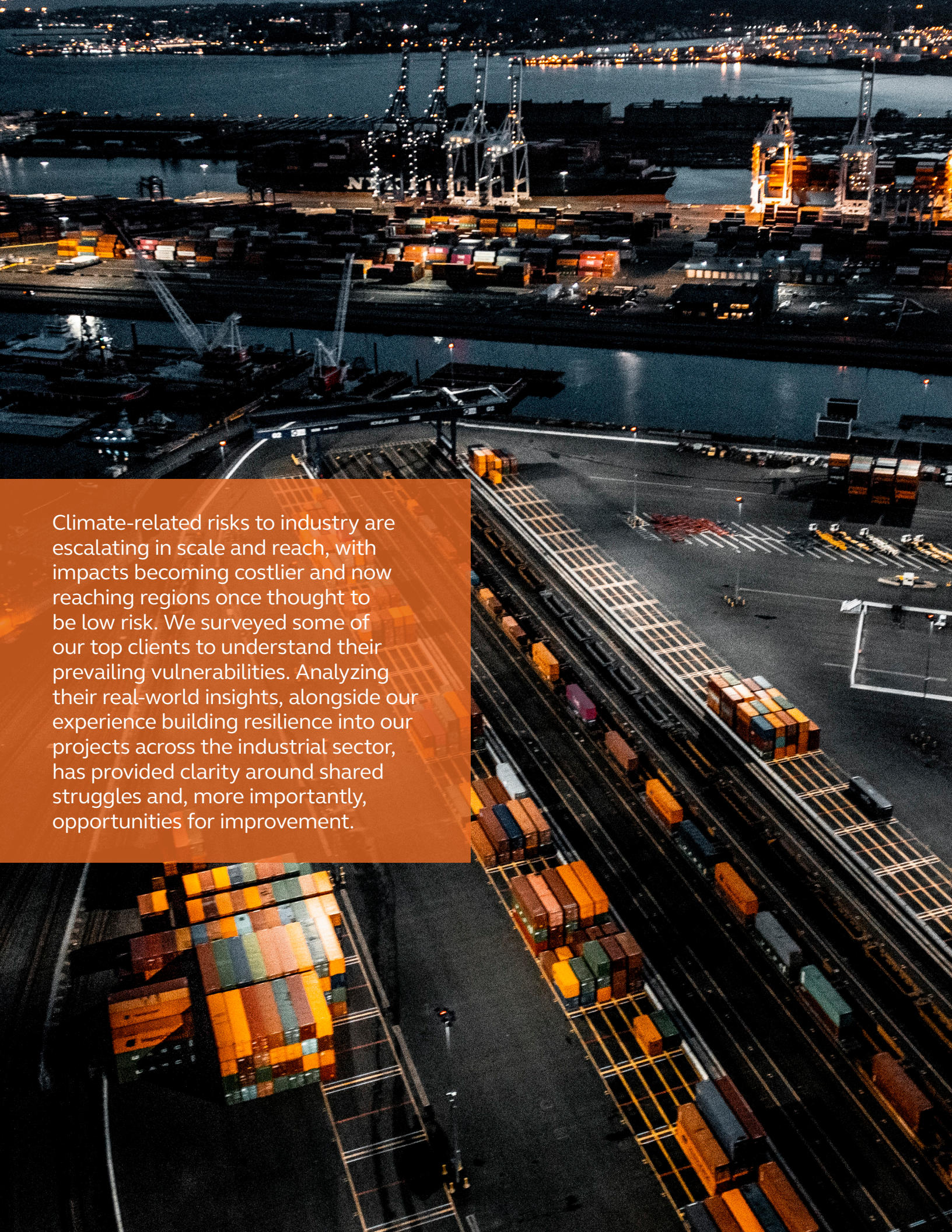


An aerial photograph of an industrial facility, likely a refinery or chemical plant, situated along a body of water. A large ship is being lifted by a crane system, with its hull and internal structure visible. The facility includes several large white storage tanks, a complex network of pipes and walkways, and various industrial buildings. The water is dark, and the sky is a deep blue.

**Building
industrial
resilience
against the
industry's top
climate-related risks**



Climate-related risks to industry are escalating in scale and reach, with impacts becoming costlier and now reaching regions once thought to be low risk. We surveyed some of our top clients to understand their prevailing vulnerabilities. Analyzing their real-world insights, alongside our experience building resilience into our projects across the industrial sector, has provided clarity around shared struggles and, more importantly, opportunities for improvement.

