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</tr>
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<td>Recipient List</td>
</tr>
<tr>
<td>Participant List</td>
</tr>
<tr>
<td>Summary</td>
</tr>
<tr>
<td>Hazard Impacts</td>
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Purpose

The purpose of the Hazard Vulnerability Analysis is to rank the hazards in Peoria County. With the hazards ranked, emergency management professionals can ensure that Peoria County is planning and preparing for these hazards. Additionally, it will prioritize what hazards should be exercised for response and recovery. The 2020 HVA was coordinated by the Peoria County Healthcare Preparedness Coalition in conjunction with the Peoria County Emergency Management Agency.

Peoria County Healthcare Preparedness Coalition Member Agencies

<table>
<thead>
<tr>
<th>Agency</th>
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</thead>
<tbody>
<tr>
<td>Advanced Medical Transport</td>
</tr>
<tr>
<td>Advocates for Access</td>
</tr>
<tr>
<td>Central Illinois Chapter of American Red Cross</td>
</tr>
<tr>
<td>City of Peoria Office of Emergency Management</td>
</tr>
<tr>
<td>Human Service Center</td>
</tr>
<tr>
<td>Illinois Air National Guard 182d Airlift Wing</td>
</tr>
<tr>
<td>Kindred Hospital</td>
</tr>
<tr>
<td>OSF-Saint Francis Medical Center</td>
</tr>
<tr>
<td>Peoria City/County Health Department</td>
</tr>
<tr>
<td>Peoria County Coroner's Office</td>
</tr>
<tr>
<td>Peoria County Emergency Management Agency</td>
</tr>
<tr>
<td>UnityPoint Health</td>
</tr>
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The following list of agencies/individuals were recipients of the 2020 Peoria County Hazard Vulnerability Analysis survey.

<table>
<thead>
<tr>
<th>Agency (Discipline)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Advanced Medical Transport</td>
</tr>
<tr>
<td>• Director of Communications</td>
</tr>
<tr>
<td>• Director of Compliance /QA</td>
</tr>
<tr>
<td>• Director of Operations</td>
</tr>
<tr>
<td>• East Market Director</td>
</tr>
<tr>
<td>• Peoria Operations Manager</td>
</tr>
<tr>
<td>• Vice President of Operations</td>
</tr>
<tr>
<td>• Vice President of Strategy</td>
</tr>
<tr>
<td>Advocates for Access</td>
</tr>
<tr>
<td>• Direct Services Coordinator</td>
</tr>
<tr>
<td>• Executive Director</td>
</tr>
<tr>
<td>Akron-Princeville Ambulance</td>
</tr>
<tr>
<td>Akron-Princeville Fire Protection District</td>
</tr>
<tr>
<td>• Chief</td>
</tr>
<tr>
<td>• Deputy Fire Chief</td>
</tr>
<tr>
<td>• Assistant Fire Chief - 2</td>
</tr>
<tr>
<td>Akron-Princeville Township</td>
</tr>
<tr>
<td>• Road Commissioner</td>
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<tr>
<td>• Supervisor</td>
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<tr>
<td>Apostolic Christian Skylines</td>
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<tr>
<td>Archer Daniels Midland Company</td>
</tr>
<tr>
<td>Bartonville, Village of</td>
</tr>
<tr>
<td>• Fire Department</td>
</tr>
<tr>
<td>• Chief</td>
</tr>
<tr>
<td>• Assistant Fire Chief - 2</td>
</tr>
<tr>
<td>• Mayor</td>
</tr>
<tr>
<td>• Park District Chairman</td>
</tr>
<tr>
<td>• Police</td>
</tr>
<tr>
<td>• Public Works Manager</td>
</tr>
<tr>
<td>Bradley University</td>
</tr>
<tr>
<td>• Director of Health Services</td>
</tr>
<tr>
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</tr>
<tr>
<td>• Captain</td>
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<tr>
<td>• Chief</td>
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<tr>
<td>Organization</td>
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<td>---------------------------------------------------</td>
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<tr>
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<tr>
<td>B.Y.E. Ambulance Service</td>
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<tr>
<td>Caterpillar Inc.</td>
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<tr>
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</tr>
<tr>
<td>of Schools for distribution to all Catholic</td>
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<td>Schools in Peoria County</td>
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<td>Chillicothe Township</td>
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<td>Dunlap, Village of</td>
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<tr>
<td>Organization/Position</td>
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<tr>
<td>---------------------------------------------------------</td>
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<tr>
<td>Easter Seals Central Illinois</td>
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<tr>
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<tr>
<td>Elmwood, City of</td>
</tr>
<tr>
<td>• Administration</td>
</tr>
<tr>
<td>• Fire Department</td>
</tr>
<tr>
<td>▪ Chief</td>
</tr>
<tr>
<td>▪ Assistant Chief</td>
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<tr>
<td>▪ Captain</td>
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<tr>
<td>• Police Chief</td>
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<tr>
<td>• Public Works</td>
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<tr>
<td>Elmwood Township</td>
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<tr>
<td>• Road Commissioner</td>
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<tr>
<td>• Supervisor</td>
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<tr>
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<td>• President and CEO</td>
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<tr>
<td>Evonik</td>
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<tr>
<td>Farmington Fire Department</td>
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<tr>
<td>• Chief</td>
</tr>
<tr>
<td>▪ Assistant Chief</td>
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<tr>
<td>General Wayne A. Downing Peoria International Airport</td>
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<tr>
<td>• Director of Airport</td>
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<tr>
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</tr>
<tr>
<td>• Mayor</td>
</tr>
<tr>
<td>▪ Police Chief</td>
</tr>
<tr>
<td>Greater Peoria Sanitary District</td>
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<tr>
<td>• Director of Operations</td>
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<tr>
<td>▪ Director of Planning</td>
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<tr>
<td>▪ Executive Director</td>
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<tr>
<td>Hallock Township</td>
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<tr>
<td>• Road Commissioner</td>
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<tr>
<td>Hanna City, Village of</td>
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<tr>
<td>• Clerk</td>
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<tr>
<td>▪ Mayor</td>
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<tr>
<td>Heartland Community Health Clinics</td>
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For Official Use Only (FOUO)
<table>
<thead>
<tr>
<th>Location</th>
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<tr>
<td>Heddington Oaks</td>
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<tr>
<td>Heritage Manor</td>
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<tr>
<td>Hollis Park District</td>
<td>• Director of Parks and Recreation</td>
</tr>
<tr>
<td></td>
<td>• Superintendent of Recreation</td>
</tr>
<tr>
<td>Hollis Township</td>
<td>• Road Commissioner</td>
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<tr>
<td></td>
<td>• Supervisor</td>
</tr>
<tr>
<td>Human Service Center</td>
<td></td>
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<tr>
<td>Illinois Air National Guard 182d Airlift Wing</td>
<td>• Assistant Fire Chief</td>
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<tr>
<td></td>
<td>• Deputy Fire Chief</td>
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<tr>
<td></td>
<td>• Fire Chief</td>
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<tr>
<td></td>
<td>• Installation Emergency Manager</td>
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<tr>
<td></td>
<td>• Public Health Technician</td>
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<tr>
<td>Illinois Central College</td>
<td>• Police Chief</td>
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<tr>
<td>Ingredion</td>
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<tr>
<td>Kickapoo Township</td>
<td>• Road Commissioner</td>
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<td></td>
<td>• Supervisor</td>
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<tr>
<td>Kindred Hospital Peoria</td>
<td>• Director Quality Management</td>
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<tr>
<td>Lanxess Solutions US Inc.</td>
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<tr>
<td>Liberty Village of Peoria</td>
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<tr>
<td>Limestone Fire Protection District</td>
<td>• Chief</td>
</tr>
<tr>
<td></td>
<td>• Deputy Chief</td>
</tr>
<tr>
<td>Limestone Township</td>
<td>• Road Commissioner</td>
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<tr>
<td>Logan Township</td>
<td>• Road Commissioner</td>
</tr>
<tr>
<td></td>
<td>• Supervisor</td>
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<tr>
<td>Organization</td>
<td>Positions</td>
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</tr>
<tr>
<td>Logan-Trivoli Fire Protection District</td>
<td>Chief, Assistant Chief - 2</td>
</tr>
<tr>
<td>Lonza</td>
<td></td>
</tr>
<tr>
<td>Lutheran Hillside Village</td>
<td>Clerk</td>
</tr>
<tr>
<td>Mapleton, Village of</td>
<td></td>
</tr>
<tr>
<td>Matheson Tri-Gas</td>
<td></td>
</tr>
<tr>
<td>Medina Township</td>
<td>Road Commissioner, Supervisor</td>
</tr>
<tr>
<td>Norwood, Village of</td>
<td>President</td>
</tr>
<tr>
<td>OSF Healthcare System</td>
<td>Distributed throughout the OSF Healthcare System by the OSF Disaster Preparedness Manager</td>
</tr>
<tr>
<td>OSF Home Health Care</td>
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</tr>
<tr>
<td>Peoria Academy</td>
<td>Head of Schools</td>
</tr>
<tr>
<td>Peoria Area EMS</td>
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<tr>
<td>Peoria Christian Schools</td>
<td>Superintendent of Schools</td>
</tr>
<tr>
<td>Peoria, City of</td>
<td>(Distributed to City of Peoria representatives by the City of Peoria Office of Emergency Management)</td>
</tr>
<tr>
<td>Peoria City/County Health Department</td>
<td>Director of Emergency Management and Preparedness, Director of Environmental Health, Director of Epidemiology and Clinical Services, Disease Specialist/Emergency Planner - 3, Public Health Administrator, Public Information Officer</td>
</tr>
</tbody>
</table>
Peoria County

- Administration
  - Assistant County Administrator
  - Chief Financial Officer
  - County Administrator
  - Court Administrator
  - Information Technology Director
  - Facilities & Ground Operations Director
  - GIS Manager
  - Planning & Zoning Director
  - Planning & Zoning Senior Planner
  - Purchasing Agent
  - Recycling Director
  - Strategic Communications Director

- Animal Protective Services - Director

- Coroner's Office
  - Coroner
  - Deputy Coroner

- Elected Officials
  - Auditor
  - Circuit Clerk
  - County Board - 18 Board Members
  - State's Attorney
  - Treasurer

- Emergency Management Agency

- Emergency Telephone System Board

- Highway
  - County Engineer

- Regional Office of Education Regional Superintendent

- Sheriff's Office
  - Captain-Field Operations
  - Chief Deputy
  - Corrections Superintendent
  - Lieutenant-Patrol
  - Lieutenant-Search and Rescue
  - Lieutenant-Special Projects
  - Lieutenant-Training
  - Sheriff

Peoria County Farm Bureau

Peoria Heights, Village of

- Fire Department
  - Chief
  - Deputy Chief

- Mayor

- Police Chief
Peoria Park District

- Executive Director
- Police Chief

Peoria Regional Office of Education distributed to schools districts within Peoria County

- Bartonville School District #66
- Brimfield CUSD #309
- Dunlap CUSD #323
- Elmwood CUSD #322
- Farmington Central CUSD #265
- Hollis School District #328
- Illini Bluffs CUSD #327
- Illinois Valley Central CUSD #321
- Limestone Community High School District #310
- Limestone Walters School District #316
- Monroe School District #70
- Norwood School District #63
- Oak Grove School District #68
- Peoria Heights CUSD #325
- Peoria School District #150
- Pleasant Hill School District #69
- Pleasant Valley School District #62
- Princeville CUSD #326

Peoria School District #150

- Police Chief

Peoria Township

- Supervisor

Petersen Health Care

Princeville, Village of

- President
- Public Works

Princeville Township

- Road Commissioner

Proctor Place

Richwoods Township

- Supervisor

Rosefield Township

- Road Commissioner

Salvation Army - Emergency Disaster Services
<table>
<thead>
<tr>
<th>Organization</th>
<th>Positions</th>
<th>Details</th>
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<tbody>
<tr>
<td>Sharon Healthcare Complex</td>
<td>Fire Chief</td>
<td></td>
</tr>
<tr>
<td>Timber Hollis Fire Protection District</td>
<td>Fire Chief</td>
<td></td>
</tr>
<tr>
<td>Tuscarora Fire Department</td>
<td>Assistant Chief, Fire Chief</td>
<td></td>
</tr>
<tr>
<td>UnityPoint Health Methodist/Proctor</td>
<td>Distributed throughout the UnityPoint Healthcare System by the Manager ED Support/EMS</td>
<td></td>
</tr>
<tr>
<td>UnityPoint Home Health and Hospice</td>
<td>Vistra - Edwards Power Station</td>
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</tr>
<tr>
<td>West Peoria</td>
<td>Fire Department: Chief, 1st Assistant Chief, 2nd Assistant Chief, Mayor</td>
<td></td>
</tr>
<tr>
<td>West Peoria Township</td>
<td>Public Works, Supervisor</td>
<td></td>
</tr>
</tbody>
</table>
The following list of agencies/individuals responded to the 2020 Peoria County Hazard Vulnerability Analysis survey.

