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NDSTF Purpose and Objectives

The Next-Day Study Task Force (NDSTF) was created to address specific items identified in the September 8th event report related to Next-day Studies. The focus of the NDSTF is not limited strictly to Next-day Studies. The scope of the NDSTF covers Near-term Studies, which may extend beyond the Next-day sub-horizon (i.e., hour-ahead studies, same-day studies, or studies performed beyond next-day).

The NDSTF objective is to improve all aspects of Near-term Studies, including, but not limited to – input data, study processes and quality, and communication and coordination of study results. The group will also address the WECC Mitigation efforts related to Next-day Studies established in response to the September 8th event.

The NDSTF approached its goal of improving Near-term Studies in the WECC footprint by focusing its efforts on the following work items:

- What Near-term Studies Need to Accomplish
- Key Input Data Used in Near-term Studies
- Performing the Near-term Studies
- Sharing and Coordination of Operating Plans

Each work item consisted of a face-to-face meeting in which task force members brainstormed and developed a series of papers. Some of the work items led to initiatives such as the development of the COS Outage Manual, the how-to guide that ultimately standardizes outage submittals in the WECC footprint. There were several other items identified in this white paper that may lead to future data-request changes by the Reliability Coordinator. It is envisioned that the NDSTF would potentially continue its efforts as the Next-day Study Work Group (NDSWG) to serve as a forum for discussion and continuous improvement of all aspects related to Near-term Studies.

What Near-term Studies Need to Accomplish

Scope of Near-term Studies

The NDSTF has narrowed its focus to both the Next-day and Same-day Study sub-horizons, which in combination will be referred to as Near-term Studies throughout this and the other white papers produced by the NDSTF. Near-term Studies are a collective subset of studies performed in the Operations Horizon. Peak Reliability’s Reliability Coordinator (RC) System Operating Limits (SOL) Methodology defines the Operations Horizon as a rolling 12-month period starting at Real-time (now) through the last hour of the twelfth month into the future. The Operations Horizon is subdivided into sub-horizons that include those in Figure 1 below.
Near-term Studies

Figure 1: Definition of Operations Horizon

Other sub-horizons defined in the Operations Horizon are outside the scope of the NDSTF:

- Seasonal studies are typically looking at timeframes much further out than Near-term Studies and generally make limited use of forecast data. Forecast data consists of topology, load and generation changes. The guidelines for performing Seasonal studies have already been established by the RC; therefore, this set of studies will not be considered by the NDSTF.

- Outage Planning is also not being considered by the NDSTF due to that subject being the primary focus of Outage Coordination, which is a much broader topic requiring its own effort.

- Real-time Studies use Real-time information and are intended to study Real-time system conditions.

Although the transition between Near-term Studies and Outage Planning is listed above as 45 days, the specific point at which an Outage Planning Study becomes a Near-term Study is not always distinct. Prior to entering the near-term horizon, there is an expectation that all outages have been evaluated in the Outage Planning horizon and that all applicable operational or mitigation plans have already been developed. Outside of urgent or emergent outage situations, outages being studied in the near-term horizon are generally being reviewed for at least a second time.

**Fundamental Objectives of Near-term Studies**

The fundamental objective of performing studies in the Operations Horizon is to ensure system operators are prepared for Real-time. When studies are first performed in the Operations Horizon (i.e., Seasonal and Outage Planning sub-horizons), the initial input data may not be as accurate due to forecast data quality. As Real-time approaches, forecast data ideally becomes more accurate, resulting in a more realistic representation of expected Real-time system conditions. Performing studies in the Operations Horizon is an iterative process in which changes in system conditions (e.g., forced outages, scheduling of urgent or emergent outages, changes in load forecast) may require the study to be
repeated with updated information. It is the responsibility of every entity to determine when another iteration of the Near-term Study is necessary.

Near-term Studies serve as a final assessment, prior to Real-time, to determine whether changes from initial assumptions result in unexpected reliability issues. This analysis could lead to a refinement of generation requirements, pre-outage configuration (including Remedial Action Scheme/Special Protection System (RAS/SPS) arming) or improvements to operational or mitigation plans. Some objectives to consider during Near-term Studies include:

- Validate existing operational or mitigation plans
- Assess whether added outages (planned and/or forced) conflict with the previously studied topology
- Review and refine previously established generation requirements
- Determine whether changes in the load forecast result in newly identified reliability issues

Ideally, operational or mitigation plans needed to ensure acceptable system performance would have been established prior to the Near-term Study phase; however, new operational or mitigation plans can also be developed in the Near-term Study phase. Those new plans would typically be driven by a late change in forecast data.

Types of Studies that can be performed

There are a variety of studies that can be performed to assess system reliability in both the pre- and post-contingency state. The type, extent, and frequency at which an entity performs those studies need to be evaluated and determined by that entity. The NDSTF will identify a compilation of studies that can be performed as a part of the Near-term Study, but it will be up to that entity to determine what studies, if any, are necessary for their analysis.

The following are examples of studies that can be performed in the near-term horizon:

- Steady state analysis (N)
- Steady state contingency analysis – N-1, N-1-1, credible multiple facility contingencies
- Multiple time point studies – study peak hour, off-peak, peak outage, morning ramp up, etc.
- Voltage stability studies – system voltage collapse, reactive margin, etc.
- Transient stability studies – fault simulations, rotor angle stability, damping, etc.
- Transfer analysis – voltage stability, thermal and system voltage limitations
- Sensitivity analysis – additional system stressing (i.e., directional or load adjustments)
-Geomagnetic Disturbance (GMD) Analysis
Generally, only a few of the above studies are needed in the Near-term study horizon with steady state analysis (N, N-1) being the most used. This topic will be more thoroughly discussed and examined in the section, “Performing the Near-term Studies.”

**Potential Near-term Study Barriers**

Barriers exist today that prevent entities from performing accurate Near-term Studies. These barriers can include items both inside and outside the control of the entity responsible for the Near-term Study. These barriers will be considered when the NDSTF gets more in depth on topics involving input data, performing studies and coordinating study results and operational plans, to make sure that they are being addressed.

