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ERO Enterprise Themes and Best Practices for Sustaining Accurate Facility Ratings

October 20, 2022

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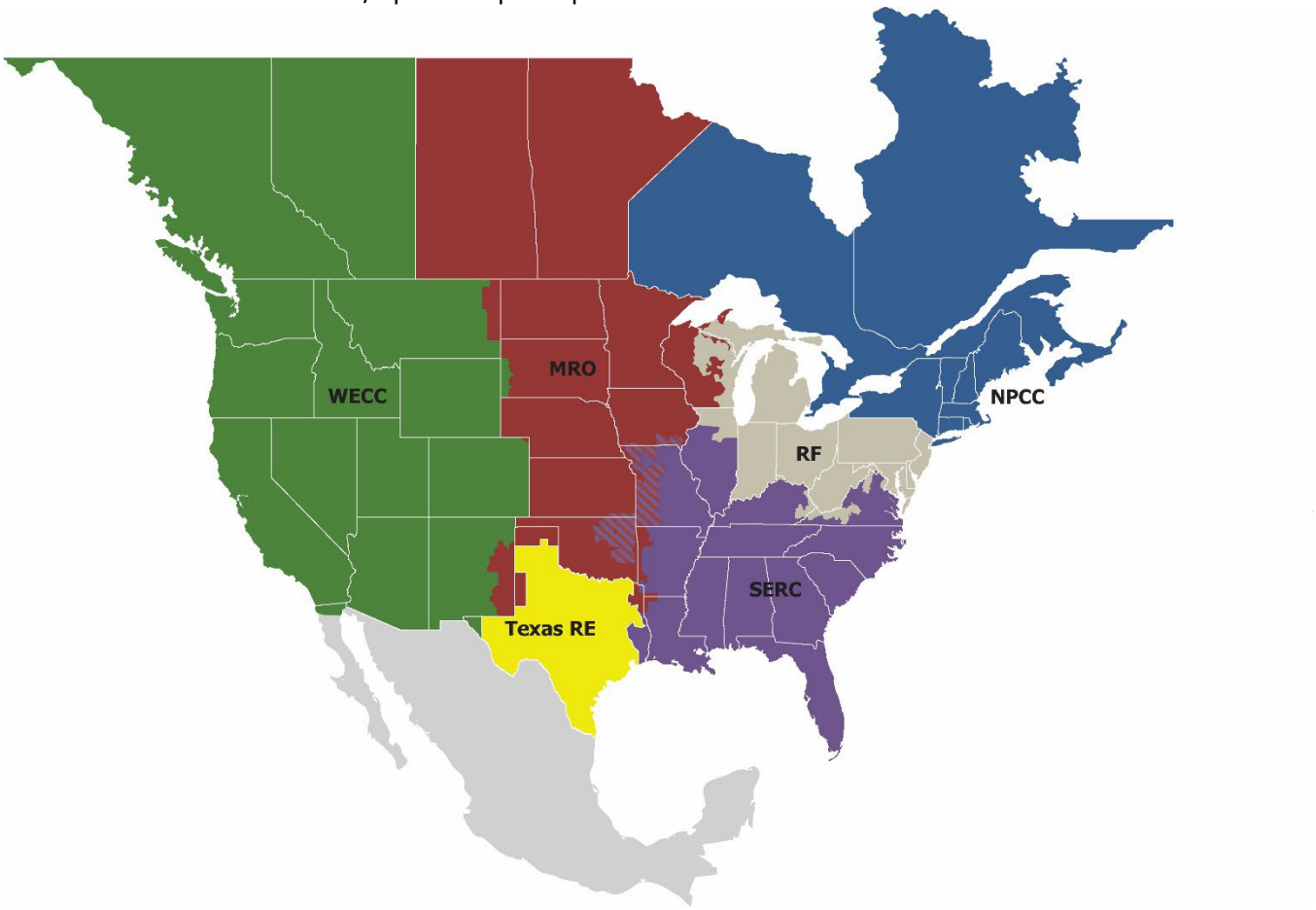
Preface

Electricity is a key component of the fabric of modern society and the Electric Reliability Organization (ERO) Enterprise serves to strengthen that fabric. The vision for the ERO Enterprise, which is comprised of the North American Electric Reliability Corporation (NERC) and the six Regional Entities, is a highly reliable and secure North American bulk power system (BPS). Our mission is to assure the effective and efficient reduction of risks to the reliability and security of the grid.

Reliability | Resilience | Security
Because nearly 400 million citizens in North America are counting on us

The North American BPS is made up of six Regional Entity boundaries as shown in the map and corresponding table below. The multicolored area denotes overlap as some load-serving entities participate in one Regional Entity while associated Transmission Owners/Operators participate in another.



