



TREND ANALYSIS

Emergency Preparedness: Secondary Hazards Associated with Severe Winter Weather

April 1, 2013

TREND

The review of seventeen winter and ice storm after action reports (AARs) housed in the Lessons Learned Information Sharing document library shows that many jurisdictions experience similar secondary hazards during severe winter weather events. Key issues that responders are likely to encounter during a winter and/or ice storm are:

- Power Outages
- Road Closure
- Downed Trees and Power Transmission Lines
- Responder Communications Issues
- School Closure
- Warming Station Required
- Shelters Required
- Phone Service Outages
- Water Distribution Issues
- Public Transportation Closure

The findings and recommendations listed in this document can help emergency managers and responders prioritize available resources to best prepare for severe winter weather events.

| 2006-2011 Winter Fatalities and Damage Cost | | |
|---|-------------------|----------------------|
| Year | Winter Fatalities | Damage (millions \$) |
| 2006 | 17 | 571.00 |
| 2007 | 16 | 101.23 |
| 2008 | 21 | 951.59 |
| 2009 | 28 | 341.56 |
| 2010 | 21 | 348.31 |
| 2011 | 17 | 133.06 |

Note: 2012 data not available

(Source: [NWC Office of Climate, Water, and Weather Sciences](#))

DESCRIPTION

The National Weather Service (NWC) refers to winter storms as the “[Deceptive Killers](#)” because most storm associated deaths are caused by secondary hazards. These hazards include extreme low temperatures, snow, strong winds, icing, sleet, and freezing rain.

During storms, people may die in vehicle accidents or of hypothermia from prolonged exposure to cold. Further, unsafe use of heaters, generators, grills, or other gasoline, propane, natural gas, or charcoal-burning devices can cause fires and carbon monoxide poisoning. (Please refer to Appendix A for additional information on winter weather fatalities)

Winter storms can range from a moderate snow over a few hours to blizzard conditions that lasts for several days. Snow and ice accumulation and strong winds can stop the influx of critical supplies to a region; disrupt emergency and medical services; and bring down trees, electrical wires, telephone lines, and communication towers. Storms near coastal areas also

can cause flooding and beach erosion.



AAR Sample

The LLIS team reviewed seventeen AARs related to snow and ice storm emergencies to develop this Trend Analysis. These AARs refer to winter weather events ranging from December 2006 to January 2012. Ten AARs refer to snow storms while seven are related to ice storms. The majority of these AARs focus on response operations taking place in a county, two describe state-wide response operations, and two refer to operations in metropolitan areas.

The review of these AARs found that impacted jurisdictions experience recurrent secondary winter storm effects. The graphic above displays the ten recurring issues identified as well as the number of AARs listing these effects.



(Source: National Oceanic and Atmospheric Administration)

Trends and Recommendations

Power Outages

Power outage issues are described across all the seventeen AARs, making this the most frequent winter storm hazard experienced by jurisdictions. In most cases, the AARs report

that the loss of power was caused by downed trees and power lines.

The AARs indicate that power outages can negatively impact response operations. For example, a 2006 winter storm AAR reports that the local Police Department, Emergency Operations Center, and National Weather Service had to utilize backup generators to operate during the severe weather event. Similarly, during a December 2008 ice storm, “the EOC was not usable due to lack of power including standby power”

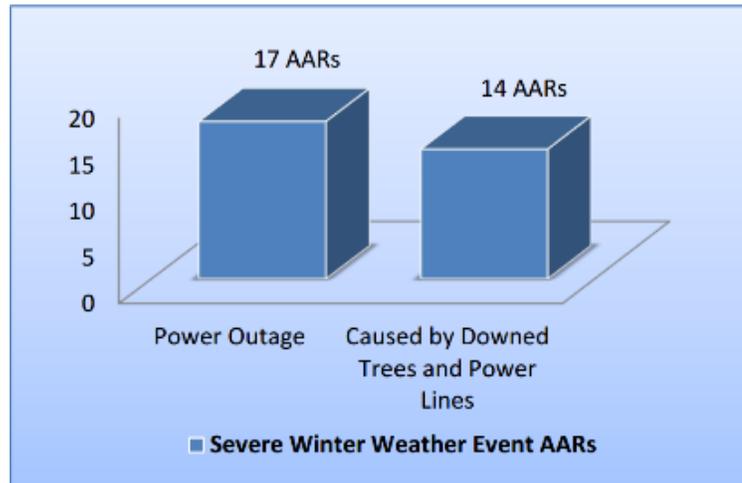
and during an October 2011 storm, “Numerous critical infrastructure and key resources facilities were without power for extended periods including the Police HQ, two Fire Stations, the Waste Water Treatment Facility, three city communications towers, Streets Department HQ, Public Works HQ, Transit HQ, numerous schools, and Parks & Recreation HQ.”

