NERC Transmission Availability
Data System (TADS)
Part A – Scope & Reports

TADS Training – Fall 2011
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Presentation: Part A – Scope & Reports

- Automatic Outages & Non-Automatic Outages
- Why TADS is needed
- What’s New?
- Coordination and Quality Control
- Region and NERC summary Reports
- Q & A

Presentation: Part B – Key Definitions and Forms

- Key Definitions
- Forms – other details
- Open Q & A
Outages – scope of work

- **Automatic Outages** – Momentary and Sustained
- **Non-Automatic Outages** – one minute or more duration
- **Elements** to be reported
  - AC Circuits
  - DC Circuits
  - Transformers (low side $\geq 200$ kV)
  - AC/DC Back-to-Back Converters

\[ \geq 200 \text{ kV} \]
Auto Outages - Overview of Data & Metrics

- **Automatic Outage Data**
  - Event ID & Event Type
  - Outage ID code
  - Fault Type
  - Outage Initiation Code
  - Outage Start Time
  - Outage Duration
  - Outage Cause Codes
    - Initiating (17 codes)
    - Sustained (17 codes)
  - Outage Mode

- **Inventory Summary**
  - Voltage Classes for OH & UG
  - # of Circuits & Circuit Miles
  - Multi-Circuit Structure Miles

- **Auto Outage - basic metrics**
  - Outage frequency
  - Outage Duration per Element
  - Mean time between failure
  - Mean time to repair
  - Median time to repair
  - Percent availability
  - Percent of Elements with no Automatic outages

- **RMWG metrics ALR6 - 11 to 15**
  Automatic AC Transmission Outages initiated by:
  - Failed Protection System Equipment (ALR6-11), Human Error (ALR6-12), Failed AC Substation Equipment (ALR6-13), Failed AC Circuit Equipment (ALR6-14)
  - Element Availability % (ALR6-15)
Non-Auto Outages - Overview

- **Non-Automatic Outage Data**
  - Outage ID code
  - Outage Start Time
  - Outage Duration
  - Outage Type
    - Planned Outage
    - Operational Outage
  - Planned Outage Cause Codes
    - Maintenance and Construction
    - Third Party Request
    - Other Planned Outage
  - Operational Outage Cause Codes
    - Emergency
    - System Voltage Limit Mitigation
    - System Operating Limit Mitigation, except voltage
    - Other Operational Outage

- **Non-Auto Outage - basic metrics**
  - Outage frequency
  - Outage Duration per Element
  - Mean Outage Time
  - Median Outage Time
  - Percent of Elements with no Non-Automatic outages
  - Maximum Percent of simultaneous outages
http://www.nerc.com/filez/tadswg.html

## TADS Data Instruction Manual and Workbook

<table>
<thead>
<tr>
<th>File Type</th>
<th>Size</th>
<th>Date</th>
<th>Description</th>
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<tbody>
<tr>
<td>Acrobat</td>
<td>1345 KB</td>
<td>12/09/10</td>
<td>TADSWG Data Reporting Instruction Manual</td>
</tr>
<tr>
<td>Acrobat</td>
<td>340 KB</td>
<td>12/09/10</td>
<td>TADSWG Appendix 7</td>
</tr>
<tr>
<td>Excel</td>
<td>1202 KB</td>
<td>12/09/10</td>
<td>TADSWG 2011 Workbook</td>
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## TADS Proposed Event Type Numbers

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<tr>
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<tr>
<td>Acrobat</td>
<td>463 KB</td>
<td>11/12/10</td>
<td>TADSWG Request for Approval of Changes to TADS Event Type Data Collection</td>
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<tr>
<td>Acrobat</td>
<td>203 KB</td>
<td>11/12/10</td>
<td>TADSWG Response to Comments on Proposed Revision to TADS Even Type Data Collection</td>
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<tr>
<td>Acrobat</td>
<td>186 KB</td>
<td>07/07/10</td>
<td>TADS Proposed Event Type Numbers - Data Request Letter</td>
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<tr>
<td>Acrobat</td>
<td>143 KB</td>
<td>05/10/10</td>
<td>DRAFT - TADS Data Reporting Instruction Manual with Proposed Event Type Numbers</td>
</tr>
<tr>
<td>Acrobat</td>
<td>316 KB</td>
<td>05/10/10</td>
<td>DRAFT - TADS Appendix 7 Definitions with Proposed Event Type Numbers</td>
</tr>
</tbody>
</table>
webTADS Software and hardware service by OATI

- software ‘Help’ menu → ‘Documents’
  - reference guides & training material including this presentation

- software Support desk is available every work day 7AM to 7PM Central prevailing time.

