Assessing Assets for Climate-Related Severe Weather Threats to Reduce Vulnerability and Increase Resilience - A Risk-based Process

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“It is probable that improbable things will happen. Granted this, one might argue that what is improbable is probable.” Aristotle
Introduction to Cardno Government Services
Approach to Climate Change and Facility Resilience

• Risk-based Approach
• Definitions of Terms Used
• 3 Phased Assessment Process
• Adaptation and Resilience Improvement Planning
• Standardized Process
• Lessons Learned
Cardno Government Services’ Analysis of Climate Change Effects, Adaptation and Resilience

• Our approach is **not about the science** of Climate Change

• **It is about installation and facility** assets and their vulnerability to climate severe weather threats, resilience, and related risk

• **Problem:** How to address enterprise-wide and installation-specific need for climate and weather related assessments and prioritize potential investments to improve adaptation and resilience?

• **Goal:** A qualitative, systematic risk-based approach that is simple & scalable; designed to be easily communicated to decision-makers

• **Objective:** Defensible, Auditable, Repeatable, and Transparent (DART™) Method
We Start With Definitions, Which Should Be

- Simple
- Shared
- If possible, already used by the organization
- Easily communicated within the organization
- Translatable outside the organization
Defining Facility Resilience

*Capacity and Capability of a system to adapt to disruption (shocks...), and recover to a structure and state of function similar to what previously existed...* (Synthesized from C.S. Holling)

• Others Important Terms...
  – Robust
  – Redundant
  – Ready
  – Adaptation
  – Risk
Definition of Risk-Related Terms Used

• Risk is related to two factors/elements:
  
  – **Threat**: a possible bad event with a bad result (“stuff happens”) for an installation, facility, asset

  – **Vulnerability**: how easy (more vulnerable) or difficult (less vulnerable) it is for a facility to have bad “stuff” happen to it

• Risk rated qualitatively by combining:
  
  – **Likelihood**: uncertainty of bad “stuff” happening

  – **Severity**: consequences or how bad the bad “stuff” can be
Threat and Vulnerability Risk and Resilience Assessment – Key Terms and Activities
Approach to Climate Severe Weather Event Threat and Vulnerability Assessment – Likelihood and Severity Indicators of Risk

• Types of threats as Likelihood Indicators:
  – Sea Level Rise (and flooding; storm/tidal surge)
  – Severe Weather - historical storm tracks (hurricanes/typhoons/tornados/hail)
  – Precipitation change (rain; drought)
  – Temperature Increase (energy use/habitability)

• We establish likelihood by combining events, conditions because they are synergistic

• We establish severity as Current Replacement Value (CRV) for effect in $$

• Rate risk by combining Likelihood and Severity ratings of individual facilities

• Identify natural breaks in the data to set levels of risk: High, Medium and Low

• Rank according to risk-level ratings to identify “most at risk to climate/severe weather events”
Qualitative Risk Rating

Likelihood x Severity = Risk (Qualitative)

Example Likelihood Matrix

<table>
<thead>
<tr>
<th>Sea Level Rise Vulnerability Likelihood</th>
<th>Located within a model-defined SLR affected area</th>
<th>Proximity to shoreline (less than 1 Mile)</th>
<th>Proximity to shoreline (More than 1 Mile)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Located within a model-defined SLR affected area</td>
<td>High</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>Elevation less than 25 feet MSL</td>
<td>High</td>
<td>High</td>
<td>Medium</td>
</tr>
<tr>
<td>Elevation greater than 25 MSL</td>
<td>High</td>
<td>Medium</td>
<td>Low</td>
</tr>
<tr>
<td>If Sea Level Rise at nearest station has a negative trend:</td>
<td>Low</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SEVERITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
</tr>
<tr>
<td>Medium</td>
</tr>
<tr>
<td>Low</td>
</tr>
</tbody>
</table>

If CRV > $9.5 mm
If CRV < $9.5 mm but > $1 mm
If CRV < $1 mm
Phase I of Assessment
Identify and Rank Facilities Most at Risk to Climate/Severe Weather Event Threats and Vulnerability

- Identify inventory/list and locations of installations, facilities, assets to evaluate
- Use existing publicly available data to specify location
- Screen installations, facilities, assets identify
- Determine properties/facilities/assets most important to the organization
- Rate and rank by relative risk to identify and prioritize installations, facilities, assets most at risk.
Phase II: On-Site Assessments

- Establish Guiding Principles for on-site analysis and standardized process of analysis
- Develop a defined, standardized process for the assessment to provide consistency of comparison across installations, facilities, assets
- Conduct site-specific installation severe weather condition assessments (ISWCA) at high risk locations and assets
- Evaluate vulnerability to local climate and weather conditions/events along with local infrastructure support networks (e.g., roads, power, crisis management)
- Research local climate-related planning efforts for collaboration and synergy
Phase III: Adaptation and Resilience Improvement Plans

- Plans based on findings of the ISWCAs along with prior Asset Management Facility Condition Assessments (FCA)
- Identify technologies to improve robust nature of the building envelop, e.g. paints, windows, stormwater management
- Identify means to improve placement of key equipment, e.g. generators, HVAC
- Identify additional or improved scheduling of maintenance
- Recommend prioritized future facility improvement investments, e.g. landscaping, equipment replacement
- Recommend rough order of magnitude (ROM) costs of investments, e.g. replacement of key building envelop components
- Compile Lessons Learned and share
Summarized Key Guiding Principles

• Integrate climate/severe weather considerations, assessment data, and adaptation and resilience improvement plans into other enterprise, installation, asset planning

• Use results of analysis to inform short and long-term maintenance and continuity of operations documents

• Resilience assessment is an ongoing, iterative exercise

• Facility Climate and Weather Condition Assessments and Facility Condition Assessment data, should be easily available for future planning efforts
Summary of Key Standardized Process Steps

- Conduct in-briefs with high-level overview of background and intent of the assessment and planned use of results

- Gather comments and updates to preliminary information obtained and thoughts, ideas, anecdotal data from SMEs not available in databases

- Assessment team and installation management SMEs consider local and regional:
  - Severe weather impacts
  - Planning efforts
  - Host Nation Code assessments
  - Validate background research
  - Collect anecdotal and other information
Lessons Learned

- Using existing data allows for lower cost of analysis and less controversy
- Review/recheck generally-accepted and locally developed data for accuracy
- Analysis of individual sites requires on-site, face-to-face assessment
- Include local leadership, management and operations SMEs on the team
- Facility condition assessments (FCA) data is effective for aiding development of sound adaptation and resilience improvement actions
Lessons Learned

- Local conditions can accelerate building system degradation and system failures, e.g., salty air, severe weather, drought, sun

- Facility configuration should be evaluated as part of any FCWA, including the location of critical equipment inside and outside a building (e.g., boilers in the basement of a building inside a flood zone)

- Key data can be gained by considering the building size, shape, orientation, landscaping, and local features
High-level Themes

• Keep it simple – It is not easy!
• Develop a common vocabulary for a shared understanding
• Make the approach DART™ (Defensible, Auditable, Repeatable and Transparent)
• Use data and analysis to drive action
• Integrate climate/severe weather plans into other enterprise, installation and local planning/plans
• Use the assessment process as a learning process
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