Some identified barriers include:

- Resources (personnel, financial, time, etc.)
- Experience with performing and analyzing specialized studies
- Lack of awareness of high-impact outages on neighbors
- Access to accurate forecast data
- Dynamic nature of forecast data
- Timely availability of forecast data
- Inadequate internal processes to use forecast data
- Model inconsistencies and inaccuracies
- Inconsistent contingency lists among entities
- Inadequate RAS/SPS modeling
- Variation of study tools and processes
- Inconsistent study results reporting

**Desired End State as Related to Near-term Study Process**

A thorough Near-term Study process should be flexible enough to account for various types of last-minute changes in forecasted system conditions. Data sharing methods and mechanisms must be in place to provide all the necessary inputs in a timely manner for the Near-term Study. The data being shared must also be in a standardized and usable format to ensure it is accurately implemented while also supporting the automation of study processes where deemed necessary.

There would also be an ongoing effort to ensure best practices are being employed by both the Transmission Operators and RCs. Awareness of such best practices will be presented and shared in this
forum, such as a work group, with the intent of creating awareness of the most recent Near-term Study processes. This forum will also manage and report on various Near-term Study metrics to drive continuous improvement in the quality and effectiveness of the study. This forum will serve as a platform to ask questions and solicit feedback for all issues pertaining to Near-term Studies.

**Types of Input Data to the Near-term Study Process**

Input data is arguably the most important part in improving Near-term Studies. Using inaccurate or insufficient input data when performing a Near-term Study may invalidate the results of the study. The most serious consequence of inaccurate or insufficient input data is for a reliability issue to go undetected during the Near-term Study phase and then appear in Real-time where system operators may not have enough time to prepare an adequate operating plan. The size and complexity of each entity’s respective system(s) will determine what and how much input data they will need to perform an accurate study. It is the responsibility of every entity to determine what set of input data is necessary to perform an accurate Near-term Study.

Input data to the Near-term Study process can be divided into two key categories, static and variable input data. Examples of static input data are those used to support the network model (e.g., branch impedances, transformer data, load types, etc.), station one-line diagrams, and system overview maps. Static input data rarely changes during the Near-term Study timeframe and is generally addressed and maintained prior to entering this sub-horizon. The other category is variable input data. Examples of variable input data include topology, system load, unit commitment, interchange, dynamic ratings, spinning reserve and Remedial Action Scheme/Special Protection Schemes (RAS/SPS) status. The key characteristic of variable input data is that they can generally change throughout the Near-term Study sub-horizon. It is very important that the appropriate data sharing mechanisms are in place to support the retrieval of the most current set of variable input data.

The complete list of both static and variable input data to the Near-term Study process is both lengthy and complex. The NDSTF has narrowed its focus for improving Near-term Studies to four key variable input data categories:

- Topology
- Load Forecast
- Generator Unit Commitment
- Interchange

This section of the white paper will discuss in detail what each data set represents, best practices of using this data, the data sharing mechanisms in place, and steps the NDSTF is taking to ensure its improvement.
Four Key Variable Input Data Types

The objective of this section is to describe in detail what each of the four variable input data categories are and what they should consist of. Best practices and other nuances of interpreting this data will also be explained with the goal of better use of this data for the Near-term Study. The Near-term Study process is an iterative process. As Real-time approaches, input data may become more accurate and should be used when available and appropriate. It is up to every entity to determine when another iteration of their Near-term Study needs to be executed.

Topology

This is the most fundamental set of variable input data used in the Near-term Study. Topology data primarily consists of planned and/or forced equipment outages. Some planned outages may require switching external to the equipment being outaged, such as an adjacent breaker or line, to prevent both pre- and post-contingency system issues. Topology data may also consist of equipment status changes due to power system conditions (e.g., opening of lines for voltage control). To perform an accurate Near-term Study, the entity must be aware of the current and forecasted system topology, per the BES definition, which may include sub 100 kV elements.

The universal source of topology data in the Western Interconnection is the Coordinated Outage System (COS) software tool, also known as the Control Room Operator Window (CROW). The RC Data Request (IRO-010) requires all entities that fall under the RC purview to submit outage data per its instructions. In early discussions of the input data topic, the NDSTF raised concerns regarding the accuracy of the topology data contained in COS. Efforts towards data standardization could directly result in an immediate improvement to the Near-term Study process.

The current version of the RC Data Request requires entities to simply submit outage data. It does not go into detail as to how each entry needs to be submitted, e.g., identify which switches are to remain open during a particular line outage. This has resulted in an inconsistent submission of element outages which leaves the individual performing the study left to make assumptions. The NDSTF decided to address the problem of correcting the inconsistent outage data submission issue by developing a how-to guide when submitting outages. This guide essentially requires every entity, subject to the RC Data Request, to begin submitting outage data down to the switching point level, i.e., circuit breakers and disconnect switches. The benefit of this approach is that it greatly reduces the interpretation generally required to properly model an outage in a Near-term Study. The guide also introduces the term Outage End-State which is defined as the moment when all switching has been completed and work now is ready to begin on that piece of equipment. The Outage End-State represents the state a particular outage spends the majority of its time in and is what every impacted entity should include when setting up their Near-term Study case. There may be some exceptions, as
determined by the entity, where the entire switching sequence needs to be studied to assess its impact (e.g., abnormally long switching times, numerous elements out potentially resulting in system issues).

The name given to the how-to guide for these specific outage instructions is called the COS Outage Manual. This is included as an exhibit to this white paper. The COS Outage Manual will eventually be integrated into the COS User Guide where an RC Data Request change will point to that section, requiring all entities to submit outage data in that format.

**Load Forecast Data**

Load forecast data is the prediction of system load in megawatts for a particular footprint. This data is typically produced by the Balancing Authority (BA) for the BA system footprint. To properly use the data, it is important to understand the boundaries, the forecast calculation and how the value is applied in the study case.

The most common approach in calculating Real-time system load is for the BA to sum the net interchange and generation in the Balancing Area. This approach accounts for two key parameters, all load buses within the BA boundary and the system losses associated with moving energy across that system. One assumption the NDSTF is making is that the load forecast value accounts for the same area, tie-lines and generators as the Real-time system load value. In other words, the BA load definition for the two values (forecasted and Real-time) has to be the same or a correction factor will have to be applied to the forecasted value used in the Near-term Study.

This section describes how to apply the load forecast to the Near-term Study case. Most study tools (EMS, off-line, etc.) provide a summary of load on an area or zonal basis. This summary is typically a summation of all the pre-identified load buses associated with a particular BA Area. This approach does not typically account for the system losses associated with moving energy across the Balancing Area. Therefore, to properly apply the forecasted system load value to the study case, the load and loss factors have to be accounted for in determining an appropriate correction factor for the forecasted load value. A direct comparison can also be made using the Real-time load value against a study using Real-time data of the same timestamp to determine if a correction factor is needed when applying the load forecast. Some analysis will need to be done to determine whether the difference is due to system losses, incorrect boundaries, meter error, etc.

