



**Memorandum from the Office of the Inspector General**

June 22, 2021

Aaron P. Melda

**REQUEST FOR FINAL ACTION – EVALUATION 2020-15749 – TRANSMISSION  
SWITCHING AND CLEARANCE PROCEDURES**

Attached is the subject final report for your review and final action. Your written comments, which addressed your management decision and actions planned or taken, have been included in the report. Please notify us when final action is complete. In accordance with the Inspector General Act of 1978, as amended, the Office of the Inspector General is required to report to Congress semiannually regarding evaluations that remain unresolved after 6 months from the date of report issuance.

If you have any questions or wish to discuss our findings, please contact Heather R. Kulisek, Manager, Evaluations, at (423) 785-4815 or E. David Willis, Director, Evaluations, at (865) 633-7376. We appreciate the courtesy and cooperation received from your staff during the evaluation.

David P. Wheeler  
Assistant Inspector General  
(Audits and Evaluations)

HRK:FAJ  
Attachment

cc (Attachment):

TVA Board of Directors  
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OIG File No. 2020-15749



Office of the Inspector General

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# *Evaluation Report*

To the Senior Vice President,  
Transmission and Power Supply

# TRANSMISSION SWITCHING AND CLEARANCE PROCEDURES

## **ABBREVIATIONS**

CFR	Code of Federal Regulations
COP	Consolidated Outage Portal
CP	Certified Person
eSOMS	Enterprise Shift Operations Management System
iTOA	Integrated Tool for Operations Applications
LMS	Learning Management System
QP	Qualified Person
SOP	Standard Operating Procedure
SPP	Standard Programs and Processes
TFO	Transmission Field Operations
TOp	Transmission Operator
TOPS	Transmission Operations and Power Supply
TPS	Transmission and Power Supply
TRANS	Transmission
TVA	Tennessee Valley Authority

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MEMORANDUM DATED JUNE 16, 2021, FROM AARON MELDA TO  
DAVID P. WHEELER



# Evaluation 2020-15749 – Transmission Switching and Clearance Procedures

## EXECUTIVE SUMMARY

### Why the OIG Did This Evaluation

Working in industrial environments is inherently dangerous and steps must be taken to ensure the safety of personnel performing work on energized equipment. Proper practices and procedures can reduce the number of accidents resulting from an inadvertent release of hazardous energy,<sup>i</sup> according to the Occupational Safety and Health Administration.

Clearance procedures establish standardized requirements to ensure equipment is isolated from energy sources and rendered nonoperative before performing work where unexpected energizing, start up, or release of stored energy could occur and cause injury or property damage.

Transmission line switches provide the ability to remotely isolate a section of the line, reconfigure power flow, and minimize outage impact for customers. Switching in electric power systems must be performed safely to avoid injury to workers who perform the operations and to minimize the possibility of unscheduled outages or equipment damage due to erroneous switching.

Due to the importance of switching and clearances being performed safely to avoid injuries and to minimize the possibility of unscheduled outages or equipment damage, we performed an evaluation to determine if switching and clearances, required training, and audits were performed in compliance with Transmission and Power Supply's switching and clearance procedures.

### What the OIG Found

We determined the selected procedural requirements for requesting and tracking of switching and clearances were generally performed in accordance with procedures. We could not assess most procedural requirements related to preparation and performance of switching orders because field personnel performing the work do not always submit the completed switching order. However, we identified several instances where switching order steps were not performed in sequence as required. We also determined employees who performed key functions received required training; however, tracking of training could be improved. In addition, while clearance audits were completed by the appropriate personnel within the required time frames, their effectiveness could be increased.

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<sup>i</sup> Energy sources including electrical, mechanical, hydraulic, pneumatic, chemical, thermal, or other sources in machines and equipment can be hazardous to workers. During the servicing and maintenance of machines and equipment, the unexpected startup or release of stored energy can result in serious injury or death to workers.



