RF Fall Virtual Workshop

Brian Thiry

Manager, Entity Engagement

August 25, 2020






Welcome!

- **Morning Session: Facility Ratings**
  - 8:00 a.m. – Noon
- **Afternoon Session: Supply Chain**
  - 1:00 p.m. – 5:00 p.m.

Before We Get Started...

- Please make yourself comfortable
- Eliminate unnecessary distractions
- Participate by joining us at Slido.com
  #RFFacilityRatingsWS
- Take notes, be engaged, and share what you learned

The purpose of today's morning session:

- Provide an overview of the Facility Ratings issue
- Discuss risks and mitigations we have seen
- Share internal controls and best practices

Morning Agenda

- **Welcome - Background and History of the Facility Ratings Risk**
  - Brian Thiry, Manager – Entity Engagement
- **Compliance Monitoring and Facility Ratings**
  - Derek Kassimer, Principal Analyst – Risk Analysis & Mitigation
- **Internal Controls and Facility Ratings**
  - Denise Hunter, Principal Technical Auditor – Operations & Planning
  - Brian Hallett, Principal Reliability Consultant – Entity Engagement
- **Commissioning Process and Facility Ratings**
  - Jim Kubrak, Manager – Operations & Planning
- **Validation and Verifications of Facility Ratings**
  - Johnny Gest, Manager – Engineering & System Performance
- **Virtual Breakout Sessions**

Virtual Breakout Sessions

➢ Large Transmission Owners

- **American Electric Power Service Corporation**
  - Kamran Ali, Managing Director
  - Hassan Hayat, Regional Manager
- **PPL Electric Utilities Corporation**
  - David Quier, Director of Asset Management
  - Shadab Ali, Manager of Transmission

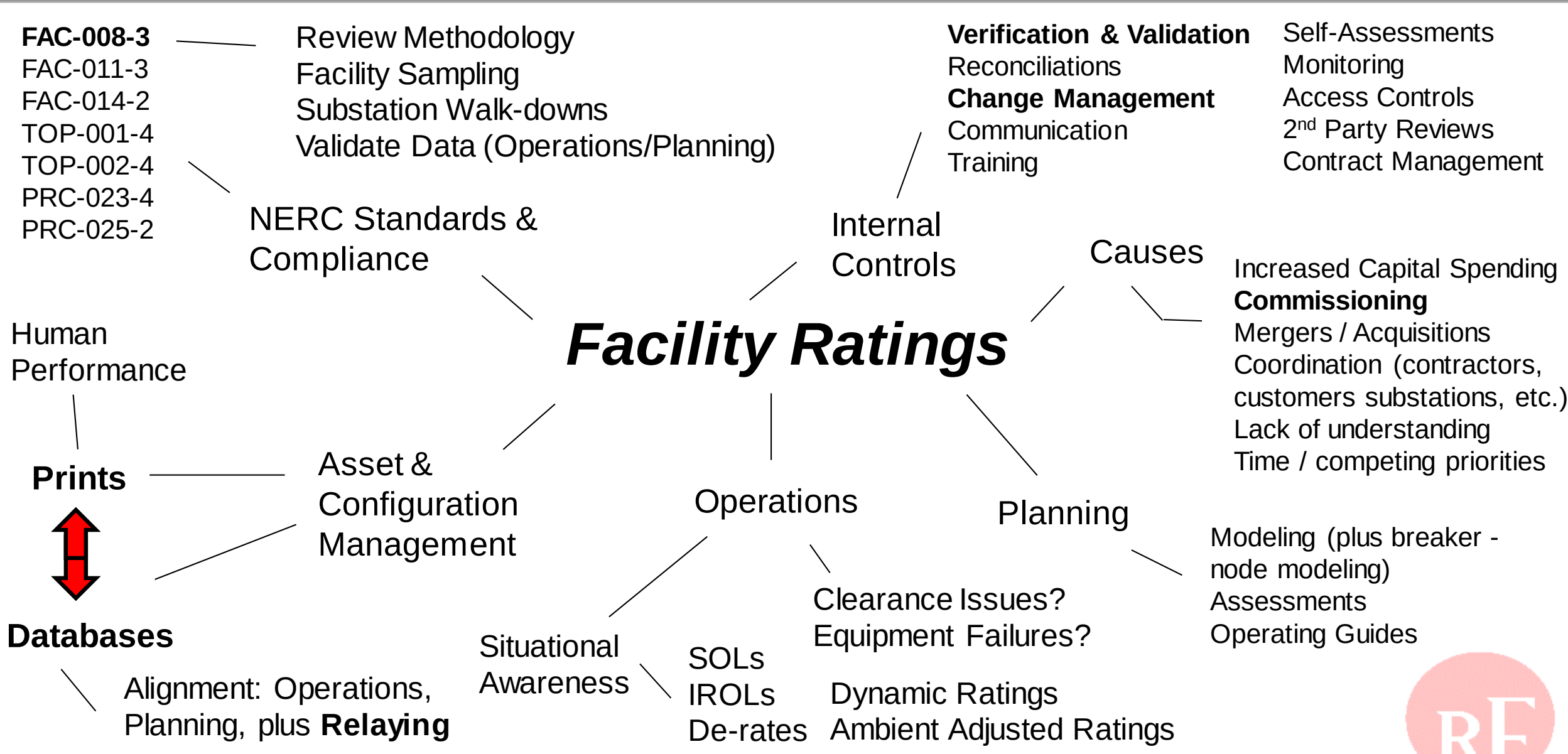
➢ Medium-Small Transmission Owners

- **CenterPoint Energy (Vectren)**
  - Ryan Abshier, Manager of the Indiana Planning & Protection Group
- **Duquesne Light Company**
  - Joe Pilch, Transmission Planning Engineer

➢ Generator Owners

- **Talen Energy**
  - Nick Poluch, Senior Manager, NERC & Cyber Protection

More Than Just FAC-008

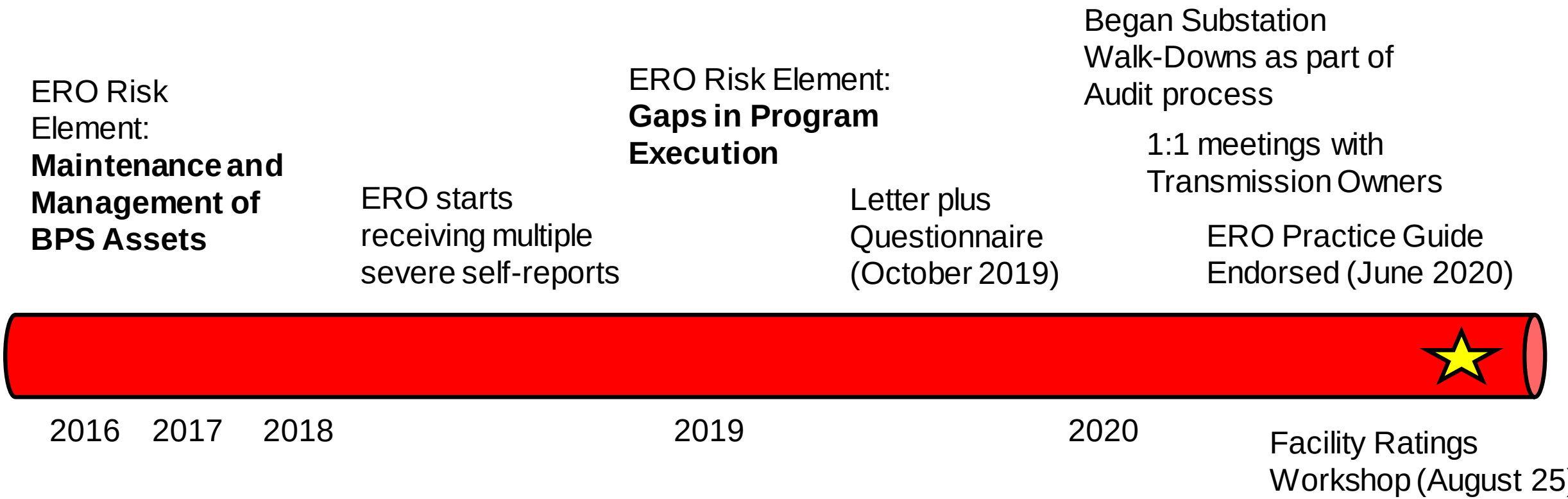


What is the Risk?

- **Cannot wait for the risk to be realized**
  - Mitigate Facility Rating risks before equipment failures and outages
  - Key example: Cyber-security risks and threats
- **Facility Ratings and Modeling are the building blocks**
  - Operational and Planning studies are predicated on these being accurate
  - Challenges to advance to dynamic ratings/sensors if base is not correct
- **Incorrect ratings are violations of a Standard developed and approved by industry, and need to be corrected**
  - Correcting ratings to properly reflect system conditions mitigates unnecessary risk
- **FAC-008 is not a Print Management Standard**
  - However, it's extremely challenging to be good at Facility Ratings and have incorrect prints
  - Inaccurate prints/databases impacts other risks (Human Performance, Relaying, etc.)

ERO Action Items

- **Work with Industry to Analyze, Communicate & Mitigate the Risk**



Compliance Monitoring and Facility Ratings

Derek Kassimer
Principal Analyst, Risk Analysis & Mitigation

RF Fall Virtual Workshop

August 25, 2020






Agenda

- Definition of Terms
- Facility Ratings use in Operations and Planning
- What to expect during compliance monitoring of FAC-008-3
- CMEP Practice Guide

Terms

- **System Operating Limit (SOL)** – The value (such as MW, MVAR, amperes, frequency or volts) that satisfies the most limiting of the prescribed operating criteria for a specified system configuration to ensure operation within acceptable reliability criteria. System Operating Limits are based upon certain operating criteria. These include, but are not limited to:
  - **Facility Ratings** (applicable pre- and post-Contingency Equipment Ratings or Facility Ratings)
  - **Transient stability ratings** (applicable pre- and post-Contingency stability limits)
  - **Voltage stability ratings** (applicable pre- and post-Contingency voltage stability)
  - **System voltage limits** (applicable pre- and post-Contingency voltage limits)

Terms (cont'd)

- **Facility**
  - A set of electrical equipment that operates as a single Bulk Electric System Element (e.g., a line, a generator, a shunt compensator, transformer, etc.)

- **Equipment Rating**
  - The maximum and minimum voltage, current, frequency, real and reactive power flows on individual equipment under steady state, short-circuit and transient conditions, as permitted or assigned by the equipment owner.

- **Facility Rating**
  - The maximum or minimum voltage, current, frequency, or real or reactive power flow through a facility that does not violate the applicable equipment rating of any equipment comprising the facility.

Example Facility Data Tracking

Facility

Equipment Ratings

Facility Rating

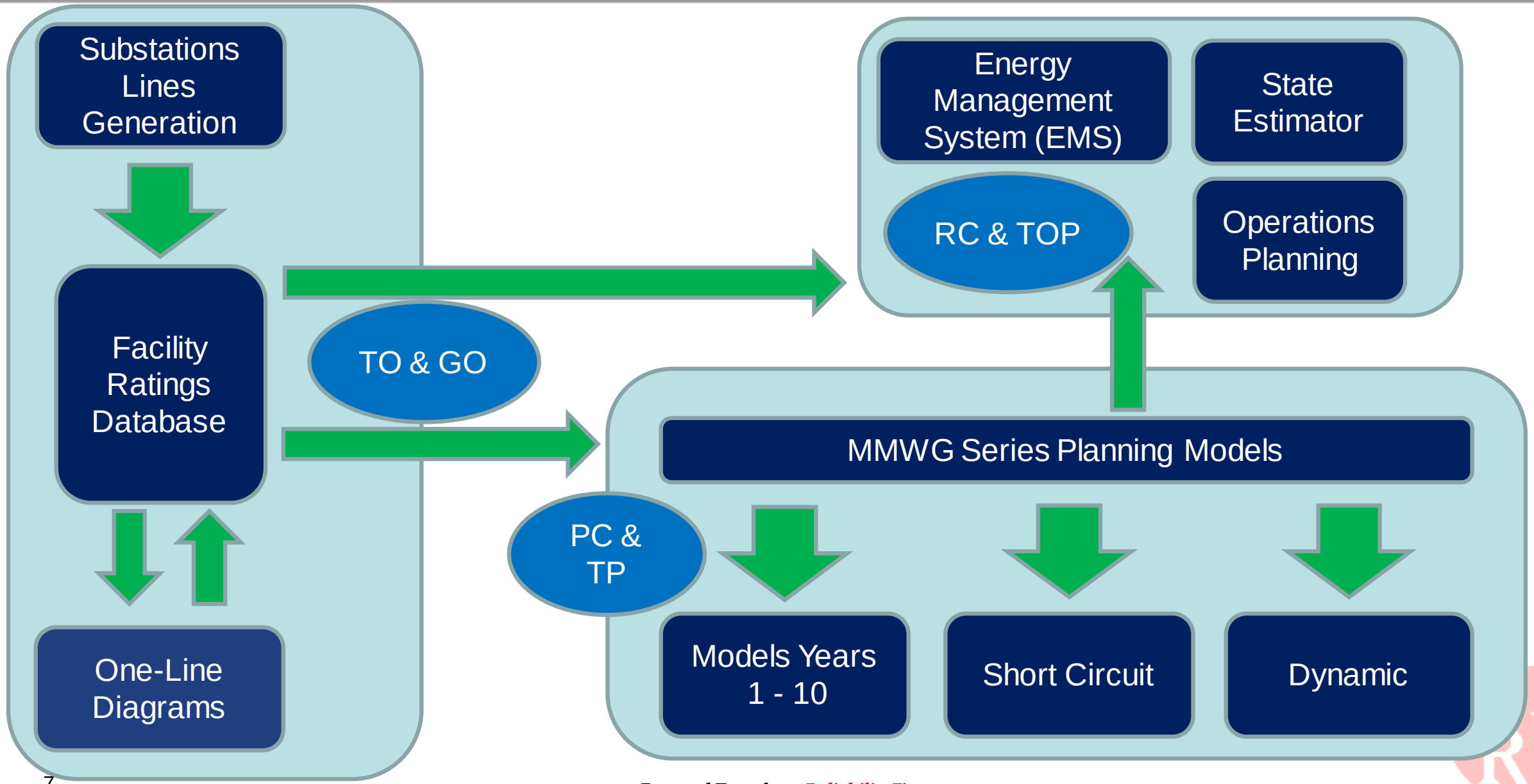
Facility Rating Sample FAC008 R6	From Substation: MRO1	To Substation: MRO2	Summer Normal (SN)	Summer Emergency (SE)	Winter Normal (WN)	Winter Emergency (WE)
Facility Limits: MRO1 to MRO2			1030	1043	1221	1231
Facility Limits: MRO2 to MRO1			1030	1043	1221	1231
Substation: MRO1	Owner: Utility A					
Equipment	**Description**		**SN**	**SE**	**WN**	**WE**
Conductor	1 - 795.0 kcmil ACSR 26/7 Drake, JUMPER, 200°F Norm, 300°F Emer		1030	1402	1221	1524
Trap	2000A, B-Phase		2040	2240	2100	2400
Conductor	2 - 1590.0 kcmil AAC 61 Coreopsis, JUMPER, 200°F Norm, 275°F Emer		3096	4000	3668	4404
Switch	1600A, Switch #78661-L, AO6		1795	2126	2264	2482
Conductor	2 - 1272.0 kcmil AAC 259 Rope-Lay, JUMPER, 200°F Norm, 275°F Emer, 5% derate proximity effect		2637	3401	3124	3743
CT	1200:5 Full Ratio, 1200:5 Conn Tap, RF = 2.00, Bushing (Bkr)-Type		2400	2400	2400	2400
Circuit Breaker	1600 A, OIL, Device #78661		1704	1894	2101	2264
Relay	Forward Setting		5631	5631	5631	5631
Relay	Non-Directional Thermal		3600	3600	3600	3600
RTU	RTU		13708	13708	13708	13708
CT	1200:5 Full Ratio, 1200:5 Conn Tap, RF = 2.00, Bushing (Bkr)-Type		2400	2400	2400	2400
Conductor	2 - 1272.0 kcmil AAC 259 Rope-Lay, JUMPER, 200°F Norm, 275°F Emer, 5% derate proximity effect		2637	3401	3124	3743
Switch	1600A, Switch #78661-B, AO6		1795	2126	2264	2482
Conductor	1 - 5.0" Al Tube, Sch 40, 6063-T6, BUS		4608	5075	5590	5998
From- To Nodes	**Line Segments - Description**		**SN**	**SE**	**WN**	**WE**
MRO1 to STR 125	1 - 795.0 kcmil ACSR 26/7 Drake, 200°F Norm, 245°F Emer		1030	1214	1221	1367
STR 125 to MRO2	1 - 795.0 kcmil ACSR 26/7 Drake, 200°F Norm, 203°F Emer		1030	1043	1221	1231
Substation: MRO2	Owner: Utility B					
Equipment	**Description**		**SN**	**SE**	**WN**	**WE**
Conductor	1 - 795.0 kcmil ACSR 26/7 Drake, JUMPER, 200°F Norm, 300°F Emer		1030	1402	1221	1524
Trap	1200A, B-Phase		1224	1344	1260	1440

NERC Reliability Standards

➢ Numerous Standards touch upon Facility Ratings

- FAC-008-3 – confirm TO and GO have Facility Ratings consistent with the Facility Ratings Methodology (FRM)
- FAC-014-2– confirm RC and TOP SOLs are consistent between Real-time models and models used for Operational Planning Analysis
- FAC-014-2 – confirm PA/PC and TP SOLs are consistent in planning models
- TOP-001-4 and TOP-002-4 – confirm TOP SOLs are consistent between Real-time and the models used for Operational Planning Analysis
- PRC-023-4 and PRC-025-2 – Transmission and Generator Relay Loadability based upon Facility Ratings

Facility Rating Locations – Tools and Applications



Facility Rating Locations

What to Expect from Compliance Monitoring

➢ Prior to the engagement

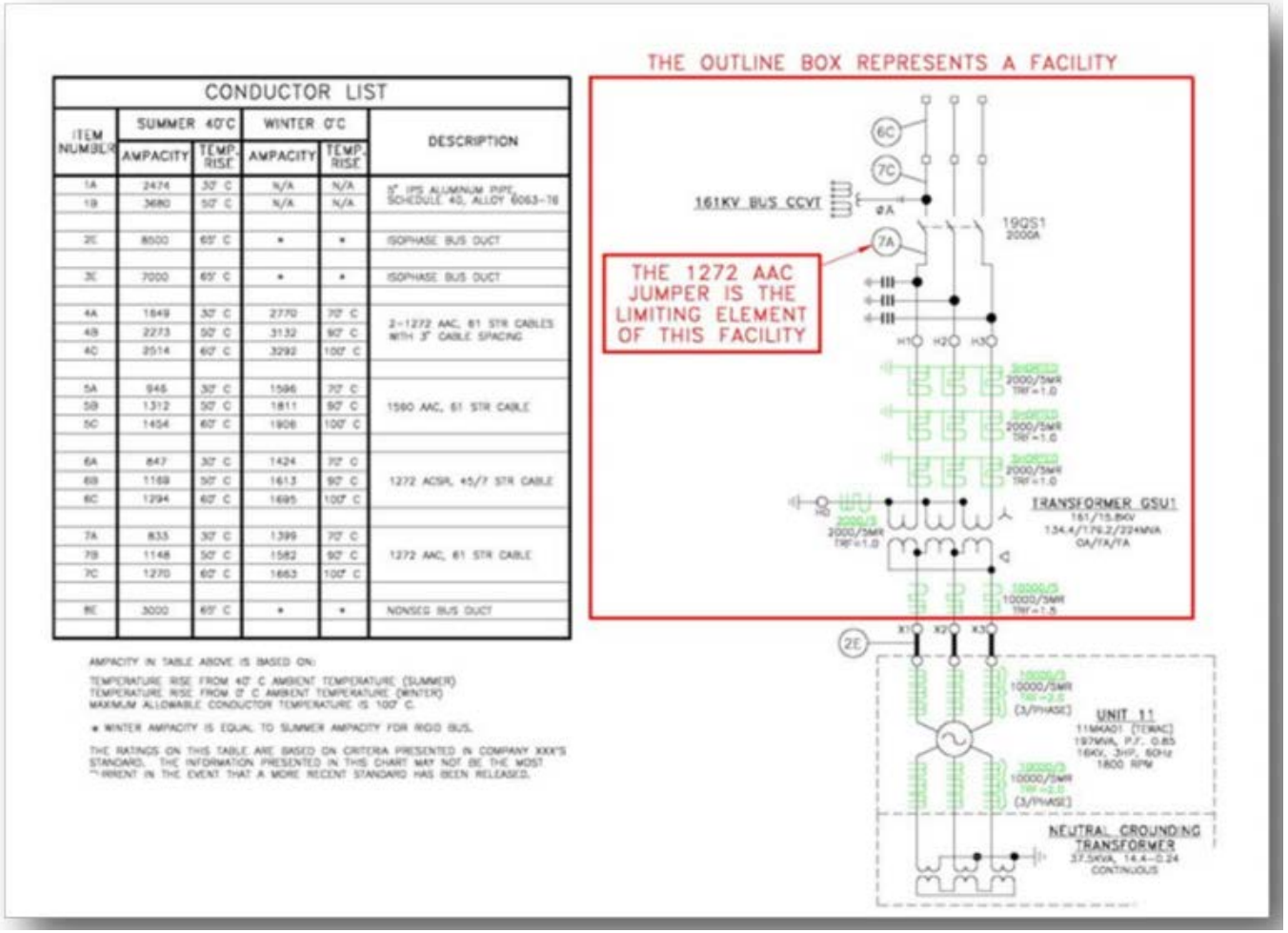
- Data Sampling will be performed, and a complete list of all transmission and generation facilities will be requested.
- From that list, certain facilities will be selected.
- Evidence will need to be provided showing the Facility, Equipment Ratings, Facility Ratings, etc.

➢ Don’t be surprised if…

- You are requested to provide one line diagrams of the selected Facilities
- You are asked to discuss how you define “terminal equipment” or the difference between normal and emergency Ratings
- Even if FAC-008-3 R3 isn’t in scope, you are requested to provide your Facility Ratings Methodology to ensure it is being followed

What to Expect from Compliance Monitoring (cont'd)

- **Please remember to include source documents/evidence corroborating Ratings**



CONDUCTOR LIST

ITEM NUMBER	SUMMER 40°C AMPACITY	SUMMER 40°C TEMP. RISE	WINTER 0°C AMPACITY	WINTER 0°C TEMP. RISE	DESCRIPTION
1A	2474	30° C	N/A	N/A	5" IPS ALUMINUM PIPE, SCHEDULE 40, ALLOY 6063-T6
1B	3680	50° C	N/A	N/A	
2C	8500	65° C	*	*	ISOPHASE BUS DUCT
3C	7000	65° C	*	*	ISOPHASE BUS DUCT
4A	1849	30° C	2770	70° C	2-1272 AAC, 61 STR CABLES WITH 3" CABLE SPACING
4B	2273	50° C	3132	90° C	
4C	2514	60° C	3292	100° C	
5A	945	30° C	1596	70° C	1590 AAC, 61 STR CABLE
5B	1312	50° C	1811	90° C	
5C	1454	60° C	1906	100° C	
6A	847	30° C	1424	70° C	1272 ACSR, 45/7 STR CABLE
6B	1168	50° C	1613	90° C	
6C	1294	60° C	1695	100° C	
7A	833	30° C	1399	70° C	1272 AAC, 61 STR CABLE
7B	1148	50° C	1582	90° C	
7C	1270	60° C	1663	100° C	
8E	3000	65° C	*	*	NONSEG BUS DUCT

AMPACITY IN TABLE ABOVE IS BASED ON:

TEMPERATURE RISE FROM 40° C AMBIENT TEMPERATURE (SUMMER)
TEMPERATURE RISE FROM 0° C AMBIENT TEMPERATURE (WINTER)
MAXIMUM ALLOWABLE CONDUCTOR TEMPERATURE IS 100° C.

* WINTER AMPACITY IS EQUAL TO SUMMER AMPACITY FOR RIGID BUS.

THE RATINGS ON THIS TABLE ARE BASED ON CRITERIA PRESENTED IN COMPANY XXX'S STANDARD. THE INFORMATION PRESENTED IN THIS CHART MAY NOT BE THE MOST CURRENT IN THE EVENT THAT A MORE RECENT STANDARD HAS BEEN RELEASED.

What to Expect from Compliance Monitoring (cont'd)

- **During the engagement, a walkthrough of various Facility Rating processes will be performed, which may include:**
  - The use of a Facility Ratings Database or asset management system
  - Processes around equipment commissioning, modification and retirement
  - Processes around the flow of Ratings data from the field to the one line diagrams, Facility Ratings Database, EMS, models, etc.
  - Internal controls around the Facility Ratings processes

What to Expect from Compliance Monitoring (cont'd)

➢ Field verifications

- Substation field inspections may take place to verify the Facility and Equipment Ratings provided.
  - This will be a collaborative effort between CM (Compliance Monitoring) staff and the entity to determine which substations to visit, safety protocols, etc.
- Within the control room, Facility Ratings within the EMS may be compared to those within the Facility Ratings database.
- The Facility Ratings provided to the Reliability Coordinator through PJM's eDART or MISO's CROW systems may be verified to ensure they align with those within the EMS and Facility Ratings database.

Facility Ratings CMEP Practice Guide

NERC
NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION

ERO Enterprise CMEP Practice Guide

Evaluation of Facility Ratings and System Operating Limits
June 17, 2020

Background

In support of successful implementation of and compliance with the North American Electric Reliability Corporation (NERC) Reliability Standards, the Electric Reliability Organization (ERO) Enterprise[1] adopted the Compliance Guidance Policy.[2] The Compliance Guidance Policy outlines the purpose, development, use, and maintenance of guidance for implementing Reliability Standards. According to the Compliance Guidance Policy, Compliance Guidance includes two types of guidance – Implementation Guidance and Compliance Monitoring and Enforcement Program (CMEP) Practice Guides.[3]

Purpose

CMEP Practice Guides are developed solely by the ERO Enterprise to reflect the independent, objective professional judgment of ERO Enterprise CMEP staff (CMEP staff), and, at times, may be initiated following policy discussions with industry stakeholders. Following development, they are posted for transparency on the NERC website. It is to be noted, especially to registered entities using this guide as a reference, that while some aspects of this guide may assist CMEP staff directly in determining compliance, some parts of the guide are to assist CMEP staff in understanding how an entity mitigates risk in order to inform risk-based compliance monitoring. This understanding of the controls to mitigate risk can affect monitoring activities, such as substation walkdowns, requests for information, and adjustments to an entity's compliance oversight plan.

Facility Ratings CMEP Practice Guide (cont'd)

- The CMEP (Compliance Monitoring and Enforcement Program) Practice Guide provides guidance for CMEP staff, however, since it is publicly available, it also provides insights that Registered Entities can benefit from.
- CMEP staff will use this document as a guide to assist in the review of Facility Ratings over the aforementioned Standards in the hopes of promoting consistency across the ERO.
- However, each case will be evaluated based on the specific facts and circumstances for compliance monitoring determinations.

Facility Ratings CMEP Practice Guide (cont'd)

➢ Validation of Facility Ratings in the EMS and models

- Compare Real-time models and Facility Ratings to identify any discrepancies. If there are, is there a valid reason?
- Do Real-time models use the most limiting applicable Equipment Rating that comprises that Facility?
- How are temperatures adjusted or seasonal ambient ratings reflected in Real-time operations? How are temporary Rating changes accounted for?

➢ Dynamic Facility Ratings

- If Real-time ratings based on certain factors (e.g., temperature, wind speed, etc.) are used, how is that calculation consistently applied and updated within Real-time operations?

Facility Ratings CMEP Practice Guide (cont'd)

➢ Field Verification of Equipment

- As stated previously, physical walk-downs of substations to verify Facility Ratings are consistent with documentation will most likely be performed. Normally, this will include 2 to 3 substations relatively close to the engagement location.
- If walk-downs are not currently being performed, the ERO strongly encourages the practice to properly validate Facility Ratings.
- If walk-downs are performed for all or some substations, discuss how this is achieved. Is it risk-based or simply on voltage level? Is it performed during commissioning? How is it documented?
- Keep in mind, if walk-downs are being performed by your entity to a level to which the CM staff believes the risk is addressed, walk-downs by the CM staff may not be necessary during the engagement.

Facility Ratings CMEP Practice Guide (cont'd)

➢ Design Ratings

- "CMEP staff shall not accept design drawings as **sole** evidence of Equipment Ratings."
- Please verify Equipment Ratings, not assuming that the design drawings accurately reflect the actual installed equipment.
- Follow your Facility Ratings Methodology ensuring that Equipment and Facilities are rated accordingly.

➢ Internal Controls

- As with all Reliability Standards, the review of internal controls will be a focus.
- Communicate with CM staff the controls in place and how they help mitigate the risks.

Facility Ratings CMEP Practice Guide (cont'd)

➢ Use these to assess your current practices

When reviewing compliance with FAC-008-3 R6, the following practices should be considered with the sampled Facilities:

- Identification of each BES Facility and its Facility Rating is consistent with FRM
- Identification of all equipment comprising the Facility
- Ratings of all the equipment comprising a Facility are consistent with FRM
- Identification of the Most Limiting Series Element (and if applicable, the next Most Limiting Series Element)
  - For each owner and each joint owner
  - Identification of Normal and Emergency Ratings, as appropriate
- Comparison of Facility Ratings between Facility Rating database and:
  - Planning models
  - EMS/SCADA (tools used to alarm and perform RTCA)
  - One-lines and/or design drawings
  - Actual field equipment

Closing Remarks

- Understand that Facility Ratings reach into numerous areas of Operations and Planning
- Use the resources available such as the CMEP Practice Guide and ERO Standard Application Guide to evaluate your current practices **(https://www.nerc.com/pa/comp/guidance/Pages/default.aspx)**
- **RF is always willing to discuss any questions you may have. Feel free to contact me:**
  - Derek Kassimer, Principal Analyst, Risk Analysis & Mitigation
  - 216-503-0638
  - derek.kassimer@rfirst.org

Questions & Answers

Forward Together ReliabilityFirst

Internal Controls and Facility Ratings

Denise Hunter – Principal Technical Auditor, Compliance Monitoring
Brian Hallett – Principal Reliability Consultant, Entity Engagement
RF Fall Virtual Workshop
August 25, 2020



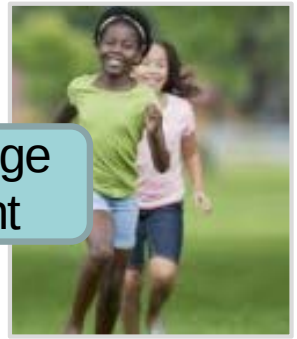



Why Focus On Controls?