For increased Near-term Study accuracy, entities should use smaller subregional load forecast values when the data is available. Load forecast values are typically given for an entire BA Area; however, the load forecast values may be broken into smaller areas in some cases; i.e., a TOP footprint. There are many reasons why this is desired, such as appropriate scaling of a large load areas (i.e., conforming vs. non-conforming load types), temperature variances across a geographically diverse region. To use smaller subregional forecast values in the Near-term Study, the entity must ensure the subregional boundaries are accounted for in the study case and that all applicable correction factors have been
identified. The entity should also ensure the forecast is available at an appropriate interval and that a Real-time subregional load value is being calculated.

**Generator Unit Forecast**

Generator unit forecast data is broken down into two primary categories; Generation Unit Commitment and Generator Unit Dispatch. Generator Unit Commitment data is used to indicate whether or not a generating unit or facility has been committed to generate. Generator Unit Dispatch is the forecasted MW output a generating unit or facility is predicted to run at. This data is typically provided by the BA and/or the Generator Operator (GOP) in the footprint the generating facility resides in. Generator unit commitment data includes generators of all fuel types including variable generation, e.g., wind and solar, whose forecasted megawatt output is highly dependent on a weather forecast.

One of the issues in using generator unit forecast data is its availability and accuracy. Typically this data is not available until very late in the day prior to the study date, which forces the individual performing the study to make assumptions. Since the first iteration of the Near-term Study is typically done several days in advance, the most common practice is to set the initial generation unit commitment and dispatch to a similar load and day type. This can work in most instances, but in others this practice may result in both false and/or undetected violations in the study results. It is important that all known planned generating facility outages are accounted for along with those facilities returning to service. That data should be entered into COS and is typically accounted for when applying topology changes. The third white paper will discuss more study techniques as to how generator unit dispatch can be set for the Near-term Study.

**Net Interchange Schedule**

Net Interchange Schedule is the algebraic sum of all Interchange Schedules with each Adjacent Balancing Authority. For the Near-term Study, the net interchange value that is needed is the summation of all scheduled power flow across the BA Area’s tie lines. If there is more load than generation, then the interchange value is negative as the BA Area is deficient and will need to purchase energy to serve its load. Likewise when there is more generation dispatched than internal load to serve, then the excess (positive interchange) leaves the BA Area and flows external across its tie lines. Interchange data is typically provided by the BA at its metered boundaries on the tie lines.

Interchange values have to be provided on BA-Area basis. This data is typically processed in a Near-term Study by uniformly ramping up or down all generation identified in a BA Area. If generators are not defined correctly or appropriately, then a mismatch may occur resulting in an incorrect application of the data. In addition, generator operating zones are important in determining a unit’s participation: where interchange capacity on Paths may exist, operating limits of generation may limit further use of
interchange capacities in real time. Interchange can either serve as a check against generation dispatch, or serve a key operating value when there is limited dispatch information.

TOPs should consider the reasonability of stressing the interchange value in their Near-term Study, given limits on capacity of generation to operate to those limits. The accuracy of forecast Interchange can qualify the study limits a BA poses. The relationship between Interchange, unit commitment, and forecast generation dispatch can significantly impact the approach to studies. While load confidence may be high, the projected generation and interchange may be driven by market volatility and fuel availability. A TOP must consider the behavior of generators and confidence in interchange, to best choose the projected operating point:

- Where a TOP has a high level of confidence in the projected interchange, with unit commitment, interchange can drive the expected operating point for the study. Using known or expected generation operations (based on market history, recent behavior, etc.), a BA may choose interchange as a reasonable starting point from which appropriate deviation of generation or stressing can be assessed.

- Where a BA has a high level of confidence in the Unit Dispatch, Interchange can be used as a check for reasonability of the operating point.

While unit commitment provides availability and expectation of some level of use in real time, taken together with forecast interchange and known generation operating limitations, a BA can assess reasonable generation dispatch for the study. Where dispatch is available, a greater confidence in Interchange can be assigned.

The use of the WECC Interchange Tool (WIT) interchange scheduling data may provide a common frame for use of Interchange forecast data as it provides the known energy schedule nets at a common point in time. All BAs submit interchange into WIT, however not all entities extract data from WIT as a source of Interchange data for Near-term Studies. WIT was initially decided to coordinate hourly interchange but with the onset of intra-hour scheduling (e.g., 5/15 minute) the tool is updated more routinely during the hour can provide an accurate interchange value for entities to include as part of the iterative study approach and incorporating the most recent data.

While some BAs may have forecast interchange information made available but not yet tagged, it is not available to all transmission participants. However, the use of this data will be helpful in determining the likely operating point. A future improvement could be to include such data when it becomes available to reduce uncertainty in the Interchange.

**Data Sharing Mechanisms and Timing Requirements**

Variable input data is expected to change throughout the Near-term Study horizon. The updating of variable input data may prompt another iteration of the Near-term Study. To do so in a timely manner,
the entity will need to ensure 1) a sharing mechanism is in place to facilitate frequent updates and 2) the data is in a usable format where it can be quickly used in the Near-term Study.

Depending on the data being forecasted, the entity will have to determine which data sharing mechanisms are most appropriate for incorporation of the data into the Near-term Study. Model mapping and some automation processes may need to exist to allow for the data to be used in a timely manner. Ultimately the goal is to have the appropriate mechanisms in place to facilitate as many iterations of the Near-term Study as deemed necessary by the entity.

Topology

Timing of submittal of outages is critical to ensure adequate time to perform studies. Entities should follow the COS Outage Manual that is included as an exhibit to this Guideline and Peak RC data specifications when submitting outages. Entities are able to enter outage data into COS via the web interface or through the Application Programming Interface (API). One of the primary reasons for running another iteration of the Near-term Study is to account for any forced or unplanned outages that were not a part of the first Near-term Study iteration. Entities will need to update COS, per Peak RC data request specifications, when forced or non-planned outages occur.

As mentioned earlier in this white paper, the NDSTF began standardizing the COS database so entities could have a clearer understanding of how to model the outaged element along with any additional system reconfiguration required to facilitate the outage. Another key benefit that is realized by standardizing COS is the ability for each entity to create an outage file, potentially a .csv, that would include their footprint and as many neighboring entities as needed for their Near-term Study. This file could be used manually or allow the entity an opportunity to create an automated application for Topology updates to their individual study models.

