# Agenda Overview

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Activities</th>
</tr>
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<tbody>
<tr>
<td>October 23, 2018</td>
<td>1:00-5:00 PM ET</td>
<td><strong>TADS 101</strong></td>
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<tr>
<td></td>
<td></td>
<td>• Overview of TADS</td>
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<tr>
<td></td>
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<td>▪ The why and who of TADS</td>
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<td>• TADS Mechanics</td>
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<td></td>
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<td>▪ Accessing the portal</td>
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<td>▪ Live OATI demo</td>
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<td>▪ Annual Maintenance</td>
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<td>• Outage Reporting</td>
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<td>▪ In-Service State</td>
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<td></td>
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<td>▪ Preparing an outage for reporting</td>
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<tr>
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<td>▪ Outage reporting start to finish</td>
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<tr>
<td>October 24, 2018</td>
<td>9:00 AM-5:00 PM ET</td>
<td><strong>In-Depth Training Session</strong></td>
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<tr>
<td></td>
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<td>• Overview of TADS</td>
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<td>▪ TADS Mechanics</td>
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<td>▪ Annual Maintenance</td>
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<td></td>
<td>• In-depth Coding</td>
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<td></td>
<td>▪ In Service State</td>
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<td></td>
<td></td>
<td>▪ Event code and types</td>
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<tr>
<td></td>
<td></td>
<td>▪ Fault Type</td>
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<tr>
<td></td>
<td></td>
<td>▪ Initiation code</td>
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<td>▪ Cause code (Initiating and sustained)</td>
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<td>▪ Outage Mode</td>
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<td>• Data Validation</td>
</tr>
<tr>
<td>October 25, 2018</td>
<td>9:00 AM-noon ET</td>
<td><strong>Examples</strong></td>
</tr>
<tr>
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<td>• Test Your Knowledge</td>
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<td>▪ Group and table top exercises</td>
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<td>▪ Attendee supplied scenarios</td>
</tr>
<tr>
<td></td>
<td></td>
<td>▪ TADS Jeopardy</td>
</tr>
</tbody>
</table>

**Breakfast & Lunch provided**

**Breakfast provided**
Instructors and Contributors

• Instructors
  ▪ Brian Starling – Project Manager; Dominion Energy
  ▪ Dan King – Transmission Operations Supervisor; Ameren
  ▪ Jack Norris – Engineer; NERC
  ▪ Kurt Weisman – Reliability Performance Consultant; ATC
  ▪ Maggie Peacock – Analyst, Performance Analysis; WECC
  ▪ Mark Matthews – Lead Engineering Technologist; Duke Energy
  ▪ Mike Bocovich – Principal System Protection Engineer; MRO
  ▪ Scott Clemons – System Engineer; TVA
  ▪ Tammy Norwood – Transmission Engineer; Southern Company
  ▪ Brian Nolan – Associate Director; OATI

• Contributors
  ▪ Brantley Tillis – Director of P&C Engineering; Duke Energy
  ▪ Sal Marino – Transmission Control Center Support Manager; Southern Company
Welcome

• Introduction of Attendees
  ▪ Your name
  ▪ Company
  ▪ TADS Experience
TADS Day 2

October 24, 2018
9:00 a.m.-5:00 p.m. ET
• Overall TADS In Depth Training Course Objective (i.e. what you will learn or our goal):
  ▪ Consistent, complete and accurate outage and event reporting for TADS elements.
Learning Objective 1:
Understand the TADS In Depth Training Learning objectives.
TADS In Depth Training Learning Objectives (i.e. the road map for achieving our course objective):

1. Understand the TADS In Depth Training Learning objectives.
2. Review of why TADS is collected and how the data is used.
3. Get acquainted with the Annual Maintenance for TADS and where to find details on how to perform the necessary tasks.
4. Determine the difference between in-service and not in-service states.
5. Understand event id code creation and assignment.
6. Become familiar with the assignment of fault type and why the information is collected.
7. Learn the six outage initiation codes and how to use them to describe where the outage was originated.
TADS In Depth Training Learning Objectives (i.e. the road map for achieving our course objective):

8. Obtain the options for selecting the correct initiating cause code for automatic and operational outages.

9. Recognize what contributed to the longest duration for a sustained outage and select the correct sustained cause code for automatic outages.

10. Identify the difference between the outage mode codes and how to use them to show the relationships between automatic outages.

11. Explore common validation errors and how to avoid them.

12. Participate in test your knowledge activities to strengthen and solidify newly acquired TADS reporting concepts.
TADS In Depth Training Learning Objectives:

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Learning Objective 2:
Review of why TADS is collected and how the data is used.
November 9, 1965 Northeast black out
  - 30 million people affected
  - $100 million of economic losses (~$770 million today)

1967 Federal Power Commission investigation, recommends “council on power coordination”.

1968 Regional groups formed NERC

August, 2003 Largest blackout in North America to date
  - The Northeast blackout of 2003 was a widespread power outage throughout parts of the Northeastern and Midwestern United States and the Canadian province of Ontario.
    - 50 million people affected

April, 2006 NERC designated as Electric Reliability Organization (ERO) by FERC as well as most Canadian provincial authorities
What is TADS?

- **T** - Transmission
- **A** - Availability
- **D** - Data
- **S** - System
Authority to collect TADS data

• NERC Rules of Procedure Section 1600 data request
  ▪ October 23, 2007 – NERC Board of Trustees approved the Phase I report
    o Authorized collection of Automatic outages
  ▪ October 29, 2008 – NERC Board of Trustees approved the Phase II report
    o Authorized collection of non-Automatic outage
  ▪ October 29, 2008 – NERC Board of Trustees approved the Phase II report
    o Authorized collection of non-Automatic outage
  ▪ December 19, 2012 – NERC Board of Trustees approved TADSWG memo:
    o Authorized quarterly reporting and detailed inventory
    o Aligned the TADS definitions with the BES definition
  ▪ November 2015 – NERC Board of Trustees approved the Phase II sunset memo
    o Authorized the discontinuation of the collection of planned outages
“...the premise that transmission availability data will help quantify system performance and reliability.”

Source: Phase I Report page 5
Where is TADS Data Being Used?

• Annual State of Reliability (SOR)
  ▪ Key Findings
  ▪ Chapter 3: Severity Risk Assessment and Availability Data Systems
  ▪ Chapter 4: Reliability Indicator Trends
  ▪ Appendix B: Statistical Analysis of Transmission Data

• Technical & Statistical Papers
  ▪ Performance Analysis of North American AC Circuits on Common Structures Using TADS and CEA Outage Statistics (IEEE PMAPS, Pending)
  ▪ Transmission Availability Data Systems Reporting and Data Analysis (IEEE PMAPS, 2016)
  ▪ North American AC Circuit Outages Initiated by Transmission Equipment Failures and Human Error (IEEE PES, 2016)
Who needs to report TADS?

- All NERC Registered Transmission Owners who own the following Bulk Electric System Elements:
  - AC Circuits (Overhead and Underground)
  - Transformers with ≥ 100 kV secondary voltage
  - AC/DC Back-to-Back Converters
  - DC Circuits (Overhead and Underground)

1Generator Step-up Transformers are excluded from TADS reporting
What is being collected through TADS?

- Basic Company Information (Forms 1.x)
- Inventory Information (Forms 2.x and 3.x)
- Event Information (Form 5)
- Automatic Outage Information (Forms 4.x)
- Non-Automatic Outage Information (Forms 6.x)
TADS In Depth Training Learning Objectives:

1. Understand the TADS In Depth Training Learning objectives.
2. Review of why TADS is collected and how the data is used.
3. Get acquainted with the Annual Maintenance for TADS and where to find details on how to perform the necessary tasks.
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7. Learn the six outage initiation codes and how to use them to describe where the outage was originated.
Learning Objective 3:
Get acquainted with the Annual Maintenance for TADS and where to find details on how to perform the necessary tasks.
Each year TADS reporting Transmission Owners are required to:

- Activate and Updating the Checklist
- Review their contacts
  - Contacts should be kept up-to-date throughout the year

Add, modify or retire shared and reporting TO’s inventory for the year
TADS In Depth Training Learning Objectives:

1. Understand the TADS In Depth Training Learning objectives.
2. Review of why TADS is collected and how the data is used.
3. Get acquainted with the Annual Maintenance for TADS and where to find details on how to perform the necessary tasks.
4. Determine the difference between in-service and not in-service states.
5. Understand event id code creation and assignment.
6. Become familiar with the assignment of fault type and why the information is collected.
7. Learn the six outage initiation codes and how to use them to describe where the outage was originated.
Learning Objective 4:
Determine the difference between in-service and not in-service states.
• AC Circuit A is bound by the two breakers
• Transformer A is bound by a breaker and a disconnect switch
• AC Circuit B is bound by a breaker and a disconnect switch
• Transformer B is bound by a breaker and a disconnect switch.
• A 230 kV bus fault opens the designated breakers.
  - AC Circuit A reports an outage – one terminal is disconnected
  - Transformer A reports an outage – both terminals are disconnected
  - AC Circuit B DOES NOT report an outage – both terminals are connected
  - Transformer B reports an outage – one terminal is disconnected
• Transformer B experiences a fault. The fault is interrupted by the breakers on AC circuit A and Transformer B. After the disconnect switch is opened AC Circuit A is automatically restored within a minute.

  ▪ AC Circuit A reports a momentary outage
  ▪ AC Circuit A returns to an in service state per the multi terminal tapped transformer exclusion
  ▪ Transformer B reports an outage - is not in service
TADS In Depth Training Learning Objectives:

1. Understand the TADS In Depth Training Learning objectives.
2. Review of why TADS is collected and how the data is used.
3. Get acquainted with the Annual Maintenance for TADS and where to find details on how to perform the necessary tasks.
4. Determine the difference between in-service and not in-service states.
5. Understand event id code creation and assignment.
6. Become familiar with the assignment of fault type and why the information is collected.
7. Learn the six outage initiation codes and how to use them to describe where the outage was originated.
Learning Objective 5:
Understand event id code creation and assignment.
Event Codes and Types
Form 5.0
Event Identification (ID) Code

- Event ID Codes must be created on Form 5 before outages can be entered on Form 4.x.
- An Event associated with a Single Mode Outage will have one Event ID Code.
- Each outage in a related set of two or more outages (e.g., Dependent Mode, Dependent Mode Initiating, Common Mode, Common Mode Initiating) shall be given the same Event ID Code.
- For outages within a single TO, the TO assigns its own Event ID Code.
- webTADS tracks each TO’s Event ID codes over multiple years and does not permit the same Event ID to be used twice by any given TO.
- Any pattern of alphanumeric characters may be used on Form 5 to define the Event ID code. Example: 1-2017 or A-2017
- Each year a new Form 4.x Outage ID Code is required, however, for outages due to an Event which started in the prior year, the prior year Form 5 Event ID code must be used on the current year Form 4.x.
• Click on Transmission (TADS)
• Select Forms
• Select Event ID Codes 5.0
**Event Identification (ID) Code New**

- Click on Add Event ID Code
- Enter unique Event ID Code

**Company Name:** American Transmission Company  
**Reporting Period:** 2017 (01/01/2017 - 12/31/2017)  
**Event ID Code:** 102-2017  
**Event Type Number:** 62 Security (unintended operation)  
**Description:**  
**Disturbance Report Filed:** Not Known

**Case Study Assignment**  
- This Event ID Code can be saved as a member of one or more Case Studies below.  
  All Event IDs associated with a case study can be excluded from a report by using the report’s filtering options.

