# EMERGENCY COMMUNICATIONS AND EXTREME WEATHER

## OVERVIEW

More states, tribal lands, and territories are experiencing uncommon weather phenomena in their regions. Emergency communications practitioners may not have previous response or mitigation expertise as a result. **This resource aims to familiarize practitioners with the impacts of extreme weather on emergency communications.** Some weather events may also produce multiple kinds of extreme conditions, resulting in compounding and concurrent communications concerns.

## EXTREME WEATHER IMPACTS ON EMERGENCY COMMUNICATIONS

Statewide Interoperability Coordinators (SWIC) and Emergency Support Function (ESF)-2 personnel from areas that have experienced these weather events provided the following considerations and expectations for the impacts of extreme weather on emergency communications. Where applicable, mitigation and prevention best practices are mentioned.

### Extreme Winds

- High winds can blow microwave dishes and other antenna apparatus out of alignment, resulting in a lost connection to the system core and disruptions to communications systems.
  - MITIGATION: Set up backup paths for redundancy (e.g., multiple microwave paths, fiber, cellular, and satellite)
- High winds can bend cross-braces, resulting in a permanent frame weakening and requiring the replacement of the entire brace.
  - MITIGATION: Ensure that industry standards[1] and manufacturer guidance and procedures are followed during antenna installation.

### Extreme Heat/Dry

- Dry, cracking soils could damage tower guyed wire anchors, making tower grounding less effective.
  - MITIGATION: Periodically water the ground plane around tower site(s), as water resources allow. Inspect guy anchors as heat could have shifted the concrete base.
- Lightning during extreme heat puts vegetation around towers at risk of fire.
  - MITIGATION: Follow the R56 Standard for grounding the equipment and tower locations. Sufficiently clear the area around towers.
- Prolonged heat can cause failures in mechanized systems, seals, and gaskets.

### Extreme Flooding

- Six inches of flowing water can knock someone over. Twelve inches can move vehicles. Sixteen inches is enough to float a semi-trailer.
- Access is the biggest concern after a flood.
  - MITIGATION: High-water vehicles (HWV) or helicopters are the safest transportation options. They can carry portable radio sites and repeaters to supplement coverage in blackout areas.

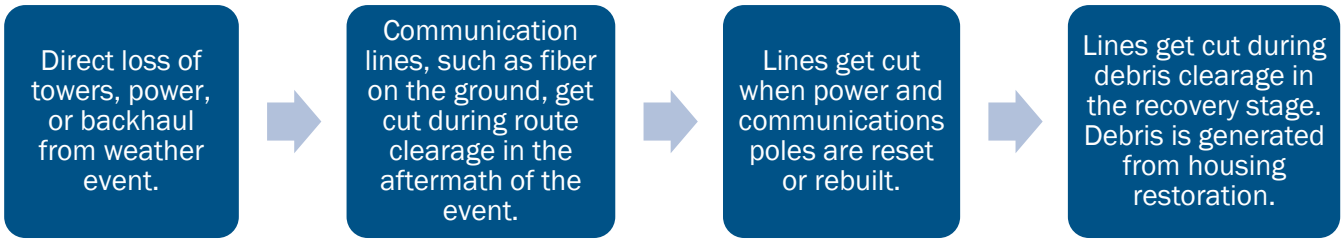
### Extreme Cold

- Power poles are subject to the same ice loading concerns as towers.
  - MITIGATION: Structures should meet ice loading specifications according to their ice zones[1].
- When fiber is encased in ice, the only solution is to wait. Attempting to melt or chip off the ice can damage the cables underneath.
  - PREVENTION: Fiber is safest when installed underground.

[1] Related tower standards are covered in several standards including TIA-222, TIA/ANSI-322, and TIA-5053.

## Phases of Communication Loss

Weather-related communications outages occur in predictable patterns that are hard to avoid. Understanding and anticipating these phases of loss will better position you for recovery.




## Re-Establishing Communications

### *Access*

Weather and its aftereffects do not just disrupt communications but also hinder re-establishment. Routes towards the problem sites may be inaccessible after a severe weather incident, so coordination with the Emergency Operations Center (EOC) or Central Coordination Group (CCG) can circumvent issues. CISA Action Coordination Request letters are helpful but not guaranteed to be accepted in affected areas. Advise those who require access to remain in contact with the EOC and to arrive with identification and marked vehicles, especially if they are subcontractors.

- If the issue is debris, the local public works and county-level operations representatives can coordinate removal.
- If the issue is a barricade set up as a security measure, the ESF-13 and law enforcement representatives can coordinate permission for access.
    - NOTE: This will not work while the barricade is a life-saving measure.

