NERC
NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION

Framework to Address Known and Emerging Reliability and Security Risks

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This document outlines a risk framework for the ERO and details how such a framework provides an important extension of the ERO's core activities. The ERO mission[1] requires establishing a consistent framework to identify, prioritize and address known and emerging reliability and security risks. To support its mission the ERO has developed policies, procedures and programs, which are identified and briefly described in Section I. These policies, procedures and programs have been incorporated into an iterative six-step risk management framework outlined in Section II. Mitigation of risks to Bulk Electric System (BES) reliability can be classified according to the likelihood of the risk occurring and the severity of its impact. Section III addresses how the ERO's policies, procedures and programs identified in Section II map into the risk likelihood and severity space. Resilience is an important component of reliability risk management and is discussed in Section IV. Section V cover the application of ERO Policies, Procedures and Programs, within time required to apply the mitigation and the likelihood and severity.

I. ERO Policies, Procedures and Programs

The ERO's mission ultimately exists to serve the public interest, and it must serve that interest by developing and using the ERO Policies, Procedures and Programs to monitor and mitigate risks to the BES, balancing their use by considering what is possible against what is reasonable and necessary. Further, ensuring reliability and security also require improving the resilience of the BES by building the robustness to withstand unexpected events, supporting controlled degradation when an event is beyond design basis (providing an Adequate Level of Reliability), and supporting restoration following an event.

The ERO identifies risk both in a leading and lagging manner. The ERO scans the horizon for emerging risks such as grid transformation and critical infrastructure interdependencies (leading). At the same time, the ERO is gathering data and information on the performance of the existing bulk power system to uncover unexpected risks such as large quantities of photovoltaic generation ceasing to operate under certain system conditions (lagging). In addition, the ERO annually releases its State of Reliability Report that documents the annual system performance in a comparative fashion. The ERO's Policies, Procedures and Programs are then used to address mitigation of these identified risks.

Five of NERC's most significant reliability risk mitigation activities are Reliability Standards, Assurance and Enforcement activities; Reliability Guidelines; Technical Engagement; Reliability and Risk Assessments; and Alerts:

1. **Reliability Standards, Assurance, and Enforcement** processes are the common way to address reliability and security risks when addressing sustained risks with moderate impacts which are

[1] Electric Reliability Organization (ERO) consists of NERC and the 6 Regional Reliability Organizations. The ERO's mission is to assure the reliability and security of the North American bulk electric system (BES). The ERO is supported by subject matter expertise from the owners and operators of the bulk electric system. In the United States the ERO is authorized the Energy Policy Act of 2003 and overseen by FERC.

likely (e.g., inaccurate planning models), and high impacts, whether likely or unlikely (e.g., vegetation management and geomagnetic disturbances). Standards provide the greatest degree of certainty for risk mitigation. Following NERC and Regional Reliability Standards should not be seen as a burden but rather an outcome of good reliability performance, with that desired outcome on each individual system contributing to the reliability of the entire interconnection, and ultimately, the North American BES.

As a matter of public policy, Reliability Standards should credibly address primary risks that are sustained, high impact and likely. Establishing a baseline of Reliability Standards assures accountability for the public's benefit when minimum expectations of performance or behavior are not met. The public expects a regulator to enforce accountability on at least those actions related to sustained, high impact, and likely risks within its scope of oversight.

A key factor in the success of compliance monitoring and enforcement of mandatory standards rests on a common understanding among industry and the ERO as set forth in the ERO's Compliance Monitoring and Enforcement Program (CMEP) which details how compliance will be monitored and enforced. Implementation Guidance is developed by industry and/or vetted through pre-qualified organizations to show examples of compliant implementations. These vetted examples can then be submitted to the ERO for endorsement, and, if endorsed, the ERO would give the example deference during CMEP activities with consideration of facts and circumstances.

Risk elements associated with the Reliability Standards are documented annually in the ERO CMEP Implementation Plan, which provides guidance to industry on North American-wide and regional risks that the ERO's Reliability Assurance and Enforcement staff will be focusing on addressing in the coming year. Regional Entities review the risks each individual registered entity may have, and identify which Reliability Standards they wish to focus on based on these risks. This risk-based approach enables focus on the most important risks to reliability, and review of the controls in place to address them for each individual organization.

Information and data gathered as a result of compliance monitoring and enforcement activities can inform about the effectiveness of a Reliability Standard or the need for enhancements. At a high level, this recommendation can be passed on through the Standards Development process for consideration.

2. **Reliability Guidelines** are the common approach to use when addressing moderate impact sustained risks that are unlikely, and low impact sustained risks that are unlikely or likely (such as reduced or lack of equipment maintenance resulting in the loss of an individual element which is a low impact to BPS reliability, while the probability of failure increases over time). Reliability Guidelines are also used for those issues that are or are not in the ERO's jurisdiction, but are practices that improve reliability. Guidelines provide three advantages:

   - Together with a strong minimum baseline fabric of standards, guidelines can be a strong and timely way to address risk.
   - Reliability Guidelines enable the ERO to highlight expectations or priorities on appropriate practices for a given subject area.

- Reliability Guidelines may also be used to establish performance expectations for emerging risks rather than or prior to codifying those expectations into Reliability Standards.

