verified.” However, EA identified through interviews and a review of training records that some workers listed in Center 1800 WCA documents are not qualified to perform the defined scope of work because they have not completed the required mentoring or training described in the WCA document. Although EA did not observe any unqualified/untrained researchers performing work, some NTESS Center 1800 WCA documents include workers on the approved activities team list who are not trained and/or qualified to perform the defined scope of work, even after considering limiting conditions placed on work authorizations, contrary to GN470115, sections 3.4.3 and 3.4.5. (See **Deficiency D-NTESS-6.**) The Center 1800 WP&C procedure does not explain why WCA documents are to include a list of workers; allowing unqualified workers to participate in Center 1800 work activities can expose workers to unnecessary health and safety risks.

3.2.2 Center 4700 - Maintenance

The objective of this portion of the assessment was to evaluate the implementation of WP&C in Center 4700 - Maintenance through defining the scope of work, identifying and analyzing hazards, developing and implementing hazard controls, and performing work within controls.

Defining the Scope of Work

Work scope boundaries and limitations for the 17 Center 4700 WOs observed by EA were adequately identified, with one exception that NTESS resolved in the field. The 13 reviewed SoC WOs for low-rigor level work activities were within the identified SoC JSAs. The three reviewed medium-rigor level WOs were appropriately developed in accordance with PCD-059, appendix A. However, contrary to PCD-059, appendix A, WI-038, *Performing Hoisting and Rigging/Heavy Lifting*, EA observed the performance of one work order (WO 20220168426) involving a lift with a crane that was inappropriately planned as low-rigor level instead of medium-rigor level. The NTESS team leader (foreman) immediately corrected this issue in the field by implementing requirements for a medium-rigor level WO.

Identifying and Analyzing Hazards Associated with the Work

Center 4700 - Maintenance personnel generally identified and analyzed work hazards adequately. For example, the WO for an observed painting activity appropriately identified the locations of lead-based paint and determined the work to be asbestos free. The WO included photographs of the hallway to be painted to detail the areas with lead-based paint and included appropriate controls. However, contrary to PCS.083, *Maintenance Process Map, D2*, the pre-task evaluations for four other observed work activities

did not correctly document hazards (i.e., the proper arc flash hazard category for PPE for three electrical WOs, and the heat/steam hazard for one humidifier WO). (See **Deficiency D-NTESS-7.**) In the absence of proper hazard identification and documentation, workers may be exposed to workplace hazards without the appropriate hazard controls.

Developing and Implementing Hazard Controls

Appropriate hazard controls were adequately developed and implemented for Center 4700 - Maintenance WOs for all observed work. For example, WOs appropriately addressed controls for hot work, hoisting and rigging, elevated work, excavations, and penetrations. Observed hazard controls for hot work (welding, cutting, and grinding) performed in the structural millwright shop were posted as an annual hot work permit that was current, was signed by users, and listed refresher training dates for each employee, allowing easy verification that training is up to date. Observed local exhaust ventilation was used effectively in the hot work area to exhaust fumes. Observed hazard controls associated with hoisting and rigging activities (to place heating, ventilation, and air conditioning actuators on a roof) included appropriate documentation on the *Ordinary Lift Worksheet*, current annual inspection of the crane and lifting basket, daily crane inspections, and crane operator certification (i.e., National Commission for the Certification of Crane Operators and Licensed in New Mexico).

Performing Work Within Controls

Center 4700 - Maintenance personnel generally performed work within identified controls for all observed work. Seven observed work activities demonstrated adequate implementation of identified hazard controls in accordance with WO and SoC JSA instructions. As work steps were performed by craft personnel, the steps were checked off on an electronic MAXIMO (maintenance work control system) WO to verify that each step was completed. The interviewed workers confirmed that they were knowledgeable of stop-work ability and had returned WOs for needed revisions. However, contrary to 29 CFR 1910.147(c)(4)(i) exception (5), workers used a simple LOTO (a single lockout device to achieve a locked-out condition) instead of the complex LOTO (multiple LOTO devices and written procedure) during the observed repair of a hot water line. (See **Deficiency D-NTESS-8.**) The simple LOTO did not include the requirement to lock out both the supply and return valves to control the hazard. Although both valves may have been locked out, the work was performed under a simple lockout without the required written procedure.

Work Planning and Control Implementation Conclusions

Center 1800 WCA documents adequately define work scopes and critical job tasks, and low probability/high consequence research-related hazards are well analyzed and documented in WCAs. Observed hazard controls were generally implemented as described in WCA documents, and observed work was performed within identified controls. However, while failure mode analyses presented in WCA documents captured potential failures and unacceptable consequences, the analyses did not meet all the institutional WP&C requirements for a failure mode analysis. In addition, EA identified multiple examples in which WCA documents did not adequately identify and analyze routine hazards and document hazard controls associated with routine work or experimental activities, which could result in unacceptable consequences to worker safety and health. Furthermore, some hazard controls listed in IH exposure assessments were not incorporated into WCAs; and some workers listed in WCAs were not fully qualified to perform the work scope described in the WCA document.

