



# Performance Assurance Assessment Report

[ASMT-783246](#), Assessment Report for Department 635 Analysis of Fiscal Year 2021 ES&H Events

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## List of Acronyms

Acronym	Definition
COVID-19	Coronavirus 2019
DOE	United States Department of Energy
ES&H	Environment, Safety, and Health
FY	fiscal year
ISMS	Integrated Safety Management System
LTA	less than adequate
N/A	not applicable
NEPA	National Environmental Policy Act
NOTE	Non-Occurrence Trackable Event
Q	quarter

## Executive Summary

This assessment analyzes Environment, Safety, and Health (ES&H) occurrences and Non-Occurrence Trackable Events (NOTEs) from fiscal year (FY) 2021. For this report, assessors used three primary methods for categorizing occurrence and NOTE data: issue categorization, DOE reporting criteria groups, and DOE cause codes.

The FY 2021 Q1 occurrence and NOTE total was the lowest since this type of analysis began in FY 2018 Q4, following a downward trend from the FY 2019 Q3 high point (Figure 1). The FY 2021 Q2 occurrence and NOTE total was nearly double the FY 2021 Q1 total; occurrence totals declined slightly in Q3 and Q4, while NOTE totals remained the same. NOTEs in each of the final three quarters were more than double the amount from Q1.

This assessment resulted in one observation. As COVID-19 vaccination rates increase and COVID-19 impacts on operations decrease, the number of workers on-site and the amount of activity-level work will increase. With these changes, focused attention on the following areas related to work planning and controls may reduce the probability of future events:

- Hazard Identification and Analysis
- Compliance with Standards
- Formality of Operations
- Job scoping

Top elements for each division's occurrences and NOTEs (multiple listed if tied)

<b>600</b>	<b>1000</b>	<b>2000</b>	<b>4000</b>	<b>5000</b>	<b>6000</b>	<b>7000</b>	<b>8000</b>
Hazard Identification and Analysis	Hazard Identification and Analysis	Asset Integrity and Reliability	Compliance with Standards	Asset Integrity and Reliability	Hazard Identification and Analysis	Asset Integrity and Reliability	Compliance with Standards
Human Performance		Hazard Identification and Analysis		ES&H Knowledge Management			Formality of Operations
				Usability of Design			Hazard Identification and Analysis

## 1 Purpose

This assessment analyzes Environment, Safety, and Health (ES&H) occurrences and Non-Occurrence Trackable Events (NOTEs) from fiscal year (FY) 2021. Expected outcomes from this assessment include learning sufficient information to identify:

- Patterns in occurrences and NOTEs to inform management decisions
- Patterns in issues identified through causal analysis that, if corrected, could reduce the probability of future events

## 2 Scope

The scope of this assessment incorporates FY 2021 ES&H events that were categorized as occurrences in accordance with DOE O 232.2A, *Occurrence Reporting and Processing of Operations Information*, or as NOTEs.

The analysis results described in sections 4.1 and 4.2 are based on occurrences and NOTEs with categorization dates between October 1, 2020, and September 30, 2021, as described in Section 3.1.

The analysis results described in sections 4.3 and 4.4 are based on content from the final causal analysis reports, as described in sections 3.2 and 3.3. Thus, analysis results in sections 4.3 and 4.4 are based on occurrences and NOTEs with causal analysis reports approved between October 1, 2020, and September 30, 2021.

## 3 Methodology

Occurrence report and NOTE documentation data was collected from the DOE Occurrence Reporting and Processing System, ESHield, Sage, and the Electronic Information Management System.

Occurrences and NOTEs undergo causal analysis, which results in the identification of facts, issues, and causes. Department 635 personnel are responsible for categorizing events. The causal analysis process is a collaborative effort among event-owning organization personnel, Department 635 personnel, and other stakeholders. The final causal analysis report is owned by the event-owning organization and is approved by the accountable manager.

For this report, assessors used three primary methods for categorizing occurrence and NOTE data, including categorization by DOE reporting criteria groups, issues, and DOE cause codes; these methodologies are further detailed in sections 3.1, 3.2, and 3.3.

### 3.1 DOE Reporting Criteria Groups

Assessors sorted FY 2021 occurrences by the 10 major reporting criteria groups under DOE O 232.2A, *Occurrence Reporting and Processing of Operations Information*:

- Group 1—Operational Emergencies
- Group 2—Personal Safety and Health
- Group 3—Nuclear Safety Basis
- Group 4—Facility Status

- Group 5—Environmental
- Group 6—Contamination/Radiation Control
- Group 7—Nuclear Explosive Safety
- Group 8—Packaging and Transportation
- Group 9—Noncompliance Notifications
- Group 10—Management Concerns and Issues

### **3.2 Issue Categorization**

Assessors sorted FY 2021 issues into 18 elements developed from the Center for Chemical Process Safety's *Guidelines for Risk Based Process Safety*, modified to align with Sandia operations. *Issue Element Descriptions for ES&H Events* provides the definitions that form the basis for this analysis. Reflecting the Center for Chemical Process Safety's approach, the 18 elements are divided among four foundational blocks. Following the DOE approach to ES&H outlined in DOE P 450.4A, *Integrated Safety Management Policy*, each of the 18 elements also aligns with one of the five Integrated Safety Management System (ISMS) core functions or with the ISMS overall. One issue element (Element 9, Work Instructions) aligns with two ISMS core functions, Define the Scope of Work and Develop and Implement Hazard Controls. Element 9 is split into 9a and 9b to reflect the two ISMS core function options.