<table>
<thead>
<tr>
<th>Agency (Discipline)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Advanced Medical Transport</td>
</tr>
<tr>
<td>• Operations Manager</td>
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<tr>
<td>• Vice President</td>
</tr>
<tr>
<td>• Vice President of Operations</td>
</tr>
<tr>
<td>Advocates for Access</td>
</tr>
<tr>
<td>• Independent Living Coordinator</td>
</tr>
<tr>
<td>Apostolic Christian Skylines</td>
</tr>
<tr>
<td>• IT Systems Manager</td>
</tr>
<tr>
<td>Archer Daniels Midland Company</td>
</tr>
<tr>
<td>• Environmental Technician/AFSO</td>
</tr>
<tr>
<td>Bartonville, Village of</td>
</tr>
<tr>
<td>• Public Works Superintendent</td>
</tr>
<tr>
<td>Bradley University</td>
</tr>
<tr>
<td>• Director of Health Services</td>
</tr>
<tr>
<td>Brimfield, Village of</td>
</tr>
<tr>
<td>• Fire Department</td>
</tr>
<tr>
<td>◦ Chief</td>
</tr>
<tr>
<td>◦ Village Clerk</td>
</tr>
<tr>
<td>B.Y.E. Ambulance Service</td>
</tr>
<tr>
<td>• Board Member/Manager/Paramedic</td>
</tr>
<tr>
<td>Central Illinois Chapter of the American Red Cross</td>
</tr>
<tr>
<td>• Disaster Program Manager</td>
</tr>
<tr>
<td>• Government Operations Volunteer</td>
</tr>
<tr>
<td>CF Industries</td>
</tr>
<tr>
<td>• Superintendent</td>
</tr>
<tr>
<td>Chillicothe, City of</td>
</tr>
<tr>
<td>• Mayor</td>
</tr>
</tbody>
</table>
Chillicothe Township
- Supervisor

Community Workshop and Training Center
- Safety Director

Easter Seals Central Illinois
- Executive Vice President

Elmwood, City of
- Fire Department
  - Assistant Chief
- Police Chief

EPIC
- Chief Executive Officer

Evonik
- EHSS Manager

General Wayne A. Downing Peoria International Airport
- Metropolitan Airport Authority of Peoria
  - Director of Airport

Glasford, Village of
- Police Chief

Greater Peoria Sanitary District
- Director of Planning and Construction
- Executive Director

Heddington Oaks
- Maintenance Supervisor

Hollis Township
- Road Commissioner

Illinois Air National Guard 182d Airlift Wing
- Medical

Illinois Central College
- Deputy Police Chief
<table>
<thead>
<tr>
<th>Organization</th>
<th>Role</th>
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<tbody>
<tr>
<td>Kindred Hospital Peoria</td>
<td>Director of Quality and Risk</td>
</tr>
<tr>
<td>Lanxess Solutions US Inc.</td>
<td>Plant Manager</td>
</tr>
<tr>
<td>Limestone Township</td>
<td>Road Commissioner</td>
</tr>
<tr>
<td>Logan-Trivoli Fire Protection District</td>
<td>Assistant Chief</td>
</tr>
<tr>
<td>Lonza</td>
<td>EHS Specialist</td>
</tr>
<tr>
<td>Lutheran Hillside Village</td>
<td>Care Center Administrator</td>
</tr>
<tr>
<td>Mapleton, Village of</td>
<td>Clerk</td>
</tr>
<tr>
<td>Matheson Tri-Gas</td>
<td>Plant Manager</td>
</tr>
<tr>
<td>Medina Township</td>
<td>Road Commissioner</td>
</tr>
</tbody>
</table>
OSF Healthcare System

- Director
- Disaster Preparedness
  - Director
- Occupational Health Supervisor
- OSF St. Francis Medical Center
  - Chief Nursing Officer
  - Children's Hospital of Illinois
    - Director
    - President
  - Clinical Educator
  - Director
  - Director Environmental Services
  - Director of Facilities Operations & Planning
  - Director of Medical Services
  - Director of Supply Chain
  - Director of Women's Services
  - Disaster Coordinator
  - Educator - Disaster Preparedness
  - Hospitality
    - Guest Service Concierge
  - Laboratory Supervisor
  - Manager Biomedical Services
  - Manager Communications/Central Transport
  - Manager Disaster Preparedness
  - Manager OB
  - Manager Supply Chain
  - Manager of Trauma Services and EMS
  - Manager Women's Health Strategy
  - Nursing Director
  - Pediatric Coordinator
  - President
  - Program Coordinator
  - Safety
    - Registered Nurse

Peoria Academy

- Head of Schools

Peoria Area EMS

- EMS Educator
- Educator
- Interim EMS System Coordinator
<table>
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<tr>
<th>Peoria, City of</th>
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<tbody>
<tr>
<td>- Emergency Communications Center</td>
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<td>- ECC Manager</td>
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<tr>
<td>- Fire Department</td>
</tr>
<tr>
<td>- Assistant Fire Chief</td>
</tr>
<tr>
<td>- Division Chief in Charge of Training</td>
</tr>
<tr>
<td>- Fire Chief</td>
</tr>
<tr>
<td>- Office of Emergency Management</td>
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<tr>
<td>- Emergency Management Coordinator</td>
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<tr>
<td>- Police Department</td>
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<th>Peoria City/County Health Department</th>
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<tr>
<td>- Director of Emergency Management and Preparedness</td>
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<td>- Director of Environmental Health</td>
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<td>- Director of Epidemiology and Clinical Services</td>
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<td>- Director of Human Resources</td>
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<td>- Public Health Administrator</td>
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<tr>
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<td>- GIS Manager</td>
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<td>- Planning &amp; Zoning Director</td>
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<td>- Purchasing Agent</td>
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<td>- Animal Protective Services - Director</td>
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<td>- Coroner's Office</td>
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<td>- Deputy Coroner</td>
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<td>- Elected Officials</td>
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<td>- Auditor</td>
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<td>- County Board - 6 Board Members</td>
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<td>- State's Attorney</td>
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<td>- Emergency Management Agency</td>
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<td>- EHS Manager/Risk Manager</td>
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<td>Peoria Regional Office of Education distributed to schools districts within Peoria County</td>
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UnityPoint Health

- Chief Medical and Chief Quality Officer
- Companion Care Services
  - Agency Manager
- Director - 5
- Emergency Department Nurse Manager
- Emergency Management Coordinator
- Manager
- Methodist College
  - Chancellor
- Regional Director of Support
- Regional EMS Manager
- Regional Supply Chain Manager
- Registered Nurse Manager
- UnityPoint Methodist
  - Neonatal Nurse Manager
  - Nurse Manager
  - Nurse Manager Postpartum/Pediatrics
  - Pediatric Quality Coordinator
  - Regional Director, Quality Safety and Analytics
- UnityPoint Pekin Hospital
  - Lab Manager
  - Manager Cardiopulmonary and EEG Services
  - Medical Imaging Operations Manager
- UnityPoint Proctor Hospital
  - Nurse Manager - 2
- Vice President of Hospital Operations

Vistra - Edwards Power Station

- Safety Specialist
Methodology

The Peoria County Hazard Vulnerability Analysis was initiated via survey in December 2019. It was sent to a wide audience of community partners and they were encouraged to share the survey with any individuals whom they felt it was relevant to. The analysis itself asked individuals to rank the probability, impact, and community preparedness for each of the identified hazards. To rank the hazards the hazard vulnerability analysis followed the Kaiser Permanente HVA Tool.

Results
<table>
<thead>
<tr>
<th>Rank</th>
<th>Hazard</th>
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<tr>
<td>1</td>
<td>Severe Thunderstorm</td>
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<td>Tornado</td>
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<td>3</td>
<td>Active Shooting</td>
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<td>Blizzard</td>
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<td>Ice Storm</td>
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<td>4</td>
<td>Extended Power Outage</td>
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<td>Flood</td>
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<td>Infectious Disease Epidemic</td>
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<td>Mass Casualty Incident</td>
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<td>Wind Storm</td>
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<td>Drought</td>
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<td>7</td>
<td>Bridge Collapse (major interstate/county/township)</td>
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<td>Earthquake</td>
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<td>HAZMAT (Fixed Location)</td>
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<td>HAZMAT (Transportation)</td>
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<td></td>
<td>Large Scale Fire Incident</td>
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<td>Terrorist Use of WMD</td>
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<td>8</td>
<td>Agricultural Disaster</td>
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<td>Food Supply Contamination/Interruption</td>
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<td>Fuel Shortage</td>
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<td>Infectious Disease Pandemic</td>
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<td>9</td>
<td>Large Scale Aircraft Incident</td>
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<td>Labor Shortage</td>
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<td>10</td>
<td>Civil Disturbance</td>
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<td>Landslide</td>
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<td>Mine Collapse/Sink Hole</td>
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<td>Pipeline Incident</td>
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<td>VIP Visit</td>
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HAZARD IMPACTS

The Hazard Impact Analysis is a comprehensive list of potential impacts resulting from various natural, technological, and other manmade hazards. While each hazard will undoubtedly have multiple direct and indirect impacts, the Hazard Impact Analysis only captures those impacts that are deemed to be most significant and operationally relevant. The list of impacts in this section should correlate directly to the Hazard Profile Analysis, and each impact is presented in an all-hazards format. As stated in an earlier section, the impacts capture “what happens” as a result of a hazard, whereas “operational considerations” indicate “what a jurisdiction should do” to address the impacts. Here is an example that illustrates this point:

- **Hazard** = Tornado; **Impact** = displaced persons; **Operational Considerations** = Mass Care/Sheltering
- **Hazard** = Severe Winter Storm; **Impact** = Stranded Motorists; **Operational Considerations** = Search and Rescue, Mass Care/Sheltering

Each Impact Analysis will consist of the following sections. A description of what each of these sections will include is also provided below:

- **Introduction/Overview**
  - This section defines and provides a general description of the impact.