Prevention

Managing Specifications

Training



Asset + Change Management

Problem

Facility Ratings Issues / Bad Print Management

Cure

Mitigation

Data / Record Corrections

Increased Regulation

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Framework

Drive Consistency + Efficiency + Identify Gaps

Tx Planning

ACM – BU1
- Act 1
- Act 2

EXID – BU1
- Act 1
- Act 2

GPs (Sustaining)

- Process to develop ratings based on design drawings and one-lines following FAC-008 methodology
- Process to verify that ratings in the system-of-record are aligned with planning and operations models

Sub/T-line Design

ACM – BU2
- Act 1
- Act 2

EXID – BU2
- Act 1
- Act 2

GPs (Sustaining)

- Drawing/Print version controls
- Process to issue drawing packages to various engineering groups
- Process to update records based on field mark-ups

Commissioning

ACM – BU3
- Act 1
- Act 2

EXID – BU3
- Act 1
- Act 2

GPs (Sustaining)

- Procedure to make changes to official engineering drawings to reflect changes made in the field
- Checklist to notify owners of systems-of-record that new equipment has been placed in-service

Operations

ACM – BU4
- Act 1
- Act 2

EXID – BU4
- Act 1
- Act 2

GPs (Sustaining)

- Process to notify Tx Planning + Sub/T-Line Design should inconsistent facility ratings be identified

Storm/ Emergency

ACM – BU5
- Act 1
- Act 2

EXID – BU5
- Act 1
- Act 2

GPs (Sustaining)

- Process to notify systems-of-record owners that equipment has failed
- Process to notify systems-of-record owners that new equipment has been placed in-service

Drive Mitigation of Risks

Current State

- **FAC-008-3 Effective Date 1/1/2013**

- **2015 to Current opportunities found on audit: 52 PNC/AoC/Recommendations, 6 Positive Observations**

  Note: Many more FAC-008-3 fall downs were self reported

- **Various opportunities: Change management, Commissioning, Verification/Validation, Mergers and Acquisitions**

- **We're still talking about it**

COSO

COSO Internal Control Framework Summary with RF Examples			
Component	**Principles**	**Point(s) of Focus**	**Examples**
Control Environment	1. Demonstrate commitment to integrity and ethical values	1.1 Tone at the Top	Management attitude, values and control, consciousness of personnel; Importance of integrity and ethical values
		1.2 Mission Statement	Identifies organization's purpose
		1.3 Standards of conduct	Expectations of Board and Sr. Mgmt concerning integrity and ethical values are defined and understood by all levels of organization, as well as outside sources with processes in place to evaluate performance against expected conduct
		1.4 Address deviations timely	Unethical, immoral, etc. activities addressed appropriately and timely
	2. Exercise oversight of the internal control program	2.1 Oversight structure defined	Board of Directors, Supervisory Board, etc.
		2.2 Applies relevant expertise	Appropriate decisions to achieve objectives
		2.3 Operates independently	Independent from organization
		2.4 Oversight of the internal control program	Oversees management design, implementation, operation of the internal control program
	3. Establish structure, reporting, authority, responsibilities	3.1 Internal Control Program documented	Document the "Who, What, Where, When, Why" of the internal control program
		3.2 Reporting lines established	Reliably report quality information
		3.3 Assign responsibility and delegation of authority	Provides ownership of the control program and ensures segregation of duties
		4.1 Establishes Policies and practices	Appropriate policies and procedures ensure all applicable risk has been addressed
		4.2 Addresses competence gaps	Organization has identified competence gaps and either established

- Control Environment
- Risk Assessment
- Internal Controls
- Information and Communication
- Monitoring

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Establish a Baseline

- **Without a valid baseline all other changes are suspect.**

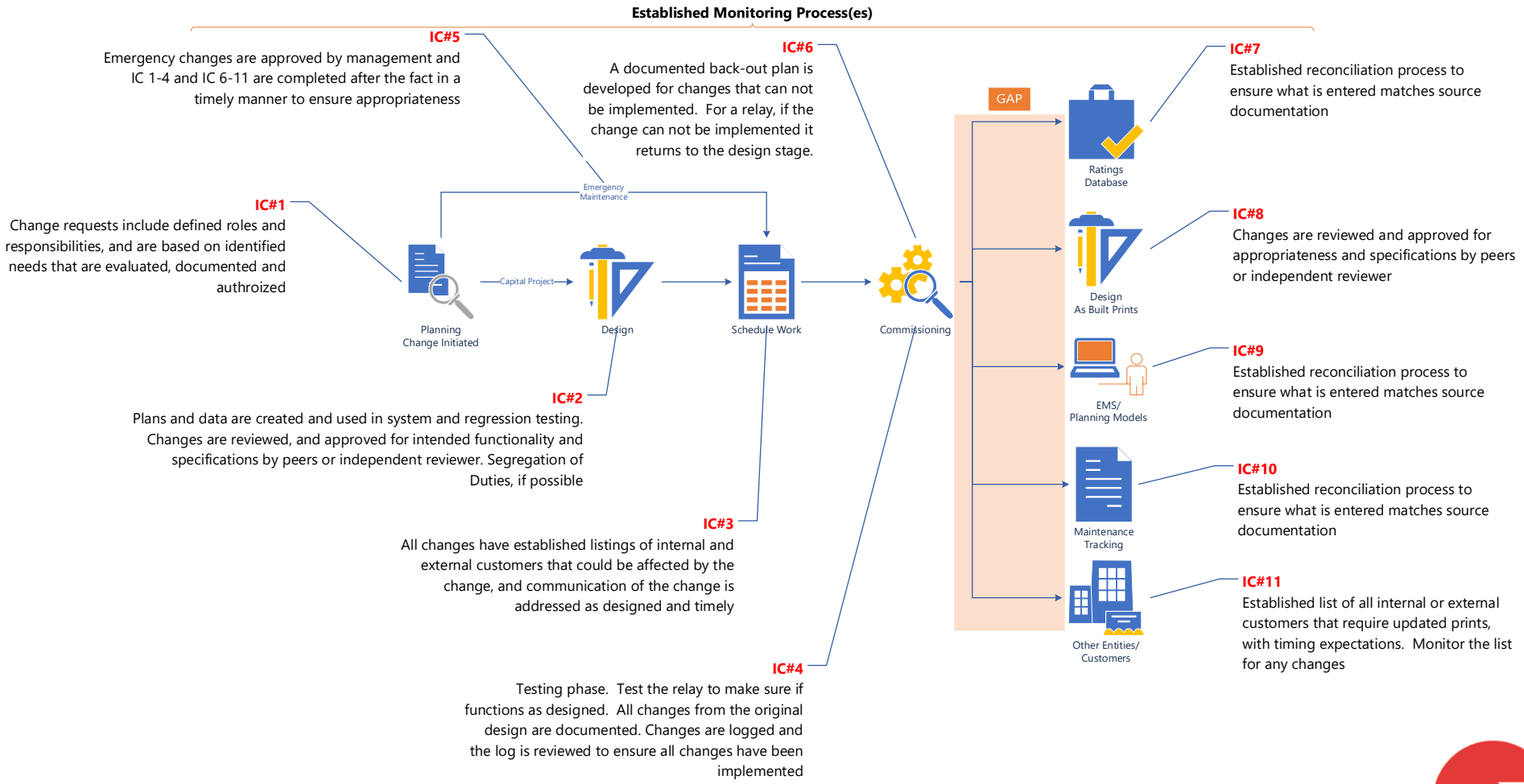
- **Create a schedule including:**
  - Cost baselines
  - Identify the resources needed
  - Estimate the number of hours to complete each task

- **This could be a large lift, therefore BE REALISTIC!**

Change Management

- Establish a plan to identify changes to operations, operating conditions or deviations from an established baseline.
- Establish a change approval process.
- Develop a change implementation program that details proper coordination of approved asset changes.
- Monitor the change process.
- Document changes, following the change trail from conception to monitoring.
- Define an emergency change process.

Change Process Flow



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Mergers and Acquisitions

1) Provide increased visibility and transparency by identifying key risks related to the strategic transaction change (i.e., highlight potential operational risks).

2) Identify gaps in the integration or separation project management plan (i.e., determine if all required NERC responsibilities have been met and are documented).

3) Call out the impact that the acquisition and its integration, or the divestiture, may be having on other parts of the business and established internal controls.

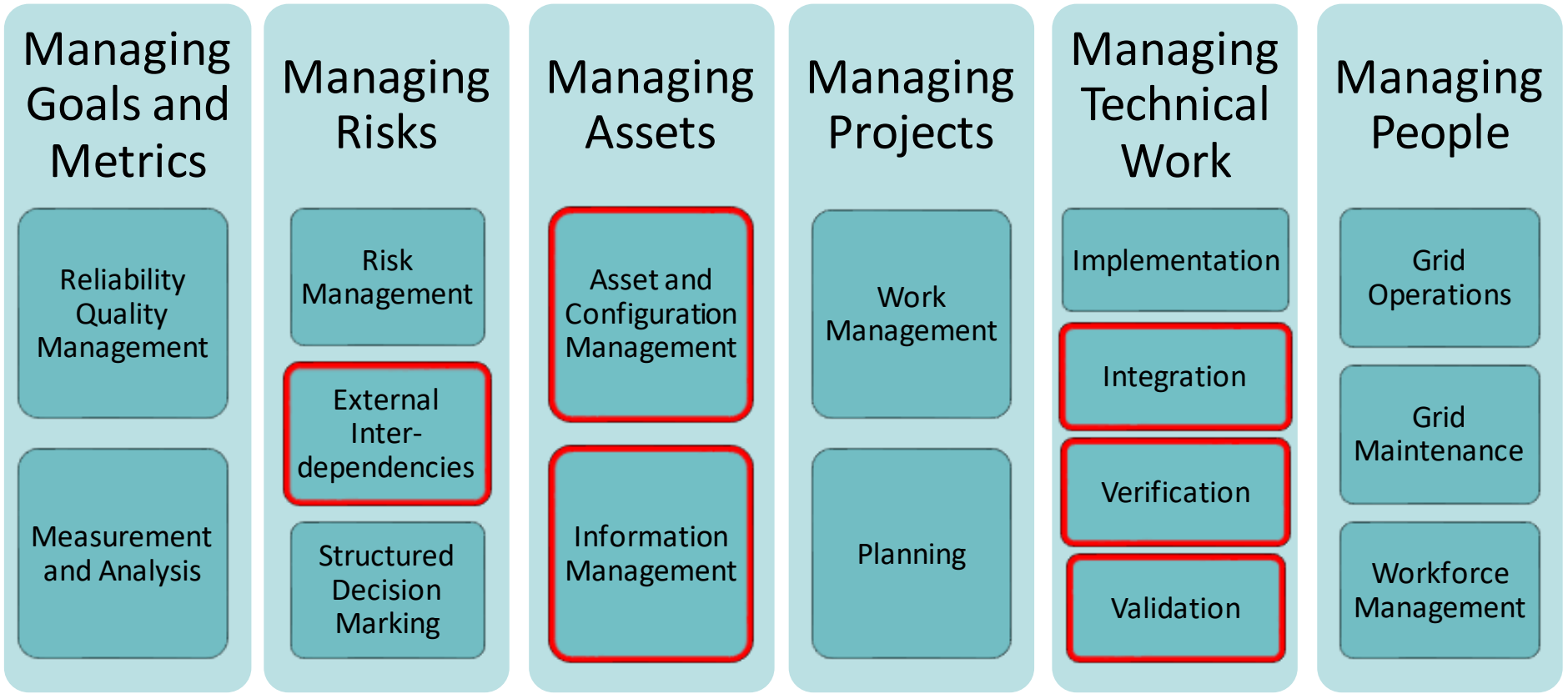
4) Support management's prioritization of risks of transition and organizational readiness for the effective and efficient allocation of resources to address the risks and controls.

5) Provide increased visibility of changes impacting established processes and controls.

Managing Your Business Through Internal Controls

- Internal control or an internal control system is the integration of the activities, plans, attitudes, policies and efforts of the people of an organization working together to provide reasonable assurance that the organization will achieve its objectives and mission.

RF Management Practices



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Appraisal Process

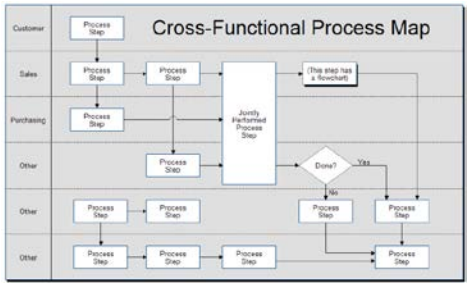
Inputs

Sample
or
"Widgets"

Management Practices Lens

- RFI questions
- Thermometers

Process Document



Outputs

- Implementation Level
- Process document citations
- Reviewer comments / recommendations

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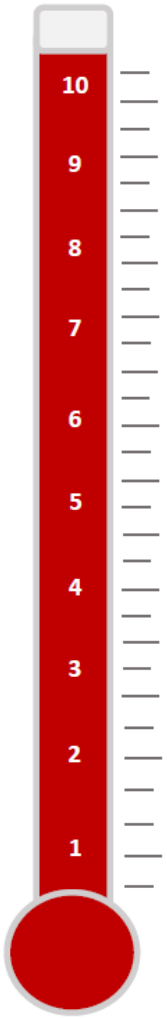
Management Practice: Asset and Configuration Management

The purpose of Asset and Configuration Management (ACM) is to establish an inventory of assets and configuration items, define the attributes of those assets and items, and maintain their integrity in the context of reliability and resilience.

Objective 1	**Establish assets and configuration items inventory**
Activity 1.1	Identify assets and configuration items
Activity 1.2	Define asset and configuration item attributes
Activity 1.3	Establish inventory and configuration control systems
Activity 1.4	Establish inventory and configuration baselines
Objective 2	**Control Changes**
Activity 2.1	Establish change control
Activity 2.2	Control changes to assets and configuration items and baselines
Objective 3	**Verify Integrity**
Activity 3.1	Establish and maintain change records
Activity 3.2	Perform assessments

Asset and Configuration Management Thermometer



ASSET & CONFIGURATION MANAGEMENT (ACM)

Activity 1.1: Establish assets & configuration items inventory	Activity 1.2: Define assets & configuration item attributes	Activity 1.3: Establish inventory & configuration control systems	Activity 1.4: Establish configuration baselines	Activity 2.1: Establish change control	Activity 2.2: Control changes to assets, configuration items & baselines	Activity 3.1: Establish & maintain change records	Activity 3.2: Perform assessments
Full assessment process in place	Fully defined; formal interview process	Fully developed & automated system	Fully established baselines	Fully established process	Change control owner and roles clearly defined	Organized system in place that tracks change records	Fully perform assessments
Assets updated but not frequent enough	Defined but no 3rd consulted; need benchmarks	Organized system but needs some updating	Some regular assessments performed; all assets covered	Established process but lacks collaboration	Responsibilities defined but not all stakeholders defined	Change records kept, but not all criteria tracked	Low frequency or not completing all assessments
Lack of process to regularly update	Out of box vendor default attributes	Some inventory or configuration, but not well managed	Less regular assessments; frequency based on asset; not all assets covered	Process in place but not well maintained or defined	Owner exists but responsibilities not defined	Change records not consistent	Reactive controls
No inventory established	Not defined	No inventory system	No baselines established	Not established or responsible party not assigned	No owner of configuration changes	Change records not kept or missing	No assessment performed

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Generic Goals and Practices

Generic practices (GP) relate to process **institutionalization**, which measure an entity's ability to sustain the effectiveness of the internal controls around the management practices evaluated.

GG 1.0 Achieve the specific goals
- GP 1.1 Perform specific practices

GG 2.0 Perform and institutionalize a managed process
- GP 2.1 Establish and maintain governance
- GP 2.2 Plan and monitor the process
- GP 2.3 Provide resources for the process
- GP 2.4 Define responsibility and stakeholder involvement
- GP 2.5 Education and train the process
- GP 2.6 Manage and control the process
- GP 2.7 Objectively monitor the process

GG 3.0 Perform and institutionalize a defined process
- GP 3.1 Define the process
- GP 3.2 Improve the process

Report Out

Management Practice Description

Overall Capability Score Across Organization

Strengths Observed by Activity and Business Unit

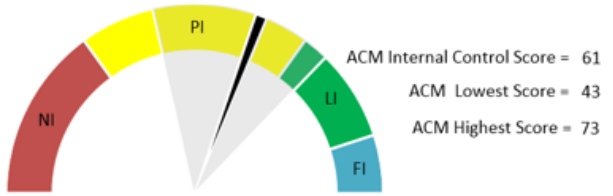
Specific Recommendations to Improve Capability

General Areas of Focus

Asset and Configuration Management

Management practice area to establish an inventory of assets and configuration items, define the attributes of those assets and items, and maintain their integrity in the context of reliability and resilience.

Implementation Level:



Strengths:

a) Developed best-practice governance process related to asset and inventory management. This process should be replicated for all data management processes that highly impact the organization. **[ACM SP 1.1, BU1]**

b) Excellent commissioning checklist review by Policies and Procedure Team (includes solicitation from engineering teams). Largely implemented in this area due to frequency of reviews and involvement from stakeholders. **[ACM SP 1.1, BU4]**

c) The formation of a Data Quality Team is considered a best practice. This team checks data prior to entry into the system-of-record and provides a Pass/Fail grade for data entry (completeness and accuracy) for all employees. **[ACM SP 2.1, BU4]**

Areas for Improvement:

a) It is recommended that BU1 explore better ways to link and query assets within the Asset and Configuration Management System. This will increase user efficiency within the tool, (i.e. identify all protection devices on a circuit basis). **[ACM SP 1.2, BU1]**

b) Consider adjusting existing policies and procedures to incorporate time durations and checks associated with data changes in Asset and Configuration Management System due to emergency/failure work and errors found during maintenance work. It may be beneficial to add a field within the system that clearly labels the source of the data change (i.e. capital project, maintenance correction, emergency fixes, etc.). This may facilitate better tracking the source of errors. **[ACM SP 1.3, BU1, BU4]**

c) A project has been identified as an in-flight solution to further coordinate and automate model coordination, including short circuit data. Ensure the following capabilities/requirements are considered: establish clear baselines, track projects by in-service date, manual and automated checks for data entry, periodic spot-checks, and periodic meetings with all stakeholders to provide feedback regarding data characteristics.**[ACM SP 1.1-1.4, BU2]**

d) It may be beneficial to keep a repository of older models used to develop relay settings. This may provide useful when trying to determine root cause associated with relay misoperations and model improvement initiatives. **[ACM SP 3.2, BU2]**

Management Practice Maturation:

In most organizations, irrespective of their size or domain in the BES, the volume of data involved in effectively establishing and maintaining an asset inventory makes it impractical to manually implement the practices in the process area. Furthermore, because relationships between assets and their associated attributes can be one-to-one, one-to-many, many-to-one, or many-to-many, defining and associating attributes to assets is most effective when done so using a relational database table-driven information technology

RELIABILITY FIRST

Summary

- **Each Business Unit needs to deploy the appropriate controls to mitigate the various risks.**

- **A model-based framework can be used to assess similar types of controls across an organization, focusing on:**
  1. Gaps that need to be filled
  2. Increasing maturity
  3. Sharing best practices

- **Both approaches work together to promote "Operational Excellence"**

Questions & Answers

Forward Together ReliabilityFirst

Facility Ratings & Commissioning Process

Jim Kubrak

Manager, Operations and Planning Monitoring

RF Fall Virtual Workshop

August 25, 2020






Agenda

- Discuss the industry shift in transmission investments
- Review entity feedback from the questionnaire
- Discuss the importance/process of commissioning
- Identify the trend in gaps and failure modes we are seeing from entities
- Provide suggestions on best practices we have seen so far on mitigating risk

DOE Annual U.S. Transmission Data Review March 2018

- Investments in Transmission almost doubled between 2010 to 2015

- With this amount of investment focus on upgrading the BES change in a shorter time span results in a heightened risk in change management programs

2.4 Transmission Investment

Information on transmission investment is taken from EEI, which publishes an annual summary of information on transmission investment by member IOUs (investor-owned utilities), which includes investment and projected investment figures derived from EEI surveys and investor presentations, supplemented with additional data from FERC Form 1 filings (See Figure 2-9.). Note that the investment totals are presented in nominal dollars. Investments by public power and cooperative utilities are not included.

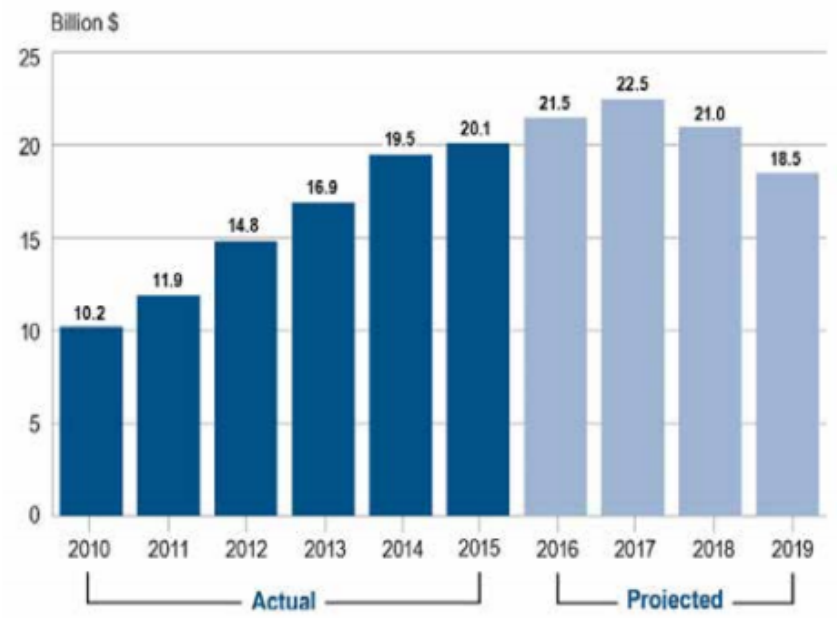


Figure 2-9. Historical and projected transmission investment by shareholder-owned utilities

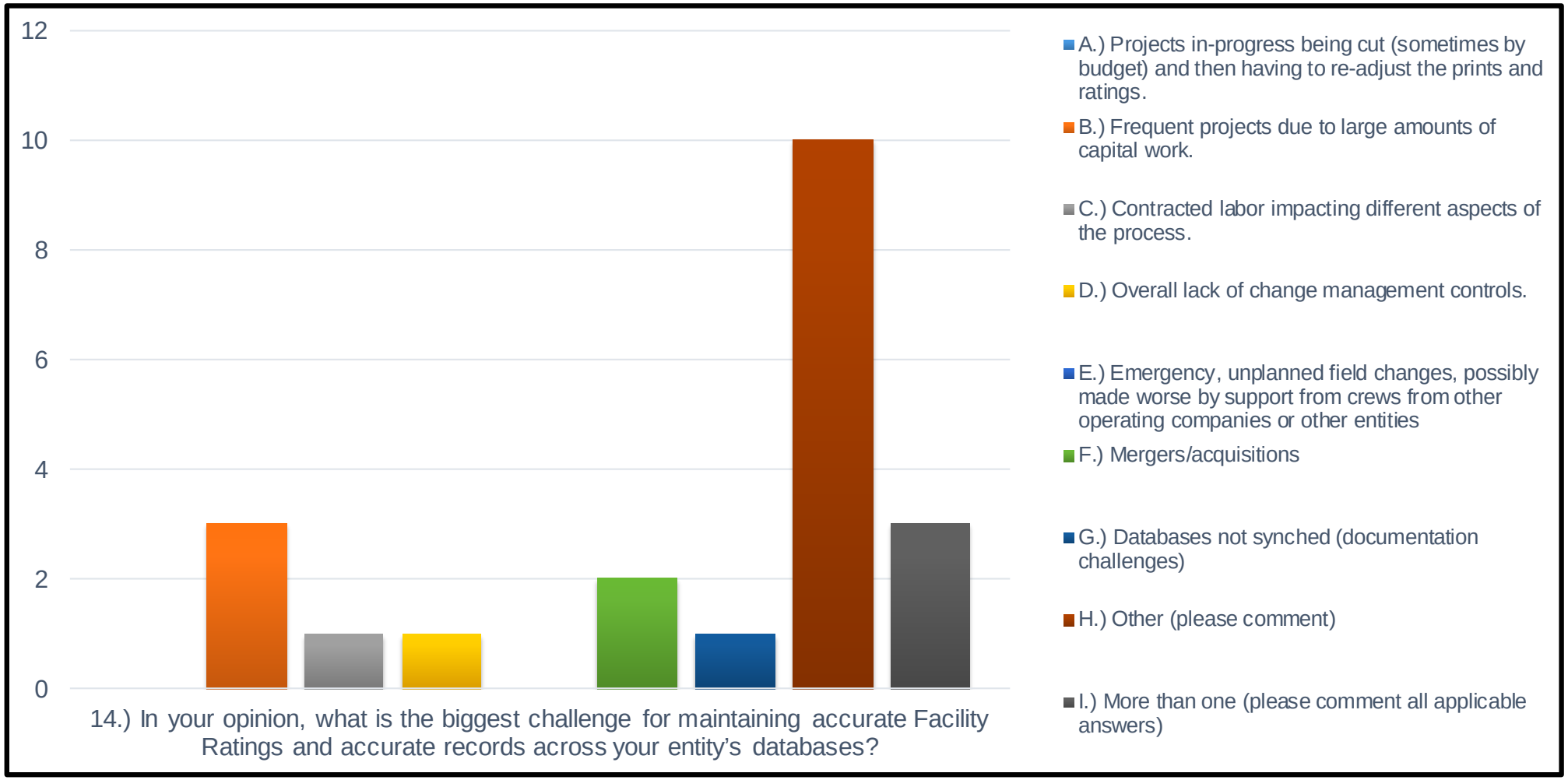
Source: EEI (2016): http://www.eei.org/issuesandpolicy/transmission/Pages/transmissionprojectsat.aspx

Commissioning Importance/Process

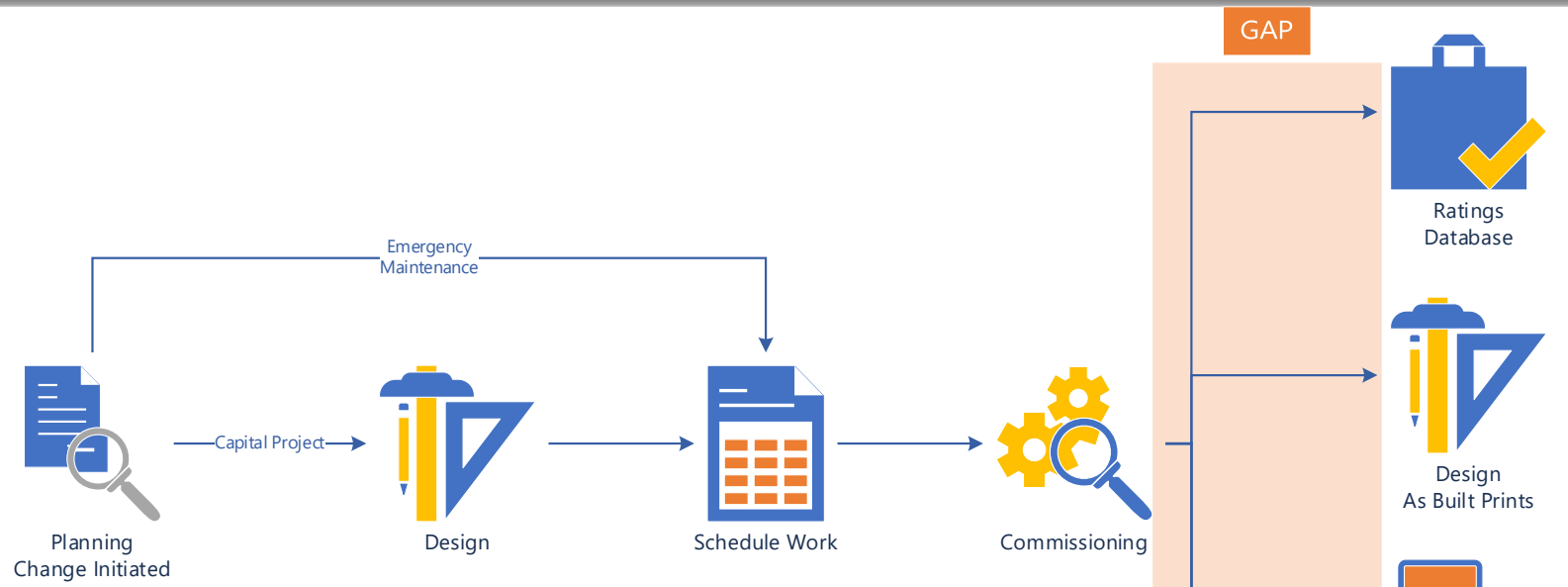
- Last verification that the design/equipment works as intended
- Coordination between multiple personnel/groups
- Information from the commissioning process needs to be provided to the key personnel who update that information in the ratings database, EMS model, etc.
- Once all sign offs are completed, In-Service load checks (if applicable) and visual inspections are performed
- As-built prints need to be provided to the personnel responsible for maintaining as-built prints

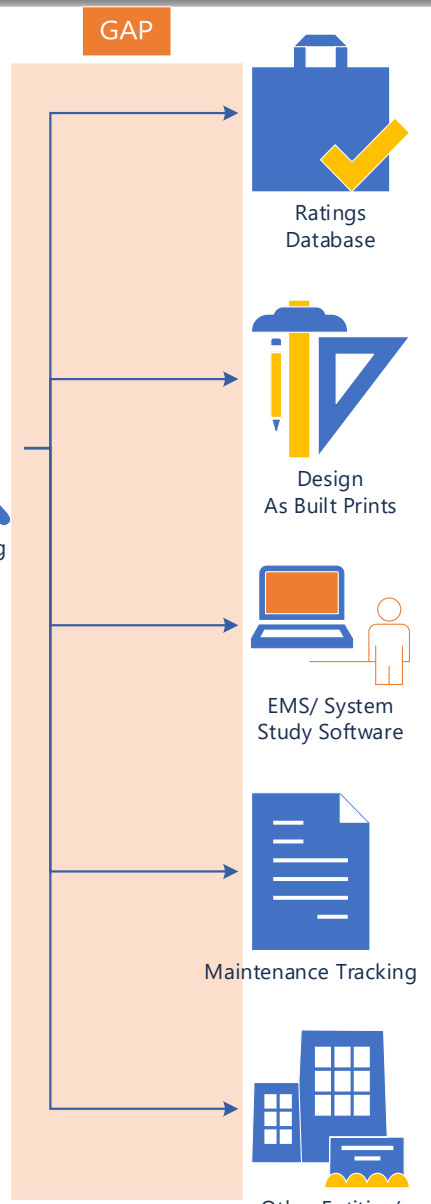
FAC-008 Questionnaire

In your opinion, what is the biggest challenge for maintaining accurate Facility Ratings and accurate records across your databases?



