Independent Assessment of Safety Culture Survey Methods and Interpretation at Argonne National Laboratory

July 2023

Office of Enterprise Assessments
U.S. Department of Energy

Table of Contents

Acronyms

ANL	Argonne National Laboratory
ASO	Argonne Site Office
DEI	Diversity, Equity, and Inclusion
DOE	U.S. Department of Energy
EA	Office of Enterprise Assessments
EFCOG	Energy Facility Contractors Group
HPI	Human Performance Improvement
OFI	Opportunity for Improvement
PEMP	Performance Evaluation and Measurement Plan
PSE	Physical Sciences and Engineering Directorate
SCIT	Safety Culture Improvement Team
Argonne	UChicago Argonne, LLC

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SAFETY CULTURE SURVEY METHODS AND INTERPRETATION
AT ARGONNE NATIONAL LABORATORY

Executive Summary

The U.S. Department of Energy (DOE) Office of Enterprise Assessments (EA) conducted an independent assessment of safety culture survey methods and interpretation at Argonne National Laboratory (ANL) from April 3 to May 11, 2023. UChicago Argonne, LLC (Argonne) is the management and operating contractor at ANL. This assessment also evaluated the effectiveness of safety culture monitoring activities conducted by the DOE Argonne Site Office (ASO).

Argonne is currently transitioning to a more formal approach to surveying and monitoring safety culture. The Argonne approach to safety culture monitoring does not include use of safety culture surveys; however, Argonne includes safety culture questions into periodic diversity, equity, and inclusion surveys. Argonne's Physical Sciences and Engineering Directorate (PSE) has conducted a series of independent safety culture reviews for its five divisions. In its future formal approach, Argonne plans to improve their process by integrating defined quantitative and qualitative data inputs considered to be important contributors to risk mitigation.

EA identified the following positive attributes, including two best practices:
- Argonne formally includes safety culture as a risk factor that is monitored in its Enterprise Risk Management program. (Best Practice)
- ASO uses the performance evaluation and measurement plan to communicate Argonne safety culture observations to the contractor. (Best Practice)
- Argonne recently established a Safety Culture Improvement Team (SCIT) reporting to the Deputy Chief Operations Officer and the Environment, Safety, and Health Senior Director. The SCIT is tasked, in part, to develop methods to monitor safety culture improvement.
- Argonne PSE review activities associated with safety culture have prompted actions to improve policies and practices (e.g., onboarding, working alone practices, defined authorities for Laboratory area leads).
- Argonne has deployed an active diversity, equity, and inclusion effort to create a psychologically safe environment supported by a data-driven approach to continuous improvement.

EA also identified several areas needing attention, as summarized below:
- Argonne does not use generally accepted best practices for validity of survey methods and data as referenced in DOE and Energy Facility Contractors Group guidance and scientific reports.
- Argonne lacks an empirically validated safety culture model appropriate for the organization.
- Argonne relies on practice-based experience, without formal involvement of professional expertise in safety culture survey and assessment design, evaluation, and analysis.
- ASO does not have a safety culture monitoring framework, nor has it initiated a formal effort to ensure that ASO staff members have safety culture training commensurate with their safety culture responsibilities.

Argonne acknowledges that it is in the early stages of developing formalized, scientifically based safety culture measuring and monitoring methods. Argonne's current approaches are basic in design and implementation and do not ensure the quality of data needed to support informed decisions and improvement opportunities. The desire to incorporate a data-driven approach, with high-quality sources of data, feedback, and information, into monitoring methods is an indicator of Argonne and ASO leadership's commitment to ongoing organizational learning and continuous improvement in safety culture.

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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 UChicago Argonne, LLC (Argonne), the management and operating contractor at Argonne National Laboratory (ANL, also referred to as the Laboratory). Assessment activities were conducted remotely from April 3 to May 5, 2023, and on-site from May 9 to 11, 2023.

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 the goal of conducting follow-up reviews of the quality of safety culture surveys used for safety culture decision-making, both of contractors that were assessed in the rollup report and some 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 Argonne Site Office (ASO).

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 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 is implemented through a comprehensive set of internal protocols, operating practices, assessment guides, and process guides. As identified in the assessment plan, EA used selected criteria from objectives SC.1 and SC.3 of EA Criteria and Review Approach Document 30-08, Rev. 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 references used in this assessment included the DOE Safety Culture Improvement Panel's *Tailoring the*

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[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.

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*, Rev. 0, September 2015; EFCOG's *Safety Culture Practitioner's Resources Guide*, Rev. 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*, Rev. 0, June 2016.