- [ ] TO Case 1:  
- [ ] TO Case 2:  
- [ ] RE Case 1:  
- [ ] RE Case 2:  
- [ ] NERC Case 1:  
- [ ] NERC Case 2:
Select correct Event Type Number

- Event Identification (ID) Code New

Company Name: American Transmission Company

Reporting Period: Please select one...

Event ID Code: 05 Single bus section fault or failure.
06 Single internal circuit breaker fault.

Event Type Number: 13 Automatic Outage of two or more Elements within one Normal Clearing Circuit Breaker Set (NCCBS).
11 Automatic Outage of a Single Element.

Description:
- 13 Automatic Outage of two or more Elements within one Normal Clearing Circuit Breaker Set (NCCBS).
- 31 Automatic Outages of two or more TADS adjacent AC Circuits or DC Circuits on common structures.
- 49 Other Automatic Outage(s) with Normal Clearing.
- 60 Breaker Failure.
- 61 Dependability (failure to operate).
- 62 Security (unintended operation).
- 90 Other Automatic Outage(s) with Abnormal Clearing.

All Event IDs associated with a case study can be excluded from a report by using the report's filtering options.

TO Case 1: ☐ TO Case 2: ☐
RE Case 1: ☐ RE Case 2: ☐
NERC Case 1: ☐ NERC Case 2: ☐

Update History
- Updated by: KurtWeisman on 11/20/2017 07:37 CST
- Created by: KurtWeisman on 11/20/2017 07:37 CST

Modify Delete Audit Close
• Enter brief Description
• Disturbance Report
• Click on Enter
Event Identification (ID) Code New


**SYSTEM REPORT**
File within 1 Business Day

- 1. Physical attack that causes major interruptions or impacts to critical infrastructure or to operations
- 2. Cyber event that causes interruptions of electrical system operations
- 3. Complete operational failure or shutdown of the transmission and/or distribution of electrical system
- 4. Electrical System Separation (Islanding) where part or parts of power grid remain(s) operational in an otherwise blocked-out area or within the partial failure of an integrated electrical system
- 5. Uncontrolled loss of 300 Megawatts or more of firm system loads for 15 minutes or more from a single incident
- 6. Firm load shedding of 100 Megawatts or more implemented under emergency operational policy
- 7. System-wide voltage reductions of 3 percent or more
- 8. Public appeal to reduce the use of electricity for purposes of maintaining the continuity of the Bulk Electric System

**NORMAL REPORT**
File within 6 Hours

- 9. Physical attack that could potentially impact electric power system adequacy or reliability; or vandalism which targets components of any security systems
- 10. Cyber event that could potentially impact electric power system adequacy or reliability
- 11. Loss of electric service to more than 50,000 customers for 1 hour or more
- 12. Fuel supply emergencies that could impact electric power system adequacy or reliability

**EMERGENCY ALERT**
File within 1 Hour

- If any box 1-8 on the right is checked, this form must be filed within 1 hour of the incident; check Emergency Alert (for the Alert Status) on Line A below.

- If any box 9-12 on the right is checked, this form must be filed within 6 hours of the incident; check Normal Report (for the Alert Status) on Line A below.
• Click on OK

Case Study Assignment: Allows the TO, RE or NERC to checkmark multiple events and then filter based on selected events for a special report e.g. Polar Vortex report

Note: Events have to be manually unchecked after case study is complete.
• A new Event ID Code is created
• Click on Edit to modify existing Event Code ID
• Modify data as needed
• Click on Modify
Event Identification (ID) Code Edit

- Click on OK

Company Name: American Transmission Company
Reporting Period: 2017 (01/01/2017 - 12/31/2017)
Event ID Code: 102-2017
Event Type Number: 62 Security (unintended operation)
Description: System Protection
Disturbance Report Filed: Not Known

Case Study Assignment
- This Event ID Code can be saved as a member of one or more Case Studies below.
- All Event IDs associated with a case study can be excluded from a report by using the report's filtering options.

TO Case 1: [ ] TO Case 2: [ ]
RE Case 1: [ ] RE Case 2: [ ]
NERC Case 1: [ ] NERC Case 2: [ ]

Update History
Updated by: KurtWeisman on 11/20/2017 07:38 CST
Created by: KurtWeisman on 11/20/2017 07:38 CST

Message from webpage

? You are about to modify Event ID Code.
Do you want to continue?

OK Cancel

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Event Identification (ID) Code Edit

- Event ID Code is Modified

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<thead>
<tr>
<th>Event ID Code</th>
<th>Event Type Number</th>
<th>Event Description</th>
<th>Disturbance Report Filed</th>
<th>TO Case 1</th>
<th>TO Case 2</th>
<th>RE Case 1</th>
<th>RE Case 2</th>
<th>NERC Case 1</th>
<th>NERC Case 2</th>
<th>Created on</th>
<th>Created By</th>
<th>Updated on</th>
<th>Updated By</th>
<th>Action</th>
</tr>
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<tbody>
<tr>
<td>101-2017</td>
<td>01</td>
<td>Lighting</td>
<td>Not Known</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>11/17/2017 14:01 CST</td>
<td>KurtWeisman</td>
<td>11/17/2017 14:31 CST</td>
<td>KurtWeisman</td>
<td>Edit</td>
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<tr>
<td>102-2017</td>
<td>02</td>
<td>System Protection</td>
<td>Not Known</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>11/17/2017 14:00 CST</td>
<td>KurtWeisman</td>
<td>11/17/2017 14:13 CST</td>
<td>KurtWeisman</td>
<td>Edit</td>
</tr>
</tbody>
</table>

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Event Identification (ID) Code NMU

- TOs (or Regional Entities) coordinate a unique NERC wide (NMU) Event ID code on Form 5 if outages affect two or more Reporting TO’s. NMUs are only for automatic outages where multiple reporting TOs are entering data on 3.X forms.
  - Open Form 5
    - Click the Filter Options Icon on the right hand side of the screen
  - In the filtering options menu click the Company drop down menu and select “NERC Event ID Codes”
  - Click Apply
Event Identification (ID) Code NMU

- Click “Add Event ID Code” to create the next NMU number
- Fill out the form and share the NMU with the other effected TOs

- NOTE: The Event ID Code, Event Type number and event description will be public to any TO in TADS but the TO information will remain confidential

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<table>
<thead>
<tr>
<th>Event Type No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>Single bus section fault or failure resulting in one or more Automatic Outages.</td>
</tr>
<tr>
<td>6</td>
<td>Single internal circuit breaker fault resulting in one or more Automatic Outages.</td>
</tr>
<tr>
<td>11</td>
<td>Automatic Outage of a single Element not covered by Event Type Numbers 05 and 06.</td>
</tr>
<tr>
<td>13</td>
<td>Automatic Outage of two or more Elements within one NCCBS.</td>
</tr>
<tr>
<td>31</td>
<td>Automatic Outages of two or more TADS adjacent AC Circuits or DC Circuits on common structures. To qualify as Event Type Number 31 the Automatic Outages must be the direct result of the circuits occupying common structures.</td>
</tr>
<tr>
<td>49</td>
<td>Automatic Outage(s) with Normal Clearing not covered by Event Type Numbers 05 through 31 above.</td>
</tr>
</tbody>
</table>
Event Type – Normal Clearing

**Event Type Determination**

- **Abnormal**
  - Normal or Abnormal clearing
  - Type 05 or 06
    - Yes: Event Type 05 Bus section fault or failure
    - No: Event Type 11 Single mode or dependent mode outage ONLY
      - Yes: Event Type 13 Automatic outage of two or more elements within one NCCBS
      - No: Event Type 31 Automatic outage of two or more TADS adjacent AC/DC circuits on common structures
        - Yes: Event Type 49 Other Normal Clearing event not covered by type 05-31
        - No:

- **Normal**
  - Type 05 or 06
    - Yes: Event Type 06 Single internal circuit breaker fault
    - No: Type 11 or 13
      - Yes: Event Type 13 Automatic outage of two or more elements within one NCCBS
      - No: Type 31
        - Yes: Event Type 49 Other Normal Clearing event not covered by type 05-31
        - No:

**4.X Dependent mode initiating outage or Dependent mode outage**
### Events with Abnormal Clearing

<table>
<thead>
<tr>
<th>Event Type No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>60</td>
<td><strong>Breaker Failure:</strong> One or more Automatic Outages with Delayed Fault Clearing due to a circuit breaker being stuck, slow to open or failure to interrupt current.</td>
</tr>
</tbody>
</table>
| 61             | **Dependability (failure to operate):** One or more Automatic Outages with Delayed Fault Clearing due to failure of a single Protection System (primary or secondary backup) under either of these conditions:  
  a. failure to initiate the isolation of a faulted power system Element as designed, or within its designed operating time, or  
  b. In the absence of a fault, failure to operate as intended within its designed operating time. (Item b is a very rare type of event.) |
| 62             | **Security (unintended operation):** One or more Automatic Outages caused by improper operation (e.g. overtrip) of a Protection System resulting in isolating one or more TADS Elements it is not intended to isolate, either during a fault or in the absence of a fault. |
| 90             | Automatic Outage(s) with Abnormal Clearing not covered above. |
Event Type – Abnormal Clearing

Event Type 60
Breaker failure: Automatic Outages experienced Delayed Clearing due to one or more circuit Breaker Failures

Yes

Event Type 61 or 62
Dependability (failure to operate)

Yes

Event Type 60
Abnormal Clearing

No

Event Type 61 or 62
Normal Clearing

No

Event Type 90
Other Abnormal Clearing event not covered by type 60-62

Yes
Which of these isn’t an actual event code?

<table>
<thead>
<tr>
<th>Choice</th>
<th>Event Type No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>5</td>
<td>Single bus section fault or failure resulting in one or more Automatic Outages.</td>
</tr>
<tr>
<td>B</td>
<td>6</td>
<td>Single internal circuit breaker fault resulting in one or more Automatic Outages.</td>
</tr>
<tr>
<td>C</td>
<td>11</td>
<td>Automatic Outage of a single Element not covered by Event Type Numbers 05 and 06.</td>
</tr>
<tr>
<td>D</td>
<td>13</td>
<td>Automatic Outage of two or more Elements within one NCCBS.</td>
</tr>
<tr>
<td>E</td>
<td>21</td>
<td>Automatic Outage of two or more Elements within two NCCBS.</td>
</tr>
<tr>
<td>F</td>
<td>31</td>
<td>Automatic Outages of two or more TADS adjacent AC Circuits or DC Circuits on common structures. To qualify as Event Type Number 31 the Automatic Outages must be the direct result of the circuits occupying common structures.</td>
</tr>
<tr>
<td>G</td>
<td>49</td>
<td>Automatic Outage(s) with Normal Clearing not covered by Event Type Numbers 05 through 31 above.</td>
</tr>
</tbody>
</table>
Normal Clearing Event Type Numbers

• Which of these isn’t an actual event code?