Center 4700 - Maintenance is generally effective in defining the scope of work, identifying, and analyzing hazards, developing and implementing hazard controls, and performing work within controls. However,

EA identified instances in which the selected work rigor level was too low, hazards were incorrectly documented in pre-task evaluations, and one instance where LOTO requirements were not met.

3.3 Center 4700 - Projects Flowdown of Construction Safety Requirements to Subcontractors

The objective of this portion of the assessment was to verify that NTESS appropriately flowed down DOE construction safety requirements to its Center 4700 - Projects' lower-tier construction subcontractors and to evaluate the implementation of WP&C for the observed projects.

DOE Requirements Flowdown

NTESS appropriately flowed down DOE construction safety requirements to its Center 4700 - Projects construction subcontractors. NTESS included DOE safety requirements in first-tier "partner" construction subcontracts, including 10 CFR 851, *Worker Safety and Health Program*, and the Department of Energy Acquisition Regulation (DEAR) Clause 970.5223-1, *Integration of Environment, Safety, and Health into Work Planning and Execution*. In addition, NTESS first-tier subcontracts incorporate the construction standard specification section 01065, *Environment, Safety, and Health for Construction Contracts*, which appropriately addresses ISM, WP&C, and 10 CFR 851 safety requirement implementation for subcontracted construction work.

The observed first-tier subcontractors effectively flowed down the construction safety and WP&C requirements to NTESS second-tier subcontractors. For example, the B&D Industries, Inc. and the Applied Construction Technologies, Inc. subcontracts contained language to ensure that these second-tier subcontractors comply with requisite contract-specific safety plans (CSSPs) and NTESS construction specifications. The observed subcontractor work was generally performed in accordance with NTESS contractual requirements, section 01065 implementation procedures, and the first-tier subcontractors' CSSP.

Subcontracted Construction Work Planning and Control Implementation

Subcontractors on Center 4700 - Projects generally implemented effective WP&C at each observed construction projects. For example, all observed construction project subcontractors appropriately maintained WP&C documentation required by NTESS construction standard specification section 01065, including a CSSP, an activity hazard analysis (AHA) for higher-risk work, and the daily superintendent job aid and pre-task plan (PTP); this documentation is available for review by all workers. Most WP&C documents adequately addressed the observed hazards and controls, with some exceptions addressed below.

Defining the Scope of Work

NTESS satisfactorily established scopes of work for construction projects in reviewed subcontracts. For activity-level work, subcontractors adequately described their work scopes in their daily-prepared PTPs and in AHAs. However, in two of the 10 PTPs, scopes of work (daily tasks) were not revised as required when new activities (not listed on the PTP) were introduced (i.e., adding a light requiring a LOTO at the building 960 basement project, and using a concrete saw at the building 814 project). (See **Deficiency D-NTESS-9**.)

Identifying and Analyzing Hazards Associated with the Work

Center 4700 construction project subcontractors prepared thorough AHAs for higher-risk hazards, such as working at height or controlling substantial occupational silica exposures. NTESS ES&H provided

substantial input to AHAs resulting in the identification of the high-risk hazards and the development of robust hazard controls.

However, several weaknesses were identified related to PTPs prepared to address lower-risk hazards occurring in the subcontractor daily scopes of work. Contrary to NTESS construction standard specification section 01065, paragraph 1.7.I, *Pre-Task Planning*, seven of 10 reviewed PTPs did not adequately identify hazards and controls. (See **Deficiency D-NTESS-9**.) Five of the 10 PTPs associated with the observed work listed activities, general construction hazards, and hazard controls randomly, without systematically analyzing and documenting the hazards and controls associated with the specific activity/task. There is potential for injuries and illnesses when hazards are not analyzed and controlled or when hazard controls are not clearly communicated to workers.

Developing and Implementing Hazard Controls

Center 4700 - Projects effectively coordinated the development of job site hazard evaluations (JSHEs) with NTESS ES&H SMEs, who support all NTESS organizations, to identify hazards within the facilities where construction subcontractors will be working. JSHEs appropriately convey these facility-based hazards (e.g., radiological contamination, asbestos, beryllium, and/or hazardous chemicals) and the identified controls to the subcontractors working at each construction project location. The reviewed JSHEs were appropriate to the facility hazards in the areas where construction projects were observed.

For subcontractor activity-level work, hazard controls were satisfactorily addressed institutionally by procedure-based hazard controls contained in each subcontractor CSSP. Additionally, specific task-based hazard controls were generally adequate for identified hazards in reviewed PTPs and AHAs.