3. **Technical Engagement** can be used to address sustained risks or one-and-done activities with low impacts, whether likely or unlikely. Activities here include webinars, site visits, presentation and reports, workshops, conferences and technical meetings. This includes not only activities of the ERO, but the ERO supporting industry engagement through the reliability ecosystem, such as the North American Transmission and Generation Forums, professional organizations, researchers, and government. Technical engagement also serves to promote future sustained risk mitigation and support for using Reliability Guidelines, industry notices, newsletters, bulletins, or Reliability Standards.
4. **Reliability and Risk Assessments** coupled with the biennial report outlining the Reliability Issues Steering Committee's (RISC) findings identifies risks, whether likely or unlikely.[2] Generally, these activities are used to inform and influence policymakers, industry leaders, and the general public about the impact of important public and energy policy issues impacting BPS reliability.
5. **Alerts** are used for sharing information, especially time-sensitive information, to request action or direct action. They can also serve as a more nimble, foundational activity for other ERO Policies, Procedures and Programs. As part of its normal course of business, NERC often either discovers, identifies, or is provided with information that is critical to ensuring the reliability of the bulk power system in North America. In order to effectively disseminate this information, NERC utilizes email-based "alerts" designed to provide concise, actionable information to the electricity industry. As defined in its Rules of Procedure, NERC alerts are divided into three distinct levels, as follows:

   - **Level 1 Industry Advisory**: Purely informational, intended to alert registered entities to issues or potential problems. A response to NERC is not necessary.
   - **Level 2 Recommendation to Industry**: Recommends specific action be taken by registered entities. A response from recipients, as defined in the alert, is required.
   - **Level 3 Essential Action**: Identifies actions deemed to be "essential" to bulk power system reliability and requires NERC Board of Trustees' approval prior to issuance. Like recommendations, essential actions also require recipients to respond as defined in the alert.

   Since Level 2 and Level 3 alerts require acknowledgement of receipt and response to the alerts, they are used in higher risk impact situations than Level 1 alerts, which are purely informational.

II. ERO Iterative Risk Management Framework

During the last ten years, the ERO has expanded its implementation of risk-based approaches across its program areas. During this transition, the ERO has continued to lead industry in reliability, resilience, and security initiatives to identify known and emerging risks, and to engage industry in a collaborative approach to mitigating that risk. The primary reliability, resilience, and security activity for risk mitigation the ERO currently deploys includes, but is not limited to: outreach events such as webinars and conferences, Reliability Guidelines, Alerts, Reliability Standard development, registration and certification, and compliance monitoring and enforcement. In addition, the ERO can engage Forums

[2] Instead of using "mitigating risks," the RISC uses "managing risks." These terms are used interchangeably and mean the same thing in this whitepaper.

such as the North American Transmission Forum (NATF) and the North American Generator Forum (NAGF), as well as the industry trade associations, industry groups such as the Energy Systems Integration Group (ESIG), and research organizations such as the Electric Power Research Institute and the Power Systems Engineering Research Center (PSERC) to assist with development of best practices, increased awareness, Implementation Guidance, and other solutions used to address identified risks.

Additionally, a set of industry indicators has been developed to measure reliability and security. These indicators need further refinement, maturation and linkage to industry performance, as they are key to evaluating the effectiveness of mitigation efforts, identifying the residual risk that remains, and considering whether the remaining risk is at acceptable levels.

This framework is meant to guide the ERO in the prioritization of risks and provide guidance on the application of ERO Policies, Procedures, and Programs, to inform resource allocation and project prioritization in the mitigation of those risks. Additionally, the framework accommodates measuring residual risk after mitigation is in place, enabling the ERO to evaluate the success of its efforts in mitigating risk, which provides a necessary feedback for future prioritization, mitigation efforts, and program improvements.

The successful reduction of risk is a collaborative process between the ERO, industry, and the technical committees including the Reliability and Security Technical Committee (RSTC) and RISC. The framework provides a transparent process using industry experts in parallel with ERO experts throughout the process, from risk identification, deployment of mitigation strategies, to monitoring the success of these mitigations.

Six specific steps have been identified, consistent with risk management frameworks used by other organizations and industries: 1) Risk Identification; 2) Risk Prioritization; 3) Mitigation Identification and Evaluation; 4) Deployment; 5) Measurement of Success; and 6) Monitoring. Each of these steps will require process development, including stakeholder engagement, validation/triage approaches, residual risk monitoring, ERO's level of purview over a risk, etc. These processes will be developed once the framework has been finalized.

1. **Risk Identification and Validation:** As mentioned above, the ERO identifies risks using both leading and lagging approaches. The RISC biennial report and Long-Term and Seasonal Reliability Assessments (leading) have successfully brought together industry experts to identify and prioritize emerging risks, as well as suggest mitigation activities. A partnership between the ERO leadership and both the RISC and RSTC enables input from the ERO program areas, industry Forums and trade associations to provide additional context in risk identification.

   Once the ERO, NERC Committees, Forums, or industry subject matter experts identify and validate a risk, it is critical that the corresponding recommendation for mitigation describe, explain, and provide support for the basis for selecting the particular approach to mitigation. A template will be created, that mirrors the Standards Authorization Request template, that requires an explanation of the risk, approach(es) for mitigation, and estimate of residual risk.