In addition to accounting for internal transmission/generation outages, entities should also coordinate with neighboring TOPs for consideration of external transmission/generation outages that may have impact. Entities (BA, TOP) should consider participating in a daily morning conference calls with BAs, RC, & neighboring TOPs to review and coordinate transmission/generator outages. There are also weekly Outage Forums with BAs and neighboring TOPs that are available as well for exchanging and coordinating near-term and longer term outages. These calls not only discuss planned outages but also discuss any issues related to voltage control equipment and other system abnormalities that could impact Next-day Studies.

Load Forecast Data

Load Forecast Data is typically submitted for a BA footprint. As mentioned in the previous section, it is desirable to have load forecast data available in smaller subregions, e.g., down to the TOP level within a BA. This will allow for more accurate modeling of certain load pockets that exist in a particular area. A future improvement to the availability of load forecast data would be the creation of a central
database similar to COS. This central database would house all load forecast data for the entities in the RC footprint and would allow both the submission and extraction of this data. It would be up to the entities to determine if they would leverage this database for automation purposes. This is one of many areas the proposed NDSWG could be tasked to evaluate and develop possible recommendations.

The scenario when data is not received are fairly easy to identify, however if the data being submitted is inaccurate then that can be more difficult to determine. Some type of data benchmarking needs to be established to determine when these instances occur. For example, an entity may have established some reasonability limits based on some historically observed Real-time values of the input data. Entities may determine what an appropriate high and low load forecast values are on a seasonal basis and screen the received forecast value through a reasonability test. If the data ends up falling outside of those bounds, then a replacement value will have to be used. Determining the replacement value may require using some historical data and substituting a reasonable value in its place.

For accurate Near-term Studies, the frequency at which load forecast data is updated will need to be determined and implemented. Next-day Studies could be improved by allowing for more periodic updates prior to running final study. The typical practice for BAs submitting this data has been to update is every hour. This practice is most appropriate when dealing with same-day studies, i.e., within 24 hours of Real-time. Hourly updates may not be necessary or provide value when the entity is greater than 24 hours away from Real-time. Therefore it is necessary for every entity to specify the format of the data such as hourly intervals and how often they would need that hourly data refreshed.

**Generator Unit Forecast**

Generator Unit Commitment and Dispatch data is either provided by the BA or GOP. This data may be submitted on either an individual- or aggregated-facility level as determined by RC data specifications. Due to the nature of its availability, generator data is typically available in its most accurate form late in the afternoon prior to Real-time. As with load forecast data, once within the same-day study timeframe the generator unit data may be available on an hourly basis. This becomes more important when determining where to dispatch variable generation resources such as wind or solar.

As with the previous sections, the existence of a central database similar to COS would also be desirable for this input data. It would allow for both the submission and extraction of this data and give the entities the ability to leverage it for automation purposes. As noted above, this is one of many areas the proposed NDSWG could be tasked to evaluate and develop possible recommendations.

Generator unit commitment data like interchange and load forecast is typically submitted once per day and generally early into the planning day (10:00 a.m.) Next-day Studies could be improved by allowing for more periodic updates prior to running final study. When determining unit commitment data, entities should review generator maintenance activity and expected schedule transmission outages.
that might impact generating facilities. Additionally, entities may want to consider fuel supply impacts when determining unit commitment and the impact fuel curtailments or interruptions could have.

Net Interchange

Net Interchange data is dependent on Load and Generator Unit Forecast data. Due to this relationship, this data needs to be updated and shared at the same frequency. Depending on the entity's study method, net interchange data can function as a validation for an accurate load forecast and generation dispatch balance. Due to its reliance on generator unit forecast data, this input data set is also not typically accurate until the afternoon prior to Real-time. However, once within the same-day study timeframe this data should be analyzed and the need to run another iteration of the Near-term Study should be evaluated accordingly.

As with generator unit commitment data, interchange data is typically more accurate the closer you get to Real-time. Since the generator unit commitment data typically does not get finalized until late afternoon of the prior business day, the entity will have to determine which data sharing mechanisms are most appropriate for incorporation of the data into the Near-term Study. Depending on the size of the system being studied, model mapping and some automation processes may need to exist to allow for the data to be used in a timely manner.

For WECC BAs, the WIT is the central database and source for coordinated hourly and historical interchange between all WECC BAs. It allows for both the submission and extraction of this data and provides the entities the ability to leverage it for automation purposes. Interchange data is typically submitted once per day and generally early into the planning day (10:00 a.m.) Next-day Studies could be improved by allowing for more periodic updates prior to running final study. BAs should use the WIT to obtain Interchange Data. TOPs who are not BAs will need a process with their host BA to obtain hourly interchange values.

Data Quality and Validation

The adequacy of Near-term Studies depends on how extensively and accurately facilities and system conditions are incorporated into the models used for the studies. To perform an accurate Near-term study, having accurate input data is of the upmost importance. As a starting point the entity may want to perform some initial benchmarking of the input data against the actual observed value. A common, sometimes undetected, issue in receiving variable input data is the accuracy of the data. The following are possible processes to consider for checking Near-term Studies for accuracy and ensuring accurate data:

- Validate projected load, interchange, and generation values with actual values
- Use the previous-day (i.e., similar-day) peak load estimation to validate projected load
Perform a load forecast validation by comparing the sum of hourly interchange + unit commitment to hourly load forecast values.

• Check pre-contingency flows in study case against current SCADA flows

• Check pre-contingency flows in study case against trended historical flows

• Compare study results to the Peak RC Operations Planning Analyses

• Compare study results with neighboring systems

• Have studies reviewed by other internal organizations/staff members

• Use state estimation data to validate study results

• Evaluate and bench-mark study results the day after

• Use COS to plan for scheduled outages

Benchmarking and developing a data validation process around the variable input data may eventually result in an improvement of the overall study. The NDSTF understands the importance of establishing benchmarks around input data and its relationship to the accuracy of the Near-term Study.

Performing the Near-term Studies

Now that all of the input data is collected and deemed acceptable, it will need to be applied in the form of study. There are many types of studies that can be performed in the Near-term Study horizon. It is up to each entity to evaluate what studies are most appropriate for their respective systems to ensure acceptable system performance is met under both pre- and post-contingency conditions. The following are examples of the most common types of studies that may be performed in the Near-term Study horizon:

• Steady state analysis (Normal (N) or pre-contingency)

• Steady state contingency analysis – N-1, N-1-1, credible multiple facility contingencies

• Multiple time-point studies – study peak hour, off-peak, peak outage, morning ramp up, etc.