Assessors reviewed facts, issues, and causes identified for each occurrence and NOTE and then categorized each issue by the applicable element. Issues unrelated to the actual event, issues without identified causes, or issues resulting from personal medical incidents were categorized as N/A (not applicable).

### **3.3 DOE Cause Codes**

Causes are identified for occurrences and NOTES through causal analysis. Each cause may be assigned a DOE cause code as described in DOE-STD-1197-2011, *Occurrence Reporting Causal Analysis*. Assessors sorted the causes from FY 2021 occurrences and NOTES by DOE cause codes per the causal analysis tree.

The causal analysis tree organizes more than 100 specific DOE cause codes into multiple nodes within three levels, with Level A nodes being the most general. DOE cause codes have seven Level A nodes:

- A1 Design/Engineering Problem
- A2 Equipment/Material Problem
- A3 Human Performance Less Than Adequate (LTA)
- A4 Management Problem
- A5 Communication LTA
- A6 Training Deficiency
- A7 Other Problem

Level B and Level C nodes are increasingly specific cause categories. They are defined in DOE STD-1197-2011, *Occurrence Reporting Causal Analysis*.

## 4 Analysis Results

The analysis results described in sections 4.1 and 4.2 are based on occurrences and NOTES with categorization dates between October 1, 2020, and September 30, 2021.

The analysis results described in Section 4.3 are based on content from final causal analysis reports, as described in sections 3.1 and 3.2. Thus analysis results in Section 4.3 are based on occurrences and NOTES with causal analysis reports approved between October 1, 2020, and September 30, 2021.

### 4.1 Total Occurrences and NOTES

Forty-nine occurrences and 42 NOTES were categorized between October 1, 2020, and September 30, 2021. Figure 1 shows the number of occurrences, the number of NOTES, and the combined total for each quarter since Q4 of FY 2018. It also shows the number of recordable injury and illness cases, with and without COVID-19 cases.