- **Vulnerabilities or At-Risk Populations**
  - At-Risk populations relate specifically to public health related impacts. Vulnerabilities, if applicable, relates to all other impacts. In this section, vulnerabilities can include social, physical, economic, environmental, and political considerations and factors.

- **Operational Considerations**
  - Operational considerations indicate “what a jurisdiction should do” to address the impact. This section is especially important as it will validate a jurisdiction’s various preparedness and planning efforts.
• **References**
  - Because knowledge is cumulative, all sections will provide references. This will allow users to locate sources mentioned in these sections if further information is required, and will further validate the information in these sections.

• **Contributors**
  - The success and continual evolution of each Hazard Impact Analysis will depend greatly on collaboration. Also, in order to recognize the contributions of each individual, this section highlights those individuals -- by name -- that have contributed to the furthering of knowledge regarding each impact.
Introduction/Overview
A significant factor associated with many disasters is employee absenteeism. Absenteeism has been associated with many types of hazards ranging from natural, biological, chemical, and man-made hazards. Absenteeism occurs when employees are unable or unwilling to perform their job activities. Common reasons for absenteeism include personal/family safety concerns, transportation safety/road navigability, and household dependent care.

Absenteeism has a considerable affect on the economy. According to the US Department of Labor, an estimated 74 billion dollars is lost every year due to absent workers. During a disaster, this problem can be compounded. The cost associated with absenteeism and the associated loss of productivity can lead to economic slowdowns that can last many months after the initial disaster.

Estimates for absenteeism vary depending on the disaster. A combination of factors can contribute to absenteeism including individuals that are directly affected by the disaster, individuals that must stay home and care for disaster victims, and individuals fearing for their safety. These factors have led to absentee estimates as high as 40 percent for natural and intentional biological disasters.

In addition to the economic toll, absenteeism can have a harmful affect on our nation’s key resources and critical infrastructure. Our society relies on the performance of critical infrastructure workers to support our life and safety needs. Their absence will affect our ability to produce food and power, provide healthcare, and maintain our public works and sewage systems. For health related hazards, absenteeism in the healthcare industry may be greater depending on how early a localized outbreak will occur. Healthcare workers are at higher risk for illness in the healthcare setting and in their community in general. Consequently, the number of available workers can be expected to be reduced.

Absentee rates in first responders has been shown to increase in the months following response to disasters. Responders have reported increased rates of musculoskeletal, respiratory, nonspecific ill health (e.g., malaise, fatigue), and psychological issues during the first year after the disaster. Elevated absentee rates have been known to persist for years after the incident.

Although, mitigating the effects of absenteeism is often overlooked in preparedness plans, evidence suggests preparedness efforts can have a positive effect on absenteeism. Providing information related to the hazard prior to the incident along with encouraging personnel to develop family disaster plans will alleviate some of the transportation and household dependent issues that contribute to absenteeism. Additionally, providing preferential access to prophylactic therapies and personal protective equipment will engender confidence in the personnel and familial safety of personnel leading to higher attendance rates.

Vulnerabilities or At-Risk Populations

- **Healthcare Workers** - during a disaster, the healthcare system will be inundated with requests to attend to sick and/or injured first responders, citizens, and the worried well. This will put an enormous stress on the system. In addition, healthcare workers will be susceptible to cross contamination from disaster-related contaminants and communicable strains of disease. These factors, coupled with concerns for personnel and family safety, will put enormous amount of stress on healthcare workers, possibly leading to increased absenteeism.

- **First Responders** - studies have shown increased absentee rates in the months following a response to a disaster. In addition to the increased risk of injury during the response, responders have reported increased rates of musculoskeletal, respiratory, general fatigue, and psychological issues for months after a disaster.

- **Caretakers** - caretakers such as those with young children and elderly dependents may have the added responsibility of tending to disaster affected individuals in their home. Additionally, measures such as school closures and isolation and quarantine may reduce the availability of normal respite resources. During a pandemic, the CDC estimates up to...
ten percent of the workforce will be absent due to caretaking responsibilities.

- **Commuters** - man-made and natural disasters such as floods, earthquakes, winter weather events, and explosive hazards may render certain roadways impassable. In addition, travel advisories and criminal investigations may close normal routes of transportation to the workplace. These factors along with fear of personal safety may limit attendance of individuals that commute to work. Following this logic, commuters with longer commute times may be more likely to miss work.

**Operational Considerations**

- Organizations should address absenteeism in their preparedness plans informing personnel of potential hazards and encouraging them to develop family disaster plans to address family safety and caretaking issues.
- Integrate staffing considerations in Continuity of Operations plans. Ensure personnel are educated and trained in COOP procedures and protocols.

**References**


**Contributors**

- Paul DeLuca, MPH, Integrated Solutions Consulting
4.3.1.2.1.5.2 Hazard Impact: Ambulatory Snow and Ice Injuries - Hazard
Vulnerability Analysis
Published 1/10/2019 10:17 by Jason Marks

Introduction/Overview
Winter weather related injuries are a common impact associated with severe winter weather. Two activities associated with many injuries in severe winter weather are falls on surfaces covered with ice and snow and the act of removing ice and snow from walkways on top of injuries that can take place during normal commuting or transportation.

Navigating across slick surfaces is extremely dangerous. Many cold-weather injuries result from falls on ice-covered sidewalks, steps, driveways, and porches. Even surfaces that have been shoveled can still have "black ice" and cause injury. Older individuals and older women in particular are susceptible to injury by falling. Injuries associated with falls include bruises, fractured wrists and legs, cracked ribs, whiplash, concussions, torn rotator cuffs and broken hips. These injuries are exacerbated when the victim is not discovered immediately, adding to discomfort and increased exposure to the natural elements (i.e. cold).

Falling debris, such as tree branches and ice from building sides and balconies, also pose a significant danger. Individuals should be aware of their surroundings to mitigate and avoid being struck by falling ice and debris. Although rare, serious injury can occur if struck. For example, the upper part of the body, such as the head and neck are vulnerable to falling debris.

Snow removal is another common cause of injury in severe winter weather. Manual shoveling can lead to back injury, over exertion, and heart attacks. Smokers and individuals with a history of heart disease are especially at risk for a heart attack during shoveling. Moreover, cold temperatures, which constrict blood vessels and makes the blood more viscous, combined with the extremely strenuous activity of shoveling may potentially result in many fatal heart attacks, even in individuals as young as 35. This is especially true in people who already have plaque built up in their arteries because the constriction can decrease blood flow to the heart.

Mechanized snow blowers, although safer than manual shoveling, still pose certain health risks. Injuries have been known to occur when wet slushy snow clogs the discharge chute and operators try to unclog it with their hands. Turning blades inside can break bones and in severe cases sever fingers and hands. Mechanized blowers can also send projectiles flying toward people or objects causing injury.

A complicating factor in winter-related injuries is that during snow storms the streets are less likely to be occupied and victims less likely to be found in a timely fashion. Also, emergency vehicles may have limited access to certain streets and traffic conditions may inhibit an expedited trip to the hospital.

At-Risk Populations

- **Any individual who is overweight, has high blood pressure, high cholesterol or history of heart disease, or smokes:** Shoveling snow is a very strenuous activity that can put a lot of pressure on the heart. This has been known to cause heart attacks and be fatal.
- **Older Persons:** People over the age of forty can incur a heightened risk of heart attack from strenuous outdoor activities such as snow shoveling. This risk is exacerbated if the individual is overweight or out of shape. This is especially a concern for individuals who live a more sedentary lifestyle or smoke. These persons may not pace themselves as required for the vigorous activities involved in snow removal.
- **Elderly Population:** Elderly people are more at risk to fall during the winter when indoor and outdoor floors are more slippery. Also, when they fall, they are more likely to fracture bones more frequently because the bones are not as strong. This is especially true for those who have osteoporosis.
Operational Considerations

- Agencies should consider working with their local PIO or JIS to provide press releases and media to the public forewarning of potential severe winter weather and associated health issues mentioned above. This information can also be permanently posted on the agency's website or other media relations as part of personal preparedness informative resources.
- Agencies should coordinate snowplowing efforts to ensure that major roadway arteries to hospitals are kept cleared and are considered higher priority for plowing operations. Emergency response times or personal transportation to the hospital can be delayed and dangerous due to bad road conditions.
- **Public health agencies should coordinate with city hospitals to inquire if they need any assistance in treating victims.** Additionally, demographic information on those being treated for winter-related injuries can be obtained to determine if there is any particular trends which could indicate future actions to be taken.
- Agencies should coordinate with advocate groups for the mentioned at-risk populations as an informational resource and offer other assistance.
- Governments should consider ordinances that require owners of tall buildings to post warning signage or take preventative measures to mitigate pedestrians being struck by ice that accumulates on their buildings. Agencies can also consider closing particular sidewalks or parts of walkways where falling ice is a reoccurring issue during the winter.

References


Contributors

- Joseph Monahan, Integrated Solutions Consulting
Introduction/Overview

Although automobile accidents are common occurrences, these incidents can be exacerbated during an emergency or disaster; and can place great strain on emergency response systems and personnel. Moreover, automobile accidents are sometimes cascading impacts resulting from a major emergency or disaster (i.e. severe winter storm/ice storm, earthquake, etc.). For example, extremely cold temperatures, heavy snow, ice, and localized flooding can cause hazardous conditions and hidden problems for drivers. Every winter, people are injured or killed during winter storms in automobile accidents. About 70 percent of winter deaths related to ice and snow occur in automobiles. Auto accidents during storms happen due to reduced visibility, intense winds, and slippery road conditions. These serious conditions are often underestimated.

It should be noted that road transportation systems are the most complex and the most dangerous. Worldwide, an estimated 1.2 million people are killed in automobile (or related) accidents each year, and as many as 50 million are injured. Some research institutions project that these figures will increase by about 65 percent over the next 20 years as more and more nations become increasingly dependent on these vast transportation networks. In the United States, motor vehicle crashes are the leading cause of death among those ages 5 – 34.

Classifications of Automobile Accidents

- head-on collisions
- run-off-road collisions
- rear-end collisions
- side collision
- rollovers
- vehicle pile-ups

Risk factors influencing crash involvement

- Inappropriate or excessive speed
- Presence of alcohol, medicinal or recreational drugs
- Fatigue
- Being a young male
- Being a vulnerable road user in urban and residential areas
- Traveling in darkness
- Vehicle factors – such as braking, handling and maintenance
- Defects in road design, layout, and maintenance which can also lead to unsafe road user behavior
- Inadequate visibility due to environmental factors (making it hard to detect vehicles and other road users)
- Poor road user eyesight
- Debris

Risk factors influencing crash severity

- Human tolerance factors
- Inappropriate or excessive speed
- Seat-belts and child restraints not used
- Crash helmets not worn by users of two-wheeled vehicles
- Roadside objects not crash protective
- Insufficient vehicle crash protection for occupants and for those hit by vehicles
- Presence of alcohol and other drugs

**Risk factors influencing severity of post-crash injuries**

- Delay in detecting crash or access to crash site
- Presence of fire resulting from collision
- Leakage of hazardous materials
- Presence of alcohol and other drugs
- Difficulty rescuing and extracting people from vehicles
- Difficulty evacuating people from buses and coaches involved in crash
- Lack of appropriate pre-hospital care
- Lack of appropriate care in the hospital emergency rooms

**Vulnerabilities or At-Risk Population**

- **Young Children and Infants**: Accidents are the most frequent cause of death among children, and car accidents are the leading cause (40 percent die in car accidents, followed by 15 percent from drownings). Children in a car, who are not fastened with a seat belt or who are not placed in an appropriate sized and correctly fitted child seat, may be seriously injured or even die in a car accident. The relatively large weight of their heads, as they’re thrown forward, makes them particularly vulnerable.

