

Draft TADS Quarterly Reporting and Inventory Data Collection

Recommendation

The Performance Analysis Subcommittee (PAS) will work with the Transmission Availability Data System Working (TADSWG) Group to develop a proposal for:

1. **Quarterly reporting of TADS**
2. **Collection of Inventory data to support TADS**

Introduction

NERC's mission is to ensure the reliability of the North American bulk power system. With that responsibility, NERC and its stakeholders require accurate and complete data sets provided in a timely fashion to assess projected bulk power system reliability as well as analyze its ongoing performance and reliability risk. As evidenced in *2012 State of Reliability* report,¹ the TADS database is vital to support NERC in its assessment of bulk power system reliability.

The annual submission of TADS data does not align with other NERC metric reporting periods, and the out of sync reporting can lead to validation errors. Quarterly reporting of TADS data will enable more consistent reporting and metric display across all NERC data, and assist reporting entities in a more timely review of the data. Inventory data would help support risk studies such as determination of credible contingencies and bridging gaps between operating studies and planning assumptions.

Currently, cumulative inventory and individual transmission line outage data is submitted annually to NERC by Transmission Owners (TOs) via webTADS. Detailed inventory data for individual circuits and circuit miles along with outages associated with those circuits are currently not collected. Without this information, analysis of important explanatory variables affecting transmission performance determined by transmission line exposures (e.g. line length, number of terminals, etc.) cannot be conducted. Further, the data and output analysis cannot be used to support accurate year-to-year comparison and root cause analysis.

The two proposals for quarterly reporting and collection of detailed inventory data for TADS will provide the necessary information to be able to further analyze the data and provide high value information for risk analysis and shed light on areas where improvements can be made when appropriate and desired, in a timely manner. The benefits of each proposal along with next steps are described in detail below.

¹ http://www.nerc.com/files/2012_SOR.pdf

Data Submittal on a Quarterly Basis

Currently, transmission outage data is submitted annually to NERC by TOs via webTADS. NERC and the Regional Entities have identified the following issues with the current TADS annual reporting timeline:

1. Not able to identify risk trending in a timely fashion

NERC uses the severity risk index (SRI) to measure risks from major events.² The SRI considers generator outages, transmission outages, load loss and load restoration time. The generator outages can be obtained quarterly from webE-GADS. The disturbance event reports contain the load loss and restoration, which are available days after the events took place. However, NERC must wait until March 21 of the next calendar year for the transmission outages. The SRI values can only be computed annually, which delays NERC from identifying risk factors and trends on a quarterly basis.

2. Not synchronized with GADS and other non-TADS related metric reporting periods

The annual submission of TADS data does not align with NERC generator outage and non-TADS related metric reporting periods. The GADS data and non-TADS metric trends are updated and displayed quarterly on the NERC website using iDashboard. Therefore, quarterly reporting of TADS data would lead to consistent reporting and metric display across all NERC data.

3. Difficult for Registered Entities, Regional Entities and NERC to correct reporting errors from earlier periods

After significant time has passed, it is difficult for TOs, Regional Entities, and NERC to correct errors in the earlier quarters, which could potentially lead to a misrepresentation of the state of the North American transmission system.

4. Insufficient time to submit, vet and/or analyze 12-month data by Registered Entities, Regional Entities and NERC within first quarter of next year

TADS annual submission does not provide sufficient time for vetting and validating data by TOs, Regional Entities and NERC, which significantly impede NERC's ability to complete the annual state of reliability report in the second quarter of each year.

5. Not able to correlate event and TADS associated contributing factor(s) quarterly

Consistent and accurate reconciliation of yearly TADS data is difficult. On numerous occasions during event analysis of disturbances on the system, TADS data would have been helpful to analyze the event. With such a large lag in receiving the data, it is rare that the TADS data provides value to analyze disturbances on the system. With the new cause coding initiative at NERC, it is imperative to have transmission outage data within 3-4 months of a disturbance on the system. This data would help give a basic extent of the event for cause coding. Regional Entities and NERC staff spend many hours contacting TOs to determine completeness of TADS outage data and associated causes correlate to the transmission outages and causes in disturbance event reports.