MRO	Midwest Reliability Organization
NPCC	Northeast Power Coordinating Council
RF	ReliabilityFirst
SERC	SERC Reliability Corporation
Texas RE	Texas Reliability Entity
WECC	WECC

Executive Summary

To ensure a reliable and secure BPS, it is of utmost importance that registered entities have strong and sustainable facility ratings programs. Facility ratings play a significant role in planning and operating the BPS. System operating limits (SOLs)—essential components in real-time operations of the grid—are based on facility ratings and are vital to supporting and maintaining situational awareness. Incorrect facility ratings can result in operating in an unknown state, uncontrolled widespread service outages, and fires, among other things. In addition, facility ratings and system limitations play a key role in modeling the grid as future BPS projects are contemplated to manage load growth and mitigate system constraints.

The ERO Enterprise has been actively engaged in identifying and working to mitigate challenges associated with facility ratings programs. These efforts include outreach; education; discussions at Regional Entity and NERC technical committee meetings; and monitoring, enforcement, and mitigation activities. For example, facility ratings issues have been identified as an ERO Enterprise risk element area of focus in the annual Compliance Monitoring and Enforcement Program (CMEP) implementation plan since 2016.

Based on data and information compiled by the ERO Enterprise over the years of performing these activities and working directly with applicable registered entities (or entities), the ERO Enterprise has identified common themes (**Chapter 1**) that have impacted and posed challenges to the sustainability of accurate facility ratings. Specifically, the ERO Enterprise determined that issues have primarily been associated with the following broader themes while the identified facility ratings program challenges may be attributed to multiple causal factors:

- **Theme 1: Lack of Awareness**
- **Theme 2: Inadequate Asset and Data Management**
- **Theme 3: Inadequate Change Management**
- **Theme 4: Inconsistent Development and Application of Facility Ratings Methodologies**

This report provides potential best practices to address these themes. It is intended to aid registered entities in strengthening the accuracy and sustainability of their facility ratings programs, thereby lessening the risks of facility ratings challenges and ensuring a more reliable and secure BPS. A critical point to underscore is the importance for entities to perform routine monitoring of its facility ratings programs and associated controls to ensure that the programs remain effective and sustainable.

The potential best practices in this report are not directives to industry to undertake any actions. Rather, they are suggestions on best practices for mitigating risks in the area of facility ratings and for addressing the themes identified in this report. These suggestions were assembled based on ERO Enterprise monitoring, enforcement, and mitigation activities, as well as through direct feedback and input from registered entities that have encountered facility ratings program challenges and/or have successfully mitigated them with internal controls. Additionally, these suggestions on best practices are not one-size-fits-all since variables (e.g., entity size, workforce/staffing levels, corporate structure, and other factors) will affect the feasibility of each potential resolution.

In addition, in early 2019, NERC and the Regional Entities partnered with the North American Transmission Forum (NATF) to help industry improve the accuracy of facility ratings across North America. In connection with this effort,

the NATF worked with its membership to develop a maturity model to guide establishing a sustainable and continuously improving facility ratings program.[1]

[1] NATF created the *Key NATF Facility Ratings Practices Document* and *NATF Risk Construct for Prioritizing Facility Ratings Reviews Document* as valuable resources that provide guidance for establishing sustainable facility ratings programs. Both documents are linked in **Appendix A** of this report.

Introduction

To ensure a reliable and secure BPS, it is of utmost importance that registered entities have strong and sustainable facility ratings programs. Accurate facility ratings are needed for operating, planning, and maintaining the Bulk Electric System (BES). Facility ratings are an essential component of determining SOLs and interconnection reliability operating limits (IROL) and are used for making decisions associated with operating the BPS. Without accurate facility ratings, accurate real-time situational awareness is jeopardized. System operators depend on accurate ratings when taking actions during real-time operations. Inaccurate ratings amplified during high demand or extreme weather conditions could lead to unneeded operator actions. Additionally, inaccurate low facility ratings could lead to unneeded operator action, and inaccurate high facility ratings could result in loss of equipment life or equipment failure.

As illustrated in **Figure I.1**, facility ratings also play a major role in the system planning process whereby Transmission Planners and Planning Coordinators use these ratings to assess system weakness and determine system additions, enhancements, or replacements. Accurate facility ratings are needed to study the reliability impact of connecting new facilities or modifying existing interconnections. For example, when considering required system improvements, required system improvements may be insufficient if a particular facility rating is too high, leading to inadequate system reliability when the interconnection is placed in service. Similarly, if a particular facility rating is too low, required system improvements may be excessive, leading to the interconnecting entity being required to fund more construction than necessary.

Additionally, facility ratings are important for system re-dispatch when congestion takes place and are used when curtailing transmission service.