Performing Work Within Controls

Overall, subcontractors generally implemented hazard controls contained in CSSPs, PTPs, AHAs, and JHSEs while performing observed work, with the following exceptions:

- Contrary to American National Standards Institute (ANSI) Z358.1, *Standard for Plumbed and Portable Eyewash Stations*, as specified in the OSHA interpretation of 29 CFR 1926.50 (g), NTESS did not provide an eyewash station for potential caustic concrete splashes to the eyes during concrete pours at the Kirtland landfill project and the building 814 project. Also, workers pouring concrete at building 814 did not use face shields as required by the PTP. (See **Deficiency D-NTESS-10**.) The lack of adequate eyewash stations and face shield use could result in eye injuries from the concrete splash hazard. When EA identified this issue, NTESS ES&H and Center 4700 - Projects took appropriate action to formally clarify to subcontractors the circumstances requiring ANSI eyewash stations at construction projects.
- Contrary to NTESS construction standard specification section 01065, section 3.2.C.1 and 10 CFR 851.23(9), the cutting of concrete at building 814 and jackhammering concrete during the installation of a generator at building 726 was not conducted in a manner consistent with DOE silica exposure control requirements and the NTESS silica control table or use of alternative exposure assessment data. (See **Deficiency D-NTESS-11**.) Not following engineered controls and/or not wearing required respiratory protection during silica dust-producing activities may expose workers to silica exceeding the American Conference of Governmental Industrial Hygienists (ACGIH) threshold limit value (TLV).

Although the use of a permit (form SR 2001-WLD, *Contractor Welding, Cutting, Brazing*) is intended to drive contractor pre-planning and communication with NTESS ES&H oversight and document a joint

agreed upon control set for the activity, the permit does not address the need for exposure assessment monitoring records to demonstrate the IH control set for these activities were effective.

Feedback and Improvement

Center 4700 - Projects and NTESS ES&H SMEs provide feedback and improvement through oversight and mentoring of subcontractors, as well as by supporting the development and implementation of subcontractor work control documents. NTESS ES&H SMEs use a comprehensive checklist to review and document their recommendations for approval of CSSPs and AHAs prior to approval by project Sandia Delegated Representatives.

Additionally, EA observed NTESS ES&H construction safety inspectors frequently observing construction projects and providing feedback to subcontractor superintendents on the effectiveness of WP&C documents and safety requirement implementation; the reviewed documents reflected this positive interactive approach. Observations and reviewed documents demonstrate that NTESS uses this feedback to develop lessons learned and improve subcontractor performance through briefings at quarterly construction safety seminars. Reviewed lessons learned that NTESS shared with subcontractors in fiscal year (FY) 2021 addressed safe excavator use and drill press operations.

Contrary to 10 CFR 851.20(a)(10), all observed subcontracted construction projects displayed the New Mexico OSHA poster instead of the DOE-designated worker safety and health (WSH) poster. (See **Deficiency D-NTESS-12.**) Interviews confirmed that NTESS Center 4700 construction managers did not fully understand DOE's WSH jurisdiction. Displaying the incorrect poster misinforms subcontract workers of their DOE rights, responsibilities, and DOE points of contact to provide feedback under 10 CFR 851. When EA identified this issue, NTESS determined that the OSHA poster was incorrectly made available to subcontractors on the NTESS internal "HUB" webpage and took appropriate action to post the required DOE-designated poster.

Center 4700 - Projects Flowdown of Construction Safety Requirements to Subcontractors Conclusions

NTESS appropriately flowed down DOE construction safety and WP&C requirements to its Center 4700 - Projects' construction subcontractors. Center 4700 - Projects' subcontractors generally implemented effective WP&C at each observed project through the development of CSSPs, JSHEs, and AHAs, and daily completion of the PTPs. These WP&C-related documents effectively identified most construction safety-related hazards and controls. Center 4700 - Projects and NTESS ES&H SMEs provide oversight and mentoring of subcontractors, supporting the development and implementation of subcontractor work control documents. However, EA identified weaknesses associated with not identifying hazards and controls in some PTPs, inadequately controlling potential concrete splashes to the eyes, not identifying and controlling potential silica exposures, displaying the incorrect WSH poster, and providing incomplete permit content for exposure assessments during welding, cutting, and brazing.

3.4 Electrical Safety

The objective of this portion of the assessment was to assess the adequacy of the NTESS Center 4700 - Maintenance electrical safety program for arc flash and electrical shock hazard warnings; safety practice implementation during work performance; and electrical LOTO, including the temporary grounding of circuits and equipment.

Additionally, although EA did not focus its assessment of electrical safety on Center 1800, the WP&C review identified one electrical safety weakness during observation of Center 1800 research activities.

Specifically, contrary to 10 CFR 851, OSHA 29 CFR 1910.303(a), and National Fire Protection Association (NFPA) 70-2017, *National Electrical Code*, section 110.2, NTESS researchers have not acquired a nationally recognized testing laboratory (NRTL)-type inspection of the following two pieces of electrical equipment. (See **Deficiency D-NTESS-13.**) Electrical equipment improperly wired and/or grounded presents an electrical safety hazard.

- The Fumic Robocut EDM in the Meso Manufacturing machine shop, which was constructed in Japan, is a non-NRTL equipment item that has not been inspected.
- A high voltage box in the Material Physics Laboratory, which was constructed by the research group, was not NRTL approved and did not display a non-NRTL sticker indicating inspection by the Sandia Electrical Group.

