Independent Assessment of Safety Culture Survey Methods and Interpretation at Sandia National Laboratories

June 2024

Office of Enterprise Assessments
U.S. Department of Energy

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Acronyms

CRAD	Criteria and Review Approach Document
DOE	U.S. Department of Energy
EA	Office of Enterprise Assessments
EFCOG	Energy Facility Contractors Group
FY	Fiscal Year
ISM	Integrated Safety Management
NTESS	National Technology and Engineering Solutions of Sandia, LLC
OFI	Opportunity for Improvement
SCWE	Safety Conscious Work Environment
SFO	Sandia Field Office
SNL	Sandia National Laboratories
TA-V	Technical Area V

INDEPENDENT ASSESSMENT OF SAFETY CULTURE SURVEY METHODS AND INTERPRETATION AT SANDIA NATIONAL LABORATORIES

Executive Summary

The U.S. Department of Energy Office of Enterprise Assessments (EA) conducted an independent assessment of safety culture survey methods and interpretation at Sandia National Laboratories in February 2024. National Technology and Engineering Solutions of Sandia, LLC (NTESS) is the management and operating contractor at Sandia National Laboratories. This assessment also evaluated the effectiveness of safety culture monitoring activities conducted by the Sandia Field Office (SFO).

In 2023, NTESS identified safety culture as an enterprise-level risk. At the time of this assessment, two organizations within two different divisions (Facilities and Technical Area V, or TA-V) had conducted safety culture surveys and established teams to support improvements. Laboratories-wide employee engagement surveys that included some elements of safety culture were also conducted.

EA identified the following positive attributes, including two best practices:

- NTESS has included safety culture as an enterprise-level risk, which provides visibility to executive management. (Best Practice)
- NTESS uses a systems approach to safety and safety culture (Engineered Safety), rather than limiting the focus to personal safety. (Best Practice)
- Facilities and TA-V safety culture surveys have provided insights on safety culture and led to improvement initiatives.
- NTESS has dedicated an experienced individual from the communications organization to draft and support the implementation of a multifaceted communications plan for the laboratory's safety culture risk treatment plan.
- NTESS has personnel with the knowledge, experience, and expertise to develop safety culture surveys and assessments in accordance with accepted scientific practices and standards.
- SFO members and leadership have participated in safety culture-related training courses with NTESS staff and senior leaders.
- SFO has documented safety culture observations in a wide range of records.

EA also identified some areas needing attention, as summarized below:

- The current Facilities and TA-V safety culture surveys are not fully consistent with generally accepted practices for validity of methods and data.
- NTESS has not identified a collective set of skills, knowledge, and abilities for a core group charged with facilitating the safety culture improvement efforts as currently envisioned, precluding the identification of those resources that may exist within NTESS.

NTESS acknowledges that it is in the early stages of developing laboratories-wide safety culture measuring and monitoring methods, and a survey is likely several years from being funded and conducted. However, NTESS has the appropriate capabilities to monitor its culture, and SFO has been engaged with the culture improvement efforts and provides feedback through routine interactions and formal reports. Leveraging the demonstrated competence of Facilities and TA-V at a broader scale can help NTESS develop a scientifically sound safety culture monitoring approach consistent with accepted industry standards.

INDEPENDENT ASSESSMENT OF SAFETY CULTURE SURVEY METHODS AND INTERPRETATION AT SANDIA NATIONAL LABORATORIES

1.0 INTRODUCTION

The U.S. Department of Energy (DOE) Office of Nuclear Safety and Environmental Assessments, within the independent Office of Enterprise Assessments (EA), conducted an assessment of safety culture survey methods and interpretation used by National Technology and Engineering Solutions of Sandia, LLC (NTESS), the management and operating contractor at Sandia National Laboratories (SNL). Assessment activities were conducted in February 2024.

The EA report, *Assessment of Safety Culture Sustainment Processes at U.S. Department of Energy Sites – June 2020*, is a rollup report of eight safety culture assessments performed at a cross-section of DOE sites. The rollup report identified that one of the most significant areas of variance within the DOE complex is the quality of safety culture survey instruments and the proper interpretation of gathered survey data.[1] In consultation with the Office of Environment, Health, Safety and Security, program offices, and local DOE field offices, EA established a goal to conduct follow-up reviews of the quality of safety culture surveys that inform safety culture decision-making, including contractors that were assessed in the rollup report and others that were not. This series of follow-up reviews is being performed in accordance with the *Plan for the Enterprise-wide Assessment of Safety Culture Survey Methods and Interpretation – February 2022*. This assessment also evaluated the effectiveness of safety culture monitoring activities conducted by the Sandia Field Office (SFO).