Power outages also can have negative cascading effects on delivery of other critical services and can intensify existing health and safety risks for responders and the whole community. For instance, loss of electrical power can hinder distribution of food, water, and fuel supplies in a jurisdiction or region. A February 2009 ice storm AAR reports that, “the electrical outage cascaded into problems with water distribution” for an entire district. In addition, “due to the power outage, the [local university] campus network and phone lines could not be used and no building alarms were able to be monitored.”

Finally, limited access to backup power during power outages can lead to loss of lives in hospitals and nursing homes, and chaos in coordination facilities such as airports and train stations. A 2006 winter storm AAR, for instance, states that the local chapter of the American Red Cross (ARC) responsible for managing mass care in 18 adjacent counties did not have backup generators available throughout the storm. This hindered ARC’s ability to provide essential services to a large section of the local population in the impacted region.

The AARs identify a number of areas for improvement related to managing power outages, including:

- “Identify facilities across City that should have the capability of being supported by a portable generator.”
- “Work with City Utilities and Electric Cooperative partners to establish power priority procedures to attempt, when possible, to restore power to essential facilities during times of emergency or disaster.”
- “Investigate feasibility of backup power supply or at the very least a redundant power supply from two different zones.”
- At schools, universities campuses, and other essential facilities, “There should be several portable generators available. Some portable generators can be powered by multiple fuels including gasoline and natural gas.”
- “Determine the viability of developing a list of residents who have portable generators willing to loan them to other residents during an emergency.”



Road Closure

Road closure is mentioned in 14 out of the 17 AARs. In most cases, the AARs state that road closure was due to snow and ice built up on primary and secondary roads. In some cases, downed trees or tree branches, utility poles, and electrical lines are also cited.

The AARs indicate that, in many instances, extensive road impassability hindered response operations. According to a 2007 winter storm AAR, many emergency responders had to travel through difficult and dangerous roads to assist storm victims and perform response operations.

In some cases, this meant that “help might not be available if the rescuers themselves ran into trouble.” Further, “other key staff worked from home because they were snowed-in and unable to travel. Many staff slept in their offices or even in their vehicles when a few minutes could be found.”

The AARs include the following recommendations, among others, related to road closure issues:

- Jurisdictions “should review its current policies to mandate certain approaches for snow and ice removal and to ensure that sufficient chemical additives are stockpiled.”
- “Work with local officials to enhance shelter capabilities in communities likely to harbor travelers” and “When possible, locate ends of large closures in larger communities with more capacity to harbor travelers.”

Downed Trees and Power Transmission Lines

Issues related to downed trees and power transmission lines are cited in 14 out of the 17 AARs. These AARs generally refer to downed trees and power transmission lines as underlying causes of other secondary hazards, including power outages, road closures, debris removal issues, and restoration challenges.

The AARs indicate that it was generally challenging to collect information on trees and downed lines during response and recovery operations. Public works and utility companies often worked in dangerous conditions for long hours to restore power and clear roads for emergency vehicles. Further, utility and tree trimming and chipping crews were often contracted from adjacent localities through prior agreements. To address issues related to downed trees and power lines, the AARs include the following key recommendations:

- “Formalize the information needs and communications strategy to coordinate across agencies. (Police, Fire, EMS, Public Works, Utilities)”

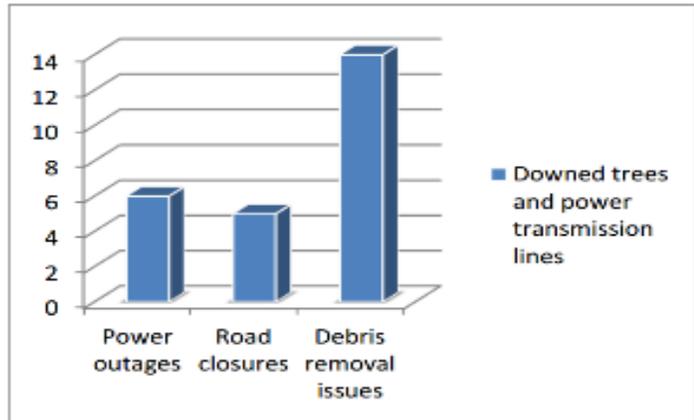
According to the [U.S. Department of Transportation Federal Highway Administration](#) (DOT FHA), over 70 percent of the U.S. roads are located in snowy regions that annually receive more than five inches average snowfall. Approximately 70 percent of the U.S. population also lives in these regions. Each year state and local agencies spend more than 2.3 billion dollars on snow and ice control operations.