- For software navigation, display or logon related questions - call OATI Support (763-201-2020, support@oati.net)

Note: For TADS Data Instruction Manual issues call your TADS Regional Entity Coordinator (REC). If REC not available, call Clyde Melton (404-446-2576) or Jim Robinson (610-841-3362).
Why TADS is Needed

- Energy Information Administration data (Schedule 7 on Form 411) was voluntary and of no use to NERC
  - EIA proposed to make Schedule 7 mandatory in 2008
- Prior to 2008 no systematic transmission outage data collection existed for all of North America

Intended Uses and Limitations of Data and Metrics

- Automatic Outage cause and Event analysis.
- Event analysis will aid in determination of ‘credible contingencies’ and will result in better common understanding among all sectors and stakeholders.
Intended Uses and Limitations (continued)

- Common understanding of outage statistics will improve planning, operations, and improve Standards.
- Trending each Regional Entity’s performance against its own history will show how performance is changing.
- Years of data collection (3-5 years) are needed before a Region’s data can be useful for analysis.
- Vast physical differences exist between Regions
  - Weather, load density, geography, system age, customer mix, impact of events, average circuit mileage, etc.
Clarified Definitions

- Normal Clearing Circuit Breaker Set
- Non-Automatic outages – one minute or more duration

2012 – Revised Event Type Numbers (Form 5 and Form 4.x)

- 2011: No change – #10, 20, 30, 40 “Normal Clearing” & 50 “Other”
- 2012: Six “Normal Clearing” & four “Abnormal Clearing” Event Type Numbers

Data Quality Review REPORTS for TO review prior to March 1st

- webTADS Software Training under HELP documents
- Auto Outage – “Data Quality Report”, Unknown outage Cause per Circuit
- Auto Outage – “Event ID Possible Consolidation” Report
- Inventory EOY versus BOY Comparison Report
The Outage Mode Code describes whether an Automatic Outage is related to other Automatic Outages. Several Outage Mode Codes are provided:

- **Single Mode Outage** is one Automatic Outage which occurred independent of any other Automatic Outages (if any).

- **Dependent Mode Initiating Outage** is a Single Mode Outage that initiates one or more subsequent Automatic Outages.

- **Dependent Mode Outage** is one that occurred as a result of an initiating outage, whether the initiating outage was an Element outage or a non-Element outage.

- **Common Mode Outage** is 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).

- **Common Mode Initiating Outage** is a Common Mode Outage that initiates one or more subsequent Automatic Outages.
No Change - Event Identification

- Network incident that results in the Sustained or Momentary outage of **one or more TADS Elements**.

- Each outage in a related set of two or more outages (e.g., Dependent Mode, Dependent Mode Initiating, Common Mode, or 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.

- TOs (or Regional Entities) coordinate a unique NERC wide Event ID code if outages affect two or more Reporting TOs
  - On Form 5 in webTADs select the ‘NERC company’ and Add a NERC ‘Event ID’ code using the GUI display.
  - The Description of the Event can be read by any webTADS TO user. However, such ‘NERC company’ Event ID information is not public.

- Event associated with a **Single Mode Automatic Outage** will have just **one 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.
- 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.
For TADS purposes Normal Clearing includes a Protection System operating as designed for non-fault conditions where an Outage occurs as expected with proper functioning of the installed Protection System.

Normal Clearing applies to the opening of circuit breakers. Subsequent automatic reclosing by the Protection System is not included in the Normal Clearing time frame.

Example of Normal Clearing where reclosing did not function properly;

- A single AC Circuit is struck by lightning (with no damage to the equipment) and the Protection System clears the fault as designed with Normal Clearing. However;
- Protection System automatic reclosing equipment fails to re-energize the AC Circuit.
- The above sequence of events is still an example of “Normal Clearing” coded as an Automatic Outage of a single Element (#10-2011, #11-2012).
### Five 2011 Event Type Numbers

<table>
<thead>
<tr>
<th>Event Type Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>Automatic Outage of an AC Circuit or Transformer with Normal Clearing.</td>
</tr>
<tr>
<td>20</td>
<td>Automatic Outage of a DC Circuit with Normal Clearing.</td>
</tr>
<tr>
<td>30</td>
<td>Automatic Outage of two ADJACENT AC Circuits on common structures with Normal Clearing.</td>
</tr>
<tr>
<td>40</td>
<td>Automatic Outage of two ADJACENT DC Circuits on common structures with Normal Clearing.</td>
</tr>
<tr>
<td>50</td>
<td>Other</td>
</tr>
</tbody>
</table>
### Event Type Mapping

<table>
<thead>
<tr>
<th>2011 Event Type Numbers</th>
<th>2012 Event Type Numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>11</td>
</tr>
<tr>
<td>20</td>
<td>11</td>
</tr>
<tr>
<td>30</td>
<td>31</td>
</tr>
<tr>
<td>40</td>
<td>31</td>
</tr>
<tr>
<td>50</td>
<td>Two separate categories: Normal Clearing – 05, 06, 13, and 49; Abnormal Clearing - 60, 61, 62 and 90</td>
</tr>
<tr>
<td>Event Type Number</td>
<td>Description</td>
</tr>
<tr>
<td>-------------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>05</td>
<td><strong>Single bus section fault or failure</strong> (200kV or above) resulting in one or more Automatic Outages.</td>
</tr>
<tr>
<td>06</td>
<td><strong>Single internal circuit breaker fault</strong> (200kV or above) resulting in one or more Automatic Outages.</td>
</tr>
<tr>
<td>11</td>
<td><strong>Automatic Outage of a single Element.</strong></td>
</tr>
<tr>
<td>13</td>
<td><strong>Automatic Outage of two or more Elements within one Normal Clearing Circuit Breaker Set (NCCBS).</strong></td>
</tr>
<tr>
<td>31</td>
<td><strong>Automatic Outages of two or more TADS adjacent AC Circuits or DC Circuits on common structures.</strong> 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><strong>Other Automatic Outage(s) with Normal Clearing</strong> not covered by Event Type Numbers 05 through 31 above.</td>
</tr>
</tbody>
</table>
Events with Abnormal Clearing