# Evaluation 2020-15749 – Transmission Switching and Clearance Procedures

## EXECUTIVE SUMMARY

### What the OIG Recommends

We recommended the Senior Vice President, Transmission and Power Supply, take actions to address (1) completing switching order steps in sequence, (2) switching order documentation, (3) tracking of training, and (4) effectiveness of audits.

Our detailed recommendations are listed in the body of this report.

### TVA Management's Comments

In response to our draft report, TVA management accepted our recommendations and provided planned actions. See the Appendix for TVA's complete response.

### Auditor's Response

We concur with TVA management's planned actions for the recommendations.

## **BACKGROUND**

Working in industrial environments is inherently dangerous and steps must be taken to ensure the safety of personnel performing work on energized equipment. Proper practices and procedures can reduce the number of accidents resulting from an inadvertent release of hazardous energy,<sup>1</sup> according to the Occupational Safety and Health Administration. Clearance procedures establish standardized requirements to ensure equipment is isolated from energy sources and rendered nonoperative before performing work where unexpected energizing, start up, or release of stored energy could occur and cause injury or property damage.

Transmission line switches provide the ability to remotely isolate a section of the line, reconfigure power flow, and minimize outage impact for customers. According to the Electric Power Research Institute, switching operations in electric power systems must be performed safely to avoid injury to workers who perform the operations and to minimize the possibility of unscheduled outages or equipment damage due to erroneous switching.

Occupational Safety and Health Standards, Title 29, Code of Federal Regulations (CFR), Section 1910.269 (29 CFR §1910.269) provides requirements for de-energizing transmission lines, distribution lines, and equipment for the purposes of protecting employees. Transmission (TRANS) Standard Programs and Processes (SPP) 18.005, *Transmission Switching and Clearance Procedure*, implements the requirements of the regulation.

The switching and clearance roles are assigned to workers who have been trained to perform the roles described in TRANS-SPP-18.005. Key roles in the clearance and switching procedure include:

- Power System Transmission Operator (TOp) – Writes, reviews, and issues clearances.
- Qualified Person (QP) – Implements clearance by operating energy isolating devices in accordance with switching and clearance instructions to de-energize lines or equipment and installing clearance tags at each isolation point.
- Certified Person (CP) – Holds a clearance on lines or equipment for which servicing, maintenance, testing, and/or modifications are being performed.

The Consolidated Outage Portal (COP) is used to request switching and clearances held by the CP and contains information such as clearance points and performance dates. The TOp prepares, reviews, and issues switching orders. The QP then performs the work, provides step completion times, and

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<sup>1</sup> Energy sources including electrical, mechanical, hydraulic, pneumatic, chemical, thermal, or other sources in machines and equipment can be hazardous to workers. During the servicing and maintenance of machines and equipment, the unexpected startup or release of stored energy can result in serious injury or death to workers.

initials the switching orders. After the work is completed, the switching or clearances should be tracked through the Enterprise Shift Operations Management System (eSOMS) narrative log.<sup>2</sup> In addition, a Transmission Operator Record of Clearance form is used to track the clearances and provides pertinent information regarding the clearances.

TRANS-SPP-18.005 includes a requirement to complete periodic audits to ensure employees are knowledgeable of the clearance process and utilize the required clearance when performing maintenance or modification on equipment. The SPP requires (1) a TOp manager to perform at least one audit every year and (2) Transmission Field Operations (TFO) managers to perform audits approximately once a month. The monthly audit should include a walk-down inspection of the clearances being audited.

Due to the importance of switching and clearances being performed safely to avoid injuries and to minimize the possibility of unscheduled outages or equipment damage, we performed an evaluation of the transmission switching and clearance procedures.