Upon EA's identification of these issues, the equipment was tagged out, inspected, and returned to service.

Center 4700 - Maintenance has generally implemented an effective approach to electrical safety. The electrical safety program (MN471022, *ES&H Manual, Electrical Safety*) adequately integrates the requirements of 10 CFR 851 and the contract (including NFPA 70-2017, OSHA 29 CFR 1910 Subpart S Electrical, and NFPA 70E-2018, *Standard for Electrical Safety in the Workplace*). Additionally, PCD-005, *Performing Lockout-Tagout (LOTO)*, adequately addresses the requirements of NFPA 70E-2018, article 120, *Establishing an Electrically Safe Work Condition*. Further, NTESS has established an electrical safety committee, staffed with SMEs and authorities having jurisdiction, who are qualified in electrical safety. The committee ensures that the electrical safety program maintains compliance with appropriate electrical codes and standards. EA observed one committee meeting that demonstrated appropriate attention to electrical safety issues. Additionally, committee members serve as advisors to promote updates to the ELC200, *Electrical Safety for Electrical Worker*, program to ensure that electrical workers maintain their skills and knowledge of electrically safe work practices. However, contrary to NFPA 70E-2018, section 110.1(I), which always requires a pre-job brief, WI-025, table 2.1 allows electrical low-rigor work performance by SoC (e.g., simple LOTO zero voltage verification) without requiring a pre-job briefing. (See **Deficiency D-NTESS-14.**) In the absence of a pre-job briefing, relying on SoC controls for electrical work may result in exposures to electrical hazards without the appropriate PPE and safe work practices.

Center 4700 - Maintenance employees are adequately informed of electrical arc flash and shock hazards. The observed 208-volt and greater, three-phase, electrical panels, disconnect switches, motor control centers, and switchgear either have current arc flash and shock warning labels or have the electrical hazards documented in the WO or procedure, as required by NFPA 70E-2018, section 130.5(H), *Equipment Labeling*. Arc flash and shock hazard information is appropriately communicated to all affected workers. Labels and procedures provide appropriate warnings and guidance to maintenance and operations personnel interacting with the electrical equipment. Warnings and guidance properly identify potential arc flash hazards and the associated arc flash boundary, potential shock hazards and the shock hazard boundaries, and required PPE for working within arc flash and shock boundaries.

The observed performance of 11 Center 4700 - Maintenance work activities on de-energized electrical equipment generally demonstrated effective implementation of the NTESS electrical safety and LOTO programs. The training/qualification records for four qualified electrical workers confirmed that each was properly qualified. All observed workers performed their assigned tasks in accordance with requisite electrical safety practices and procedures. All workers properly performed individual task risk assessments of electrical hazards throughout their task evolutions to respond to changing work area conditions (for example, dry versus wet environments) in accordance with the requirements of the

electrical safety and LOTO programs. Electrical maintenance personnel appropriately verified that previously applied energy controls were properly installed and provided the required protection in compliance with LOTO program requirements. Additionally, all electrical maintenance personnel donned appropriate PPE for shock and arc flash hazards and implemented safe work practices, including zero energy checks and the application of temporary protective grounding, where applicable. However, EA identified the following two weaknesses:

- Contrary to NFPA 70E 2018, 120.4(A)(6)(1), for one observed LOTO of a de-energized circuit, the voltage meter was not tested properly. The worker tested the voltage meter as required before confirming the absence of voltage on the de-energized circuit but did not re-test the voltage meter after determining the circuit was de-energized. (See **Deficiency D-NTESS-8.**) The voltage meter post-test is required to verify that the meter is operating, the test was valid, and energy was appropriately removed to control the hazard.
- Contrary to NFPA 70E-2018, 110.1(I), no pre-job briefing was conducted for one observed maintenance evolution for workers exposed to electrical hazards. (See **Deficiency D-NTESS-14.**) Without a pre-job briefing, electrical workers may not be fully aware of job hazards and PPE requirements.

Electrical Safety Conclusions

NTESS Center 4700 - Maintenance has generally implemented an effective approach to electrical safety, and its electrical safety program adequately integrates electrical safety requirements. For the observed electrical equipment, arc flash and electrical shock warnings were appropriately communicated to workers. The NTESS electrical safety and LOTO programs were implemented for electrical maintenance work activities performed on de-energized electrical equipment. However, NRTL-type inspections were not performed for two pieces of Center 1800 electrical equipment. Further, in Center 4700 - Maintenance, EA identified weaknesses associated with not performing required pre-job briefings for electrical work and not meeting LOTO requirements in one instance.

3.5 Contractor Assurance System

The objective of this portion of the assessment was to verify that NTESS has established a CAS to plan and conduct risk-based assessments, analyze WP&C issues and manage associated corrective actions, review performance, and share lessons learned.

NTESS has established a generally effective CAS that is adequately established through NTESS SAND2021-6292, *Quality Assurance Program Description*, which is reviewed and approved by SFO whenever changes are issued (approximately annually). The NTESS performance assurance organization implements adequate processes to plan and conduct assessments, manage issues, and issue periodic performance reports.