<table>
<thead>
<tr>
<th>Choice</th>
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<tr>
<td>A</td>
<td>60</td>
<td><strong>Breaker Failure</strong>: One or more Automatic Outages with Delayed Fault Clearing due to a circuit breaker being stuck, slow to open or failure to interrupt current.</td>
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| B      | 61             | **Dependability (failure to operate)**: One or more Automatic Outages with Delayed Fault Clearing due to failure of a single Protection System (primary or secondary backup) under either of these conditions:

  a. failure to initiate the isolation of a faulted power system Element as designed, or within its designed operating time, or

  b. In the absence of a fault, failure to operate as intended within its designed operating time. (Item b is a very rare type of event.) |
| C      | 62             | **Security (unintended operation)**: One or more Automatic Outages caused by improper operation (e.g. overtrip) of a Protection System resulting in isolating one or more TADS Elements it is not intended to isolate, either during a fault or in the absence of a fault. |
| D      | 63             | **Bus Failure**: Improper operation of a Protections System resulting in a Single Bus section interruption. |
| E      | 90             | Automatic Outage(s) with Abnormal Clearing not covered above. |
1. Press any button to turn the clicker on
   Icons in the upper corners of the screen indicates it is on & 41 selected (Figure 2)

2. When ready to vote press the black letter button that corresponds to your answer

3. Your answer has been submitted when you see your letter with a checkmark on the screen (Figure 3)
• A fault occurs on Line A-B.
  ▪ What is the Event Type No. for the Event?

A. 05 – Bus Section Fault
B. 06 – Circuit Breaker Fault
C. 11 – Automatic of Single not covered in 05 or 06
D. 13 – Two or more Elements within one NCCBS.
E. 31 – Two or more adjacent AC Circuits on common structures
F. 60 – Breaker Failure to Operate
• A fault on AC Circuit ‘A-X’.
  ▪ What is the Event Type No. for the Event?

A. 05 – Bus Section Fault
B. 06 – Circuit Breaker Fault
C. 11 – Automatic of Single not covered in 05 or 06
D. 13 – Two or more Elements within one NCCBS.
E. 31 – Two or more adjacent AC Circuits on common structures
F. 60 – Breaker Failure to Operate
Tornado destroys a rivers crossing tower shared by 3 lines.

- What is the Event Type No. for the Event?

A. 05 – Bus Section Fault
B. 06 – Circuit Breaker Fault
C. 11 – Automatic of Single not covered in 05 or 06
D. 31 – Two or more adjacent AC Circuits on common structures
E. 60 – Breaker Failure to Operate
F. 61 – Dependability – Failure to Operate

Example 3

Event Type

0% 0% 0% 0% 0% 0%
A. B. C. D. E. F.
Lines TL-A1, TL-A2, and TL-A3 share a common river crossing tower. Lightning strikes TL-A1. The breaker at Station A is stuck closed so the breakers on TL-A2 and TL-A3 open to clear fault.

- What is the Event Type No. for the Event?

A. 05 – Bus Section Fault
B. 06 – Circuit Breaker Fault
C. 11 – Automatic of Single not covered in 05 or 06
D. 31 – Two or more adjacent AC Circuits on common structures
E. 60 – Breaker Failure to Operate
F. 61 – Dependability – Failure to Operate

- What is the Event Type No. for the Event?

A. 05 – Bus Section Fault
B. 06 – Circuit Breaker Fault
C. 11 – Automatic of Single not covered in 05 or 06
D. 31 – Two or more adjacent AC Circuits on common structures
E. 61 – Dependability – Failure to Operate
F. 62 – Security – unintended operation
TADS In Depth Training Learning Objectives:

1. Understand the TADS In Depth Training Learning objectives.
2. Review of why TADS is collected and how the data is used.
3. Get acquainted with the Annual Maintenance for TADS and where to find details on how to perform the necessary tasks.
4. Determine the difference between in-service and not in-service states.
5. Understand event id code creation and assignment.
6. Become familiar with the assignment of fault type and why the information is collected.
7. Learn the six outage initiation codes and how to use them to describe where the outage was originated.
Learning Objective 6:
Become familiar with the assignment of fault type and why the information is collected.
Fault Type
Form 4.X
The descriptor of the fault, if any, associated with each Automatic Outage of an Element.

1. No fault
2. Phase-to-phase fault (P-P)
3. Single phase-to-ground fault (P-G)
4. Phase-to-phase-to-ground (P-P-G), 3P, or 3P-G fault
5. Unknown fault type

NOTE for TADS purposes the Fault Type chosen should be: based on TO best judgment of what occurred represent the worst impact on system dynamic stability
• If an Element has an Automatic Outage and its Outage Initiation Code is:
  
  ▪ Element-Initiated - report Fault Type 1-5 as appropriate.
  ▪ Other Element-Initiated - report Fault Type 1, No fault
    o the Fault Type will be reported for the other Element that initiated the outage
  ▪ AC Substation-Initiated or AC/DC Terminal Initiated
    o If fault occurred on BES AC equipment report Fault Type 2-5 as appropriate.
    o If a fault did not occur OR if a fault occurred on non-BES AC equipment report type 1, No fault.
  ▪ Other Facility-Initiated or Protection System-Initiated - report Fault Type 1, No fault.
• No Fault: An outage occurs and no electrical short circuit was present to cause the outage **on the element being reported**.
  - Over/Under voltage, overload, RAS schemes, Dependent Mode outages, Protection System component failures would be coded as no fault.

• A BES 500kV line tripped because of incorrect relay settings during a 3 phase fault on a 230kV line a bus away. The outage record for the 500kV line would be selected as no fault.
• This fault occurs when a single phase conductor short circuits to the earth (ground) neutral point.
  
  - Typical targets would include Ground, Neutral, Ground Inst, Z1 G, Carrier Ground, Z2 G, Ground Time, etc. However if any multi-phase or phase pair targets are indicated this would not be a single phase to ground fault.

• Bird contamination on a bottom phase of a vertical constructed circuit causes a flash from the bottom line conductor to tower. Relay targets were Ground Inst and Carrier Ground.
Phase to Phase fault (P-P)

• This fault type occurs when any two phase wires short circuit to each other without contacting the earth ground plain or the third phase in the circuit.
  ▪ Typical targets could be AB, BC, CA, Zone 1 Phase, Zone 2 Phase, A and B Time, B and C Time, C and A Time. If any ground targets are indicated, it is not a Phase to Phase fault.

• A tree branch breaks cleanly from the tree and falls into two phase wires on a horizontal circuit.
• This fault type occurs when any two phase wires short circuit to each other and earth neutral or ground at the same time. Or when all three phase wires short to each other by themselves or with ground contact.

• A transmission crossarm breaks and drops all three phase wires to the ground. All three phase wires make contact with the earth at the same time causing a 3 phase fault.
• In instances where the fault type changes over the duration of the fault, the fault type should be reported as the most egregious option.

• As an example; a fault initiates as a single phase to ground then evolves into a two phase to ground fault. The fault should be reported as a two phase to ground fault.
Best methods to determine fault type

• Fault recorder/Digital Relay records
  ▪ While not always available, records from remote stations could indicate which phases were involved and provide the best information for determining fault type.

• Relay Targets
  ▪ While usually available, may be cumbersome to evaluate when multiple events have occurred before the targets are obtained from a station.

• Patrol Results
  ▪ When relay targets or fault records are not available, patrol results can tell what the fault type was based on damage reports or repairs made.
Fault Type Flow Chart

Outage

- Determine the outage initiation code for the outaged element
  - Element Initiated
    - Fault?
      - Yes
      - BES
      - No
      - Non-BES
        - AC Substation Initiated or AC/DC Terminal Initiated
        - Other Element-Initiated
          - Other Facility Initiated or Protection System-Initiated
            - Non-BES
            - BES or Non-BES
              - 1. No fault
        - 2. P-P
        - 3. P-G
        - 4. P-P-G, 3P, or 3P-G
        - 5. Unknown fault type
• Lightning causes a single phase to ground fault on a 500kV AC Circuit which causes an outage to the circuit.

• A BES 500/230kV transformer is connected to the circuit at one of the circuit’s terminals.
  ▪ When an outage occurs on the 500kV line, the transformer must also be outaged.

<table>
<thead>
<tr>
<th>Element</th>
<th>Fault Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>500kV Line</td>
<td>Single Phase to Ground Fault</td>
</tr>
<tr>
<td>500/230kV Transformer</td>
<td>No Fault</td>
</tr>
</tbody>
</table>
• A 230kV wooden crossarm breaks and drops all three wires to the ground.

• One wire makes contact first and the line protection trips the circuit breakers, outaging the line before the other two phase wires make contact with the earth or each other.
  ▪ When the line recloses the breakers, all three phase wires are making contact with the earth.

<table>
<thead>
<tr>
<th>Element</th>
<th>Fault Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>230kV line</td>
<td><em>Phase-to-phase-to-ground (P-P-G), 3P, or 3P-G fault</em></td>
</tr>
</tbody>
</table>
• A Non BES 345/23kV transformer is connected to a BES 345kV line.
• The protection on the non BES transformer misoperates and sends a trip signal to outage the BES 345kV line.

<table>
<thead>
<tr>
<th>Element</th>
<th>Fault Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>345kV Line</td>
<td>No Fault</td>
</tr>
</tbody>
</table>
• A 500kV line has an A-G fault and trips out the A phase portion of the circuit, however the remaining phase B and C remained energized.
• The A phase pole successfully reclosed after 10 seconds.

<table>
<thead>
<tr>
<th>Element</th>
<th>Fault Type</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Single pole outages are not reportable.</td>
</tr>
</tbody>
</table>
TADS In Depth Training Learning Objectives:

1. Understand the TADS In Depth Training Learning objectives.
2. Review of why TADS is collected and how the data is used.
3. Get acquainted with the Annual Maintenance for TADS and where to find details on how to perform the necessary tasks.
4. Determine the difference between in-service and not in-service states.
5. Understand event id code creation and assignment.
6. Become familiar with the assignment of fault type and why the information is collected.
7. Learn the six outage initiation codes and how to use them to describe where the outage was originated.
Learning Objective 7:
Learn the six outage initiation codes and how to use them to describe where the outage was originated.
Outage Initiation Code
This is not the Initiating cause code

- The Outage Initiation Codes describe where an Automatic Outage was initiated on the power system.
  - **Element-Initiated Outage**
    - An Automatic Outage of an Element that is initiated on or within the Element that is outaged. Test
  - **Other Element-Initiated Outage**
    - An Automatic Outage of an Element that is initiated by another Element and not by the Element that is outaged.
  - **AC Substation-Initiated Outage**
    - An Automatic Outage of an Element that is initiated on or within AC Substation facilities. (Note: By the definition of “AC Substation” in Section A, Protection System Equipment is not part of the AC Substation; it is therefore included in “Protection System-Initiated Outage.”)
• **AC/DC Terminal-Initiated Outage**
  - An Automatic Outage of an Element that is initiated on or within AC/DC Terminal facilities. (Note: By the definition of “AC/DC Terminal” in Section A, Protection System Equipment is not part of the DC Terminal; it is therefore included in “Protection System-Initiated Outage.”)

• **Protection System-Initiated Outage**
  - An Automatic Outage of an Element that is initiated on or within the Protection System. (Note: This includes Automatic Outages due to the failure of a Protection System element initiated by protection equipment (including, but not limited to: incorrect protection settings, wiring errors, miscoordination, Protection System related Human Error, etc.) causing the protection system to misoperate.)