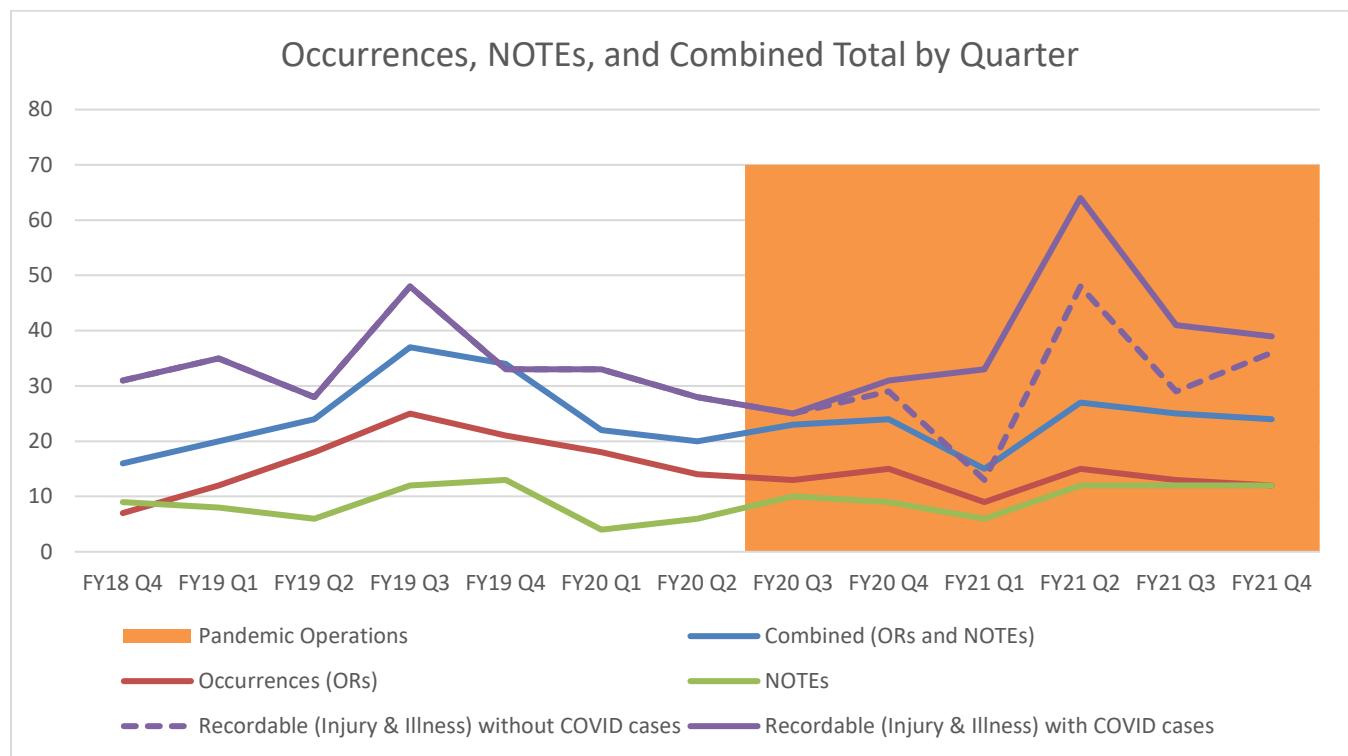
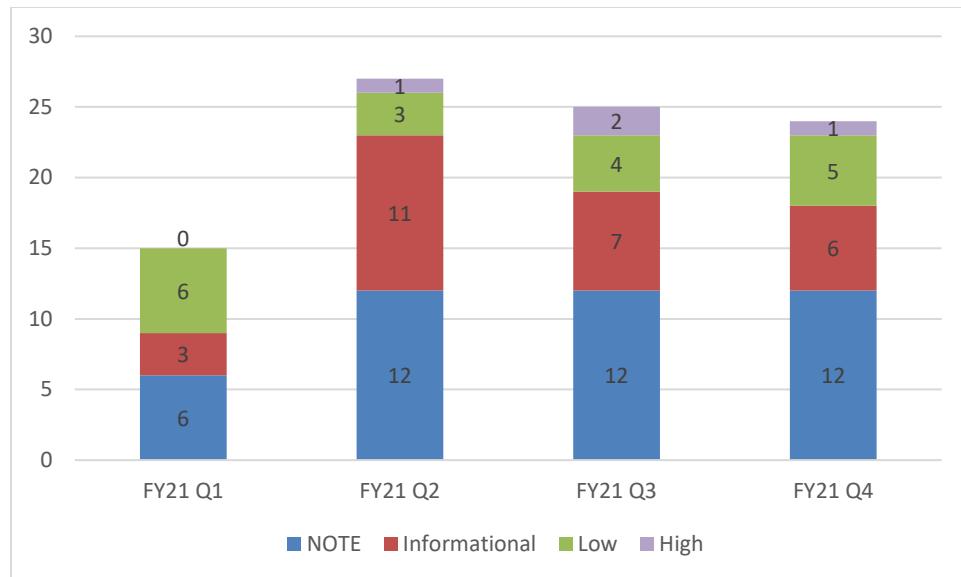


Figure 1. Occurrences, NOTES, combined total, and recordable injury and illness cases, by quarter

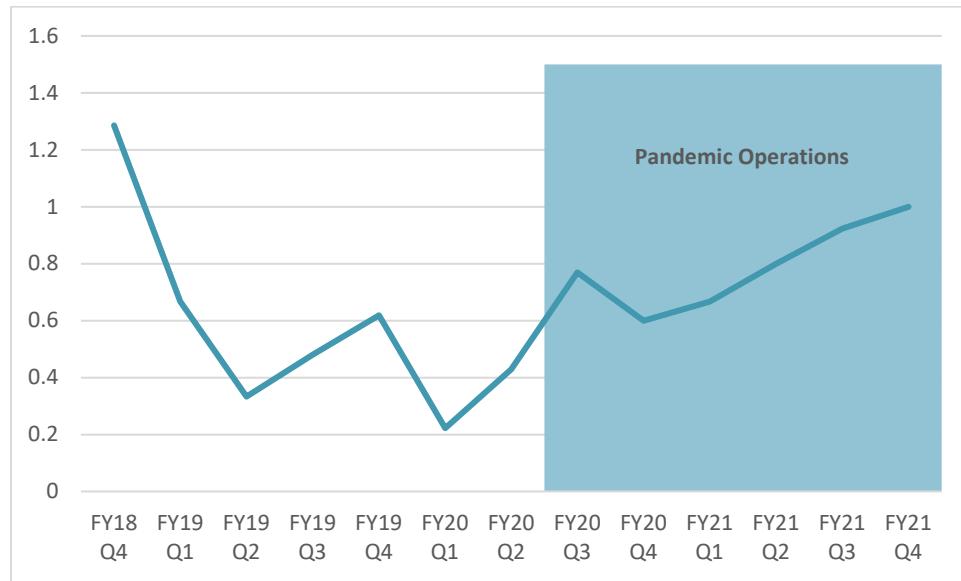
Figure 2 provides the number of NOTES and occurrences by report level for each quarter of FY 2021.