<table>
<thead>
<tr>
<th>Event Type Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>60</td>
<td>Breaker Failure: One or more Automatic Outages with Delayed Fault Clearing due to a 200kV and above circuit breaker being stuck, slow to open or failure to interrupt current.</td>
</tr>
<tr>
<td>61</td>
<td>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.)</td>
</tr>
<tr>
<td>62</td>
<td>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.</td>
</tr>
<tr>
<td>90</td>
<td>Other Automatic Outage(s) with Abnormal Clearing not covered by Event Type Numbers 60 through 62 above.</td>
</tr>
</tbody>
</table>
Normal Clearing CB Set (NCCBS)

New Definition:
#16. Normal Clearing Circuit Breaker Set (NCCBS)
The set of circuit breakers that would open to isolate a fault on a given Element under Normal Clearing.

For each Element by design, a given set of circuit breakers trip in order to interrupt fault current (if a fault occurred on the Element). In general, this set of circuit breakers may be determined by examining an elementary single line diagram of the circuit which includes the TADS defined Element.

Please note when this given set of circuit breakers open, two or more Elements may change to a not In-Service State and therefore become reportable Automatic Outages. In such a case these Outages are reportable as one Event, and the same Event ID should be used for each of the Outages.
• #05 to #49 are with Normal Clearing. They apply only when Automatic Outages are the result of Protection Systems and controls disconnecting elements that are expected to be automatically disconnected for a single event.

• Normal Clearing is defined in the NERC Glossary of Terms Used in Reliability Standards: “A protection system operates as designed and the fault is cleared in the time normally expected with proper functioning of the installed protection systems.”

• #06 -- “An internal breaker fault means a breaker failing internally, thus creating a system fault which must be cleared by protection on both sides of the breaker.”

• If a line section contains two or more Multi-Circuit Structures which form one or more multi-circuit spans, the total span length can be measured and associated mileage is be reported in ‘Multi-Circuit Structure Mile’ total inventory. If multiple circuits are connected to only one common structure, that structure should be ignored for outage and inventory mileage purposes.

• #49 includes Automatic Outage(s) initiated by normal operation of a Special Protection System (SPS) or Remedial Action Scheme (RAS). See NERC Glossary of Terms.
New Definition:

#17. Abnormal Clearing
The outage of a TADS Element that does not conform with Normal Clearing in all aspects.

For a given Event ID and its associated Automatic Outages, an Automatic Outage which results from one or more unintended 200kV or above circuit breaker operations outside the NCCBS should be categorized as Abnormal Clearing.
• #60, 61, 62 & 90 are Events with Abnormal Clearing. These numbers apply when Normal Clearing does not occur for any one or more Automatic Outage associated with the Event.

• #90 includes Automatic Outage(s) initiated by abnormal operation of a Special Protection System (SPS) or Remedial Action Scheme (RAS).
To qualify for an Event Type 31, the outages must be a direct result of the circuits occupying common structures. These characteristics will generally apply.

1. The *Outage Initiation Codes* are either Element-Initiated or Other-Element Initiated.

2. The *Outage Mode Codes* are one of the following:
   (a) Dependent Mode Initiating (one outage) and Dependent Mode (second outage);
   (b) Common Mode Initiating and Common Mode (two outages);
   (c) both Common Mode (two outages)
Example: On one AC circuit a conductor breaks (outaging the circuit), and the conductor swings into a second circuit on common structures and outages the second circuit. Both circuits have Normal Clearing.

Enter Event Type# as 31

Example: Two AC Circuits on common structures are outaged due to a bus fault in the AC Substation were the circuits terminate. Both circuits have Normal Clearing.

Enter Event Type# as 05 - Single bus section fault or failure

Event Type #13, typical Form 4 Outage Mode Codes:
• Automatic Outage of two or more Elements within one Normal Clearing Circuit Breaker Set (NCCBS).
• Dependent Mode Initiating, Dependent Mode
#11 “Automatic Outage of a single Element” is intended to include a single Automatic Outage resulting from one or more non-TADS Element outages.

- This type of Event should not be entered as #49 “Other Normal Clearing”.

If Element outage results from one or more non-TADS Element outages, the “Outage Initiation Code” (Form 4) should be entered as “Dependant Mode”.

#13 versus #11: #13 is similar to #11 except a total of two or more Element outages occur within one NCCBS.
Coordination & Quality Control

- Each TO is responsible for data quality. Each Regional Entity Coordinator (REC) is available to assist TOs.
  
  - TO contact name updates & checklist (Form 1.1 & 1.2)
  - “Multi-Owner” reporting coordination (Form 2.x)
    - single TO responsible for reporting of outages AND inventory.
  - “Event ID” code for TADS Events affecting more than one TO (Form 5).
    - Enter a TADS “NERC Company” Event ID code.
  - Prior to March 1st, TOs should reconcile their TADS reported outages with outages reported in PRC and EOP required reports.
NERC Glossary of Terms defines Misoperation as:

- “Any failure of a Protection System element to operate within the specified time when a fault or abnormal condition occurs within a zone of protection.
- Any operation for a fault not within a zone of protection (other than operation as backup protection for a fault in an adjacent zone that is not cleared within a specified time for the protection for that zone).
- Any unintentional Protection System operation when no fault or other abnormal condition has occurred unrelated to on-site maintenance and testing activity.”