## **OBJECTIVE, SCOPE, AND METHODOLOGY**

The objectives of our evaluation were to determine if switching and clearances, required training, and audits were performed in compliance with Transmission and Power Supply's (TPS) switching and clearance procedures. The scope of our review included (1) switching and clearances issued between January 1, 2020, and July 31, 2020; (2) training as of August 25, 2020; and (3) audits performed between October 1, 2018, and September 30, 2019. To achieve our objective, we:

- Reviewed applicable regulations and Tennessee Valley Authority (TVA) processes and procedures to determine procedural requirements, including:
  - 29 CFR §1910.269 (m), *Deenergizing Lines and Equipment for Employee Protection*
  - TRANS-SPP-18.005, *Transmission Switching and Clearance Procedure*
  - TRANS-SPP-17.005, *Transmission Clearance Process Training*
  - Transmission Operations and Power Supply – Transmission Operations-Standard Operating Procedure (TOPS-TO-SOP) 30.147, *Switching Instructions*
  - TRANS-SPP-30.003, *Transmission Outage Scheduling and Coordination Process*
  - TRANS-SPP-30.002, *Six Steps for Executing Switching Order Instructions*
  - TOPS-TO-SPP- 30.142, *Transmission Operator Shift Turnover Process*

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<sup>2</sup> Narrative logs provide an electronic journal for recording and capturing events that occur during an individual's shift.



- Interviewed pertinent personnel to gain an understanding of the switching and clearance procedures.
- Selected a statistical sample of 66 of 2,154 Narrative Log records from eSOMS<sup>3</sup> to determine if switching and clearances were performed in accordance with selected procedural requirements for (1) requesting and tracking of switching and clearances and (2) preparation and performance of switching orders (TVA form 40467). We used rate of occurrence sampling with a 95-percent confidence level.
- Reviewed training records in TVA's Learning Management System (LMS) to determine if TVA employees listed on the Official Clearance and Switching List<sup>4</sup> had completed required training for their designated role. In addition, we reviewed training records for the individuals performing key roles for the 66 switching and clearances in our sample to determine if they had received required training.
- Reviewed clearance audits to determine if they were performed in accordance with TRANS-SPP-18.005.

This evaluation was performed in accordance with the Council of the Inspectors General on Integrity and Efficiency's *Quality Standards for Inspection and Evaluation*.

## **FINDINGS**

We determined the selected procedural requirements for requesting and tracking of switching and clearances were generally performed in accordance with procedures. We could not assess most procedural requirements related to preparation and performance of switching orders because field personnel performing the work do not always submit the completed switching order. However, we identified several instances where switching order steps were not performed in sequence as required. We also determined employees who performed key functions received required training; however, tracking of training could be improved. In addition, while clearance audits were completed by appropriate personnel within required time frames, their effectiveness could be increased.

### **PROCEDURAL REQUIREMENTS ASSESSED WERE GENERALLY FOLLOWED BUT DOCUMENTATION WAS LIMITED**

We determined the 66 switching and clearances in our sample were performed in accordance with procedural requirements related to requesting and tracking, including:

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<sup>3</sup> We searched the eSOMS Narrative Log for entries that included "switching" and/or "clearance" and "complete." Therefore, we could not project because there could have been other narrative logs that should have been in our population but did not include the words searched.

<sup>4</sup> The Official Clearance and Switching List contains names of all personnel authorized to issue or perform switching and/or hold a clearance on electrical lines or equipment.

- Switching and clearances were scheduled within the required time frames.
- The Transmission Operator Record of Clearances included required sign-offs, name of the CP who held the clearance, and work performed where applicable.
- Switching and clearances that did not involve emergent work were requested in the COP.

We determined most procedural requirements related to preparation and performance of switching orders could not be assessed because field personnel performing the work do not always submit the completed switching order. However, we did identify that some switching order steps were not performed in sequence as required.

We reviewed the documentation for our sample and determined the switching orders were (1) not always attached or (2) incomplete in some instances. According to the Transmission Operations General Manager, eSOMS may not contain the complete version of the switching order since field personnel performing the work do not always submit the completed form. However, according to a senior program manager, there is an understanding that the switching order will be attached to eSOMS after the work is completed even though there is not a requirement in the procedures. Providing specific expectations regarding documentation requirements could provide more reliable information about the work performed in switching and clearances.