• Voltage stability studies – system voltage collapse, reactive margin, etc.

• Transient stability studies – fault simulations, rotor angle stability, damping, etc.

• Transfer analysis – voltage stability, thermal and system voltage limitations

• Sensitivity analysis – additional system stressing (i.e., directional or load adjustments)

As was done with the second white paper, the NDSTF will narrow its focus down to just steady state analysis (N, N-1, credible N-2). Steady state analysis is the most common type of study run in the near-
term horizon and it can be performed using an on-line tool such as a bus breaker EMS model or an off-line tool using a bus branch configuration (such as PSLF).

**Setting Up the Near-Term Study Case**

Another important piece of input data into the Near-term Study process is the base case. A base case is the unadjusted case that is to be used for the Near-term Study prior to applying the input data. There are different approaches, based on the tools being used for the study, in selecting the most appropriate base case for the Near-term Study. For those using an EMS, a State Estimator (SE) snapshot is one of the most common choices in choosing a base case. A good practice in selecting a good SE snapshot is to use the most recent case that best presents the expected system conditions. For example, if the forecasted temperature is expected to remain the same as yesterday and it is a similar day type (i.e., weekday, weekend, holiday, etc.) then that case should be used. SE snapshots can also be exported for use in off-line tools such as PSLF. For those using an off-line tool, another common choice for a base case is to use the most recent seasonal planning case. Either approach can produce accurate results as long as all of the expected system conditions are accounted for and applied correctly.

For off-line studies using a bus branch system configuration; i.e., no breakers or switches, special consideration must be made regarding the contingency files when accounting for breaker and switch topology changes. For example, in the case of a typical breaker and a half station (a row with three breakers and two lines) when a breaker at either end is removed from service then the next single contingency (N-1) will result in the loss of two elements. Not only does the topology have to be modeled and accounted for in the study case, but the contingency list will also have to be updated to accurately reflect single-contingency system conditions.

**Applying Load Forecast**

The next several sections are in regard to applying the input data. The starting point in applying load forecast data to the Near-term Study case is to first ensure that all differences are accounted for. For example, if the load being predicted is on a BA basis, but the model is only for a TOP, then a correction factor will need to be applied for the study to properly use the data. A correction factor may also be needed if some load buses or generators are not accounted for in either the study model or forecasted value. There are some techniques described in the previous white paper that can help determine how an appropriate correction factor is calculated.

An alternative approach in applying load forecast data involves a combination of an off-line case (planning, exported EMS snapshot, etc.) and historical Plant Information (PI) data. This approach begins with the entity determining the load forecast to be used in the study. From there, the entity will query PI to find the closest and most recent timestamp matching the forecasted load value being studied. It is up to the entity to determine how much data it wants to use from that time stamp and how to account
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for data errors. A best practice of this application involves the mapping of load buses between PI and the study model, then overwriting the base case values with the ones stored in PI. The entity will need to have some sort of error handling to account for erroneous or missing load data.

After the load forecast has been initialized, some systems may choose to scale the load an additional percentage (e.g., 105 percent scaling) to simulate a worst-case scenario. The amount and necessity of doing this will need to be evaluated by the entity as along with scaling load, other inputs such as generator and interchange data may also need to be scaled, which could result in false reliability issues.

Applying Generator and Interchange Forecast Data

As discussed in the previous white paper, generator and interchange data is typically either inaccurate or unavailable during the first iteration of the Near-term Study. For those using an EMS, a common practice in setting up a generator dispatch is to simply use a similar load and day type. After the load and generator data is set, the resulting value is considered the study interchange. This technique can work in most instances provided there are not any outages limiting the output of the generators or the power transfer across an interface. Others using an off-line case that is not from an EMS may choose to use PI data in setting up the initial dispatch. PI data can indicate which units are base-loaded, peaking units, variable generation, etc., and can help initialize a more reasonable Near-term Study dispatch.

Depending on the size of the entity and the number of generators involved, a study technique may involve doing several iterations of the Near-term Study looking at the impact of maximum and minimum generator output and/or interchange across a BA-to-BA interface. This can also be a necessary study technique when considering variable generation such as wind and solar.

Steady State Study Criteria

The Peak Reliability Coordinator’s SOL Methodology describes in detail what study case parameters need to be monitored to demonstrate acceptable system performance. The NDSTF is deferring to that document as the guiding principal as to what the Near-term Study is supposed to be evaluated against. The purpose of this section is to discuss at a high level what study criteria need to be evaluated after the study results are calculated. Steady state analysis study results typically make entities aware of the following four categories in the pre- and post-contingency state:

- Thermal Exceedances (aka Branch Overloads)
- Steady State Bus Voltage Limit Exceedances
- Invalid Solutions:
  - Entire Base case – Pre-contingency
  - Individual Contingency (ies) – Post-contingency
• Islanding Conditions

Study results from every Near-term Study iteration must be evaluated for the existence of any SOL exceedances, invalid solutions and islanding system conditions.

**Study Result Validation**

After the Near-term Study is performed and the results have been tabulated, the next step is to validate those study results. This is an important step in that it potentially reduces the amount of unnecessary communication between entities due to false system reliability issues. The most important idea in study results validation is that it serves as another round of checking the quality and application of the input data into the Near-term Study case.

A common starting point in validating a study result is to identify the root cause of the issue. The root cause of a study issue – in the example of a post-contingency overload – may be either a new planned outage, an existing outage that is returning to service, a change in the forecasted system load, etc. In most situations, the root cause is typically due to a new planned outage. When validating a study results issue, one of the first steps is to verify that the outage is applied correctly. Examples of verifying the correct planned outage application may include:

- Verifying the status of disconnects and/or circuit breakers used to isolate the outaged equipment.
- Properly accounting for all other system topology changes required to facilitate the outage. This can either be at the station of the outaged equipment or at some nearby location.
- All generation requirements for the planned outage have been accounted for.

Another technique in validating study results is to compare the study case data to either the Real-time or historically telemetered data. This step essentially serves as a sanity check to ensure the data being used is reasonable. Other internal validation techniques may involve viewing the posted study results from the impacted entities on the PeakRC.org site. These are just a few examples of how an entity may choose to validate study result issues internally. Every entity should strive to perform as much internal validation as possible prior to reaching out externally. When an entity is ready to reach out externally, some of the same internal validation steps may need to be revisited.