   Risk Identification: The ERO has a number of ways that it identifies risks:

   - ERO stakeholder supported technical organizations, industry forums, and associated subject matter experts

- Focused Compliance monitoring activities
- Reliability and Risk Assessments
- Events Analysis
- State of Reliability Report, including the analysis of Availability Data Systems (BASS, TADS, GADS, DADS, MIDAS, etc.)
- Frequency Response, Inertia, and other essential reliability service measurements
- Interconnection simulation base case quality and fidelity metrics
- Reliability Issues Steering Committee (RISC) Biennial Risk Report
- Regional Risk Assessments
- Communication with external parties, such as DOE, DHS, Natural Resources Canada, CEA and EPRI
- Shared public and/or government intelligence with special emphasis on cyber security

Risk Validation: The ERO and industry subject matter experts continuously work together validating risks to the reliable and secure operation of the bulk power system based on analysis of ongoing performance of the system (lagging). Validation of the magnitude and priority of the risks includes analysis from the ERO databases of system performance and Events Analysis. These outputs are generally covered in NERC's State of Reliability Report. In addition, the risks are further validated through working with NERC Committees, and socializing them with Forums, government, and research organizations. Leading risk validation requires analysis of system simulations, forecasts, and performance projections.

2. **Risk Prioritization:** Prioritizing risks is accomplished through an analysis of their exposure, scope, and duration as well as impact and likelihood. The primary sources of data used to support this analysis come from the Risk Identification step. Deciding if the risk requires near-term mitigation or continued monitoring is informed by technical expertise. Depending on the complexity of the risk, new models, algorithms and processes may need to be developed to better understand the potential impacts of the risk, which is necessary to develop risk mitigation tactics. The process would be consistent with other risk management frameworks used by other industries, and was recently successfully tested in collaboration with industry through a survey issued by the RISC, based upon the risks that group prioritized in early 2019.

   A ERO risk registry and heat maps will be developed encompassing prior RISC report findings, ongoing technical committee activities, and risks being monitored. This registry would be developed by the end of the second quarter of 2021. Work plans of the technical committees will then be periodically reviewed to ensure that ongoing activities are tied to identified risks in the risk registry. Further, if new risks emerge they can be added to the registry, and if it is deemed that the risks are sufficiently mitigated, they will be moved to the monitored portion of the risk registry. As the RSTC develops its annual work plan and following the publication of the biennial ERO Reliability Risk Priorities Report, the risk registry is reviewed by the RISC and the RSTC to evaluate how completed work addressed these identified risks, whether any new risks have been identified by either committee that need to be added to the risk register, and documenting monitored risks which require no additional mitigation.

3. **Remediation and Mitigation Identification and Evaluation:** The right mix of mitigation activities is balanced against both the effective and efficient use of resources and the potential risk impact and likelihood. Further, the risk tolerances needs to balanced against potential impacts so that the remediation/mitigation plans can be developed accordingly. Determining the best mix depends on a number of factors, such as:

   - What is the potential impact or severity of the risk?
   - How probable is the risk? Is it sustained, decreasing or growing?
   - Is the risk here today or anticipated in the next 3-5 years?
   - How pervasive is the risk?
   - Is mitigation expected to be a one-time action, or ongoing?
   - Have we had experience with events being exacerbated by the risks, or there is no experience, but the probability is growing (i.e. cyber or physical security)?
   - Have previous mitigation efforts been deployed? If so, were they effective? Why or why not?
   - What is an acceptable residual risk level after mitigating activities have been deployed?
   - Is the risk man-made or by natural causes?
   - Does the mix of mitigations vary based on jurisdictional or regional differences?
   - Is the risk fully or partially within the purview of the ERO?

   Input from, and allocation of, subject matter expertise through multiple sources is part of this consideration, including resources within the ERO and its stakeholders (such as standing technical committees and their subgroups, or standard drafting teams). External parties are important sources as well, such as the North American Transmission and Generation Forums (NATF and NAGF), North American Energy Standards Board (NAESB), the Institute of Electrical and Electronic Engineers (IEEE), and EPRI, to name a few.

   Once a risk to the BES has been prioritized according to its impact and likelihood, the ERO, NERC Committees, Forums, and industry subject matter experts recommend and can take on potential mitigation activities and assess their anticipated effectiveness. Coordination is key to avoid duplication and provide supportive, rather than conflicting actions.

   The ERO remains responsible for risks to the reliable and secure operation of the BES. Risk mitigation should still be followed by the ERO no matter which organization takes on activities. Examples of mitigation efforts include, but not limited to:

   - Reliability Standards, with Compliance and Enforcement for risks that are:
     - Sustained, moderate to severe impact, and likely
     - Sustained, severe impact, and unlikely
     - Focused monitoring based on risk, and in response to major events
   - Reliability Guidelines for risks that are:
     - Sustained, low to moderate impact, and likely

- Lessons Learned for risks that are:
  - Sustained, low impact, and likely
- Assist Visits for risks that are:
  - Compliance-related
  - Focused on a very specific situation or configuration
  - Generally on specific industry or entity practices or conditions
- Analysis of Major Events for risks that are:
  - Identified after a Major Event (e.g., Category 3 or higher)
  - Discreet/one-time, severe impact, unlikely
  - identified through recommended reliability improvements or best practices and lessons learned
- Analysis of "Off-Normal" Events for risks that are
  - Identified after an unusual operational condition has occurred and likely not a categorized event.
  - Discreet/one-time, moderate impact, unlikely
  - Identified through recommended reliability improvements or best practices and lessons learned
- Advisories, Recommendations or Essential Actions[3]
- Alerts[4]
- Technical Conferences and Workshops

When reviewing the type and/or depth of remediation and mitigation, a form of cost-effectiveness analysis may be considered to understand impacts and potential burdens. This analysis can then be compared to potential impacts of the risk.