Most Common Gap in Facility Ratings





Commissioning Failure Modes: Findings Through RF Data

- Single Point of Failure
- Data Entry Human Error
- As-built prints not getting back to proper personnel
- Incorrect relay settings being applied
- Errors in information transfer to new software systems
- Merger and Acquisition Commissioning differences

Understanding Failures

- Severity
- Occurrence of the failure
- Detection
- Risk

Best Practices Through Feedback & Engagements

- 5 year review (20% per year) of all facility ratings
- Commissioning Checklist sign offs before energization
- 2nd-party reviews on facility ratings data entry with field
- Eliminate single point of failure

Reference Documentation - Power System Relaying and Control Committee

- **Commissioning**
  - IEEE PSRC, WG I-25:Commissioning Testing of Protection Systems
- **Design**
  - IEEE Quality Assurance for Protection and Control Design
- https://www.pes-psrc.org/kb/published/reports.html

You Are The Change!

➢ Job Function

- PCC
- Project Manager
- Commissioning Engineer
- Technician
- PNA Engineer
- Management/Leadership

Questions & Answers

Forward Together ReliabilityFirst

Verification and Validation (V&V) of Facility Ratings

Johnny Gest
Manager, Engineering and System Performance
RF Fall Virtual Workshop
August 25, 2020






Objectives

- **Explain the difference between Verification and Validation and when each is applicable**
- **Provide insight with V&V key concepts and examples**
- **NOT intended to be a mandatory prescribed method to implement V&V**
- **V&V activities developed based on risk, impact and budget**

V&V Definitions

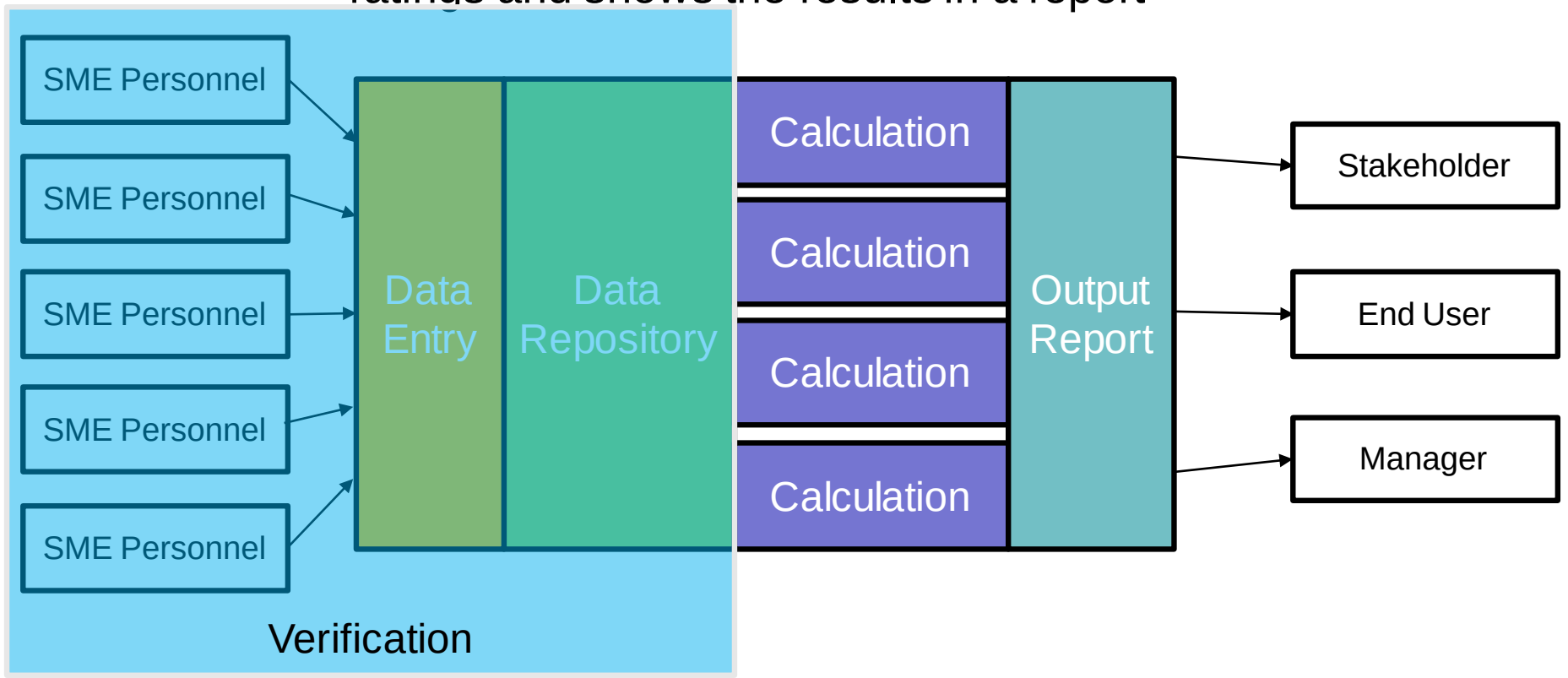
- **Requirement –** Defined characteristic or performance parameters associated with electrical equipment

- **Verification –** The act of ensuring that all relevant electrical equipment meets applicable Requirements
  - Perform review/testing ***prior*** to implementation

- **Validation –** The act of ensuring that electrical equipment operates correctly and pursuant to its intended purpose in its environment
  - Perform review/testing ***after*** implementation

Verification Example

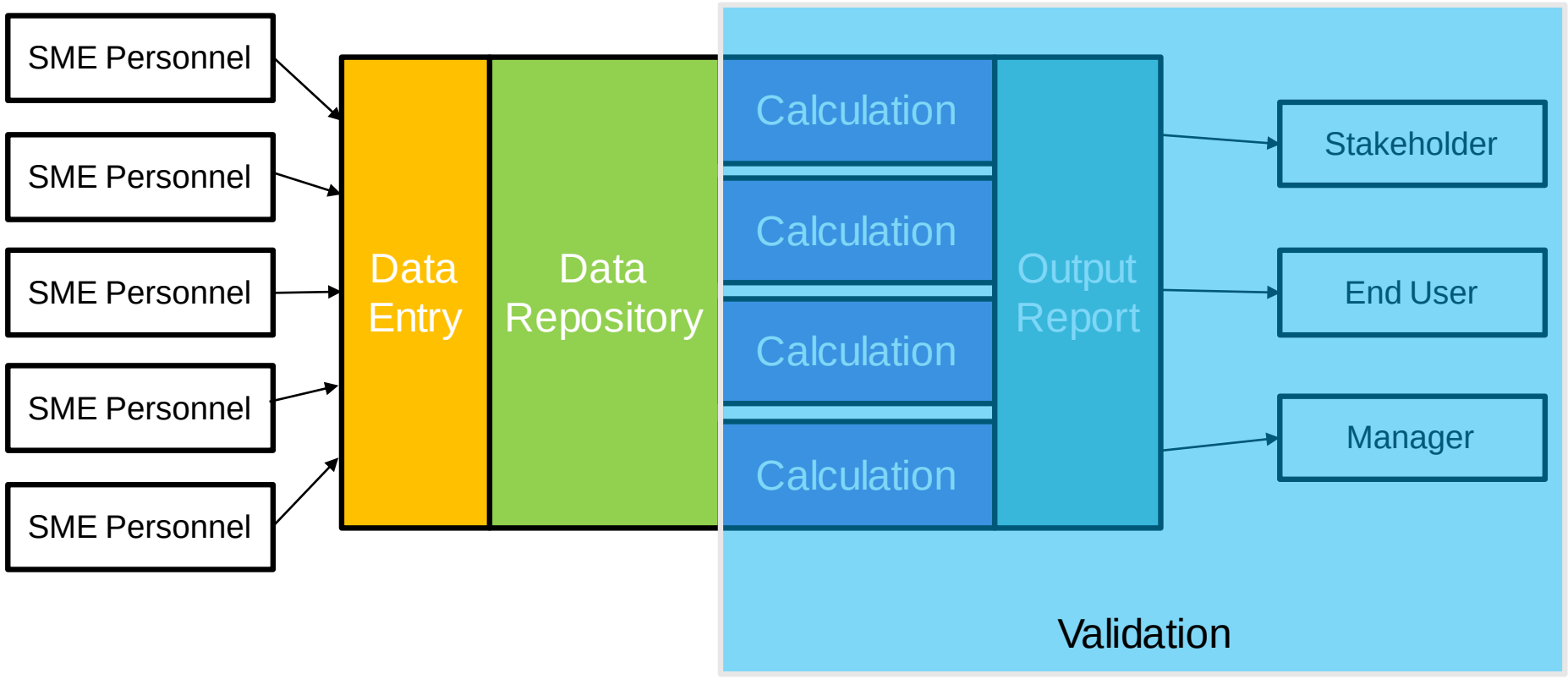
Software that calculates equipment ratings and shows the results in a report



- **Performed by technical personnel with experience on equipment and tool**
- **Identify risks associated with erroneous data from the field**

Validation Example

Software that calculates equipment ratings and shows the results in a report



- **Performed by end users and stakeholders (can interpret/communicate results)**
- **Identify value associated with testing**

Overall V&V Process

1. **Identify** – create a list of critical equipment and various relationships

2a. Risk Assessment – determine the likelihood and impact that an error could occur

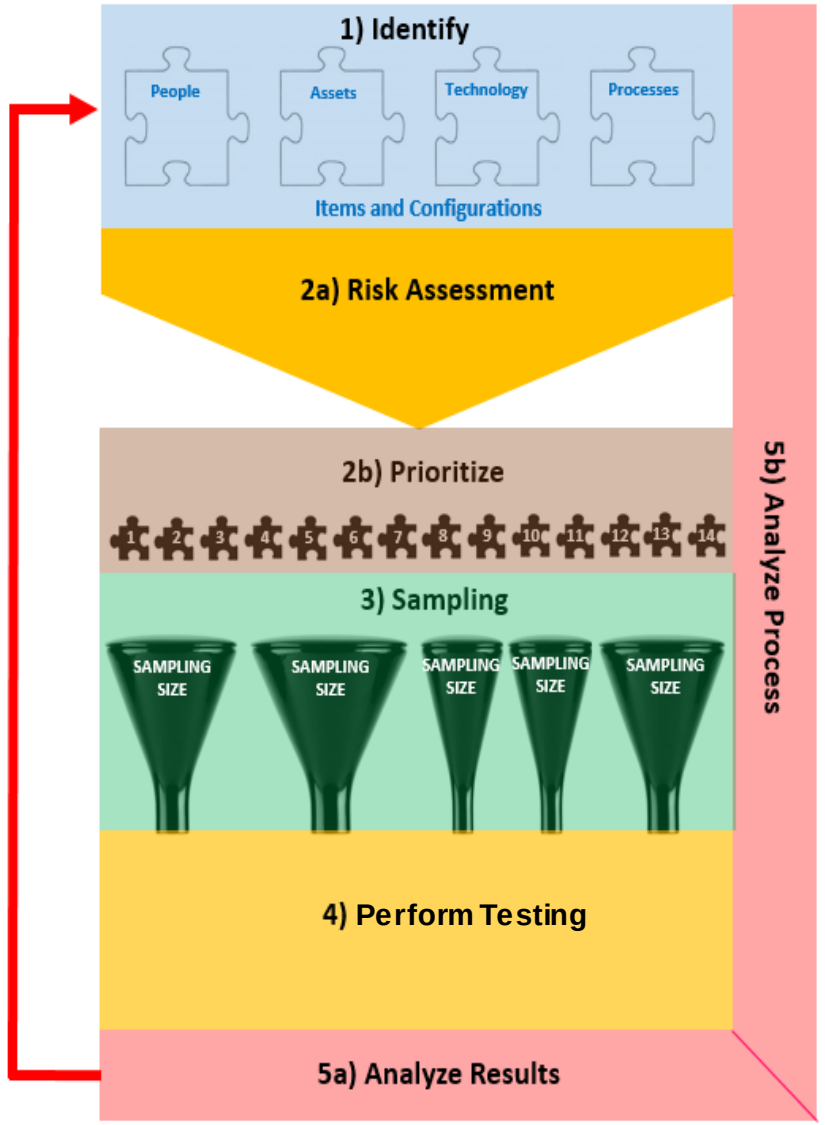
2b. Prioritize – based on the risk assessment results, rank equipment based on criticality

3. **Sampling** – determine the rigor of V&V activities to be performed (i.e., sampling size)

4. **Perform Testing** – prepare, develop procedures and criteria, test, and record results

5a. Analyze Results – check for failure trends

5b. Analyze Process – check for deviation from actual testing versus the V&V process



Identify

- **Identify assets AND the people, technology and processes related to those assets**
- **SME feedback is critical to ensure coverage of all equipment and relationships**

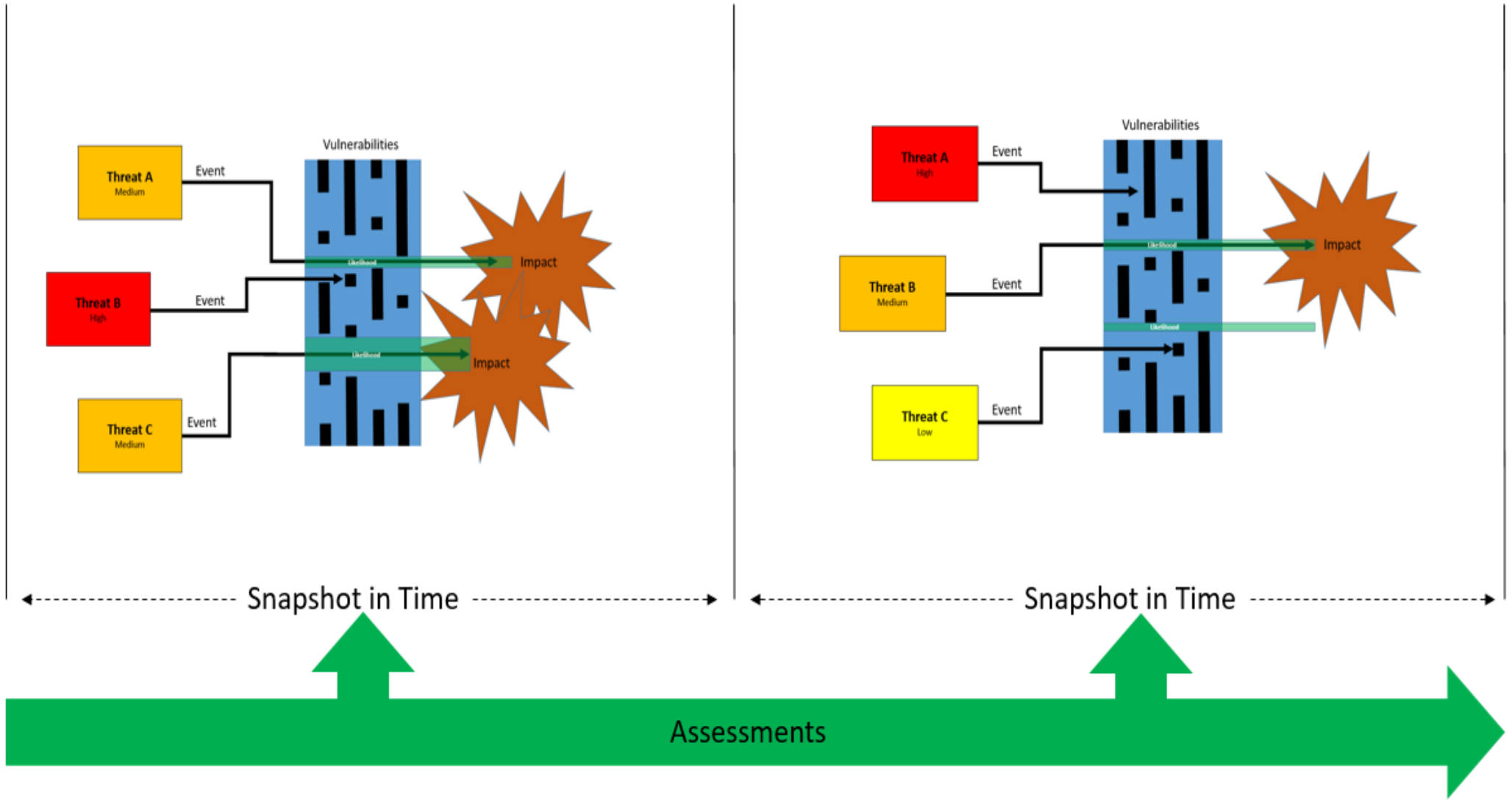
Identify
Risk Assessment
Prioritize
Sampling
Perform Testing
Analyze Results
Analyze Process

Example

Assets	People	Technology	Processes
	Manufacturer	Test Equipment	Testing Requirements
Circuit Breaker 	Supply Chain	Asset Database	Contract Requirements
	Design	Rating Database	Design Requirements
	Planning	Power Flow Model	Planning Process
	Relay Technician	EMS	Rating Methodology
	Operations	One-line	Operational Guidelines

Risk Assessment

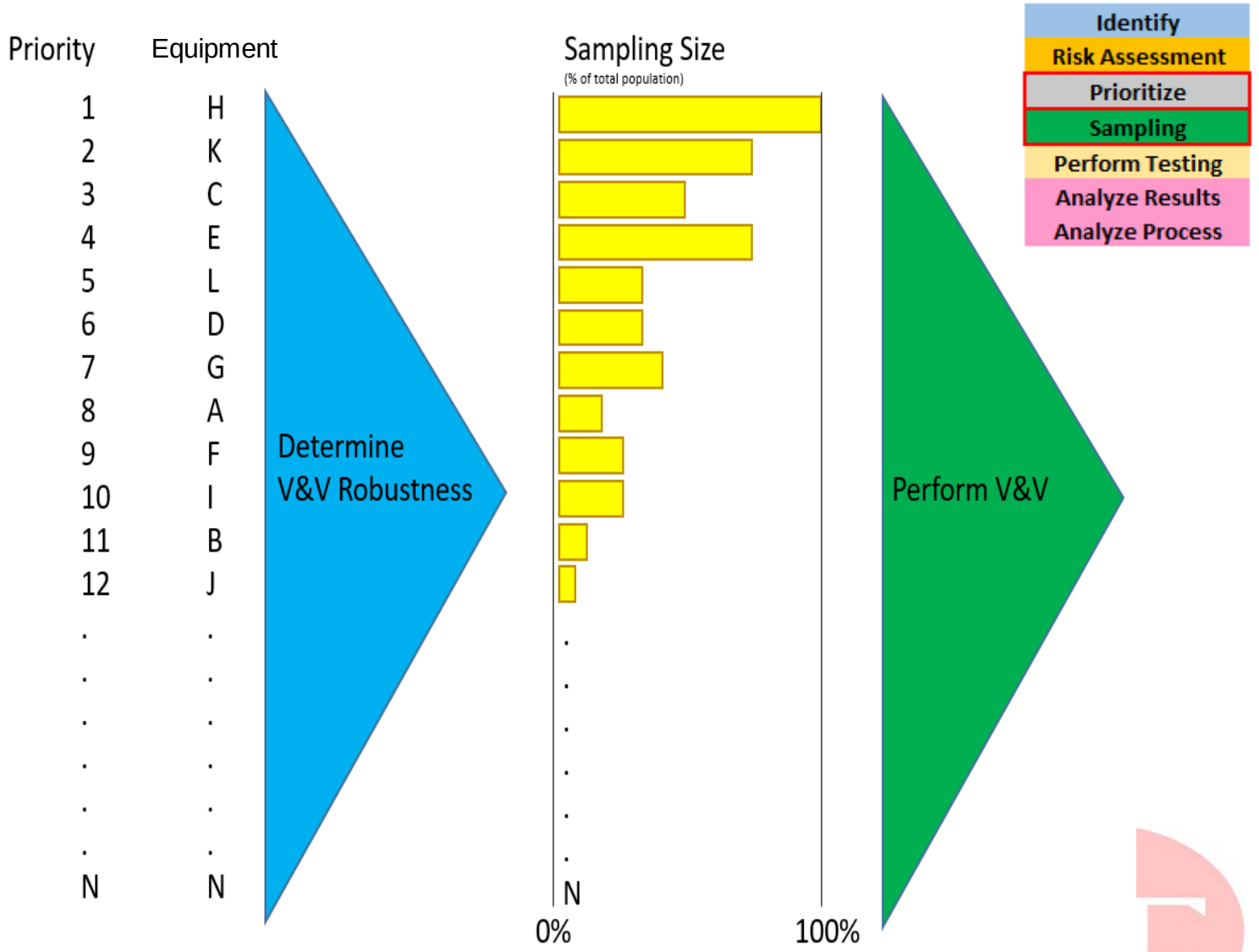
Relationship between Threats, Events, Vulnerabilities, Likelihood, and Impact



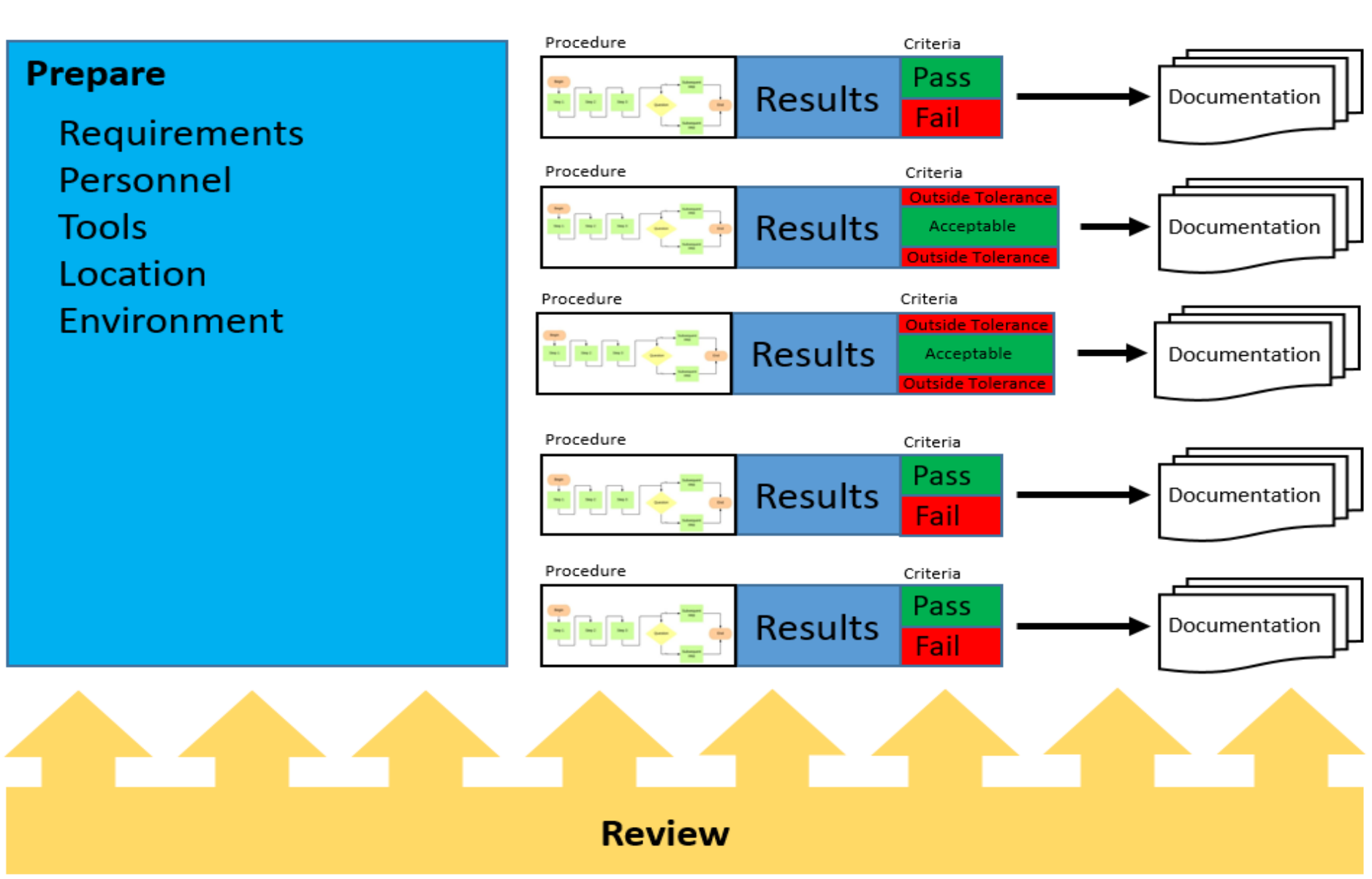
- Identify
- **Risk Assessment**
- Prioritize
- Sampling
- Perform Testing
- Analyze Results
- Analyze Process

Prioritize & Sampling

- Risk Assessment determines the Impact and Likelihood; Risk = Impact x Likelihood.
- Based on risk priority, determine the time, resources, effort, frequency, thoroughness and budget of V&V activities.
- Depending on the equipment population, it may be pertinent to perform V&V activities for only a portion of the population.
- Reducing the number of items that require V&V activities reduces resource allocation and cost, which may allow for more rigorous V&V activities.

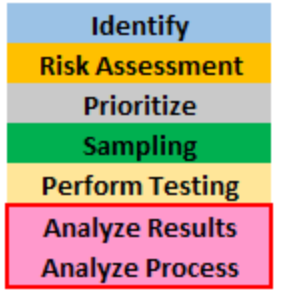


Perform Testing



Identify
Risk Assessment
Prioritize
Sampling
Perform Testing
Analyze Results
Analyze Process

Analyze V&V Results and Process



Failure Trends

- Percentage of actual failures could indicate latent failures in the remaining population
- May need to perform additional V&V activities or implement mitigation activities
- Failure trend results should be communicated and incorporated into future risk assessments

Adherence to V&V Process

- Document any deviation from the testing procedures and positive or negative observations during testing
- Review V&V procedures on a periodic basis; involve testers and stakeholders
- Review should allow for quick escalation of high risk observations (i.e., safety related)

External V&V

What approach should be taken for equipment or data produced externally?