• **Other Facility-Initiated Outage**
  - An Automatic Outage that is initiated on or within other facilities. “Other facilities” include any facilities not includable in any other Outage Initiation Code. (Note: An Automatic Outage initiated on a Transformer that is not an Element is considered an AC Substation or an AC/DC Terminal-Initiated Outage since the Transformer would be considered part of an AC Substation or AC/DC Terminal.)
• A fault on an AC Circuit.
  - Big 3 Electric is responsible for reporting outages on Line A-B.
  - A fault occurred in Standard Power section of line.
  - What is the Outage Initiation Code for Line A-B?

A. Element-Initiated
B. Other Element-Initiated
C. AC Substation-Initiated
D. Protection System Initiated
E. Other Facility Initiated
F. None of the above
• Bus Fault.
  ▪ A fault occurs on the bus at Station B.
  ▪ What is the Outage Initiation Code for Line A-B?

**Example 2**

Station A

Line A-B

Station B

A. Element-Initiated
B. Other Element-Initiated
C. AC Substation-Initiated
D. Protection System Initiated
E. Other Facility Initiated
F. None of the above

A. B. C. D. E. F.
Example 3

- A fault on AC Circuit ‘A-X’.
  - What is the Outage Initiation Code for Line X-B?

A. Element-Initiated
B. Other Element-Initiated
C. AC Substation-Initiated
D. Protection System Initiated
E. Other Facility Initiated
F. None of the above

0% 0% 0% 0% 0% 0%
A. B. C. D. E. F.
Example 4

- Bus Fault.
  - A fault occurs on the 69-kV bus at Station B.
  - What is the Outage Initiation Code for 230-kV Line A-B?

A. Element-Initiated
B. Other Element-Initiated
C. AC Substation-Initiated
D. Protection System Initiated
E. Other Facility Initiated
F. None of the above
Example 5

- Non-element Transformer Fault.
  - A fault inside the non-element 230/69-kV Transformer at Station B.
  - What is the Outage Initiation Code for 230-kV Line A-B?

A. Element-Initiated
B. Other Element-Initiated
C. AC Substation-Initiated
D. Protection System Initiated
E. Other Facility Initiated
F. None of the above
Example 6

- **Element Transformer Fault.**
  - A fault inside the BES 230/115-kV Transformer at Station B.
  - The Outage Initiation Code for Line A-B is ‘Other Element-Initiated’.
• Human Error
  ▪ An employee turns the wrong handle and accidently opens the breaker at Station B on Line A-B.
  ▪ What is the Outage Initiation Code for Line A-B

Example 7

Station A

Line A-B

Station B

A. Element-Initiated
B. Other Element-Initiated
C. AC Substation-Initiated
D. Protection System Initiated
E. Other Facility Initiated
F. None of the above

0% 0% 0% 0% 0% 0%

A. B. C. D. E. F.
A fault occurs on Line A-B. Test

- The breaker on Line B-C erroneously opens due to relays having the wrong settings.
- What is the Outage Initiation Code for Line B-C?

A. Element-Initiated
B. Other Element-Initiated
C. AC Substation-Initiated
D. Protection System Initiated
E. Other Facility Initiated
F. None of the above

Example 8
TADS In Depth Training Learning Objectives:

1. Understand the TADS In Depth Training Learning objectives.
2. Review of why TADS is collected and how the data is used.
3. Get acquainted with the Annual Maintenance for TADS and where to find details on how to perform the necessary tasks.
4. Determine the difference between in-service and not in-service states.
5. Understand event id code creation and assignment.
6. Become familiar with the assignment of fault type and why the information is collected.
7. Learn the six outage initiation codes and how to use them to describe where the outage was originated.
Learning Objective 8:
Obtain the options for selecting the correct initiating cause code for automatic and operational outages.
Initiating Cause Code
Form 4.X
• The Initiating Cause Code describes the initiating cause of the outage.
• The Sustained Cause Code describes the cause that describes the sustained cause of the outage which contributed to the longest duration.
Which Cause Code to Pick

• When analyzing event...
  - Examine each Element independently
  - Ask “Why did the interrupting device operate?”
    - Weather, excluding lightning
    - Lightning
    - Environmental
    - Fire
    - Contamination
    - Foreign interference
    - Vandalism, terrorism, malicious acts
    - Vegetation
    - Human error
    - Failed AC Substation equipment
    - Failed Protection System equipment
    - Failed AC Circuit equipment
    - Failed DC Circuit equipment
    - Failed AC/DC Terminal equipment
    - Power system condition
    - Unknown
    - Other
• A lightning strike on an AC Circuit.
  ▪ What is the Initiating Cause Code?

  A. Lightning
  B. Failed AC Circuit equipment
  C. Weather, excl. lightning
  D. Foreign Interference
A lightning strike on an AC Circuit. Big 3 Electric is the reporting entity for Line A-B.

- What Initiating Cause Code should Big 3 Electric report for interruption that didn’t occur on their equipment?

A. Lightning  
B. Failed Protection System Equipment  
C. Foreign Interference  
D. Other
A lightning strike on a circuit tap that is owned by a distributor.

- Protection is designed such that this correctly operates the breakers at either end of Line A-B.
- What is the Initiating Cause Code for Line A-B?

A. Lightning
B. Power System Condition
C. Foreign Interference
D. Environmental
• A lightning strike on an AC Circuit, Line A-X.
  - Ask yourself, why did the breaker at Terminal ‘X’ open? It opened because ...
    - The Initiating Cause Code for Line A-X is Lightning.
    - What is the Initiating Cause Code for Line X-B?

A. Not TADS Reportable
B. Failed Protection System Equipment
C. Lightning
D. Other
A sleeve failure occurs on Line #1 and the conductor breaks and falls into underbuilt Line #2.

- Both lines are BES and reportable to NERC TADS.
  - What is the Initiating Cause Code for Line #1?

A. Failed AC Circuit Equipment
B. Foreign Interference
C. Lightning
D. Squirrel
A sleeve failure occurs on Line #1 and the conductor breaks and falls into underbuilt Line #2.

- What is the Initiating Cause Code for **Line #2**?
  - Does it matter if different companies own the lines?

  A. Failed AC Circuit Equipment  
  B. Foreign Interference  
  C. Lightning  
  D. Other
• Line #1 (161-kV) was interrupted for four minutes during a storm due to a Distributor’s underbuilt conductor blowing into its guy wire.

• The guy wire was burned in two upon contact with the 13kV underbuilt Line #2.

• The wind blew the upper section of the loose guy wire into the 161kV transmission line (TL) causing the line to operate to lock out causing a four minute TL outage.

  What is the Initiating Cause Code for **Line #1**?

A. Failed AC Circuit Equipment  
B. Not TADS reportable  
C. Weather, excl. lightning  
D. Foreign interference
• Line #1 (161-kV) was interrupted for four minutes during a storm due to a Distributor’s underbuilt conductor blowing into a guy wire.

• The guy wire was burned in two upon contact with the 13kV underbuilt Line #2.

• The wind blew the upper section of the loose guy wire into the 161kV transmission line (TL) causing the line to operate to lock out causing a four minute TL outage.

  What is the Initiating Cause Code for **Line #2**?

A. Failed AC Circuit Equipment
B. Not TADS reportable
C. Weather, excl. lightning
D. Foreign interference
Lightning struck Line A-C and because of configuration, other lines lost their source and became de-energized:

- What is the Initiating Cause Code for Line TL-1, TL-2, TL-3, and TL-4?

  A. Power System Condition
  B. Weather excluding Lightning
  C. Failed Protection System Equipment
  D. Lightning

**Example 7**

Lines de-energized by fault on another line

**Power System Condition**

Automatic Outages caused by power system conditions such as instability, overload trip, out-of-step, abnormal voltage, abnormal frequency, or unique system configurations (e.g., an abnormal terminal configuration due to existing condition with one breaker already out of service).
Trivia
&
Trainer Switch Up
Lightning struck Line A-C and the breaker at Station C failed to open due to breaker issue. What is the Initiating Cause Code for Line A-C?

- A. Lightning
- B. Failed Protection System Equipment
- C. Failed AC Circuit Equipment
- D. Failed Substation Equipment
Lightning struck Line A-C and a breaker failed to open due to breaker issue.

- What is the Initiating Cause Code for TL-1, TL-2, TL-3 ...?

A. Other  
B. Lightning  
C. Weather, excl. lightning  
D. Failed Substation Equipment
• A Potential Transformer catastrophically fails causing bus fault.
  - What is the Initiating Cause Code for all lines?

  A. Failed AC Circuit Equipment
  B. Failed Protection System Equipment
  C. Failed AC Substation Equipment
  D. Power System Condition
- Failed line capacitor voltage transformer (CCVT or CVT) secondary fails causing voltage loss to relay resulting in a breaker to open on TL-3.
  - What is the Initiating Cause Code for TL-3?

A. Failed AC Circuit Equipment
B. Failed Protection System Equipment
C. Failed AC Substation Equipment
D. Power System Condition
• Lightning strikes 69-kV bus
• Consider why the breaker for the Element opened.
  ▪ What is the Initiating Cause Code?

![Diagram of power system with lightning strike]

- A. Lightning
- B. Other
- C. Failed AC Substation Equipment
- D. Foreign interference

Q: A. B. C. D.
• Breaker fails to clear lightning fault on 69-kV system
  ▪ Again, consider why the breaker for the Element opened.
    ○ What is the Initiating Cause Code for Line A-C?

A. Lightning
B. Foreign Interference
C. Failed AC Substation Equipment
D. Failed Protection System Equipment
• A car accidentally strikes a pole causing an interruption.
  
  What is the Initiating Cause Code for Line A-B?
  
  o Alternative Scenarios:
    – if driven by an employee on the way home from work in a personal vehicle.
    – if it was not an accident and clearly intentional.
A failed insulator at Station C causes a bus fault resulting in the opening of all breakers at Station C.

What is the Initiating Cause Code for the four 230-kV lines (TL-1, TL-2, TL-3, TL-4)?

A. Failed AC Circuit Equipment  
B. Failed Protection System Equipment  
C. Failed AC Substation Equipment  
D. Not TADS reportable
A failed insulator at Station C causes a bus fault resulting in the opening of all breakers at Station C.

- What is the Initiating Cause Code for 500-kV **Line A-C**?

  A. Failed AC Circuit Equipment  
  B. Failed Protection System Equipment  
  C. Failed AC Substation Equipment  
  D. Not TADS reportable
Trivia & Trainer Switch Up
Vegetation Exceptions (as contained in FAC-003-4)

- Outages that fall under the exceptions should be **reported under another Cause Code** and not the Vegetation Cause Code.
- Note: For Initiating and Sustained cause codes.

<table>
<thead>
<tr>
<th>Result from natural disasters examples include:</th>
<th>Human or Animal activity examples include:</th>
</tr>
</thead>
<tbody>
<tr>
<td>o Earthquakes, Fires, Tornados, Hurricanes, Landslides, Ice storms, Floods, etc.</td>
<td>o Logging</td>
</tr>
<tr>
<td>o Wind shear</td>
<td>o Animal severing tree</td>
</tr>
<tr>
<td>o Fresh Gale (wind force 8 on the Beaufort scale 34-40 knots or 39-46 mph)</td>
<td>o Vehicle contact with tree</td>
</tr>
<tr>
<td>o Major storms as defined either by the TO or an applicable regulatory body</td>
<td>o Arboricultural activities</td>
</tr>
<tr>
<td></td>
<td>o Horticultural activities</td>
</tr>
<tr>
<td></td>
<td>o Agricultural activities</td>
</tr>
<tr>
<td></td>
<td>o Removal or digging of vegetation</td>
</tr>
</tbody>
</table>
Human Error: Automatic Outages caused by any incorrect action traceable to *employees and or contractors* for companies operating, maintaining, and or providing assistance to the Transmission Owner will be identified and reported in this category.