**Figure 2.** Occurrences and NOTES by report level, FY 2021

#### 4.1.1 NOTE-to-Occurrence Ratio

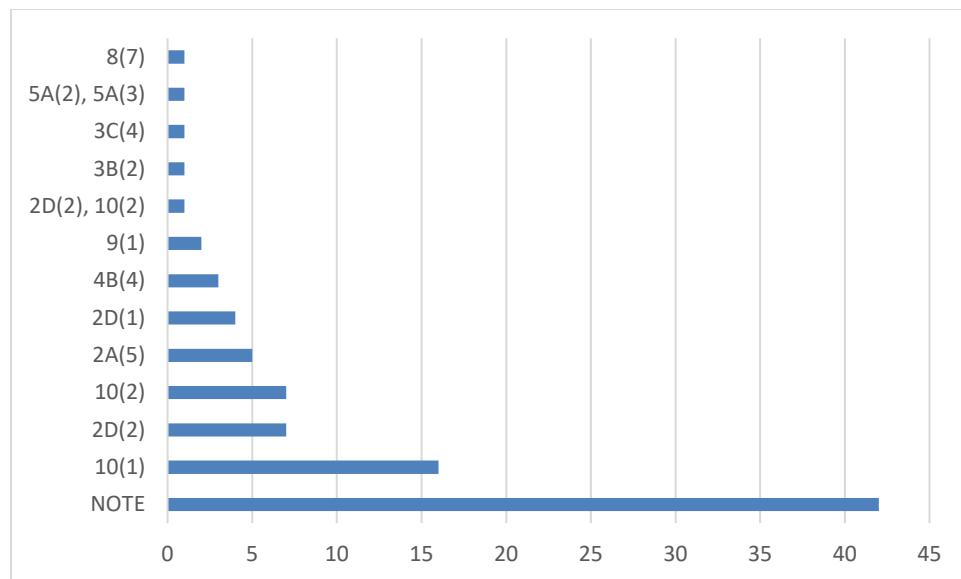
The FY 2021 NOTE-to-occurrence ratio was 0.86. This is a notable increase from the FY 2020 and FY 2019 ratios of 0.48 and 0.51, respectively. The FY21 Q4 ratio was 1.0. [Figure 3](#) shows the NOTE-to-occurrence ratio by quarter since this type of analysis began in Q4 of FY 2018.



**Figure 3.** NOTE-to-occurrence ratio, FY 2018 Q4 to FY 2021 Q2

#### 4.2 DOE Reporting Criteria

[Figure 4](#) shows FY 2021 NOTES and occurrences by DOE O 232.2A reporting criteria groups. DOE O 232.2A, *Occurrence Reporting and Processing of Operations Information*, presents reporting criteria definitions.



**Figure 4.** Occurrence count by DOE O 232.2A criteria for FY 2021

Of the 49 occurrences categorized in FY 2021, the most common DOE O 232.2A reporting criteria was 10(1), *Management Concerns and Issues*, which accounted for 33 percent of occurrences. Criteria 10(2), also *Management Concerns and Issues*<sup>1</sup>, and Criteria 2D(2), *Personnel Safety and Health: Hazardous Energy*, were the next most common; each accounted for 14 percent of occurrences.

In comparison with *Fiscal Year 2020: Analysis of ES&H Causal Analysis Reports to Identify Emerging Themes* (ASMT-737562), *Combined Fiscal Year 2019: Fourth Quarter and Annual Analysis of Safety Trends for Events* (ASMT-1038), and *Fiscal Year 2018 Event Reporting, Including Critique and Causal Analysis Implementation* (AIS 76375), the prevalence of Groups 10 and 2 as top reporting criteria in FY 2021 appears consistent with the past five years.

### 4.3 Categorization of Occurrence and NOTE Information

Forty-seven occurrences and 41 NOTES had causal analysis reports completed and signed between October 1, 2020, and September 30, 2021.

#### 4.3.1 Categorization of Occurrence and NOTE Issues by Issue Elements

The 88 occurrences and NOTES provided 195 issues for analysis and categorization. Table 1 shows the number of issues and the percentage of the total for each element. Descriptions for each element are provided in [Issue Element Descriptions for ES&H Events](#).

<sup>1</sup> Per DOE O 232.2A, 10(1) is defined as “An event, condition, or series of events that does not meet any of the other reporting criteria, but is determined by the facility manager or line management to be of safety significance or of concern for that facility or other facilities or activities in the DOE complex.” 10(2) is defined as “A near miss to an injury, where something physically happened that was unexpected or unintended AND where no barrier prevented an event from having a reportable consequence (i.e., happenstance was the main reason the event did not result in a reportable injury).”