For each sample ‘Misoperation Cause’ below, based on the current ‘TADS Cause Code’ definitions, the following ‘Cause Codes’ should be used on Form 4.x;
### Mapping of Sample Misoperation Causes to "Equivalent" TADS Cause Codes

<table>
<thead>
<tr>
<th>Misoperation Cause</th>
<th>TADS Cause Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Field/Physical Execution Error</td>
<td>- Human Error</td>
</tr>
<tr>
<td>Engineering/Design Issue/Error</td>
<td>- Human Error</td>
</tr>
<tr>
<td>Engineering/Design Issue/Error - Settings</td>
<td>- Human Error (if NERC Registered Entity staff or Entity design contractor make the error)</td>
</tr>
<tr>
<td>Engineering/Design Issue/Error - Design</td>
<td>- Human Error (if NERC Registered Entity staff or Entity design contractor make the error)</td>
</tr>
<tr>
<td></td>
<td>- Failed Protection System Equipment (if Equipment Vendor made a design error)</td>
</tr>
<tr>
<td>Relay Failure</td>
<td>- Failed Protection System Equipment</td>
</tr>
<tr>
<td>Relay condition</td>
<td>- Failed Protection System Equipment</td>
</tr>
<tr>
<td>Substation AC Failure</td>
<td>- Failed AC Substation Equipment (if failed on the primary insulation side &gt; 200 kV)</td>
</tr>
<tr>
<td></td>
<td>- Failed Protection System Equipment (if failure on secondary side of relay PT, relay control system, Current Transformer core, etc.)</td>
</tr>
<tr>
<td>Substation DC 120/240 V Power/Control Failure</td>
<td>- Failed Protection System Equipment</td>
</tr>
<tr>
<td>Communication Failure</td>
<td>- Failed Protection System Equipment</td>
</tr>
<tr>
<td>SCADA Control</td>
<td>- Other (Use 'Other’ if SCADA Control equipment failed.) (Not to be coded as Failed Protection System Equipment)</td>
</tr>
<tr>
<td></td>
<td>- Human Error (if NERC Registered Entity staff or Entity contractor make the error)</td>
</tr>
</tbody>
</table>
Each TO is responsible for data quality & checking each Form as “Complete”.

Prior to March 1st, TOs should review their TO webTADS “Reports” such as:

- End of Year (EOY) compared to Beginning of Year (BOY) inventory of # circuits and # miles.
- Outage Data summary per circuit (Auto Outages Counts per # circuits)
- “Unknown” data count per circuit - TO rank report to identify your data discrepancies. (No other TO names displayed).
- Event ID Possible Consolidations REPORT
- TADS Metrics (MTBF, MTTR, etc)
Examples in the Manual were developed to assist TOs in responding properly to TADS data request.

- Both inventory and outage examples are included in the data instruction manual.
- Inventory examples are designed to demonstrate proper calculation of entries in Form 3.x.
- Automatic ‘Outage Mode’ examples are provided to illustrate several AC Circuit & Transformer outage scenarios.
<table>
<thead>
<tr>
<th>Regional Staff Coordinator(s)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Scott Beecher</td>
<td>FRCC</td>
</tr>
<tr>
<td>Dan Jesberg &amp; Adam Flink</td>
<td>MRO</td>
</tr>
<tr>
<td>Jack Alvarez</td>
<td>NPCC</td>
</tr>
<tr>
<td>Art Buanno</td>
<td>RFC</td>
</tr>
<tr>
<td>Maria Haney, Barbara Doland</td>
<td>SERC</td>
</tr>
<tr>
<td>Temper Williams &amp; Mike Riley</td>
<td>SPP</td>
</tr>
<tr>
<td>Curtis Crews</td>
<td>TRE</td>
</tr>
<tr>
<td>Donald Davies (REC), Doug Tucker (DRE)</td>
<td>WECC</td>
</tr>
</tbody>
</table>
After webTADS Change Order #5 is placed in production, see your Region & NERC wide “Report” in webTADS. “Singleton” voltage class data is redacted (omitted).

Display or export your Region and NERC Report.

• Same format is available to you for your TO statistics.
Presentation: Part A – Scope & Reports

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Presentation: Part B – Key Definitions and Forms

- Key Definitions
- Forms – other details
- Open Q & A
**AC Circuit**
- A set of three phase conductors that are bound by AC Substations.
- In-line switches and series compensation equipment are defined to be within the boundary of the AC Circuit.

**AC Substation**
- Circuit Breakers, transformers, disconnect switches, buses, shunt capacitors, wave traps, metering PTs, etc. are AC Substation and NOT part of the AC Circuit.

