

**DEVELOPING A COMPREHENSIVE RESILIENCY
AND RECOVERY PLAN AT VERIZON:
ENHANCING THE CAPACITY TO RESPOND EFFECTIVELY
TO FUTURE SEVERE WEATHER EVENTS¹**

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**DEVELOPING A COMPREHENSIVE RESILIENCY AND RECOVERY PLAN AT VERIZON:
ENHANCING THE CAPACITY TO RESPOND EFFECTIVELY TO FUTURE SEVERE WEATHER EVENTS²**

Jim Gowen is the Vice President, Global Supply Chain Operations and Chief Sustainability Officer at Verizon. He is responsible for the reliable and efficient flow of all materials required for Verizon's wireline business. His Supply Chain Operations (SCO) team meets weekly and includes all of his direct reports. An issue of increasing concern at these weekly meetings is preparing for severe weather events (such as prolonged droughts, hurricanes, floods, and severe rain and snow storms) that might occur anywhere within Verizon's supply chain, starting with production of many components in Asia (about 50%) and ending with delivery of customer services in the United States. The SCO team is concerned that severe weather events are increasing in frequency and severity, especially in the Northeastern and Mid-Atlantic states where Verizon has its largest customer base. Are Verizon's current business continuity and disaster recovery plans adequate to the increasing risk that these weather events pose? The team and related Verizon personnel have learned much recently about reacting promptly and effectively to imminent weather threats, and based upon that education, they have begun to develop a comprehensive resiliency and recovery plan to deal with ever-increasing climate impacts.

Climate Change. Verizon's concern about weather events is well founded. The United States Global Change Research Program indicates that the Northeast and Mid-Atlantic states had a 70% increase in the amount of precipitation falling in very heavy events (defined as the heaviest 1% of all daily events) between 1958 and 2010.³ National Geographic warns that "When large storms hit land, higher sea levels mean bigger, more powerful storm surges that can strip away everything in their path."⁴ The World Bank says that cities in the US with the greatest risk of sea level rise include New York and Boston, both cities where Verizon has a strong presence.⁵ Extreme weather events pose a significant threat to Verizon's business, operationally and financially. The EPA cites a NOAA report that indicates "between 2011 and 2013, the United States experienced 32 weather events that each caused at least one billion dollars in damages."⁶ Historical weather records are no longer

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³ Climate Change Impact in the United States, United States Global Change Research Project, 2014

⁴ <http://ocean.nationalgeographic.com/ocean/critical-issues-sea-level-rise/>

⁵ Climate Change, Disaster Risk, and the Urban Poor: Cities Building Resilience for a Changing World, Judy L. Baker, Editor, The World Bank

⁶ Billion-Dollar Weather and Climate Disasters. National Oceanic and Atmospheric Administration, National Climatic Data Center, 2013.

reliable predictors of future impacts as it has now been predicted that there will be an increase in severe weather events over the next twenty to thirty years.

Munich Re, one of the world's leading reinsurers, found that weather-related losses increased nearly fourfold in the United States from 1980 to 2011. Extreme weather events led to \$560 billion in insured losses during this time period.⁷ Experts predict climate change will continue to intensify the frequency and severity of weather-related events. "Nowhere in the world is the rising number of natural catastrophes more evident than in North America," said Munich Re's head of GeoRisk Research, Peter Höppe⁸.

Current scientific consensus is that the increase in severe weather events is attributable to the accumulation of greenhouse gases in the atmosphere. This man-made phenomenon began with the industrial revolution and has accelerated in recent years. Carbon dioxide is the most pervasive greenhouse gas, but other such gases, although less pervasive, have more powerful effects, e.g., methane. These gases affect climate mainly by trapping heat in the atmosphere, thereby raising the mean temperature on Earth. A higher mean temperature has serious consequences worldwide for food, water, ecosystems, sea level, and more frequent and severe weather events. Most of the changes expected over the next thirty to forty years are already unavoidable due to past emissions.⁹

One-hundred ninety-six nations recently committed to limit the rise in mean temperature to 2° C above preindustrial level by 2100 and to limit the increase to 1.5° C sometime between 2030 and 2050, which will require zero carbon emissions.¹⁰ The success of the 2° C goal is expected to prevent catastrophic consequences for the planet, i.e., a "tipping point"¹¹. Many national and international corporations also have committed to reduce their carbon impact, including Verizon.

Verizon's Contribution to Carbon Reduction. Verizon offers products that reduce its customers' carbon impact and undertakes sustainability initiatives that do the same for itself. For example, its products allow customers to telecommute instead of travel and manage electricity (buildings and grid) and fuel (fleets) more efficiently. Verizon's goal is to reduce its own carbon intensity - the amount of carbon its business emits divided by the number of terabytes of data it transports over its networks — by 50 % over its 2009 baseline by 2020. Its

⁷ North America Most Affected by Increase in Weather-related Natural Catastrophes, Press Release, Munich Re, October 17, 2012.