- Do your research
- Requirements are developed to reduce error
- Track performance against Requirements
- Performance results indicate level of V&V
- Be transparent with results…….benchmark performance and communicate results

Subcontractor V&V

External sources may have to utilize an outside resource or Subcontractor

- **Be aware. Require that external sources provide notification when using Subcontractors**
- **Develop comprehensive requirements for use of Subcontractors:**
  - Adhere to organizational policies, procedures, and processes (especially related to safety and security)
  - Have acceptable personnel training and certification (i.e., from a security perspective, it may be necessary to only allow Subcontractors from certain countries)
  - Utilize appropriate equipment and tools
- **Ensure that external source is periodically assessing Subcontractor performance**

V&V Tips

- **Explore other high risk industries for additional insight V&V techniques**
- **Collaborate and share effective V&V techniques with industry peers**
  - ReliabilityFirst can help: Assist Visits, Workshops, Tech Talk with RF, newsletter articles, etc.
- **Develop controls that increase both quality and efficiency (templates and checklists)**
- **Take advantage of previously performed V&V activities**
- **Take advantage of V&V toolsets that have already been developed**
- **Leverage resources performing other activities to support V&V**
- **Utilize automation when feasible**

Questions & Answers

Forward Together ReliabilityFirst

WRAP-UP AND WHAT'S NEXT AT RELIABILITYFIRST

Save the Date – Insider Threats Workshop

- **September 30, 2020 8:00 a.m. – 12:00 p.m.**
- **Insider Threat risk management, trends, program management, best practices, lessons learned, and resources**
- **Intended Audience**
  - Physical Security Managers
  - Cyber-Security Managers
  - Vendor / Supply Chain Managers
  - Human Resources (HR) Managers and Administrators
  - Privacy Attorneys
- **Guest Presentations from**
  - CERT National Insider Threat Center
  - FERC & NERC
  - PJM & MISO

Virtual Breakout Sessions

Stakeholder Facility Ratings Success and Lessons

11:00 am - 12:00 pm

LARGE TRANSMISSION OWNERS

RF Facilitators: Jeff Mitchell, Director, Special Projects, and Brian Hallett, Principal Reliability Consultant

Presenters: Kamran Ali, Managing Director, and Hassan Hayat, Regional Transmission Planning Manager, AEP

Dave Quier, Director of Asset Management, and Shadab Ali, Manager of Transmission, PPL

WebEx Link: Click Here

Meeting Number (Access Code): 160 453 4483
Password: 0123456789
Join by phone: 1-650-479-3207

SLIDO: #RFWorkshop-LargeTO

SMALL - MEDIUM TRANSMISSION OWNERS

RF Facilitators: Jim Kubrak, Manager, Ops/Planning, and Kristen Senk, Sr. Managing Counsel, Legal & Enforcement

Presenters: Ryan Abshier, Manager of the Indiana Planning & Protection Group, CenterPoint

Joe Pilch, Transmission Planning Engineer, Duquesne Light Company

WebEx Link: Click Here

Meeting Number (Access Code): 160 271 3388
Password: 0123456789
Join by phone: 1-650-479-3207

SLIDO: #RFWorkshop-MediumTO

GENERATOR OWNERS

RF Facilitators: Brian Thiry, Manager Entity Engagement, and Denise Hunter, Principal Technical Auditor

Presenter: Nick Poluch, Senior Manager, NERC & Cyber Protection, Talen Energy

WebEx Link: Click Here

Meeting Number (Access Code): 160 871 0659
Password: 0123456789
Join by phone: 1-650-479-3207

SLIDO: #RFWorkshop-GO

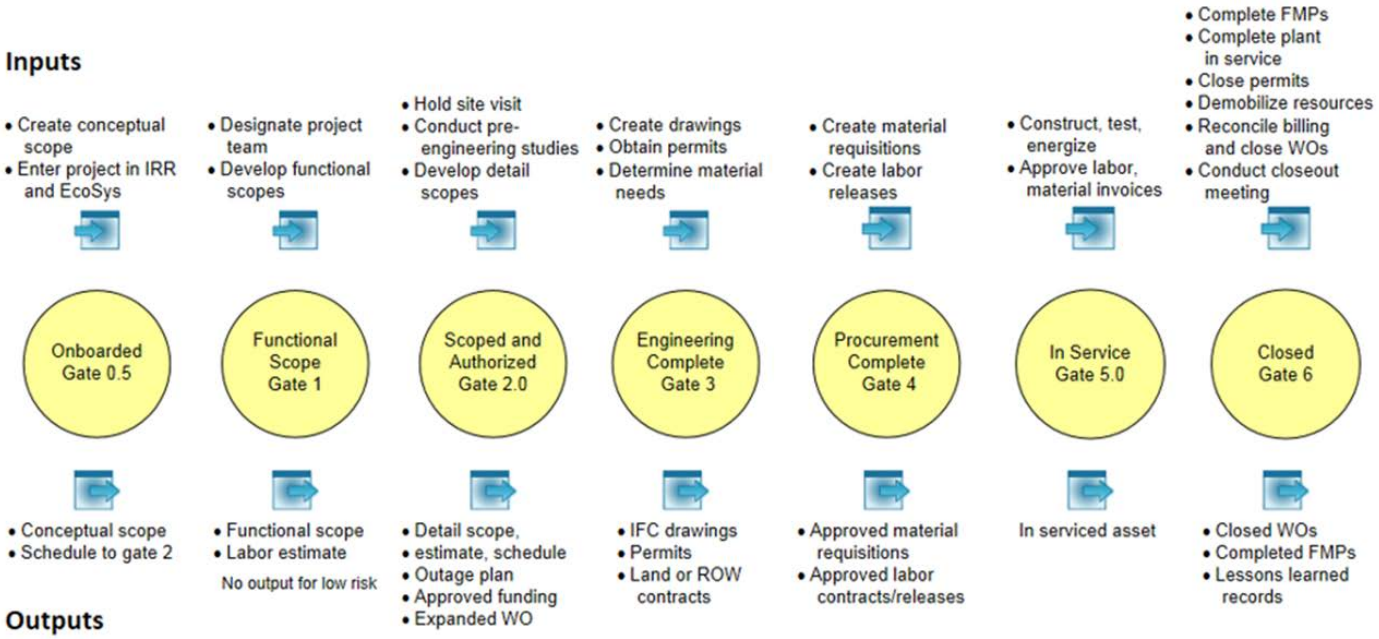
RF Facility Ratings Aug 25 Workshop

Kamran Ali
Managing Director, Transmission Planning

Hassan Hayat
Regional Manager, Transmission Planning

American Electric Power Transmission Grid Development

AEP's Project Lifecycle Management Process (PLMP)



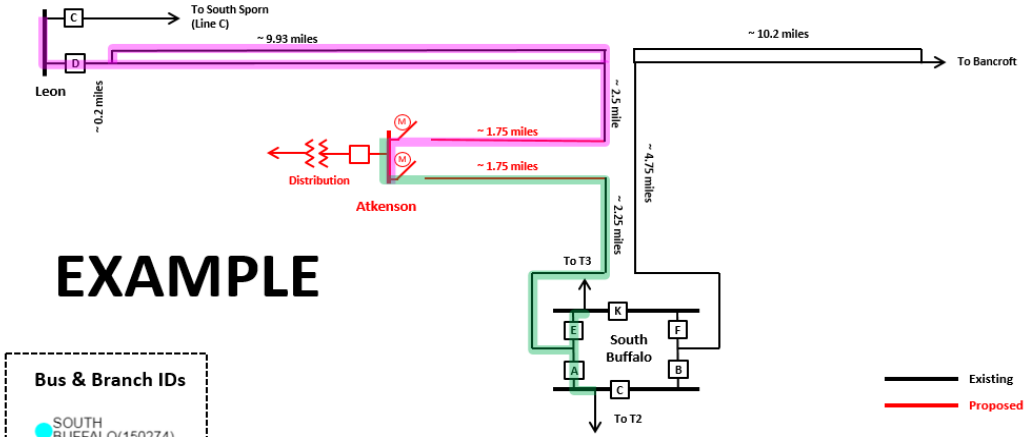
Facility Ratings Process Integration with AEP's PLMP

On-boarding	Scoping	Engineering	Construction	Energization
• Provide target ratings • Define facility series element make-up • Establish bus & branch identifiers	• Scope of work preparation to meet target ratings • Initiation of impedance sub-process • Electronic routing to establish baseline	• Construction packages issued (IFC) • Attestations drawings issued • Impedance calculations finalized • IFC topology modeling finalized	• Attestations returned (as-designed to as-built comparison) • Off-Design Process (if as-designed does not match as-built)	• As-built topology modeling finalized • Real-time Ops models updated

Facility Ratings Process Integration with AEP's PLMP

On-boarding

- Provide target ratings
- Define facility series element make-up
- Establish bus & branch identifiers



Bus & Branch IDs

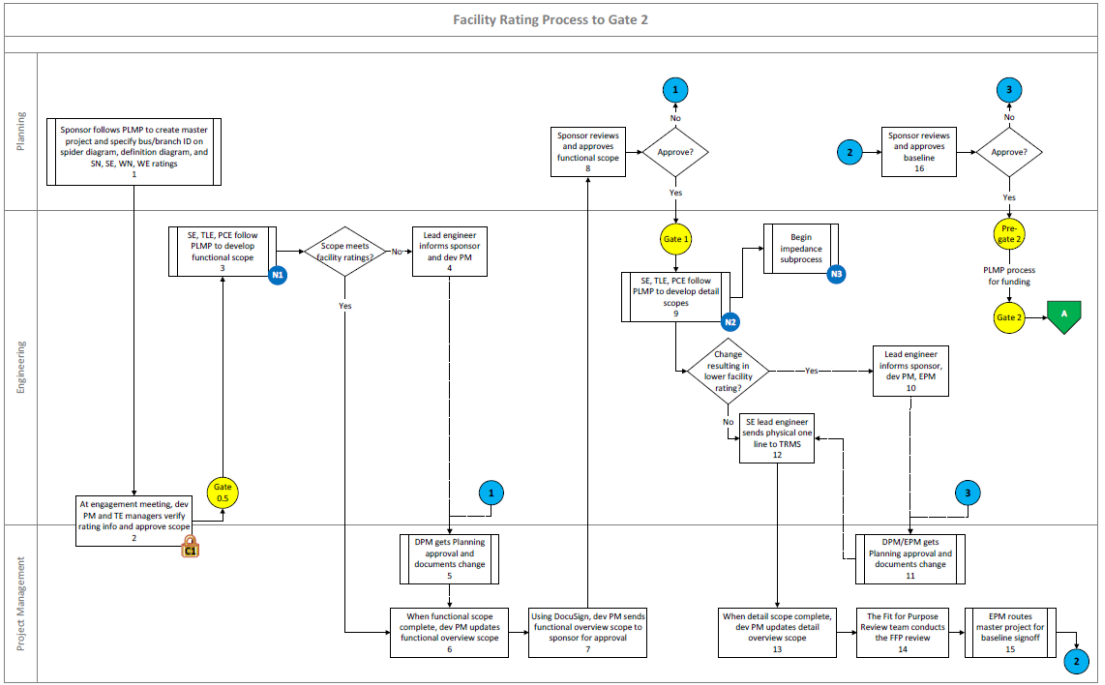
Expected branch ratings after project completion

Circuit	Branch	SN MVA	SE MVA	WN MVA	WE MVA
Leon-South Buffalo 138 kV	Atkenson-Leon	296	301	375	393
Leon-South Buffalo 138 kV	Atkenson-S Buffalo	296	301	375	393

Facility Ratings Process Integration with AEP's PLMP

Scoping

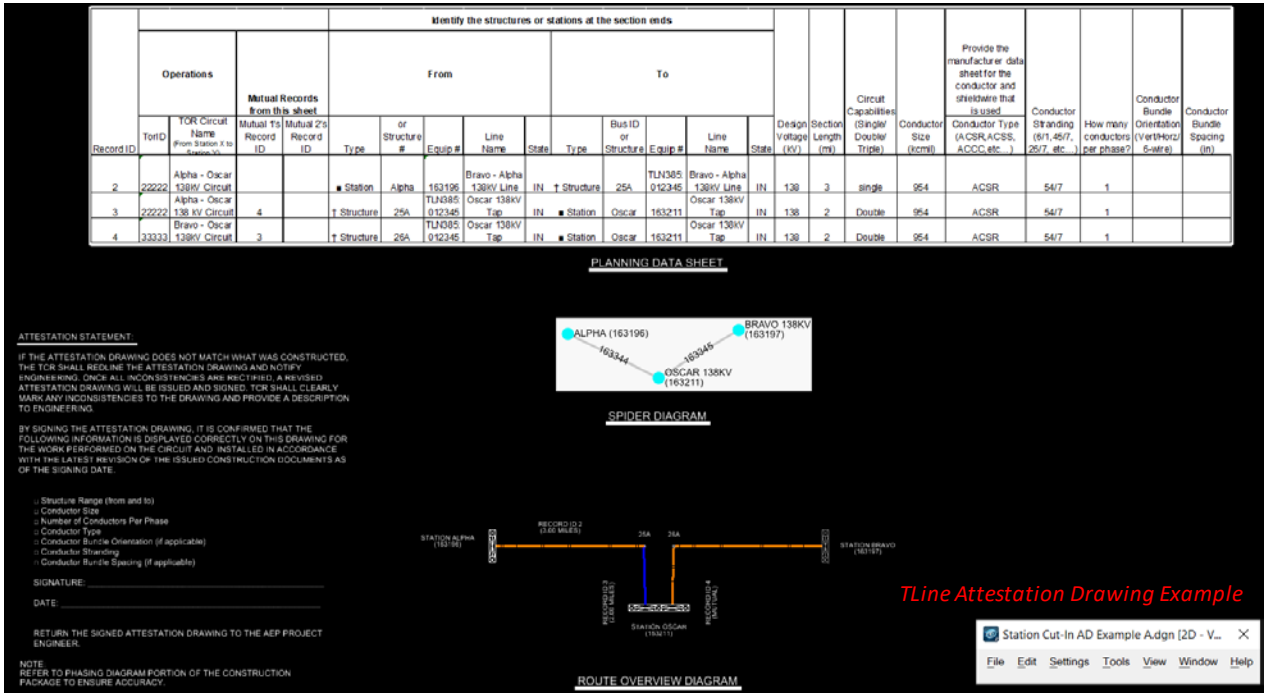
- Scope of work preparation to meet target ratings
- Initiation of impedance sub-process
- Electronic routing to establish baseline



Facility Ratings Process Integration with AEP's PLMP

Engineering

- Construction packages issued (IFC)
- Attestations drawings issued
- Impedance calculations finalized
- IFC topology modeling finalized



Identify the structures or stations at the section ends

Record ID	Operations: TorID	Operations: TOR Circuit Name (From Station X to Station Y)	Mutual Records from this sheet: Mutual 1's Record ID	Mutual Records from this sheet: Mutual 2's Record ID	From: Type	From: or Structure #	From: Equip #	From: Line Name	From: State	To: Type	To: Bus ID or Structure	To: Equip #	To: Line Name	To: State	Design Voltage (kV)	Section Length (mi)	Circuit Capabilities (Single/ Double/ Triple)	Conductor Size (kcmil)	Provide the manufacturer data sheet for the conductor and shieldwire that is used: Conductor Type (ACSR,ACSS, ACCC,etc...)	Conductor Stranding (6/1,45/7, 25/7, etc...)	How many conductors per phase?	Conductor Bundle Orientation (Vert/Horz/ 6-wire)	Conductor Bundle Spacing (in)
2	22222	Alpha - Oscar 138KV Circuit			■ Station	Alpha	163196	Bravo - Alpha 138KV Line	IN	† Structure	25A	TLN385 012345	Bravo - Alpha 138KV Line	IN	138	3	single	954	ACSR	54/7	1		
3	22222	Alpha - Oscar 138 KV Circuit	4		† Structure	25A	TLN385 012345	Oscar 138KV Tap	IN	■ Station	Oscar	163211	Oscar 138KV Tap	IN	138	2	Double	954	ACSR	54/7	1		
4	33333	Bravo - Oscar 138KV Circuit	3		† Structure	26A	TLN385 012345	Oscar 138KV Tap	IN	■ Station	Oscar	163211	Oscar 138KV Tap	IN	138	2	Double	954	ACSR	54/7	1		

PLANNING DATA SHEET

ATTESTATION STATEMENT:

IF THE ATTESTATION DRAWING DOES NOT MATCH WHAT WAS CONSTRUCTED, THE TCR SHALL REDLINE THE ATTESTATION DRAWING AND NOTIFY ENGINEERING. ONCE ALL INCONSISTENCIES ARE RECTIFIED, A REVISED ATTESTATION DRAWING WILL BE ISSUED AND SIGNED. TCR SHALL CLEARLY MARK ANY INCONSISTENCIES TO THE DRAWING AND PROVIDE A DESCRIPTION TO ENGINEERING.

BY SIGNING THE ATTESTATION DRAWING, IT IS CONFIRMED THAT THE FOLLOWING INFORMATION IS DISPLAYED CORRECTLY ON THIS DRAWING FOR THE WORK PERFORMED ON THE CIRCUIT AND INSTALLED IN ACCORDANCE WITH THE LATEST REVISION OF THE ISSUED CONSTRUCTION DOCUMENTS AS OF THE SIGNING DATE:

- Structure Range (from and to)
- Conductor Size
- Number of Conductors Per Phase
- Conductor Type
- Conductor Bundle Orientation (if applicable)
- Conductor Stranding
- Conductor Bundle Spacing (if applicable)

SIGNATURE: _____

DATE: _____

RETURN THE SIGNED ATTESTATION DRAWING TO THE AEP PROJECT ENGINEER.

NOTE:
REFER TO PHASING DIAGRAM PORTION OF THE CONSTRUCTION PACKAGE TO ENSURE ACCURACY.

SPIDER DIAGRAM

ROUTE OVERVIEW DIAGRAM

TLine Attestation Drawing Example

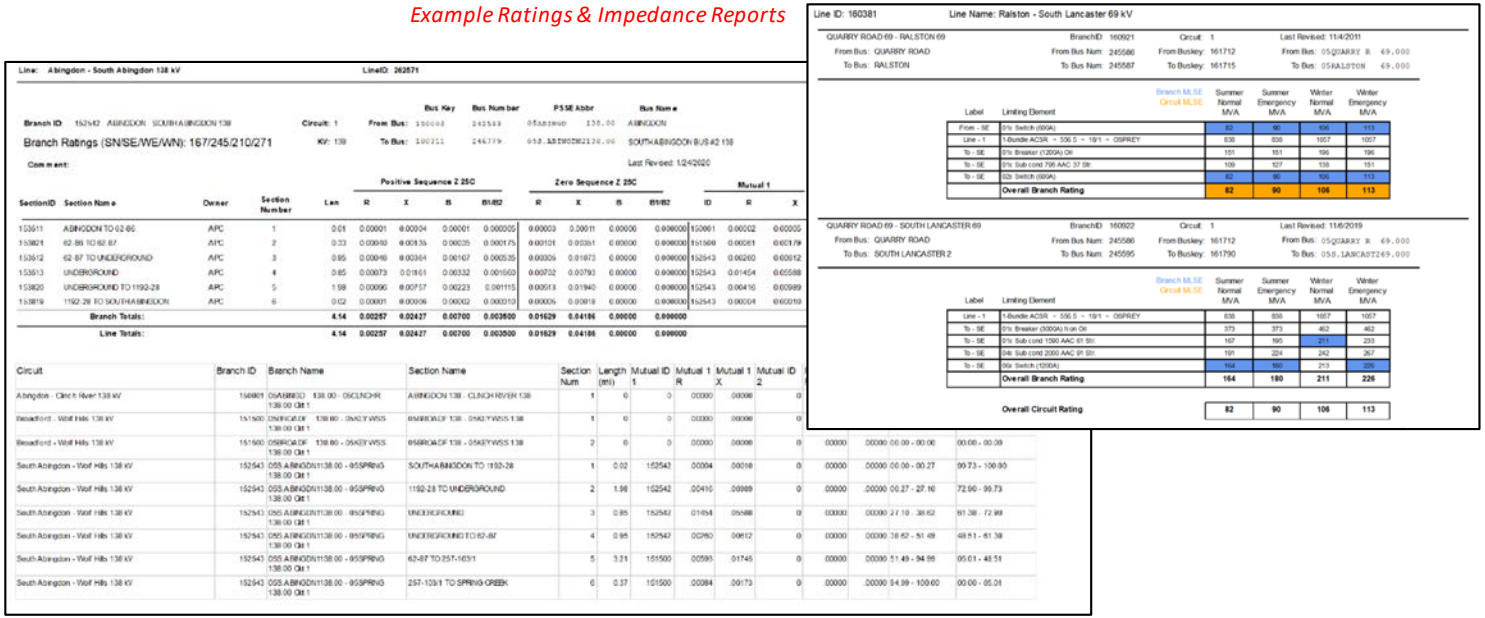
Station Cut-In AD Example A.dgn [2D - V...
File Edit Settings Tools View Window Help

Facility Ratings Process Integration with AEP's PLMP

Energization

- As-built topology modeling finalized
- Real-time Ops models updated

Example Ratings & Impedance Reports



Line: Abingdon - South Abingdon 138 kV LineID: 262571

Branch ID 152542 ABINGDON SOUTHABINGDON 138 Circuit: 1 From Bus: 152542 Bus Key Bus Number PSSE Abbr Bus Name ABINGDON

Branch Ratings (SN/SE/WE/WN): 167/245/210/271 Kit: 138 To Bus: 152711 246779 050_ABINGDON2138.00 SOUTHABINGDON BUS#2 138

Comment: Last Revised: 1/24/2020

SectionID	Section Name	Owner	Section Number	Len	Positive Sequence Z 25C R	X	B	B1/B2	Zero Sequence Z 25C R	X	B	B1/B2	Mutual 1 ID	R	X
153611	ABINGDON TO 62-86	APC	1	0.01	0.00001	0.00004	0.00001	0.000005	0.00003	0.00011	0.00000	0.000000	152081	0.00002	0.00005
153621	62-86 TO 62-87	APC	2	0.33	0.00010	0.00135	0.00035	0.000175	0.00101	0.00351	0.00000	0.000000	152543	0.00061	0.00179
153612	62-87 TO UNDERGROUND	APC	3	0.95	0.00018	0.00364	0.00167	0.000535	0.00305	0.01073	0.00000	0.000000	152543	0.00260	0.00512
153613	UNDERGROUND	APC	4	0.85	0.00073	0.01161	0.00332	0.001660	0.00702	0.00793	0.00000	0.000000	152543	0.01454	0.05588
153620	UNDERGROUND TO 1192-28	APC	5	1.98	0.00090	0.00757	0.00223	0.001115	0.00513	0.01940	0.00000	0.000000	152543	0.00416	0.00989
153619	1192-28 TO SOUTHABINGDON	APC	6	0.02	0.00001	0.00006	0.00002	0.000010	0.00005	0.00018	0.00000	0.000000	152543	0.00004	0.00010
	Branch Totals:			4.14	0.00257	0.02427	0.00700	0.003500	0.01629	0.04186	0.00000	0.000000			
	Line Totals:			4.14	0.00257	0.02427	0.00700	0.003500	0.01629	0.04186	0.00000	0.000000			

Circuit	Branch ID	Branch Name	Section Name	Section Num	Length (mi)	Mutual ID 1	Mutual 1 R	Mutual 1 X	Mutual ID 2		
Abingdon - Clinch River 138 kV	156901	050ABINGD 138.00 - 050CLNCHR 138.00 Ckt 1	ABINGDON 138 - CLINCH RIVER 138	1	0	0	0.00000	0.00000	0		
Bradford - Wolf Hills 138 kV	151500	050BRADF 138.00 - 05K3YW5S 138.00 Ckt 1	050BRADF 138 - 05K3YW5S 138	1	0	0	0.00000	0.00000	0		
Bradford - Wolf Hills 138 kV	151500	050BRADF 138.00 - 05K3YW5S 138.00 Ckt 1	050BRADF 138 - 05K3YW5S 138	2	0	0	0.00000	0.00000	0	0.00000	0.00000 00.00 - 00.00	00.00 - 00.00
South Abingdon - Wolf Hills 138 kV	152543	055 ABINGDN1138.00 - 955PRNG 138.00 Ckt 1	SOUTHABINGDON TO 1192-28	1	0.02	152542	0.00004	0.00018	0	0.00000	0.0000 00.00 - 00.27	99.73 - 100.00
South Abingdon - Wolf Hills 138 kV	152543	055 ABINGDN1138.00 - 955PRNG 138.00 Ckt 1	1192-28 TO UNDERGROUND	2	1.98	152542	0.00416	0.00989	0	0.00000	0.0000 00.27 - 27.10	72.90 - 99.73
South Abingdon - Wolf Hills 138 kV	152543	055 ABINGDN1138.00 - 955PRNG 138.00 Ckt 1	UNDERGROUND	3	0.85	152542	0.01454	0.05588	0	0.00000	0.0000 27.10 - 38.62	61.38 - 72.90
South Abingdon - Wolf Hills 138 kV	152543	055 ABINGDN1138.00 - 955PRNG 138.00 Ckt 1	UNDERGROUND TO 62-87	4	0.95	152542	0.00260	0.00512	0	0.00000	0.0000 38.62 - 51.49	48.51 - 61.38
South Abingdon - Wolf Hills 138 kV	152543	055 ABINGDN1138.00 - 955PRNG 138.00 Ckt 1	62-87 TO 257-103/1	5	3.21	151500	0.00393	0.01745	0	0.00000	0.0000 51.49 - 94.96	05.04 - 48.51
South Abingdon - Wolf Hills 138 kV	152543	055 ABINGDN1138.00 - 955PRNG 138.00 Ckt 1	257-103/1 TO SPRING CREEK	6	0.37	151500	0.00064	0.00173	0	0.00000	0.0000 94.96 - 100.00	00.00 - 05.04

Line ID: 160381 Line Name: Ralston - South Lancaster 69 kV

QUARRY ROAD 69 - RALSTON 69 BranchID 160921 Circuit 1 Last Revised: 11/4/2011

From Bus: QUARRY ROAD From Bus Num: 245586 From Buskey: 161712 From Bus: 05QUARRY R 69.000

To Bus: RALSTON To Bus Num: 245587 To Buskey: 161715 To Bus: 05RALSTON 69.000

Label	Limiting Element	Branch MLSE Circuit MLSE	Summer Normal MVA	Summer Emergency MVA	Winter Normal MVA	Winter Emergency MVA
From - SE	0% Switch (600A)		82	90	106	113
Line - 1	1-Bundle ACSR - 556.5 - 18/1 - OSPREY		838	838	1057	1057
To - SE	0% Breaker (1200A) Oil		151	151	196	196
To - SE	0% Sub cond 795 AAC 37 Str		109	107	139	151
To - SE	0% Switch (600A)		82	90	106	113
	Overall Branch Rating		**82**	**90**	**106**	**113**

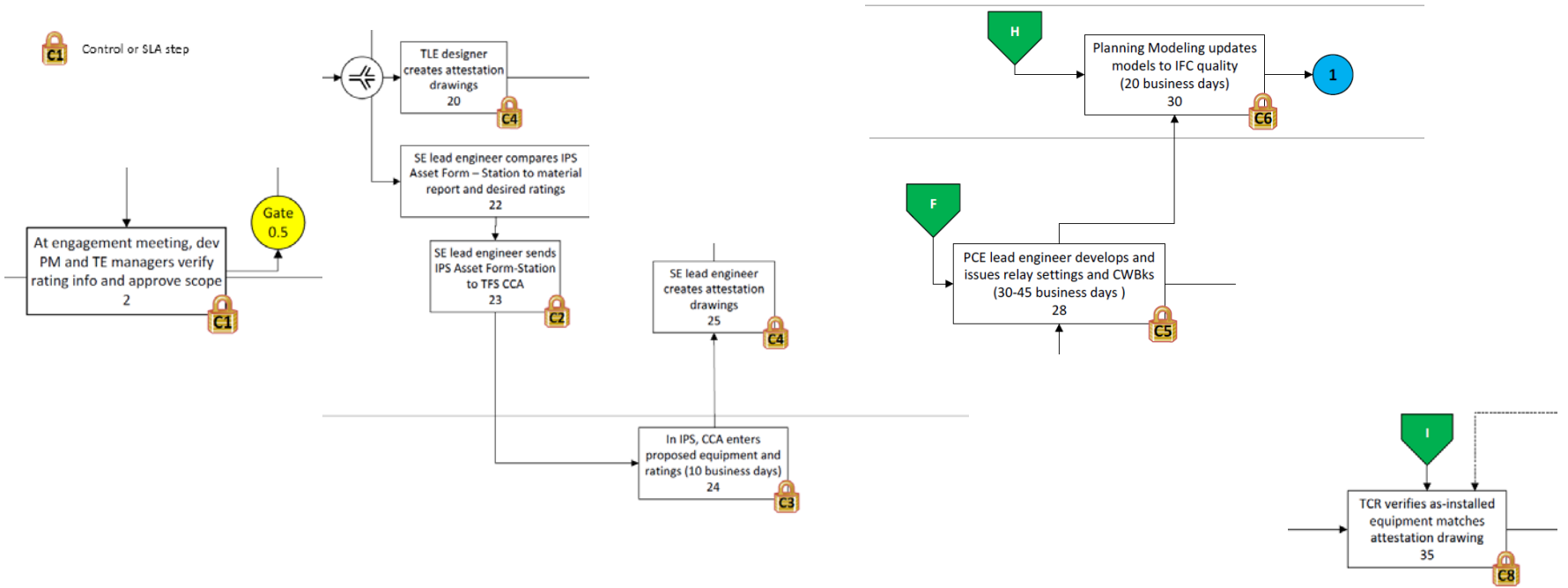
QUARRY ROAD 69 - SOUTH LANCASTER 69 BranchID 160922 Circuit 1 Last Revised: 11/6/2019

From Bus: QUARRY ROAD From Bus Num: 245586 From Buskey: 161712 From Bus: 05QUARRY R 69.000

To Bus: SOUTH LANCASTER 2 To Bus Num: 245595 To Buskey: 161790 To Bus: 05S.LANCAST249.000

Label	Limiting Element	Branch MLSE Circuit MLSE	Summer Normal MVA	Summer Emergency MVA	Winter Normal MVA	Winter Emergency MVA
Line - 1	1-Bundle ACSR - 556.5 - 18/1 - OSPREY		838	838	1057	1057
To - SE	0% Breaker (1200A) Non Oil		373	373	462	462
To - SE	0% Sub cond 1590 AAC 61 Str		167	195	211	233
To - SE	0% Sub cond 2000 AAC 91 Str		191	224	242	267
To - SE	0% Switch (1200A)		164	180	213	226
	Overall Branch Rating		**164**	**180**	**211**	**226**
	Overall Circuit Rating		**82**	**90**	**106**	**113**

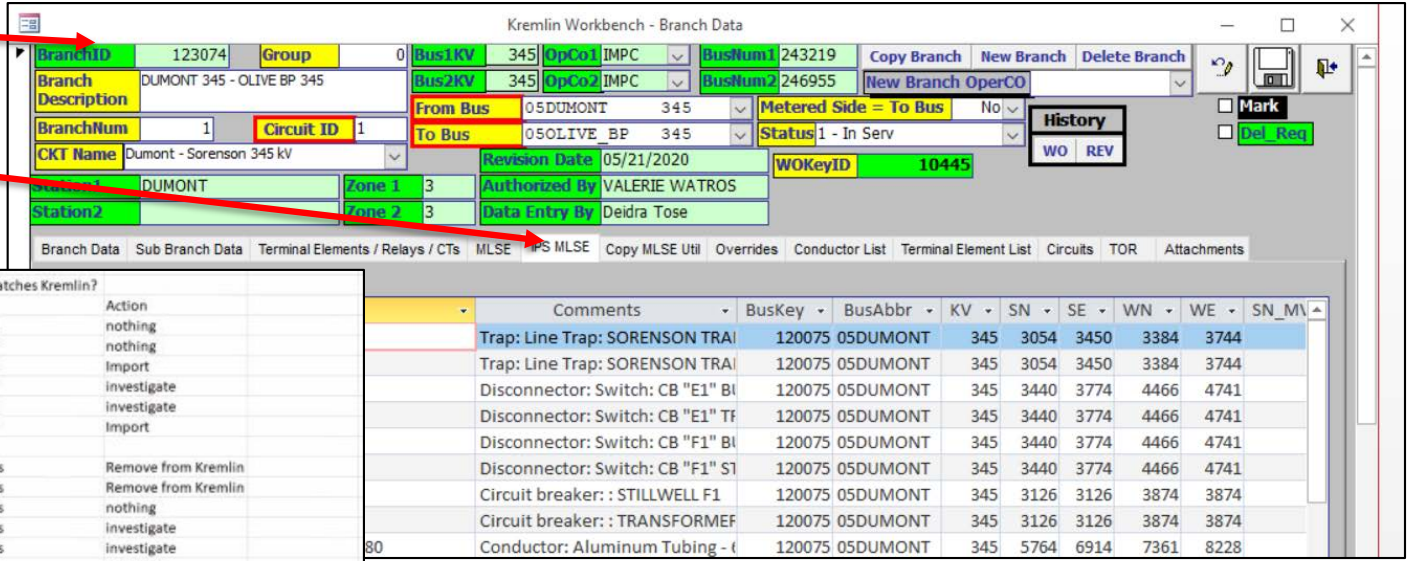
Facility Ratings Process Controls (Examples)