[3] LEVEL 1 (Advisories) – purely informational, intended to advise certain segments of the owners, operators and users of the Bulk Power System of findings and lessons learned; LEVEL 2 (Recommendations) – specific actions that NERC is recommending be considered on a particular topic by certain segments of owners, operators, and users of the Bulk Power System according to each entity's facts and circumstances; LEVEL 3 (Essential Actions) – specific actions that NERC has determined are essential for certain segments of owners, operators, or users of the Bulk Power System to take to ensure the reliability of the Bulk Power System. Such Essential Actions require NERC Board approval before issuance.

[4] ALERT 1: Industry Action Requested: Fast moving or recently detected, impacts moderate, ALERT 2: Industry Action Required: Fast moving or recently detected, impacts moderate to severe, ALERT 3: Industry Action Mandatory: Fast moving or recently detected, impacts moderate to severe.

4. **Mitigation Deployment**: Mitigation projects will be deployed by the ERO and/or industry stakeholder groups, as determined by the "Mitigation Identification and Evaluation" step. A specific mitigation plan would involve a suitable mix of the ERO policies, procedures and programs discussed in Section I. These mitigations would be coordinated with Canadian, industry partners and stakeholders.

   From time-to-time, the Federal Energy Regulatory Commission (FERC) may order the development of Reliability Standards, which can occur in this step.

5. **Measurement of Success:** Once a set of solutions has been deployed, the effectiveness of the mitigation must be measured to determine if the residual risk has been reduced to an acceptable level. Effectively, if the desired level of risk mitigation is not met, the risk is fed back to Step 1, enabling a new prioritization of risks, factoring in historic mitigation, ensuring resource allocation is adapted to the changing risk landscape. This step also informs future mitigation efforts, as industry and the ERO learn from the effectiveness of mitigation mixes for reducing risk. A partnership between the ERO leadership and both the RISC/RSTC will enable input from the ERO program areas, industry Forums and trade associations to provide additional context in the measurement of success. That said, criteria and other related processes should be developed for determining risk severity, likelihood, and mitigation activity effectiveness.

6. **Monitor Residual Risk:** Once the level of residual risk is at an acceptable level, the risk is monitored through ongoing performance measures to ensure that risk remains at acceptable risk levels. The residual risk should be monitored for progress and to ensure that the mitigations that are in place continue to address the risk (Step 5). At times, mitigations need to be deployed on a periodic basis (e.g. annual workshops, Reliability Guideline updates, etc.) to ensure continued success (Step 4). If the risk levels heighten, or increased mitigation efforts are necessary due to the changing nature of the bulk power system, the risk can be fed back (Step 1) for prioritization and the development of additional mitigation approaches. The ERO, working with its industry partners, technical committees, stakeholders and forums, would determine if the residual risk was acceptable of if additional mitigations required.

From-time-to-time risks are identified and validated which require an accelerated industry attention. The ERO risk framework can support quick implementation of industry awareness and mitigation activities. Figure 1 provides a pictorial flow chart of the ERO's risk management process.