When all impacted entities have performed their analysis and validated their study results, there may be cases in which there are still disagreements. In those cases, the conservative approach is to operate to the most limiting study results regardless of how many entities are in agreement with that result. Depending on how far in advance the study is performed, the entities should work on resolving the discrepancy in study results. There could be many explanations for the discrepancy such as inaccurate study assumptions, modeling gaps, or incorrect ratings. It is desired, but not always possible to identify
the discrepancies in advance of Real-time. If time does not allow the issue to be resolved, then again the conservative approach will be to operate to the most limiting study result.

Sharing and Coordination of Operating Plans

After study results have been validated and the most limiting conditions identified, one of the last steps is ensure all Operating Plans, where applicable, are in place to address anticipated system issues. The most immediate impact the NDSTF could make in the area of sharing and coordinating study results, was to establish an Interconnection-wide Outage Operating Memo template. The purpose of the memo is to create awareness and ensure coordination on system issues due to planned outages among the impacted entities. The memos are primarily intended for more significant system issues and are intended to be created where no pre-defined operating procedures/plans exist to sufficiently address the reliability issue. One of the challenges the NDSTF had was to define what a significant system issue was. The group leaned on both the RC’s SOL Methodology and general feedback from the group in developing the Outage Operating Memo Guidelines document, which is intended to describe when a memo is needed.

The Outage Operating Memo Guidelines document states four essential scenarios that are used to indicate when the creation of an Outage Operating Memo is necessary. As previously stated, an Outage Operating Memo is not needed if a pre-defined operating plan/procedure exists that sufficiently addresses the reliability issue and is shared with all impacted entities. For the scenarios in which those plans/procedures do not exist or the pre-defined plans/procedures do not completely address the reliability issue, an assessment is needed to determine the necessity of an Outage Operating Memo. Below are the four scenarios listed in the guidelines document:

1. **Two or more impacted entities (excluding RC)** – This category addresses the coordination concern in that two or more impacted entities understand their roles and responsibilities when planning for an outage.

2. **Potential IROL conditions** – When a planned outage is expected to result in a potential IROL condition. See the Peak Reliability SOL Methodology for qualifying conditions.

3. **Emergency outage conditions** – This category is intended to describe the scenario when a planned outage has to be taken under emergency system conditions; i.e., safety or system reliability risk is imminent. This is a scenario where no pre-existing procedures can adequately address the reliability issue due to requirements above and beyond what is typically needed to mitigate the system issue.

4. **Whenever the need arises** – If an outage impact does not fall into any of the above categories, but an entity feels more comfortable meeting the needs of reliability, then it can at any point develop an Outage Operating Memo.
It is ultimately the responsibility of the entity submitting the outage to COS to initiate the creation of an Outage Operating Memo. The outage submitting entity may delegate the Outage Operating Memo creation to another entity provided the entity being delegated the responsibility to agrees to do so. The majority of the information being reported on the Outage Operating Memo will need to be filled out as much as possible. When the draft is completed, then next steps should involve sharing that version with other, if any, impacted TOPs and the RC. Another round of edits will be necessary until all parties are in agreement with the expectations stated in the memo. A final version will then need to be distributed via email to all of the impacted entities and posted to a location (TBD) on PeakRC.org prior to the start of the outage.
Disclaimer

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Exhibit 1: Coordinated Outage System (COS) Outage Manual

The purpose of the COS Outage Manual is to establish the requirements as to how outages should be entered into COS using switching points. The outage manual will ensure consistency in the outage submittal process along with providing a clearer understanding of the system topology during the outage. This manual has included several examples of the most common outage scenarios experienced on this system. The intent of the manual is not to list all outage scenarios, but to provide a subset that will give the user a better idea as to what’s being requested when creating an outage event in COS.

Switching Points

A switching point is a device on the system used to switch elements in- and out-of-service to facilitate an outage. For the purpose of COS, a switching point will either be a circuit breaker or disconnect switch. Switching points can be used to both isolate and energize elements from the system (please see bypassing circuit breaker example). To most accurately represent the outage event in COS, every entity will have to submit all switching points and its outage status (i.e., open or closed) for all outage events in COS. Switching points can also be located outside of the station or area where the outage is being taken. Those switching points will also need to be submitted as a part of the outage they are being switched for.

To illustrate the scenario where a switching point may occur at a location several stations away, the following example has been included. Consider an outage occurring on a line from Station A to Station B, such as in Figure 1 below. Based on previous experience, this outage is known to cause loading issues on an adjacent line in the area (Station A to Station C). The entity has chosen to mitigate the loading issue by opening Circuit Breaker 1 at Station D prior to the outage beginning. When the entity submits the line outage from Station A to Station B, in addition to the switching points at Station A (CB 3) and Station B (CB 2) the entity should also include the switching point at Station D (CB 1).
Outage End State

All outages entered into COS should reflect the Outage End State which is the state that immediately follows switching, i.e., when work is ready to begin on the element being outaged. The outage end state should be represented by submitting all applicable switching points as described in the previous section.

Proper COS Element Selection

Prior to entering an outage into COS, the user shall determine what impact the outage will have on network power flow. For instance, an outage on a circuit breaker may also open end a transmission circuit. In that case the outage should be submitted as a transmission circuit outage and not a circuit breaker. If the circuit breaker being outaged is not expected to interrupt power flow on an element such as a circuit, transformer, generator, etc. and is only resulting in a topology change, then it should be submitted as a circuit breaker outage. Below are the major equipment types and some general rules to follow, if applicable, when entering an outage into COS.

- **Transmission Circuit** – Evaluate whether a transmission segment (breaker-to-disconnect or disconnect-to-disconnect) or transmission line (breaker-to-breaker) is being outaged. Please refer to the transmission circuit outage examples for further clarification.

- **Transformers** – N/A.
- **Circuit Breakers (CB) / Disconnects (DSC)** – Evaluate if the outage of the CB/DSC results in an interruption of power flow. If it does, then the element whose power flow is being interrupted is what should be entered into COS.

- **Buses** – N/A

- **Generators**\(^1\) – Evaluate whether the outage or derate of an individual unit is 50 MW or greater or a facility outage where the aggregate is 50 MW or greater.

- **Series Compensation (capacitors, reactors, etc.)** – Evaluate if the outage of the series compensation device will result in an interruption of power flow (e.g., open ending a transmission circuit). If it does, then the element whose power flow is being interrupted is what should be entered into COS (e.g., transmission circuit and not the series compensation element). Otherwise just the series compensation element should be entered.