Climate-related impacts are abundant

Seventy percent of respondents experience at least one climate-related impact each year. Flooding is by far the most disruptive – half of our survey respondents ranked flooding as the number one potential impact, and for the remaining half, it rarely fell outside the top two. Flooding is a pervasive problem in North America and beyond; stronger storms reach new regions every storm season. We saw Hurricane Harvey devastate the Gulf Coast in 2017,

Hurricane Ida cut a swath of devastation from Louisiana to New York in 2021, and deadly flooding across the UK and continental Europe in July 2021. Harvey proved just how dangerous flooding impacts can be – the storm knocked out many industrial facilities in the area for 3-6 months, not to mention the catastrophic economic, social and environmental impacts felt by the communities affected by these climate events.

After flooding, we saw smaller differences between the climate event impact rankings, which is likely tied to regional differences and the pace at which they unfold. For example, while wildfires can be just as disruptive as floods, they most commonly impact regions that are less heavily industrialized. Still, drought, wildfire, extreme heat and freezing events all have their own destructive stamps on the industrial manufacturing sector. (Figures 1-3)

What are the most disruptive climate-related events impacting your facility(ies) operations?

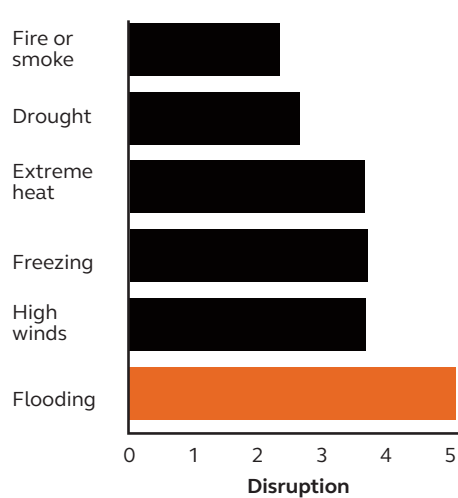


Figure 1

What percentage of your industrial facility(ies) infrastructure is impacted by climate-related events each year?

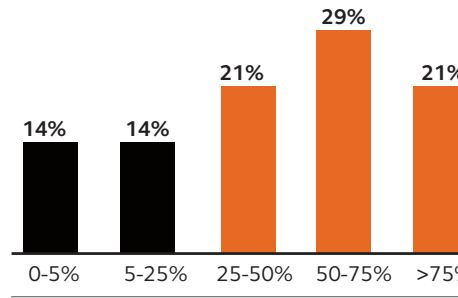


Figure 2

How often do climate-related events impact people and production at your facility(ies)?

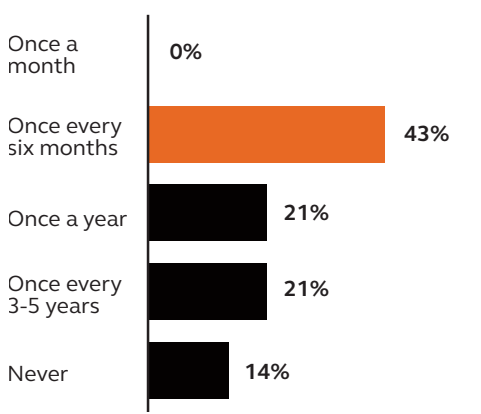


Figure 3

Risk extends beyond the fence line

Planning for the unique vulnerabilities of a facility requires a look both inside and outside the fence line. Outside influences, such as disruption to or failure of power grid systems, water drainage systems, or transportation systems, can be just as disruptive as problems that arise within your property line. In some cases, these outside factors may represent the greatest risk to a facility's continuity of operations. Eighty-six percent of industry respondents have seen climate-related impacts compounded by larger societal or surrounding/supporting infrastructure issues, and most respondents are affected by these kinds of issues at least once a year. Some are affected monthly. (Figure 4)

Similarly, the effect of climate-related impacts does not stop with the facility; impacts outside a facility's region can cause drastic effects on factors like supply

How often are the impacts of climate-related events on your facility(ies) compounded by larger societal or surrounding/supporting infrastructure outside your fence lines?

For example, power grid system disruption or failure, water drainage systems, transportation systems, etc.