² http://www.nerc.com/docs/pc/rmwg/pas/index_team/SRI_Equation_Refinement_May6_2011.pdf

6. Not able to correlate TADS with misoperations data

A significant amount of effort is needed by NERC and the Regional Entities staffs to match annual TADS data submission with the quarterly misoperations reporting. This work is necessary to ensure that NERC’s data is consistent enterprise-wide. Previous correlation attempts have resulted in serious discrepancies that could lead to potential analysis and data gaps.

The ERO-RAPA Group recommends changing current TADS annual reporting to a quarterly reporting. The quarterly reporting will provide timely trending and improve data quality. The incremental reporting effort from TOs entities appears reasonable (e.g., 3 more logins and XML uploads). The pros and cons of the quarterly reporting are summarized in Table 1.

Table 1: TADS Quarterly Reporting	
Pros	Cons
Provides timely data vetting/validation each quarter	Log into the on-line TADS tool 3 more times and upload quarterly data
Timely event and associated contributing factor trends	
Consistency for GADS and metric entry period	
TADS/Events reconciliation timely processed to ensure consistency and accuracy	
Builds expertise with stakeholders	
Faster trend determination and root-case analysis	
Help entities be more effective in reporting and reduce errors in data	

Transmission inventory Data Collection

Current TADS cumulative inventory and outage data lacks the details to conduct complete statistical analysis and ultimately providing the industry with greater value. Reporting detailed inventory of circuits and transformers would enable NERC to track outage rates on specific lines and transformers and target areas of concern.

The Western Electric Coordinating Council (WECC) has collected transmission line inventory data sets since 2007, including conductors per phase, insulation type, structure type, etc.³ to examine influencing factors, such as line mile, age, and common corridor. Besides single (category B) and multiple (category C) outages, WECC also evaluates the performance of category C5 outages (two lines constructed on the same tower), and two/more line outage in the same right-of-way. The ERO-RAPA is reviewing the WECC's 2011 transmission performance analysis results and its regional system performance criterion⁴ (TPL-001-WECC-CRT-2). Also, the former ECAR and MAIN regional councils collected some form of inventory data for their transmission line outage efforts.

Inventory data would support the following ERO risk analysis:

1. Risk studies need complete, accurate inventory data, such as determination of credible contingencies and bridging gaps between operating studies and planning assumptions, as outlined in section 2.6 (Intended Uses and Limitations of Data and Metrics) of the 2007 TADS report.⁵ Evaluating single (category B) and multiple (category C) outages will result in improved transmission system performance and contribute to modifications of the TPL standards.
2. Enable NERC to better analyze reliability trends and could potentially eliminate the need to collect automatic outage data for most individual circuits operated at 100-199 kV level.

One of the essential inventory information needed is a circuit mileage. Based on WECC's circuit inventory data, statistical analysis has revealed the circuit mileage is a significant contributor to transmission outage rates. There is a strong positive correlation of 0.44 ($-1 \leq \text{correlation} \leq 1$) between the circuit outage rate and its mileage. Without the individual circuit mileage information, the individual circuit performance cannot be correctly measured.

3. Reporting detailed inventory information would eliminate errors of multi-identifiers for a single Element. In webTADS, an outage is coded using an identifier that is free-form text. Analysis on a particular Element cannot be made as the TO can change the identifier from year to year. Reporting all lines would reduce the error of double counting inventory.
4. Listing detailed inventory would ensure complete and accurate reporting.