- **Shunt Compensation (capacitors, reactors, etc.)** – Evaluate if the outage of the shunt compensation device will result in an interruption of power flow (e.g., opening a transformer). If it does, then the element whose power flow is being interrupted is what should be entered into COS (e.g., transformer and not the shunt compensation element). Otherwise just the shunt compensation element should be entered.

- **Remedial Action Scheme (RAS)** – RAS should only be entered into COS if the entire scheme is out of service.

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\(^1\) For generating facility outages consisting of 2 or more units where one unit is 50 MW or greater and the other less than 50 MW, just the individual unit which is 50 MW or greater should be reported. A wind generating facility is an example when a generator outage should be reported as an aggregate due to the small individual turbine sizes, typically less than 5 MW individually.
Examples on how to Properly Entering Outages

The following section describes how to properly submit an outage (scheduled and forced) in COS by use of switching points by equipment type. While several outage examples are listed here, it is important to note the goal of this section is not to describe every single outage scenario. There will always outage scenarios where a phone call or some other communication is needed to determine the exact configuration.

The section will cover various examples of all the major equipment types with applicable diagrams and illustrations. Below is a legend of the symbols that will be used throughout this section.

Figure 3: Diagram Legend
COS Equipment Types

Transmission Circuits

A transmission circuit starts at a substation and ends at a different substation. Transmission circuits can be terminated at either end by a circuit breaker or disconnect. Because of this termination difference, it is necessary to separate transmission circuits into two distinct categories (Fig. 2), transmission lines and transmission segments. A transmission line is an element whose termination points at both stations are circuit breakers. Transmission segments are elements in which the termination points are either both disconnect switches or a combination of a disconnect switch and circuit breaker.

- Transmission Line Protection Zones (breaker-to-breaker)
- Transmission Line Segments (breaker-to-switch, switch-to-switch)

Figure 4: Two variations of transmission circuits in the COS data dictionary

2 The above example should have four entries in the COS data dictionary, 3 transmission line segments and 1 transmission line protection zone.
Transmission Line Protection Zone Outage

Figure 5: Example of a transmission line protection zone outage using switching points

2. Add Switching Points
   a. Circuit Breaker at Station A – outage state as “open”
   b. Circuit Breaker at Station B – outage state as “open”

Transmission Line Segment (breaker-to-disconnect) Outage

Figure 6: Example of a transmission line segment outage using switching points

2. Add Switching Points
   a. Circuit Breaker at Station A – outage state as “open”
   b. Disconnect Switch at the tap to Station B – outage state as “open”

**Transmission Line Segment Outage**

*Figure 7: Example of a transmission segment outage using switching points*

1. Select Transmission Line Segment “B-C” in COS as the Circuit/Equipment outage identifier.

2. Add Switching Points
   a. Disconnect Switch at the tap to Station B – outage state as “open”
   b. Disconnect Switch at the tap to Station C – outage state as “open”

**Transmission Line Segment (disconnect-to-disconnect) Outage**
If all of the above work is related, then the following entries should be entered as a part of the same outage record:

1. Select Transmission Line Segment “B-C” in COS as the Circuit/Equipment outage identifier.
   Add Switching Points
   a. Disconnect Switch at the tap right of Station B – outage state as “open”
   b. Disconnect Switch at the tap left of Station C – outage state as “open”

2. Select Transformer at Station C
   a. Disconnect Switch connecting the load at Station C – outage state as “open”
   b. In the comments section, the entity submitting the outage should also state whether or not the load being served by that transformer is being transferred (e.g., Station C load will be transferred to Station B).

3. Select Transmission Line Segment “C-D” in COS as the Circuit/Equipment outage identifier.
   Add Switching Points
   a. Circuit Breaker at Station D – outage state as “open”
   b. Disconnect Switch at the tap to Station C – outage state as “open”

**Note:** Because the switching points are being submitted, there is no need to create another outage request indicate the transformer outage on the tap to Station C.
Transmission Line Segments with Series Transformer (breaker-to-disconnect, transformer, disconnect-to-breaker) Outage

Figure 9: Example of a transmission line segments outage using switching points

Switching Points

Two Transmission Segment plus Transformer Example

   
   Add Switching Points
   
   a. Circuit Breaker at Station A – outage state as “open”
   b. Disconnect Switch on HV side of Transformer A – outage state as “open”

   
   Add Switching Points
   
   a. Circuit Breaker at Station B – outage state as “open”
   b. Disconnect Switch on LV side of Transformer A – outage state as “open”

3. Lastly Select Transformer A in COS as the Circuit/Equipment outage identifier.

Note: There is no need to repeat the switching points for Transformer A as they have already been entered in the previous entries. If just the transformer we’re coming out and the end of the line segments via the circuit breakers were to remain closed, then the switching points for the transformer would have to be entered.
**Circuit Breakers/Disconnect Switches**

Prior to entering a circuit breaker or disconnect switch outage, the user will have to determine if the outage end-state will result in an interruption of power flow. If it does, then the element whose power flow is being interrupted is what should be entered into COS. For example, if a transmission circuit if being opened ended due to a circuit breaker outage then the outage should be submitted as a transmission circuit and not a circuit breaker. Below are some examples of correct and incorrect outage submissions for the circuit breaker and disconnect switch category.

The outage end-state for a circuit breaker outage with no additional switching. The power flow to the transmission line is being interrupted.

*Figure 10: Example of a circuit breaker outage open ending a transmission line protection zone*

X Incorrect Outage Submittal Example

1. Select Station A “Circuit Breaker” in COS as the Circuit/Equipment outage identifier.
2. Add Switching Points
   a. Circuit Breaker at Station A – outage state as “open”

This is not the desired entry because it creates no awareness that a transmission line is being outaged. An entry such as this creates uncertainty in the outage leaving the study person to question if the circuit breaker is being bypassed or if the line is actually being open-ended.

✓ Correct Outage Submittal Example

2. Add Switching Points
   a. Circuit Breaker at Station A – outage state as “open”
Although the switching points are the same in the two above examples, the transmission line example creates greater certainty around what is actually being outaged.

The outage end-state for a circuit breaker outage which includes a disconnect switch being closed. The power flow to the transmission line is not being interrupted.