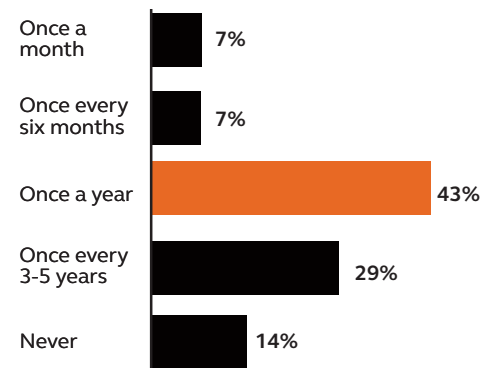


Figure 4

chain. More than half of our respondents have suffered supply chain disruptions caused by climate-related events that are more severe than the physical impacts on facility operations. Of those respondents, half have experienced such disruptions at least once a year; while once- or twice-a-year disruptions may seem manageable, facilities shouldn't consider them an acceptable risk. (Figure 5)

Most importantly, facilities must be prepared for the effects climate-related impacts can have on their workforce. Most businesses will agree that their people are their most valuable asset, and climate events can affect worker morale, well-being and safety, which also extends beyond the fence line. Workforce commuting complications, for example, can be just as disruptive as on-site challenges. Sixty-four percent of respondents noted that climate-related events occasionally, regularly, or constantly cause environmental, health, safety or sustainability concerns for employees. Making people feel safe is paramount to maximizing morale and performance, as well as efforts to attract and retain top talent. While it is tempting

How often are the impacts of climate-related events on your facility(ies) compounded by supply chain disruptions that are more severe than the physical impacts on your own facility operations?

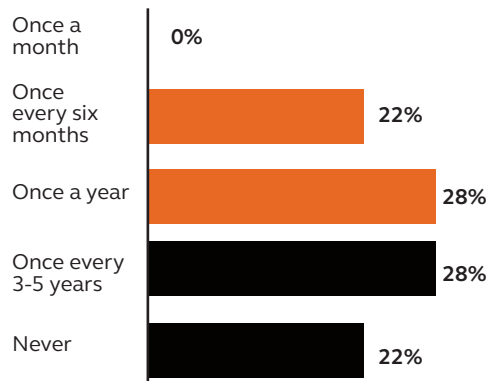


Figure 5

to first focus on protecting your facility, these broader risks cannot be overlooked. (Figures 6 & 7)

Investment levels fail to align with concerns

After seeing the frequency and variety of impacts suffered by clients, it was no surprise that nearly eighty-six percent have serious concerns about potential infrastructure impacts. However, despite respondents noting a more-than-adequate understanding of their asset vulnerabilities, there has only been a moderate impact on their investments. Most respondents felt capital investment strategies were only moderately aligned with making facilities more resilient to climate-related disruptions, with some noting they were barely aligned. (Figures 8 – 10)

The reason behind the lack of dedicated capital might be that too few organizations have a long-term

How often do climate-related conditions negatively affect worker comfort/retention/morale?

For example, difficulty commuting to a facility, power disruptions, or conditions within a facility such as dust or smoke levels, humidity, temperature, etc.

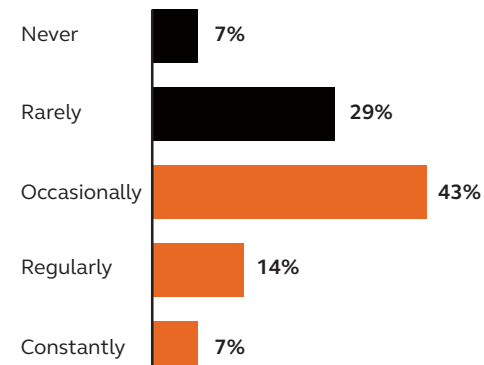


Figure 6

strategy to invest in climate event risk management. Strategies that protect, rather than generate, revenue also have a business case, which can be supported by risk analysis and precedent events that more than justify investment. Communication around strategies is vital to earning stakeholder buy-in and fixing the misalignment between risk and investment levels. (Figures 11-12)

How often are the impacts of climate-related events caused environmental, health, safety or sustainability concerns at your facility(ies)?