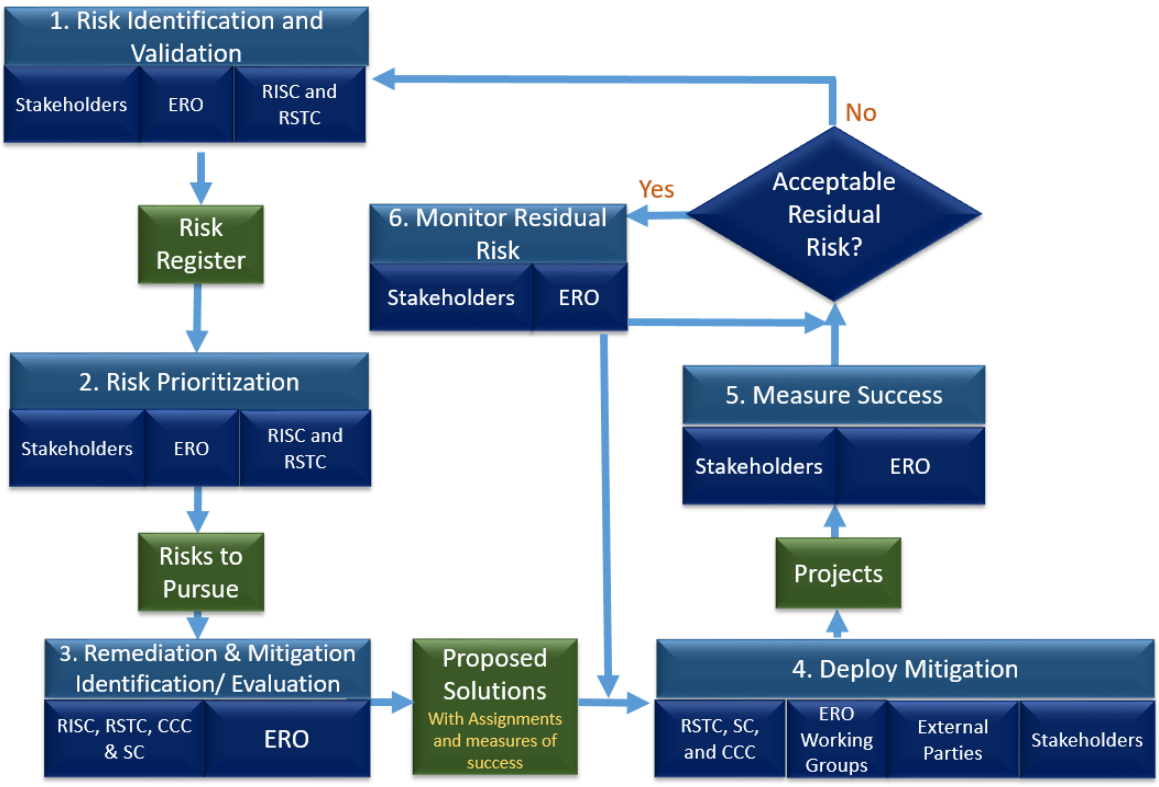

Figure 1: ERO Risk Management Process

In order to coordinate risk mitigation, the RISC and RSTC triage risk mitigations together as called for in the iterative RISC Framework process. The Standards Committee (SC) and the Compliance and Certification Committee (CCC) are key stakeholder groups that are part of this iterative process. Further, the Standing Committee Coordination Group (SCCG) is a group made up of the leadership (Chair and Vice Chair) of each Standing Committee. This group coordinates and aligns the Standing Committees activities. The touch points are shown in Figure 2.