⁸ Ibid

⁹ National Academy of Science. "Adapting to the Impacts of Climate Change: America's Climate Choices: Panel on Adapting to the Impacts of Climate Change." National Research Council. The National Academies Press: Washington, DC, 2010

¹⁰ 2 Degrees, \$100 Billion: The World Climate Agreement, By The Numbers, NPR, December 12, 2015

¹¹ Defined by the Intergovernmental Panel on Climate Change as "a threshold for abrupt and irreversible change". "Climate change 2014, Impacts, Adaptation and Vulnerability". IPCC AR5 WGII (2014)

sustainability initiatives have reduced carbon intensity to date by 48%, so the goal is in sight. Verizon has done this through data center improvements, copper-to-fiber migrations, green energy investments, building improvements and changes in fleet operations.

Ninety-two percent of Verizon's energy consumption is electricity that drives data through its networks to serve Fios and wireless customers. Six percent of its consumption is vehicle fuels and two percent is electricity for buildings, etc. Verizon has invested heavily in fuel cells and solar energy at numerous facilities. Approximately 2,000 vehicles in its fleet are powered by compressed natural gas (CNG), hybrid or full-electricity¹²; fuel use is optimized through its Networkfleet product.

Verizon's and other corporations' efforts to reduce carbon emissions will contribute to long-term climate stability. However, most scientists believe that severe weather events actually may increase in severity and frequency over the next twenty to thirty years before they begin to subside. Thus current sustainability initiatives to reduce carbon emissions over the long-term must be supplemented with plans to deal effectively with near-term severe weather events. Verizon has developed effective business continuity and disaster recovery plans to deal with current weather threats. They are essentially reactive in that their goal is to identify threats as early as possible and respond to them as quickly as possible to assure minimal disruption of supplies and services to customers. They operate within a given capability and configuration of human resources and physical assets, but can these resources and assets be developed and configured differently to enhance existing business continuity and disaster recovery plans? Planning of the latter type is anticipatory rather than reactive and is intended to develop Verizon's ability to respond more effectively to future and likely more severe weather events.

Verizon Supply-Chain Operations. Verizon is a multi-billion dollar corporation. Its wireless business revenue was \$91.7 billion in 2015 and its wireline business (traditional voice and Fios) was \$37.7 billion¹³. Viju Menon is the Senior Vice President, Global Supply Chain and responsible for Verizon's end-to-end supply chain across all business units. Jim Gowen has global supply-chain responsibility for the wireline business. His five direct reports meet weekly at the SCO staff meeting to collaborate, but they also work together on a daily basis to monitor and manage supply chain activities. Each director has several lower level/operational managers reporting to him/her. (See organization chart below in Figure 1).

¹² <http://www.tlimagazine.com/sections/trucking-and-freight/2037-verizon>

¹³ 2015 Annual Report, p. 14.

Jim Gowen is also Verizon's Chief Sustainability Officer, and meets monthly with the Sustainability Team, but is involved in some day-to-day sustainability aspects. The Sustainability team, headed by a manager, has six members. In addition to meeting monthly with the CSO, it meets biweekly to address different areas of Verizon's sustainability program. The sustainability team has been asked to develop a comprehensive resiliency and recovery plan for SCO to deal with ever-increasing and severe weather events.

Figure 1. Organization Chart for Verizon's Global Supply Chain Operations (SCO)



Verizon's Wireline Supply-Chain. Manufacturers in the wireline supply chain provide Verizon with essential Fios components for services (video, Internet, voice) that Verizon offers mostly to its residential customers (95%). Basic Home Routers (BHRs) are supplied by a contract manufacturer in Kunshan City, Jiangsu Province, China, but all other components (e.g., set top boxes, network equipment, optical networks, cables, network cards, remotes) are supplied by vendors who presumably also make these components for Verizon's competitors. Most of these vendors make these components in China or Taiwan, but usually ship them to Verizon from their

U.S. plants. Minor material like nuts, bolts, jumpers, tape, ladders, and miscellaneous material comes from a telecommunications components distributor in Pennsylvania and a fastener distributor in Virginia.

All of these components are shipped to regional distribution centers (RDCs) that serve customers in the Northeast and Mid-Atlantic states (MA, RI, NY, NJ, DE, MD, DC, VA). There are two RDCs in the US, one in Lewisberry, PA and another in Grapevine, TX. There is also an RDC in China where BHRs are staged for shipment to the US, mainly by sea, but occasionally by air.