NTESS generally plans and conducts a comprehensive set of assessments. The reviewed assessment schedule for FY 2021 demonstrates effective risk-based planning in accordance with QA 001.2, *Identify and Manage Risks*. Three of the reviewed training records demonstrate that lead NTESS assessors are formally trained and requalified biennially in accordance with QA 001.4, *Conduct Internal Assessments*. QA 001.2 provides effective guidance on the risk management processes used to assist in planning assessments. QA 001.4 and AOP 04-04, *Assessments*, provide requirements and guidance for planning and conducting assessments. Aspects of ISMS/WP&C are frequently included in planned assessments (e.g., 76 of the planned 147 independent corporate assessments in FY 2020 were related to ISMS/WP&C). The reviewed management surveillances (7), organization self-assessments (5), and

independent assessments/audits (27) were generally thorough and resulted in self-critical findings, including findings related to WP&C. An annual independent corporate assessment of ISMS provides a useful summary of metrics and analyses related to ISMS/WP&C. In practice, each NTESS assessment undergoes an independent review that assigns an assessment quality score. The scoring documents, including criteria and score, are given to the assessment originators, providing an effective learning tool for improving assessment quality. However, the reviewed assessments did not evaluate NTESS's use of worker feedback and lessons learned (e.g., communication, implementation through changes to work control documents). (See **OFI-NTESS-2**.)

NTESS generally uses a systematic approach to conduct event and issue analysis, develop corrective actions, and track corrective action status. QA 001.3, *Identify and Manage Issues*, and MN471022, *ES&H Manual*, Chapter 14, *ES&H Event Reporting and Management*, provide clear direction on event and issue analysis and corrective action management. The EShield and Sage issues tracking systems effectively support tracking of issue/event causes, corrective actions closure, extent-of-condition reviews, and effectiveness reviews. Information from these issues management systems is used to track and trend event causes and prepare performance reports for review by NTESS management. Five of the reviewed training records demonstrated that NTESS causal analysts are formally trained, qualified, and re-evaluated annually. However, a recent independent third-party assessment of the maintenance organization (November 2021) identified overdue actions as a significant issue. EA noted that NTESS does not use a forum of managers and SMEs to routinely monitor issues/event management performance (e.g., issue categorization and corrective actions development in response to high-importance events and assessment results) and to ensure effective and timely response. (See **OFI-NTESS-3**.)

NTESS generally collects, analyzes, and reports effective performance information to focus improvement efforts. PG470266, *ES&H Performance Assurance System Description*, provides a comprehensive description of the performance assurance system. Event/issue causes are binned into 19 elements, some of which are directly applicable to WP&C (e.g., hazard identification and safe work practices). Although these are lagging indicators, trending of these elements has provided useful information to inform the risk identification process and selection of assessment focus areas.

Performance metrics are reported frequently in a variety of venues (e.g., weekly slide presentations to the leadership team and quarterly reviews with SFO), and ES&H-related metrics are analyzed and summarized annually as part of a comprehensive ISMS effectiveness review. Review of the prior two years of ISMS performance analyses showed that NTESS adequately consolidates extensive performance information and determines the highest priority focus areas. ES&H also provides annual reports to individual divisions so they can review safety performance data (e.g., injury and ergonomic) and trends tailored to their organizations to inform their risk analysis and assessment selection processes. While NTESS's event/issue metrics applicable to WP&C are useful lagging indicators, NTESS has not identified leading indicators from available information, such as assessment/management surveillance findings, lessons learned, and worker feedback. (See **OFI-NTESS-4**.)

Additionally, the NTESS performance assurance organization does not collect and analyze worker feedback effectively. There is no post-job review template that encourages collection of worker feedback. Feedback derived from such sources as MAXIMO (maintenance work control system) and the Tier Board process (a communication and tracking method for concerns raised by employees) is not collected and analyzed to identify organizational weaknesses and contribute to continuous learning and improvement of WP&C. (See **OFI-NTESS-5**.)

NTESS generally develops and distributes effective DOE operating-experiences lessons learned and event lessons learned. Lessons-learned communication tools, such as flash notices, snapshots, high-value learning events, and lessons learned, are appropriately distributed to applicable worker groups and

organizations. The eight reviewed high-value learning events (tailored to managers and ES&H coordinators who are detailed to line organizations) provided excellent perspective, were well written, and were effective in enabling managers to understand issues and take appropriate actions. However, in one instance, a construction safety flash notice identifying an injury attributed to not using two hands to operate a portable band saw had not been flowed down to all members of the workforce. Although NTESS issued a flash notice on this subject before EA's onsite assessment, EA observed an individual operating a portable band saw with one hand. When EA informed NTESS management of the observation, they reissued the flash notice throughout the department.