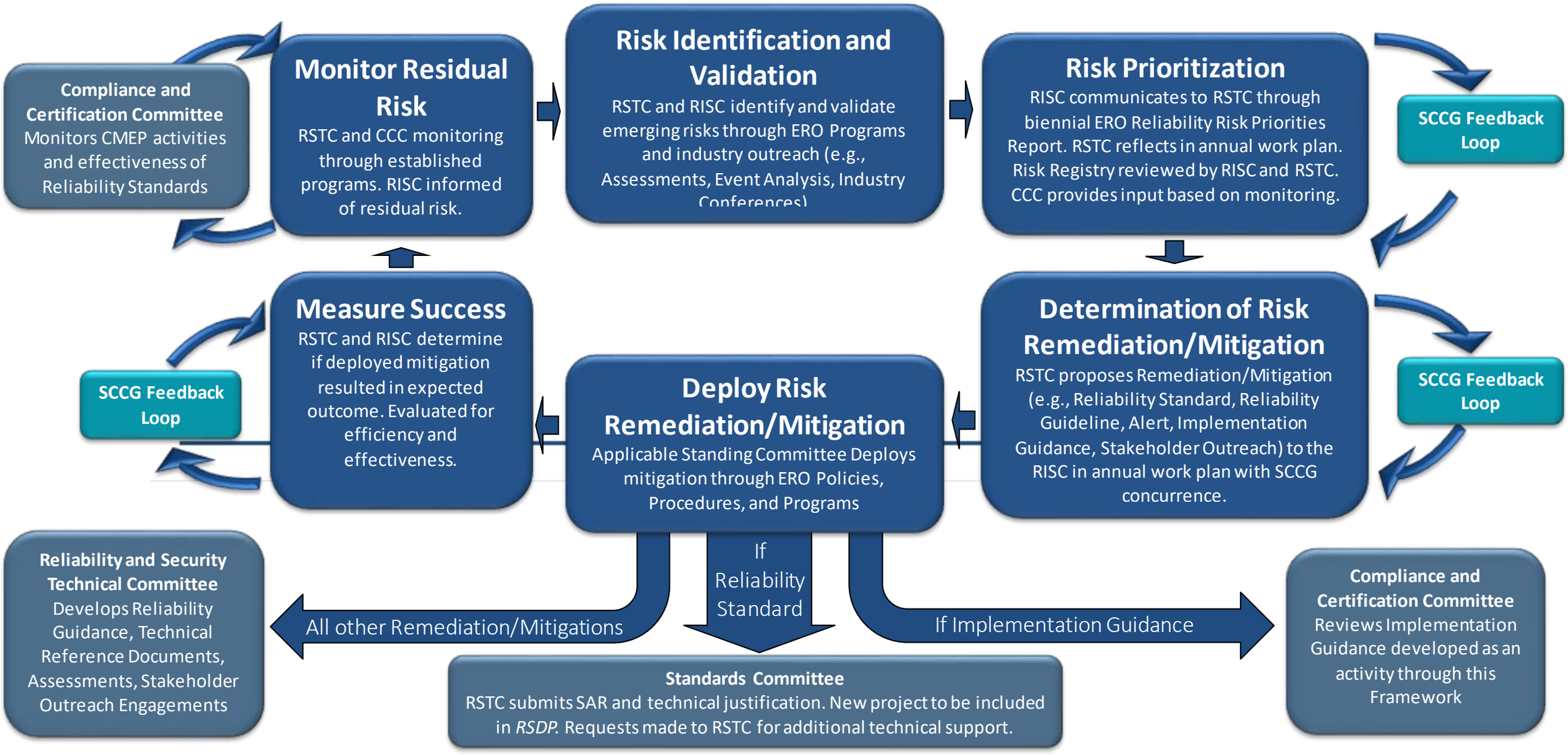

Figure 2: RSTC, RISC, SC, and CCC Coordination within the Risk Framework

1. **Risk Identification and Validation** is completed by the RSTC and RISC as they review the annual State of Reliability Report, Long-Term and Seasonal Reliability Assessments, Event Analysis records and with a joint review the biennial RISC Report incorporating prioritized risks into the RSTC's subgroup's work plans. Further, the RSTC coordinates with the RISC on long-term risks and mitigations. In this way, risks determined by monitoring the ongoing performance of the bulk power system and those identified by scanning the horizon. The risk registry will be maintained by the RISC and RSTC to determine if an inherent nature of a risk changes over time, and consider removing risks or adding others.
2. **Reliability Risk Prioritization** is completed collaboratively between the RSTC and RISC on an annual basis. Ongoing activities are calibrated, and newly identified risks are prioritized. The SCCG will serve as a coordination point to ensure broad alignment across the Standing Committees.
3. **Remediation & Mitigation Identification & Evaluation** activities to address the risks are assigned to the appropriate RSTC subgroups accounting for changing needs across the BPS. They create the ERO Policies, Procedures and Programs to address the risks. Frequent communications ensures coordination of ongoing risk prioritization. RSTC will provide updates to the RISC on the subgroup activities being taken on a quarterly basis. The SCCG will serve as a coordination point to ensure broad alignment across the Standing Committees.
4. **Deploy Mitigations** by putting ERO Policies, Procedures and Programs into effect. Depending on the Risk Remediation/Mitigation activities selected, the RSTC, SC, and CCC will be assigned certain tasks. If Implementation Guidance is identified as an activity through this framework, the CCC will be assigned to review the developed guidance prior to submission to the ERO. If a Reliability Standard is identified, the RSTC (or identified stakeholder) will need to submit a SAR to the SC and that project is to be included in the annual Reliability Standards Development Plan. For all other mitigation/remediation activities, the RSTC will be responsible for developing remediation/mitigation.
5. **Measure Success** of the strategies/plans which are jointly evaluated for effectiveness, highlighting next steps. RSTC will measure success using its annual performance measurement activities (e.g., State of Reliability Report, Long-Term Reliability Assessment, and Event Analysis). RSTC will provide updates to the RISC on the actions being taken on a quarterly basis.
6. **Residual Risk** is monitored in coordination between the RSTC coordinates and RISC towards maintaining an acceptable level of residual risk. The CCC will be responsible for measuring the effectiveness of Reliability Standard developed, as well as residual risk, and report back to the RISC through specific metrics used to measure effectiveness. The SCCG will serve as a coordination point to ensure broad alignment across the Standing Committees.

III. Risk Mitigation from Likelihood and Severity Perspective

From a likelihood and impact perspective, the ERO Policies, Procedures, and Programs above overlap based on the specifics of each risk being mitigated. In addition, there are a host of additional activities that work together to manage risks, such as engagement with the reliability ecosystem, (e.g. Forums, professional organizations (IEEE-PES, CIGRE, etc.), and government). A combination can be used towards

gaining industry action, setting the stage for standards as well as addressing a risk while a standard is being developed. Likelihood and impact have a bearing when a Reliability Standard is required. Figure 3 provides an illustration that is representative of the principles:

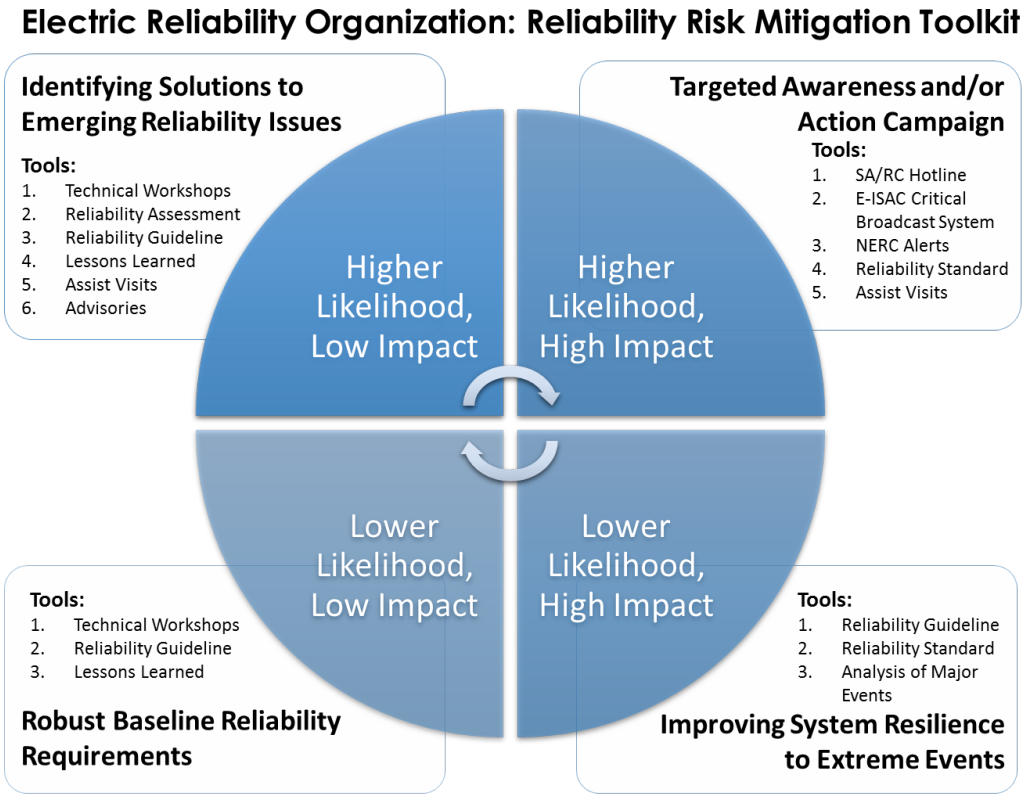

Figure 3: ERO Reliability Risk Mitigation Portfolio

IV. Resilience Impact on Risk Management

In August 2017, the Department of Energy (DOE) issued a Staff Report to the Secretary on Electricity Markets and Reliability (DOE Grid Report) regarding reliability and resilience in light of the changing energy environment. One recommendation in the DOE Grid Report stated that NERC should consider adding resilience to its mission and broadening its scope to address resilience. In response to the DOE report and NERC assessments, the NERC Board of Trustees (NERC Board) directed the Reliability Issues Steering Committee (RISC) to develop a model for resilience and examine resilience in today's environment.

In accordance with the NERC Board's directive, the RISC worked with NERC stakeholders to reexamine the meaning of resilience in today's changing environment and how resilience impacts NERC activities. Meanwhile, the DOE and FERC have continued evaluating the relationship of resilience and reliability.

In November of 2018, the NERC Board accepted the RISC's Report, titled "Reliability Issues Steering Committee Resilience Report." This report summarizes the results of the RISC's examination of resilience, including the RISC Resilience Model.

NERC has developed, filed with FERC, and later updated a definition of the adequate level of reliability (ALR) along with a technical report to guide Reliability Standards development, Reliability Assessments, guideline development, data collection, system analysis and standing committee work. In particular, the ALR, or design basis of the system, is defined as the state that design, planning, and operation the BES will achieve when five ALR performance objectives are met.[5] Each objective addresses Reliable Operation of the BES over four time frames:

1. **Steady state:** the period before a disturbance and after restoration has achieved normal operating conditions
2. **Transient:** the transitional period after a disturbance and during high-speed automatic actions in response
3. **Operations response:** the period after the disturbance where some automatic actions occur and operators act to respond
4. **Recovery and system restoration:** the time period after a widespread outage through initial restoration rebounding to a sustainable operating state and recovery to a new steady state

Further, there is a need to development of additional metrics that measure impacts from emerging risks (e.g. energy sufficiency and transmission/generation operating technology security). These metrics can inform industry on the extent of the condition, level of risk, and relative success of their mitigation.

V. Incorporating Risk Adds a Critical Dimension to the ERO's Mission

Application of ERO Policies, Procedures and Programs provides a multi-dimensional approach to address risks. Namely, some of these approaches can be put in place swiftly, while others require industry collaborative action which can take more time. Further, there are time considerations on the speed of the ERO Policies, Procedures and Programs deployment, as well as the speed at which a risk should be addressed. Figure 4 provides a risk time horizon perspective. The application of mitigation approaches in this Framework are not meant to be static. There are risks, however, that include dynamic forces outside the ERO or risks may not be fully within the ERO's purview. This can and will influence the timing and impact of risks.

The ERO Policies, Procedures and Programs deployed are largely dependent on the likelihood that a given risk would impact reliability. For example, reliability issues that have occurred are generally more

[5] **The ALR Performance Objectives are as follows:**

1. The BES does not experience instability, uncontrolled separation, Cascading, or voltage collapse under normal operating conditions and when subject to predefined Disturbances.
2. BES frequency is maintained within defined parameters under normal operating conditions and when subject to predefined Disturbances.
3. BES voltage is maintained within defined parameters under normal operating conditions and when subject to predefined Disturbances.
4. Adverse Reliability Impacts on the BES following low probability Disturbances (e.g., multiple contingences, unplanned and uncontrolled equipment outages, cyber security events, and malicious acts) are managed.
5. Restoration of the BES after major system Disturbances that result in blackouts and widespread outages of BES elements is performed in a coordinated and controlled manner.

The ALR also lists two assessment objectives for purposes of assessing risks to reliability:

1. BES transmission capability is assessed to determine availability to meet anticipated BES demands during normal operating conditions and when subject to predefined Disturbances.
2. Resource capability is assessed to determine availability to the Bulk Electric System to meet anticipated BES demands during normal operating conditions and when subject to predefined Disturbances.

likely than those that have not occurred, and risks/issues that have occurred are generally more likely to occur again.