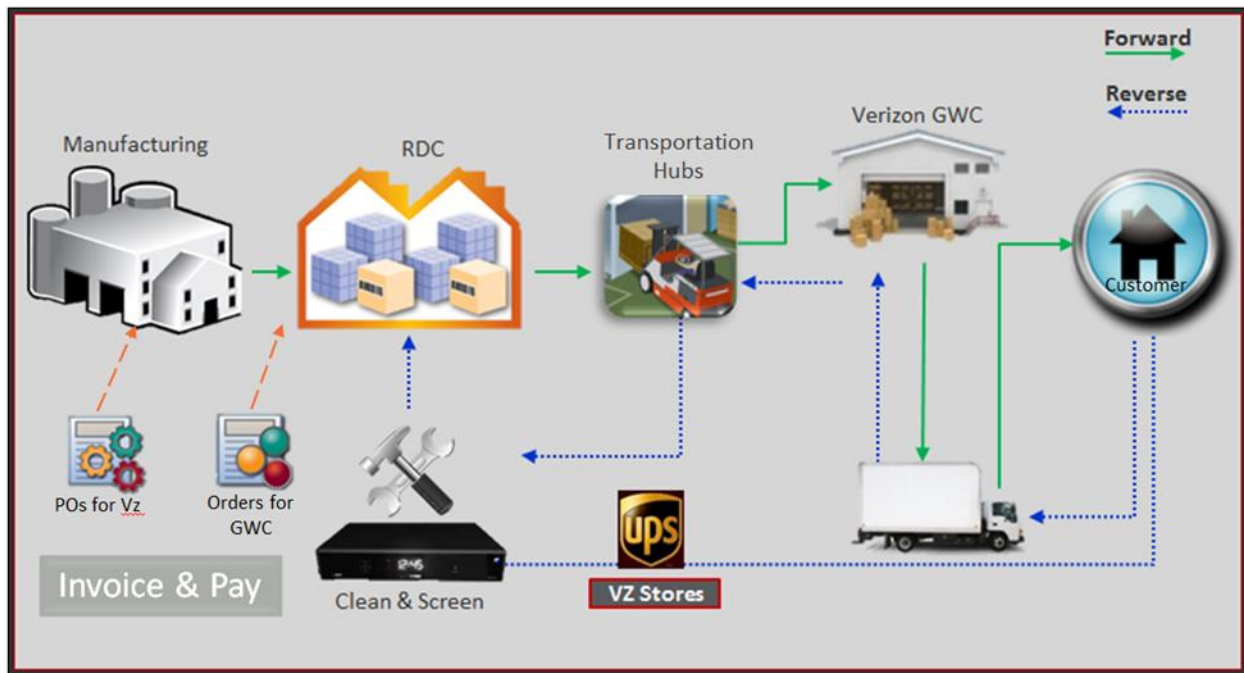
There are four transportation hubs in the U.S. These are staging areas where supplies from one transport vehicle are loaded directly onto another, with minimal or no warehousing. They are located in Lewisberry, PA, which services PA, DE, MD (hub transfer point in Oakdale, PA); also, Edison, NJ, which services NJ; Piscataway, NJ, which services MA, RI, NY (hub transfer points in Holbrook, MA and Syracuse, NY); and Ashland, VA, which services DC, VA.

There are about 400 Garage Work Centers (GWCs) in the U.S. There is at least one GWC in every state where Verizon provides Fios service, but in some states, there are many GWCs. Technicians receive orders from new or upgrading customers, and pick up their trucks and components at the GWCs.

Technicians also have to provide repair service to customers during major storms in order to get their phone lines or Fios systems up and running. The most vulnerable components that need to be replaced are outside the home, such as poles, pole hardware, fiber drops, optical network terminals, etc. RDCs can order components like these from vendors in advance of a forecasted storm.

There also is a reverse logistics or closed-loop portion of the supply chain that is shown along with the forward portion in Figure 2 below.

Figure 2 Verizon's Wireline Global Supply Chain Operations



Verizon requires its suppliers to agree to its Supplier Code of Conduct¹⁴, which commits them to high standards of ethics and conduct, human rights of workers, health and safety, and environmental responsibility. The supplier engagement member of the sustainability team works with a third party to regularly assess Verizon's suppliers on their CSR (Corporate Social Responsibility) conduct and helps them create a plan for achieving new goals.

Business Continuity and Disaster Recovery. Business Continuity/Disaster Recovery (BC/DR) is part of Business Operations, which is located within the Global Supply Chain (GSC) organization. It focuses on preparing for imminent severe weather events rather than planning for the long-term consequences of climate change. On a daily basis, the BC/DR manager receives an update from the Verizon Global Event Management Center in Cary, NC. The update includes weather events ranging from the current weather outlook to severe tropical storms, tornado outlook, volcanic activity, wildfires, flooding, earthquakes, and even space weather.