Figure I.1: Importance of Accurate Facility Ratings for a Reliable BES

Chapter 1: Themes

The ERO Enterprise has identified the following four common themes that have impacted and posed challenges to the sustainability of accurate facility ratings. The ERO Enterprise determined that facility ratings issues have primarily been associated with these themes while the identified facility ratings program challenges may be attributed to multiple causal factors.

- **Theme 1: Lack of Awareness**
- **Theme 2: Inadequate Asset and Data Management**
- **Theme 3: Inadequate Change Management**
- **Theme 4: Inconsistent Development and Application of Facility Ratings Methodologies**

Theme 1: Lack of Awareness

The ERO Enterprise has observed that lack of awareness leads to ineffective or unsustainable facility ratings programs and is primarily associated with weak or inadequate internal controls. An entity's lack of awareness may include several factors, such as the following:

- Failure to adequately document or maintain an accurate equipment inventory
- Failure to understand the current carrying series equipment within its electrical system
- An ineffective facility ratings validation program, including but not limited to identifying and assessing potential program deficiencies, inadequate methodology, and/or inadequate processes/procedures

This theme has proven to lead to inaccurate facility ratings that go undetected for long durations thereby potentially posing a greater risk to the reliability and security of the BPS.

Observations

The ERO Enterprise has identified common issues related to lack of awareness that lead to inaccurate facility ratings. These common issues tend to concern the failure to verify and validate that facility ratings accurately reflect the equipment actually installed in the field upon commissioning and/or consider any subsequent equipment changes in the field because of the addition, removal, or replacement of equipment over time or due to an event (e.g., hurricane).

Lack of awareness comes into play where an entity establishes a program without steps for adequately performing equipment in-field verification and validation (i.e., internal controls). Programs may over-rely on ratings provided by the equipment manufacturer and/or one-line diagrams or drawings that may be inconsistent with what is operational. This creates a false sense of security that equipment ratings used to set facility ratings within various program areas are still accurate. To compound this issue, if an entity then establishes a program that does not include periodic in-field verification or validation activities to confirm that its ratings remain accurate when a field change is made, the entity is substantially less likely to detect inaccuracies.

There may be various reasons, including internal control weaknesses, that cause or aggravate a lack of awareness (e.g., lack of management involvement or prioritization in program commitment or oversight, lack of engagement with an entity's respective Regional Entity(ies), or lack of training and/or an inexperienced workforce). Regardless, the overarching lesson is that entities should remain vigilant in the maintenance of facility ratings and never assume

that facility ratings issues do not exist on their systems without fully understanding and routinely evaluating the effectiveness of their facility ratings program.

Suggestions to Address Lack of Awareness

Senior Management Engagement, Oversight, and Focus on Program Sustainability and Reliability
An entity's management team plays a vital role in developing an effective and sustainable facility ratings program and correcting or preventing issues stemming from lack of awareness. Senior management can create a culture focused on reliability that treats the management of facility ratings as a program similar to how entities treat safety, not a one-time project with a finite start and end date.

Senior management can create a positive culture of reliability by understanding the need to establish and maintain an effective facility ratings program. As a result, senior management should perform the following:

- Clearly define the control environment/culture of maintaining a reliable electric system and regularly reinforce these expectations at all levels. This includes explaining to staff the foundational nature and importance of accurate facility ratings
- Establish clarity on the facility ratings program foundational components
- Identify a facility ratings program sponsor and owner who is responsible for and provides adequate supervisory controls for overall facility ratings monitoring and management
- Ensure that there are documented facility ratings processes and procedures with clear roles, clear responsibilities, and appropriate communication expectations
- Manage the facility ratings process(es) to ensure all departments and contractors have the appropriate level of expertise and are trained—at least annually or on an effective periodic basis—on the facility ratings program requirements and associated procedures and controls
- Support development of internal control testing processes and ensure assessments are performed on a consistent and periodic basis to assess facility ratings program controls efficiency and effectiveness
- Provide adequate resources in support of a robust facility ratings program and associated internal controls

Establish an Accurate Baseline: In-Field Verification
A program that includes periodic facility in-field verifications—including after an equipment change—increases the likelihood that the entity's documented facility ratings are consistent to what is deployed. Likewise, this helps reduce the risk of having an extended duration before detecting issues, provides a more current basis for the program, and improves confidence that the documentation is an accurate reflection of what is in the field.

For example, without a periodic in-field verification and validation, an entity may be unaware that its facility ratings are no longer valid due to equipment replacements. Similar challenges may arise following a merger or acquisition if the entity fails to perform a verification of equipment inventory to determine that the merged or acquired entity's legacy facility ratings are accurate.

Entities that have never performed equipment in-field verification, have newly constructed facilities, or have recently completed a merger or acquisition should perform in-field verifications to ensure its baselines are, and remain, accurate. While performing in-field verifications can be an onerous task—particularly for larger entities or short-staffed smaller entities—it is well worth the time and should be done on a risk-informed schedule to make the task more manageable and meaningful.