Figure 11: Circuit breaker bypassed (bypass and clear) with outage end-state of transmission line still in-service and carrying power (MW)

2. Select Station A “Circuit Breaker” in COS as the Circuit/Equipment outage identifier.

3. Add Switching Points
   a. Circuit Breaker at Station A – outage state as “open”
   b. Disconnect Switch at Station A – outage state as “closed”

Note: This is the first example in which a switching point outage state is being reported as closed.

The outage end-state for a circuit breaker outage that includes a circuit breaker and disconnect switch being closed. The power flow to the transmission line is not being interrupted.
The circuit breaker is bypassed (bypass and clear) and an additional circuit breaker is being closed to provide fault protection.
1. Select Station A “CB C” in COS as the Circuit/Equipment outage identifier.

2. Add Switching Points
   a. Circuit Breaker at Station A “CB C” – outage state as “open”
   b. Circuit Breaker at Station A “CB TIE” – outage state as “closed”
   c. Disconnect Switch at Station A “DSW C” – outage state as “closed”

**Note:** The outage end-state for the circuit breaker does not result in the interruption of power flow. Important to note that two switches are being reported as “closed” for their outage state.

**Series Compensation**

To properly submit series compensation outages in COS using switching points, all bypass circuit breakers or disconnect switches will need to be included in every entity’s respective COS data dictionary. Series compensation primarily refers to either series capacitors or reactors. Many of these elements can be bypassed when an outage occurs. Therefore, the user will need to evaluate if the outage of the series compensation element will result in an interruption of power flow (e.g., open ending a transmission circuit). If it does, then the element whose power flow is being interrupted is what should be entered into COS (e.g., transmission circuit and not the series compensation element). Otherwise just the series compensation element should be entered.

**Series Compensation Outage**

![Figure 14: Example of a series capacitor outage in the before state](image)
Figure 15: Example of a series capacitor outage without bypass in the after state

X Incorrect Outage Submittal Example

1. Select Station A “Series Capacitor” in COS as the Circuit/Equipment outage identifier.

2. Add Switching Points
   a. Disconnect Switch at Station A – outage state as “open”

This is not the desired entry because it creates no awareness that a transmission line is being outaged. An entry such as this creates uncertainty and leaves the study person questioning if the circuit breaker is being bypassed or if the line is actually being open ended.

V Correct Outage Submittal Example


2. Add Switching Points
   a. Circuit Breaker at Station A – outage state as “open”

Note that the series capacitor is also being outaged.

Although the switching points are the same in the two above examples, the transmission line outage entry creates awareness as to what is actually being outaged.
1. Select Station A “Series Capacitor” in COS as the Circuit/Equipment outage identifier.

2. Add Switching Points
   a. Disconnect Switch at Station A – outage state as “open”
   b. Bypass Circuit Breaker at Station A – outage state as “closed”

The above two series capacitor example requires all of the disconnect switches, circuit breakers and both series capacitors to be included in the COS data dictionary to support proper switching point outage entry.
1. Select Station A Series Capacitor CAP 1 in COS as the Circuit/Equipment outage identifier.

2. Add Switching Points
   
   a. Disconnect Switch DSW 2 at Station A – outage state as “open”
   b. Circuit Breaker CB 2 at Station A – outage state as “closed”

1. Select Station A Series Capacitor CAP 1 or CAP 2 in COS as the Circuit/Equipment outage identifier.
2. Add Switching Points
   a. Disconnect Switch DSW 1 at Station A – outage state as “open”
   b. Disconnect Switch DSW 4 at Station A – outage state as “open”
   c. Disconnect Switch DSW 5 at Station A – outage state as “closed”

**Generators**

The first step in determining if and how a generator outage is to be entered is to first evaluate whether the outage or derate of an individual unit or facility is 50 MW or greater. The switching points that are desired for a generator are typically on the high side on the step up transformer.

Figure 20: Single Generator Outage Example – In Service

Figure 21: Single Generator Outage Example – Out Of Service
1. Select “100 MW Generator” as the Circuit/Equipment outage identifier.

   Add Switching Point

   a. Circuit Breaker CB 1 at Station A – outage state as “closed”

**Note:** Although CB 2 is also coming out of service, it is not needed since CB 1 is being submitted. CB 2 is connected to a lower kV level and essentially accomplishes the same end result in outaging the generator. If there was no high-side breaker and the only way to outage the generator was by submitting CB 2, then the switching point would need to be submitted.
Exhibit 2: Outage Operating Memo Guidelines

Purpose: To establish the guidelines as to when an Outage Operating Memo should be created.

Description: An Outage Operating Memo is used to communicate pertinent operating information for planned outages of significant impact (see below). Memos are typically needed where pre-existing operating plans are not in place or do not sufficiently address the reliability issues associated with the planned outage.

Responsibility: It is the responsibility of the entity submitting the outage to determine the need for an Operating Memo based on the criteria of significant impact. If deemed necessary, that entity will also initiate the creation of an Outage Operating Memo.

Significant Impact Criteria: While it is difficult to categorize the term significant impact, below are some key system scenarios that may warrant the creation of an Outage Operating Memo.

- Two or more impacted entities – This category addresses the coordination concern in that two or more impacted entities understand their roles and responsibilities when planning for an outage. The Reliability Coordinator (RC) is almost always an impacted entity, so this criterion is in regard to two of more Transmission Operators (TOP).

- Potential IROL conditions – When a planned outage is expected to result in a potential IROL condition. See the Peak Reliability SOL Methodology for qualifying conditions.

- Emergency outage conditions – This category is intended to describe the scenario when a planned outage has to be taken under emergency system conditions, i.e., safety or system reliability risk is imminent. This is a scenario where no pre-existing procedure adequately addresses the reliability issues due to requirements above and beyond what are typically needed to mitigate.

- Whenever the need arises – If an outage impact does not fall into any of the above categories, but an entity feels more comfortable meeting the needs of reliability, then they can initiate an Outage Operating Memo.

Timelines: Upon submitting the outage and recognizing the need, the creation of an Outage Operating Memo should begin as soon as practicable. The memo should be filled out to the entity’s fullest extent prior to reaching out to the other impacted entities.

Review: When the draft is completed, the memo should then be shared for all impacted entities, including the RC, to review. There should be enough time allotted for review, editing and verification of the memo.

Distribution: Once the review process is completed and all entities agree on the mitigation plan, a final copy will need to be distributed via email prior to the start of the planned outage.

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3 The entity may delegate this responsibility to another entity provided they have agreed to do so.

4 Peak Reliability is currently developing a location on PeakRC.org to post the memos. Date is still TBD.