¹⁴ <https://www.verizon.com/about/sites/default/files/Verizon-Supplier-Code-of-Conduct.pdf>

If a weather event becomes more prominent, the BC/DR manager will receive a more specific update for this event such as a hurricane or major winter storm. The update will provide information on the anticipated impact of the storm and how it will likely impact Verizon operations. If it looks like the event will impact Verizon operations significantly, the Global Event Management Center will direct GSC to implement the Stormcon checklist. The checklist ensures that GSC works in concert with other business units to prepare for the weather event. The Stormcon checklist (Stormcon 0-5) assures that certain activities are completed in preparation for the storm as well as for post-storm recovery. The checklist is updated at least annually plus an annual exercise is held to run through various weather scenarios to test the checklist.

If a particular facility designated as a critical center is negatively impacted by the event, then that facility's Critical Center Plan would be initiated. Depending how long the facility is unusable will determine if the people and/or work need to be relocated.

If there is a severe event that catastrophically impacts the network (like Superstorm Sandy), then GSC would implement the Emergency Management Plan (EMP). The EMP would provide guidance on how to establish the Emergency Operations Center (EOC) from office supplies to the command structure.

Also on a real-time level, GSC uses a system to identify any interruptions to the manufacturing and transportation of materials overseas and domestically. The system identifies significant weather (e.g., typhoon) and man-made events (e.g., labor strike, riots) that could significantly impact the supply chain and allow GSC to make alternate arrangements if possible.

A Comprehensive Resiliency and Recovery Plan. The development of such a plan requires understanding what resiliency or resilience means and how it differs from recovery, as well as understanding what the essential elements of a comprehensive plan are. Resilience is a capability, personal or organizational, while recovery is a return to a previously existing state following a disturbance. Like recovery, resilience includes a return to a previously existing state, but with it, learning occurs before, during, and following the disturbance so that responses to future disturbances will be more effective. When applied to a plan, resilience is anticipatory of what might happen rather than reactive. It is also at least partly improvisational rather than completely predetermined.

A comprehensive plan will require Verizon to expand the scope of its plan beyond its formal boundaries to include other private as well as public sector companies. Severe weather events (hurricanes, blizzards, floods) can wreak havoc over wide geographical areas, affecting all institutions, public and private, within them. When such events occur, these institutions may close or operate at reduced capacity. Roads may be impassable and

power grids impaired or completely shut down. Also, essential data may be lost due to equipment loss or failure. The public and private sectors have a symbiotic relationship. For example, state and local governments keep roads open; public and private utilities keep electric power grids operating. The private sector needs such services in order to continue operating. Verizon, for example, can't repair its towers unless it can access them, and needs a functioning power grid to keep its data systems running. Conversely, the public sector needs the private sector, especially companies like Verizon, to keep providing telecommunication services to government officials and employees and to citizens. Companies that engage early with government on climate change impacts can positively influence public policy and the development of new services.

A comprehensive plan must also be an integral part of Verizon's strategic plan and its strategic planning process. Verizon will look very different in twenty to thirty years so its businesses, locations, buildings, and technology will be different, and an opportunity exists to invest in order to mitigate climate risk and enhance adaptive capability. Like the majority of large U.S. corporations, Verizon does not mention climate risk in its 2015 Annual Report.¹⁵ This will likely change soon, however, if severe weather events continue to increase in intensity and frequency, and investors demand more information on climate risk from publicly-traded companies. Addressing climate risk explicitly might encourage Verizon to require engineers to design future buildings with more robust construction materials and design standards. Verizon also might re-locate facilities based on vulnerability to weather conditions, allow redundancy in the supply chain, avoid clustering facilities in vulnerable locations, etc. Technology will likely improve long-term weather forecasting so that Verizon can prepare earlier and better for severe weather events.

The sustainability team must consider all of these attributes and more in designing a comprehensive resiliency and recovery plan for Global Supply Chain Operations. Answers to the questions below will help them in accomplishing their task.

¹⁵ The SEC has required such disclosure since 2010, but has not rigorously enforced it. A 2013 survey showed that 73% of publicly traded companies did not mention climate risk in their annual reports.

<https://insideclimatenews.org/news/20130919/most-us-companies-ignoring-sec-rule-disclose-climate-risks>

Questions for Analysis

1. What investments in physical assets and/or human resources should Verizon make to increase its capability to anticipate, adapt to and recover quickly from severe weather events? How might these assets and resources be organized or configured to enhance resilience?
2. What capabilities should Verizon employees and those at other companies, especially suppliers, and at government agencies develop, and what roles should they play in a comprehensive resiliency and recovery plan?
3. What relationships and/or communication channels might facilitate joint learning across the above-mentioned organizations so that responses to future weather events continually become more effective?
4. What does the sustainability team need from the CSO (or higher levels) in order for this plan to be accepted and implemented?
5. What key performance indicators could Verizon's sustainability team track to understand the success of implementing a comprehensive resiliency and recovery plan?