- **Teens**: Research shows that teen drivers exhibit high incidence of accidents. This problem is further aggravated when combined with speed, drinking and driving, not wearing seat belts, distracted driving (cell phone use, loud music, other teen passengers, etc.), drowsy driving, nighttime driving, and other drug use. Automobile accidents represent one of the leading causes of death for teens. Among young drivers, the highest accident incidence rate occurs within the first year of licensed driving.

- **Young Adults**: Motor vehicle crashes are the leading cause of death among those ages 5-34 in the U.S. While young people tend to have good reaction times, many exhibit behaviors and attitudes of risk that can place them in more hazardous situations than other road users. Insurance statistics demonstrate a notably higher incidence of accidents and fatalities among teenage and early twenty-aged drivers, with insurance rates reflecting this data. Teens and early twenty-aged drivers have the highest incidence of both accidents and fatalities among all driving age groups. This was observed to be true well before the advent of mobile phones. Females in this age group suffer a somewhat lower accident and fatality rate than males, but still well above the median across all age groups.

- **Non-Seatbelt Users**: According to studies, self-reported seat belt use has continued to increase, reaching a high of 85 percent in 2008. In contrast, in 1982, only 11 percent of U.S. residents reported seat belt use. While seatbelt use has improved, certain socio-demographic categories are less likely than others to use seat belts, such as men, young adults, residents of rural areas, and certain racial/ethnic populations.

- **Elderly**: Older drivers with slower reactions might be expected to be involved in more accidents, but this has not been the case as they tend to drive less and, apparently, more cautiously. However, there is cause for concern when elderly people do drive because they have higher rates of fatal crashes per mile driven, per 100,000 people, and per licensed driver than any other group except young drivers. Also, once they're in crashes, elderly people are more susceptible than younger people to medical complications following motor vehicle crash injuries. This means they're more likely to die from their injuries. Per licensed driver, fatal crash rates rise sharply at age 70 and older.

- **Alcohol Users**: Drivers are considered to be alcohol-impaired when their blood alcohol concentration (BAC) is .08 grams per deciliter (g/dL) or higher. Thus, any fatality occurring in a crash involving a driver with a BAC of .08 or higher is considered to be an alcohol-impaired-driving fatality. Alcohol-impaired-driving fatalities accounted for over 30 percent of the total motor vehicle traffic-related fatalities in the United States.
• **Motorcyclists**: The National Highway Traffic Safety Administration estimates that per mile traveled, motorcycle deaths are disproportionately more frequent than passenger vehicle deaths. Fatalities among motorcyclists are further exacerbated when helmets are not worn.

**Operational Considerations**

• Preparedness Measures - Officials should provide citizens with possible preparedness measures on how to be safe during dangerous road conditions in extreme weather.

• Public Messaging - During extreme weather conditions, officials should put preparedness messages out to the public about these conditions and advising motorist to avoid traveling.

• Increase Patrolling – Officials may want to increase police patrolling on major highways and roads to ensure people involved in auto accidents receive assistance.

• Following an overall assessment of the incident, emergency response units shall consider the following actions:
  - Positioning of the apparatus
  - Control traffic as required
  - Perform scene survey
  - Stabilize vehicle(s) as required
  - Provide EMS services or assistance as required
  - Initiate the Incident Command System (ICS)
  - Secure the vehicle

• If traffic conditions warrant, traffic lanes should be shut down until a scene survey/assessment can be completed and scene is deemed safe.

• When operations require medical treatment, the following protocols may be necessary.
  - Perform scene survey
  - The incident commander shall assign an EMT or First Responder to do a triage on the patient(s).
  - Stabilization shall be done on each vehicle that the occupants are still inside before any fire/EMS personnel gain entry into the vehicle.
    - Stabilization may include step chocks, wheel chocks, cribbing or securing with a winch or rope.

• For motor vehicle accidents involving wires down or a damaged transformer, consider the following:
  - If wires are down near the travel portion of the road, the traffic should be stopped until deemed safe by the utility repair company and the incident commander.
  - Request the utility repair company to respond.
  - A scene survey shall be done taking into consideration that ALL WIRES will be assumed LIVE until the utility repair company confirms that they are otherwise.
  - If wires are on or near a vehicle do not permit any person(s) to go near or leave the vehicle involved.

• Any incident involving hazardous materials, consider the following:
  - Close down all roadways to the incident location.
  - Call for a HAZMAT team.

• Establish crowd control at the scene of a motor vehicle accident.

• Ensure all members are in full protective clothing or traffic vests, as the situation dictates.

**References**

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*For Official Use Only (FOUO)*


Contributors

- Tom Russell, Integrated Solutions Consulting
- Daiko Abe, CFM, Integrated Solutions Consulting
**Introduction/Overview**

Bacterial pneumonia is an infection of the lungs. People with pneumonia usually complain of coughing, mucous production, fever, shortness of breath, and/or chest pain. The following are a list of conditions associated with bacterial pneumonia:

- Bacteria reproduce in the lungs as the body attempts to fight off the infection. Inflammation is the body's reaction to bacterial invaders.
- Fluid causes inflammation to occur in the alveoli (microscopic air sacs of the lungs).
- Reduced alveoli functionality limits the lungs ability to extract oxygen from the air. The result is a shortness of breath (most common symptom of pneumonia), fever, and chest pain (result from a weakened immune system).
- Pneumonia is a serious health concern because it interferes with the body's ability to exchange oxygen and carbon dioxide.

*Bacterial pneumonia is caused by inhaling bacteria; it is not the result of extreme cold or severe winter weather but rather a secondary impact of influenza.*

Many influenza experts, policy makers, and knowledgeable observers believe that a novel influenza A (H1N1) strain directly caused most deaths during the 1918-19 pandemic, often from a hemorrhagic pneumonitis (symptoms include bloody mucous and bloody cough) that rapidly progressed to acute respiratory distress syndrome and death. Not surprisingly, plans and resources to respond to the future influenza pandemic focus almost exclusively on influenza can predispose a patient to bacterial pneumonias, and it has been estimated that approximately 25% of deaths during the influenza season are due to this complication. Current evidence suggests that infection with influenza virus alters the tracheobronchial epithelium and damages cilia, thereby providing an environment favorable to bacterial pathogens. The most common pathogens associated with postinfluenza bacterial pneumonia include Streptococcus pneumoniae, Staphylococcus aureus, and Haemophilus influenza. Community-acquired methicillin-resistant Staphylococcus aureus (CA-MRSA) has recently emerged as a significant problem, and an increase in Staphylococcus aureus–associated deaths following influenza infection has been noted in children.

It has been estimated that 15% to 20% of influenza patients developed pneumonia during the 3 pandemics of the 20th century. Healthcare providers, medical experts, and published data from the 1918 period suggest that most deaths were caused by secondary bacterial pneumonias (bacteria infect the lungs and reproduce, causing inflammation); hemorrhagic pneumonitis that rapidly progressed to death was considered an alarming but uncommon clinical manifestation. As a result of bioterrorism preparedness efforts, Congress established a Strategic National Stockpile (SNS) containing antibiotics for Category A biological agents; this stockpile may have created a false sense of security about the availability of antibiotics during a pandemic. Unfortunately, the SNS antibiotics are not as effective against postinfluenza bacterial pneumonias.

Of laboratory-confirmed cases of community-acquired pneumonia, about 30% involve bacterial–viral co-infection. S. pneumonia is the most common cause of community-acquired pneumonia and bacterial co-infection with influenza A. Invasive pneumococcal disease is a term used when the organism is isolated from a typically sterile site, such as blood or pleural fluid. This definition therefore underestimates pneumococcal pneumonia where isolation of the organism is not possible. Notwithstanding, a number of studies have documented the temporal association between influenza and invasive pneumococcal disease, which suggests synergism.

Diagnosis of bacterial pneumonia is via chest x-ray and treatment is with an antibiotic. Early in a pandemic, strict adherence to bacterial pneumonia diagnostic and treatment protocols will be essential. Appropriate antibiotic usage will delay or mitigate the outcomes of this impact.

**At-Risk Populations**

Only suspected or proven pneumonia warrants the use of scarce antibiotics. Certain patients at high risk for mortality from bacterial pneumonia including those with chronic obstructive pulmonary disease (COPD), renal failure, congestive heart failure, or those who are immunocompromised might be considered exceptions if antivirals fail to prevent worsening of respiratory symptoms. Generally, antibiotics should be allocated to the sickest patients and to those who have the greatest likelihood for survival.

For the sickest adult inpatients (ICU=ventilated patients), the recommendation is distributing antibiotics based on Sequential Organ Failure Assessment (SOFA) scores. A SOFA score is a rapid method of assessing survival; it relies on oxygenation, blood pressure, platelet count, bilirubin, creatinine, and Glasgow Coma Score. An initial SOFA score is calculated at admission and again at 48 and 96 hours. An initial SOFA score of >11 predicts a mortality rate of 95%; a SOFA score <9 predicts a mortality rate of less than 33%. At 48 hours, the best predictor of mortality was an increase (>50% mortality) or decrease (<27% mortality) in the SOFA score.

There is a vaccine to protect high-risk individuals 2 through 64 years of age against serious pneumococcal disease. The vaccine, pneumococcal polysaccharide vaccine (PPSV), is safe and effective. Most people need a single dose of the pneumococcal vaccine in a
lifetime. All children less than 5 years of age should receive a different vaccine called pneumococcal conjugate vaccine (PCV7); high risk children 2 to 4 years of age need both pneumococcal vaccines.

**PPSV is recommended for:**
- **People who are 65 years of age and older**
- **People 2 years of age and older who have a chronic illness such as:**
  1. Cardiovascular or lung disease
  2. Sickle cell disease
  3. Diabetes
  4. Alcoholism
  5. Chronic liver disease
  6. Cerebrospinal fluid (CSF) leak
  7. A cochlear implant
- **People 2 years of age and older with a weakened immune system due to illnesses such as:**
  - HIV infection
  - AIDS
  - Chronic renal failure
  - Nephrotic syndrome
  - Organ or bone marrow transplantation
  - Hodgkin’s disease
  - Leukemia
  - Lymphoma
  - Multiple myeloma
  - Generalized malignancy
- **Those receiving immunosuppressive therapy (e.g., steroids)**
- **Those who have had their spleen removed or whose spleen is dysfunctional due to an illness such as sickle cell disease.**
- **Residents of nursing homes or long-term care facilities**
- **People 19 through 64 years of age who smoke cigarettes or have asthma.**

**Operational Considerations**
- Agencies should coordinate their efforts to determine the need (at-risk populations), the supply of vaccine, methods to disbursement, and communication with the public.
- The CDC recommends that public health departments coordinate with hospitals to properly manage medical surge operations. Points of Dispensing (POD) should be established and staffed.
- Public information campaigns regarding bacterial pneumonia, symptoms, at-risk populations, and where to get vaccines should be shared via the media and internet to educate and inform the public.