³ <http://www.wecc.biz/committees/StandingCommittees/PCC/RS/RPEWG/Shared%20Documents/2012%20WECC%20TRDTD%20Users%20Guide.doc>

⁴ <http://www.wecc.biz/library/Documentation%20Categorization%20Files/Regional%20Criteria/TPL-001-WECC-CRT-2%20System%20Performance%20Criterion%20-%20Effective%20April%202011%202012.pdf>

⁵ http://www.nerc.com/docs/pc/tadstf/TADS_PC_Revise_Final_Report_09_26_07.pdf

5. With detailed inventory, the questions on responsibility for reporting outages on lines in an EOP-004 disturbance report would be reduced.
6. A future enhancement could be made to the TADS system so that there is no need to enter TADS event IDs in the misoperation template. This would improve efficiency by reducing the amount of reporting and validation that is performed.
7. Probabilistic methods in planning and operations cannot be applied without known outage statistics on major transmission Elements.

Currently, several inventory attributes are collected for each Automatic and Non-Automatic Outage. NERC recommends that inventory related fields in the Automatic and Non-Automatic Outage forms be collected per Element in the transmission inventory data. These fields would no longer be reported for each Automatic and Non-Automatic Outage.

Also, NERC recommends TOs report the following additional transmission inventory data for each TADS Element:

1. **Element identifier – A unique identifier for each reporting transmission circuit or transformer**
The Element identifier will eliminate errors of multi entries for a single Element. In webTADS, an Element is coded using an identifier that is free-form text. This identifier is permitted to change on a year to year basis. From year to year, analysis on a particular Element cannot be made due to the possibility of the Element name changing from year to year. It is currently difficult, if not impossible, to determine outage statistics on individual circuits across years. The ability to monitor the same circuits over time is a capability that is needed for various statistical methods and reliability studies.

The Element identifier also provides information on Elements with no outages. This is because the inventory would list every Element instead of only Elements with outages. The individual Elements that have outage history will be used to determine credible contingencies, bridge gaps between operating studies and planning assumptions.

2. **Reporting TO – The TO company name with the reporting responsibility**
3. **Circuit mileage – The length of the transmission circuit**
Line mileages can track outage rates on individual circuits, identifying specific issues associated with the Element. This field would only be applicable to AC and DC circuit Elements.
4. **Voltage – The circuit nominal operating voltage**
5. **Change or Reconfiguration Date**
A new circuit/transformer or a reconfiguration for an existing circuit/transformer; a significant change in the current length of the circuit or change in route

6. Retirement Date

The retirement date is the date the Element becomes Out-of-Service for retired Elements.

7. Number of terminals – The number of connection points of the circuit**8. Terminal type** – The bus type that the Element is connected to at each of the terminals enumerated in item 3.⁶ Each terminal connection shall be coded as one of the following types:

- a. Single Bus
- b. Sectionalized Bus
- c. Main and Transfer Bus
- d. Ring Bus
- e. Breaker-and-a-Half
- f. Double Breaker-Double Bus
- g. Directly connected to another element (not necessarily a reportable Element)
- h. Other

9. Precursor Element(s): The Transmission Owner Unique Element Identifier(s) that preceded any reconfiguration of the Element. If the Element has never been reconfigured, leave blank.

The pros and cons of the inventory data collection are summarized in Table 2.

⁶ Bus types are defined in “Design Guide for Rural Substations,” Rural Utilities Service, United States Department of Agriculture, June 2001, Section 4.6, http://www.rurdev.usda.gov/SupportDocuments/UEP_Bulletin_1724E-300.pdf.

Table 2: TADS Inventory Collection

Pros	Cons
Support planning studies <ul style="list-style-type: none"> • Aid in the determination of credible contingencies • Bridge gaps between operating studies and planning assumptions • Detailed analysis to determine explanatory variables affecting line performance • Results in improved transmission system performance 	One time data collection effort required for initial inventory population
Eliminate errors of duplicate identifiers for a single Element	Yearly inventory update affecting approximately 3% of inventory data
Consistent with GADS inventory reporting	
Track outages rates on specific lines, targeting issues	
Reduce questions on responsibility for reporting outages on lines in EOP-004 disturbance reports and eliminate a possible opportunity for error in reporting number of circuits	
Possible future enhancement could use TADS inventory for misoperation reporting instead of TADS event ID	