Automation & Systems Integration

Facility Ratings Database

Facility Ratings Database vs Station Equipment Database



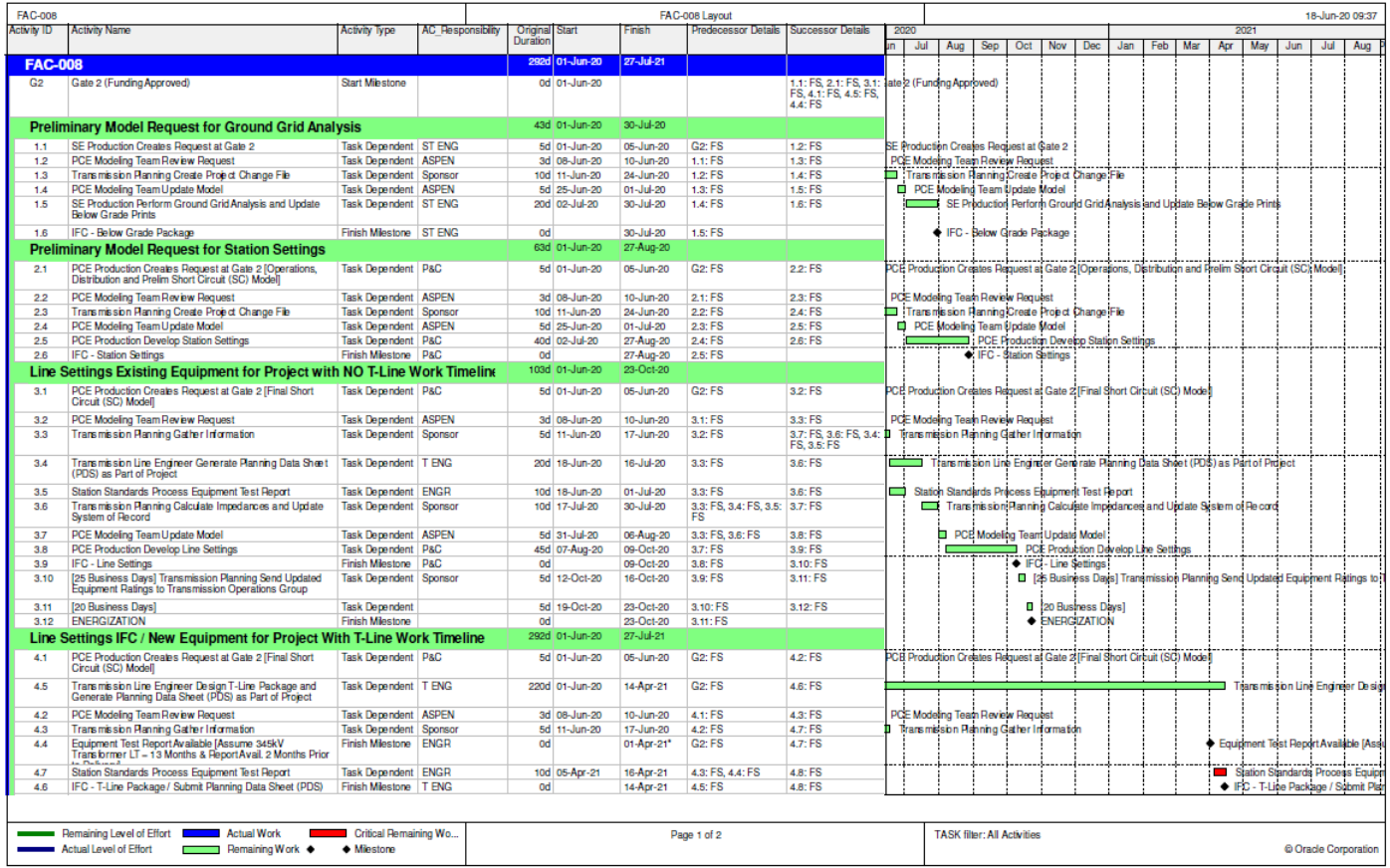
IPS	Servey 123	Kremlin	Matches Kremlin?		
Device Status	Attestation Status	Is asset ID In Kremlin Now?		Action	
In Service	Demo	no	no	nothing	
not in service	Demo	no	no	nothing	
Pending	Invested	no	no	Import	
Pending	Demo	no	no	investigate	
Pending	Verified	no	no	investigate	
In Service	Verified	no	no	Import	
In Service	Demo	Yes	Yes	Remove from Kremlin	
not in service	Demo	Yes	Yes	Remove from Kremlin	
Pending	Invested	Yes	Yes	nothing	
Pending	Demo	Yes	Yes	investigate	
Pending	Verified	Yes	Yes	investigate	
In Service	Verified	Yes	Yes	nothing	
In Service	Demo	Yes	No	remove	*first investigate
not in service	Demo	Yes	No	remove	*first investigate
Pending	Invested	Yes	No	Re-Import	*first investigate
Pending	Demo	Yes	No	Error	*first investigate
Pending	Verified	Yes	No	Error	*first investigate
In Service	Verified	Yes	No	Re-Import	*first investigate

Import Example Routine

AMERICAN ELECTRIC POWER

BOUNDLESS ENERGY℠

P6 Milestones & Schedule



FAC-008 | FAC-008 Layout | 18-Jun-20 09:37

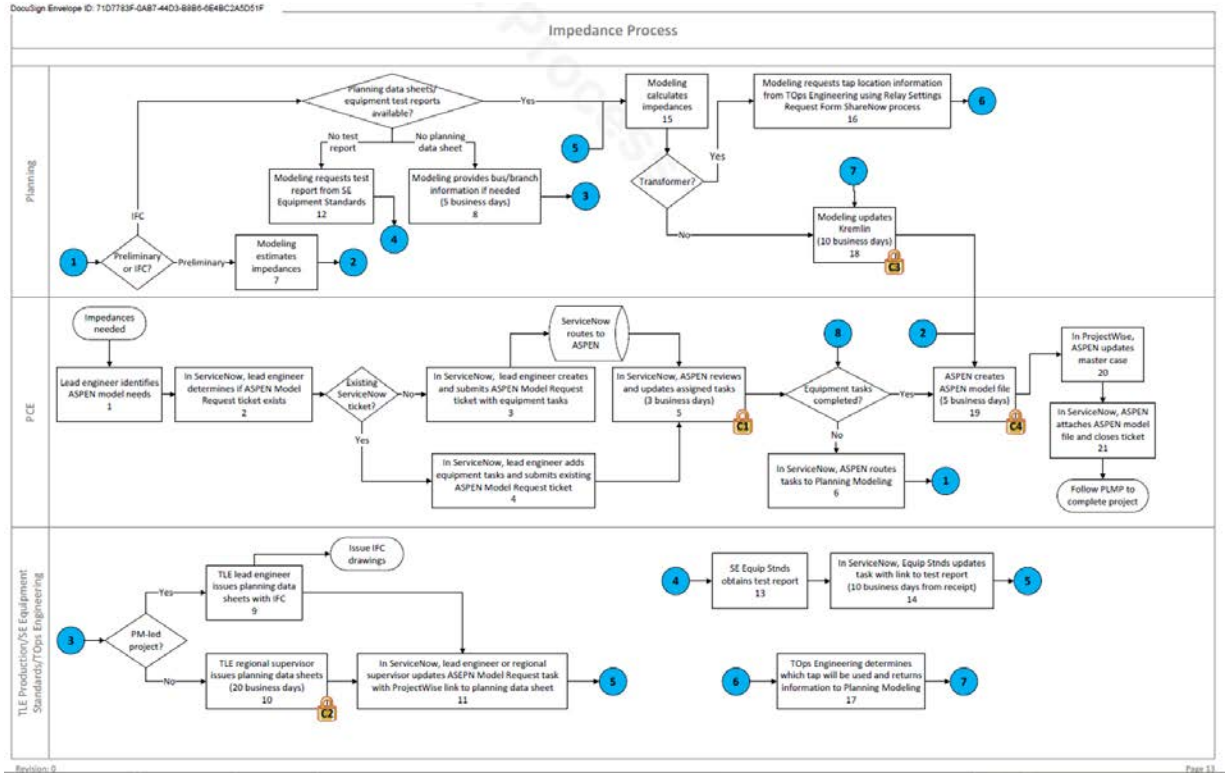
Activity ID	Activity Name	Activity Type	AC_Responsibility	Original Duration	Start	Finish	Predecessor Details	Successor Details
FAC-008				292d	01-Jun-20	27-Jul-21		
G2	Gate 2 (Funding Approved)	Start Milestone		0d	01-Jun-20			1.1: FS, 2.1: FS, 3.1: FS, 4.1: FS, 4.5: FS, 4.4: FS
Preliminary Model Request for Ground Grid Analysis				43d	01-Jun-20	30-Jul-20		
1.1	SE Production Creates Request at Gate 2	Task Dependent	ST ENG	5d	01-Jun-20	05-Jun-20	G2: FS	1.2: FS
1.2	PCE Modeling Team Review Request	Task Dependent	ASPEN	3d	08-Jun-20	10-Jun-20	1.1: FS	1.3: FS
1.3	Transmission Planning Create Project Change File	Task Dependent	Sponsor	10d	11-Jun-20	24-Jun-20	1.2: FS	1.4: FS
1.4	PCE Modeling Team Update Model	Task Dependent	ASPEN	5d	25-Jun-20	01-Jul-20	1.3: FS	1.5: FS
1.5	SE Production Perform Ground Grid Analysis and Update Below Grade Prints	Task Dependent	ST ENG	20d	02-Jul-20	30-Jul-20	1.4: FS	1.6: FS
1.6	IFC - Below Grade Package	Finish Milestone	ST ENG	0d		30-Jul-20	1.5: FS	
Preliminary Model Request for Station Settings				63d	01-Jun-20	27-Aug-20		
2.1	PCE Production Creates Request at Gate 2 [Operations, Distribution and Prelim Short Circuit (SC) Model]	Task Dependent	P&C	5d	01-Jun-20	05-Jun-20	G2: FS	2.2: FS
2.2	PCE Modeling Team Review Request	Task Dependent	ASPEN	3d	08-Jun-20	10-Jun-20	2.1: FS	2.3: FS
2.3	Transmission Planning Create Project Change File	Task Dependent	Sponsor	10d	11-Jun-20	24-Jun-20	2.2: FS	2.4: FS
2.4	PCE Modeling Team Update Model	Task Dependent	ASPEN	5d	25-Jun-20	01-Jul-20	2.3: FS	2.5: FS
2.5	PCE Production Develop Station Settings	Task Dependent	P&C	40d	02-Jul-20	27-Aug-20	2.4: FS	2.6: FS
2.6	IFC - Station Settings	Finish Milestone	P&C	0d		27-Aug-20	2.5: FS	
Line Settings Existing Equipment for Project with NO T-Line Work Timelin				103d	01-Jun-20	23-Oct-20		
3.1	PCE Production Creates Request at Gate 2 [Final Short Circuit (SC) Model]	Task Dependent	P&C	5d	01-Jun-20	05-Jun-20	G2: FS	3.2: FS
3.2	PCE Modeling Team Review Request	Task Dependent	ASPEN	3d	08-Jun-20	10-Jun-20	3.1: FS	3.3: FS
3.3	Transmission Planning Gather Information	Task Dependent	Sponsor	5d	11-Jun-20	17-Jun-20	3.2: FS	3.7: FS, 3.6: FS, 3.4: FS, 3.5: FS
3.4	Transmission Line Engineer Generate Planning Data Sheet (PDS) as Part of Project	Task Dependent	T ENG	20d	18-Jun-20	16-Jul-20	3.3: FS	3.6: FS
3.5	Station Standards Process Equipment Test Report	Task Dependent	ENGR	10d	18-Jun-20	01-Jul-20	3.3: FS	3.6: FS
3.6	Transmission Planning Calculate Impedances and Update System of Record	Task Dependent	Sponsor	10d	17-Jul-20	30-Jul-20	3.3: FS, 3.4: FS, 3.5: FS	3.7: FS
3.7	PCE Modeling Team Update Model	Task Dependent	ASPEN	5d	31-Jul-20	06-Aug-20	3.3: FS, 3.6: FS	3.8: FS
3.8	PCE Production Develop Line Settings	Task Dependent	P&C	45d	07-Aug-20	09-Oct-20	3.7: FS	3.9: FS
3.9	IFC - Line Settings	Finish Milestone	P&C	0d		09-Oct-20	3.8: FS	3.10: FS
3.10	[25 Business Days] Transmission Planning Send Updated Equipment Ratings to Transmission Operations Group	Task Dependent	Sponsor	5d	12-Oct-20	16-Oct-20	3.9: FS	3.11: FS
3.11	[20 Business Days]	Task Dependent		5d	19-Oct-20	23-Oct-20	3.10: FS	3.12: FS
3.12	ENERGIZATION	Finish Milestone		0d		23-Oct-20	3.11: FS	
Line Settings IFC / New Equipment for Project With T-Line Work Timeline				292d	01-Jun-20	27-Jul-21		
4.1	PCE Production Creates Request at Gate 2 [Final Short Circuit (SC) Model]	Task Dependent	P&C	5d	01-Jun-20	05-Jun-20	G2: FS	4.2: FS
4.5	Transmission Line Engineer Design T-Line Package and Generate Planning Data Sheet (PDS) as Part of Project	Task Dependent	T ENG	220d	01-Jun-20	14-Apr-21	G2: FS	4.6: FS
4.2	PCE Modeling Team Review Request	Task Dependent	ASPEN	3d	08-Jun-20	10-Jun-20	4.1: FS	4.3: FS
4.3	Transmission Planning Gather Information	Task Dependent	Sponsor	5d	11-Jun-20	17-Jun-20	4.2: FS	4.7: FS
4.4	Equipment Test Report Available [Assume 345kV Transformer LT – 13 Months & Report Avail. 2 Months Prior	Finish Milestone	ENGR	0d		01-Apr-21*	G2: FS	4.7: FS
4.7	Station Standards Process Equipment Test Report	Task Dependent	ENGR	10d	05-Apr-21	16-Apr-21	4.3: FS, 4.4: FS	4.8: FS
4.8	IFC - T-Line Package / Submit Planning Data Sheet (PDS)	Finish Milestone	T ENG	0d		14-Apr-21	4.5: FS	4.8: FS

Remaining Level of Effort | Actual Work | Critical Remaining Wo...
Actual Level of Effort | Remaining Work | Milestone

Page 1 of 2

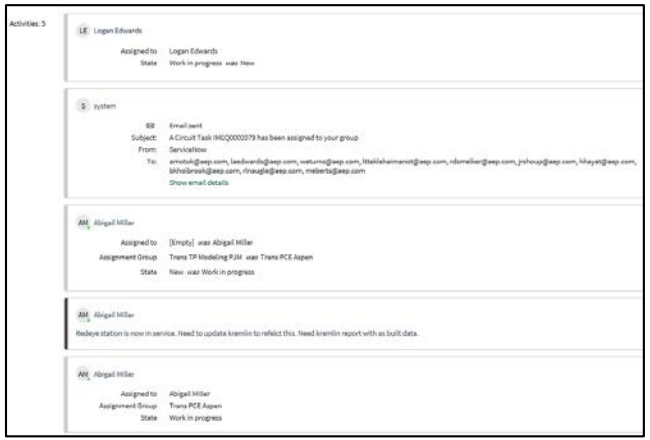
TASK filter: All Activities

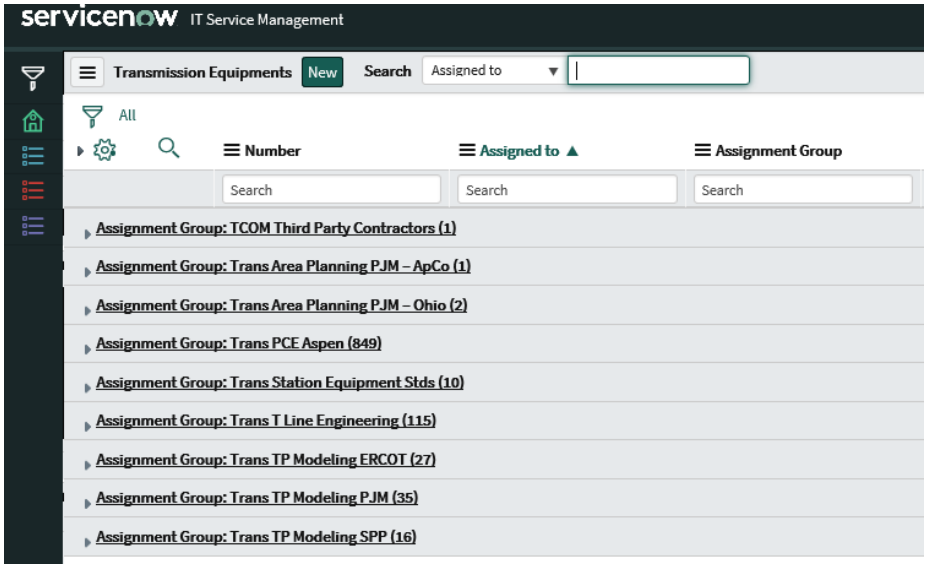
Impedance Process



Impedance Process

- ServiceNow tool is deployed to manage workflow between PCE, TP, TLE, and SEStds





Human Performance

- Relying more on automated data exchange and import
- Integrating systems to minimize human actions
- Survery 123 App and DS Track
  - Mechanism to initiate, complete, and submit as-built attestations
- Checker Tool
  - Identifies misalignment between planning and engineering data
- Integrated Datasheets
  - Correlating project accounting and scheduling information with equipment status (designed, energized etc)
- Workbench Modules
  - Differentiating between conceptual, as-designed, and as-built information

Periodic Reviews

- Preventative Actions

  On a monthly basis all projects with upcoming in-service dates are analyzed
- Detective Actions

  On a quarterly basis, 10% of the projects that were placed in-service in the previous quarter are audited
- Peer Reviews

  Incoming data and outgoing calculations are reviewed prior to release
- Training and Communications

  New trainings and communication plans are being developed to train the company on new tools, processes, and expectations

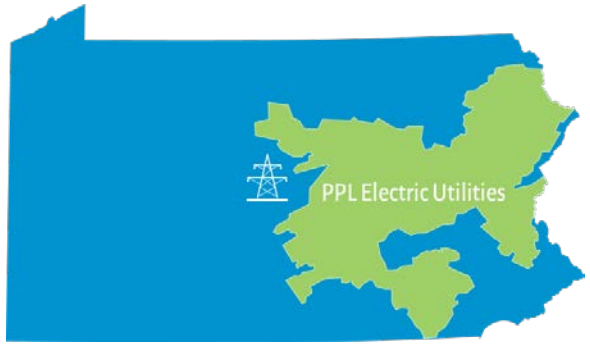
100

ppl

A century of people **powering life.**

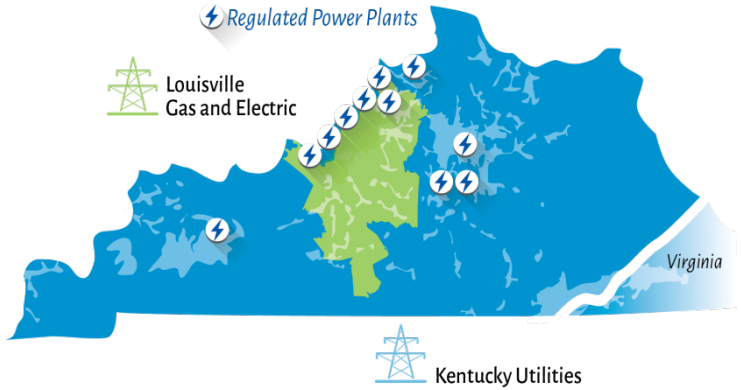
About PPL Electric Utilities

A closer look at PPL



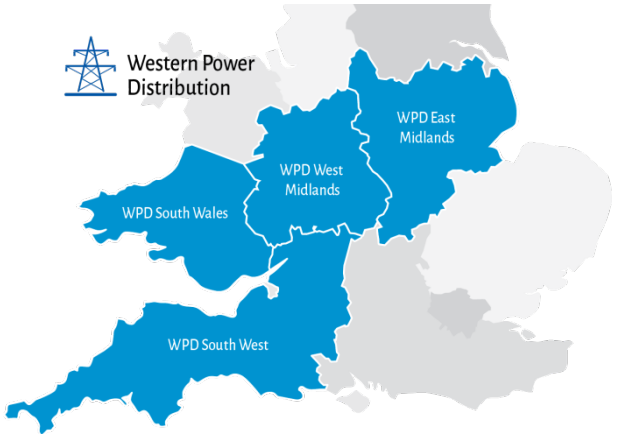
PPL Electric Utilities:

- Electricity distribution and transmission
- 1.4 million customers
- 50,000 miles of power lines in 29 counties
- 27 J.D. Power awards
- Top-decile for reliability
- Robust smart grid



Louisville Gas and Electric and Kentucky Utilities:

- Headquartered in Louisville
- 1.3 million customers across Kentucky and Virginia
- 8,000 MW of regulated power generation capacity (coal, natural gas, hydro and solar)
- 24 J.D. Power awards



Western Power Distribution:

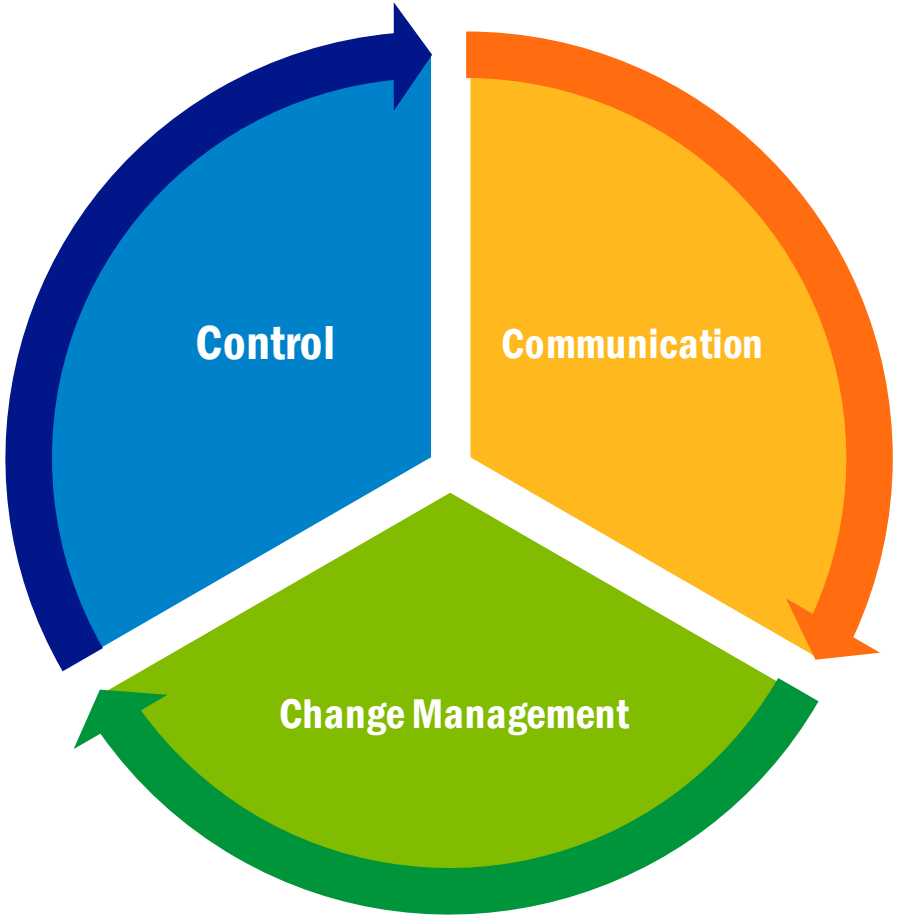
- Headquartered in Bristol, United Kingdom
- Electricity delivery only
- 7.8 million customers
- Consistently the Top 4 performers for customer satisfaction in the U.K.
- “Leading the way” in connecting solar to the grid

A century of people powering life.

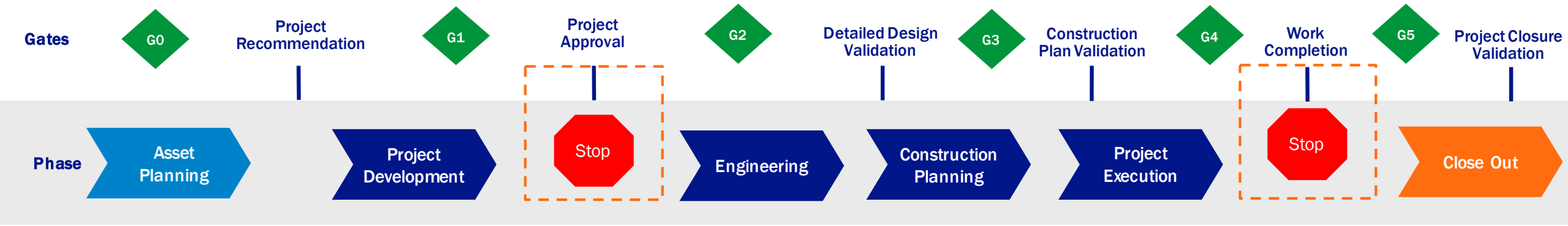
Facilities Ratings
FAC-008 Program

FAC-008 Program

PPL's FAC-008 program is built upon 3Cs



Work scope and quality control through gated process



- Planning level scope initiated to replace or build new facilities
- Rating requirements are established
- PSSE and CAPE models are updated using estimated impedance and required ratings

PSS®E

electrocon international incorporated CAPE

- Work scope is developed as per planning requirements and engineering standards (Procedural control)
- Project is financially approved at this point

- Scope governance process (Preventive Control)
  - Any work scope changes beyond this point needs to go through the approval process
  - Any rating change related request come back to Gate 0

- Engineering design is completed
- **Impedance/Line parameters** in the CAPE model are updated
- Relay loadability data and protection settings are issued

electrocon international incorporated CAPE

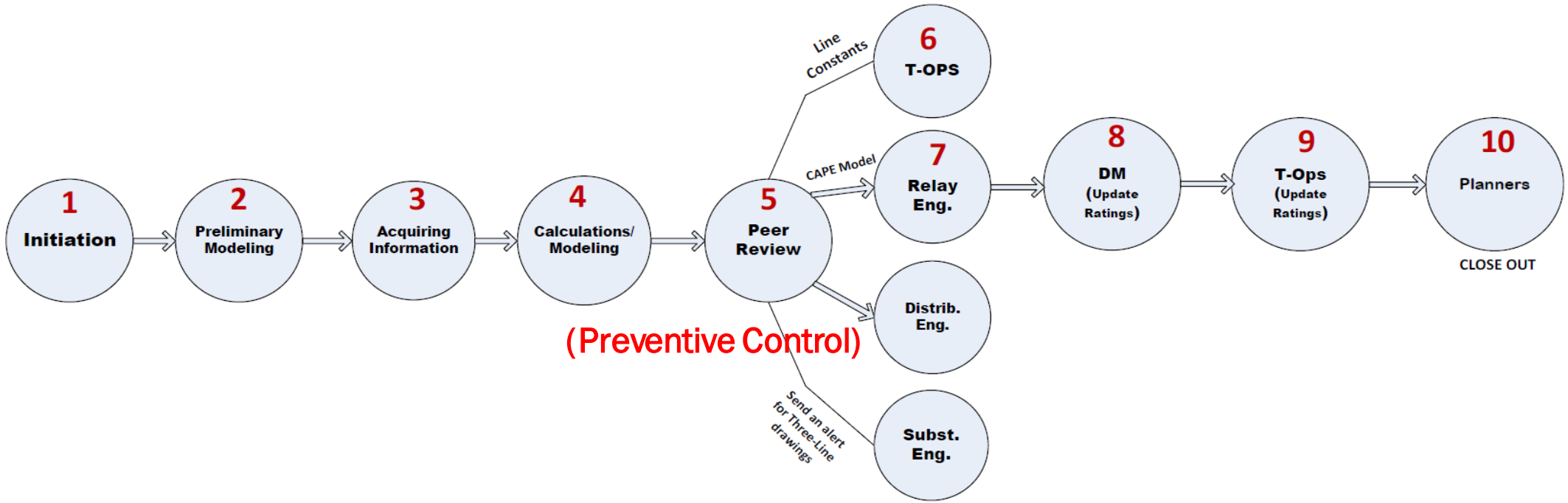
- Quality check (Acceptance of facility) is performed to make sure the facility is constructed per the design package (Preventive and Detective Controls)
- Rating database is updated
- Planning and operations models are updated accordingly

PPL internal rating database

PSS®E

TMS

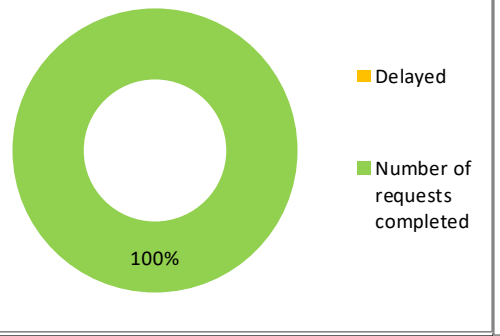
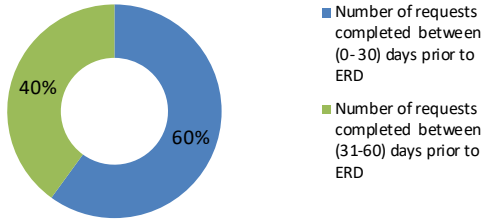
Modelling workflow control and communication

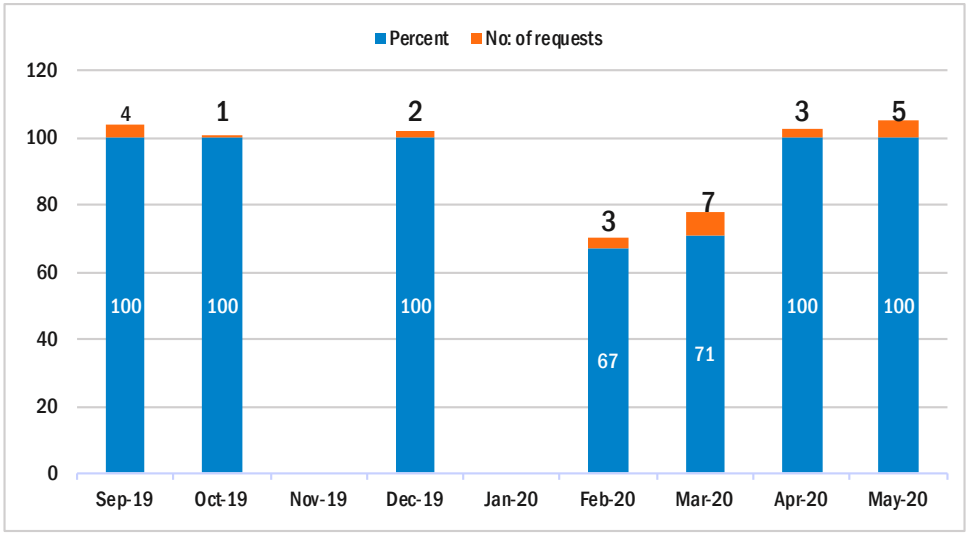


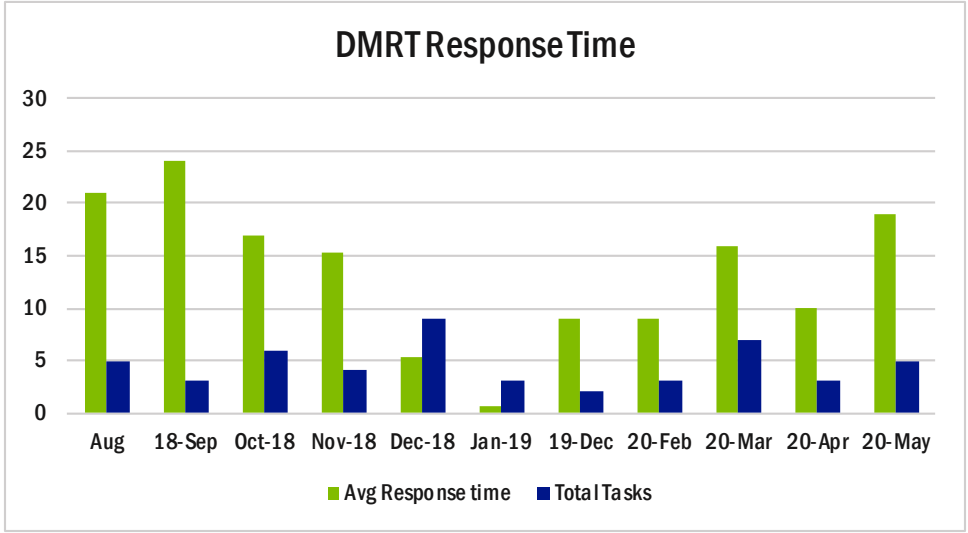
- Modelling workflow process is documented and integrated through SharePoint.
- A ticket is created on SharePoint for each modelling related activity. The SharePoint is periodically synched with the project schedule.
- New Rating and Impedance information is communicated to Planning, Protection and Operations through SharePoint.
- Performance is tracked through Performance Indicator (PI).