**References**

**Contributors**
- Emmem Ekorikoh, MIS, MPH, Integrated Solutions Consulting
4.3.1.2.1.5.5 Hazard Impact: Casualties - Hazard Vulnerability Analysis
Published 1/10/2019 10:17 by Jason Marks

Introduction/Overview

Natural and man-made hazards have the potential to generate large numbers of casualties. Many communities are vulnerable in varying probability to hurricanes, tornadoes, earthquakes, severe summer and winter storms, flooding, and other hazards. The increasing risk of technological disasters may also cause many casualties. Additionally, certain communicable diseases have the potential to spread among populations and cause illness and fatality in such large numbers that the capacity of a community’s medical infrastructure would be overwhelmed.

In disaster terms, casualty is oftentimes referred to as persons injured, permanently lost or missing, or killed/deceased as a direct or indirect result of the hazard. Casualty should not be confused with fatality. The term casualty represents a much broader categorization than fatality. It is commonly understood that fatality represents the state or condition of death whereas casualties, as a general category, represent those who are both injured and dead.

Mass Casualty

Disasters oftentimes result in mass casualties. A mass casualty incident may be generally regarded as any incident in which the number of victims exceeds the number of rescuers and resources that can immediately triage, treat, and transport them, and is also estimated to require significant additional resources or time to adequately manage, control, or mitigate the situation. There is no predetermined number of victims that triggers a mass casualty incident response. However, a mass casualty event may usually be distinguished from an emergency incident that initially overwhelms the first responders but can subsequently be managed by routine calls for mutual aid.

- **“Closed” Mass Casualty Event**
  A mass casualty event is considered a closed incident when the victims are confined to a small geographical area. Automobile accidents, train wrecks, and building explosions are examples of a closed incident. In a closed mass casualty event, the span of control is such that the scene can be managed on-scene by an Incident Commander.

- **“Open” Mass Casualty Incident**
  A mass casualty event is considered an open incident when the victims are scattered over a large geographical area. Tornadoes, floods, and earthquakes are examples of an open incident. In an open mass casualty event, the span of control is so large that the incident must be divided into multiple “scenes” within the community or impacted area.

At-Risk Populations

- **Individuals At or Near the Disaster Area**

- **Elderly:** Disasters of all kinds affect older adults disproportionately, especially those with chronic diseases, disabilities or conditions that require extra assistance to leave an unsafe area or recover from an event. For example, in New Orleans, people aged 60 and older comprised 15 percent of the population prior to Hurricane Katrina. However, more than 70 percent of those who died as a result of the hurricane were elderly. Older adults with chronic illnesses, such as diabetes or breathing disorders, may also suffer high casualties because of the inability to access medications or medical technologies/equipment that help them function independently.

- **Poor People:** According to many studies, it is commonly understood that there is a strong correlation between disasters and poverty. These hazards threaten poor people by imposing human and economic costs, including loss of life, injuries, disabilities and displacement, as well as damage to agriculture, livestock, and infrastructure. Poor people oftentimes live in marginal or hazard-prone areas, or live in poorly constructed and/or vulnerable homes. Additionally, they are increasingly vulnerable due to their limited access to services and resources before, during, and after a disaster.
• **Women and Children**: In many disasters, death rates among women and children are higher when compared to men. This death rate disparity is more pronounced in third world nations.

**Operational Considerations**

- Develop mutual aid and cultivate relationships with volunteer organizations, healthcare providers, and other private-sector services and professional associations that may be available to assist during a mass casualty event.

- Develop and maintain a comprehensive inventory system (i.e. NIMS Resource Typing) of essential medical supplies, equipment, and emergency medical services. A list of hospitals, clinics, and other medically relevant resources (including their capabilities) should also be maintained.

- Ensure medical facilities have established plans and procedures to handle a certain level of increased patient load by transferring less critical patients to other treatment facilities, canceling elective procedures, call back staff for extra shifts, and expanding to surge capacity.

- Establish communication and information systems to convey real-time data, such as hospital bed capacity.

- Establish provisions to coordinate identification and credential verification of medical volunteers. This is especially important for out-of-state volunteers.

- During a mass casualty event, activate mutual aid agreements to obtain access to additional resources.

- Identify and coordinate the deployment of EMTs, doctors, nurses, technicians, and other medical personnel to disaster areas.

- Identify staging areas for medical personnel, supplies, and equipment.

- Coordinate the activation of mobile field hospitals, as needed.

- Triage to provide medical stabilization, and continued monitoring and care for patients until they can be transported to more functioning facilities.

- Establish and implement provisions to transport victims to outlying areas that have not been affected by the mass casualty-producing event.

- In extreme mass casualty situations, consider coordinating with appropriate labor, licensing, and regulatory agencies to allow medical students, pharmacy students, emergency medical technician students, paramedic students, and nursing students, on a case-by-case basis, to practice prior to the completion of their licensing requirements.

- Ensure roads are passable for emergency ground transportation assets.

- Select airfields to transport critically injured patients to the nearest functional treatment facilities. The need for air transportation should be determined at the triage scene.

- Establish and initiate patient tracking procedures. Tracking of individuals associated in a mass casualty emergency from “first” medical contact to final release from a medical facility is a critical activity. Proper patient tracking will help promote accountability, facilitate information sharing to family members of patients, and provide accurate incident casualty numbers and status to incident management staff.

- Provide accurate and timely public information.
  - Information of greatest public interest during and immediately following a mass casualty incident may include: quarantine and isolation issues; medical-care issues, including listings of available functional hospitals and
health-care facilities; family assistance services; traffic management; law enforcement; transportation issues, including road closures; shelter locations; air quality; and water quality and water-borne disease.

- Provide counseling services to mitigate psychosocial effects of the mass casualty event. Develop procedures for rapidly providing crisis counseling and mental health assistance to individuals and families.
- Establish next-of-kin procedures and coordinate the notification process, as needed.
  - Establish a Family Assistance Center, if necessary
- Develop and activate Mass Fatality Plan as appropriate.

References


Contributors

Daiko Abe, CFM, Integrated Solutions Consulting.
4.3.1.2.1.5.6 Hazard Impact: Carbon Monoxide Poisoning - Hazard Vulnerability

Analysis

Published 1/10/2019 10:17 by Jason Marks

Introduction/Overview
When the temperature drops, it is very common for people to warm their homes using their ovens to supplement their heat source or to replace their primary source of heat (usually from heating gas). As a result of this method of heating, many people die each year from carbon monoxide poisoning. Additionally, firefighters and other first responders can suffer from carbon monoxide poisoning when responding to house fires, wildfires, hazardous material releases, etc.

Carbon monoxide (CO) is a colorless, odorless gas that is in exhaust from vehicles, stoves, generators, and other sources of combustion. As people turn to alternative sources of heat during winter storm or cold weather related power outages, they sometimes use equipment, such as generators, without properly venting exhaust leading to CO poisoning. CO poisoning also occurs as people stranded on the roads continue to run their vehicles for warmth without clearing the area around the exhaust pipe causing exhaust to back up inside the vehicle. These secondary winter storm deaths are preventable through basic awareness for the populations at risk.

High levels of inhalation of carbon monoxide can cause a variety of symptoms, which can lead to death. This condition is difficult to diagnose because its symptoms are similar to many other illnesses. Additionally, if people are sleep or intoxicated, they can die from CO poisoning before presenting with symptoms. These include:

- Loss of consciousness
- Confusion
- Chest pain
- Vomiting/nausea
- Weakness
- Dizziness
- Headache
- Seizure
- Fainting
- Visual changes
- Drowsiness
- Abdominal pain
- Depression
- Impaired judgment

In the human body, the red blood cells pick up oxygen and transport it through the body. When CO is present, red blood cells pick up CO faster than oxygen. If there is a higher ratio of CO to oxygen in the air, red blood cells begin to replace oxygen with CO. When the oxygen cannot get into the body, tissues become damaged and begin to die. In the US, there are about 20,000 CO poisoning related emergency room visits, 4000 related hospitalizations, and 400 deaths annually.
Sources of Carbon Monoxide

<table>
<thead>
<tr>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paint removers, degreasers, and spray paint</td>
</tr>
<tr>
<td>Boats (with engines)</td>
</tr>
<tr>
<td>Indoor tractor pulls</td>
</tr>
<tr>
<td>Gas powered concrete saws</td>
</tr>
<tr>
<td>Propane fueled forklifts</td>
</tr>
<tr>
<td>Cigarette smoke</td>
</tr>
<tr>
<td>Gas/diesel powered generators</td>
</tr>
<tr>
<td>Propane heaters/stoves</td>
</tr>
<tr>
<td>Charcoal grills</td>
</tr>
<tr>
<td>Kerosene space heaters</td>
</tr>
<tr>
<td>Gas water heater</td>
</tr>
</tbody>
</table>

At-Risk Populations

In general, everyone is at risk for carbon monoxide exposure simply from the use of home appliances which burn carbon based fuel sources. Those who are most susceptible include **unborn babies, infants, those with a low socio-economic status, and people with chronic heart disease, anemia, or respiratory problems**. The following are a list of specific activities which can increase the likelihood of carbon monoxide poisoning:

- Working outdoors with combustion engines or combustible gases
- Using heat sources or electric generators during power outages
- Working at the scene of a fire (fire fighters, EMS, etc.)
- Industrial workers (plants that produce coke or formaldehyde, steel, or pulp mills)
- Riding in the back of enclosed pickup trucks (particularly children)

Operational Considerations

- Agencies should consider working with their local PIO or JIS to provide press releases to the public forewarning of potential carbon monoxide poisoning during the cold winter months. As a preventative and educational measure, information about carbon monoxide detectors should be included and posted. This information can also be permanently posted on the agency’s website or other media relations as part of personal preparedness informative resources.
- Agencies should coordinate with advocate groups for the mentioned at-risk populations as an informational resource and offer other assistance.
- Agencies should coordinate with landlords, hospitals, and local school administrators to promote education, awareness, and prevention.

References


Contributors
Emmem Ekorikoh, MIS, MPH, Integrated Solutions Consulting
Introduction/Overview

Dehydration occurs when the human body loses more fluid than it takes in. This process continues until it does not have enough fluid to operate its normal functions. Dehydration occurs as a result of sickness, extreme heat, strenuous activity, or a combination of factors. Common causes of dehydration include diarrhea, vomiting, fever or excessive sweating due to strenuous physical activity. Not replenishing fluids while experiencing these factors will result in dehydration.

Dehydration is classified into three categories: early, moderate, and severe. Symptoms of early to moderate dehydration include dry mouth, sluggishness, thirst, headache, constipation, lightheadedness, and decrease urine output. Severe dehydration is a serious medical emergency that can interfere with the body’s ability to maintain vital organ function. Symptoms of severe dehydration include extreme thirst, irritability, lack of sweat, little or no urination, sunken eyes, non-elastic skin, sunken fontanels (soft spot in head) in infants, low blood pressure, rapid heartbeat, elevated body temperature, unconsciousness, seizures, brain damage, and death. Immediate medical attention should be sought in these cases.

When discovered, symptoms of dehydration should be addressed by removing the individual from the activity causing dehydration and replenishing fluids. In the case of extreme heat, individuals must first be removed from the heat and into a cool environment. In untreated, dehydration during extreme heat can lead to heat exhaustion or heat stroke. Dehydration during outbreaks of disease is more problematic due to the difficulty of removing the causal agent (disease). Severe dehydration in disease outbreaks is most likely due to excessive diarrhea.