**Table 1.** Number of issues and percent of total by element

Elements	Number of Issues	Percent of Total
Hazard Identification and Analysis	29	14.87
Compliance with Standards	20	10.26
Formality of Operations	18	9.23
Asset Integrity and Reliability	17	8.72
Change Management	15	7.69
Operational Preparedness	14	7.18
ES&H Knowledge Management	13	6.67
Human Performance	11	5.64
Subcontractor Management	11	5.64
Work Instructions	9	4.62
Usability of Design	8	4.10
Safety Culture	8	4.10
Safe Practices for Non-Routine Work	6	3.08
Not Applicable (N/A) <sup>2</sup>	5	2.56
Management Review and Continual Improvement	3	1.54
Emergency Management	2	1.03
Workforce Involvement	2	1.03
Training	2	1.03
Organizational ES&H Learning and Improvement	2	1.03
<b>Total Issues</b>	<b>195</b>	<b>100</b>

The top three elements—Hazard Identification and Analysis, Compliance with Standards, and Formality of Operations—accounted for approximately 34 percent of the issues. Examples of FY 2021 issues categorized as one of the top three elements are as follows:

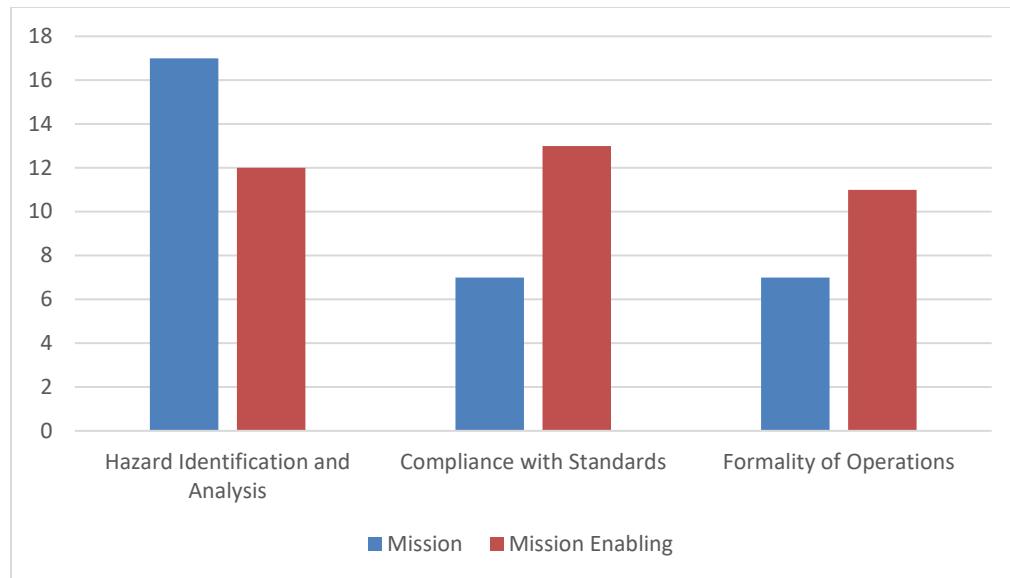
- Hazard Identification and Analysis: *Results of shock and arc flash hazard analyses were not completed prior to subcontractor performing work (NA-SS-SNL-4000-2020-0011).*
- Compliance with Standards: *Requirements outlined in the MN471022, ES&H Manual, “Chemical Hazards” were not followed (i.e., labeling chemicals, testing, and conducting inspections on a six-month basis) (NA-SS-SNL-1000-2020-0011).*
- Formality of Operations: *The standard WPC/NEPA process was not followed which resulted in activities occurring that were not covered in a NEPA checklist (NOTE-2021-033).*

The top three issue elements for FY 2021 issues are shown for mission and mission-enabling organizations in [Figure 5](#). The figure shows that events owned by mission organizations had more issues in the Hazard Identification and Analysis element than events owned by mission-enabling

<sup>2</sup> The N/A element is reserved for the following:

- Personal medical incidents
- Issues unrelated to the actual event but identified during the causal analysis as an area of inquiry by the causal team
- Issues without identified causes
- Reluctance to or delay of reporting an event to 311

organizations. In contrast, events owned by mission-enabling organizations had more issues in the Compliance with Standards and Formality of Operations elements than events owned by mission organizations.