Performance Indicators

Data Management request Deliverables Dashboard

Department	Monthly Performance	Division of number of requests completed	Target	Current	Monthly % of Request past ERD	Notes
Transmission Planning			100.0%	100.0%	100.0%	The monthly measure of number of requests completed and forwarded for relay settings job without missing any deadlines

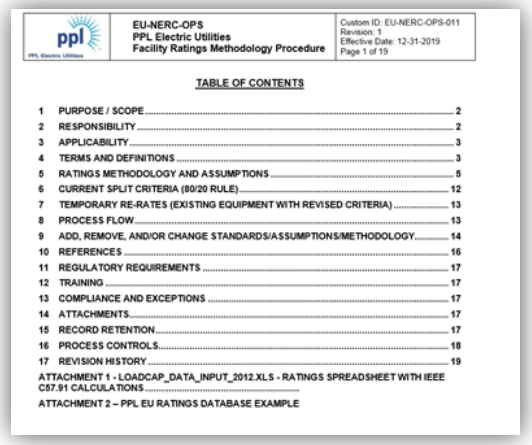




Rating process documentation and controls

1) Documented process for rating methodology
2) Ratings of all facilities are maintained under access-controlled rating database
3) Rating database has master rating library of all components based on the documented rating methodology

Procedure



EU-NERC-OPS
PPL Electric Utilities
Facility Ratings Methodology Procedure

Custom ID: EU-NERC-OPS-011
Revision: 1
Effective Date: 12-31-2019
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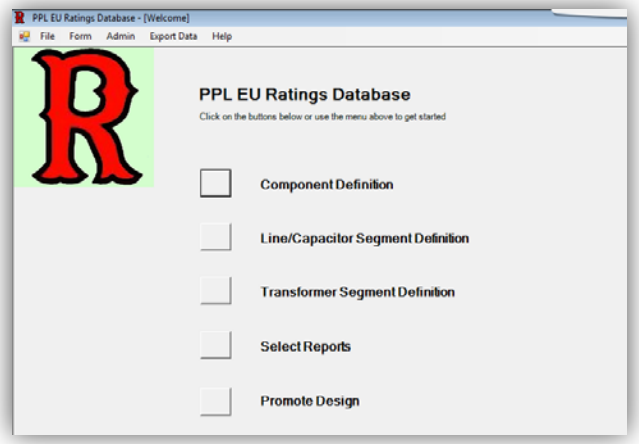
Procedural Control

Rating Database



Preventive Control

Rating components info from engineering drawings

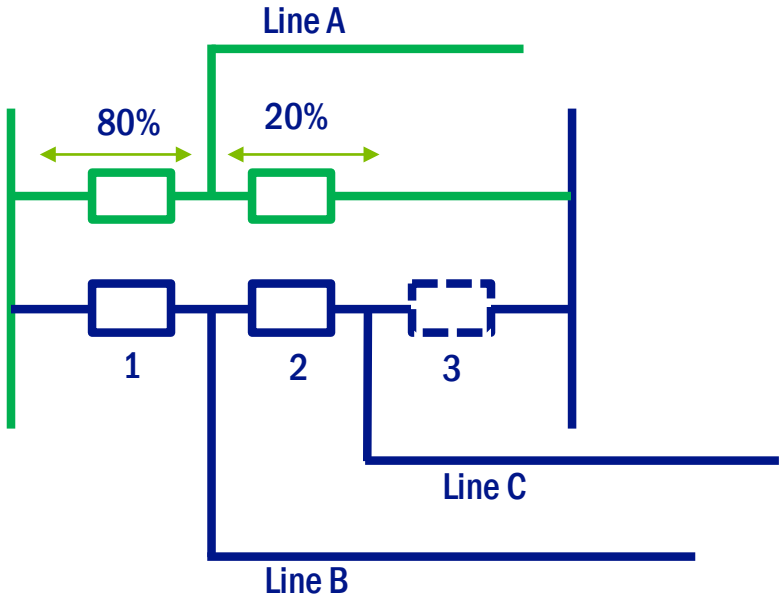
PSS®E — Planning

TMS — Operation

electrocon international incorporated CAPE — Protection

Ratings philosophy

- PPL considers all components that come in the power flow path to determine facilities' rating
  - Includes bus, bay conductors and down comers inside the substation
- All facilities' ratings are based on 100% power flow except for 500 kV lines. For those facilities, PPL applies 80/20 rule for rating calculations



Future work

Integrate field information with the substation 3D modelling initiative

Integrate node breaker model in PSSE

Develop digital architecture that provides seamless connectivity between planning database, engineering documents and field information

Questions

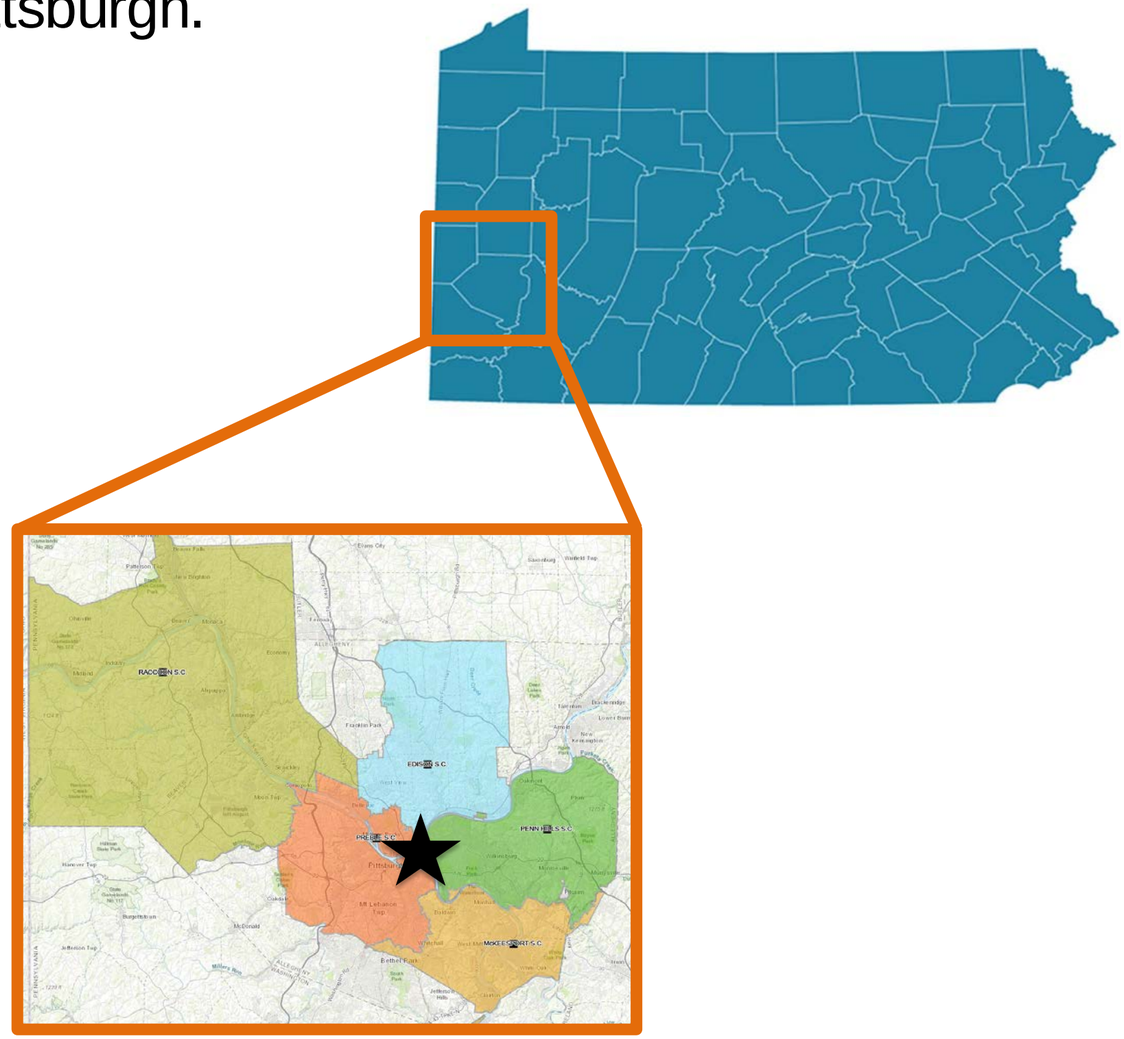
Duquesne Light Company
Facility Rating Internal Controls

Joe Pilch, Manager
Transmission Planning & Interconnection

DUQUESNE LIGHT CO.

DLC Company Profile

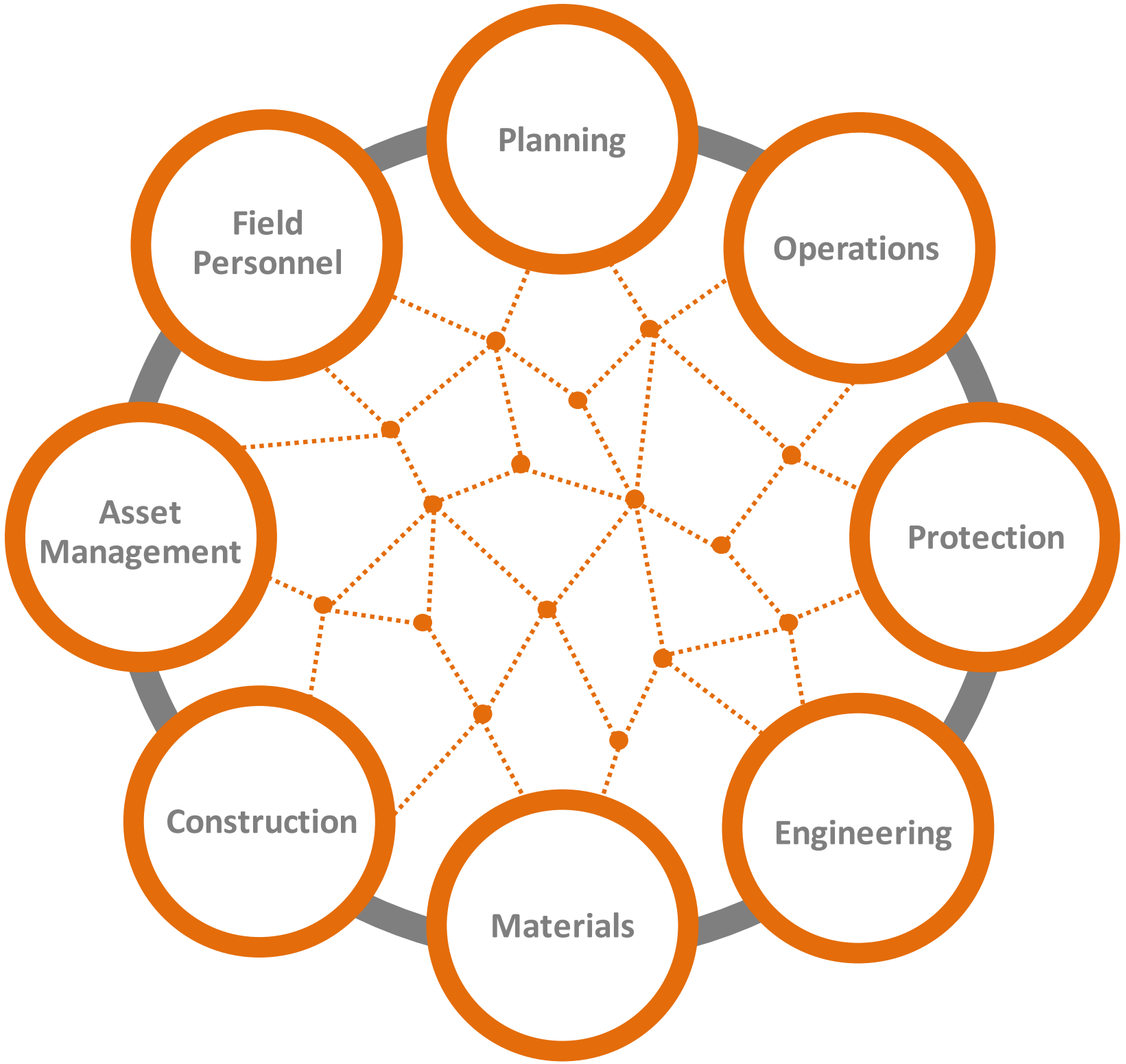
- Registered TO and DP, service territory is located in southwest Pennsylvania, surrounding the City of Pittsburgh.
  - ~ 650 miles of BES Facilities
  - ~ 120 BES Facilities
  - ~ 35 BES Substations
  - Both Rural and Urban Environments



- Transmission Voltages:
  - 345 kV
  - 138 kV
  - 69 kV

DUQUESNE LIGHT CO.

Challenges of FAC-008 Compliance



Controls make it easier!

DUQUESNE LIGHT CO.

FAC-008 Program Background

- Transmission Planning group is the FAC-008 standard owner

- Maintains all Facility Ratings in the DLC Transmission System Equipment Ratings Database
  - Built using .sql database structure
  - Equipment ratings are maintained via web interface
  - Can be exported to MS Excel

- Ratings Database is populated from engineering drawings
  - Equipment single lines
  - Protection single lines
  - Circuit maps

Voltage: 138 Miles:9.74 Status: Active

(138, 4) Type: Primary Power Take-Off: 0

		Summer 35C (95F)			Spring/Fall 20C (68F)			Winter 10C (50F)		
Type	**Class**	**Norm**	**Emrg**	**LD**	**Norm**	**Emrg**	**LD**	**Norm**	**Emrg**	**LD**
T SS Wire (3.5in AL PIPE)	2A	2481	3121	3452	2845	3407	3707	3058	3581	3864
T SS Wire (Two (2) - 3.5in AL PIPE)	2A	4143	5212	5765	4751	5690	6191	5107	5980	6453
T SS Wire (3.5in AL PIPE)	2A	2481	3121	3452	2845	3407	3707	3058	3581	3864
T Disconnect (2000A)	1	2000	2000	2060	2000	2000	2060	2000	2000	2060
T SS Wire (853.7 ACAR 24/13)	2A	1074	1267	1334	1193	1362	1423	1264	1421	1478
T CT (2000/5MR)	1	2328	2328	2400	2328	2328	2400	2328	2328	2400
T Relay CT (50)	1	4656	4656	4800	4656	4656	4800	4656	4656	4800
T Relay CT (21/79)	1	3492	3492	3600	3492	3492	3600	3492	3492	3600
T Circuit Breaker (3000A)	1	3000	3000	3090	3000	3000	3090	3000	3000	3090
T Relay CT (50)	1	4656	4656	4800	4656	4656	4800	4656	4656	4800
T Relay CT (87)	1	3492	3492	3600	3492	3492	3600	3492	3492	3600
T CT (2000/5MR)	1	2328	2328	2400	2328	2328	2400	2328	2328	2400
T SS Wire (853.7 ACAR 24/13)	2A	1074	1267	1334	1193	1362	1423	1264	1421	1478
T Disconnect (2000A)	1	2000	2000	2060	2000	2000	2060	2000	2000	2060

(138, NA) Type: Primary Power Take-Off: 0

		Summer 35C (95F)			Spring/Fall 20C (68F)			Winter 10C (50F)		
Type	**Class**	**Norm**	**Emrg**	**LD**	**Norm**	**Emrg**	**LD**	**Norm**	**Emrg**	**LD**
T OH Wire (795 ACSR 45/7)	2A	919	1039	1117	1082	1181	1273	1177	1265	1368
T OH Wire (853.7 ACAR 24/13)	2A	932	1055	1129	1098	1199	1286	1193	1285	1380
T OH Wire (795 ACSS/TW 20/7)	2A	929	1050	1153	1094	1193	1314	1189	1277	1411
T OH Wire (853.7 ACAR 24/13)	2A	932	1055	1129	1098	1199	1286	1193	1285	1380

(138, 4) Type: Primary Power Take-Off: 0

		Summer 35C (95F)			Spring/Fall 20C (68F)			Winter 10C (50F)		
Type	**Class**	**Norm**	**Emrg**	**LD**	**Norm**	**Emrg**	**LD**	**Norm**	**Emrg**	**LD**
T SS Wire (853.7 ACAR 24/13)	2A	1074	1267	1334	1193	1362	1423	1264	1421	1478
T Disconnect (2000A)	1	2000	2000	2060	2000	2000	2060	2000	2000	2060
T SS Wire (853.7 ACAR 24/13)	2A	1074	1267	1334	1193	1362	1423	1264	1421	1478
T CT (2000/5MR)	1	2328	2328	2400	2328	2328	2400	2328	2328	2400
T Relay CT (50)	1	4656	4656	4800	4656	4656	4800	4656	4656	4800
T Relay CT (21/79)	1	3492	3492	3600	3492	3492	3600	3492	3492	3600
T CT (2000/5MR)	1	3880	3880	4000	3880	3880	4000	3880	3880	4000
T Relay CT (87)	1	5820	5820	6000	5820	5820	6000	5820	5820	6000
T Circuit Breaker (3000A)	1	3000	3000	3090	3000	3000	3090	3000	3000	3090
T Relay CT (50)	1	4656	4656	4800	4656	4656	4800	4656	4656	4800
T Relay CT (87)	1	3492	3492	3600	3492	3492	3600	3492	3492	3600
T CT (2000/5MR)	1	2328	2328	2400	2328	2328	2400	2328	2328	2400
T Relay CT (87)	1	6208	6208	6400	6208	6208	6400	6208	6208	6400
T CT (2000/5MR)	1	3880	3880	4000	3880	3880	4000	3880	3880	4000
T SS Wire (853.7 ACAR 24/13)	2A	1074	1267	1334	1193	1362	1423	1264	1421	1478
T Disconnect (2000A)	1	2000	2000	2060	2000	2000	2060	2000	2000	2060

Ratings Database Controls

- Strict access controls to Ratings Database
  - Managed by internal access management group
  - Usernames and passwords are provided
  - Write access is only available to small group of engineers

- A comprehensive review of the Facility Rating is performed any time an equipment entry is added, removed, or modified (with some exceptions)

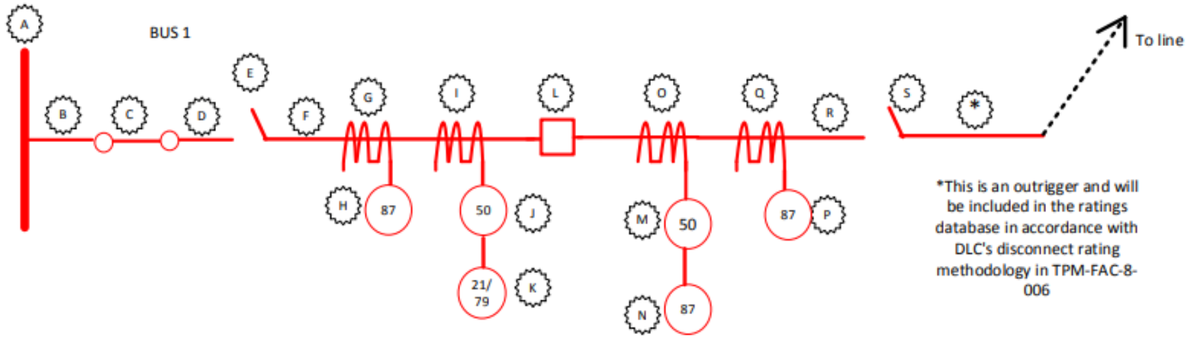
- All modifications are peer reviewed by a second engineer

Additional Ratings Database “Controls”

- Transmission System Equipment Library

Type	Manufacturer	Model	Description
T SS Wire	Mitsubishi	GIS	3000A
T SS Wire	None	AL BAR	0.225in x 4.5in AL
T SS Wire	None	AL BAR	0.25in X 6in AL
T SS Wire	None	AL BAR	0.25in x 4in AL BAR
T SS Wire	None	AL BAR	0.313in x 3in AL
T SS Wire	None	AL BAR	0.375in x 4in AL
T SS Wire	None	AL BAR	0.375in x 6in AL
T SS Wire	None	AL BAR	0.438in x 3in AL
T SS Wire	None	AL BAR	0.438in x 4in AL
T SS Wire	None	AL BAR	0.5in x 3in AL
T SS Wire	None	AL BAR	0.5in x 4in AL
T SS Wire	None	AL BAR	0.5in x 5.5in AL
T SS Wire	None	AL BAR	0.5in x 6in AL
T SS Wire	None	AL BAR	0.5in x 7in AL
T SS Wire	None	AL BAR	0.75in X 4in AL
T SS Wire	None	AL BAR	0.75in x 5in AL 6061-T6
T SS Wire	None	AL BAR	0.75in x 6in AL
T SS Wire	None	AL BAR	0.938in x 6in AL
T SS Wire	None	AL BAR	1in X 4in AL
T SS Wire	None	AL BAR	1in X 8in AL
T SS Wire	None	AL BAR	3in x 3.5in AL
T SS Wire	None	AL CHANNEL	5in Channel 0.19in WebThick AL
T SS Wire	None	AL CHANNEL	6in Channel 0.225in WebThick AL
T SS Wire	None	AL CHANNEL	6in Channel 0.314in WebThick AL
T SS Wire	None	AL CHANNEL	6in Channel 0.437in WebThick Al
T SS Wire	None	CU BAR	0.25in X 4in CU
T SS Wire	None	CU BAR	0.25in x 6in CU
T SS Wire	None	CU BAR	0.5in x 4in CU
T SS Wire	None	CU BAR	0.5in x 6in CU
T SS Wire	None	CU BAR	0.75in X 6in CU
T SS Wire	None	CU PIPE	1.5in CU PIPE

- Ratings Database equipment entry manual



Equipment Ratings

[Create Rating]

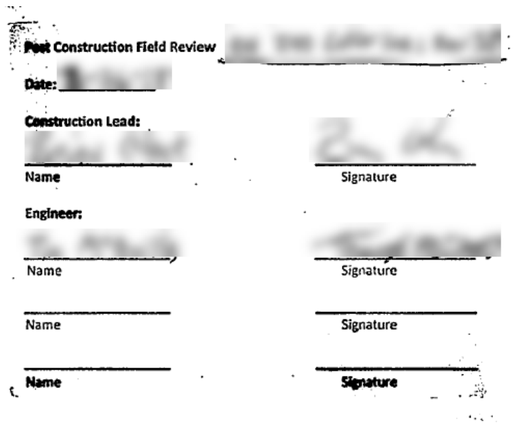
				Summer 35C (95F)			30C (86F)			25C (77F)			Spring/Fall 20C (68F)			15C (59F)			Winter 10C (50F)			5C (41F)			0C (32F)		
		Label	Class	Norm	Emrg	LD	Norm	Emrg	LD	Norm	Emrg	LD	Norm	Emrg	LD	Norm	Emrg	LD	Norm	Emrg	LD	Norm	Emrg	LD	Norm	Emrg	LD
?	Edit		2A	1424	1745	1908	1493	1798	1955	1558	1849	2001	1619	1899	2045	1678	1946	2088	1735	1992	2130	1789	2037	2170	1840	2080	2209

DUQUESNE LIGHT CO.

Facility Energization Controls

- Post Construction Field Reviews
  - Required for all transmission projects
  - Engineering/Commissioning personnel physically inspect equipment with construction team to verify as-built conditions match prints
  - Any equipment that is grounded and cleared is inspected

- Operations Center Pre-Energization Checklist
  - Includes checks for Facility Rating updates
  - Facility is not energized until all pre-reqs have been met



Post Construction Field Review

Date:

Construction Lead:

Name Signature

Engineer:

Name Signature

Name Signature

Name Signature

Data Classification: DLC INTERNAL

Operations

INITIAL ENERGIZATION PROCEDURE

<Facility Name>

At

_____ Substation

Revision _____ Date _____

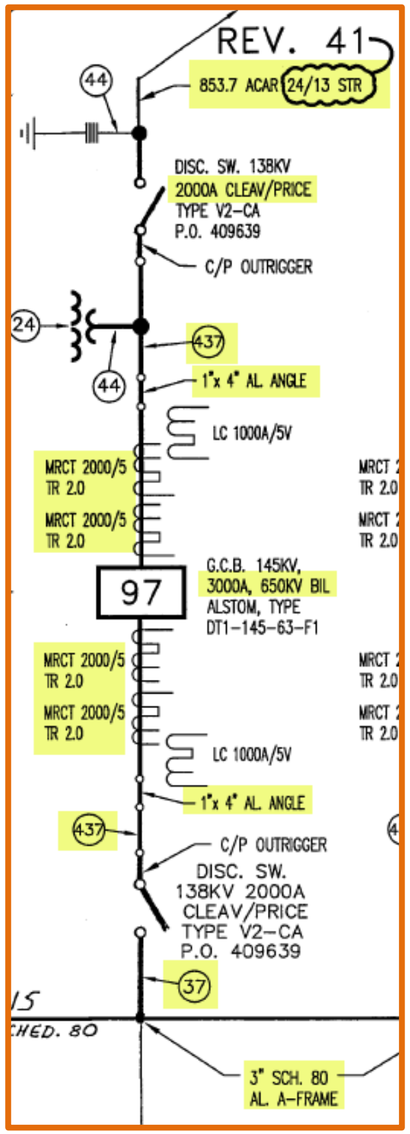
Verification of documents	Date Received	Initials	Verification of documents	Date Received	Initials
Circuit Maps (Manager, GIS and Mapping)			Updated Ratings –Tfmr (Senior Manager, System Planning)		
Station Single Lines (Manager, Substation Engineering & Manager Substation Control Engineering)			Updated Ratings – Line (Senior Manager, System Planning)		
RT Maps (Manager, Protection Engineering)			Reclosing Settings/Changes (Manager, Protection Engineering)		
Customer Single Lines (Manager, Substation Engineering & Manager Substation Control Engineering)			Temporary Settings acquired and approved (Manager, Protection Engineering)		
SCADA display updated (Manager, Operations System)			Equipment Marking signs installed (Supervisor, Substation Protection and Control)		
SOC Mapboard updated (Senior Manager, Transmission Operations)			Key Interlocks installed and functional (Supervisor, Substation Electrical Maintenance)		
State Estimator updated (Senior Manager, System Planning)			Transmission Post-Construction field review (Manager, Substation Engineering)		
eDART cut-in flag (Manager, Control Room Operations)			Transmission Planning Breaker replacement notified (Senior Manager, System Planning)		

DUQUESNE LIGHT CO.

Detective Controls

- Annual 10% Ratings Database Review
  - Comprehensive review of Facility Rating
  - Validate Ratings Database matches engineering drawings

		Summer 35C (95F)			Spring/Fall 20C (68F)			Winter 10C (50F)		
Type	Class	Norm	Emrg	LD	Norm	Emrg	LD	Norm	Emrg	LD
T SS Wire (4.0in AL PIPE)	2A	3263	4070	4479	3744	4443	4809	4025	4669	5012
T SS Wire (Two (2) - 3.0in AL PIPE)	2A	4160	5167	5678	4767	5641	6099	5124	5929	6358
T SS Wire (4.0in AL PIPE)	2A	3263	4070	4479	3744	4443	4809	4025	4669	5012
T Disconnect (2000A)	1	2000	2000	2060	2000	2000	2060	2000	2000	2060
T SS Wire (2000 AAC 91 str.)	2A	1850	2209	2335	2058	2375	2489	2182	2477	2584
T SS Wire (1in X 4in AL)	2A	3087	3754	4093	3499	4080	4386	3743	4280	4566
T CT (2000/5MR)	1	3880	3880	4000	3880	3880	4000	3880	3880	4000
T Relay CT (50)	1	7760	7760	8000	7760	7760	8000	7760	7760	8000
T Relay CT (21)	1	5820	5820	6000	5820	5820	6000	5820	5820	6000
T Circuit Breaker (3000A)	1	3000	3000	3090	3000	3000	3090	3000	3000	3090
T Relay CT (50)	1	7760	7760	8000	7760	7760	8000	7760	7760	8000
T Relay CT (87/79)	1	5820	5820	6000	5820	5820	6000	5820	5820	6000
T CT (2000/5MR)	1	3880	3880	4000	3880	3880	4000	3880	3880	4000
T SS Wire (1in X 4in AL)	2A	3087	3754	4093	3499	4080	4386	3743	4280	4566
T SS Wire (2000 AAC 91 str.)	2A	1850	2209	2335	2058	2375	2489	2182	2477	2584
T Disconnect (2000A)	1	2000	2000	2060	2000	2000	2060	2000	2000	2060



DUQUESNE LIGHT CO.