### *Damage Assessments*

Site inspections can be dangerous near the end of or after an extreme weather event. Maximize access opportunities by sending a repair team comprised of all necessary professionals (electrician, mechanic, technician, driver, etc.) during initial asset assessments to handle quick (15 – 20 minutes) fixes. Bigger repair jobs may be cataloged for later to prevent an assessment slowdown. Use Civil Air Patrol or uncrewed aerial systems (UAS) to inspect damage to towers, antenna structures, and other elevated assets.

Assessments could also be complex and unrewarding. For example, icy conditions can obscure damages underneath, in which case the only course of action is to wait. The weather event could also have damaged traditional navigation assistance like street signs and landmarks, which can hinder locating physical assets for inspection. Maintaining GPS addresses for assets and relying on local expertise of the affected areas can mitigate these conditions.

Beyond technical aspects, the assessment team should also understand the costs associated with reparations and damage assessments. The team should collect damage assessment information according to ESF-17 (Damage Assessment), determine net losses for public assistance category expenses, and submit the information to ESF-5 (Information and Planning) while directing them to priority concerns. Field intelligence is necessary for communications organizations to understand the extent of damages and quickly allocate storm restoration crews.

### *Power*

Loss of power is the most common issue that obstructs communications during extreme weather. Reliable backup power and power planning (considerations such as fuel versus electricity, how long does the backup need to last, etc.) will help mitigate the loss. Re-establishing power is a conversation best facilitated through the public utilities' organization of your state or territory. Communicate your priorities to the ESF-14 and public utilities representatives in your EOC or CCG team

in preparation for that conversation. Their established relationships with power companies will make them more effective at conveying these priorities.

- If loss of power is due to a generator, then preparation may be the best defense against future generator loss. Follow the manufacturer's guidance for properly maintaining your generators.
- BEST PRACTICE: Prepare mobile power generation equipment for deployment to blackout sites as access allows.
- READ: CISA's Communications Dependencies Case Study: 2020 Midwest Derecho describes power outages as a result of extreme weather conditions.

### *Backhaul*

Like power, re-establishing backhaul requires communication between emergency managers and network providers through the CCG. Remember that backhaul outages may intrinsically be tied to power outages, and the primary provider's backhaul may belong to a different vendor. Maintaining awareness of interconnectivity between the carriers and encouraging representation from all vendors is critical for restoration.

## ADVICE FOR IMPROVING RESPONSE

SWICs and ESF-2 personnel recommended the following actions to take before, during, and after an extreme weather event impacting emergency communications.

### Before

- Develop a working relationship with all necessary entities (i.e., repair staff, government ESF-2 personnel, etc.) during blue-sky conditions to make coordination easier during response.
- If your agency uses satellite communications, understand your capabilities: where the satellite equipment resources are, who owns them, who can transport them, who can utilize them, and who can train others on how to use them.
    - Satellite-based voice communications (i.e., satellite phones) are a viable backup option if an extreme weather event causes severe damage to earth-based infrastructure that would otherwise result in a total loss of communications. Some vendors have subscription plans as well.
- Memorialize and socialize policies that allow local emergency management coordinators to directly reach the state without relying on cellular coverage. Damage reports and situational awareness may be delayed otherwise.
- Keep an inventory of equipment. Include expected functionality, make, model, configuration, and life cycle.
- Confer with neighboring states to share regional-specific best practices and lessons learned.
- Confirm which entities need to be in the ESF-2 unit and the contributions and limitations for each. Establish an organizational chart and a clear leader—preferably the state communications coordinator—who will support restoration and recovery.
- Train and empower a cache of Communications Unit Team Leaders (COML) to independently improve field response by easing burdens through effective communications planning (i.e., radio network overloading) so that you can focus on more significant issues. Establish clear expectations for checking in with the EOC or coordinating with other COMLs to reduce duplicative efforts.
- Subscribe to CISA's suite of Priority Services – Government Emergency Telecommunications Services (GETS), Wireless Priority Service (WPS), and Telecommunications Service Priority (TSP) – to ensure wireline and wireless calls are completed despite network congestion in functioning communications networks and ensure critical voice and data circuits are prioritized for repair.
- Identify which circuits are critical to your mission and have TSP restoration priority applied prior to an outage so your service provider knows to restore those before other services that don't have TSP.
- Develop a Primary, Alternate, Contingent, and Emergency (PACE) plan. If technical assistance is needed to develop these plans, please reach out to your region's Emergency Communications Coordinator.
- Test plans with functional and tabletop exercises to strengthen the resiliency of your communications systems.

- Train personnel before field deployment to minimize hazards to life and property. This applies to both disaster response personnel and office-based personnel who may be required to participate in some circumstances.

### During

- Set up an information-sharing workspace in the EOC (i.e., a very large whiteboard in-person, a shared document or dashboard when virtual) for real-time recording of successful and unsuccessful response, recovery, and restoration attempts. This will aid in capturing best practices and lessons learned for the after-action report.
- Make coordination calls using GETS and/or WPS when network congestion impacts communications.