**Figure 5.** Top three issue elements for issues by mission and mission-enabling organizations

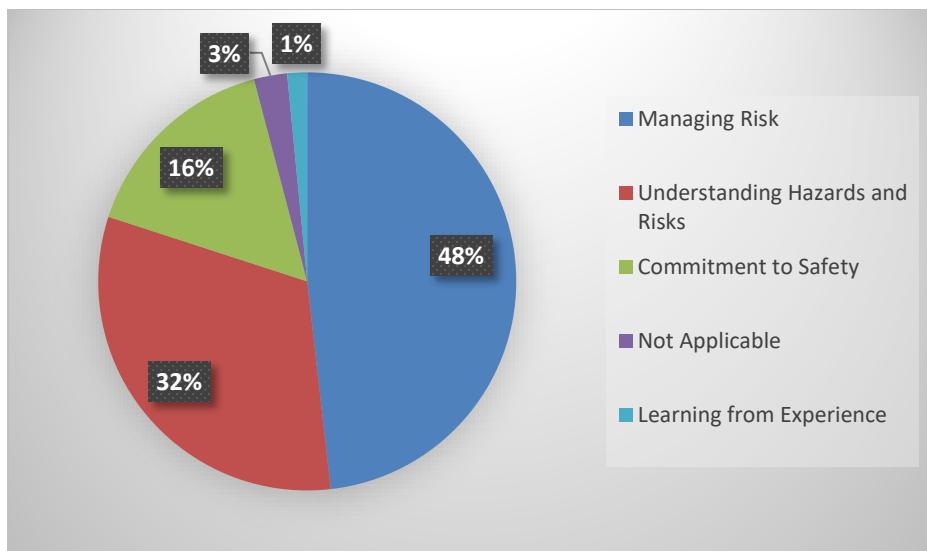
The top elements for each division's occurrences and NOTES are presented in [Table 2](#). If multiple elements are tied for top element, all the elements are listed. Divisions that did not own any events in scope are not listed in the table.

**Table 2.** Top elements for each division's occurrences and NOTES

600	1000	2000	4000	5000	6000	7000	8000
Hazard Identification and Analysis	Hazard Identification and Analysis	Asset Integrity and Reliability	Compliance with Standards	Asset Integrity and Reliability	Hazard Identification and Analysis	Asset Integrity and Reliability	Compliance with Standards
Human Performance		Hazard Identification and Analysis		ES&H Knowledge Management			Formality of Operations
				Usability of Design			Hazard Identification and Analysis

### 4.3.2 Categorization of Occurrence and NOTE Issues by Foundational Block

As described in Section [3.2](#), each element has an overarching foundational block. Consistent with FY 2020, the Managing Risk foundational block accounted for approximately half of the FY 2021 issues ([Figure 6](#)).

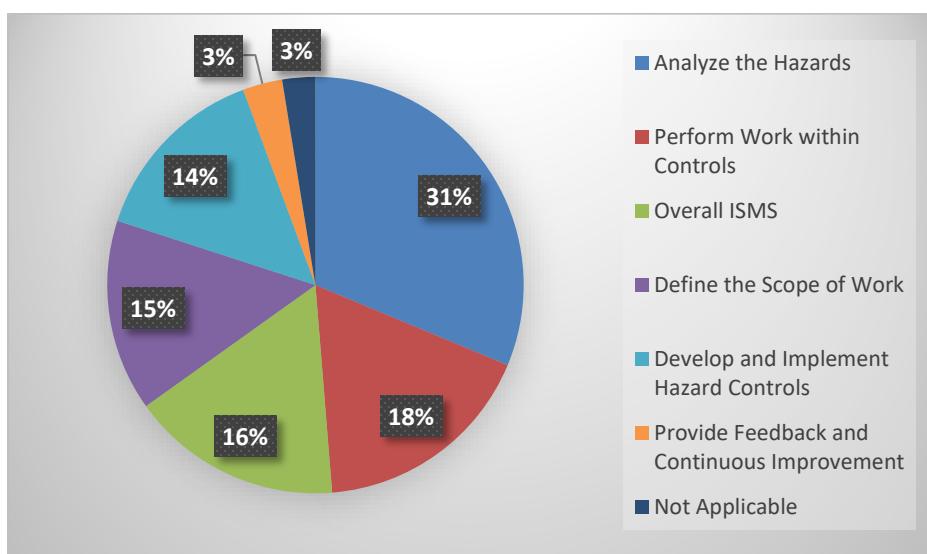


**Figure 6.** Issues by foundational block for FY 2021

The Formality of Operations element was the largest component of the Managing Risk foundational block, accounting for 18 of the 94 contributing issues. The Hazard Identification and Analysis element, the top element overall, was the largest component of the Understanding Hazards and Risks pillar, accounting for 29 of the 62 contributing issues.

#### 4.3.3 Categorization of Occurrence and NOTE Issues by ISMS Core Function

As described in Section 3.2, each element aligns with one of the five ISMS core functions or with the ISMS overall (Figure 7). The Hazard Identification and Analysis element was the largest component of the Analyze the Hazards core function, accounting for 29 of the 61 contributing issues. The Asset Integrity and Reliability element and the Formality of Operations element were the sole components of the Perform Work within Controls core function, each accounting for 17 of the 34 contributing issues.



**Figure 7.** Issues ISMS core function for FY 2021

## 4.4 Categorization of NOTES and Occurrences by DOE Cause Codes

As described in Section 3.2, causes identified through causal analysis may be assigned DOE cause codes, which have three levels of specificity. For the 88 occurrences and NOTES in FY 2021, causal analysis teams assigned DOE cause codes 318 times. Table 3, Table 4, and Table 5 show the cause codes assigned to occurrences and NOTES in FY 2021 by level, starting with Level A nodes, the broadest.