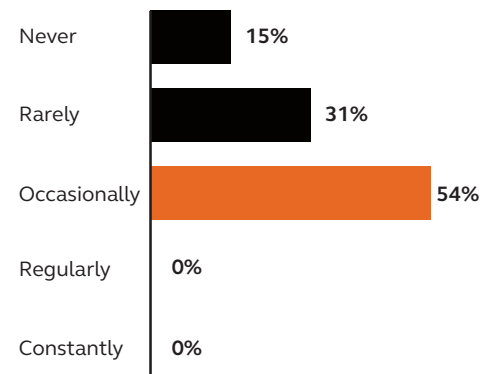


Figure 7

How concerned are you about climate-related infrastructure impacts in your facility(ies)?

Use a scale of 1-10, with 1 being not concerned at all (no expected climate-related infrastructure impacts), 5 being manageable concerns, and 10 being extremely concerned (critical impact imminent).

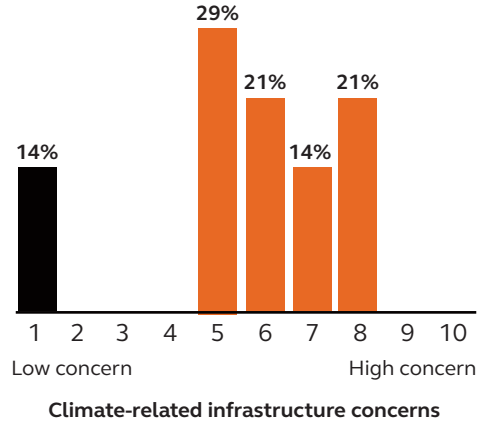


Figure 8

How has risk from climate-related events impacted your investment decisions regarding your facility(ies)?

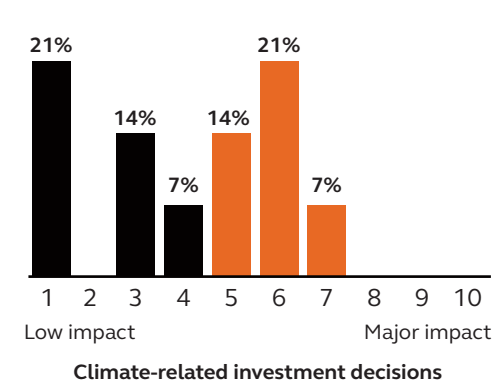


Figure 9

How well do you understand the vulnerability of your assets to climate-related disruptions?

Use a scale of 1-10, with 1 being little to no understanding, 5 being adequate understanding to manage occasional disruptions, and 10 being complete understanding and control of assets in the event of climate-related disruptions.

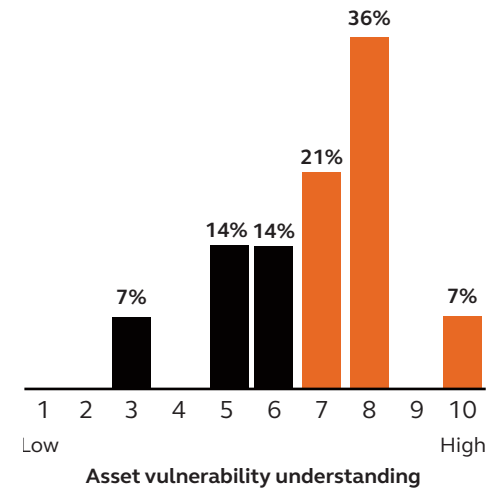


Figure 10

How aligned is your capital investment strategy with making your facility(ies) more resilient to climate-related disruptions?

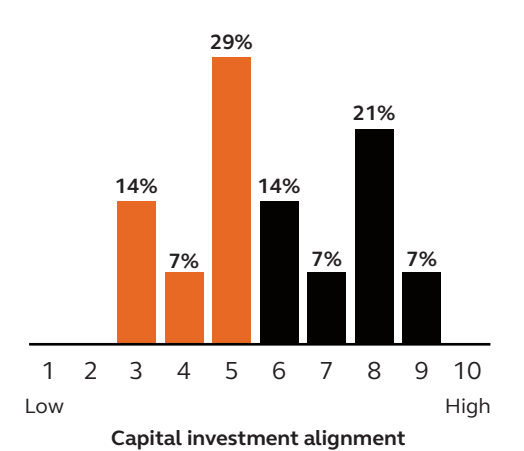


Figure 11

Do you have a long-term strategy in place to make your facility(ies) resilient to climate-related events?