**Protection System Equipment** *(including control equipment)* is excluded from AC Substations
- **Outage Initiation Code** for protection system mis-operation is **Other Facility – Initiated Outage** (NOT AC Substation – Initiated)
**AC Circuit  Transformer Exclusion**

- **AC Circuit boundaries** are defined by the red “arcs” (A, B, & C).
- **Transformer boundaries** are defined by the breaker or disconnect switch.

Dashed lines are substation boundaries.
Sectionalizing Switches

- They are considered in-line switches, regardless of location

3 in-line NC switches, 1 NC circuit breaker disconnect

In-line switches are now inside AC Substation C.

2 in-line NC switches, 1 NC circuit breaker disconnect

‘AC Circuit’ boundaries (A, B, & C) are the same, but Circuit Miles are different (120 vs. 100).
Definitions (see Manual, Appendix 7)

- **In-Service State**
  - *Element* that is energized *AND* connected at *all its terminals* to the system.

- **Automatic Outage**
  - Results from automatic operation of switching device (includes Human Error resulting in unexpected CB trip outs)
  - *Element* changes from *In-Service State* to not in-service.

- **Non-Automatic Outage**
  - Results from the manual operation (including supervisory control) of a switching device.
  - *Element* changes from *In-Service State* to not in-service.
With one exception, TADS does not recognize partial power flow outages.

The exception is a three-terminal circuit with a Transformer on one leg.

If terminal A or B open, an AC Circuit outage is recorded.

The AC Circuit is considered to be restored (in-service state) if the circuit is energized AND both A & B connectivity is restored. Even if the Transformer (TADS Element or non-TADS) is out-of-service.
Definitions (see Manual, Appendix 7)

- **Duration** of outage (Form 4.x & 6.x)
  - Based on Start Time, and stop time when the *Element* returns to an *In-Service State*.

- **Momentary Outage** (Automatic Outages only)
  - Less than one minute. (*Sustained Outage* is one minute or more)
  - If it recloses and trips within less than one minute from the initial outage, it is considered one outage

- If *Element* returns to *In-Service State* for one minute or more, then the next outage is a new reportable outage
The **Outage Start Time** - The date (mm/dd/yyyy) and time (hh:mm), rounded to the minute, that the Automatic Outage of an Element started

- Outage Start Time is stored in database as UTC time. Start time data may be entered in local time and converted to UTC.
- Use of UTC time displays will allow TOs, REs and NERC to assign a ‘NERC company’ Event ID code to an Event that crosses TO or RE boundaries
- The “TADS Calendar Year” is defined as UTC calendar year 01/01/xx 00:00hrs start and 12/31/xx 24:00hrs stop in UTC time.

The **Outage Duration** (HHHH:MM for Sustained Outages) rounded to the nearest minute.

- Momentary Outages are recorded as a zero minute outage duration time to avoid confusion in rounding to the nearest minute (< 60 seconds = 0 minutes; do not round up 30-59s)

For outages that continue beyond the reporting period, UTC 24:00hrs 12/31, use the outage Continuation Code (Section 4.1 of the Manual)
**Outage Initiation Code**

Outage Initiation Code describes *where* an Automatic Outage was initiated on the power system. Five Outage Initiation Codes are available:

- Element-Initiated
- Other Element-Initiated
- AC Substation-Initiated
- AC/DC Terminal-Initiated (for DC circuits)
- Other-Facility Initiated - any facilities not included in any other Outage Initiation Code

**Note:** The *Protection System* is not part of an *AC Substation* or an *AC/DC Terminal*. While almost all outages involve the operation of the *Protection System*, the *Protection System* is only considered in these codes if the *Protection System* *misoperates* and therefore initiates an outage. In this case, it will be classified as Other-Facility Initiated.
Fault Type (Form 4.x)

- **Fault Type** (Form 4.x); 200kV and above

Descriptor of the fault, if any, *associated with* each Automatic Outage of an Element. Four fault type choices (or ‘unknown’) are available for each Element outage. System severity level:

- No fault
- Single phase-to-ground fault (P-G)
- Phase-to-phase fault (P-P)
- Phase-to-phase-to-ground (P-P-G), 3P, or 3P-G fault

- Fault Types may be determined from recorded relay targets or by other analysis. **TOs should use the best available data to determine (1) whether a fault occurred and, if so, (2) what fault type to report.**
Fault Type (Form 4.x)

- Relay targets should be recorded as soon as possible after a fault and re-set to prepare for the next fault.

- If more than one type of fault occurred for a given Element outage, use your best judgment on the above choice of fault type based on severity to the transmission system. [Not based on highest fault current.]

- The term “associated with” could be broadly interpreted to mean any fault, no matter how remote. However, use the guideline below related to Outage Initiation Code which provides information on failure location.

- Faults on equipment less than 200kV should not be reported. They should be coded as “No Fault”.