**Human Error Automatic Outage Examples (Form 4.X)**

- Electrician hangs ground on wrong (energized) line.
- Operator accidently closes ground switch on line.
- Contractor cuts tree into energized line.
- Company or contractor bucket-truck contacts line.

**Not Human Error Examples**

- Employee flying a kite on his day off and it contacts 230-kV line is NOT Human Error (Foreign Interference).
- Customer or distribution company bucket truck contacts line (Foreign Interference).
Human Error: Automatic Outage Protection System; No Fault Examples

- Line A-B has lightning strike and the Line B-C relay ‘overtrips’ for fault on another line due to:
  - Wrong settings, Wiring error, or Switch in wrong position
    - Line A-B would have an initiating cause of Lightning
    - Line B-C would have an initiating cause of Human Error
• Wrong settings were applied to a relay and it operated 3 months later in the middle of the night opening a breaker on one end of the line when no one was around and no other interruptions.

  ▪ What is the Initiating Cause Code?

A. Not TADS reportable
B. Failed Protection System Equipment
C. Human Error – Form 6.1
D. Human Error – Form 4.1
A control house roof leak causes water to drip on a relay and causes the relay to operate opening a breaker.

What is the Initiating Cause Code?

- A. Weather, excl. Lightning
- B. Failed Protection System Equipment
- C. Foreign Interference
- D. Human Error – Form 4.1
A mouse chews a control cable in two causing a relay to operate which opens the breaker on the ring-bus at Station A.

What is the Initiating Cause Code?

A. Human Error – Form 4.1
B. Failed Protection System Equipment
C. Not TADS reportable
D. Vandalism, Terrorism or Malicious Acts
• These are reported on Form 6.1 (or 6.3):
  ▪ During planned switching, electrician operates wrong handle.
    ○ Work plan was wrong
    ○ Electrician didn’t correctly follow work plan
  ▪ Someone bumps a relay in the switch house
  ▪ During relay testing, accidently trips line
  ▪ Dispatcher remotely opens wrong breaker
  ▪ Electrician shorts out wiring behind panel while working
TADS In Depth Training Learning Objectives:

8. Obtain the options for selecting the correct initiating cause code for automatic and operational outages.

9. Recognize what contributed to the longest duration for a sustained outage and select the correct sustained cause code for automatic outages.

10. Identify the difference between the outage mode codes and how to use them to show the relationships between automatic outages.

11. Explore common validation errors and how to avoid them.

12. Participate in test your knowledge activities to strengthen and solidify newly acquired TADS reporting concepts.
Learning Objective 9:
Recognize what contributed to the longest duration for a sustained outage and select the correct sustained cause code for automatic outages.
Sustained Cause Codes
Form 4.X
• A sustained outage is an automatic outage with an outage duration of a minute or greater.
• The Sustained Cause Code describes the cause that contributed to the longest duration of the outage.
• For Sustained Cause, consider what caused the ‘longest duration’ of the outage to the Element.
• Most of the time if the Initiating Cause is one of these, then the Sustained Cause will be different, probably failed equipment (emphasis on ‘most’)...
  ▪ Weather, excluding lightning
  ▪ Lightning
  ▪ Environmental
  ▪ Fire
  ▪ Vandalism, terrorism, malicious acts

• Remember, consider what caused the ‘longest duration’ of the outage to the Element or “what did you have to fix?”
Most of the time if the Initiating Cause is one of these, then the Sustained Cause will be the same (emphasis on ‘most’)...  
- Failed AC Substation equipment  
- Failed Protection System equipment  
- Failed AC Circuit equipment  
- Failed DC Circuit equipment  
- Failed AC/DC Terminal equipment  
- Power system condition  
- Unknown  
- Other  

Remember, consider what caused the ‘longest duration’ of the outage to the Element or “what did you have to fix?”
Note, If you code a sustained outage as
- Initiating cause unknown, sustained cause unknown
- Initiating cause other, sustained cause other
You may be contacted by your regional entity to provide additional details.
Sustained Cause Code

• If the Initiating Cause is one of these, then the Sustained Cause could be anything ...
  ▪ Contamination
  ▪ Foreign interference
  ▪ Vegetation
  ▪ Human error

• Remember, consider what caused the ‘longest duration’ of the outage to the Element.
• A squirrel attack on an AC Circuit. Automatic reclosing fails to operate resulting in a five minute outage. The Initiating Cause Code is Foreign Interference.
  - What is the Sustained Cause Code?

  A. Foreign Interference
  B. Failed AC Circuit Equipment
  C. Failed Protection System Equipment
  D. Failed AC Substation Equipment
  E. Other
• A lightning strike on an AC Circuit. Automatic reclosing is intentionally disabled (or is not present) resulting in a 27 minute outage. The Initiating Cause Code is Lightning.

  - What is the Sustained Cause Code?

A. Lightning
B. Failed AC Circuit Equipment
C. Other
D. Failed AC Substation Equipment
A tornado destroys a transmission tower on an AC Circuit resulting in a five day outage. The Initiating Cause Code is Weather.

- What is the Sustained Cause Code?

A. Lightning  
B. Weather, excl. lightning  
C. Other  
D. Failed AC Circuit Equipment
Wind causes galloping on a conductor resulting in a circuit lockout. Several hours pass before the circuit can be patrolled to determine whether there was any damage. After patrolling, no damage was found and the circuit was successfully re-energized.

- What is the Initiating Cause Code?

A. Lightning
B. Weather, excl. lightning
C. Other
D. Failed AC Circuit Equipment
Wind causes galloping on a conductor resulting in a circuit lockout. Several hours pass before the circuit can be patrolled to determine whether there was any damage. After patrolling, no damage was found and the circuit was successfully re-energized.

What is the Sustaining Cause Code?

- A. Lightning
- B. Weather, excl. lightning
- C. Other
- D. Failed AC Circuit Equipment
Other examples where the sustained cause code would be Failed AC Circuit equipment:

- Fire destroys transmission pole
- Hurricane destroys transmission tower
- Car hits transmission pole
- Employee accidentally saws down transmission pole rather than tree
- Alien spacecraft crashes into transmission line
Now for something completely different
A tree on the right-of-way, falls on a sunny, calm day into the transmission line. The tree is leaning into the conductor, but no equipment damage. It takes three hours to remove the tree. The Initiating Cause Code is Vegetation.

What is the Sustained Cause Code?

A. Unknown
B. Vegetation
C. Failed AC Circuit Equipment
D. Foreign interference
A tree on the right-of-way, falls on a sunny, calm day into the transmission line. The tree breaks the conductor. It takes three hours to repair the conductor. The Initiating Cause Code is Vegetation.

- What is the Sustained Cause Code?

A. Unknown
B. Vegetation
C. Failed AC Circuit Equipment
D. Foreign interference
• A tree is cut into the energized line, breaking the conductor. It takes three hours to repair the conductor. The Initiating Cause Code is Human Error (Form 4.1).
  - What is the Sustained Cause Code?

A. Unknown  
B. Vegetation  
C. Failed AC Circuit Equipment  
D. Foreign interference
A tree is cut into the energized line by your utility employee, conductor doesn’t break, leans into line. It takes three hours to remove the tree. The Initiating Cause Code is Human Error (Form 4.1).

What is the Sustained Cause Code?

- A. Human Error
- B. Vegetation
- C. Failed AC Circuit Equipment
- D. Foreign interference

Refer to the definitions document (Appendix 7):
- Not vegetation because of exception,
- Nothing broke so not Failed equipment,
- Not Foreign Interference because of exception.
A tree off the right-of-way, falls during a storm into the transmission line. The tree is leaning into the conductor, but no equipment damage. It takes three hours to remove the tree.

- What is the Initiating Cause Code?

A. Vegetation  
B. Foreign Interference  
C. Weather, excl. Lightning  
D. Failed AC Circuit Equipment
A tree off the right-of-way, falls during a storm into the transmission line. The tree is leaning into the conductor, but no equipment damage. It takes three hours to remove the tree.

What is the Sustaining Cause Code?

A. Vegetation
B. Foreign Interference
C. Weather, excl. Lightning
D. Failed AC Circuit Equipment
A tree far off the right-of-way, is uprooted and carried into the transmission line by a tornado. The tree is leaning into the conductor, but no equipment damage. It takes three hours to remove the tree.

What is the Sustaining Cause Code?

A. Vegetation
B. Foreign Interference
C. Weather, excl. Lightning
D. Failed AC Circuit Equipment
TADS In Depth Training Learning Objectives:

8. Obtain the options for selecting the correct initiating cause code for automatic and operational outages.

9. Recognize what contributed to the longest duration for a sustained outage and select the correct sustained cause code for automatic outages.

10. Identify the difference between the outage mode codes and how to use them to show the relationships between automatic outages.

11. Explore common validation errors and how to avoid them.

12. Participate in test your knowledge activities to strengthen and solidify newly acquired TADS reporting concepts.
Learning Objective 10:
Identify the difference between the outage mode codes and how to use them to show the relationships between automatic outages.
Outage Mode
Form 4.X
The Outage Mode Code describes whether an Automatic Outage is related to other Automatic Outages.

- Single Mode Outage
- Dependent Mode Initiating Outage
- Dependent Mode Outage
- Common Mode Outage
- Common Mode Initiating Outage
Outage Mode Code
Outage Mode Decision Tree

TADS Outage

Was this the result of another TADS or non-TADS outage?

Yes -> Dependent Mode

No -> Any other related TADS outages at the same time?

No -> Single Mode

Yes -> Did this cause another TADS outage?

No -> Common Mode

Yes -> Any other related TADS outages not caused by this one?

Yes -> Common Mode Initiating

No -> Dependent Mode Initiating
• An Automatic Outage of a single Element that occurred independent of any other Automatic Outages (if any).
• One of two or more Automatic Outages with the same Initiating Cause Code and where the outages are not consequences of each other and occur nearly simultaneously (i.e., within cycles or seconds of one another).

- Bus Fault
Outage Mode Code
Common Mode

- One of two or more Automatic Outages with the same Initiating Cause Code and where the outages are not consequences of each other and occur nearly simultaneously (i.e., within cycles or seconds of one another).

- Single Cause (Lighting, Tornado, etc.), near simultaneous:
  - Do they share tower (River Crossing?) – Common Mode
  - Are they in close proximity, share ROW – Common Mode
• Two or more outages
  ▪ One outage can be non-Element; hence not all Dependent Mode outages will have an associated Dependent Mode Initiating Outage
  ▪ Dependent Mode Outage must be a result of another outage.
    o Initiating Outage:
      – Single Element: Dependent Mode Initiating Outage
      – Multiple Elements with same Cause at the same time and not consequences of each other: Common Mode Initiating Outage
    o Resulting Outage:
      – Single Element: Dependent Mode Outage
      – Multiple Elements with same Cause at the same time and not consequences of each other: Common Mode Outage
      – Multiple Elements with same Cause at the same time and are consequences of each other: Dependent Mode Outage
• Line A-B experiences a fault and Line B-C erroneously trips (relay overtrips) at Station C.
  - Line A-B – Dependent Mode Initiating Outage
  - Line B-C – Dependent Mode Outage
Lightning strikes Line A-X:

- Line A-X: Dependent Mode Initiating
- Line X-B: Dependent Mode

Reference: Dependent Mode Initiating, Dependent Mode FAQ Chapter 4 page 7
https://www.nerc.com/pa/RAPA/tads/Key_TADS_Documents/TADS%20FAQ%202016.pdf
• Breaker at Terminal X trips due to low SF6 gas:
  - Line A-X: Common mode
  - Line X-B: Common mode

Reference: Common mode FAQ Chapter 4 page 7
https://www.nerc.com/pa/RAPA/tads/Key_TADS_Documents/TADS%20FAQ%202016.pdf
Lightning strikes Line A-B and Line C-D a few seconds apart. They don’t share ROW or any equipment. All lines are BES elements.