At Level A, *A4 Management Problem* cause codes accounted for the highest percentage of codes assigned (41 percent), significantly more than the second highest, *A5 Communication LTA* (18 percent). The B level provides useful insight. In FY2021, less than adequate work organization and planning (A4B3), less than adequate management methods (A4B1), and less than adequate change management (A4B5) contributed to occurrences and NOTES. Level C is specific—the top Level C code was A4B3C08, “Job scoping did not identify special circumstances and/or conditions.” This code was used almost twice as much as the second-most used Level C codes, demonstrating the significant contributions of work planning and control to FY2021 occurrences and NOTES.

**Table 3.** DOE cause codes (Level A)

DOE Cause Codes (Level A)	Percent of Total
A4 Management Problem	40.67
A5 Communication LTA	18.04
A3 Human Performance LTA	14.68
A1 Design/Engineering Problem	11.62
A2 Equipment/Material Problem	7.95
A6 Training Deficiency	2.75
A7 Other Problem	1.53

**Table 4.** DOE cause codes (Level B) that account for at least six percent of causes

DOE Cause Codes (Level B)	Percent of Total
A4B3 Work Organization & Planning LTA	12.23
A4B1 Management Methods LTA	8.87
A4B5 Change Management LTA	8.26
A5B2 Written Communication Content LTA	6.42
A4B2 Resource Management LTA	6.42

**Table 5.** DOE cause codes (Level C) that account for at least three percent of causes

DOE Cause Codes (Level C)	Percent of Total
A4B3C08 Job scoping did not identify special circumstances and/or conditions	7.03
A4B1C01 Check of work was LTA	3.67
A5B2C08 Incomplete/situation not covered	3.67
A5B4C01 Communication between work groups LTA	3.06
A5B3C01 Lack of written communication	3.06

## 5 Discussion

### 5.1 Total Occurrences and NOTES

The FY 2021 Q1 occurrence and NOTE total was the lowest since this type of analysis began in FY 2018 Q4, following a downward trend from the FY 2019 Q3 high point ([Figure 1](#)). The FY 2021 Q2 occurrence and NOTE total was nearly double the FY 2021 Q1 total, with the total declining slightly in Q3 and Q4. Injury and illness cases (with COVID-19 cases) also saw a sharp increase in FY 2021 Q2 before falling in Q3 and Q4. Sandia began its pandemic operating posture in FY 2020 Q3; the number of occurrences and NOTES may have decreased with the reduction of workforce on-site and the subsequent reduction in activity-level work.

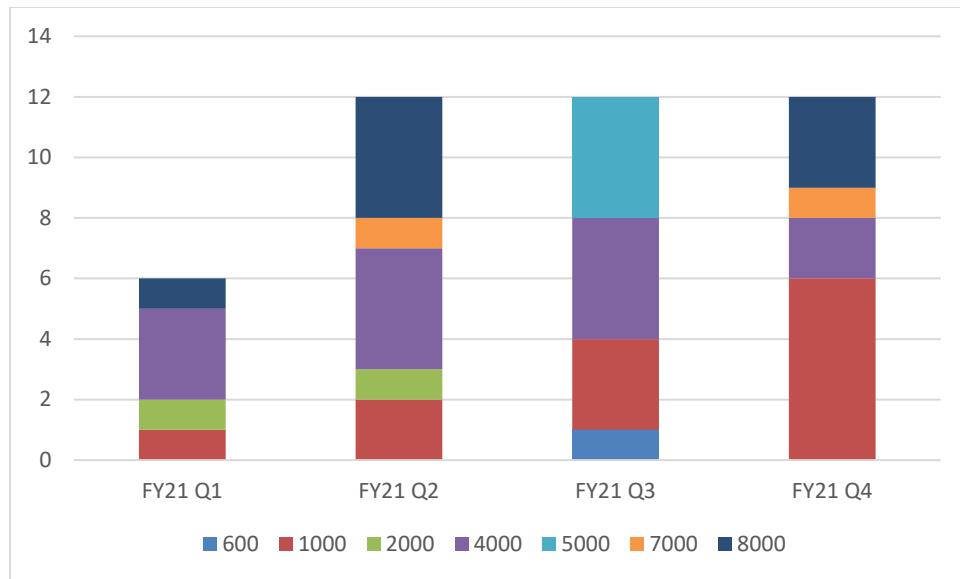
While still in a pandemic operating posture, FY 2021 Q2 marked the beginning of more Sandia workers returning to on-site and performing activity-level work. This may have contributed to the near doubling of occurrences and NOTES from FY 2021 Q1 to Q2. The first quarter of the fiscal year also includes holidays and Sandia's winter shutdown.

#### 5.1.1 NOTE-to-Occurrence Ratio

The NOTE-to-occurrence ratio (Section 4.1.1) increased about 60 percent from the FY 2020 and FY 2019 average. This may be an indicator of an improving culture, wherein issues are being reported and analyzed for organizational learning. However, the FY2021 NOTE-to-occurrence ratio is only 66 percent of the ratio observed in FY2018 Q4.