For instance, an entity could perform a walk-down of its applicable facilities by completing a percentage of transmission and/or generation facilities annually. Completing 20% of an entity's applicable facilities annually would result in all applicable facilities being completed in five years. Again, the in-field verification process should be risk-informed (e.g., facility ratings age, recent equipment upgrades/changes, facility criticality). The ERO Enterprise recommends that qualified personnel perform the in-field verifications and be independent of the individual responsible for developing and/or maintaining the specific facility ratings. The individual completing the in-field verifications should perform the following:

- Identify all equipment and take photos of nameplates where possible
- Document/record equipment details in a spreadsheet or other tracking tool
- Have drawings, equipment ratings information, and one-line diagrams in hand to make note of field equipment that does not appear in the drawings/diagrams
- Be aware of the internally and externally documented facility ratings
- Identify ownership of the equipment comprising the facility

Once in-field verifications are complete, personnel should compare the equipment inventory, equipment ratings, and other information obtained during the in-field verification to all relevant source documents (e.g., one-line diagrams, design drawings, ratings database/drawings) to ensure what is in the field matches the source documents. Any discrepancies between the field and documentation should be reconciled regardless of the immediate potential impact on the facility rating.

Once any discrepancies are resolved, authorized and qualified personnel should update the data in the official facility ratings database/repository/master spreadsheet as necessary. This allows the entity to rate all equipment and identify the most limiting element for each facility to determine facility ratings. To avoid data entry errors, the entity should have other qualified individuals perform a quality assurance data entry verification/peer review.

Once an entity establishes its baseline, any equipment rating and facility rating changes thereafter should follow a robust change management process.

New Installations and Commissioning

The ERO Enterprise has observed that certain deficiencies in entities' facility ratings programs have been in place since initial substation/facility installation. A corrective action could be to perform an in-field verification and validation upon the commissioning of new equipment or modifications of existing equipment. In addition, the ERO Enterprise recommends performing periodic in-field verifications post maintenance and/or emergency activities (e.g., restorations from hurricanes, tornadoes, ice storms).

Corrective Action Program

A corrective action program is a risk management and continuous improvement tool integral to supporting sustained safe and reliable operations. This program identifies and analyzes conditions and/or problems to gain an understanding of the underlying cause(s). This enables an entity to develop solutions to resolve identified underlying cause(s) and monitor performance for corrective action effectiveness. An entity should have a corrective action program that establishes responsibility and describes the process to document, track, and trend things like the following:

- Adverse conditions, including industrial safety incidents and compliance issues
- Restoration efforts involving equipment changes in the field

- Minor problems that may be precursors to more significant problems
- Areas for improvement identified during assessments
- Other internally identified issues
- Corrective actions pertaining to identified underlying causes

Registered Entity Engagement with ERO Enterprise

To improve the chances of identifying and addressing deficiencies in an entity's facility ratings program before they occur, the ERO Enterprise recommends that registered entities continuously monitor ERO Enterprise communications; in particular, in recent years, the ERO Enterprise has performed a significant amount of dedicated facility ratings outreach and communications. The ERO Enterprise has observed that registered entities that choose to remain disconnected from these communications face greater odds of having facility ratings program failures.

To increase facility ratings program implementation success, the ERO Enterprise encourages entities to participate in the various seminars, technical committees, and Regional Entity assistance programs as well as to stay abreast of available resources (e.g., compliance guidance, regional websites, trainings). These resources are free and provide entities a forum for sharing best practices and lessons learned as well as the opportunity to benchmark against other entities.

Theme 2: Inadequate Asset and Data Management

Asset management (as it relates to facility ratings) is the identification, management, and tracking of physical facility ratings assets. Data management (as it relates to facility ratings) is the collection, validation, and storage of all data associated with facility ratings. Effective and efficient asset and data management plays an integral role in the success of an entity's facility ratings program and reduces the risk of inaccurate facility ratings.

Depending on entity size and structure, there could be various locations that contain some form of equipment or facility ratings data. This data is often shared across various business groups, particularly in larger entities; for instance, equipment ratings from the field are recorded in some type of ratings database/repository and sometimes, in best practice scenarios, into one-line and any other associated diagrams. Equipment and facility ratings data can be transferred from the facility ratings database/repository into planning models and operation models. These moving parts can make asset and data management in the area of facility ratings challenging and likewise reinforce the importance of maintaining accurate facility ratings. **Figure 1.1** depicts the challenges of maintaining accurate facility ratings; therefore, the need for adequate asset and data management is paramount.