Therefore, the ERO Policies, Procedures and Programs used to mitigate risks that have occurred may be different than those used to mitigate longer-term issue that haven't impacted reliability yet. For instance, after analysis of major and/or off-normal events, depending on the potential impacts and reoccurrence likelihood, strong action can be taken by the ERO with nearly immediate response by issuing up to three levels of NERC Alerts, Assist Visits, followed by Reliability Guidelines, technical conferences, and enhancement of Reliability Standards.

Generally, industry action to address medium to high impact and likelihood risks employs Reliability Standards which provide the highest certainty of risk mitigation. Following Reliability Standards is mandatory and provides a high value by creating comfort and certainty for interconnected organizations of expectations and roles, ensuring that the adequate level of reliability will be maintained. In the end, following the Reliability Standards is an outcome of good industry reliability performance.

High-Impact, Low-Frequency-type risks generally do not have a historical record of technical information. Longer-term risks can be difficult to quantify—therefore, much of the work the ERO can do is to assemble industry experts and stakeholders to agree on and validate what the reliability risk is and how it should be considered and addressed within the ERO Policies, Procedures and Programs, including the full reliability ecosystem. These risks require more collaborative effort and more time towards developing technical references, convening industry stakeholders, and conducting independent reliability assessments to determine the best way to mitigate the risk.

The ERO's risk-based approach is fundamental to the success of its mission to ensure the reliability and security of the BES in North America.

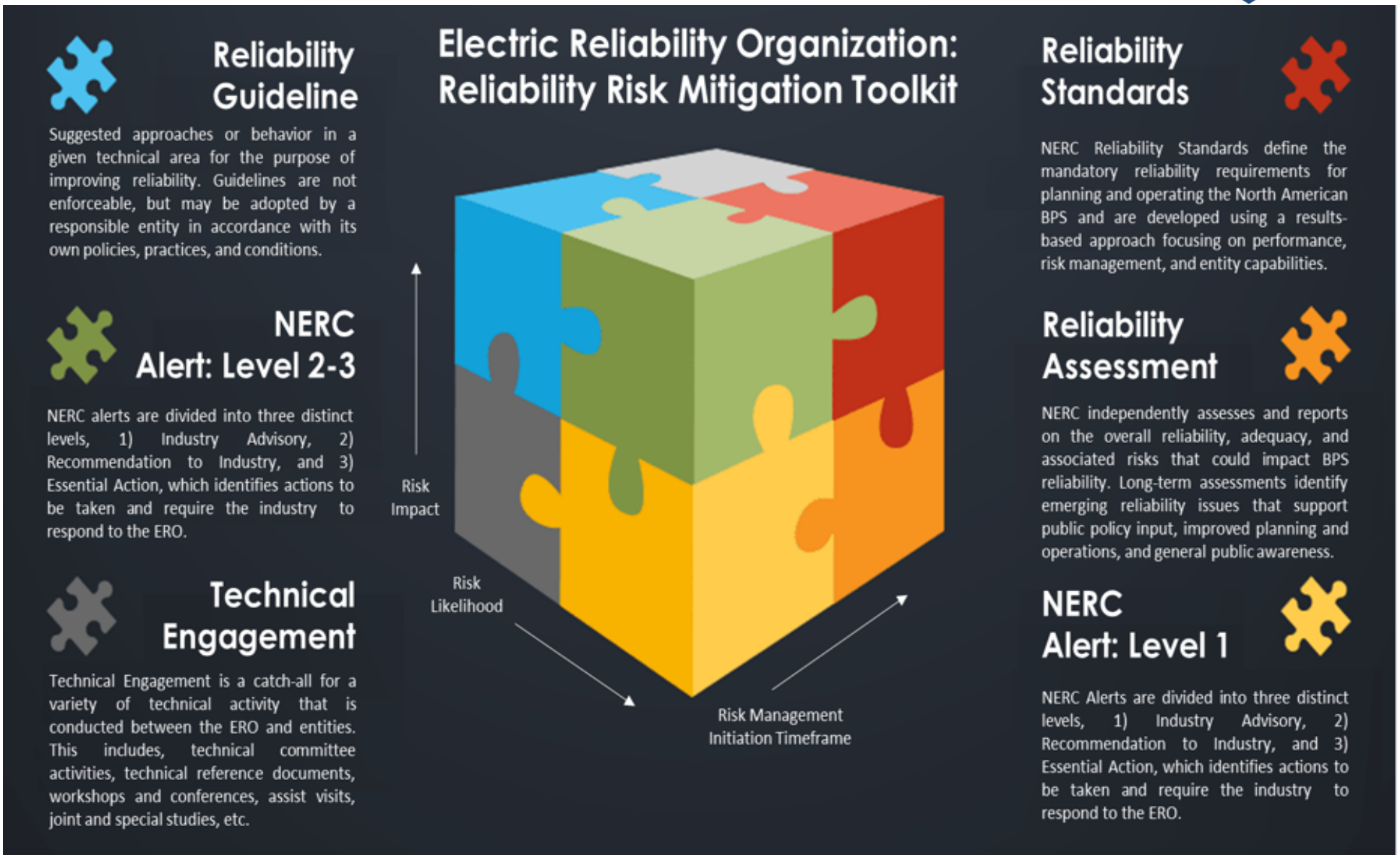

Figure 4: Risk Time Horizon