42 (guideline continued on next slide).
Fault Type (Form 4.x)

- Each Outage ID (Form 4.x) within an Event (Form 5), if the Outage Initiation Code is;

  - “Element-Initiated” -- report one of the Fault Types.
  - “Other Element-Initiated” -- report “No fault” for this outage since the Fault Type will be reported on the other Element that initiated this outage. [This guideline assumes the other Element was the only fault (if any). If this Outage ID also had a fault, report it.]
  - “Other Facility-Initiated” -- report “No fault” as the Fault Type. [This guideline assumes the Other Facility was the only fault (if any). If this Outage ID also had a fault, report it.]
  - “AC Substation-Initiated” or “AC/DC Terminal Initiated,” -- report a Fault Type ONLY if a fault occurred on 200kV or above AC equipment. Report “No fault” if a fault occurred on less than 200kV AC equipment.
Examples:

- 500 kV AC Circuit has one single line-to-ground fault that also trips a tapped 500/230 kV Transformer.
  - The AC Circuit’s *Outage Initiation Code* would be “Element-Initiated” and its *Fault Type* reported as “Single P-G fault.”
  - The Transformer’s *Outage Initiation Code* would be “Other Element-Initiated” and its *Fault Type* reported as “No fault.”

- 230kV bus has one single line-to-ground fault that opens two 230kV AC Circuits connected to the bus.
  - Each circuit’s *Outage Initiation Code* would be “AC Substation-Initiated” and
  - because the bus is 200 kV or greater, both AC Circuit’s *Fault Type* would be reported as “Single P-G fault.”
  - The 230kV bus is not a TADS reportable Element. It is AC Substation equipment.
Fault Type (Form 4.x)

Examples:

- 500kV AC Circuit trips when its relays operate due to a Protection System misoperation for a 230kV single phase-to ground fault on a 230/69 kV Transformer.
  - The AC Circuit’s Outage Initiation Code should be entered as “Other Facility-Initiated Outage” (because it was initiated by the Protection System which misoperated).
  - The AC Circuit’s Fault Type should be reported as “No fault.”

- 230kV AC Circuit trips due to a 230kV bushing insulator failure on a 230/69 kV Transformer which is tapped on the line terminal within the AC Substation. The failure was a 230kV single phase-to ground fault.
  - The AC Circuit’s Outage Initiation Code should be entered as “AC Substation-Initiated” and
  - since the fault was on 200kV or above AC Substation equipment (on the 230kV side of the 230/69kV transformer), the AC Circuit’s Fault Type should be reported as “Single P-G fault.”
**Outage Type** for Non-Automatic Outage

- **Operational Outage** (Form 6.x)
  
  ➢ A Non-Automatic Outage for the purpose of *avoiding an emergency* (i.e., risk to human life, damage to equipment, damage to property) OR *to maintain the system within operational limits* AND an outage that cannot be deferred.

- **Planned Outage** (Form 6.x)
  
  ➢ A Non-Automatic Outage with *advance notice* for the purpose of *maintenance, construction, inspection, testing, or planned activities* by third parties *that may be deferred* [Sustained Outage].
**Planned Outage** (continued)

- **Additional Switching Outage – 30 minute exclusion**

  An Outage of a TADS Element of 30 minutes or less duration resulting from switching steps or sequences that are performed in preparation for, or restoration of, the Planned Outage are NOT reportable.

  ✓ Appendix 10 “Planned Outages and the 30-Minute Exclusion Examples”

  ✓ See Example 2 and Example 2A

  ✓ The *Planned Outage* actual duration is reported in HHHH:MM even if it is 1-30 minutes in duration.

  ✓ Other element outages resulting from associated switching steps or outage sequences, are NOT reported unless their duration exceeds 30 minutes.
Cause Code for Non-Automatic Outage

- **Planned Outage Cause Codes** (3)
  - Maintenance and Construction
    - Planned Outage requests from any entity that is defined in the NERC Functional Model.
  - Third Party Request
    - Planned Outage requests from highway depart., Coast Guard, etc.
  - Other Planned Outage
    - Planned Outages for reasons not included in the above list, including human scheduling error.

- **Operational Outage Cause Codes** (4)
  - Emergency
    - Operational Outages that are taken for the purpose of avoiding risk to human life, damage to equipment, damage to property, or similar threatening consequences.
Operational Outage Cause Codes (continued)

- **System Voltage Limit Mitigation**
  - Operational Outages taken to maintain voltage on the transmission system within desired levels (i.e., voltage control).

- **System Operating Limit Mitigation, except voltage**
  - Operational Outages taken to keep the transmission system within System Operating Limits, except for System Voltage Limit Mitigation. The term “System Operating Limit” is defined in the NERC Glossary of Terms Used in Reliability Standards (see text box in TADS Appendix 7)

- **Other Operational Outage**
  - Outages for reasons not included in the above list, including emergency decision human judgment errors.
  - Does NOT include manual switching Human Error. These have no advance notice. Code these outages as Automatic Outages.
TADS Forms Overview

- **Administrative Forms with Transmission Owner Information**
  - 1.1 Non-Reporting Transmission Owner Statement
  - 1.2 Reporting Transmission Owner Information

- **Forms for TO Multi-Owner Facilities**
  - 2.1 TO Multi-Owner AC and DC Circuits
  - 2.2 TO Multi-Owner AC/DC Back-to-Back Converters

- **Forms for Element Inventory and Summary Outage Data**
  - 3.1 AC and DC Circuit Inventory Data
  - 3.2 Transformer Inventory Data
  - 3.3 AC/DC Back-to-Back Converter Inventory Data
  - 3.4 Summary of Outage Data
TADS Forms Overview