Drinking moderate amounts of fluids in a slow manner is usually sufficient for early dehydration. Electrolyte solutions or freezer pops are also effective. Sport drinks contain a lot of sugar and can cause or worsen diarrhea. In infants and children, avoid using water as the primary replacement fluid. Intravenous fluids and hospitalization may be necessary for moderate to severe dehydration.

Populations particularly at risk for dehydration include infants as their systems have higher turnover rates of water and electrolytes and the elderly as their bodies are not as equipped to deal with the stresses brought on by dehydration.

To prevent dehydration, avoid consumption of alcohol, sugar, and caffeine prior to engaging in activities that may cause dehydration. Alcohol, sugar, and caffeine will rob the body of needed fluid and will complicate attempts at rehydration. During hot weather, fluid intake should be increased regardless of activity level. During strenuous activity, it is recommended to drink two to four glasses (16-32 ounces) of cool (50°-60°F) fluids each hour.

Vulnerabilities or At-Risk Populations

- **Infants/Toddlers** - are especially vulnerable to dehydration due to their susceptibility to diarrheal type illness and their dependency on others for hydration. Infants also have a smaller body mass and turnover fluids and electrolytes more rapidly than adults.

- **Elderly** - the elderly have difficulty coping with dehydration due to the stress dehydration symptoms cause on the body. Additionally, the elderly are more likely to be on prescription medicine that interferes with the body’s ability to cope with dehydration.

- **Individuals with Chronic Illness** - such as heart, lung, kidney disease, hypertension, and diabetes are at high risk. Prescription medications (e.g., diuretics, anticholinergics, antipsychotics, and antihypertensives) that individuals may take to treat their conditions (e.g., depression, insomnia, or poor circulation) may hinder the body’s ability to dissipate heat and regulate the body’s temperature. Additionally, chronically ill individuals with intestinal disorders or intestinal complications caused by prescription medicine are more likely to lose fluids, which will increase the likelihood of...
dehydration.

- **First Responders and Outdoor Workers**— strenuous outdoor activity and heavy personal protective equipment will accelerate perspiration levels. Fluid replenishment must be carefully monitored to avoid dehydration.

**Operational Considerations**

- Support EOC operations and assist in cooling center operations as requested or identified in local Emergency Operations Plan.
- Coordinate with hospitals to assist in managing medical surge operations.
- Collect epidemiological and surveillance information related to biological agents correlated with dehydration.
- Coordinate with advocate groups for at-risk populations to disseminate messages about dehydration prevention.

**References**


**Contributors**

- Paul DeLuca, MPH, Integrated Solutions Consulting
Introduction/Overview
Disasters have a major impact on the living conditions, economic performance, and environmental assets/services of affected areas. Consequences may be long term and/or irreversibly affect economic and social structures. As an example, in 2010, disaster events cost the US over $7 billion in cleanup and recovery costs. To reduce the long-term effects of disasters, affected areas must take actions along parallel paths for consistency by city, state, region, and federally.

Whether disasters are natural or man-made in origin, their consequences derive from a combination of human action and interaction with nature’s cycles or systems. Disasters occur frequently and their incidence and intensity seem to be increasing in recent years. They can lead to widespread loss of life, directly and indirectly (primarily or secondarily) affect large segments of the population and cause significant environmental damage and large-scale economic and social harm.

In general, there are two kinds of economic costs coming from a disaster event. The cost of increased sickness/death of humans and damage to property is the first cost a society must be responsible for. The second cost is of the strategies by the public and private sector to prevent, control, and/or cope with the illness/deaths and property damage attributed to the disaster event. The goal for governments and society would be a reduction or avoidance of deaths to the population along with minimizing property damage. If the world labor force were ill or dying, then there would ultimately be a decline in productivity. Medical treatment and hospitalization would only add to these costs. Since most governments and nations work within a budget, it would only be natural for economics to play a part in the response strategy implemented.

Economic disruption would adversely affect transportation (rail, air, bus, etc), critical manufacturing (along with the transportation of goods), agriculture and food, government facilities (including the administration of services), communications, information technology, and many other sectors. This would affect people’s ability to commute to work, purchase equipment necessary to be productive (desks/PCS), access grocery stores, or enter homes.

The following are a list of indirect economic losses that can result from a disaster event. The nature of the loss varies greatly depending on the disaster type:

- Costs of monitoring and controlling the spread of infectious/contagious diseases and the harmful effects on health
- Public/private costs of hospital and outpatient care
- Cost of reinforcing primary care for vulnerable groups and those in rural areas
- Decline in victims' well-being and living standards due to the deterioration of the standards of public hygiene
- Additional cost of treatment and health care for the affected population
- Injuries or illnesses can result from non-impact, excessive or repetitive physical activity in a variety of scenarios.

At-Risk Populations
Due to the variety of unplanned associated costs, at-risk populations include the following groups:

- Those characterized as having a low socio-economic status (living below the poverty line) and the unemployed who need public services
- Underinsured/uninsured persons
- Adults 65 and older who need public services and have transportation needs
- People with certain chronic medical conditions (such as asthma, heart failure, chronic lung disease) who need ongoing care and access public services for their transportation needs
- Those with disabilities (blind, deaf, etc)

Operational Considerations
There are two monetary strategies that can be used in planning process to offset economic impacts. First, as an integral
part of their economic and social development strategy, financial resources should be identified and assigned for the prevention and mitigation of the foreseeable impact of a disaster. This funding source can be seen as a savings account or high-yield investment for achieving long-term growth and to off-set unexpected expenses related to a disaster. Second, once a disaster has occurred, reconstruction investments should be identified and include vulnerability-reduction features (reinforced basements for earthquakes, inoculations at the workplace or religious institution to decrease the number of people who are susceptible in the general population) to favor an adequate level of sustainable growth.

Reconstruction of damaged or destroyed assets normally requires resources above and beyond those available during the emergency. As a result, vulnerability is reconstructed instead of being reduced. To avoid this, immediately after the emergency stage, an assessment must be made of the direct and indirect effects of the event and their consequences on the social well-being and economic performance of the affected area. This assessment should be comprehensive in that it covers the complete range of effects and their cross-implications for economic and social sectors, physical infrastructure, and environmental assets.

References


Contributors

- Emmem Ekorikoh, MIS, MPH, Integrated Solutions Consulting
4.3.1.2.1.5.9 Hazard Impact: Facility Contamination - Hazard Vulnerability Analysis
Published 1/10/2019 10:17 by Jason Marks

Introduction/Overview
A release of a toxic agent can have many deleterious health effects ranging from skin rashes and respiratory ailments to death. One of the lesser discussed but nonetheless serious effects of a hazardous release is facility contamination. Facility contamination occurs when a hazard is spread within a facility or when a hazard causes everyday toxic materials within a facility to spill and render a facility hazardous to humans. Facility contamination can be the result of an insidious biological or chemical agent release or occur due to natural hazards such as a flood.

Health risks from facility contamination include re-exposure to the original biological or chemical agent and exposure to hazardous everyday materials that have been spread through a facility its associated health effects. In the case of a natural hazard contamination, health effects include exposure to common toxic indoor materials such as cleaning agents, paint related products and pesticides. In addition, hazards such as floods can contaminate facilities with biological pathogens such as E. Coli. Damp conditions can also promote the growth of mold.

Depending on the hazard and the level of contamination, decontaminating a facility can be lengthy and costly. Contaminants can infiltrate HVAC systems and be present in building vents, crevices, behind tiles and walls, and in dust and debris existing in a facility prior to the disaster. Desktop computers and other objects with internal fans that have filters may be another reservoir of contamination. Cleanup methods include vacuuming with high efficiency particulate air (HEPA) vacuums, using detergents or antimicrobial cleansers, fumigation, chemical sterilization, or irradiation technologies. The method of cleanup chosen is dependent on the hazard and severity of contamination. Judging the success of a decontamination effort may require highly specialized lab sampling and building inspection. In the case of mold, sewage and other contaminants, a facility is most likely still contaminated if the contaminant odor still permeates.

Strategies to mitigate facility contamination include: keeping important equipment elevated or out of the flood plain, keeping the facility clear of dust and debris to the extent possible, and turning off HVAC systems as soon as possible.

Vulnerabilities or At-Risk Populations
- **Individuals with Respiratory Issues** - such as emphysema and asthma- inhaling toxic substances is the quickest and more dangerous mode of transmission into the body. Individuals with preexisting respiratory issues are more susceptible to compromised airways.

- **Individuals with Existing Allergies** - that would be complicated by exposure to the hazard or the contaminants the hazard will spread.

Operational Considerations
- Organizations should conduct a public information dissemination campaign to the population in general and focus on at risk population messaging

- Organizations should coordinate with the healthcare system to assess impact of contamination and track epidemiological data

- Organizations should coordinate with local and state laboratories to process specimens

References


Contributors

- Paul DeLuca, MPH, Integrated Solutions Consulting
4.3.1.2.1.5.10 Hazard Impact: Fatalities - Hazard Vulnerability Analysis

Published 1/10/2019 10:18 by Jason Marks

Introduction/Overview
It is an undeniable fact that if a disaster were to occur, citizens will directly/indirectly be affected by primary and/or related secondary causes. Local medical facilities, first responders, funeral directors and many others need to prepare for managing the possibly high numbers of deaths during a disaster. Patients at high risk (about 15% of the population) would account for approximately 84% of all deaths (depending on the threat). Risk factors include age (young children, older adults) and chronic medical conditions (depending on the event). Pre-existing health conditions (such as asthma) or proximity to the threat (nuclear, chemical) can increase the likelihood of death for an individual.

Fatalities can be caused by the following:

- Bioterrorism event or the initial presentation of an emerging infection that may result in an epidemic.
- Events due to nature (hurricane, earthquake), nuclear, biological, chemical, or other mass fatality event.
- Homicidal, suicidal, accidental, or undetermined causes related to a mass casualty event. Bioterrorism deaths are homicides.

Global deaths and death rates for various types of events, 1900-1989 and 1990-2006

<table>
<thead>
<tr>
<th>Event Type</th>
<th>1900-1989</th>
<th>1990-2006</th>
</tr>
</thead>
<tbody>
<tr>
<td>Droughts</td>
<td>130,042</td>
<td>185</td>
</tr>
<tr>
<td>Floods</td>
<td>75,212</td>
<td>7,637</td>
</tr>
<tr>
<td>Windstorms</td>
<td>10,856</td>
<td>13,650</td>
</tr>
<tr>
<td>Slides</td>
<td>469</td>
<td>868</td>
</tr>
<tr>
<td>Waves/Surges</td>
<td>128</td>
<td>207</td>
</tr>
<tr>
<td>Extreme Temperatures</td>
<td>110</td>
<td>5,671</td>
</tr>
<tr>
<td>Wild Fires</td>
<td>21</td>
<td>47</td>
</tr>
<tr>
<td>Total</td>
<td>216,839</td>
<td>28,266</td>
</tr>
</tbody>
</table>

Sources: EM-DAT (2007); McEvedy and Jones (1978); WRI (2007)

At-Risk Populations

- **Proximity to the disaster event** (geographic location-coastal region, employment at a nuclear power plant)
- **First responders, rescue workers and volunteers** (increased risk for these injuries)
- **Those with pre-existing medical conditions and allergies** (to antibiotics and medical countermeasures)
- **Older adults and young children**
- **Those with limited access to transportation resources**

Operational Considerations

- Develop, maintain, and continually update a Mass Fatality Plan.
- In the event of mass fatalities, organizations should coordinate with the medical examiner/coroner's office to report information on:
  - Names and number of deceased individuals.
  - Location where the injuries/disease occurred.
  - Identified hazards (biological, radiation, chemical, explosive, nuclear, etc.)
  - Location and capacity of the reporting institution's morgue or staging area to store and secure remains.
- Accurately report the cause of death for documentation purposes. Below are a few examples:
  - Cold related injury-includes excessive cold as the cause of hypothermia
  - Heat related injury-includes excessive heat as the cause of hypothermia, heat stroke, or others
  - Structural collapse-including but not limited to building or structural collapse
Poisoning/toxin exposure-includes accidental poisoning by and exposure to liquids of gases and ingestion of drugs or substances.