Contractor Assurance System Conclusions

NTESS has established a generally comprehensive CAS that provides adequate corporate processes, assessments, issues management tools, and periodic performance reports. Corporate independent internal assessments and independent audits are robust and self-critical. NTESS uses a systematic and effective approach for event and issue analysis, development of corrective actions, and tracking of corrective action status. NTESS has effective processes for frequent performance review, and lessons-learned communications are generally well written and effective. However, weaknesses were identified in the areas of assessing worker feedback and lessons learned, ensuring management review of corrective actions, developing a set of leading indicators for WP&C, and collecting worker feedback.

3.6 Sandia Field Office

The objective of this portion of the assessment was to verify the adequacy of the SFO oversight process for overseeing and evaluating NTESS WP&C operations and the implementation of specific SFO programs, including SFO's use of assessments and operational awareness activities, issues management, and performance assurance analysis. This portion of the assessment also assessed the SFO implementation of its internal ECP.

3.6.1 Sandia Field Office Oversight

SFO has procedures that provide an effective overall approach to oversight by establishing the functions, responsibilities, authorities, and processes for conducting safety oversight. The SFO implementing procedures document 0804, *SFO Oversight of the Management and Operating Partner*, and document 0802.05, *SFO Management System Description*, for conducting oversight of NTESS adequately describe the oversight process. The SFO oversight policy sets the framework for conducting SFO risk-based oversight using the National Nuclear Security Administration's Site Governance Model, which is described in document 0804. SMEs routinely conduct oversight of assigned NTESS high-risk facilities and maintain oversight of other, lower-risk facilities using a risk-based approach. Although the number of in-person oversight activities was reduced because of the Operations line function's maximum telework posture during the pandemic, SMEs maintained oversight by virtually attending weekly operations calls and NTESS meetings, reviewing NTESS WP&C packages, and performing oversight of onsite quality assurance reviews and approvals of materials, instrumentation, and calibration of equipment.

The SFO Site Integrated Assessment Plan (SIAP) identified the broad topical areas to conduct operational awareness activities (OAAs) and considered inputs from prior assessment activities and the NTESS CAS. The SMEs planned and conducted OAAs in the various subtopical areas, and OAA observations were adequately documented. Weekly summary reports reviewed by EA demonstrate adherence to the SIAP. SMEs tracked the issues identified in the NTESS issues management system. Performance assurance analysts effectively analyzed the NTESS issues management database for trends and the status of issues and provided feedback. From the CAS input and information from OAAs, SFO identified

accomplishments and high-level issues and provided feedback to NTESS through interim feedback reports and annual performance evaluation reports.

SFO line functions have not had a unified approach for documenting the results of their OAAs and any identified issues in a central database system since they stopped using the ePegasus issues management system. As a result, the current data is maintained in multiple locations and thus does not lend itself to efficient trending and analysis and preservation of data, thereby limiting the ability to plan future oversight activities using a risk-based approach. Some SMEs stated that they also use their personal databases for tracking their OAAs. (See **OFI-SFO-1**.)

The SFO training program for oversight personnel is implemented effectively. Training, qualifications, and re-qualifications are tracked in the eTQP database. The required 80 hours of continuous training for technical qualification program (TQP) participants are adequately recorded and tracked separately, and then uploaded in eTQP to ensure documentation of training. TQP participants were current on their training.

3.6.2 Sandia Field Office Employee Concerns Program

The SFO ECP procedure 0604.01, *SFO Employee Concerns Program*, adequately describes the ECP process, consistent with DOE Order 442.1B, *Department of Energy Employee Concerns Program*. SFO has implemented some required aspects of the ECP, including assigning an ECP Manager with a backup person and ensuring that the employee concerns they received were electronically logged in the DOE Headquarters ECP database. However, contrary to DOE Order 442.1B, SFO has not implemented an effective ECP based on the following observed weaknesses. (See **Deficiency D-SFO-1**.) An ineffective ECP can hinder the prompt identification and resolution of employee concerns. (See **OFI-SFO-2**.)

- EA reviewed two of the three employee concern cases reported in FYs 2019 to 2021. The reviewed case files were not documented in sufficient detail and results of the investigations were not documented as required by DOE Order 442.1B, appendix A, paragraphs 2, 4.f, and 5.
- One reviewed case file was incorrectly recorded as “resolved informally” when it was transferred to the DOE Headquarters ECP. The record was promptly corrected once this issue was identified by EA.
- SFO is overdue for conducting biennial self-assessments of the SFO ECP, the last self-assessment was conducted in 2018 and oversight assessments of the NTESS ECP have not been conducted as required by DOE Order 442.1B, appendix A, paragraphs 6.b(1) and 6.b(2).

Sandia Field Office Conclusions

SFO has established a generally comprehensive, integrated process for Federal line oversight. SFO has a strong TQP program, conducts adequate OAAs and performance assurance analyses, and effectively communicates issues from oversight activities to NTESS. However, SFO lacks a unified approach for documenting the results of OAAs and any identified issues, making trending and analysis difficult. Additionally, SFO has not implemented an effective ECP.