Annual Impact of Snow, Sleet, and Ice on U.S. Roadways

| | Number of Incidents | Percent of All Weather-Related Incidents |
|----------|---------------------|--|
| Crashes | 1,511,200 | 39% |
| Injuries | 181,300 | 29% |
| Deaths | 2,179 | 31% |

Source: [DOT FHA Road Weather Management Program](#)

- “Utilize a real time GIS based mapping system that responders can access for trees and downed wires. (In one case an online/updateable Google spreadsheet in the cloud was used)”
- “Establish a phone line or other system to collect tree and power line down standardized details.”



Note: The AARs report that in many instances, downed trees and power transmission lines caused both power outages and road closures. All of the 14 AARs also state that downed trees and power transmission lines cause debris removal issues.

Responder Communications Issues

Responders communications issues are mentioned in 13 out of the 17 AARs. In some cases, these issues were attributed to lack of an adequate infrastructure and technology. For example, one AAR reports: “The 9-1-1 center also discovered that they needed more secondary telephone lines in the center to maintain adequate communications flow. Extra lines were ran during the event and new lines are being planned.” In other instances, lack of power made responders communications challenging. One AAR reports, “Late Wednesday evening, the phone lines were inoperable, leaving the police department with no communications other than handheld radios and personal cell phones.” However, these radios had short battery life and poor performance inside of buildings. Relevant AAR recommendations include:

- “Encourage local telecommunication providers to review plans for extended power outages (which already exist) in concert with local emergency management.”
- “Continue to support alternative communications systems such as amateur radio (HAM) to allow vertical and horizontal communications in a disaster.”

School Closure

Nine AARs mention school closure as a consequence of snow or ice storms. Dangerous weather conditions, snow accumulation, and loss of power were cited as the leading factors determining school closure. Many schools relied on the local school board or, during larger emergencies, on their State Department of Education for guidance on early release and closure.

Some AARs also indicate that a few schools were closed to be used as shelters. To address issues related to school closure and use of these buildings as shelters, the AARs include the following key recommendations:

- “Have a shelter agreement in place with a school.”
- “Define the role of school cafeteria and janitorial staff during shelter operations.”
- “Use school telephone notifications for disseminating safety information.”



(Source: City of St. Louis, Missouri)

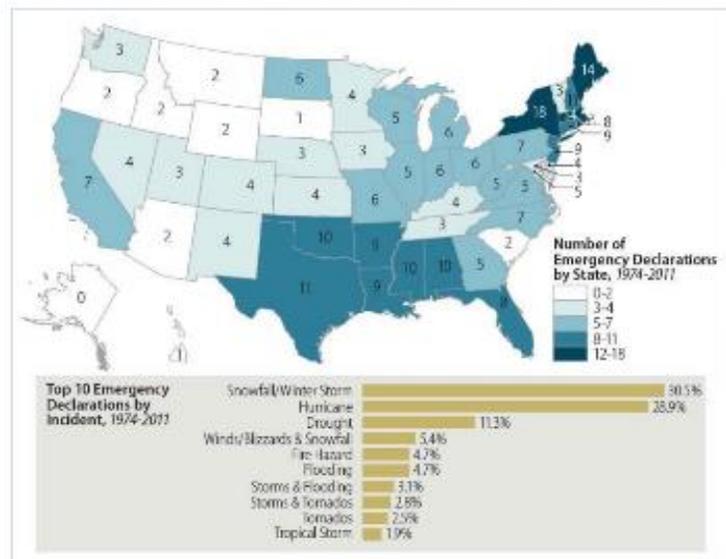
Warming Station Required

Six AARs report the need for warming stations to be open in a region. The AARs indicate that in most cases jurisdictions opened warming stations when a region experienced extensive power outages combined with extreme cold temperatures.

Warming stations provide temporary relief from the cold and can be used to distribute hot meals, provide information, and stage transportation to overnight shelters. Typically, schools, churches, libraries, and public and private community centers served as stations. Issues related to warming station management listed in the AARs included ensuring sufficient staffing, understanding roles and responsibilities, having safe transportation to and from the stations, having emergency power, and coordinating delivery of supplies.

To address issues related to warming station management, the AARs include the following key recommendations:

- “Review and revise guidelines for establishment of warming shelters and train agencies on their roles in sheltering. Coordinate with relevant partners such as utilities and school boards for planning based on power restoration and school re-openings.”
- “Inform residents on what to expect at stations and what supplies to bring with them.”
- “Ensure designated or impromptu warming stations have emergency power sources.”