Even though documentation was incomplete, we were able to identify some switching order steps were not performed in proper sequence. TRANS-SPP-18.005, *Transmission Switching and Clearance Procedure*, required the QP to perform the operations “exactly in the order given” on the switching order. For 12 of the 54 switching and clearances in our sample that had the switching order available to review, there were steps completed out of the sequence designated on the switching order. For example, in one instance, personnel who should have been notified before the work was performed were not notified until the switching operation was complete. Performing steps out of sequence could result in an increased risk to employee safety and transmission equipment.

## **TRAINING WAS COMPLETED BUT TRACKING COULD BE IMPROVED**

We determined employees performing the functions of TOp, QP, and CP received required training; however, tracking of training could be improved. The Official Clearance and Switching List used to track individuals’ qualifications for key roles contained inaccurate information.

TRANS-SPP-18.005, *Transmission Switching and Clearance Procedure*, requires the Official Clearance and Switching List to be reviewed at least quarterly to verify individuals have completed training requirements and to remove delinquent individuals. According to TVA management, an automated

check between the Official Clearance and Switching List and LMS is used to determine if individuals on the list are qualified. However, there were several inaccuracies found on the list as noted below.

- Seven TOps who performed work on switching and clearances in our sample were not on the Official Clearance and Switching List and their training records had not been entered in LMS. We determined these individuals were qualified at the time they were assigned to the switching and clearances.
- Sixteen terminated employees still showed as qualified CPs. One individual was terminated in October 2019 and was still listed in August 2020.
- Fifty-five employees were listed as qualified for a function that no longer existed.

Inaccuracies in the Official Clearance and Switching List could increase the risk of an unqualified individual performing work on switching and clearances.

## **AUDITS WERE PERFORMED BUT COULD BE MORE EFFECTIVE**

We determined audits were completed by appropriate personnel within required time frames. However, we could not determine if the correct number of clearances were reviewed or confirm whether audited clearances had been written or issued by someone other than the auditor. Additionally, we determined effectiveness of the audits could be increased. Specifically, we found (1) the procedure does not provide specific requirements for how to perform the audit, and (2) there was no requirement to follow up on previous recommendations.

TRANS-SPP-18.005, *Transmission Switching and Clearance Procedure*, requires audits (1) be performed by TOp managers at least annually and TFO managers approximately monthly, (2) include at least 10 percent of active clearances in the annual audit, and (3) cannot be performed by managers who wrote or issued the clearances. We confirmed audits were performed by TOp managers annually and TFO managers monthly as required. However, we could not determine if the correct number of clearances were reviewed or confirm whether the audited clearances were written or issued by someone other than the auditor because of limited documentation. According to the interview with the TOp manager, at least 10 percent of active clearances were selected at the time the audit was performed.

TRANS-SPP-18.005 provides elements that could be included in the audit; however, the procedure does not provide specific requirements for the auditor to utilize when performing the audit. TRANS-SPP-18.005 states the audit may include a (an):

- Interview between the auditor and the QP, CP, or TOp of their responsibilities.
- Interview with QP/CP employees whose work activities are, or may be, in the areas of the equipment under the specific clearance being audited.

- Review of training records for the assigned positions QP, CP, or TOp employees in accordance with LMS.
- Determination that the Official Clearance and Switching List is current.
- Determination that paper or automated clearance forms are being maintained in accordance with this procedure.

Of the elements listed above, the annual clearance audit documentation shows evidence of interviews with the TOPs and a review of the Transmission Operator Record of Clearance. The form completed for the monthly clearance audit includes evidence of four of the five elements listed above. The form does not indicate there is an interview with QP/CP employees whose work activities are, or may be, in the areas of the equipment under the specific clearance being audited. This could indicate key elements are not being verified in the annual and monthly clearance audits.