3.7 Follow-up on 2014 Finding

EA previously assessed WP&C at SNL-NM in 2014, as documented in *Office of Enterprise Assessments Targeted Review of Work Planning and Control at the Sandia National Laboratories, November 2014*. This current EA assessment examined the completion and effectiveness of corrective actions for the one finding cited in that assessment (SNL-FINDING-01), addressing the previous failure mode analysis

requirement. EA found that the requirements for a failure mode analysis as previously described in SNL Manual 471021 have significantly improved since 2014 with the issuance of the current WP&C Manual GN470155. The corrective actions adequately addressed the concerns identified in the 2014 Finding.

During this assessment, EA observed that each of the reviewed Center 1800 WCA documents included a failure mode analysis. However, these analyses were inconsistent with the requirements of the current WP&C Manual GN470155. (See **Deficiency D-NTESS-3.**)

4.0 BEST PRACTICES

Best practices are safety-related practices, techniques, processes, or program attributes observed during an assessment that may merit consideration by other DOE and contractor organizations for implementation. The following best practice was identified as part of this assessment:

NTESS's emphasis on the critical thinking approach as fundamental to WP&C has enabled staff to focus on identifying those risks at the work activity level that may have a low probability of occurrence but unacceptably high consequences to worker safety and health. This practice has led to more broadly identifying and understanding failure modes, unacceptable consequences, mitigation and control measures, and the definition of acceptable risks.

5.0 FINDINGS

Findings are deficiencies that warrant a high level of attention from management. If left uncorrected, findings could adversely affect the DOE mission, the environment, the safety or health of workers and the public, or national security. DOE line management and/or contractor organizations must develop and implement corrective action plans for findings. Cognizant DOE managers must use site- and program-specific issues management processes and systems developed in accordance with DOE Order 226.1, *Implementation of Department of Energy Oversight Policy*, to manage corrective actions and track them to completion.

National Technology and Engineering Solutions of Sandia, LLC

Finding F-NTESS-1: NTESS did not ensure that routine hazards and controls for four observed Center 1800 research activities were sufficiently identified, analyzed, and controlled in associated WCA documents. In general, the NTESS WP&C process is more effective in the identification and analysis of hazards and specification of hazard controls for low probability/unacceptably high consequence events, but less effective in the identification, analysis and documentation of hazards, and specification of hazard controls for routine work activities, which have a higher probability of occurrence but may result in lesser, but still unacceptable, consequences. (GN470115, section 3.2.1)

6.0 DEFICIENCIES

Deficiencies are inadequacies in the implementation of an applicable requirement or standard. Deficiencies that did not meet the criteria for findings are listed below, with the expectation from DOE Order 227.1A for site managers to apply their local issues management processes for resolution.

National Technology and Engineering Solutions of Sandia, LLC

Deficiency D-NTESS-1: The NTESS Center 1800 WP&C process (CP 1800-WPC01) does not adequately describe how WP&C institutional criteria are to be implemented for activity level work performed in Center 1800. (GN470155, section 1.2)

Deficiency D-NTESS-2: NTESS Center 4700 supplemental documents contain weaknesses that do not produce clear definition of hazards. (GN470115, Section 3.2.1)

Deficiency D-NTESS-3: NTESS did not meet all institutional requirements for a failure mode analysis for all 14 Center 1800 WCA documents reviewed. (GN470115, section 3.2.3 & PG470252, section 3.3.4)

Deficiency D-NTESS-4: NTESS Center 1800 does not always ensure that WCAs adequately identified all training requirements for the work scope defined in the WCA documents. (CP 1800-WPC01, WCA Tool, Step 11)

Deficiency D-NTESS-5: NTESS Center 1800 does not always ensure that the hazard controls identified in IH exposure assessments were incorporated into the associated WCA documents. (IH PG-01-02, section 2.3.3.1)

Deficiency D-NTESS-6: Some NTESS Center 1800 WCA documents include workers on the approved activities team list who are not trained and/or qualified to perform the defined scope of work. (GN470115, sections 3.4.3 and 3.4.5)

Deficiency D-NTESS-7: NTESS Center 4700 does not always correctly document hazards in the pre-task evaluations for work activities. (PCS.083, D2)

Deficiency D-NTESS-8: NTESS Center 4700 does not always ensure that LOTOs were performed in compliance with LOTO requirements. (29 CFR 1910.147(c)(4)(i) exception (5) and NFPA 70E-2018, 120.4(A)(6)(1))

Deficiency D-NTESS-9: NTESS Center 4700 -Projects does not always adequately identify hazards and controls in PTPs. (NTESS construction standard specification section 01065, section 1.7.I)

Deficiency D-NTESS-10: NTESS Center 4700 -Projects does not always adequately control the potential hazard of caustic concrete splashes to the eyes during concrete pours. (ANSI Z358.1; OSHA interpretation of 29 CFR 1926.50 (g); and building 814 PTP)

Deficiency D-NTESS-11: NTESS Center 4700 -Projects does not always use silica controls in a manner consistent with DOE silica exposure control requirements and the NTESS silica control table or use of alternative exposure assessment data to control potential silica exposures at subcontractor projects. (NTESS construction standard specification section 01065, section 3.2.C.1, and 10 CFR 851.23(9))