### After

- Do not assume everything is working in the immediate aftermath of the incident. Verify your assets once safe.
- Use Civil Air Patrol or UAS to bring coverage to an area by flying an airborne repeater.
- Proactively share information with the external teams (e.g., federal, out of state/region) who arrive to assist the affected area: system documentation (i.e., detailed information on provider contacts, Internet Protocol network topography, and any necessary programming data), the locations and mission-criticality of radio assets, and key personnel to contact.
- Use translation services and universities to navigate language and cultural differences in impacted communities that may influence response. For example, if the affected region has tribal nations, dialect differences could impede information exchange and dissemination. Additionally, lands and symbols of cultural significance may require special attention during the recovery phase.
- If relocation of critical sites is necessary and your service provider cannot promptly install needed communications, consider requesting TSP provisioning priority to expedite the installation of the services.

## WEATHER RESPONSE TOOLS

This table describes resources that emergency communications professionals use to anticipate and respond to extreme weather events.

***Table 1: When and how to use weather response tools to assist with emergency communications planning and response***

| Tool | Timing | Description |
|---|---|---|
| GETS, WPS, TSP | Before, During, After | GETS and WPS prioritize wireline and wireless calls when networks are degraded or congested but still maintain some functionality. GETS/WPS is useful not just for response and recovery calls but also for coordination and planning calls. TSP prioritizes the installation and repair of critical voice and data circuits supporting operations. |
| Tactical Weather Reports | Before | Also known as Spot Forecasts. Call your local National Weather Service office for weather support for a specific theatre where you conduct operations (i.e., a riverfront). They will warn about imminent impacts from severe or extreme weather conditions, enabling quick de/mobilization depending on the forecast. They will direct reports to the asker. |
| Roll Call | Before, After | Roll Call is a Federal Communications Commission (FCC) and Federal Emergency Management Agency service that can help identify specific public safety or critical infrastructure systems outages resulting from a disaster. |
| Disaster Information Reporting System (DIRS) | During, After | This FCC service infers impacts on communications by understanding the active conditions of energy, electricity, and backhaul connectivity systems. The percentage of cell sites down, areas of downed sites, and damages to those sites may indicate similar potential impacts to land mobile radio sites. |

| Tool | Timing | Description |
|---|---|---|
| Situational Awareness Dashboard(s) | During, After | • Use a GIS platform to map tower sites and coverage manually and in real-time to provide decision-makers and responders with visual and actionable status updates.<br>• Create a dashboard that tracks the availability of communications resources (i.e., talk groups, channels) to help prevent conflicts and downtime.<br>• Use electronic damage assessment tools to quickly collect and share damage assessment data with relevant agencies. |

## SPACE WEATHER

NOAA tracks three kinds of space weather that impact communications.

1. **Radio blackouts** modify or completely block skywave transmissions, including high-frequency (HF) radio communication (between 3 to 40 megahertz). Impacts occur on the dayside region of the Earth and can last for minutes or up to 3 hours depending on the intensity of the originating solar flare.
2. **Geomagnetic storms** can degrade power grid performance, interfere with HF radio propagation, or affect long-distance conductive cables (e.g., copper). An intense storm can last for days, but sporadic outages or hours-long downtimes are more common.
3. **Radiation storms** primarily affect satellite communications but can cause HF blackouts in the Earth's polar regions. In all cases, outages of days to weeks and complete loss of the satellite are rare but possible.

NOAA ranks space weather events on a scale from 1 to 5, similar to the hurricanes scale, and describes corresponding effects on communications. An explanation of the scaling criteria can be found on NOAA's website.

### Mitigating Communications Impacts from Space Weather Events

- Cellular and public safety line-of-sight radio networks (i.e., very-high and ultra-high frequency [VHF, UHF]) should experience little to no impact from space weather as long as power is available.
- Digital HF signals are less susceptible to noise than analog HF signals. If voice communications are impacted, try using digital HF email.
- The effects of **radio blackouts** are most substantial at lower frequencies and move to higher frequencies as storm intensity increases, so higher frequencies will be the first to recover. Check the higher bands for openings in the maximum usable frequency and communicate on those frequencies instead, if authorized and able. Using high power will also help, if authorized.
- **Geomagnetic storms** affect higher frequencies first, so try communicating on lower frequencies.
- Groundwave and near-vertical incidence skywave communications may be an option if you need to communicate over short ranges via HF.
- An uninterruptable power supply that can compensate for under- and over-voltage conditions can protect equipment from voltage irregularities during a severe or extreme event.
- Using HF relays and internet gateways to communicate to destination stations may improve success.
- Using services with access to multiple satellites can improve resilience.

Visit CISA's Extreme Weather and Climate Change website for more extreme weather actions and resources.

For inquiries about this document, contact us at ECD@cisa.dhs.gov.