- What is the Outage Mode Code for Line A-B?

A. Single Mode Outage
B. Dependent Mode Initiating Outage
C. Dependent Mode Outage
D. Common Mode Outage
E. Common Mode Initiating Outage
Lightning strikes Line A-B and Line C-D a few seconds apart. They don’t share ROW or any equipment. All lines are BES elements.

- What is the Outage Mode Code for Line C-D?

A. Single Mode Outage
B. Dependent Mode Initiating Outage
C. Dependent Mode Outage
D. Common Mode Outage
E. Common Mode Initiating Outage
Fault on Line B-C. Two separate relay issues (Protection System) at Station A and Station D. All lines are BES elements.

- What is the Outage Mode Code for Line B-C?

A. Single Mode Outage
B. Dependent Mode Initiating Outage
C. Dependent Mode Outage
D. Common Mode Outage
E. Common Mode Initiating Outage
Fault on Line B-C. Two separate relay issues (Protection System) at Station A and Station D. All lines are BES elements.

- What is the Outage Mode Code for Line A-B?

A. Single Mode Outage
B. Dependent Mode Initiating Outage
C. Dependent Mode Outage
D. Common Mode Outage
E. Common Mode Initiating Outage
Fault on Line B-C. Two separate relay issues (Protection System) at Station A and Station D. All lines are BES elements.

- What is the Outage Mode Code for Line C-D?

A. Single Mode Outage  
B. Dependent Mode Initiating Outage  
C. Dependent Mode Outage  
D. Common Mode Outage  
E. Common Mode Initiating Outage
Line D-E has fault and breaker at E fails to open. The bus at Station E Clears fault. All lines are BES elements.

What is the Outage Mode Code for Line D-E?

A. Single Mode Outage
B. Dependent Mode Initiating Outage
C. Dependent Mode Outage
D. Common Mode Outage
E. Common Mode Initiating Outage
• Line D-E has fault and breaker at E fails to open. The bus at Station E Clears fault. All lines are BES elements.
  ▪ What is the Outage Mode Code for TL-1, TL-2, TL-3, TL-4?

A. Single Mode Outage
B. Dependent Mode Initiating Outage
C. Dependent Mode Outage
D. Common Mode Outage
E. Common Mode Initiating Outage
• Bus at Station E has fault. A relay on Line D-E misoperates. All lines are BES elements.
  ▪ What is the Outage Mode Code for Line D-E?

Example 4a
Bus Fault

- Single Mode Outage
- Dependent Mode Initiating Outage
- Dependent Mode Outage
- Common Mode Outage
- Common Mode Initiating Outage

A. B. C. D. E.
• Bus at Station E has fault. A relay on Line D-E misoperates. All lines are BES elements.
  ▪ What is the Outage Mode Code for lines TL-1, TL-2...?

A. Single Mode Outage
B. Dependent Mode Initiating Outage
C. Dependent Mode Outage
D. Common Mode Outage
E. Common Mode Initiating Outage
Lightning strikes river crossing tower on lines TL-A1, TL-A2 and TL-A3. Breaker on TL-A3 fails to open resulting in TL-D1 and TL-D2 opening. All lines are BES elements.

- What is the Outage Mode Code for Line TL-A3?

A. Single Mode Outage
B. Dependent Mode Initiating Outage
C. Dependent Mode Outage
D. Common Mode Outage
E. Common Mode Initiating Outage
Lightning strikes river crossing tower on lines TL-A1, TL-A2 and TL-A3. Breaker on TL-A3 fails to open resulting in TL-D1 and TL-D2 opening. All lines are BES elements.

- What is the Outage Mode Code for Line TL-A1 and TL-A2?

A. Single Mode Outage
B. Dependent Mode Initiating Outage
C. Dependent Mode Outage
D. Common Mode Outage
E. Common Mode Initiating Outage
Lightning strikes river crossing tower on lines TL-A1, TL-A2 and TL-A3. Breaker on TL-A3 fails to open resulting in TL-D1 and TL-D2 opening. All lines are BES elements.

- What is the Outage Mode Code for Line TL-D1 and TL-D2?

A. Single Mode Outage
B. Dependent Mode Initiating Outage
C. Dependent Mode Outage
D. Common Mode Outage
E. Common Mode Initiating Outage
TADS In Depth Training Learning Objectives:

8. Obtain the options for selecting the correct initiating cause code for automatic and operational outages.

9. Recognize what contributed to the longest duration for a sustained outage and select the correct sustained cause code for automatic outages.

10. Identify the difference between the outage mode codes and how to use them to show the relationships between automatic outages.

11. Explore common validation errors and how to avoid them.

12. Participate in test your knowledge activities to strengthen and solidify newly acquired TADS reporting concepts.
Learning Objective 11:
Explore common validation errors and how to avoid them.
Validating Your Data
• Invalid Retirement Date. 'Retirement Date' must be within the reporting period range.
• Change/Reconfiguration Date is missing
• Mismatched Precursor Elements. Precursor Elements does not belong to provided Voltage Class (KV) or Circuit Type.
• Duplicate Element Identifier in the file
• Circuit Type is missing
• Invalid KV
• In Service date cannot be set after the Outage(s) creation date on this inventory. Either adjust the Inventory In Service date or Outage start date
• Circuit Mileage is missing
• Invalid To Bus
• High Side kV is missing
• Low Side kV is missing
• Duplicate Element Identifier in the file
• Invalid Retirement Date. 'Retirement Date' must be within the reporting period range.
• Invalid Change/Reconfiguration Date. 'Change/Reconfiguration Date' must not be in the future or must be prior to the 'Retirement Date'.
• Invalid High or Low Side Voltage
• Invalid Three Phase Rating
• Warning - For Outage ID [] associated with Event ID [], 'Failed Protection System Equipment' was entered as the 'Initiating Cause Code.' Therefore the cause of this outage is likely to be abnormal clearing (per NERC definition of Normal Clearing). However, the associated Event Type number entered on Form 5 is less than 50, which are 'Normal Clearing' event types. Warning: Please consider entering an abnormal clearing Event Type Number on Form 5, or do not enter 'Failed Protection System Equipment' as the 'Initiating Cause Code' for this Outage.

• Event ID Code not in Form 5 of current period

• Outage ID Code [] has the Outage Continuation field entered as Continues into next period with a Start Date/Time = MM/DD/YYYY HH:MM [] time zone. However, the entered DURATION does not equal the HH:MM [] time zone [the EOYCD] remaining in the given reporting year. Enter a DURATION equal to HH:MM [the EOYCD], or change your data entry in the Outage Continuation Field.
• For a '0' duration outage, the Sustained Outage Cause Code must be 'N/A - Momentary'. Please enter this Sustained cause code OR change the Duration to a number greater than zero.

• For a duration outage greater than '0', the Sustained Outage Cause Code CAN NOT be 'N/A - Momentary'.

• Outage duration overlap other outage(s) in the XML with the same element.

• Duplicate Event ID Code and Element Identifier

• In XML file, Same Event ID Code is used with another outage having one of them as a Single mode outage

• Invalid Sustained Cause Code
• Outage Duration is invalid. (hhhh:mm) Max Duration: XXX:XX
• Invalid Fault Type
• Outage Duration is invalid. Format is hhhh:mm
• Sustained Cause Code is missing
• Outage continuation flag is missing (0,1,2)
• Outage Mode is missing
• Outage Duration is out of range in [] timezone. (Max duration: XXX:XX)
• Initiating Cause Code is missing
• Invalid Initiating Cause Code
• Event ID Code not in Form 5 of current period

• A transformer outage has been entered with zero outage duration, indicating the outage was momentary. Momentary transformer outages are rare. Please verify that the outage duration should be zero. If OK, please proceed. If not, enter a duration greater than or equal to 1 minute.

• Warning - For Outage ID [ ] associated with Event ID [ ], 'Failed Protection System Equipment' was entered as the 'Initiating Cause Code.' Therefore the cause of this outage is likely to be abnormal clearing (per NERC definition of Normal Clearing). However, the associated Event Type number entered on Form 5 is less than 50, which are 'Normal Clearing' event types. Warning: Please consider entering an abnormal clearing Event Type Number on Form 5, or do not enter 'Failed Protection System Equipment' as the 'Initiating Cause Code' for this Outage.
• Outage continuation flag is missing (0,1,2)
• Outage Initiation Code Name is missing
• Outage Mode is missing
• Fault Type is missing
• Invalid Outage Initiation Code Name
• Outage Duration is invalid. Format is hhhh:mm
• Outage ID Code [] has the Outage Continuation field entered as Continues into next period with a Start Date/Time = MM/DD/YYYY HH:MM [] timezone. However, the entered DURATION does not equal the HH:MM [] timezone [the EOYCD] remaining in the given reporting year. Enter a DURATION equal to HH:MM [the EOYCD], or change your data entry in the Outage Continuation Field.
• Sustained Cause Code is missing
ID Code and Event Type Number Data

- Duplicate Event ID Code
- Disturbance Report Filed flag is missing
- Event Type ID is missing
- Event ID Code is missing
- Event ID Code exists in another Reporting Period: 2016
• Warning - An old version of xml schema is uploaded. We will not be processing extra field (Planned Cause Code) in the file.
• Outage Duration is invalid. (hhhh:mm) Max Duration: XXX.XX
• Outage duration overlap existing outage(s) with the same element.
• Planned Outage Cause Code CANNOT be 'NA'
• Planned outages are not allowed from year 2016 and forward.
• Outage Duration is missing or zero
• Outage Duration is invalid. Format is hhhh:mm
• For the selected 'Outage Continuation Code', the Outage Duration is out of range (Minimum Duration: XXX:XX)
• Outage continuation flag is missing (0,1,2)
• Outage Duration is out of range in [] timezone. (Max duration: XXX.XX)
• Outage duration overlap other outage(s) in the XML with the same element
• Outage ID Code [] has the Outage Continuation field entered as Continues into next period with a Start Date/Time = MM/DD/YYYY HH:MM [] timezone. However, the entered DURATION does not equal the HH:MM [] timezone [the EOYCD] remaining in the given reporting year. Enter a DURATION equal to HH:MM [the EOYCD], or change your data entry in the Outage Continuation Field.
• Operational Cause Code is missing
• Warning - An old version of xml schema is uploaded. We will not be processing extra field (Planned Cause Code) in the file.