References


Contributors

- Emmem Ekorikoh, MIS, MPH, Integrated Solutions Consulting
Introduction/Overview

Frostbite is the result of exposure to temperatures below the freezing point of skin. As a result, the tissues of the body freeze. It is preceded by a condition called frostnip which is when the top layers of the skin freeze. Frostnip can be seen on earlobes, cheeks, toes, and fingers. With treatment, this condition can be reversed; without treatment (warming), the condition can progress to frostbite. Long-term effects of frostbite include phantom pain of amputated limbs, intrinsic muscle atrophy, tremors, joint stiffness, cold sensitivity, abnormal skin changes indicative of vasospasm (blood vessels spasms), cracking skin and loss of nails, and sensory deficits.

Frostbite has two causes: ice crystals and damaged lining of the blood vessels. Ice crystals form inside the cells causing them to rupture. The loss of water inside the cells causes dehydration which destroys the cells. When damage to the lining of blood vessels is the cause, it creates holes and tears. As blood returns to the extremities during the rewarming process, blood leaks into the tissues. The blood flow becomes turbulent and impeded, creating clots in small vessels located in the extremities. This results in inflammation and additional tissue damage.

In conditions of prolonged cold exposure, the body sends signals to the blood vessels in the arms and legs telling them to constrict (narrow). By slowing blood flow to the skin, the body is able to send more blood to the vital organs, supplying them with critical nutrients, while also preventing a further decrease in internal body temperature by exposing less blood to the outside cold.

As this process continues and the extremities become colder and colder, a condition called the hunter’s response is initiated. The blood vessels are dilated (widened) for a period of time and then constricted again. Periods of dilatation are cycled with times of constriction in order to preserve as much function in the extremities as possible. However, when the brain senses that one is in danger of hypothermia (when the body temperature drops significantly below 98.6°F), it permanently constricts these blood vessels in order to prevent them from returning cold blood to the internal organs. When this happens, frostbite has begun.

Frostbite is most common along the northern United States, Alaska, and Canada. A rate of frequency for frostbite has not been determined because a standardized system does not exist. The only research on frostbite incidence is from Finland from 1986-1995. In this study, researchers determined that there were 2.5 cases of frostbite per 100,000 people.

During the Korean and Falkland Island Wars, African-Americans, South Asians, and Pacific Islanders were more susceptible to frostbite than their Caucasian-American and British counterparts. Military researchers found that these groups were 30 times more likely to suffer from a cold injury than their Caucasian counterparts.
Frostbite Severity

<table>
<thead>
<tr>
<th>Degree</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st</td>
<td>Epidermal or surface involvement; causes some redness, swelling, and sensitivity for a few weeks. In superficial frostbite, you may experience burning, numbness, tingling, itching, or cold sensations in the affected areas. The regions appear white and frozen, but if you press on them, they retain some resistance.</td>
</tr>
<tr>
<td>2nd</td>
<td>Full thickness of the skin freezes; swelling and blisters for weeks progressing to dark eschars.</td>
</tr>
<tr>
<td>3rd</td>
<td>Freezing goes deeper than the skin; hemorrhagic blisters form, bluish-grey skin, painful rewarming; gangrenous eschars. In deep frostbite, there is an initial decrease in sensation that is eventually completely lost. Swelling and blood-filled blisters are noted over white or yellowish skin that looks waxy and turns a purplish blue as it rewarms. The area is hard, has no resistance when pressed on, and may even appear blackened and dead.</td>
</tr>
<tr>
<td>4th</td>
<td>Muscle, bone, and tendons involved.</td>
</tr>
</tbody>
</table>

*At first the areas may appear deceptively healthy. Most people do not arrive at the doctor with frozen, dead tissue. Only time can reveal the final amount of tissue damage.

Adapted from Reamy BV. Frostbite: review and current concepts. J Am Board Fam Pract 1998; 11:34-40 and WebMD.

Vulnerabilities or At-Risk Populations

- **Military forces** - The most commonly affected areas are the extremities, toes, fingers, ears, cheeks, and nose.
- **Participants in outdoor activities at high altitudes** - These individuals suffer fatigue and have improper clothing.
- **People with psychiatric illness/recreational drug users/alcoholics/tobacco smokers and those with diseases of the blood vessels** - These individuals have decreased amounts of blood flow to arms and legs and are more susceptible to frostbite.
- **Those in car accidents or car breakdowns in bad weather** - Prolonged exposure to cold weather with insufficient clothing puts this group at risk.
- **Homeless people** - These individuals can be exposed to cold weather for indefinite periods of time and may not have sufficient clothing to endure cold weather.

The table below defines risk factors associated with cold injuries and divides them into 3 groups: physical, social, and weather factors.
### Risk Factors for Cold Injury

<table>
<thead>
<tr>
<th>Physical Factors</th>
<th>Social Factors</th>
<th>Weather Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elderly (age &gt; 65)</td>
<td>Low income</td>
<td>Low ambient temperatures</td>
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<tr>
<td>Infants (age &lt;1)</td>
<td>Homeless</td>
<td>Strong winds</td>
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<tr>
<td>Physically disabled</td>
<td>Socially isolated</td>
<td>Wet conditions</td>
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<tr>
<td>Mentally impaired</td>
<td>Urban residence</td>
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<td>Concurrent infectious disease</td>
<td>Poor access to healthcare</td>
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<td></td>
<td>or warming shelters</td>
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<tr>
<td>Fatigue</td>
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<td>Smoking</td>
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<tr>
<td>Malnourished</td>
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<tr>
<td>Engaged in winter sports, outdoor exercise, or work</td>
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<tr>
<td>Users of alcohol or illegal drugs</td>
<td></td>
<td></td>
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<tr>
<td>Medical conditions that affect the body’s ability to produce heat such as spinal cord injury, diabetes, stroke, hypothyroidism, Parkinson's Disease, arthritis.</td>
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</tr>
</tbody>
</table>

### Operational Considerations

- Agencies should consider working with their local PIO or JIS to provide press releases and media to the public forewarning of potential severe winter weather and associated health issues such as frostbite. This information can also be permanently posted on the agency's website or other media relations as part of personal preparedness informative resources.
- Agencies should coordinate with advocate groups for the mentioned at-risk populations as an informational resource and offer other assistance.
- If officials are not able to get people indoors (such as the homeless) during cold winter weather, they can bring people into warming stations to allow them to stay warm. A warming center is a short term emergency shelter that operates when temperatures or a combination of precipitation, wind chill, wind and temperature become dangerously inclement. Their paramount purpose is the prevention of mortality and morbidity related to exposure to the elements.
- Winter weather survival can test the limits of human endurance and stamina. Those unprepared and untrained often succumb to the harsh circumstances. It is important for individuals to have information about basic survival (shelter, food and water), first aid, and prevention of dangerous cold weather conditions, such as hypothermia, frostbite and snow blindness. Officials should provide citizens with possible preparedness measures, survival kit information, and guidance on what to be aware of and what to do if stranded.

### References


### Contributors

For Official Use Only (FOUO)
Emmem Ekorikoh, MIS, MPH, Integrated Solutions Consulting
Introduction/Overview
Heat cramps and heat exhaustion are two forms of heat related syndromes with heat cramps being the mildest and heat exhaustion being slightly more serious. Each of these syndromes can progress to heat stroke, which a serious condition and requires immediate medical attention.

Heat Cramps
Heat Cramps are a milder form of hyperthermia than heat exhaustion and heat stroke. Heat cramps are brief but painful muscle cramps marked by involuntary spasms or jerking that occurs after exercising or work (i.e. strenuous physical activity) in extreme heat environments. Heat cramps usually occur in larger muscles such as calves, thighs, abdomen, and shoulders. Heat cramps are thought to be caused by electrolyte imbalance. Essential minerals such as sodium, potassium, calcium, and magnesium—collectively known as electrolytes—are essential for bodily movements as they are responsible for initiating and propagating action potentials in muscle cells. Therefore, electrolyte imbalance can disrupt critical functions of the body. In addition, heat cramps are known to be induced by salt deficiency, a serious condition known as hyponatremia. Sweat contains a high amount of sodium; therefore, drinking fluids lacking in salt after perspiring profusely may lead to this condition.

Individuals are likely to experience heat cramps if they engage in excessive physical activity during extreme heat weather. Also, individuals who perspire excessively during exercise or work and do not intake sufficient fluids to replenish the salts, electrolytes, and fluids lost through perspiration are also at higher risk. Thus, replenishing the body with fluids high in electrolyte and salt content after outdoor work or exercise will significantly reduce the risk of heat cramps. However, the best prevention is to avoid strenuous physical activity in extreme heat weather.

Heat Exhaustion
Heat Exhaustion is a mild form of hyperthermia that arises after exposure to extreme heat and insufficient replacement of lost fluids, particularly when combined with high humidity and strenuous physical activity. Other causes of heat exhaustion include dehydration, alcohol use, and overdressing. Heat exhaustion can occur after prolonged exposure (days) to extreme heat or can be acute and occur in a matter of minutes.

Symptoms of heat exhaustion are similar to those of shock and include heavy sweating, faintness, weak but rapid pulse, low blood pressure, increased internal body temperature (up to 102 degrees Fahrenheit), headache, nausea, and dark colored urine. Without prompt treatment, heat exhaustion will progress to heat stroke with more severe symptoms that may lead to death or permanent disability. Therefore, immediate medical help should be sought if symptoms are identified. The risk of heat exhaustion is exacerbated by factors such as obesity, age (elderly and infants), dehydration, chronic diseases such as cardiovascular disease and respiratory disease, and medications that hinder the body’s cooling mechanisms such as antipsychotics, tranquilizers, antihistamines, tricyclic antidepressants, and some over-the-counter sleeping pills.

To avoid the symptoms of heat exhaustion individuals should avoid prolonged periods outside, especially in direct sunlight, and seek shelter in cool places. Additionally, individuals should avoid any strenuous activity in extreme heat conditions. Individuals that have reduced ability to adapt with extreme heat such as the elderly should have caretakers check on their well being periodically. Finally, it is important to replenish fluids and electrolytes lost through perspiration.

Heat exhaustion may begin with mild symptoms such as muscle cramps and gradually progress to more serious health conditions related to heat stroke. Thus, although milder than heat stroke, individuals suffering from heat exhaustion must see a doctor immediately to avoid further, more serious, health complications.

Vulnerabilities or At-Risk Populations
Infants and young children- are more sensitive to the effects of high temperatures; therefore, they may experience the symptoms of heat exhaustion to a more severe degree.

Elderly- individuals do not adjust as well to sudden changes in temperature. Older adults who suffer from heart disease, lung disease, kidney disease, or who are taking medications that inhibits the body’s ability to regulate body temperature are particularly at risk.