EA examined approximately 400 Argonne documents and exhibits related to safety culture management and surveys, including but not limited to policy, program/process descriptions, self-assessment reports, the Enterprise Risk Management program, performance evaluation and measurement plans (PEMPs), event analysis reports, safety culture training material, and communication examples. EA also reviewed documents related to ASO safety culture oversight. EA observed a Safety Culture Improvement Team (SCIT) meeting while on site, and remotely observed two "micro-learning" sessions related to safety culture, as well as the Safe Culture Workshop training. EA interviewed Argonne and ASO 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

Argonne developed and deployed several methods to monitor factors indirectly related to safety culture. In 2015, Argonne began using a data-driven approach for diversity, equity, and inclusion (DEI) with a customized survey conducted in September of that year, and a subsequent survey in 2017. In 2020, Argonne expanded its DEI efforts with a Laboratory-wide independent assessment conducted by an external firm. The assessment was based on a model of DEI consisting of workplace, marketplace, community, and supplier factors in addition to a maturity model. Interviews, focus groups, document reviews, and a quantitative survey were used for data collection during the assessment. While not a structured safety culture survey, Argonne's approach to that assessment provided insights about psychological safety, which is a prerequisite for a healthy safety culture. A psychologically safe culture is one where people are comfortable being genuine and expressing themselves and are confident that they can speak up and not be embarrassed, ignored, or blamed.

Further, after a series of incidents at the Laboratory in 2017, the Argonne Physical Sciences and Engineering Directorate (PSE) began conducting independent safety and safety culture reviews of its five divisions, completing one per year from 2018 to 2022. These reviews used interviews and focus groups to provide qualitative information on factors related to safety. Each review was designed to support the specific interest of the assessed division. Example topics included insights about employees' working knowledge of the Integrated Safety Management System (ISMS) core functions and principles and employees' perceptions about the importance of ISMS to safe operations; leadership's commitment to safety; safety engagement at all levels of the division; and safety protocols and work planning. According to interviews, PSE engaged the National Laboratory Directors' Council Environment, Safety, and Health Directors working group to obtain external assessment team members from other laboratories and

organizations. PSE is planning a second series of independent safety culture reviews for its five divisions, and a workshop is being planned to discuss enhancements to the review process, as well as the potential for sitewide implementation of a similar process of independent reviews. (See **OFI-Argonne-1**)

Finally, the SCIT was chartered in January 2023 as a Laboratory-wide committee to promote safety culture and champion continuous improvement. The SCIT reports to the Argonne Deputy Chief Operations Officer and the Environment, Safety, and Health Senior Director. Specific activities assigned to the SCIT include developing a means to monitor the Laboratory's safety culture, and monitoring trends that have the potential to impact the safety culture within ANL.

Culture Survey Results Analysis and Communication

Argonne uses the results of its safety-culture-related monitoring efforts to improve its organization. Argonne used the DEI survey results of 2015 and 2017, and the 2020 Laboratory-wide DEI assessment to gain insight into certain areas related to psychological safety. Survey results were used to consistently enhance the Laboratory's approach to DEI by developing improved implementation plans. Document reviews and interviews demonstrated proactive communication efforts to share feedback from surveys and encourage increased participation in future surveys.

The PSE independent safety reviews identified several concerns of directorate employees, resulting in several improvements. For example, interviewees stated that the reviews were particularly beneficial for reaching employees who came on board during the time when the Laboratory was conducting remote work due to the COVID-19 pandemic. Actions in response to these reviews included changes to policies for onboarding and working alone. The divisions also further developed Laboratory area lead authorities, so that leads could complete their responsibilities without having to defer all actions to higher-level management. These review results and actions taken were communicated through division-wide meetings and email messages.

Argonne has established an enterprise risk management program that identifies and categorizes risks to the Laboratory. "Mature safety culture" is included under this program as an endemic (i.e., ongoing) risk. Risks are categorized as higher or lower, and as having nascent mitigation or sufficient mitigation. As of this assessment, mature safety culture was categorized as higher risk with nascent mitigation, making it a high priority for Laboratory-level resources. Including safety culture as an endemic risk has created an ongoing priority for Argonne executive leadership to discuss safety, safety culture, and risk mitigation strategies. Seven tasks are included in the risk mitigation plan for safety culture. The task of improving the use of metrics identifying key performance indicators is scheduled to be addressed in calendar year 2023. The inclusion of safety culture in Argonne's Enterprise Risk Management program is cited as a **Best Practice** because it promotes continuous attention to safety culture and risk mitigation plans by executive management and the Laboratory Board of Governance. (See **BP-Argonne-1**)

Qualification of Responsible Personnel

Argonne's two principal personnel responsible for safety culture support have documented training and certifications relevant to their safety culture responsibilities. The Safety Culture Specialist, a position that was established in 2021, has attended DOE-sponsored safety culture training, and as a co-developer of the multi-laboratory collaboration Safety Academy for Excellence curriculum, is qualified to deliver the ANL Safe Culture Workshop and associated training. The Specialist for Human Performance Improvement (HPI) completed a professional university HPI certification curriculum and has attended other recognized HPI educational workshops. Additionally, each specialist engages in ongoing self-study of scientific and practice literature relevant to safety culture.