Figure 12

Building a strategy that earns buy-in:

4 essential action items



1. Map the assets, systems, and functions critical to your mission

To most efficiently and effectively allocate resources toward both the assessment process and any future risk mitigation actions, efforts must be continuously and systematically prioritized. The prioritization process should determine both the breadth and depth of focus related to any site, function, system, asset or action evaluation. Criticality mapping provides a mechanism and foundation upon which to improve visibility and build a resource prioritization process.

Asset mapping involves the tiering and prioritization of facilities, structures, functions, systems and assets based on their relative contribution and importance to the mission of the company and its constituents or of the facility, dependent upon the scale of the evaluation. Asset mapping also supports the identification of external and internal interdependencies to ensure that all potential high priority vulnerabilities are identified during the risk assessment, as well as the quantification of potential consequences of direct and indirect impacts to facilities, structures, functions, systems, people and assets. Avoid the tendency to look only at risks to hard assets and those within the fence line; significant events in the surrounding community can jeopardize your mission and endanger the people you rely on to carry it out.



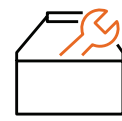
2. Assess your risk

The risk assessment combines the results of the asset criticality mapping and hazard analysis to prioritize assets that are both critical and exposed to hazards based on potential consequences to the facility, company and its stakeholders. Functions, systems, assets and their interdependencies prioritized through the criticality mapping process should be analyzed for consequence of failure in terms of business function, supply chain impacts, restoration costs, risks to health and safety, and other financial liabilities (such as fines), as applicable. The output of this process should be a prioritized list of risks that should be addressed, and the results will be leveraged to develop a viable mitigation strategy and options.

Risk assessment should include the following key elements:

- Identify priority assets (criticality + hazard)
- Assess vulnerability of priority assets
- Risk scoring/ranking
- List viable mitigation solutions

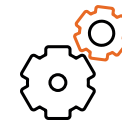
The risk assessment integrates all known information related to historical hazard events and will provide a root cause analysis of those events to better prevent similar impacts in the future.



3. Develop a mitigation strategy

Once the portfolio is assessed and risk allocation is finalized the next step in the process should be to develop a list of mitigation solutions (i.e., a solutions toolkit). These strategies will be informed by the type of vulnerabilities that have been identified for the critical assets across the portfolio. Current industry standard performance criteria for asset protection infrastructure, along with applicable codes and standards, should be established to evaluate and prioritize the risk mitigation level of protection for each site. Site-specific solutions at all, one, or some of the following scales: equipment / asset, structure, systems, facility, grounds and community interdependence should be developed.

Your personnel are equally important in maximizing the value of resilience measures and getting the buy-in for mitigation strategies. They are the ones who will have the most experience with threats and can detail how climate-related impacts reduce productivity. Giving them a voice in the process will lead to more effective designs and smoother implementations. Not to mention, it will create a personal stake that breaks resilience out of its silo and embeds it into company culture – turning resilience from a weakness to a competitive edge.



4. Develop an implementation strategy

Developing an implementation strategy gives teams a finite range to thoroughly explore and plan for potential scenarios. Compared to strategies with limited scopes, such as building to code, deep dives into a defined period keep the focus on maintaining operations through challenging events.

An alternatives analysis is a great tool for prioritizing where to start. It incorporates variables such as available capital, priority assets, and whether the solution will be permanent or temporary, to strike a balance between protection and cost.

Having choices softens financial impacts, and staging approaches can minimize downtime or even keep a facility running through implementations. Phased risk reduction allows companies to protect the most critical assets first while laying the groundwork for a site-wide strategy as part of long-term capital improvement plans. Instead of being seen as a separate effort, resilience building becomes part of ongoing operational processes.

Project phasing recommendations, concepts, cost estimates, benefit cost analysis and return on investment should be developed as part of the implementation strategy.

Substantiated recommendations, prioritized capital investments and performance-based design criteria for application at facilities should be developed and presented to the stakeholders to ensure there is top-down and bottom-up buy-in.



Benefits:

- Measurable reduction in your risk exposure
- Confidence you are investing every dollar in the most important areas to achieve your mission
- Ability to communicate to stakeholders where you are today and what you're doing to reduce your risk level
- Holistic approach to stakeholder buy-in that empowers workforce and community to implement the strategy
- Investor confidence that reasonable measures are in place to protect their investment in your enterprise



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Contact us

Ketan Maroo

Vice President
Industrial Infrastructure

E ketan.maroo@arcadis.com

Matt DeMarco

Vice President
Clients & Business Development

E matt.demarco@arcadis.com

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