- **Forms for Detailed Element Automatic Outage Data**
  - 4.1 AC Circuit Detailed Automatic Outage Data
  - 4.2 DC Circuit Detailed Automatic Outage Data
  - 4.3 Transformer Detailed Automatic Outage Data
  - 4.4 AC/DC Back-to-Back Converter Detailed Automatic Outage Data

- **Form for Event ID Code Data**
  - 5 Event ID Code and Event Type No. Data

- **Forms for Detailed Element Non-Automatic Outage Data**
  - 6.1 AC Circuit Detailed Non-Automatic Outage Data
  - 6.2 DC Circuit Detailed Non-Automatic Outage Data
  - 6.3 Transformer Detailed Non-Automatic Outage Data
  - 6.4 AC/DC Back-to-Back Converter Detailed Non-Automatic Outage Data
Update reporting TO Primary, Secondary contacts and TO security Administrator

- Other contacts for TADS email notice purposes may also be entered

The “Checklist” table accounts for all forms for a given Reporting TO

- Which forms are declared ‘Exempt’ (not applicable for that TO in that year)
- Remaining forms are then created by webTADS
- Checklist tracks status of each TO’s form
  - “Awaiting Data” (no data entered)
  - “Data Submitted” (but not complete)
  - “Complete” (and passed basic error checks) by March 1st
Multi-Owners of a DC or AC Circuit

- Designated “Reporting TO” (Form 2.x) submits all circuit outages. The “Reporting TO” also reports the entire circuit on only ONE Inventory Form 3.x.

- Other multi-owners DO NOT report these circuits as Inventory on their Form 3.x. TO outage frequency metric calculations use total# of outages / # in inventory.

- Reporting of tie lines on Form 2.1 is NOT necessary if DC or AC Circuit’ Element is owned 100% by one TO.
  - Other TOs or other entities may own the substation equipment, but such a Circuit does not need to be reported on Form 2.1
  - It is assumed that the TO who owns 100% of the DC or AC Circuit Element will report all of the outages & inventory
  - However, substation equipment Owners for a given Element must report Element terminal outages to the “Reporting TO”.
Multi-Owners of a DC or AC Circuit

- Some entities that multi-own a DC or AC Circuit are not on the NERC Compliance Registry as a T-Owner
  - NCR ID numbers are not entered in TADS for Functional Entities which are not on the NERC compliance registry as a TO.
  - Example: A registered LSE wholesale customer owns a 345/138kV tap off of a registered TOs circuit, but the customer is not a registered TO.
    - The single registered TO then has 100% reporting responsibility
    - If the customer was also registered as a TO, this would be a Multi-Owner circuit reportable on Form 2.1
List any Multiple-Owner circuit that was in-service for at least part of the reporting period.

If a Multiple-Owner circuit configuration changes during the year which changes the number of circuits or mileage, list each of the configurations on Form 2.x with a different Element ID.
What if a TO wants to have another entity (like a Transmission Operator, TOP) report its data without joint registration?

- **TO may “subcontract”** its data reporting to another entity, but the **TO is still “responsible”** for timely and quality data to meet the NERC Board request.

- A written agreement between the TO and the other entity would be prudent.
The number of circuits and associated Circuit Miles are adjusted for time in-service of added or retired circuits to properly account for average exposure during the year.

- If *circuits* are added or retired, this data cannot be ‘Completed’ until the end of the reporting period.
- Appendix 7 has examples that calculate the “equivalent” data for “number of circuits” and “circuit miles”

<table>
<thead>
<tr>
<th>Row No.</th>
<th>Voltage Class [2]</th>
<th>No. of Circuits (End-of-Year)</th>
<th>Circuit Miles (End-of-Year)</th>
<th>No. of Circuits Added</th>
<th>Equivalent Annual No. of Circuits Added [3]</th>
<th>No. of Circuit Miles for Circuits Added</th>
<th>Equivalent Annual No. of Circuit Miles for Circuits Added [3]</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>200-299 kV AC Overhead</td>
<td>83.0</td>
<td>400.0</td>
<td>8.0</td>
<td>6.2</td>
<td>66.0</td>
<td>55.0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>No. of Circuits Removed</th>
<th>Equivalent Annual No. of Circuits Removed [3]</th>
<th>No. of Circuit Miles for Circuits Removed</th>
<th>Equivalent Annual No. of Circuit Miles for Circuits Removed [3]</th>
<th>CALCULATED Annual Equivalent No. of Circuits = B-D+E+I</th>
<th>CALCULATED Annual Equivalent No. of Circuit Miles = C-F+G+K</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.0</td>
<td>2.1</td>
<td>28.0</td>
<td>21.0</td>
<td>83.3</td>
<td>410.0</td>
</tr>
</tbody>
</table>
Rows 19-25: report **AC Multi-Circuit Structure Miles**

- We did not define a “circuit” for common structures, so the number of circuits is not required.
- Multi-circuit structures that are occupied by only one TADs reportable circuit do not contribute to the tabulation of Multi-Circuit Structure Miles. Examples:
  - A structure designed to have two 345 kV circuits that has only one circuit on the structure does not contribute.
  - A structure contains a 230 kV circuit and a 138 kV circuit does not contribute since the 138 kV circuit is < 200 kV.