Deficiency D-NTESS-12: NTESS Center 4700 -Projects displayed the New Mexico OSHA poster instead of the DOE-designated WSH poster at all observed subcontracted construction projects. (10 CFR 851.20(a)(10))

Deficiency D-NTESS-13: NTESS Center 1800 researchers did not always acquire an NRTL-type inspection for all electrical equipment. (10 CFR 851, OSHA 29 CFR 1910.303(a), and NFPA 70-2017, section 110.2)

Deficiency D-NTESS-14: NTESS Center 4700 procedure WI-025, table 2.1 inappropriately allows electrical low-rigor work performance by SoC (e.g., simple LOTO zero voltage verification) without requiring a pre-job briefing. (NFPA 70E-2018, section 110.1(I))

Sandia Field Office

Deficiency D-SFO-1: SFO did not document two employee concern case files in sufficient detail, and the final dispositions of the cases were not correctly documented and communicated to the concerned employee. Also, SFO is overdue for conducting the required biennial self-assessments of the SFO ECP and assessments of the NTESS ECP. (DOE Order 442.1B, appendix A, paragraphs 2, 4.f, and 5; DOE Order 442.1B, appendix A, paragraphs 6.b(1) and 6.b(2))

7.0 OPPORTUNITIES FOR IMPROVEMENT

EA identified seven OFIs to assist cognizant managers in improving programs and operations. While OFIs may identify potential solutions to findings and deficiencies identified in assessment reports, they may also address other conditions observed during the assessment process. These OFIs are offered only as recommendations for line management consideration; they do not require formal resolution by management through a corrective action process and are not intended to be prescriptive or mandatory. Rather, they are suggestions that may assist site management in implementing best practices or provide potential solutions to issues identified during the assessment.

National Technology and Engineering Solutions of Sandia, LLC

OFI-NTESS-1: Consider reviewing IH exposure assessments across the SNL-NM divisions to verify the adequacy and ease of correlation of IH exposure assessments to activity-level work control documents (such as the Center 1800 WCA documents), and to verify that the IH exposure assessments reflect the current work scope, hazards, and controls of the work activity. Benchmarking Los Alamos National Laboratory's approach to IH exposure assessments and reviewing the Energy Facility Contractors Group guidance on IH exposure assessments may be helpful.

OFI-NTESS-2: Consider conducting periodic independent assessments to determine how well applicable worker feedback and lessons learned are captured and subsequently implemented through changes to work control documents. Similar assessments conducted by the lessons-learned coordinator at Four Rivers Nuclear Partnership, LLC at the Paducah Gaseous Diffusion Plant provide useful examples.

OFI-NTESS-3: Consider establishing a forum of managers and SMEs to review corrective actions for high-importance events and assessment findings to ensure effective and timely responses. Review of the Corrective Action Review Board charter at Argonne National Laboratory may be useful.

OFI-NTESS-4: Consider identifying a set of leading indicators for monitoring WP&C performance to supplement the lagging indicators that are already in use. Review of WP&C-related metrics developed by Lawrence Livermore National Laboratory WP&C program management may be useful.

OFI-NTESS-5: Consider collecting worker feedback from such sources as a post-job review template, MAXIMO, and the Tier Board system to enable identification and analysis of organizational weaknesses and to contribute to continuous learning and improvement of WP&C. Review of the feedback collection processes used at Lawrence Livermore National Laboratory may be useful.

Sandia Field Office

OFI-SFO-1: Consider streamlining the data recording process to improve the efficiency of data analysis and tracking and evaluation of NTESS performance, and to maintain data continuity. The SN-OAA-Tracker developed by SFO engineering may be a tool that can be used for entering and tracking issues revealed during all SFO oversight activities.

OFI-SFO-2: Consider coordinating with the DOE Headquarters ECP director within the office of EHSS for the ECP manager training needs.

Appendix A Supplemental Information

Dates of Assessment

Onsite Assessment: February 7-10 and 22-25, 2022

Office of Enterprise Assessments Management

John E. Dupuy, Director, Office of Enterprise Assessments
William F. West, Deputy Director, Office of Enterprise Assessments
Kevin G. Kilp, Director, Office of Environment, Safety and Health Assessments
David A. Young, Deputy Director, Office of Environment, Safety and Health Assessments
Kevin M. Witt, Director, Office of Nuclear Safety and Environmental Assessments
Charles C. Kreager, Director, Office of Worker Safety and Health Assessments
Jack E. Winston, Director, Office of Emergency Management Assessments
Joseph J. Waring, Director, Office of Nuclear Engineering and Safety Basis Assessments

Quality Review Board

William F. West, Advisor
Kevin G. Kilp, Chair
Joseph J. Waring
Joseph E. Probst
Michael A. Kilpatrick

Office of Enterprise Assessments Assessors

David Olah, Lead
Nimalan Mahimaidoss
Kimberly Nelson
Roby D. Enge
Terry Krietz
James R. Lockridge
Daryl Magers
Dennis K. Neitzel