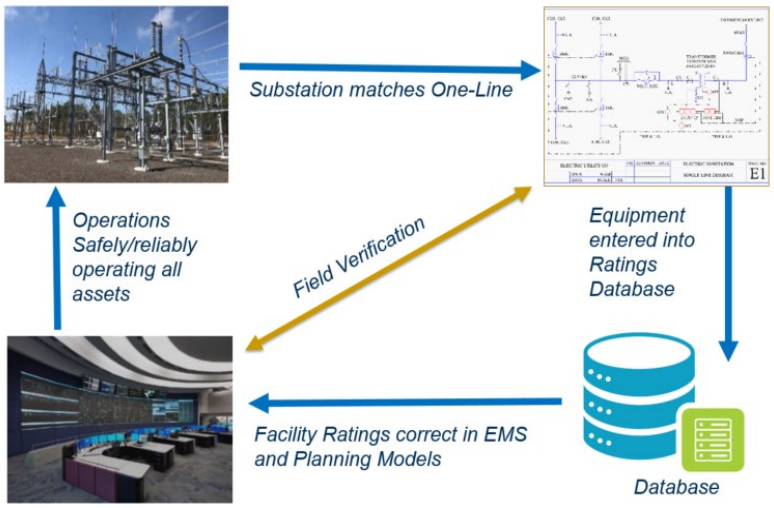


Figure 1.1: Need for Adequate Facility Rating Asset and Data Management

Observations

The ERO Enterprise observed that common data management failures involve instances where entities consolidate equipment in the database instead of listing equipment individually. Another common data management failure observation involves programs that do not identify and account for all necessary pieces of equipment or the equipment's ownership in the field when determining a facility rating. This precludes the ability to rate and consider each piece of equipment in accordance with the overarching facility ratings methodology. The ERO Enterprise also observed that programs frequently miss accounting for equipment such as wave traps, jumpers, connectors, and bus work.

For example, one Generator and Transmission Owner did not include certain bus elements in its facility ratings determination for one of its transmission facilities. The facility ratings included substation equipment up to and including the bus side disconnect switches for circuit breakers; however, they did not include the bus elements beyond those switches.

Common data management failures involve instances where entities consolidate equipment in their database instead of listing equipment individually. For example, one Transmission Owner discovered two bundled transmission line conductors transitioned to a single conductor on a unique style switch outside of a station. Due to the limited bending radius of the conductor, the entity used a single conductor to jumper to the switch. The entity had situations where it failed to consider the switch configuration, and in each scenario, the switch became the most limiting element of the facility.

A related asset management example involved an entity that identified situations where line segments contained multiple conductor types and it failed to identify the most limiting conductor rating for the particular line, resulting in inaccurate facility ratings.

Furthermore, the ERO Enterprise observed instances where asset management challenges resulted from inadequate contractor oversight and training. For example, in one instance, a Generator Owner hired a third-party contractor to determine its facility ratings. However, the contractor was unfamiliar with the entity's facilities, which led to the omission of certain elements and incorrect equipment ratings. The incorrect equipment ratings impacted the facility ratings for all entity generation units, resulting in a 50% facility rating derate for each unit. The ERO Enterprise has recognized that inadequate oversight for third-party contractors is a weakness in facility ratings programs.

ASSET AND DATA MANAGEMENT

Challenges

- Large amounts of equipment and facility ratings data to manage
- Large amounts of changing equipment due to aging infrastructure
- Lack of official, well-controlled facility ratings database
- Reliance on contractors without proper training or oversight

Controls

- In-field verification (e.g., walk-downs)
- Quality assurance reviews
- An official facility ratings database or repository with strict access controls
- Data entry verification
- Contractor management controls

Remember to Always

- Identify each individual piece of equipment even those that typically do not impact facility ratings
- List each piece of equipment individually; do not consolidate equipment
- Recognize differences in equipment ratings that allow for emergency facility ratings

As an example of a data management challenge, a Transmission Owner updated its facility ratings program and hired a new contractor to calculate the new ratings, update all one-line diagrams, and perform an independent review of the calculations and updates. When responding to an audit sampling request, the entity discovered that the contractor made over 100 incorrect equipment ratings, which resulted in incorrect Facility Ratings.

Suggestions to Address Inadequate Asset and Data Management

In-Field Verification and Quality Assurance Reviews

Performing an in-field verification of equipment by physically walking-down facilities can be one of the most effective controls to ensure that an entity has identified and inventoried every piece of equipment in the field. This way, a program can ensure the proper inclusion and rating of each piece of equipment in the field and determine facility ratings in accordance with the overarching facility ratings methodology. The in-field verification should be followed by a quality assurance review by experienced personnel to ensure the correct equipment ratings have been captured.