Each DC pole outage (plus or minus polarity) is a separate DC Circuit outage (on Form 4.2) and each DC overhead line counted in Inventory (on Form 3.1) as 2 circuits (2 poles).
Form 3.2 (Transformer Inventory Data) and Form 3.3 (AC/DC Back-to Back Converter Inventory Data) are similar to Form 3.1 for the number of circuits

For Transformers

- The Voltage Class is the **high-side** voltage
- Transformers with low side voltage less than 200kV shall not be included in Form 3.2 inventory
- Do not include spares… only include transformers that are “in-service”
Data to be recorded for each outage includes…

- Several Element descriptors.
  - Element Type and Voltage Class
  - Location: (e.g., Substation Names that define an AC Circuit or Substation Name where Transformer is located)
  - TO’s Element Identifier – unique ID for each TO circuit
  - For AC or DC Circuits, was it an Overhead or Underground Circuit?

- Outage ID Code
  - Company unique ID assigned by the TO to each specific Element outage being reported. [Do not use the same Outage ID in different Calendar Years.]

- Event ID Code.
  - Company unique ID assigned by the TO for each specific Event defined on Form 5. ‘NERC company’ Event ID is required for two or more TOs.
  - Data for each Event ID Code is described on other slides for Form 5.
Sustained Outages have two step Cause Codes:

- An Initiating Cause Code that describes the initiating cause of the outage.
- A Sustained Cause Code that describes the cause that contributed to the longest duration of the outage. (Momentary Outages omit this second code)

Example: A lightning strike on an AC Circuit (the Initiating Cause Code is Lightning) that should have cleared normally became a Sustained Outage because of relay equipment misoperation (the Sustained Cause Code is Failed Protection System Equipment)

Seventeen (17) Cause Codes are defined
# Automatic Outage Cause Codes

1. Weather (excl. lightning)
2. Lightning
3. Environmental
4. Contamination
5. Foreign interference
6. Fire
7. Vandalism, terrorism, malicious acts
8. Failed AC Substation equipment
9. Failed AC/DC Terminal equipment
10. Failed Protection System equipment
11. Failed AC Circuit equipment
12. Failed DC Circuit equipment
13. Vegetation
14. Power system condition
15. Human error
16. Unknown
17. Other
18. Unavailable (2008 only)

Definitions of each cause code are included in the Manual, Appendix 7
Was the Event associated with the filing of a disturbance report (an EOP-004-01 disturbance report filing)?

- TO may select “yes,” “no,” or “unknown”
- Year-to-date public (i.e., non-confidential) data of all disturbance report filings are no longer listed on the NERC website. Talk with your TADS Regional Entity Coordinator (REC) if you are not sure whether your company (or TOP) filed a report with the Region.
- TADS REC & NERC staff will examine reports to fill in “unknown” responses
OUTAGE SUMMARY data (Form 3.4)

- Contains Automatic and Non-Auto Outage summary data

<p>| AC &amp; DC Circuit Automatic and Non-Automatic Outage Data |
|------------------|------------------|------------------|------------------|</p>
<table>
<thead>
<tr>
<th>(A)</th>
<th>(B)</th>
<th>(C)</th>
<th>(D)</th>
<th>(E)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Row No.</td>
<td>Voltage Class [2]</td>
<td>No. of Circuits with Zero Automatic Outages</td>
<td>Calculated Percentage Circuits with Zero Automatic Outages expressed as %</td>
<td>No. of Circuits with Zero Non-Automatic Outages</td>
</tr>
<tr>
<td>1</td>
<td>200-299 kV AC Overhead</td>
<td>41</td>
<td>60.00%</td>
<td>50</td>
</tr>
</tbody>
</table>

- Column B & D are the numbers that the Reporting TO must enter. Its based upon the number of Element IDs (AC Circuits, Transformers, etc.) that were “in-service” during any portion of the reporting period.

- The “Designated Reporting TO” on Form 2.x for multi-owner circuits reports the data for such circuits. The other Reporting TO owners must NOT double account for it on their Form 3.4
Confidential Information

- Non-Automatic Outage data (Form 6.x)
- Automatic Outage and Event data (Form 4.x & 5)
- Outage summary data (Inventory Form 3.4)
- TADS Element owned by more than one Transmission Owner (Form 2.x)
How TADS Was Developed

- Sept. 26, 2007  TADS Revised Phase I Report
- Oct. 23, 2007  NERC Board of Trustees approved mandatory collection of TADS Phase I data for U.S. Transmission Owners (TOs) on the NERC Compliance Registry.
- Sept. 11, 2008  TADS Phase II Final Report
- Oct. 29, 2008  NERC Board of Trustees approved Phase II under Rules of Procedure 1600 applicable to all NERC members.

See NERC website ‘Committees’ → NERC PC → TADS → TADSTF related files (see TADSTF archives for documents prior to July 1, 2009).
OUTLINE

Presentation: Part A – Scope & Reports
- Automatic Outages & Non-Automatic Outages
- Why TADS is needed
- What’s New?
- Coordination and Quality Control
- Region and NERC summary Reports
- Q & A

Presentation: Part B – Key Definitions and Forms
- Key Definitions
- Forms – other details
- Metric results need to be consistent. Please help us!
- Open Q & A
Thank you for your patience and hard work!

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TADS Manual w/Definitions
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