Further, these two individuals are permanent members of the SCIT and are in the process of providing safety culture and HPI training for SCIT members. EA observed two "micro-learning" training sessions in which SCIT members participated, and observed training conducted as part of the SCIT monthly meeting. A detailed roadmap has been developed for providing a comprehensive practical safety culture knowledge base for Laboratory personnel.

Areas Needing Attention

Culture Survey Development and Survey Methods

Argonne safety culture-related surveys and independent safety culture reviews are not fully consistent with generally accepted practices used in other complex hazardous domains. Argonne has only indirect methods of monitoring safety culture and has not conducted a Laboratory-wide structured safety culture survey. The DEI surveys in 2015 and 2017, and the 2020 Laboratory-wide DEI assessment covered areas related to psychological safety. Only a small number of questions were relevant to safety culture. Additionally, the reports did not provide information about the validity or reliability of the survey questions.

Further, the independent safety culture reviews conducted within PSE do not represent the Laboratory as a whole. These independent safety culture reviews were experience-based and did not employ scientifically developed safety culture assessment models or methods that could enhance the credibility and usefulness of expert perspectives for safety culture monitoring and enhancement. Many data sources cited by Laboratory leadership during interviews were qualitative or based solely on personal experience. (See **OFI-Argonne-2**)

Culture Survey Results Analysis and Communication

Argonne has not developed or adopted a formal safety culture model. Credible safety culture data analysis requires the use of a safety culture model or construct consistent with established standards and practices. Such models promote understanding by using a common language and provide the basis for a benchmark for monitoring improvement or identifying potential vulnerabilities. Models for which construct validity have been established are preferable to informal experience-based models. ANL's directorates and divisions are characterized by unique subcultures due to the differing expert fields associated with their specific scientific disciplines and research lines, and the lack of a common language can serve to inhibit a cohesive Laboratory-wide safety culture. (See **OFI-Argonne-3**)

Qualification of Responsible Personnel

Developing safety culture surveys and assessments, conducting them, and analyzing the data obtained require specialized expertise that is different from knowledge about safety culture practices and improvement. Argonne acknowledges that it is in the early stages of developing formalized approaches to monitoring and measuring safety culture, and, as such, Argonne does not have scientific competencies in developing, administering, and analyzing safety culture surveys or assessments consistent with accepted standards and practices. (See **OFI-Argonne-4** and **OFI-Argonne-5**) While key personnel have obtained relevant skills and knowledge related to developing and sustaining healthy safety culture, Argonne has not codified these as position-specific skills, knowledge, and abilities for qualifying or recruiting similar personnel for the future.

3.2 DOE Oversight of Contractor Safety Culture Efforts

Positive Attributes

Culture Monitoring Framework

During interviews with several ASO staff members, each interviewee demonstrated a clear professional interest in monitoring safety culture. ASO Facility Representatives who were interviewed discussed how they maintain good rapport to facilitate informal oversight and consider safety culture to inform all of their oversight activities. In particular, an ASO Facility Representative was an observer for the safety and safety culture reviews conducted by PSE. ASO leadership is aware of the safety culture monitoring improvement efforts underway at the Laboratory.

When appropriate, cultural weaknesses and strengths are captured in the PEMP and discussed with the Laboratory. ASO's use of the PEMP is considered to be a **Best Practice** because it communicates the importance of safety culture to the Office of Science and the ASO, and is a valuable avenue of communication for culture topics. (See **BP-ASO-1**) In 2017, the PEMP, which is jointly written by ASO and the program offices, noted that DOE was concerned about the path forward to enhance the safety culture of Argonne, related to events that year that impacted safety. Two years later, the PEMP noted that the Laboratory had taken positive steps to address "complex cultural issues," referring to both safety culture and DEI issues. Most recently, the PEMP captured both the establishment of the safety culture advisory group in May 2022 (precursor to the SCIT) and the performance of the 2022 PSE Materials Science Division safety culture review.