DOE Policy 450.4A, *Integrated Safety Management Policy*, sets the expectation that all organizations embrace a strong safety culture where core values are safe work performance and worker involvement in all aspects of work performance. That culture includes, among other key considerations, establishing a safety conscious work environment (SCWE) in which employees feel free to raise safety concerns to management without fear of retaliation. While DOE does not set specific requirements for how organizations should promote and maintain a strong safety culture or how they should assess or monitor their culture, DOE and industry guidance documents present acceptable methods for safety culture evaluation as described in section 2.0 below.

2.0 METHODOLOGY

The DOE independent oversight program is described in and governed by DOE Order 227.1A, *Independent Oversight Program*, which EA implements through a comprehensive set of internal protocols, operating practices, assessment guides, and process guides. This report uses the terms "best practices and opportunities for improvement (OFIs)" as defined in the order. As identified in the assessment plan, EA used selected criteria from objectives SC.1 and SC.3 of criteria and review approach document (CRAD) EA CRAD 30-08, Revision 0, *Safety Culture Assessment*, to guide the assessment.

Because DOE provides guidance related to safety culture but expresses no specific requirements, EA referenced generally accepted standards and practices for safety culture surveys and monitoring. Core

[1] Safety culture surveys, as discussed in the 2020 EA report, are quantitative instruments and associated administrative processes used to gather employee perceptions about factors important for the safe performance of work. To be helpful in decision-making, survey questions should be designed to measure the right factors, and the people participating in the survey should be representative of the full organization.

references used in this assessment included the DOE Safety Culture Improvement Panel's *Tailoring the Analysis of Safety Culture Health Monitoring Means and Methods Working Group*, January 2022; the Energy Facility Contractors Group's (EFCOG's) *A Guide to Safety Culture Evaluation*, Revision 0, September 2015; EFCOG's *Safety Culture Practitioner's Resources Guide*, Revision 1, September 2022; EFCOG's *Best Practice #249: Strategy and Design for Internal Surveys*, November 18, 2021; and the International Atomic Energy Agency's *Performing Safety Culture Self-Assessments*, Revision 0, June 2016.

EA examined approximately 200 NTESS documents and exhibits related to safety culture management and surveys, including but not limited to program/process descriptions, self-assessment reports, performance evaluation reports, safety culture training material, and communication examples. EA also reviewed documents related to SFO safety culture oversight. EA interviewed NTESS and SFO personnel responsible for monitoring topics related to safety culture and leadership responsible for acting on the results. The combination of document reviews, observations, and interviews with involved individuals provided the data for this assessment.

The members of the assessment team, the Quality Review Board, and the management responsible for this assessment are listed in appendix A.

3.0 RESULTS

3.1 Valid and Reliable Methods to Maintain Cognizance of Safety Culture

Positive Attributes

Culture Survey Development and Survey Methods

In 2023, NTESS identified safety as an enterprise-level risk and drafted a risk treatment plan that focuses on safety culture. The plan includes oversight from senior leadership (Champions) and senior managers representing the Environment, Safety and Health Governance Board (Ambassadors), and a Safety Culture Strategy Working Team to identify good practices and execute the plan. This enterprise focus on safety culture is considered a **Best Practice** because it provides visibility of safety culture improvement efforts at the executive level. (See **BP-NTESS-1**.) The plan initially focuses on four of NTESS's safety culture overarching principles (responsibility for safety, leadership commitment to safety, questioning attitude, and organizational learning), and is intended to build on good practices implemented by sub-tier organizations. The plan includes an action to conduct a laboratories-wide safety culture survey. During interviews with NTESS representatives, they stated their intention to conduct a comprehensive survey using a questionnaire, focus groups, and interviews.

Employee engagement surveys conducted in 2021 and 2023 provide a model for conducting a valid laboratories-wide survey that can be leveraged as part of the strategic safety culture effort. The employee engagement surveys also contained some questions related to a SCWE. NTESS hired a professional survey organization to assess employee engagement. Employees were asked to complete the survey anonymously using a link to the external survey organization's website. Survey data were collected and analyzed by individuals outside of NTESS to assure employees that their responses would be kept confidential. Appropriate demographic information was collected and used to perform comparisons of the survey responses obtained from various subgroups of employees, as well as to verify a representative response rate was obtained. Response rates for each division within SNL were above 50%, indicating representative sampling of each subunit (67% participation rate for the 2021 survey and 56% for the 2023 survey).