• Outage Duration is invalid. Format is hhhh:mm

• Outage Duration is missing or zero

• Planned Cause Code is missing

• Planned Outage Cause Code CANNOT be 'NA'

• Planned outages are not allowed from year 2016 and forward.
### Common Data Validation Errors

**All fatal errors for completed forms must be fixed before checklist can be saved**

<table>
<thead>
<tr>
<th>Quarter</th>
<th>Form(s)</th>
<th>Validation Error Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quarter 1</td>
<td>3.2 &amp; 6.3</td>
<td>No inventory exists on Form 3.2 for Form 6.3 Outage ID Code [RE40].</td>
</tr>
<tr>
<td>Quarter 2</td>
<td>3.2 &amp; 4.3</td>
<td>No inventory exists on Form 3.2 for Form 4.3 Outage ID Code [RE40].</td>
</tr>
<tr>
<td>Quarter 2</td>
<td>3.2 &amp; 4.3</td>
<td>No inventory exists on Form 3.2 for Form 4.3 Outage ID Code [RE40].</td>
</tr>
<tr>
<td>Quarter 2</td>
<td>3.2 &amp; 6.3</td>
<td>No inventory exists on Form 3.2 for Form 6.3 Outage ID Code [RE40].</td>
</tr>
<tr>
<td>Quarter 3</td>
<td>3.2 &amp; 6.3</td>
<td>No inventory exists on Form 3.2 for Form 6.3 Outage ID Code [RE40].</td>
</tr>
<tr>
<td>Quarter 3</td>
<td>3.2 &amp; 6.3</td>
<td>No inventory exists on Form 3.2 for Form 6.3 Outage ID Code [RE40].</td>
</tr>
<tr>
<td>Quarter 3</td>
<td>3.2 &amp; 6.3</td>
<td>No inventory exists on Form 3.2 for Form 6.3 Outage ID Code [RE40].</td>
</tr>
<tr>
<td>Quarter 4</td>
<td>3.1 &amp; 6.1</td>
<td>No inventory exists on Form 3.1 for Form 6.1 Outage ID Code [RE40].</td>
</tr>
<tr>
<td>Quarter 4</td>
<td>3.1 &amp; 6.1</td>
<td>No inventory exists on Form 3.1 for Form 6.1 Outage ID Code [RE40].</td>
</tr>
</tbody>
</table>

RED = Fatal Errors  
YELLOW = Warnings
• The excel sheet will allow an AC outage to have the initiating cause code of Failed AC/DC Terminal Equipment to be selected but this is an invalid cause code for AC circuits. It is only valid for DC circuits (not sure if this is something we should just have NERC fix but it has caused issues.
Objective Review

TADS In Depth Training Learning Objectives:

8. Obtain the options for selecting the correct initiating cause code for automatic and operational outages.

9. Recognize what contributed to the longest duration for a sustained outage and select the correct sustained cause code for automatic outages.

10. Identify the difference between the outage mode codes and how to use them to show the relationships between automatic outages.

11. Explore common validation errors and how to avoid them.

12. Participate in test your knowledge activities to strengthen and solidify newly acquired TADS reporting concepts.
Learning Objective 12:
Participate in test your knowledge activities to strengthen and solidify newly acquired TADS reporting concepts.
- Galloping conductors on a double circuit structure carrying a 138kV line (Line X-Y) and a 230kV line (Line A-B) resulted in momentary outages to both lines. The faults occur between phases on the same voltage.

<table>
<thead>
<tr>
<th>Fields</th>
<th>Form 4.1 Line A-B</th>
<th>Form 4.1 Line X-Y</th>
<th>Form 5.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fault Type</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Outage Initiation Code</td>
<td></td>
<td></td>
<td>Event Type Number</td>
</tr>
<tr>
<td>Initiating Cause Code</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sustained Cause Code</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Outage Mode Code</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
• Galloping conductors on a double circuit structure carrying a 138kV line (Line X-Y) and a 230kV line (Line A-B) resulted in momentary outages to both lines. The faults occur between phases on the same voltage.

<table>
<thead>
<tr>
<th>Fields</th>
<th>Form 4.1 Line A-B</th>
<th>Form 4.1 Line X-Y</th>
<th>Form 5.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fault Type</td>
<td>P-P fault</td>
<td>Not reportable</td>
<td></td>
</tr>
<tr>
<td>Outage Initiation Code</td>
<td>Element-Initiated</td>
<td>Not reportable</td>
<td></td>
</tr>
<tr>
<td>Initiating Cause Code</td>
<td>Weather</td>
<td>Not reportable</td>
<td>Event Type Number</td>
</tr>
<tr>
<td>Sustained Cause Code</td>
<td>NA- Momentary</td>
<td>Not reportable</td>
<td>11</td>
</tr>
<tr>
<td>Outage Mode Code</td>
<td>Single Mode</td>
<td>Not reportable</td>
<td></td>
</tr>
</tbody>
</table>
Motor operated disconnect control circuit misoperates and opens the disconnect. For this example, motor operated disconnect is located on the circuit. Breakers do not operate and there is not a BES fault.

<table>
<thead>
<tr>
<th>Fields</th>
<th>Form 4.1 Line A-B</th>
<th>Form 5.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fault Type</td>
<td></td>
<td>Event Type Number</td>
</tr>
<tr>
<td>Outage Initiation Code</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Initiating Cause Code</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sustained Cause Code</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Outage Mode Code</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Motor operated disconnect control circuit misoperates and opens the disconnect. For this example, motor operated disconnect is located on the circuit. Breakers do not operate and there is not a BES fault.

### Example 2: Answers

<table>
<thead>
<tr>
<th>Fields</th>
<th>Form 4.1 Line A-B</th>
<th>Form 5.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fault Type</td>
<td>No Fault</td>
<td>Event Type Number</td>
</tr>
<tr>
<td>Outage Initiation Code</td>
<td>Element-Initiated</td>
<td>90</td>
</tr>
<tr>
<td>Initiating Cause Code</td>
<td>Failed AC Circuit Eq.</td>
<td></td>
</tr>
<tr>
<td>Sustained Cause Code</td>
<td>Failed AC Circuit Eq.</td>
<td></td>
</tr>
<tr>
<td>Outage Mode Code</td>
<td>Single Mode</td>
<td></td>
</tr>
</tbody>
</table>
A 138 kV two-terminal transmission line experiences an outage due to bird contamination which resulted in a single phase to ground fault. The faulted line trips and successfully returns to an in-service state in less than one minute. On an adjacent 138 kV three-terminal line one remote breaker opens due to a failed communication system and failed to return to an in-service state due to a failed reclosing scheme.
• A 138 kV two-terminal transmission line experiences an outage due to bird contamination which resulted in a single phase to ground fault. The faulted line trips and successfully returns to an in-service state in less than one minute. On an adjacent 138 kV three-terminal line one remote breaker opens due to a failed communication system and failed to return to an in-service state due to a failed reclosing scheme.

---

**Fields**

<table>
<thead>
<tr>
<th>Fields</th>
<th>Form 4.1 Line 6</th>
<th>Form 4.1 Line 7</th>
<th>Form 5.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fault Type</td>
<td></td>
<td></td>
<td>Event Type Number</td>
</tr>
<tr>
<td>Outage Initiation Code</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Initiating Cause Code</td>
<td></td>
<td></td>
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<tr>
<td>Sustained Cause Code</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Outage Mode Code</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Test Your Knowledge – Example 3

Answers

- A 138 kV two-terminal transmission line experiences an outage due to bird contamination which resulted in a single phase to ground fault. The faulted line trips and successfully returns to an in-service state in less than one minute. On an adjacent 138 kV three-terminal line one remote breaker opens due to a failed communication system and failed to return to an in-service state due to a failed reclosing scheme.

```
No Op
Line 6

No Op  O-C
Line 7
```

<table>
<thead>
<tr>
<th>Fields</th>
<th>Form 4.1 Line 6</th>
<th>Form 4.1 Line 7</th>
<th>Form 5.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fault Type</td>
<td>No fault</td>
<td>Not reportable</td>
<td></td>
</tr>
<tr>
<td>Outage Initiation Code</td>
<td>Protection System</td>
<td>Not reportable</td>
<td></td>
</tr>
<tr>
<td>Initiating Cause Code</td>
<td>Failed Protection System Eq.</td>
<td>Not reportable</td>
<td></td>
</tr>
<tr>
<td>Sustained Cause Code</td>
<td>Failed AC Substation Eq.</td>
<td>Not reportable</td>
<td></td>
</tr>
<tr>
<td>Outage Mode Code</td>
<td>Dependent Mode</td>
<td>Not reportable</td>
<td></td>
</tr>
</tbody>
</table>

Event Type Number: 62
A 138 kV three-terminal line experiences a single phase to ground fault due to lightning. The fault was cleared correctly but one terminal did not close due to a faulty recloser.
• A 138 kV three-terminal line experiences a single phase to ground fault due to lightning. The fault was cleared correctly but one terminal did not close due to a faulty recloser.
A 138 kV three-terminal line experiences a single phase to ground fault due to lightning. The fault was cleared correctly but one terminal did not close due to a faulty recloser.

### Form 4.1 Line 6
- **Fault Type**: Single P-G fault
- **Outage Initiation Code**: Element-Initiated
- **Initiating Cause Code**: Lightning
- **Sustained Cause Code**: Failed AC Substation Eq.
- **Outage Mode Code**: Single Mode

### Form 5.0
- **Event Type Number**: 11
A 138 kV three-terminal line experiences a single phase to ground fault due to lightning. The fault was cleared correctly but one terminal did not close due to a faulty recloser.
A 138 kV three-terminal line experiences a single phase to ground fault due to lightning. The fault was cleared correctly but one terminal did not close due to a faulty recloser.
A 138 kV three-terminal line experiences a single phase to ground fault due to lightning. The fault was cleared correctly but one terminal did not close due to a faulty recloser.

<table>
<thead>
<tr>
<th>Fields</th>
<th>Form 4.1 Line 6</th>
<th>Form 4.3 XF 1</th>
<th>Form 5.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fault Type</td>
<td>Not reportable</td>
<td>Not reportable</td>
<td></td>
</tr>
<tr>
<td>Outage Initiation Code</td>
<td>Not reportable</td>
<td>Not reportable</td>
<td></td>
</tr>
<tr>
<td>Initiating Cause Code</td>
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<td>Not reportable</td>
<td></td>
</tr>
<tr>
<td>Sustained Cause Code</td>
<td>Not reportable</td>
<td>Not reportable</td>
<td></td>
</tr>
<tr>
<td>Outage Mode Code</td>
<td>Not reportable</td>
<td>Not reportable</td>
<td></td>
</tr>
</tbody>
</table>

Event Type Number: Not reportable
A 345/138 kV Transformer fails internally with a phase to phase fault. Per the relay design, the line correctly trips allowing the transformer to auto-sectionlize and the line automatically recloses.
A 345/138 kV Transformer fails internally with a phase to phase fault. Per the relay design, the line correctly trips allowing the transformer to auto-sectionallize and the line automatically recloses.
A 345/138 kV Transformer fails internally with a phase to phase fault. Per the relay design, the line correctly trips allowing the transformer to auto-sectionalize and the line automatically recloses.