Development of Safety Culture Competencies

Some ASO staff attend safety culture-related training offered by the Laboratory. The ASO Deputy Manager is an instructor for TLP-150, *Safety Culture Training for Front Line Leaders*, and TLP-200, *Safety Culture Leadership for DOE and DOE Contractor Senior Leaders*, and has plans to teach TLP-200 at various sites this year. The ASO Deputy Manager has also participated in the DOE safety culture improvement panel.

Areas Needing Attention

Culture Monitoring Framework

ASO does not have a culture monitoring framework defined by a process documented in a procedure. ASO staff do not document safety culture observations as they are made, but rather focus on documenting observations related to specific requirements. (See **OFI-ASO-1**) Safety culture observations are captured only if they rise to the level of a PEMP discussion. The understanding in the field office is that the PEMP is the only oversight tool that allows for observations beyond those related to specific requirements.

Development of Safety Culture Competencies

ASO has not initiated a formal effort to ensure that ASO staff members have safety culture training commensurate with their safety culture responsibilities. Training records reviewed indicate current ASO staff have not completed TLP safety culture courses since 2018. Information gathered during interviews with a range of ASO staff members with safety culture responsibilities, indicate they have acquired the necessary competencies from previous work experience and training.

3.3 SUMMARY

Argonne is in the early stages of developing formalized, scientifically based safety culture measuring and monitoring methods. Argonne's current approaches are basic in design and implementation and do not ensure the quality of data needed to support informed decisions and subsequent improvement opportunities. Laboratory leadership recognizes the benefit of maturing their safety culture monitoring. Through conducting their safety culture reviews, PSE leadership became aware that safety culture is an inherent part of organizational culture, and with variability among the division subcultures.

Argonne and ASO staff and leadership have shared aspirations to use a data-driven approach for risk mitigation, given the inherent nature of safety culture as a determinant of world class research performed safely. The espoused goal for the Laboratory safety culture, as with DEI, and consistent with the nature of a scientific research institution, is that the Laboratory takes action based on multiple high-quality sources of data, feedback, and information. Argonne is moving in a positive direction toward achieving that goal.

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:

UChicago Argonne, LLC

BP-Argonne-1: Argonne has established safety culture as an endemic risk factor in the Enterprise Risk Management program. Laboratory resources are provided consistent with risk ratings and the effectiveness of mitigation plans. Executive leadership and the Laboratory Board of Governance actively monitor the status of safety culture and mitigations.

Argonne Site Office

BP-ASO-1: ASO uses the PEMP to reinforce the importance of safety culture and to communicate safety culture observations to Argonne.

5.0 OPPORTUNITIES FOR IMPROVEMENT

EA identified opportunities for improvement (OFIs) as shown below. 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.

UChicago Argonne, LLC

OFI-Argonne-1: Consider developing collaborative safety culture assessment approaches with other DOE Office of Science Laboratories, including organizations with experience in culture monitoring. A consensus safety culture survey methodology could promote shared competencies and best practices, enhance credibility, and broaden professional expertise.

OFI-Argonne-2: Consider adopting accepted standards and practices for safety culture surveys, reviews, and assessments. 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),* chap. 5, *Safety Culture Assessment and Measurement*, provide important context and examples that may be useful.

OFI-Argonne-3: Consider adopting a Laboratory reference model of safety culture. The Safety Academy for Excellence Workbook uses a model of eight safety culture principles; the pedigree of that model is traceable to years of research and development in the commercial nuclear industry.

OFI-Argonne-4: Consider developing organizational competencies in safety culture surveys and assessments by providing specialized training in survey psychometrics and assessment methods or obtaining such expertise from external specialists. Other organizations recruit social science expertise to expand organizational competence or provide opportunities for existing staff to broaden their expertise by pursuing accreditation or advanced academic degrees in safety culture-relevant sciences such as sociology or organizational psychology.

OFI-Argonne-5: Consider benchmarking DOE contractor organizations that are more mature in their safety culture monitoring capabilities. Example areas for shared learning include surveys, assessments, and monitoring teams. Some DOE operations subject to the Defense Nuclear Facilities Safety Board Recommendation 2011-1 have developed relatively mature monitoring and measuring programs.

Argonne Site Office

OFI-ASO-1: Consider developing a formal safety culture oversight monitoring strategy and providing guidance for ASO staff members on how to tailor their oversight efforts to inform that monitoring strategy on an ongoing basis. DOE Guide 226.1-2A, *Federal Line Management Oversight of Department of Energy Nuclear Facilities*, contains guidance on safety culture oversight strategies.

Appendix A
Supplemental Information

Dates of Assessment

Remote Data Collection: April 3–May 5, 2023
Onsite Assessment: May 9–11, 2023

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