Facility Ratings Database, Effective Data Capture and Verification, and Access Controls

Some registered entities (generally smaller entities) use facility ratings spreadsheets to manage their facility ratings while others may use a formal facility ratings database(s). There are challenges associated with each of these approaches. To reduce the risk of inaccurate facility ratings, entities should perform the following:

- Establish a single official facility ratings database or declare an official facility ratings repository or a master spreadsheet at minimum
- Ensure downstream processes that require facility ratings (such as model building for real-time operations or planning) leverage the facility ratings database as the official record
- Communicate the location of the official facility ratings database (or repository or master spreadsheet) to all relevant personnel
- Document the process to obtain information from the field and enter the data into the official database, repository, or master spreadsheet
- Reinforce the documented process with work-flow diagrams and provide training on the process on at least an annual basis or an effective periodic basis
- Ensure that a peer review is performed to verify that the data has been entered into the database, repository, or master spreadsheet correctly
- Implement strict access controls to the official facility ratings database, repository, or master spreadsheet to limit write access so that only a small group of necessary personnel can make changes in the database and source documents (Individuals with write access should be properly trained before receiving write access and on a continuous basis thereafter.)

Contractor Management

The ERO Enterprise strongly recommends that entities establish effective contractor management to reduce the risk of asset and data management failures that could affect equipment ratings and/or facility ratings.

Proper contractor management should start with ensuring contractor training on the entity's facility ratings program processes and procedures. Additionally, an entity should ensure there is sufficient oversight of contractor activities. Contractor oversight can include assigning a trained entity employee to work with the contractor team throughout the project to provide real-time or periodic verification and oversight during each phase of a project. An entity project

manager may not have the set of skills needed to provide an effective assessment of the contractor's efforts as it relates to facility ratings.

After project completion, the entity can assign personnel to perform reviews of contractor reports and work orders among other things. For instance, another qualified individual who did not perform the work can be given a one-line diagram and a list of all associated equipment so that the qualified individual can conduct a methodical walk-down of the facility to ensure the equipment listed matches what is in the field and report any discrepancies so they can be addressed.

Theme 3: Inadequate Change Management

Broadly, change management as it relates to facility ratings may involve coordination across multiple models, departments, and entities. Change management processes and controls enable facility and equipment rating changes to be captured, coordinated, and implemented throughout the entity in a timely manner. Without a strong and sustainable change management process, there is a significant risk that inaccuracies in facility ratings will occur.

Observations

The ERO Enterprise has identified areas of concern with entities that had no prior facility ratings challenges but had weak change management controls that could ultimately affect the entity's ability to maintain the accuracy of their facility ratings.

Common Change Management Failures

- Lack of, or delay in, communicating changes to all necessary personnel
- Lack of data entry verification
- Lack of oversight over contractors performing facility ratings work

ERO Enterprise staff also observed instances where inadequate change management procedures and controls led to inaccurate facility ratings. The following are some examples:

- One Generator and Transmission Owner placed a new transformer into service at a facility. The retired transformer had been the most limiting element, but the new transformer had a higher rating and was therefore no longer the most limiting element. The entity did not have controls in place to ensure that it updated the facility ratings documentation, resulting in an incorrect facility rating.
- An entity owned two units that shared a transformer. When the entity retired one of the units and reconfigured the high voltage bus, it similarly did not have controls in place to ensure that it adjusted the facility ratings based on the equipment reconfiguration.
- Another Generator and Transmission Owner identified numerous transmission equipment rating discrepancies, some of which impacted the most limiting element at its substations. This was the result of the entity not having sufficient controls in place to ensure timely updates were made to its facility ratings documentation when personnel installed a device in the field with a different rating than planned or directed.
- An entity unintentionally omitted correct information or entered incorrect information into its facility ratings database. The entity discovered these issues only after completing a walk-down of all of its transmission facilities.
- A Transmission Owner had a situation where a field change that differed from the original design occurred, but the entity's personnel did not update the transmission line's construction one-line diagram after completion of the project. As a result, the entity did not record the field changes for re-configuration of the transmission line in the database.
- A Transmission Owner discovered that a planned upgrade to the most limiting element on a network line was not completed by the contractor responsible for the work. During the project, the line's most limiting element (a 3,000 amp wave trap) was supposed to be replaced with a 5,000 amp wave trap. The project was incorrectly marked as complete even though the work had not been done, resulting in a change to the facility

rating that did not reflect the actual most limiting element. In this instance, the entity had a written process that required additional review and sign-off (i.e., an internal control). However, the entity deviated from the written process by accepting verbal affirmation from the contractor based on working relationships and positive past experiences with the contractor.

Suggestions to Address Inadequate Change Management

Strong Change Management Process

An entity that is not properly tracking, documenting, and communicating all field changes to the appropriate individuals and/or groups when equipment changes occur has an increased risk of using inaccurate facility ratings. Having a strong change management process helps an entity assure that its facility ratings are based on the equipment installed and energized and that changes that affect the facility ratings are flagged or communicated to all relevant parties.