In addition, there was no requirement in the procedure to review recommendations from previous year's audits. As a result, we found the 2019 audit had similar conclusions and recommendations as the 2018 audit, indicating recommendations were either not implemented or not effective. Providing specific requirements for completing audits, including reviewing previous audit recommendations, could increase the effectiveness of the audits.

## **RECOMMENDATIONS**

We recommend the Senior Vice President, TPS:

- Communicate the importance of completing switching order steps in sequence as required in TVA procedures.

**TVA Management's Comments** – A joint bulletin from TFO and TOPS management will be created and distributed to TPS, reinforcing the requirement of completing switching steps in the sequence they are released by the TOp. In addition, language will be added in the next off cycle revision of the *Transmission Switching and Clearance Procedure* to address line switching with multiple QPs and TOp approval for deviation in performance sequences.

**Auditor's Response** – We concur with TVA management's planned actions.

- Revise procedures to include steps for attaching completed switching orders to the eSOMS narrative logs.

**TVA Management's Comments** – The new outage application, Integrated Tool for Operations Applications (iTOA), will include a switching module. This application will have all planned switching archived as part of normal practice. Switching that is required outside of this application is required to be logged in the Operator log module of iTOA.

**Auditor's Response** – We concur with TVA management's planned actions.

- Revise the Official Clearance and Switching List to reflect current qualifications.

**TVA Management's Comments** – iTOA contains periodic updates from LMS to confirm a person's training is up to date before it allows switching steps to be issued for completion. A Maximo Action Tracking Item will be created to send an e-mail to the area supervisor of personnel listed in iTOA as QP or CP to verify their staff is listed correctly.

**Auditor's Response** – We concur with TVA management's planned actions.

- Revise the process for updating the Official Clearance and Switching List to check for employees no longer in a position to perform the function designated on the list, including terminated employees.

**TVA Management's Comments** – iTOA contains periodic updates from LMS to confirm a person's training is up to date including identifying personnel who are no longer TVA employees. For contract employees, additional steps will be required to maintain the Official Clearance and Switching List.

**Auditor's Response** – We concur with TVA management's planned actions.

- Revise procedures to include requirements for completing audits, including following up on previous recommendations.

**TVA Management's Comments** – An Operator Peer Team will review the standardized process of performing the clearance audits that includes a process for addressing recommendations from previous audits. Language will be added in the next off-cycle revision of the *Transmission Switching and Clearance Procedure* to address improvement items identified by the Operator Peer Team.

**Auditor's Response** – We concur with TVA management's planned actions.

June 16, 2021

David P. Wheeler, WT 2C-K

RESPONSE: DRAFT EVALUATION 2021-15749 – TRANSMISSION SWITCHING AND CLEARANCE PROCEDURES

Thank you for the opportunity to address the recommendations from Draft Evaluation 2021-15749 – Transmission Switching and Clearance. We accept these recommendations and have created CRs to track these and subsequent actions. We are confident that these measures will ensure that our organization will improve our alignment on strategy, team engagement and operational performance.

**Below are the five recommendations and identified CAPs in the CR:**

**Recommendation 1: Communicate the importance of completing switching order steps in the sequence as required in the TVA procedures.**

**Corrective Action 1:** Depending on the switching, multiple stations may be included and it may be acceptable to start at one station or the other, as long as the field staff perform the steps as they are released by the Transmission Operator (TOp). The TOp determines when it is acceptable to deviate from the station order listed on the switching. When a single station is involved, no deviation is allowed unless a step cannot be accomplished due to equipment trouble, and communication with the TOp is made and additional action is agreed upon by all parties. TRANS-SPP-18.005 R7 Section 3.2.2.D.4 addresses Qualified Person (QP) action if unable to perform the switching as written.

**Actions Taken 1:**

- (1) Create a joint bulletin from Transmission Field Operations (TFO) and Transmission Operations & Power Supply (TOPS) management and distribute to Transmission & Power Supply (TPS), reinforcing the requirement of completing switching steps in the sequence they are released by the TOp. The steps are sequenced in particular order based on procedural guidance and industry best practices to prevent risk to personnel safety, equipment damage, and customer service impacts.