### 5.2 DOE Reporting Criteria

The FY 2021 Q2 occurrence and NOTE total was nearly double the FY 2021 Q1 total; occurrence totals declined slightly in Q3 and Q4, while NOTE totals remained the same. NOTES in each of the final three quarters were more than double the amount from Q1. [Figure 8](#) shows the NOTES categorized in FY 2021 by owning division. The NOTES are owned by a variety of divisions, thus demonstrating the range of events and types of work conducted by Sandia personnel.



**Figure 8.** FY21 NOTES by owning divisions

### 5.3 Categorization of Occurrence and NOTE Information

Consistent with FY 2020 and FY 2019, Hazard Identification and Analysis was the top issue element for FY 2021 (Section 4.3.1). This element prescribes identifying the hazards and evaluating the risks of all activities, throughout their life cycles, to ensure that risks to workers, the public, and/or the environment are controlled consistently within the organization's risk tolerance and resource limitations.

In FY 2021, Compliance with Standards was the second-most common issue element, rising nine spots from eleventh-most common in FY 2020. Knowledge of and conformance to standards (Sandia, DOE, and other), codes, regulations, laws, or requirements help Sandia personnel (1) operate and maintain a safe facility, (2) implement safety practices consistently, and (3) minimize legal liability.

In FY 2021, Formality of Operations was the third-most common issue element, consistent with FY 2020. Formality of operations is the overall execution of operational and management tasks in a deliberate and structured manner. Formality of operations institutionalizes the pursuit of excellence in the performance of every task and minimizes variations in performance.

Notably, Asset Integrity and Reliability was the top issue element for Divisions 2000, 5000, and 7000. Those divisions account for approximately 30 percent of hours worked at Sandia in FY 2021. Asset Integrity and Reliability was the fourth-most common issue element for FY 2021 and was tied with Formality of Operations as the second-most common issue element for FY 2020.

### 5.4 Categorization of NOTES and Occurrences by DOE Cause Codes

Consistent with FY2020, the top Level C cause code assigned in FY2021 was A4B3C08, "Job scoping did not identify special circumstances and/or conditions." This code was used almost twice as much as the second-most used Level C codes, demonstrating the significant contributions of work planning and control to FY2021 occurrences and NOTES.

## 5.5 Results

### 5.5.1 Findings

No violations of policy, requirements, or standards were identified; this assessment has no findings.

### 5.5.2 Observations

#### Observation 1

As COVID-19 vaccination rates increase and COVID-19 impacts on operations decrease, the number of workers on-site and the amount of activity-level work will increase. With these changes, focused attention on the following areas related to work planning and controls may reduce the probability of future events:

- Hazard Identification and Analysis
- Compliance with Standards
- Formality of Operations
- Job scoping

### 5.5.3 Noteworthy Practices

The FY 2021 NOTE-to-occurrence ratio was 0.86. This is a notable increase from the FY 2020 and FY 2019 ratios of 0.48 and 0.51, respectively.

## Resources

### Related Laboratory Policies and Processes

- [QA001.4, Conduct Internal Assessments](#)
- [ESH001, Environment, Safety, and Health Policy](#)
- [ESH001.1, Integrate ES&H into Work Planning and Execution](#)

### References

- Center for Chemical Process Safety. 2007. [Guidelines for Risk Based Process Safety](#). New York, NY: American Institute of Chemical Engineers; Hoboken, NJ: John Wiley & Sons.
- *Combined Fiscal Year 2019: Fourth Quarter and Annual Analysis of Safety Trends for Events* (ASMT-1038 in Sage).
- [DOE O 232.2A Chg 1, Occurrence Reporting and Processing of Operations Information](#).
- [DOE P 450.4A Chg 1 \(MinChg\), Integrated Safety Management Policy](#).
- [DOE-STD-1197-2011, Occurrence Reporting Causal Analysis](#).
- *Fiscal Year 2018 Event Reporting, Including Critique and Causal Analysis Implementation* (76375 in [AIS Individual Evaluation Report](#) from Enterprise Business Intelligence).
- *Fiscal Year 2020: Analysis of ES&H Causal Analysis Reports to Identify Emerging Themes* (ASMT-737562 in Sage).
- *Fiscal Year 2020: First- and Second-Quarter Analysis of ES&H Events* (ASMT-2499 in Sage).
- Fiscal Year 2021 Q1 and Q2: Analysis of ES&H Occurrence and NOTE Causal Analysis Reports to Identify Emerging Themes (ASMT-751188 in Sage).
- *FY20 Review of Sandia National Laboratories Safety Incidents and Occurrence Reports*.
- [MN471022, ES&H Manual, “ES&H Assessments.”](#)

### Systems, Applications, and Websites

- [Sage](#)