NERC
NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION

NERC Event Analysis Subcommittee Response to Request for Research

NERC Project 2010-01

Project Statement

The Event Analysis Subcommittee (EAS) has been asked by the Standards Committee (SC) via the NERC Operating Committee (OC) to offer opinions on NERC Project 2010-01 Request for Research. The core question to the EAS is: Do people other than System Operators need training and possibly certification? The basis for this question is the 2003 Blackout recommendation 19 – summarized as: *Improperly trained generator operators and operations planning and support staff can inadvertently take actions detrimental to the reliability of the Bulk Electric System.*

Does the need above correctly document the concern described in the following recommendations (excerpted from the August 14, 2003 Blackout Report), noting that Project 2007-04 Certifying System Operators has already partially addressed some of these concerns? *NERC should require training for the planning staff at control areas and reliability coordinators concerning power system characteristics and load, VAr, and voltage limits, to enable them to develop rules for operating staff to follow. NERC should require control areas and reliability coordinators to train grid operators, IT support personnel, and their supervisors to recognize and respond to abnormal automation system activity.*

Is a standard the appropriate vehicle to address this problem, or should an alternative approach be used? If an alternative is recommended, what would that alternative be? The Standards Committee's perspective in this question includes EMS support personnel, transmission and generation field personnel, and Engineering Support personnel. The ongoing implementation of PER-005 is also a consideration in this question. The Standards Committee would like to hear back from the EAS by Q1 2013.

Event Analysis Subcommittee Response

NERC currently has an Events Analysis database that includes the reportable events on the BPS from October 2010 to the present. The database has over 263 events, with 208 of those events cause coded to allow for trending and cluster analysis. The EAS and NERC EA staff, in response to the OC request, queried the 208 events and looked in particular for cause codes that pertain to human errors and training that was less than adequate. The query produced 44 events that had the possibility for human errors or training being a contributing factor in the event. After further review, the percentage of qualified events that had human error and less-than-adequate training is less than five percent of the total events that have been cause coded to date.

The 44 events were further reviewed and analyzed with 10 of the events having either human error or training less than adequate as a contributing factor. Six of the 10 events were related to the loss of EMS or

SCADA. With regards to the six EMS events, the EAS EMS Task Force is currently reviewing the events as part of a larger review of the 63 total EMS events which have occurred since October 2010. The task force, with industry subject matter experts, is reviewing the EMS events to determine what reliability risks are associated with the events and possible interventions to prevent them from happening again in the future. Additionally, BA, TOP, and RC EMS support staff typically undergo training.

Therefore, based on the information discussed in this document, the EAS does not believe it is necessary at this time to require EMS support personnel, transmission and generation field personnel, and Engineering Support personnel to receive the level of training required of a BA, TOP, and RC by NERC standard PER-005 or for them to be required to be certified at the BA, TOP, or RC level.

*Formatting edits made by Jordan Mallory on May 6, 2013.

NERC Event Analysis (EA) staff received a request to provide more clarity or depth regarding the above mentioned EA reports, specifically those that involved EMS and SCADA technicians or engineers as well as associated support personnel. The specific request was for EA staff to provide more detail into the types of errors and the generic basis of the events where training could be a possible contributing cause the reportable event. Below are the results of this continuation of the NERC EA staff review.

NERC EA Staff Response to Research Request

In an effort to provide more detailed information on the types of errors that were observed in the bulk power system (BPS) events since the inception of the NERC Events Analysis program, specifically the six EMS events that involved human error or potentially less than adequate training, the following summary is provided.

Generally, individual error is classified in the mode of performance that the individual was operating in when the error was committed. The NERC Cause Code Assignment Process uses a popular methodology as prescribed by Jens Rasmussen[1] where errors occur in one of three modes of human performance. Rasmussen's suggests that humans operate at one of the three levels, depending on the nature of the task and the level of experience with the particular situation. That is, when information is first perceived and interpreted in the processing system, that information is processed cognitively in either the skilled-based, knowledge-based or rule-based levels, depending on the individual's degree of experience with the particular situation. As previously noted, human error has not been the root cause in the below mentioned events but as a contributing cause.

NERC CCAP definitions

Skill-Based Errors

Inattention or over-attention to performance of work affected the event.

[1] *Skills, rules, and knowledge: signals, signs and symbols and other distinctions in human performance models*. IEEE Transactions: Systems, Man & Cybernetics, 1983, SMC-13, pp.257-267.

Actual examples: EMS technician made changes on the operational environment screen versus the test platform screen because the two screens looked exactly alike. While this can easily be labeled human error and it would be correctly labeled as such. However, no amount of training will make this type of error extinct. The most appropriate intervention is to either make the two screens fundamentally different or use some sort of physical displacement to make the error substantially less viable.

A similar event occurred when an EMS technician labeled a file name in excess of the 80 character maximum, resulting in a lock-up of an EMS system. There was no procedure or documentation in reference to the maximum number of characters that could be used in file naming.

Rule-Based Error

A misapplication of a good rule for behavior or application of a bad rule applied for behavior during the work process impacted the event.

Actual examples: An EMS technician applied a 'group control' for nearly 300 breakers. The SCADA application did not properly check that the number of controls issued and exceeded the maximum, resulting in alarms not being acknowledged and SCADA not being able to restart. The EMS technician applied the 'group control' for the large number or breakers in accordance with the training that he has received. Unfortunately, there was not extensive testing with the large number of breakers and the system exceeded its capabilities with no internal error catching capabilities.

An EMS technician conducted a soft reboot of an EMS system in accordance with the training procedures that he had received in the past. Unfortunately, the particular error being experienced would not be corrected by this rebooting but instead would further complicate the error diagnosis and the experienced downtime. The procedures influenced the haste in rebooting instead of different diagnostic strategies. This type of error has occurred during three distinct events.

An EMS technician inserted a new configuration into the database without properly 'deleting' or removing previous database files present in the database build directory. This action resulted in the corruption of the new configuration database. It was later discovered that the vendor never made the entity aware of this necessary procedure. The operation had worked previously without the removal but now knowing this requirement, the entity has made it part of the procedure.

Knowledge-Based Error

The problem was solved without using stored rules for behavior. The involved personnel were in a problem-solving/troubleshooting mode. Many find it easier to think of this node as "Lack of Knowledge-Based Error" since the essential gap is experiential.

There have been two cases that EMS technicians have been unfamiliar with the error discovered and have tried to fix the immediate EMS problem instead of determining the underlying network problem that

caused the EMS problem. This type of error seems to show the challenges associated with the demarcation of EMS type troubleshooting versus the traditional IT communication network type. The potential of one individual being able to diagnosis and remedy the potentially infinite number of problems is unlikely. The cooperative work of the two different trade skills becomes critical for efficient remediation of integrated system problems.

While effective training is almost always a good way to improve performance and productivity, the analysis of current events show only a small fraction of events that could be most effectively influenced by training. The preponderance of the events to date point to organizational processes and procedures that are creating latent error in the system, not untrained operators. Our data suggests that humans are rarely ever the *sole* cause of an event but illustrates a complicated relationship from several factors including interactions with individuals, their equipment and their general work environment, including processes and procedures, both recorded and practiced.