A strong change management process for equipment changes is one that is documented, provides clear roles and responsibilities, and includes a quality assurance review process for each change. To avoid bias, experienced personnel not involved in the work should perform the quality assurance review. Personnel conducting reviews should have the proper training and knowledge to make sure all equipment is accounted for and rated according to the entity's facility ratings methodology.

Change Management Controls

- Change checklist
- Quality assurance reviews after any change
- Validation through periodic reviews
- Data entry verification
- Periodic in-field verifications

A strong change management process should also include, but is not limited to, the following:

- A requirement for data entry verification by qualified personnel
- A clearly outlined approval process prior to a change being implemented
- Notification to update equipment inventory after a change is implemented
- Confirmation that the change is implemented as planned
- Automated notification of the change to all appropriate departments and external stakeholders
- Checklist to verify all appropriate follow-up actions are taken after a change (e.g., an equipment change should prompt a review of other facility equipment ratings to ensure the most limiting element has not changed)
- Validation through periodic reviews
- A change process flowchart to help personnel and project teams identify the different steps in the change process and understand the relationships among the various steps

An entity's change management process should not be limited to capturing changes occurring as the result of general maintenance and construction projects, and the process should include capturing changes as a result of emergency repairs or changes following post-storm or extreme weather restoration. Thus, it is important for an entity to have comprehensive change management work practices for planned construction, acquired facilities, and unplanned or restoration work.

Personnel Training
An entity's change management process should include a comprehensive training program with a knowledge assessment for all personnel involved in the change management process. A clear understanding of the roles and responsibilities with an emphasis on adequate communication between field and office personnel is critical to a sustainable facility ratings program.

Periodic In-Field Verification
Even where an entity has previously performed in-field verifications, there is no guarantee that facility ratings remain accurate since equipment in the field can be added or removed in following years. As such, as previously discussed, the ERO Enterprise recommends that entities perform periodic in-field verifications where a percentage of facilities are completed annually. This process should be risk-informed.

Another practice for entities to consider is utilizing subject matter experts from one or more other entities during in-field verifications as a form of peer review. This brings in outside experts that will look at the entity's field equipment and facility ratings from an unbiased standpoint that is focused on the integrity of the system, not on compliance. This approach may help the entity identify discrepancies not identified by its own subject matter experts.

If any discrepancies between the field and documentation are identified, entity personnel/subject matter experts should follow the entity's documented change management process to ensure all changes are approved, properly documented in the formal database, repository, or master spreadsheet, and communicated to all appropriate individuals and groups.

Theme 4: Inconsistent Development and Application of Facility Ratings Methodologies

Each applicable registered entity is required to have a documented methodology for determining facility ratings of its solely and jointly owned facilities. While there are considerations that an entity must address when establishing its equipment ratings, there is flexibility for an entity to use multiple methods for establishing its equipment ratings.

The methodology used to establish the ratings of the equipment that comprises the facility may include the following:

- Manufacturer's nameplate
- IEEE standards or engineering evaluations
- Testing or performance history
- Assumptions with respect to temperature
- Assumptions with respect to voltage
- Emergency ratings that are greater than normal ratings
- Emergency ratings that are equal to normal ratings
- Differences in how entities determine facility ratings for jointly owned facilities
- Physical or mechanical limitations that may be more restrictive than electrical ratings

There are coordination challenges when facilities are jointly owned, particularly given that each owner can establish its own facility ratings methodology. Therefore, the same piece of equipment or like equipment within a jointly owned facility could have a different rating because each owner applied a different methodology. This creates the need for

these entities to coordinate its most limiting and next most limiting element to establish a single facility rating for the facility.

Observations

ERO Enterprise staff has observed issues in this area when entities determine generator facility ratings. For example, one entity may only consider the ratings of electrical elements of the facility while another may also consider the maximum mechanical rating of a generator prime mover; this could require several assumptions when converting potential mechanical power into a potential electrical equivalent and possibly have multiple results. Another process may include conducting a performance test that would also consider mechanical limitations but represent a facility rating under a specific operating condition; as a result, entities may have multiple methodology criteria for rating different transmission and generating facilities. This can create confusion on which criteria to apply or make it difficult to apply the criteria consistently.

The ERO Enterprise has also observed that numerous entities are failing to identify the next most limiting element. When the most limiting element is removed from service, it is important to know the next most limiting element to ensure reliability.

Furthermore, there could be issues when there is a jointly-owned transmission line. For example, one owner could rate its current transformers (CT) strictly with the manufacturer nameplate (e.g., using a thermal rating factor of 1.0); this CT could become the most limiting series element. The other end of the line could have the same type of CT, but its owner chooses to apply a higher thermal rating factor to its CTs. This owner may have a higher rating due to a different limiting component. Overall, the facility would be limited by the conservative CT value used by one entity. Each owner is permitted to rate their equipment how they choose. This creates the need for these entities to coordinate the most limiting and next most limiting elements to establish a single facility rating for the facility.