Detective Controls

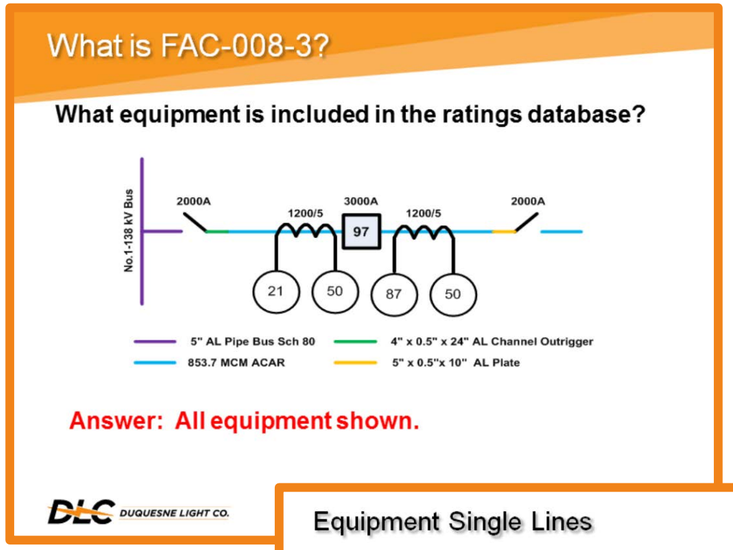
- Annual 5% Field Review
  - Facilities are removed from service and physically inspected
  - Validate engineering drawings match field conditions
  - Outages are optimized to maximize inspections with a single outage

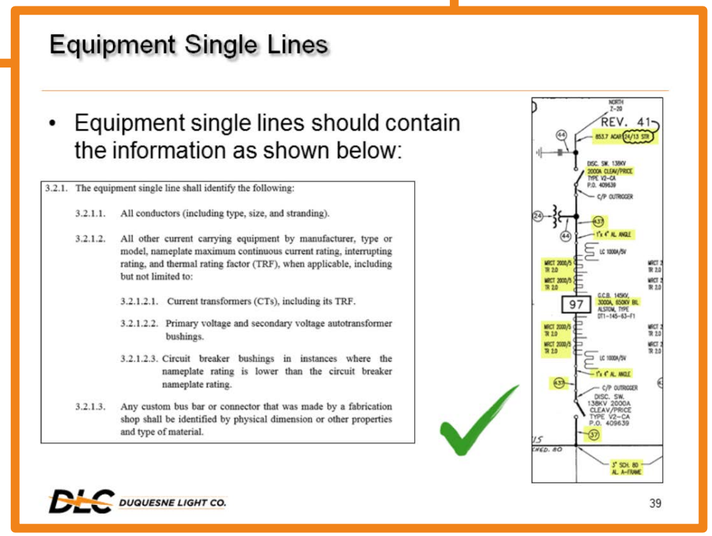
DUQUESNE LIGHT CO.

Training

- Annual training for engineering teams
  - Overview of standard
  - Actions/expectations of various groups
  - Communications between groups

- Annual refresher training for field personnel
  - Overview of standard
  - Expectations for field changes / red-lined drawings
  - Review specific examples of past oversights





Documentation

- Transmission Planning Manual – FAC-008 Sections
  - Equipment rating methodologies
  - Requirements for ratings database maintenance
  - Ratings communications

DUQUESNE LIGHT CO.		Transmission Planning Manual	
Title:	System Ratings Database	Procedure Number:	TPM-FAC-8-002
		Revision Number:	1.9
CONFIDENTIAL DOCUMENT		Effective Date:	December 18, 2019

NERC Standard(s) Reference: FAC-008-3

- Engineering Manual
  - Requirements for information contained on drawings
  - Approval of field modifications
  - Post-construction field reviews

3.2.1. The equipment single line shall identify the following:

3.2.1.1. All conductors (including type, size, and stranding).

3.2.1.2. All other current carrying equipment by manufacturer, type or model, nameplate maximum continuous current rating, interrupting rating, and thermal rating factor (TRF), when applicable, including but not limited to:

3.2.1.2.1. Current transformers (CTs), including its TRF.

3.2.1.2.2. Primary voltage and secondary voltage autotransformer bushings.

3.2.1.2.3. Circuit breaker bushings in instances where the nameplate rating is lower than the circuit breaker nameplate rating.

3.2.1.3. Any custom bus bar or connector that was made by a fabrication shop shall be identified by physical dimension or other properties and type of material.

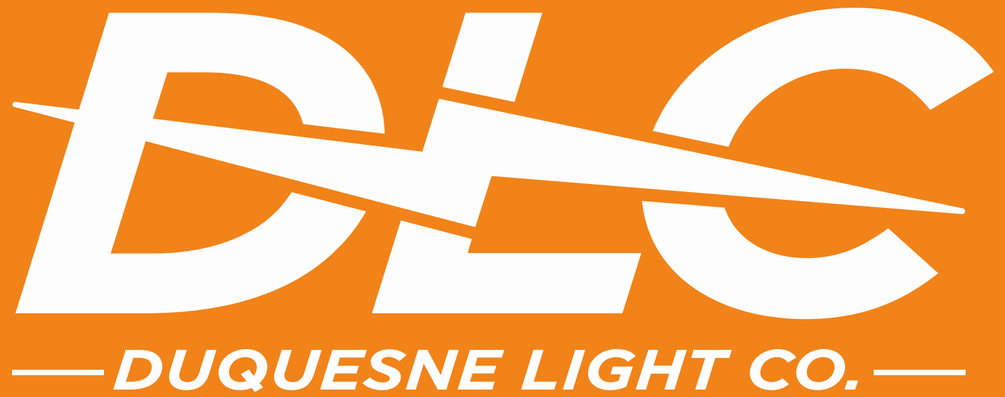
Planned Work vs. Emergent Work

- Controls still apply during emergency situations
- Post-Construction Field Reviews
- Operations Center Check

Potential Future Controls

- Establishment of FAC-008 charter
  - Cross functional team accountable to executive steering group
  - Identify risks in Facility Ratings process
  - Brainstorming controls to mitigate risks

- Potential controls include:
  - Better utilization of work management software
    - Prerequisites to ensure specific steps are being completed
    - Jobs cannot advance until task have been completed
    - Examples include: drawing manifests sent, drawings issued, post-construction field review complete, ratings database updated, etc.
  - Enhanced Training
    - More role specific training
    - Use of pre-recorded FAC-008 training for new hires


DLC
DUQUESNE LIGHT CO.

Facility Ratings

Ryan Abshier
Indiana Planning & Protection Manager

August 25, 2020

CenterPoint Energy

CenterPoint Energy

We Deliver.

Energy.

Reliability.

Service.

Value.

Innovation.

Agenda

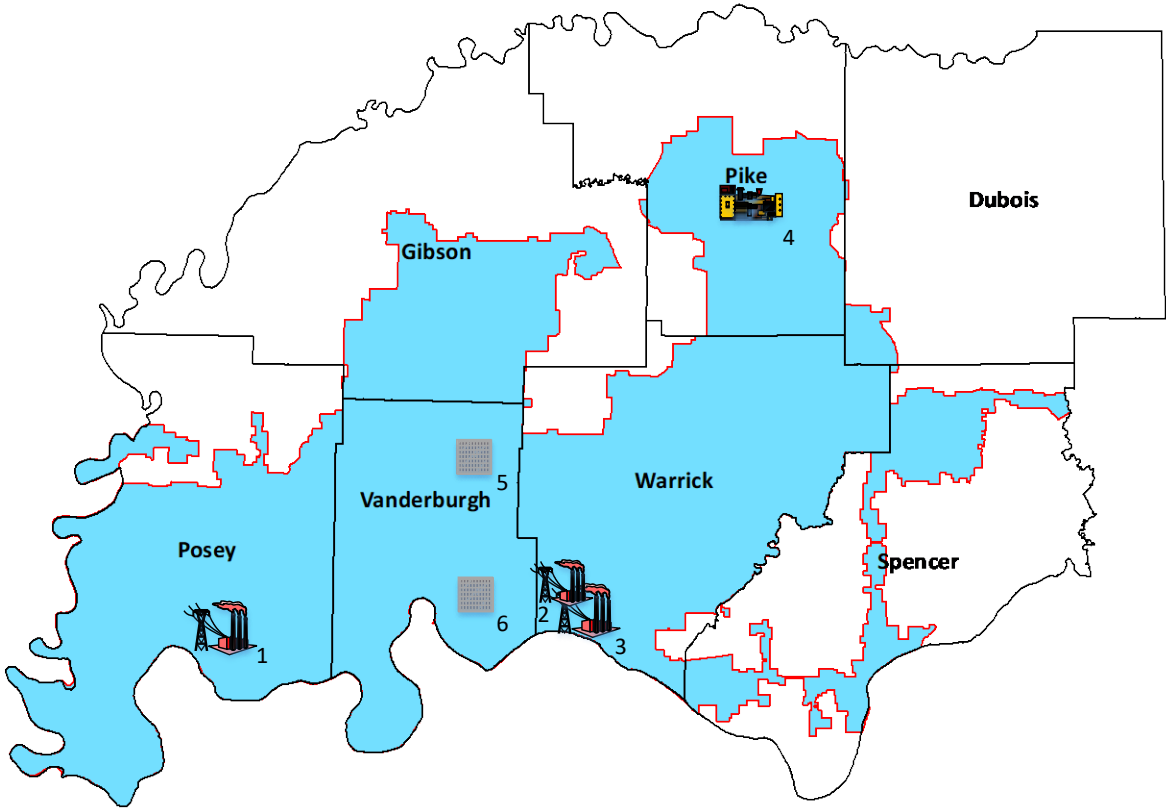
- Vectren, A CenterPoint Energy Company
- Facility Ratings Methodology
- Entering and Maintaining Facility Ratings
- Reviewing Database
- Change Management
- Mapping Process

Vectren Background

Electric Territory

Vectren Energy Delivery of Indiana – "Vectren South" (SIGECO)

- 1,308 square miles
- 7-counties
- 144,000 electric customers
- 1,360 MW total generating capacity
- 4 MW of solar / 1 MW battery
- 1,445 MW total load



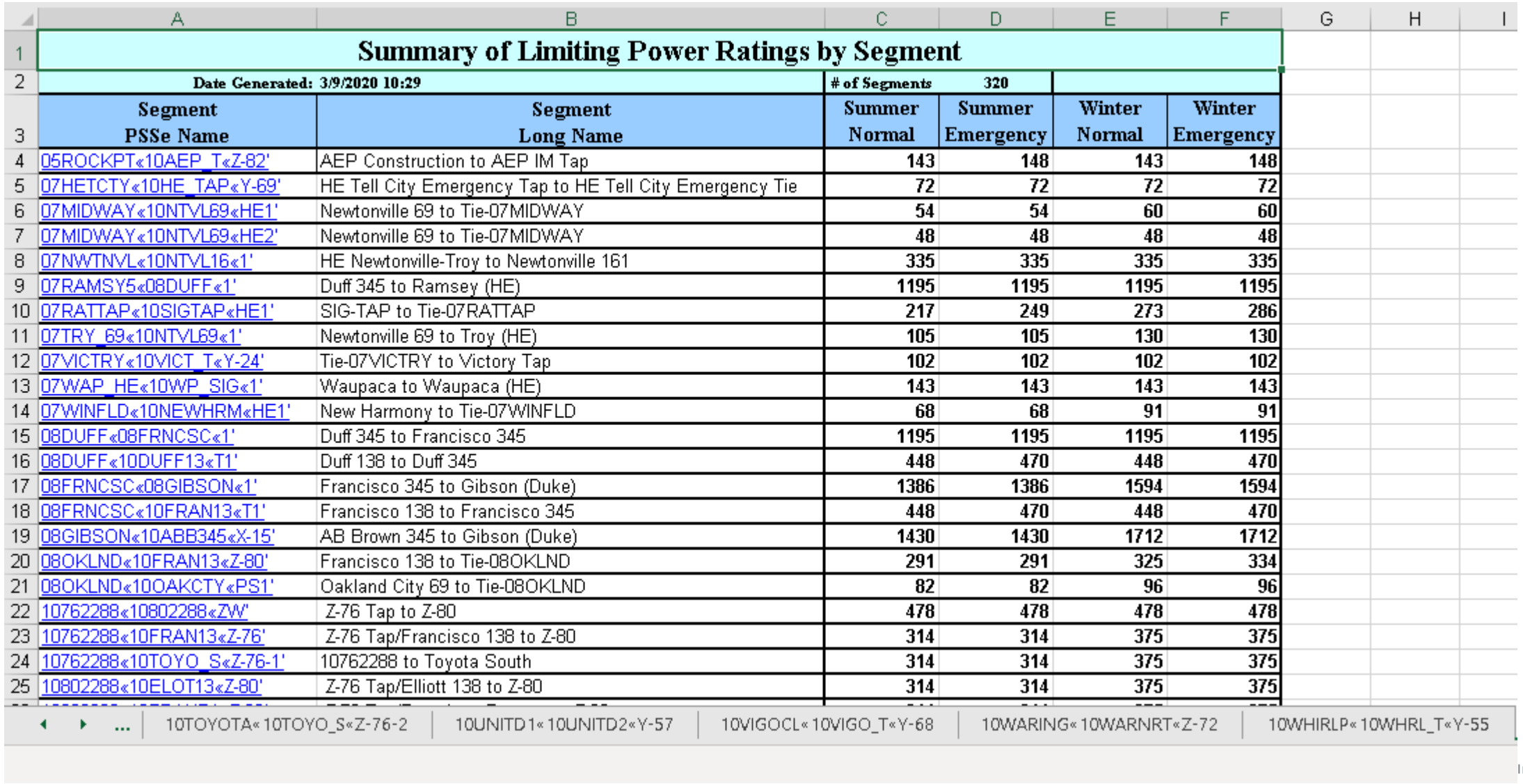
Generating Facilities

1 AB Brown
2 Warrick Unit 4
3 FB Culley
4 Blackfoot Clean Energy Facility
5 Volkman Road Solar / Battery
6 Oakhill Road Solar

Facility Ratings Methodology

- Methodologies
  - Conductors
    - Ratings calculated using ambient temperature, wind speed, and other parameters
    - Dual conductor ratings are 90% of the sum of the individual conductor ratings
  - All other devices
    - Nameplate ratings
- Emergency Ratings
  - Transformers only
    - 5% over highest rating
    - Limited to 4 hours total in a 24 hour period
- Seasonal Ratings
  - Winter
  - Summer
- Not used - Dynamic Line Ratings and Ambient Adjusted Ratings

Facility Ratings Database



	A	B	C	D	E	F	G	H	I
1	**Summary of Limiting Power Ratings by Segment**								
2	**Date Generated: 3/9/2020 10:29**		**# of Segments**	**320**					
3	**Segment PSSe Name**	**Segment Long Name**	**Summer Normal**	**Summer Emergency**	**Winter Normal**	**Winter Emergency**			
4	05ROCKPT«10AEP_T«Z-82'	AEP Construction to AEP IM Tap	143	148	143	148			
5	07HETCTY«10HE_TAP«Y-69'	HE Tell City Emergency Tap to HE Tell City Emergency Tie	72	72	72	72			
6	07MIDWAY«10NTVL69«HE1'	Newtonville 69 to Tie-07MIDWAY	54	54	60	60			
7	07MIDWAY«10NTVL69«HE2'	Newtonville 69 to Tie-07MIDWAY	48	48	48	48			
8	07NWTNVL«10NTVL16«1'	HE Newtonville-Troy to Newtonville 161	335	335	335	335			
9	07RAMSY5«08DUFF«1'	Duff 345 to Ramsey (HE)	1195	1195	1195	1195			
10	07RATTAP«10SIGTAP«HE1'	SIG-TAP to Tie-07RATTAP	217	249	273	286			
11	07TRY_69«10NTVL69«1'	Newtonville 69 to Troy (HE)	105	105	130	130			
12	07VICTRY«10VICT_T«Y-24'	Tie-07VICTRY to Victory Tap	102	102	102	102			
13	07WAP_HE«10WP_SIG«1'	Waupaca to Waupaca (HE)	143	143	143	143			
14	07WINFLD«10NEWHRM«HE1'	New Harmony to Tie-07WINFLD	68	68	91	91			
15	08DUFF«08FRNCSC«1'	Duff 345 to Francisco 345	1195	1195	1195	1195			
16	08DUFF«10DUFF13«T1'	Duff 138 to Duff 345	448	470	448	470			
17	08FRNCSC«08GIBSON«1'	Francisco 345 to Gibson (Duke)	1386	1386	1594	1594			
18	08FRNCSC«10FRAN13«T1'	Francisco 138 to Francisco 345	448	470	448	470			
19	08GIBSON«10ABB345«X-15'	AB Brown 345 to Gibson (Duke)	1430	1430	1712	1712			
20	08OKLND«10FRAN13«Z-80'	Francisco 138 to Tie-08OKLND	291	291	325	334			
21	08OKLND«10OAKCTY«PS1'	Oakland City 69 to Tie-08OKLND	82	82	96	96			
22	10762288«10802288«ZW'	Z-76 Tap to Z-80	478	478	478	478			
23	10762288«10FRAN13«Z-76'	Z-76 Tap/Francisco 138 to Z-80	314	314	375	375			
24	10762288«10TOYO_S«Z-76-1'	10762288 to Toyota South	314	314	375	375			
25	10802288«10ELOT13«Z-80'	Z-76 Tap/Elliott 138 to Z-80	314	314	375	375			

... | 10TOYOTA«10TOYO_S«Z-76-2 | 10UNITD1«10UNITD2«Y-57 | 10VIGOCL«10VIGO_T«Y-68 | 10WARING«10WARNRT«Z-72 | 10WHIRLP«10WHRL_T«Y-55

Facility Ratings Database

CenterPoint Energy

Line Y-32 Facility Ratings																
69kV Line from Aventine to Leonard Rd. ('10AVENTN') to ('10LEONRD')																
Station Name	Part Group	Symbol	Equipment	Summer Normal		Summer Emergency		Winter Normal		Winter Emergency		Check	Voltage	Author	Date Created	Notes
				Ampacity	MVA	Ampacity	MVA	Ampacity	MVA	Ampacity	MVA					
Aventine	177	177	CT Setting	2000	239	2000	239	2000	239	2000	239	Y	0.069	Brantly Sturgeon	6/11/2008	
Aventine	177	177	CT Setting	2000	239	2000	239	2000	239	2000	239	Y	0.069	Brantly Sturgeon	6/11/2008	
Aventine	177	177	CT Setting	2000	239	2000	239	2000	239	2000	239	Y	0.069	Brantly Sturgeon	6/11/2008	
Aventine	177	177	CT Setting	2000	239	2000	239	2000	239	2000	239	Y	0.069	Brantly Sturgeon	6/11/2008	
Aventine	177	Dual 500 CU	Jumpers	1930	231	1930	231	2300	275	2300	275	Y	0.069	Ryan Abshier	7/2/2009	Updated Jumper Rating
Aventine	177	177	Breaker	2000	239	2000	239	2000	239	2000	239	Y	0.069	Brantly Sturgeon	6/11/2008	
Aventine	177	171	Switch	2000	239	2000	239	2000	239	2000	239	Y	0.069	Brantly Sturgeon	6/11/2008	
Aventine	177	173	Switch	2000	239	2000	239	2000	239	2000	239	Y	0.069	Brantly Sturgeon	6/11/2008	
Aventine	bus	4 IPS AL	Bus Conductor	2888	345	2888	345	3690	441	3690	441	Y	0.069	Ryan Abshier	6/21/2010	
Aventine	bus	500	Switch	2000	239	2000	239	2000	239	2000	239	Y	0.069	Brantly Sturgeon	6/11/2008	
Aventine/Leonard Rd.	line	477 ACSR 26/7	Line Conductor 100	858	103	858	103	1023	122	1023	122	Y	0.069	Ryan Abshier	6/21/2010	
Leonard Rd.	1277	1277	CT Setting	2000	239	2000	239	2000	239	2000	239	Y	0.069	Ryan Abshier	7/6/2016	
Leonard Rd.	1277	1277	CT Setting	2000	239	2000	239	2000	239	2000	239	Y	0.069	Ryan Abshier	7/6/2016	
Leonard Rd.	1277	1277	CT Setting	2000	239	2000	239	2000	239	2000	239	Y	0.069	Ryan Abshier	7/6/2016	
Leonard Rd.	1277	1277	CT Setting	2000	239	2000	239	2000	239	2000	239	Y	0.069	Ryan Abshier	7/6/2016	
Leonard Rd.	1277	Dual 500 CU	Jumpers	1930	231	1930	231	2300	275	2300	275	Y	0.069	Ryan Abshier	7/6/2016	
Leonard Rd.	1277	1277	Breaker	2000	239	2000	239	2000	239	2000	239	Y	0.069	Ryan Abshier	7/6/2016	
Leonard Rd.	1277	1271	Switch	2000	239	2000	239	2000	239	2000	239	Y	0.069	Ryan Abshier	7/6/2016	
Leonard Rd.	1277	1273	Switch	2000	239	2000	239	2000	239	2000	239	Y	0.069	Ryan Abshier	7/6/2016	
Leonard Rd.	1300	1300	CT Setting	2000	239	2000	239	2000	239	2000	239	Y	0.069	Ryan Abshier	7/6/2016	
Leonard Rd.	1300	1300	CT Setting	2000	239	2000	239	2000	239	2000	239	Y	0.069	Ryan Abshier	7/6/2016	
Leonard Rd.	1300	1300	CT Setting	2000	239	2000	239	2000	239	2000	239	Y	0.069	Ryan Abshier	7/6/2016	
Leonard Rd.	1300	1300	CT Setting	2000	239	2000	239	2000	239	2000	239	Y	0.069	Ryan Abshier	7/6/2016	

10AVENTN<<10LEONRD<<Y-32 | 10AVENTN<<10S_WIND<<Y-32 | 10AZTE_J<<10VIP<<Y-74 | 10AZTECA<<10AZTE_J<<Y-74 | 10AZTECA<<10PPG<<Y-74 | 10BENTON<<10MTVN69<<Y-33 | 1(...

Facility Ratings Database

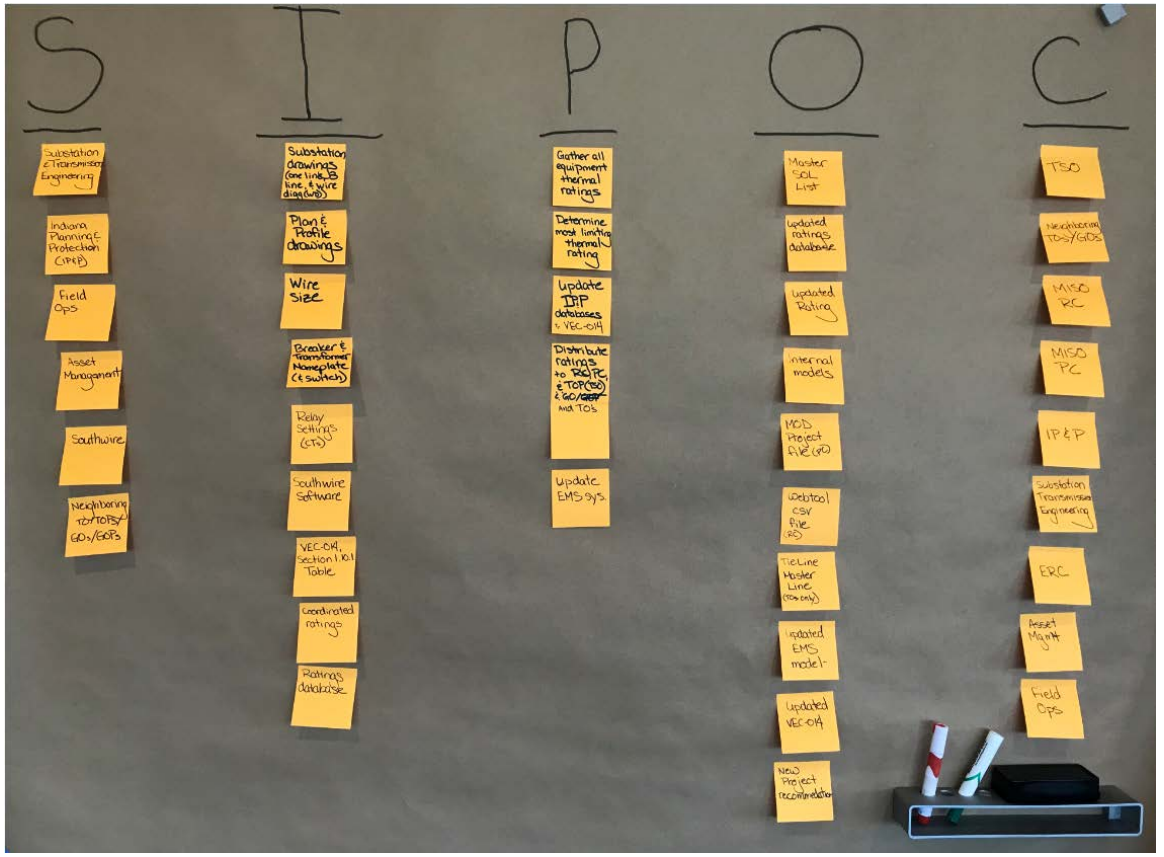
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
19	Leonard Rd.	1277	1277	CT Setting	2000	239	2000	239	2000	239	2000	239	Y	0.069	Ryan Abshier	7/6/2016	
20	Leonard Rd.	1277	Dual 500 CU	Jumpers	1930	231	1930	231	2300	275	2300	275	Y	0.069	Ryan Abshier	7/6/2016	
21	Leonard Rd.	1277	1277	Breaker	2000	239	2000	239	2000	239	2000	239	Y	0.069	Ryan Abshier	7/6/2016	
22	Leonard Rd.	1277	1271	Switch	2000	239	2000	239	2000	239	2000	239	Y	0.069	Ryan Abshier	7/6/2016	
23	Leonard Rd.	1277	1273	Switch	2000	239	2000	239	2000	239	2000	239	Y	0.069	Ryan Abshier	7/6/2016	
24	Leonard Rd.	1300	1300	CT Setting	2000	239	2000	239	2000	239	2000	239	Y	0.069	Ryan Abshier	7/6/2016	
25	Leonard Rd.	1300	1300	CT Setting	2000	239	2000	239	2000	239	2000	239	Y	0.069	Ryan Abshier	7/6/2016	
26	Leonard Rd.	1300	1300	CT Setting	2000	239	2000	239	2000	239	2000	239	Y	0.069	Ryan Abshier	7/6/2016	
27	Leonard Rd.	1300	1300	CT Setting	2000	239	2000	239	2000	239	2000	239	Y	0.069	Ryan Abshier	7/6/2016	
28	Leonard Rd.	1300	Dual 500 CU	Jumpers	1930	231	1930	231	2300	275	2300	275	Y	0.069	Ryan Abshier	7/6/2016	
29	Leonard Rd.	1300	1300	Breaker	2000	239	2000	239	2000	239	2000	239	Y	0.069	Ryan Abshier	7/6/2016	
30	Leonard Rd.	1300	1302	Switch	2000	239	2000	239	2000	239	2000	239	Y	0.069	Ryan Abshier	7/6/2016	
31	Leonard Rd.	1300	1304	Switch	2000	239	2000	239	2000	239	2000	239	Y	0.069	Ryan Abshier	7/6/2016	
32	Leonard Rd.	bus	4 IPS AL	Bus Conductor	2888	345	2888	345	3690	441	3690	441	Y	0.069	Ryan Abshier	7/6/2016	
33	Leonard Rd.	line	1370	Line Switch	2000	239	2000	239	2000	239	2000	239	Y	0.069	Ryan Abshier	7/6/2016	
34	**Limiting Equipment Ratings**																
35	**Station Name**	**Part Group**	**Symbol**	**Equipment**	**Summer Normal**		**Summer Emergency**		**Winter Normal**		**Winter Emergency**		**Check**	**Voltage**	**Author**	**Date Created**	**Notes**
36					Ampacity	MVA	Ampacity	MVA	Ampacity	MVA	Ampacity	MVA					
37	Aventine/Leonard Rd.	line	477 ACSR 26/7	Line Conductor 100	858	103	858	103	1023	122	1023	122	Y	0.069	Ryan Abshier	6/21/2010	
38	**Overall Limiting Rating**					**103**		**103**		**122**		**122**					
39																	
40	Goto Limit Summary Page																
41																	

Change Management

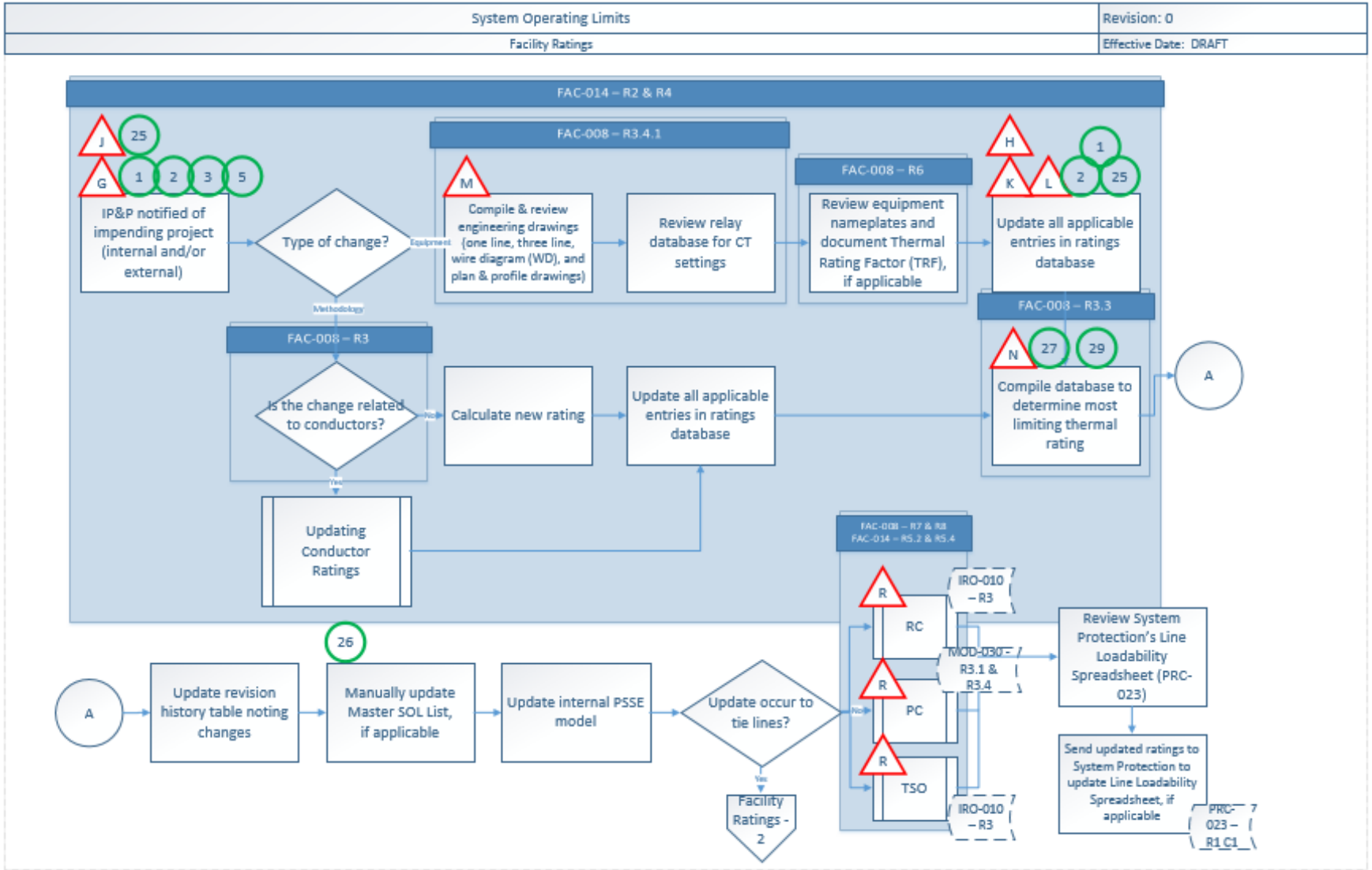
- Planning Engineer involved in scoping of projects
- Planning Engineer participates in project coordination meetings (with engineering, field operations, and system operations)
- Issued For Construction (IFC) design package used for updates
- Database compared to as-built package and reviewed with engineers
  - Updates sent to entities if changes identified
- Planning Engineer notified of emergency replacements by engineering, field operations, or system operations
- Emergency replacement information entered in Database and peer reviewed before submission

SIPOC – SOL Process

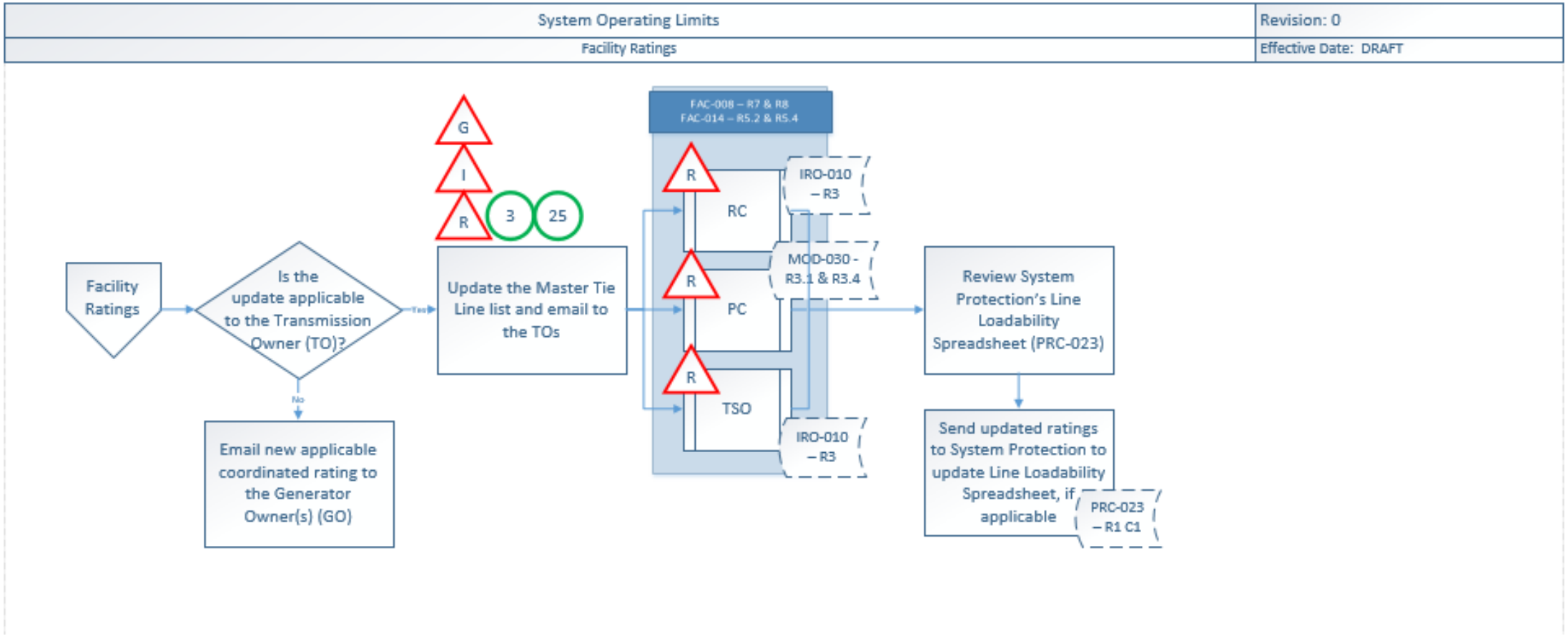
We began by completing a SIPOC map, which stands for suppliers, inputs, processes, outputs, and customers. The SIPOC ensures all parties involved in the process are accounted for when mapping the current state.