Although NTESS has not yet conducted a laboratories-wide safety culture survey, two NTESS organizations have been conducting safety culture surveys of their employees. Technical Area V (TA-V) leaders developed nuclear safety survey questions, collaborating with an external assessor, using the nine traits of a positive safety culture from the Nuclear Regulatory Commission and internal knowledge of TA-V. The surveys were distributed via an email link to members of TA-V for the first time in 2019, and the surveys were completed via an electronic data collection platform to allow for anonymity. The results were collected and analyzed to provide a basis for follow-up interviews. The nuclear safety culture surveys were conducted again in 2021 and 2023, using the same set of questions, to measure the change in nuclear safety culture after the completion of TA-V's continuous improvement plan. The survey response rates for the surveys were 75% for the initial survey, 54% for the 2021 survey, and 59% for the 2023 survey, all above the minimum of 50%, indicating a representative sampling of the organization. The TA-V survey contains appropriate questions for measuring SCWE perceptions. The combination of consistently using the same set of survey questions each year and conducting surveys every other year allows for the comparison of responses over time and the identification of positive or negative changes in the culture between surveys. Similarly, the Facilities organization worked with a member of the Environment, Safety and Health Strategy, Reporting and Development organization who was familiar with the Facilities operations to develop safety culture attributes using DOE Guide 450.4-1C, *Integrated Safety Management System Guide*, attachment 10, *Safety Culture Focus Areas and Associated Attributes*, combined with applicable traits from the Institute of Nuclear Power Operations publications. The 2022 survey was made available digitally, as well as in paper form with a drop box to provide anonymous participation. Multiple communications conveyed the purpose for the survey and encouraged participation.

Since its introduction in 2010, the concept of "engineered safety" has matured at SNL through use of a disciplined and rigorous systems engineering approach to building layered defenses against hazards to prevent accidents. This approach ensures safety is considered beginning with planning and designing and is carried through the conduct of hazardous operations. A key characteristic is that the engineered safety concept considers safety as a property of an operational system as a whole, not a property of individual components or people in the system, and this concept has become a part of the culture. This unique systems approach to safety is considered a **Best Practice** because it provides a strong basis for continuous improvement of NTESS's safety culture principles. (See **BP-NTESS-2**.)

Culture Survey Results Analysis and Communication

TA-V leadership includes multiple sources of feedback in their safety culture assessments. The TA-V safety culture team analyzes the feedback from its nuclear safety culture assessments, documenting it in detailed written reports that capture the numerical results of the safety culture surveys, identified trends, potential areas of concern, and recommended improvements. TA-V survey results and improvements are communicated in townhall meetings, shared by supervisors to staff, and posted on a TA-V website. Lessons learned from other organizations are also integrated to aid in organizational learning. TA-V uses its survey results to improve its organizational processes and focus on the systems approach to safety.

Facilities leadership in conjunction with their safety culture core team analyzed the Facilities survey data and identified four focus areas to continue improving their organization's culture. The detailed written report documents the numerical results, identifies potential areas of concern, and establishes improvement actions and objectives. Facilities leadership shared with the workforce the process improvements that have been implemented as a direct result of their survey feedback. Survey results were posted on the website and presented to members of Facilities' workforce. Additionally, Facilities evaluated the maturity of its safety culture using the three safety culture focus areas of DOE Guide 450.4-1C.

NTESS recognizes the importance of communications regarding safety culture and the safety culture risk treatment plan, and has dedicated an experienced staff member from its communications organization to develop and support implementation of a communications plan. At the time of the assessment, the communications plan was a draft. This approach will enhance communication by including success metrics, an analysis to determine the information needs and key messages by audience, and a schedule and approach for delivery of information to the identified audiences.

Qualification of Responsible Personnel

NTESS has personnel with the appropriate knowledge, experience, and expertise to develop organizational/safety culture surveys and assessments in accordance with accepted scientific practices and standards. TA-V used a statistician who was familiar with TA-V operations to analyze survey results. Several NTESS staff members also participate in the EFCOG safety culture working group. A communications expert with prior safety culture experience is developing the communications plan for the safety culture risk treatment plan.