Suggestions to Address Inconsistent Development and Application of Facility Ratings Methodology

Entities should take special note of where options or ambiguous guidance is allowed and establish controls to minimize facility ratings inconsistencies. Entities should strive to use a single consistent methodology and apply the same criteria when rating like components of a facility rather than using a mix of options. Deviations from that single consistent methodology are allowed, but entities should establish processes and controls to ensure the deviation is justified, consistently applied, well documented, and minimizes inconsistent facility ratings.

Best practices show that entities most successful in this area do the following:

- Develop and maintain a detailed and comprehensive facility ratings methodology
- Provide the specific rating method for each class and type of element comprising a BES facility
- Train appropriate personnel on how to apply the methodology

Entities should also increase coordination with neighboring entities to understand not only what their limiting elements are but also how their methodology may be different from their own and consider adopting a joint consistent facility rating methodology for facilities that have more than one owner.

Chapter 2: Sustaining Facility Ratings Programs

Throughout this report, the ERO Enterprise shared several considerations to support registered entities' establishment, improvement, and sustainability of a sound facility ratings program.

To sustain a program, it is important to establish an accurate starting point or baseline. This is typically done through a number of steps that start with field verification of the assets. Field verification is typically followed by a review of the drawings and a recalculation of the facility ratings while keeping in mind that this rating is an aggregate of a number of system elements as defined in the NERC Glossary of Terms. Entities should consider evaluating the effectiveness of their change and asset management process periodically. This evaluation could reveal specific areas that may benefit from additional attention. It is also vital to ensure appropriate internal team stakeholders, such as key departments and contractors, are being accounted for and involved in the periodic review/assessment process. Once the change and asset management processes are reviewed, the current documentation associated with the processes and procedures should also be reviewed and updated as needed. Clear roles and duties should be assigned and documented.

The impact of mergers and acquisitions should also be taken into consideration as the merger of two or more registered entities will likely result in more than one set of facility ratings methodologies, supporting policies, and procedures. Company executives should reinforce efforts to create and maintain a single detailed and comprehensive facility ratings methodology and program. This pre-merger effort will serve to ensure the consistent establishment and management of facility ratings across the new organization.

Companies that are successful in establishing sustainable programs have a positive cultural environment. This positive cultural environment is established by the "tone from the top." In other words, company executives help ensure that involved personnel and departments are aware that they are key and critical components in assuring overall reliability. Their work is crucial and accuracy is important. Successful companies usually have an executive sponsor to support this effort.

In summary, the following list highlights (in no particular order) the best practices used by companies that have positioned their facility ratings programs for long-term sustainability:

- Robust documented change management process
- Inventory management tools, with required training
- Checklists for new inventory to be added
- Effective data capture processes
- Single database for master record keeping
- Access controls established for facility management tools
- Built in quality assurance reviews, in concert with internal controls
- Periodic in-field validation/field walk-downs
- Facility ratings program owner
- Management oversight

Chapter 3: Conclusion

While designing and implementing an effective facility ratings program can be challenging, the aforementioned best practices may help entities better mitigate the themes identified in this report. A critical point to underscore is the importance for an entity to perform routine monitoring of its facility ratings program and associated controls to ensure that the program remains effective and sustainable. This routine self-assessment will better position an entity to identify and address any existing or emerging blind spots before they develop into more challenges that are significant.

The ERO Enterprise encourages entities to reach out to Regional Entity staff as well as their industry peers, to share information and lessons learned, ask questions, and request assistance if needed in the area of facility ratings. **Appendix A** provides some helpful facility ratings resources.

Appendix A: Facility Ratings Resources

The ERO Enterprise continues to enhance and expand its outreach efforts to stress the importance of accurate facility ratings, highlighting extent of condition, potential gaps, recommended mitigation activities, and best practices. Linked below are helpful resources for establishing and sustaining accurate facility ratings. In addition, the ERO Enterprise encourages registered entities to contact their Regional Entity(ies) with specific questions or concerns.

- ERO Enterprise CMEP Practice Guide
- 2021 ERO Enterprise CMEP Implementation Plan
- MRO Standard Application Guide FAC-008-3
- NERC Facility Ratings Problem Statement
- NPCC Fall 2021 Compliance Webinar with FAC-008
- NPCC 2022 Focus on Facility Ratings Statement
- ReliabilityFirst Facility Ratings Webinar
- ReliabilityFirst Facility Ratings Workshop
- SERC Facility Ratings Overview Presentation
- SERC Facility Rating Expectations and Lesson Learned Presentation
- SERC Facility Ratings E-Learning Module
- Texas RE FAC-008 Common Themes
- Texas RE Resource Hub
- WECC FAC-008 Position Paper
- Key NATF Practices for Facility Ratings
- NATF Risk Construct for Prioritizing Facility Ratings Reviews