The majority of emergencies declared between 1974 and 2011 were issued in responses to a winter storm event. (Source: Congressional Research Service)

Shelters Required

Eight AARs report that shelters were opened within a region. Review of these AARs show that the demand for shelters increased significantly during larger-scale, prolonged events. Shelters usually provided cots, food, water, and sometimes shower facilities. They also served as places to gather information, charge electronics, and pick up supplies.

The AARs report that local communities largely relied on non-governmental organizations to establish and manage shelters. However, many communities did not have a sufficient number of pre-identified sheltering locations. Temporary, ad-hoc shelters often lacked emergency power and trained personnel.

The AARs include the following selected recommendations:

- “Work with utility partners to communicate power restoration timelines for individual and shelter planning decisions and to have power restoration priority for essential facilities to prevent the need to evacuate and shelter nursing homes, homeless shelters, etc.”
- “Encourage local communities and non-governmental organizations to create additional shelter capacity by pre-identifying facilities, increasing shelter supply caches and training additional shelter volunteers.”

- “Ensure that shelters have emergency power or specifications for generator needs.
- “Pre-planning to ensure adequate staffing and volunteer support if shelter activation is necessary.”
- “Inform residents of personal essential items to bring.”

Phone Service Outages

Phone service outages caused mainly by downed telephone wires are reported in five AARs. The AAR analysis found that the public relied heavily on phones for critical safety information as power outages and drained batteries affected many traditional communications mechanisms, including television, radio, and computers. The five AARs include recommendations such as:

- “Ensure there is appropriate telephone and data infrastructure as well as radio capability for critical facilities and responders and that infrastructure such as towers and repeaters has emergency power and plans for re-fueling generators in adverse weather.”
- “Develop a guideline and partnership with the school district to use their telephone notification system for safety messages for parents when the school district cancels school.”



(Source: National Oceanic and Atmospheric Administration)

Water Distribution Issues

Issues with water distribution due to power loss or burst pipes are mentioned in five AARs. Other issues identified are informing the public on water safety and providing water to shelters, distribution points, and livestock. Maintaining water systems is especially important for winter storms as power outages prevent customers from following boil water and other safety notices. Some AARs also indicate the National Guard can play a large role in providing water buffaloes for portable water distribution points and distributing other essential items.

Public Transportation Closure

Three AARs report public transportation closure in a region as a result of a winter weather event. Snow clearing operations, downed trees and wires, landslides, and overall dangerous conditions contributed impeding transit. Recommendations include:

- “Have a strategy for large scale 24-hour snow removal and de-icing operations with contracts in place for additional crews and equipment.”
- “Encourage community members to perform checks on neighbors as response personnel cannot reach everyone for performing wellness checks.”
- “Track back-up power capacity for local gas stations and plan for provision of gas to emergency response and key transportation vehicles as power outages prevent many gas stations from pumping fuel for local emergency vehicles, personal vehicles and generators.”

APPENDIX A

2006-2011 Winter Weather Fatalities

According to the NWC Office of Climate, Water, and Weather Services' [Natural Hazard Statistics](#):

- 2011: There were 17 winter weather fatalities in the U.S. in 2011; 10 (59%) died outside while 5 (29%) died in a vehicle. Illinois and South Dakota recorded the highest number of deaths for the year (2 in each State).
- 2010: There were 21 winter weather fatalities in 2010; 11 people (52%) died outside while 7 (33%) died in a vehicle. North Carolina recorded the highest number of fatalities (3), followed by Alabama, Delaware, Minnesota, New Jersey, New York, Tennessee, and Wisconsin with 2 each.
- 2009: There were 28 winter storm deaths in 2009; 12 people (43%) died in a vehicle while 7 (25%) died outside. Texas recorded the highest death toll with 4 fatalities, followed by Arkansas and Montana with 3 each.
- 2008: There were 21 winter storm deaths in 2008; 14 people (67%) died in a vehicle while 6 (29%) died outside. Texas recorded the highest death toll with 5 fatalities, followed by California and Oklahoma with 3 each.
- 2007: There were 16 winter storm deaths in 2006; 7 people (44%) died in a vehicle while 4 (38%) died at home because of insufficient heat. Delaware, Oklahoma and Texas had 3 deaths each, followed by New Jersey with 2 fatalities.
- 2006: There were 17 winter storm deaths in 2006; 11 people (65%) died in a vehicle while 5 (29%) died outside. Arizona had highest death toll with 8 fatalities, followed by California with 4.

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