<table>
<thead>
<tr>
<th>Fields</th>
<th>Form 4.1 Line 6</th>
<th>Form 4.3 XF 1</th>
<th>Form 5.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fault Type</td>
<td>No fault</td>
<td>P-P fault</td>
<td></td>
</tr>
<tr>
<td>Outage Initiation Code</td>
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<td>AC Substation-Initiated</td>
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</tr>
<tr>
<td>Initiating Cause Code</td>
<td>Failed AC Substation Eq.</td>
<td>Failed AC Substation Eq.</td>
<td>Event Type Number</td>
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<tr>
<td>Sustained Cause Code</td>
<td>NA- Momentary</td>
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</tr>
<tr>
<td>Outage Mode Code</td>
<td>Dependent Mode</td>
<td>Dependent Mode Initiating</td>
<td></td>
</tr>
</tbody>
</table>
A lightning strike occurs on the 69-kV line B-C.

- The breaker on line B-C fails to open causing the 230kV breaker to open on line A-B.
- 230 kV Line A-B is a BES Element.
  - How should this be coded?
A lightning strike occurs on the 69-kV line B-C.
- The breaker on line B-C fails to open causing the 230kV breaker to open on line A-B.
- 230 kV Line A-B is a BES Element.
  - How should this be coded?

### Diagram

![Diagram showing the system with a lightning strike at 69-kV line B-C, breaker failure, and 230kV breaker opening on line A-B.]

### Table

<table>
<thead>
<tr>
<th>Fields</th>
<th>Form 4.1 A-B</th>
<th>Form 4.1 B-C</th>
<th>Form 5.0</th>
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<tr>
<td>Outage Initiation Code</td>
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<td></td>
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<tr>
<td>Initiating Cause Code</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Sustained Cause Code</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Outage Mode Code</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Form 5.0**

| Event Type Number | 60 |
A lightning strike occurs on the 69-kV line B-C.

- The breaker on line B-C fails to open causing the 230kV breaker to open on line A-B.
- 230 kV Line A-B is a BES Element.
  - How should this be coded?

<table>
<thead>
<tr>
<th>Fields</th>
<th>Form 4.1 A-B</th>
<th>Form 4.1 B-C</th>
<th>Form 5.0</th>
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</thead>
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<td>Fault Type</td>
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</tr>
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<td>Failed AC Substation Eq.</td>
<td>Not reportable</td>
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</tr>
<tr>
<td>Sustained Cause Code</td>
<td>Failed AC Substation Eq.</td>
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<td></td>
</tr>
<tr>
<td>Outage Mode Code</td>
<td>Dependent Mode</td>
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<td></td>
</tr>
</tbody>
</table>
A technician applies settings to a relay and the settings result in an immediate trip. The relay issued the trip at the exact moment when the relay accepted the settings after the technician loaded and implemented the settings.

- How should this be coded?
A technician applies settings to a relay and the settings result in an immediate trip. The relay issued the trip at the exact moment when the relay accepted the settings after the technician loaded and implemented the settings.

- How should this be coded?
A technician applies settings to a relay and the settings result in an immediate trip. The relay issued the trip at the exact moment when the relay accepted the settings after the technician loaded and implemented the settings.

How should this be coded?

<table>
<thead>
<tr>
<th>Fields</th>
<th>Form 6.1 A-B</th>
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<tr>
<td>Outage Initiation Code</td>
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<tr>
<td>Initiating Cause Code</td>
<td>Human Error</td>
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<td>Sustained Cause Code</td>
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<tr>
<td>Outage Mode Code</td>
<td>N/A</td>
<td></td>
</tr>
</tbody>
</table>
Two circuits exist in parallel both originating from Substation A and running through switching station B, which contains no terminal circuit breakers, before traveling on to two separate remote substations. Whenever a communication link outage of the circuits’ protection system occurs one of the parallel lines has to be opened.

How should this be coded?
Two circuits exist in parallel both originating from Substation A and running through switching station B, which contains no terminal circuit breakers, before traveling on to two separate remote substations. Whenever a communication link outage of the circuits’ protection system occurs one of the parallel lines has to be opened.

- How should this be coded?

<table>
<thead>
<tr>
<th>Fields</th>
<th>Form 6.1 A-B</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Fault Type</td>
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</tr>
<tr>
<td>Outage Initiation Code</td>
<td></td>
<td>Event</td>
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<tr>
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<td>Initiating Cause Code</td>
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<td>Number</td>
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<tr>
<td>Sustained Cause Code</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Outage Mode Code</td>
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</tr>
</tbody>
</table>
Two circuits exist in parallel both originating from Substation A and running through switching station B, which contains no terminal circuit breakers, before traveling on to two separate remote substations. Whenever a communication link outage of the circuits’ protection system occurs one of the parallel lines has to be opened.

- How should this be coded?

<table>
<thead>
<tr>
<th>Fields</th>
<th>Form 6.1 A-D</th>
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</thead>
<tbody>
<tr>
<td>Fault Type</td>
<td>N/A</td>
<td>Event Type Number</td>
</tr>
<tr>
<td>Outage Initiation Code</td>
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<td>N/A</td>
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<tr>
<td>Initiating Cause Code</td>
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<td>Sustained Cause Code</td>
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</tr>
<tr>
<td>Outage Mode Code</td>
<td>N/A</td>
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</tr>
</tbody>
</table>
Test Your Knowledge – Example 8

- Single P-G fault on the Bus due to contamination, no damage resulted.
  - At what point are the individual outages over?
  - Which line(s) should this outage be reported for?
  - How would this be coded?

![Diagram showing a bus with lines L1, L2, L3, and a contamination point J.]
Test Your Knowledge – Example 8

• Single P-G fault on the Bus due to contamination, no damage resulted.
  ▪ At what point are the individual outages over?
  ▪ Which line(s) should this outage be reported for?
  ▪ How would this be coded?

<table>
<thead>
<tr>
<th>Fields</th>
<th>Form 4.1 L1, L2, L3</th>
<th>Form 5.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fault Type</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Outage Initiation Code</td>
<td></td>
<td>Event Type Number</td>
</tr>
<tr>
<td>Initiating Cause Code</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sustained Cause Code</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Outage Mode Code</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
• Single P-G fault on the Bus due to contamination, no damage resulted.
  - At what point are the individual outages over?
  - Which line(s) should this outage be reported for?
  - How would this be coded?

<table>
<thead>
<tr>
<th>Fields</th>
<th>Form 4.1 L1, L2, L3</th>
<th>Form 5.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fault Type</td>
<td>Single P-G fault</td>
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<tr>
<td>Outage Initiation Code</td>
<td>AC Substation-Initiated</td>
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<tr>
<td>Initiating Cause Code</td>
<td>Contamination</td>
<td>Event Type Number</td>
</tr>
<tr>
<td>Sustained Cause Code</td>
<td>Contamination</td>
<td>05</td>
</tr>
<tr>
<td>Outage Mode Code</td>
<td>Common Mode</td>
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</tr>
</tbody>
</table>
• Lines L4 and L5 are located on a common structure. A single lightning strike hits both circuits causing them to each experience a single phase to ground fault. Both breakers automatically reclose successfully and simultaneously.

  ▪ How would this be coded?
Test Your Knowledge – Example 9

- Lines L4 and L5 are located on a common structure. A single lightning strike hits both circuits causing them to each experience a single phase to ground fault. Both breakers automatically reclose successfully and simultaneously.
  - How would this be coded?

<table>
<thead>
<tr>
<th>Fields</th>
<th>Form 4.1 L4, L5</th>
<th>Form 5.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fault Type</td>
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<td></td>
</tr>
<tr>
<td>Outage Initiation Code</td>
<td></td>
<td>Event Type Number</td>
</tr>
<tr>
<td>Initiating Cause Code</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sustained Cause Code</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Outage Mode Code</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Lines L4 and L5 are located on a common structure. A single lightning strike hits both circuits causing them to each experience a single phase to ground fault. Both breakers automatically reclose successfully and simultaneously.

- How would this be coded?
Test Your Knowledge – Example 10

• A relay fails causing a 230/345 kV transformer outage.
  ▪ How would this be coded?
A relay fails causing a 230/345 kV transformer outage.

- How would this be coded?

<table>
<thead>
<tr>
<th>Fields</th>
<th>Form 4.3 TF1</th>
<th>Form 5.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fault Type</td>
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<tr>
<td>Outage Initiation Code</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Initiating Cause Code</td>
<td></td>
<td>Event Type Number</td>
</tr>
<tr>
<td>Sustained Cause Code</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Outage Mode Code</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
A relay fails causing a 230/345 kV transformer outage.

- How would this be coded?

<table>
<thead>
<tr>
<th>Fields</th>
<th>Form 4.3 TF1</th>
<th>Form 5.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fault Type</td>
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<tr>
<td>Outage Initiation Code</td>
<td>Protection System-Initiated</td>
<td>Event Type Number 62</td>
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<tr>
<td>Initiating Cause Code</td>
<td>Failed Protection System Eq.</td>
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<tr>
<td>Sustained Cause Code</td>
<td>Failed Protection System Eq.</td>
<td></td>
</tr>
<tr>
<td>Outage Mode Code</td>
<td>Single Mode</td>
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</tr>
</tbody>
</table>
A conductor breaks causing a phase to phase fault. The breaker on one end of the line fails to operate due to a relay Misoperation causing breakers on lines L2 and L3 to open.

- How would this be coded?
A conductor breaks causing a phase to phase fault. The breaker on one end of the line fails to operate due to a relay Misoperation causing breakers on lines L2 and L3 to open.

- How would this be coded?

<table>
<thead>
<tr>
<th>Fields</th>
<th>Form 4.1 L1</th>
<th>Form 4.1 L2, L3</th>
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<tr>
<td>Outage Initiation Code</td>
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<tr>
<td>Initiating Cause Code</td>
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<td></td>
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<tr>
<td>Sustained Cause Code</td>
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<td>Event Type Number</td>
</tr>
<tr>
<td>Outage Mode Code</td>
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<td></td>
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</tr>
</tbody>
</table>
A conductor breaks causing a phase to phase fault. The breaker on one end of the line fails to operate due to a relay Misoperation causing breakers on lines L2 and L3 to open.

- How would this be coded?

<table>
<thead>
<tr>
<th>Fields</th>
<th>Form 4.1 L1</th>
<th>Form 4.1 L2, L3</th>
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<td>Protection System-Initiated</td>
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<td>Failed Protection System Eq.</td>
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<td>Failed Protection System Eq.</td>
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<tr>
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<td>Dependent Mode</td>
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</tbody>
</table>

Event Type Number: 61
Course and Objective Review
Course Objective

- Overall TADS In Depth Training Course Objective (i.e. what you will learn or our goal):
  - Consistent, complete and accurate outage and event reporting for TADS elements.
Learning Objective

TADS In Depth Training Learning:

1. Understand the TADS In Depth Training Learning objectives.
2. Review of why TADS is collected and how the data is used.
3. Get acquainted with the Annual Maintenance for TADS and where to find details on how to perform the necessary tasks.
4. Determine the difference between in-service and not in-service states.
5. Understand event id code creation and assignment.
6. Become familiar with the assignment of fault type and why the information is collected.
7. Learn the six outage initiation codes and how to use them to describe where the outage was originated.
TADS In Depth Training Learning:

8. Obtain the options for selecting the correct initiating cause code for automatic and operational outages.

9. Recognize what contributed to the longest duration for a sustained outage and select the correct sustained cause code for automatic outages.

10. Identify the difference between the outage mode codes and how to use them to show the relationships between automatic outages.

11. Explore common validation errors and how to avoid them.

12. Participate in test your knowledge activities to strengthen and solidify newly acquired TADS reporting concepts.
Break

Return at XX:XX a.m.
Exercise

Return at XX:XX a.m.
Questions and Answers