Owner: Smith/Shultz Date: 09.17.2021

- (2) Add language in the next off cycle revision of TRANS-SPP-18.005 to Section 3.2.2.D to address line switching with multiple QPs and TOp approval for deviation in performance sequences.

Owner: Shultz Date: 12.17.2021

**Recommendation 2: Revise procedures to include steps for attaching completed switching order to the eSOMS narrative logs.**

**Corrective Action 2:** During the review period, Transmission Operations, Reliability, & Supervisory Control and Data acquisition (TORS) was in the process of implementing a new outage application. Integrated Tool for Operations Applications (iTOA) will include a switching module. This application will have all planned switching archived as part of normal practice. Switching that is required outside of this application is required to be logged in the Operator log module of iTOA. Guidance for logging is provided in TRANS-TSO-SPP-30.142 section 3.3.B.

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**Action(s) Taken 2:**

- (1) Include review of logging requirements in TRANS-TSO-SPP-30.142 section 3.3.B in Operator cycle training.

Owner: Wise      Date: 11.15.2021

**Recommendation 3: Revise Official Clearance and Switching List to reflect current qualifications.**

**Action(s) Taken 3:** During the review period, TORS was in the process of implementing a new outage application. Integrated Tool for Operations Applications (iTOA) will include a switching module. This model contains periodic updates from LMS to confirm a person's training is up to date before it allows switching steps to be issued for completion. This list performs an equivalency for all QP types. This also flags persons not qualified to perform switching steps.

- (1) Create a Maximo Action Tracking Item (ATI) to send an email to the area supervisor of personnel listed in the iTOA application as QP or Certified Person (CP) to verify their staff is listed correctly.

Owner: Plumb      Date: 09.17.2021

**Recommendation 4: Revise the process for updating the Official Clearance and Switching list to check for employees no longer in a position to perform the function designated on the list, including terminated employees.**

**Action(s) Taken 4:** During the review period, TORS was in the process of implementing a new outage application. Integrated Tool for Operations Applications (iTOA) will include a switching module. This model contains periodic updates from LMS to confirm a person's training is up to date including identifying personnel who are no longer TVA employees. The Official Switching and Clearance List also contains personnel who are contracting with TVA. The process for contracting employees will require two additional steps to fully maintain the list. The contractor supervisor will notify GM TORS to remove contracting personnel as well as TORS personnel will periodically notify staff to check their personnel on the switching lists.

- (1) Create a Maximo Action Tracking Item (ATI) to send an email to the area supervisor of personnel listed in the iTOA application as QP, CP to verify their staff is correctly listed and reassign designations as needed.

Owner: Plumb      Date: 09.17.2021

**Recommendation 5: Revise procedures to include requirements for completing audits, including following up on previous recommendations.**

**Action(s) Taken 5:** The clearance audit process has been completed as required in the procedure. Recommendation from the audits have been addressed by supervisor coaching of individual crews and inclusion in annual operator cycle training.

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- (1) TORS to utilize its Operator Peer Team to review and improve the standardized process of performing the clearance audits that includes a process for addressing recommendations from previous audits.

Owner: Shultz (Manager, Transmission Operations; Plumb) Date: 12.17.2021

- (2) Add language in the next off-cycle revision of TRANS-SPP-18.005 to Section 3.2.5 to address improvement items identified by the Operator Peer Team.

Owner: Shultz (Plumb) Date: 12.17.2021

#### **CONCLUSION**

All of the OIG's recommendations have been addressed, with corrections made or process improvements ongoing and tracked in the CR process. Accordingly, we submit this memorandum as our notice of acceptance of recommendations, as well as our initial corrective action plans. If you have further questions, please contact Josh Shultz at 423-751-8385.



Aaron Melda  
Senior Vice President  
Transmission & Power Supply

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OIG File No. 2020-15749