Areas Needing Attention

Culture Survey Development and Survey Methods

NTESS safety culture-related surveys and independent safety culture assessments are not fully consistent with generally accepted practices recommended by DOE and used in other complex hazardous domains. NTESS has recognized the need to conduct a laboratories-wide safety culture assessment as a baseline for future survey efforts. The most recent safety culture assessment was conducted in 2016; however, no information was provided on the validity or reliability of the survey questions used in that assessment. (See **OFI-NTESS-1**.) At the time of this EA assessment, the safety culture risk treatment plan and associated safety culture charter had not been finalized. Targeted completion dates for actions were not established. During interviews, NTESS representatives stated that a safety culture survey was likely several years from being funded. The draft safety culture charter includes some quantitative measures of success, such as an increased number of issues reported and/or concerns raised. Organizational lessons learned and insights from the employee engagement survey are also integrated into the charter. However, the charter does not include mechanisms to seek early employee feedback on the implementation of the actions.

The Facilities and the three TA-V safety culture surveys are not fully consistent with generally accepted practices, although they provide useful information. Along with the limited evidence on the validity and reliability of the surveys, it is unclear whether the results are representative of subgroups within Facilities and TA-V, and whether survey participants had confidence that their individual responses were confidential. The participation rate for the Facilities survey was 21%, which is below the minimum of 50% considered to be a representative sampling. TA-V did not collect sufficient qualitative information about the status of its safety culture. Also, TA-V does not document its processes for deciding what needs to be changed to improve its safety culture. Written reports describing the assessments are missing some important elements. (See **OFI-NTESS-2**.)

Culture Survey Results Analysis and Communication

Both the Facilities organization and TA-V use safety culture teams to help interpret safety culture survey results and to develop recommendations for areas of improvement. During interviews, it was stated that the approaches of both groups are being developed by the team participants via continuous improvement, and that they have not been using a previously tested proven framework. (See **OFI-NTESS-3**.) Additionally, team processes for combining quantitative survey information with other sources of

qualitative information are not documented, which limits their ability to achieve consistent results with new members.

NTESS has not adopted reference standards for monitoring and improving safety culture at the organizational level; a lack of such references hinders a laboratories-wide effort of developing, conducting, and interpreting culture/safety culture assessments and surveys and communicating progress on improvements. (See **OFI-NTESS-4**.)

Qualification of Responsible Personnel

Although NTESS has two employees with leadership positions within the EFCOG safety culture community of practice (COP), minimal reference was made to using EFCOG safety culture documents/expertise in the ongoing safety culture surveys in the Facilities organization or TA-V, or in the laboratories-wide strategic safety culture effort. Additionally, although SNL's safety culture COP members have access to EFCOG material and expertise, it was not clear whether NTESS plans to leverage EFCOG resources with its current safety culture survey or planned strategic safety culture efforts.

NTESS has not identified a collective set of skills, knowledge, and abilities for a core group charged with facilitating its safety culture improvement efforts as currently envisioned. As such, although expertise in safety culture survey development, safety culture (and related topics) training, and safety culture survey analysis exists at SNL, it is uncertain at what level this expertise will be used for planned strategic safety culture efforts. (See **OFI-NTESS-5**.)

3.2 DOE Oversight of Contractor Safety Culture Efforts

Positive Attributes

Culture Monitoring Framework

SFO has documented safety culture observations in a wide range of records. For example, beginning in calendar year 2020, SFO personnel documented observations from operational awareness activities related to the management of safety culture improvements through the environment, safety, and health five-year strategic plan. The operations weekly reports include a section for integrated safety management (ISM)/safety culture/work planning and control, ensuring a consistent location where safety culture observations from the Operations division can be captured. SFO also provided the fiscal year (FY) 2022 *Performance Evaluation Summary* where it credited TA-V with enhancing the formality and rigor of its operations under goal 6: *Mission Leadership*, something that SFO leadership described as a culture change. SFO members, particularly those involved with TA-V, have been aware of, and involved in, safety culture improvement efforts undertaken there. Additionally, SFO subject matter experts are sensitive to different safety subcultures in organizations at the laboratories, such as the influences of combat safety culture at the explosives ranges due to the backgrounds of the workforce there, and of nuclear safety culture at TA-V.

SFO has incorporated mentions of safety culture into procedure 0802.05, *SFO Management System Description*, where safety culture is discussed along with the ISM system guiding principles. SFO provides to NTESS the formal NNSA expectation to include safety culture in NTESS' safety performance oversight measures and commitments (SPOMCs). Per DOE Order 450.2, *Integrated Safety Management*, the head of the field element is responsible for ensuring that contractor SPOMCs are established to drive performance improvement or maintain excellent performance. SPOMCs for FY 2024 include two objectives under the National Nuclear Security Administration focus area of Organizational and Safety

Culture, one to increase leadership engagement, and the other to provide more tools to the workforce for identifying and controlling hazards. Similar objectives were included in the FY 2023 SPOMCs. Annually, NTESS proposes SPOMCs for the fiscal year to SFO for review and approval. NTESS provides periodic SPOMC implementation progress reports to SFO for review through the fiscal year.