Visio flowcharts – facility ratings

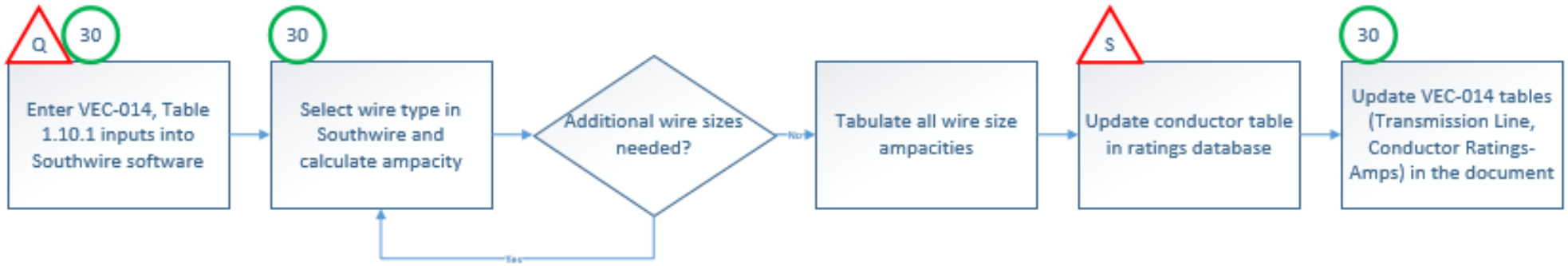


Visio Flowcharts – Facility Ratings (cont'd)



Visio Flowcharts – Updating Conductor Ratings

System Operating Limits	Revision: 0
Updating Conductor Ratings	Effective Date: DRAFT



Process Mapping

- Mapped stability ratings updates process
- Mapped voltage limit update process
- Mapped process for submitting to various entities
  - Neighboring utilities
  - TSO (control center)
  - Planning Coordinator
  - Reliability Coordinator

Identified Process Risks

- Several potential risks were identified that could lead to inaccurate or incomplete data
  - Documented processes
  - Software
  - New personnel
- Risks identified in this mapping process were not necessarily realized or experienced issues, they were merely potential risks we thought of that COULD lead to issues
  - This concept took a while to adapt to

Identified Controls

- Preventative Controls
  - Indiana Planning & Protection attend bi-weekly and monthly project coordination meetings with Engineering, Field Operations, and TSO
  - Project Managers send project design reviews (PDR) to Indiana Planning & Protection identifying the scope of upcoming projects
  - Planning Engineers receive outage communication from TSO to review unplanned emergency work to verify if unanticipated outages will occur
  - Planning Engineers verify data with external entities

- Detective Controls
  - Planning Engineer completes a peer review with a High Voltage Engineer after entering the Facility Ratings into the database
  - Planning Engineer completes peer review with other Planning Engineer or Manager prior to finalization
  - Planning Engineer performs MOD-032 model review comparing elements in the Facility Ratings database to the planning model
  - Planning Engineer compiles Facility Ratings database one transmission line at a time
  - Planning Engineer reviews entries by updating SOL spreadsheet and creating comparison table

Questions & Answers

IMPLEMENTING INTERNAL CONTROLS - A GO/GOP'S PERSPECTIVE ON FAC-008

Nicholas Poluch
Senior Manager, NERC & Cyber Compliance
Talen Energy

About Talen Energy

- **Talen was formed and became a public company in June 2015**
  - Represents the combination of the former PPL unregulated generation assets and three Riverstone generation portfolios.
  - In December 2016, Talen was taken private through an acquisition by Riverstone.

- **Talen is a privately-owned Independent Power Producer (IPP)**
  - IPPs own stations that generate electric power for sale to regional transmission organizations and commercial, industrial, and residential customers.
  - IPPs, like most generators in competitive markets, must operate very efficiently.

- **What makes Talen Energy unique?**
  - We generate approximately 15,000 MW through 21 plants in 7 states.
    - We are the largest owner of electricity generation in the Commonwealth of Pennsylvania.
  - We employ ~3,000 people throughout the US.

Talen Terminology

- Plant NERC Contact **PNC**
  - Note: PNC is not to be confused with Potential Non Compliance
- Regional NERC Contact **RNC**
  - PNCs and RNCs have other job responsibilities besides NERC
- TE-NERC-212 Facility Ratings Procedure **FAC-008 Procedure**
- Government Accounting Office (GAO) Pyramid **Internal Controls Pyramid**

Key Takeaways

➢ **Risk-based**	Talen's Internal Controls Program prioritizes limited resources to areas of higher risk; BES reliability & compliance are always paramount
➢ **Scalable**	Talen's Internal Controls Program is designed for ease of adaptability to changes in personnel or fleet asset configuration
➢ **Procedures**	Clarity, local guidance and interpretations of NERC terms are hallmarks of good NERC procedures, not simple regurgitation of Standards' language
➢ **Internal Controls Pyramid**	Provides a simple framework to build strong internal controls

Agenda

- **Climb the internal controls pyramid**

Internal Controls Pyramid: Control Environment

Control Enviroment

- Talen's Control Environment has 4 Elements
- Plant Accountability in FAC-008
- Interpretations in FAC-008 Procedure

Control Environment (cont'd)

- **Talen's 4 Control Elements**
  1. **Team**: NERC compliance team, Training, Corporate Security, and Operations
  2. **Independent**: Independent reporting structure; NERC Group reports to the CEO separately
  3. **Uniformity**: Uniformity of fleet reporting and fleet expectations thru the MRRE registration
     - During an audit it was very clear that we had different expectation on what was required for evidence
  4. **Procedure:** FAC-008 Facility Ratings Procedure establishes the control environment

     Important Aspects

     Accountabilities

     Interpretations…what do NERC terms mean to Talen

Control Environment: Accountabilities

➢ Plant Accountability in FAC-008

- Plant Manager:
  - Assigns personnel to perform the obligations stated in this procedure
- Plant NERC Contact (PNC):
    - Informs the Regional NERC Contact (RNC) of any replacements, Operating Limitations or ratings changes for equipment subject to FAC-008-3
    - Informs the RNC of any requests for FAC-008-3 data by the Reliability Coordinator (RC), Planning Coordinator (PC), Transmission Planner (TP), TO or Transmission Operator (TOP) pursuant to R7 or R8 of the standard (see paras. 6.4 and 6.5 of this procedure)
- Regional NERC Contact (RNC):
    - Provides assistance to PNC on clarification of Potential FAC-008 issues
    - Passes PNC inputs to the NERC Group for action

Control Environment: Accountabilities (cont'd)

- **Corporate NERC Team Accountability in FAC-008 Procedure**
  - Manager, NERC Operations & Planning Standards
    - Responsible for creating and maintaining FAC-008-3 data sheets (delegating work as appropriate)
    - Responds to FAC-008-3 R7 or R8-related requests

Control Environment: Interpretations

➢ Interpretations in FAC-008 Procedure

- **Element:** Any electrical device with terminals that may be connected to other electrical devices such as a generator, transformer, circuit breaker, bus section, or transmission line. An Element may be comprised of one or more components...

  - What does Element mean to Talen??

  ❖ **Talen Interpretation**: *NERC uses the word "Element" to refer to an individual piece of equipment, as shown above, and also in a collective sense. "Element" is used in this procedure to refer to the individual pieces of equipment for which Talen must identify Equipment Ratings for FAC-008-3.*

- **Emergency Rating:** The rating as defined by the equipment owner that specifies the level of electrical loading or output, usually expressed in megawatts (MW) or MVAR or other appropriate units, that a system, facility, or element can support, produce, or withstand for a finite period. The rating assumes acceptable loss of equipment life or other physical or safety limitations for the equipment involved.

  - What does Emergency Rating mean to Talen??

  ❖ **Talen Interpretation**: *Talen does not operate Elements above their electrical Normal Ratings. The Emergency and Normal values for FAC-008-3 Equipment Ratings and Facility Ratings are therefore the same. Both are listed on the data sheet.*

Internal Controls Pyramid: Risk Assessment

Risk Assessment

- What is Risk assessment to Talen?
- Talen's attribute risk assessment has 4 Goals
- Process for reviewing identified risk or potential risks-Talen CCR Process
- Industry and Regulatory Guides to minimize risk
- Challenges of FAC-008 Risks from GO perspective

Risk Assessment (cont'd)

➢ What is Risk assessment to Talen?

- Attribute risk assessment

➢ Talen's 4 attribute risk assessment Goals

1. **Active**: Risk assessment is an on-going, **active** process. For Talen it means reviewing risks and reacting to feedback from the operations plant team.
2. **Cross Functional**: Cross-functional review team which includes Operations, Security and NERC Group
3. **Identifies**: Identifies potential non-compliances and course corrects
4. **Usable:** Tools for risk assessment are Usable by implementing team

   Example for Talen: PNC checklist

Risk Assessment (cont'd)

➢ Talen CCR Process

- **Compliance Condition Reporting (CCR):** Process used to evaluate potential non-compliance events; events treated similarly as a "near miss" in the Safety environment, where we use it as an opportunity to improve
  - CCR Form has internal control items listed below
    - "*Was this non-conforming condition previously reported or discovered?*"
      - ❖ This question helps to evaluate adequacy of existing internal controls
    - "*Do we need additional internal controls*?"
      - ❖ Extent of Condition evaluation looks at similar vulnerabilities across the fleet

➢ Reliability Impact and Risk Assessment

- Potential impact to BES
- Actual impact to BES

Risk Assessment: Guides

- **Industry**: Active Participant in Industry-wide feedback loops (i.e., North American Generation Forum (NAGF))

- **Guides**: FAC-008 New CMEP Practice Guide
  - Can the new suggested CMEP internal controls be incorporated easily into the current internal controls program?
  - Is there additional costs for new controls for Plant or NERC team?
  - What is the cost of controls vs BES/Compliance risk?
  - Note: New controls are piloted with Plants before implementation

Potential Risks of FAC-008

➢ Challenges of FAC-008

- FAC-008 no activity then a flurry of activity
- New projects such as solar additions….are we getting the information to support FAC-008??
- Small retro-fit projects that float under the radar screen

Internal Controls Pyramid: Control Activities

Control Activities

➢ Control Activities

- Plants have standardized, NERC data sheets and check lists
- Work management systems
- Training (building human capital)-reviewed monthly on PNC checklist for new personnel
- Ensure that Preventive, Detective and Corrective aspects are addressed
- **FAC-008-Facility Ratings Procedure**
- **What other control activities can be added?**

Control Activities (cont'd)

- **FAC-008 Facility Ratings Procedure:** Talen NERC procedures provides clarity and instructions, rather than just reiterating the Standard
  - **Examples of statements in FAC-008 Procedure**
    - **Statement 1**: FAC-008 deals only with electrical ratings, not boiler or turbine capabilities
    - **Statement 2**: Requirement 2
      - "Relay protective devices" refers to loadability relays (compliant with PRC-025 = Pass)
      - "Transformers" refers to GSUs and CTs

Control Activities

- **What other control activities can be added??**
  - Change control at the corporate level to catch projects?
    - When project is being approved add a box that its been vetted by NERC Team
  - Small retro-fit projects at the plant need to be vetted through the RNC

Internal Controls Pyramid: Monitoring

Monitoring

➢ Monitoring

- Annual Self Certifications
- Annual RSAW updating
- Biweekly NERC meetings
- Quarterly/Semi-annual RNC Workshops
- **Monthly PNC and RNC Checklists**

PNC Checklist

Talen Energy NERC Plant Monthly Checklist Menu Master Rev. 0 Effective for April 2020 reports

Plant:_____ **Month and Year Being Reported:** _____/_____

Instructions
- **Form is to be printed out and filled out each month.**
- Include documentation for operational events/tests and describe under "comments" at end of form.
- Send completed forms to the NERC Regional Contact (RNC) and NERC operational and support leads.
- Promptly notify NERC regional contact of compliance questions or concerns.

Plant	NCR#	TOP	BA/PC/RC	TO/TP	Dispatch	Regional Entity
Athens	07154		NYISO	Nat'l Grid	Nat'l Grid	
Barney M Davis U1	04010	AEP/ERCOT CFR00075	ERCOT	AEP	QSE-Twin Eagle (SQ9)	Texas RE
Barney Davis LLC	04009	AEP/ERCOT CFR00075	ERCOT	AEP	QSE-Twin Eagle (SQ9)	Texas RE
Brandon Shores	11308		PJM	BGE	Tenaska	
Brunner Island	11362		PJM	PPL	Tenaska	
Camden	00838		PJM	PSEG	EDF	
Colstrip	05329		Northwestern Corp (CAISO is RC)	Northwestern Corp	Northwestern Corp.	
Dartmouth	02922		ISO-NE	Eversource	ISO-NE	
Laredo	04090	AEP/ERCOT CFR00075	ERCOT	AEP	QSE-Twin Eagle (SQ9)	Texas RE
Lower Mount Bethel	11362		PJM	PPL	EDF	
Martins Creek	11362		PJM	PPL	EDF	
Millennium	07144		ISO-NE	Nat'l Grid	Nat'l Grid	
Montour	11362		PJM	PPL	Tenaska	
Newark Bay	00838		PJM	PSEG	EDF	
Nueces Bay	04106	AEP/ERCOT CFR00075	ERCOT	AEP	QSE-Twin Eagle (SQ9)	Texas RE
Pedricktown	00838		PJM	ACE	EDF	
Susquehanna	00889		PJM	PPL	Tenaska	
Wagner	11308		PJM	BGE	Tenaska	

Yes No
☐ ☐ **Did the station operate during this month?**

Yes No
New Personnel
☐ ☐ **Were there any new personnel?**
☐ ☐ If "Yes" above, was Monique Scott contacted to insure people are in LMS

Yes No
Training Rosters
☐ ☐ **Any changes to control room operators (CROs) or supervisors?**
☐ ☐ If "Yes" above, training rosters for TNT001, 3, 5, 6, 7 and 8 revised before new personnel start dates?

☐ ☐ **Any changes to personnel dealing with batteries or protective relays (including contractors)?**
☐ ☐ If "Yes" above, training rosters for TNT010, 011, revised as appropriate?
NOTE: New personnel cannot operate units until trained in TNT001 & TNT003
Supervisors can operate units at non-bargaining unit plants (e.g. Raven), not just CROs

PNC Checklist (cont'd)

Yes	No		
Training			
☐	☐	**TNT 001**	**NERC COM-002 R3, Three-part communications - anyone in operations**
☐	☐	**TNT 003**	**NERC VAR-002 - Voltage control training - control room operators and supervisors**
☐	☐	**TNT 005**	**Introduction to NERC - All employees**
☐	☐	**TNT 007**	**Winter readiness - typically anyone other than administrative**
☐	☐	**TNT 008**	**Protection System misoperation identification and correction – CROs, relay techs, and supervisors**
☐	☐	**TNT 010**	**Training for people performing battery maintenance (including contractors)**
☐	☐	**TNT 011**	**Training for people performing relay maintenance (including contractors)**
☐	☐	**TNT 012**	**Operational Functionality of Protection Systems & Remedial Action Schemes (RAS)**
☐	☐		**Was all training completed per LMS?**
BAL-001-TRE-1, Primary Frequency Response in the ERCOT Region. **Topaz plants only**			
☐	☐		**Governor settings correct? (R6)**
☐	☐		**Governor in service at all times? (R7)**
☐	☐		**Was there a Governor status change?**
☐	☐		If "Yes" for the status change question above, was ERCOT notified within 30 minutes? (R8)
BAL-005-0.2b, Automatic Generation Control in the ERCOT Region. **Topaz plants only**			
☐	☐		**Collect annual AEP Meter calibration: (CFR75-R1.2-AEP) Next Due_____**
COM-001-3, Communications			
☐	☐		**Were there any changes or modification plans affecting communication paths to BA and TOP? (R8)**
☐	☐		If "Yes" above, was the communication path documentation updated?
☐	☐		**Were there any failures of normal or backup communication means with BA or TOP? (R11)**
☐	☐		If "Yes" above, were events reported to Dispatch?
COM-002-4, Operating Personnel Communications Protocols			
☐	☐		**Was an Operating Instruction received during an emergency from the BA, RC or TOP? (R6)**
☐	☐		If "Yes" above, was three-part communication used?
EOP-004-4, Event Reporting			
☐	☐		**TE-NERC-202 Attachments A and C information up-to-date? (R1)**
☐	☐		**Were there any reportable events per TE-NERC-202 para 6.1? (R2)**
☐	☐		If "Yes" above, were events reported per TE-NERC-202 within 24 hrs.?

PNC Checklist (cont'd)

FAC-008-3, Facility Ratings

☐ ☐ **Were there any temporary, major, electrical derates (MVA, requiring an outage to address)? (R1, R2)**

☐ ☐ If "Yes" above, did you report these to the RNC?

☐ ☐ **Was there a request for FAC-008 data from the PC, RC, TO, TOP or TP? (R7 & R8)**

☐ ☐ If "Yes" above, was the information received by the requesting entity?

Yes No

IRO-001-4, Reliability Coordination – Responsibilities, and TOP-001-4, Transmission Operations

☐ ☐ **Did you receive any Operating Instructions from the BA, RC or TOP? (IRO-001 R2 & 3, TOP-001 R3-6)**

☐ ☐ If "Yes" above, was the Operating Instruction logged and dated by operator?

☐ ☐ If "Yes" above, did you comply with the instructions?

☐ ☐ If "No" above, provide remarks in comments section explaining why not

IRO-010-2, Reliability Coordinator Data Specification and Collection, and TOP-003-3, Operational Reliability Data

☐ ☐ **Were there any data conflicts or data requests? Note: data was provided to RC/BA/TOP per their specification through Talen Asset Management? (IRO-010 R3, TOP-003 R5)**

MOD-025-2, Real and Reactive Power Capability Verification

☐ ☐ **Tests run this month and reported to RNC? Next test due _____ (R1 & R2)**

☐ ☐ **Were there any changes affecting real or reactive power ≥10% and expected to last ≥6 months?**

☐ ☐ If "Yes" above, identify the retest schedule for MOD-025: change date_____, test date _____

☐ ☐ **Were test results reviewed and submitted (w/i 90 days) to the Region? Submittal date_____**

MOD-026-1, Excitation System Model Verification

☐ ☐ **Tests run this month and reported to RNC? Next test due _____ (R2)**

☐ ☐ **Were there any changes to excitation system (e.g. set pts, gains, rating, time const., PSS tuning)?**

☐ ☐ If "Yes" above, identify the retest schedule for MOD-026: change date _____, test date _____

☐ ☐ **Did you receive from the TP concerns about or a rejection of the MOD-026 test report?**

☐ ☐ If "Yes" above, was a response received by the TP within 90 days? (R3)

PNC Checklist (cont'd)

Cyber Security

Yes	No	
☐	☐	**Performed Cyber Security Awareness activities (e.g. attend CIP meetings, posters, plant-wide email)?**
☐	☐	If "Yes", has evidence been submitted?
		If "No", explain _____
☐	☐	**All new contractors and new employees with access to Cyber Assets that could affect generation reviewed the site's Cyber Security Incident Response procedure (TE-NERC-307-CSIR-ALL)?**
		If "No", explain _____
☐	☐	**Was there a suspected or actual security event related to plant physical or cyber assets?**
☐	☐	If "Yes", were events reported per the site's Cyber Security Incident Response Plan (TE-NERC-308-CSIR-CR)?
☐	☐	If "Yes", are there any follow-up work activities required? _____
☐	☐	**Were Transient Cyber Assets used on BES Cyber Systems (control systems, relays, etc)? (reference TE-NERC-218)**
☐	☐	If "Yes", were the checklists signed, dated and properly filed?
☐	☐	If "Yes", was the SharePoint log updated?
☐	☐	**Were Removable Media used on BES Cyber Systems? (reference TE-NERC-218)**
☐	☐	If "Yes", were the checklists signed, dated and properly filed?
☐	☐	If "Yes", was the SharePoint log updated?
☐	☐	**Were there any changes to the plant control system network or firewalls that may require an update to documentation?**
☐	☐	If "Yes", are the documentation updates complete? _____
		If "No", explain _____
☐	☐	**Are there any upcoming changes to the plant control system network that may require an update to documentation or firewall configuration (reference TE-NERC-217)?**
		If "Yes", what is the anticipated time frame for the change _____
		If "Yes", has the NERC Group or Talen IT been contacted (list contact) _____
☐	☐	**Were there any changes to the plant physical protection controls that may require and update to procedures or documentation (reference TE-NERC-309)?**
☐	☐	If "Yes", are the updates complete?
		If "No", explain _____
☐	☐	**Did you conduct the quarterly physical assessment and complete the documentation for this quarter? (reference TE-NERC-309)?**
		If "Yes", were there any deficiencies noted? _____
		If "No", when is it scheduled? _____

Name _____ Date _____

RNC Checklist

Talen Energy NERC RNC Monthly Checklist Menu Rev. 12, Effective for January 2020 reports

Plant:_____ **Month and Year Being Reported:** _____/_____

Instructions
-PERS
- **Form is to be printed out and filled out each month.**
- Include documentation for operational events/tests, and describe under "comments" at end of form.
- Send completed forms to the NERC Regional Contact (RNC) and NERC operational and support leads.
- Promptly notify NERC regional contact of compliance questions or concerns.

Plant	NCR#	TOP/BA/TP/RC	TO	Dispatch
Athens	07154	NYISO	Nat'l Grid	Nat'l Grid
Barney M Davis U1	04010	ERCOT (AEP is TOP)	AEP	QSE-Twin Eagle
Barney M Davis LP	04009	ERCOT (AEP is TOP)	AEP	QSE-Twin Eagle
Brandon Shores	11308	PJM	BGE	Tenaska
Brunner Island	11362	PJM	PPL	Tenaska
Camden	00838	PJM	PSEG	EDF
Colstrip	05329	Northwestern Corp (CAISO is RC)	Northwestern Corp	Northwestern Corp
Dartmouth	02922	ISO-NE	Eversource	ISO-NE
Laredo	04090	ERCOT (AEP is TOP)	AEP	QSE-Twin Eagle
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Pedricktown	00838	PJM	ACE	EDF
Susquehanna	00889	PJM	PPL	Tenaska
Wagner	11308	PJM	BGE	Tenaska

Yes No
New Personnel
☐ ☐ Were there any new personnel?
☐ ☐ If "Yes" above, was Monique Scott contacted to ensure new personnel are in LMS

Yes No N/A
Training Rosters
☐ ☐ Any changes to control room operators (CROs) or supervisors?
☐ ☐ ☐ If "Yes" above, training rosters for TNT001, 3, 5, 6, 7 and 8 revised before new personnel start dates?
☐ ☐ Any changes to personnel dealing with batteries or protective relays (including contractors)?
☐ ☐ ☐ If "Yes" above, training rosters for TNT010, 011, revised as appropriate?
NOTE: New personnel cannot operate units until trained in TNT001 & TNT003
Supervisors can operate units at non-bargaining unit plants (e.g. Raven), not just CROs

RNC Checklist (cont'd)

Yes **No**

Training

☐ ☐ Is all Training up to date per LMS requirements?
Comments:

BAL-001-TRE-1, Primary Frequency Response in the ERCOT Region. **Topaz plants only**

☐ ☐ Are there any actionable items required by the PNC, RNC or the Plant to complete?
Comments:

COM-001-3, Communications

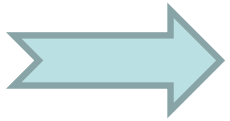
☐ ☐ Are there any actionable items required by the PNC, RNC or the Plant to complete?
Comments:

COM-002-4, Operating Personnel Communications Protocols

☐ ☐ Are there any actionable items required by the PNC, RNC or the Plant to complete?
Comments:

EOP-004-4, Event Reporting

☐ ☐ Are there any actionable items required by the PNC, RNC or the Plant to complete?
Comments:



FAC-008-3, Facility Ratings

☐ ☐ Are there any actionable items required by the PNC, RNC or the Plant to complete?
Comments:

IRO-001-4, Reliability Coordination – Responsibilities, and TOP-001-4, Transmission Operations

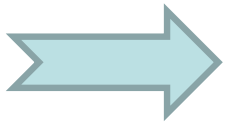
☐ ☐ Are there any actionable items required by the PNC, RNC or the Plant to complete?
Comments:

IRO-010-2, Reliability Coordinator Data Specification and Collection, and TOP-003-3, Operational Reliability Data

☐ ☐ Are there any actionable items required by the PNC, RNC or the Plant to complete?
Comments:

RNC Checklist (cont'd)

Yes	No	Cyber Security	
☐	☐		Are there any actionable items required by the PNC, RNC or the Plant to complete? Comments:



Name _____ Date _____

RNC Checklist Revisions

Rev. 9	06/13/19	Wording/formatting changed to support ease of use and to build in internal controls.
Rev. 13	02/06/2020	-Moved CIP Section to its own page and added line items relative to removable media & TCA. -Added CIP Procedure reference. -Line items reorganized per standard with appropriate R #'s added to line items. -N/A category removed. -Identified each Plant's TO/TOP/BA/RC/DP -Formatting changes

RNC Checklist

- **Revision 9 to Revision 13 illustrates that Checklist is maturing as we learn and define responsibilities and implementation**
  - Add notes for clarification
  - Remove information that is not required

Pyramid: Information & Communication

Information and Communication

➢ Communication

- **Biweekly**: NERC meetings with Operational and NERC teams

- **Monthly:** Checklist Review Meetings with NERC Senior Manager and RNCs
  - Important meeting to ensure information is effectively communicated from implementing teams to NERC management and throughout executive management, as needed
    - ❖ These small informal one-on-one discussions bring out open and honest dialogue on the state of the program…discussions are also a driver to a lot of positive program changes
  - Provides NERC training/mentoring opportunity for implementing team

- **Quarterly**: Senior Management NERC Committee Meetings (SMNC Meetings)

  Note: These meetings provide a common thread of communications from plant level to Senior Management level….consistent **messaging of Information** provides support for the internal controls

Information and Communication (cont'd)

- **Information**
  - Messaging information is a strong internal control
- **Talen Works hard to provide Information that is-------**
  - **Consistent:** the message at the Ops plant meeting is the same at the SMNC meeting
  - **Clear:** NERC jargon is intentionally minimized in meetings
    - *Example: "FAC-008 looks for the weakest link in the electrical system from the generator to the Point of Interconnection"*
  - **Repeatable:** Repeat the same message across the organization and actively following-up to insure understanding of the message. Take every opportunity to **repeat how internal controls** are incorporated into daily operations. Treat it as a campaign requiring long-term engagement.

Summary

- **FAC-008 Internal Controls**
  - Use the Pyramid as a guide…picture clarifies each member's position in program
  - Be **Active** with internal controls…things are always changing
  - Be **Clear** with internal controls messaging
  - Be **Consistent** with internal controls expectations
  - Most of all, make FAC-008 internal controls easy to implement for ops personnel

QUESTIONS