Development of Safety Culture Competencies

Several members of the SFO management team took training TLP-200, *Safety Culture for DOE & DOE Contractor Senior Leaders*, with the NTESS senior leadership and spoke highly of their experience. Additionally, SFO members have participated in TLP-150, *Safety Culture for Front Line Leaders,* and in culture-related trainings that NTESS has provided, both to demonstrate their support of the safety culture efforts by the contractor and to understand and use the same language that the contractor staff uses for discussing culture.

Newly hired technical staff in SFO receive safety culture training as part of the General Technical Base training. Several SFO members also have safety culture experience from previous work within the DOE complex and with outside organizations.

Areas Needing Attention

Culture Monitoring Framework

SFO has not communicated a clear expectation or provided procedural guidance for how to document safety culture observations from oversight activities; as a result, organizations within SFO have different approaches on how to document these observations. Additionally, SFO does not currently incorporate insights from the employee concerns program into its safety culture oversight, precluding a deeper insight into employees' willingness to raise concerns, an important component of safety culture.

Development of Safety Culture Competencies

Although new technical employees received the General Technical Base training, SFO has not defined the need for safety culture oversight training for technical staff beyond that. Additionally, SFO does not set expectations for safety culture awareness for its non-technical staff members. All field office members that interact with the contractor can have an impact on the contractor's safety culture.

3.3 Summary

NTESS acknowledges that it is in the early stages of developing a laboratories-wide, formalized, scientifically based safety culture measuring and monitoring method, and that it is likely several years from being funded and implemented. NTESS has the appropriate capabilities to monitor its culture across the laboratories, as demonstrated through its employee engagement surveys and other activities. Organizations within two divisions have demonstrated competence that can be leveraged on a broader scale, such as creating near term opportunities to seek employee insights and feedback.

SFO has maintained awareness of NTESS's safety culture initiatives and trends and provides feedback through routine interactions and formal reports. Engagement by both SFO members and leadership in safety culture trainings with NTESS demonstrates the support of the field element for these efforts and fosters the use of a common language for safety culture-related communications. The increased mission expectations at SNL could create a challenge for balancing production and safety priorities, and continuing efforts by both NTESS and SFO to better monitor the safety culture are needed to reduce risk.

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 practices were identified as part of this assessment:

National Technology and Engineering Solutions of Sandia, LLC

BP-NTESS-1: NTESS has included safety culture as an enterprise-level risk, which provides visibility to executive management.

BP-NTESS-2: NTESS takes a systems approach to safety that combines the social and technical systems along with layered defenses, which NTESS can leverage to broaden its perspective for its safety culture improvement efforts.

5.0 OPPORTUNITIES FOR IMPROVEMENT

EA identified the OFIs shown below to assist cognizant managers in improving programs and operations. 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 the periodic use of a reliable, validated safety culture survey method that can demonstrate representativeness of the results and ensure employee confidentiality, supplemented with focus groups and interviews. Consider adopting accepted standards and practices for safety culture surveys, reviews, and assessments. Refer to the EFCOG *Safety Culture Evaluation Guide*, the Total Quality Framework, and the National Academy of Sciences report *Strengthening the Safety Culture of the Offshore Oil and Gas Industry (2016)*, chapter 5, *Safety Culture Assessment and Measurement*, for important context and examples.

OFI-NTESS-2: Consider enhancing in-house safety culture monitoring capabilities by leveraging in-house expertise and benchmarking with other DOE sites or more broadly within the EFCOG safety culture community.

OFI-NTESS-3: Consider the learning history approach as the analytical framework for supporting the safety culture improvement efforts. A "learning history" is a unique approach for helping an organization learn from the experience and implications of its own learning and change initiatives. By seeking to document perceptions of people engaged in organizational change, a learning history both captures key aspects of the learning experience and serves to promote continuous learning across the organization.

OFI-NTESS-4: Consider adopting a laboratories-wide reference model of safety culture, tailored appropriately within suborganizations. Models for which construct validity have been established, such as the one described in International Atomic Energy Agency's *Performing Safety Culture Self-Assessments*, Revision 0, June 2016, are preferable to informal, experience-based models.

OFI-NTESS-5: Consider identifying the desired organizational set of skills, knowledge, and abilities in safety culture surveys and assessments.

Appendix A
Supplemental Information

Dates of Assessment

February 5-29, 2024

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