Chronically ill individuals- who take drugs that affect the body’s ability to remain hydrated and respond appropriately to extreme heat. These include drugs that that narrow your blood vessels (vasoconstrictors, such as ergotamine), regulate your blood pressure by blocking adrenaline (beta blockers, such as atenolol), rid your body of sodium and water (diuretics, such as hydrochlorothiazide), alleviate allergy symptoms (antihistolines), calm you (tranquilizers, such as phenothiazines, butyrophenones and thioxanthenes), or reduce psychiatric symptoms such as delusions (neuroleptics, such as olanzapine).

Obese or overweight individual's- bodies must work harder to pump blood to the skin surface to maintain body temperature. Excess body mass leads to excess skin that causes the body to retain more heat since the body must work harder to expel excess heat due to greater surface area of skin.

Athletes or exercisers- who perform strenuous activities outdoors are likely to suffer from dehydration and symptoms of heat related syndromes including, heat cramps, heat exhaustion, and heat stroke due to prolonged exposure to extreme heat and excessive perspiration from the hot weather and physical activity.

Outdoor workers- are required to exert themselves physically. During extreme heat, without sufficient breaks and hydration, outdoor workers are susceptible to heat related syndromes including, heat cramps, heat exhaustion, and heat stroke.

Operational Considerations

- Support Emergency Operations Center operations
- Conduct public information dissemination campaigns for the general population and pay special attention to the at risk populations
- Coordinate with Cooling Services and other public and private agencies to develop and supply temporary shelters with adequate cooling systems for the homeless and socioeconomically disadvantaged individuals
- Coordinate with hospital and provide assistance as necessary for individuals hospitalized with hyperthermia
- Coordinate with advocate groups for the above identified at risk populations

References


Contributors

- Paul DeLuca, MPH, Integrated Solutions Consulting
- Su Aung, MPH, Integrated Solutions Consulting
Introduction/Overview
Heat rash is a skin irritation caused by profuse sweating during hot, humid weather. It can occur in individuals of any age but is most common in infants and young children. Heat rash is a red or pink rash that develops on the skin. It forms when the sweat ducts become clogged and begin to swell. This results in an uncomfortable itchy sensation. In extreme instances, heat rash can become infected and result in inflamed pustules. Visible signs of heat rash appear like dots or tiny pimples on the epidermis. Heat rash occurs most commonly in babies, but it can also develop in adults under extreme heat and humidity.

Heat rash can usually be identified by its appearance and does not usually require medical attention. However, heat rash is one of the warning signs of heat exhaustion and if the condition does not subside after 3 or 4 days, or it appears to have worsened, or a fever develops (particularly in children) a health professional should be contacted immediately. Signs of infection should be carefully monitored, especially in children. These include: increased pain, swelling, redness, or warmth around the affected area, red streaks extending from the affected area, discharge of pus from the affected area, swollen lymph nodes in the neck, armpit, or groin, fever of 100 F or higher, or chills with no other known cause. Development of any of these symptoms is serious and medical help should be sought promptly.

Heat rash can also be problematic for first responders. Strenuous activity in personal protective equipment that traps air between the body and clothing can lead to excessive perspiration and increase the likelihood of heat rash. Although, the condition is not overly serious, it can be painful enough to disrupt the performance of these workers.

Most heat rashes heal within days without treatment. However, while the condition persists, it is imperative to keep the skin cool and dry. This will expedite the healing process. Topical corticosteroids may be used to alleviate irritation.

Vulnerabilities or At-Risk Populations

- **Individuals of Any Age** - may develop heat rash; however, infants and young children are most susceptible. Infants and children should never be left unattended in enclosed areas such as vehicles during hot humid weather.

- **First Responders** - in heavy personal protective equipment that does not allow the transfer of air between the skin and clothing, especially those that sweat excessively, are at risk for heat rash.

Operational Considerations

- Support Emergency Operations Center operations

- Conduct public information dissemination campaigns for the general population and pay special attention to the at risk populations

References


Contributors

- Paul DeLuca, MPH, Integrated Solutions Consulting
- Su Aung, MPH, Integrated Solutions Consulting
4.3.1.2.1.5.14 Hazard Impact: Heat Stroke - Hazard Vulnerability Analysis

Published 1/10/2019 10:18 by Jason Marks

Introduction/Overview
Heat stroke is an acute condition that occurs when the body absorbs more heat than it can dissipate. Heat stroke is the most serious heat-related disorder. This type of hyperthermia may be life threatening without proper and prompt treatment. During heat stroke, the body’s temperature elevates to unsafe levels, eventually overwhelming its heat-regulating mechanisms. The body responds by changing physically and neurologically.

One of the body’s mechanisms to cooling itself is to allow blood flow closer to the skin surface. This allows heat to dissipate through the skin into the surrounding environment. As this process continues, the body will pump blood faster so more blood will be closer to the surface of the skin and more heat will dissipate. The body also cools itself by secreting sweat. This transfers heat from the body to the surrounding air. However, these cooling mechanisms require the loss of water and salt from the body and stress the heart and circulatory system. In periods of extreme heat or physical activity, these systems can fail to reduce the body’s inner temperature. As internal temperature continues to rise, heat stroke can occur.

There are many variables, which will make an individual prone to heat stroke including external temperature, their physical shape and endurance, and how much liquid they have ingested but generally, heat stroke will occur when the body’s internal temperature reaches 106 degrees Fahrenheit. Depending on the conditions, this can happen in as little as ten to fifteen minutes.

Symptoms of heat stroke include psychological ones such as exhibiting hostility, confusion, and disorientation. Some children may experience hallucinations and appear intoxicated. Other common symptoms may include headache, fainting or dizziness, nausea, and vomiting. Moreover, the skin may become red as the blood vessels dilate in order to induce the skin to release the excess heat. Heart rate and respiration rate will increase as blood pressure declines. This decrease in blood pressure will cause the dilated blood vessels to constrict as the condition worsens, resulting in a pale and bluish skin tone. Gradually, the body organs begin to fail and unconsciousness and coma will ensue. Without immediate treatment as this state, the condition will be fatal or lead to permanent disability.

To avoid heat stroke individuals should avoid direct sunlight and stay in cool areas, drink plenty of fluids to replace salts and electrolytes lost through perspiration, wear light colored, loose-fitting clothing, and refrain from any strenuous activity.

Heat stroke is a medical emergency that requires hospitalization. If symptoms are detected, local emergency services should be contacted as quickly as possible to obtain immediate treatment.

Vulnerabilities or At-Risk Populations

- **Infants and Young Children** - are at risk for heat stroke because they are generally unaware of the dangers of extreme heat and strenuous activity in direct sunlight. This group also counts on adults for supervision and access to water and fluids.

- **Elderly** - individuals do not adjust as well to sudden changes in temperature. Older adults who suffer from heart disease, lung disease, kidney disease, or who are taking medications that inhibit the body’s ability to regulate body temperature are particularly at risk.

- **Outdoor workers** - including construction and crop workers performing strenuous activities outdoors are likely to suffer from dehydration and the symptoms of heat stroke due to prolonged exposure to extreme heat. Excessive perspiration that occurs from strenuous activity will also lead to dehydration among this group.

Operational Considerations
• Coordinate with organizations such as the National Weather Service to engage in public information campaigns about 
heat stroke safety

• Coordinate with workers organization to stress worker safety in outdoor settings.

• Coordinate with schools systems to reduce outdoor activity for students.

• Coordinate with advocate groups for at-risk populations to disseminate messages about any open cooling centers.

References


Contributors

• Paul DeLuca, MPH, Integrated Solutions Consulting

• Su Aung, MPH, Integrated Solutions Consulting
Introduction/Overview
Hypothermia occurs when the body loses more heat than it can produce. It is commonly caused by exposure to cold weather or immersion in a cold body of water which results in a dangerously low body temperature (95°F or lower). This drop in body temperature can lead to organ failure and improper nervous system function. The primary method of treatment is to warm the body to a normal temperature (98.6°F). If untreated, the individual can suffer heart failure, respiratory system failure, and eventually death.

When hypothermia occurs, the body’s attempts to warm itself by shivering; additional symptoms include:

- Shallow breathing
- Weak pulse
- Progressive loss of consciousness
- Lack of concern for one’s condition (apathy)
- Drowsiness/very low energy
- Poor decision making (trying to remove one’s clothes)
- Confusion or difficulty thinking
- Stumbling
- Slurred speech or mumbling
- Clumsiness or lack of coordination

Although hypothermia is common in frigid conditions, it can also occur in tepid conditions. This is usually when the body is wet and exposed to outdoor conditions for an extended period of time. Hypothermia can occur as the result of cold temperatures indoors. Examples include an air-conditioned or a poorly heated home (when outdoor temperatures are below freezing). Older persons may suffer mild hypothermia after extended exposure to indoor temperatures that would not adversely affect a younger, healthier person. Symptoms for mild hypothermia are as follows:

- Fatigue
- Lack of coordination
- Nausea or vomiting
- Dizziness
- Confusion
Common Causes of Hypothermia

<table>
<thead>
<tr>
<th>Specific Conditions</th>
<th>Radiated Heat</th>
<th>Direct Contact</th>
<th>Wind</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wearing clothes that aren’t warm enough for weather</td>
<td>Most heat loss is due to heat radiated from</td>
<td>If you’re in direct contact with something very cold, such as cold water or the</td>
<td>Wind removes body heat by carrying away the thin layer of warm air at</td>
</tr>
<tr>
<td>conditions</td>
<td>unprotected surfaces of your body.</td>
<td>cold ground, heat is conducted away from your body. Because water is very good</td>
<td>the surface of your skin. A wind chill factor is important in causing</td>
</tr>
<tr>
<td>Staying out in the cold too long</td>
<td>Your head has a large surface area and accounts</td>
<td>at transferring heat from your body, body heat is lost much faster in cold</td>
<td>heat loss. For example, if the outside temperature is 32 F and the</td>
</tr>
<tr>
<td>Unable to get out of wet clothes and move to a warm,</td>
<td>for about half of all heat loss.</td>
<td>water than in cold air. Water that is 65 F — a relatively mild air</td>
<td>wind chill factor is minus 15 F, your body loses heat as quickly as</td>
</tr>
<tr>
<td>dry location</td>
<td></td>
<td>temperature — can lead to hypothermia very quickly. Similarly, heat loss from</td>
<td>if the actual temperature outside were minus 15 F.</td>
</tr>
<tr>
<td>Accidental falls in water (such as a boating accident)</td>
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<td>your body is much faster if your clothes are wet, as when you’re caught out in</td>
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<td>Inadequate heating in the home (especially for the</td>
<td></td>
<td>the rain.</td>
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<tr>
<td>elderly and infants)</td>
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<td></td>
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<tr>
<td>Air conditioning that is too cold (especially for the</td>
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<td></td>
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<tr>
<td>elderly and infants)</td>
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</table>

Adapted from data provided by the MayoClinic.
http://www.mayoclinic.com/health/hypothermia/DS00333/DSECTION=causes

Without treatment, hypothermia can result in heart and respiratory failure and eventually death. Those who develop hypothermia from cold weather or cold water exposure are susceptible to other cold weather injuries such as:

- **Frostbite** (freezing of the tissues)
- **Trench foot** (immersion foot) – This causes nerve and small blood vessel damage as a result of extensive immersion in water.
- **Chilblains** – This condition is caused by exposure to above freezing cold temperatures. The skin becomes inflamed with painful, itchy patches. Damage to small blood vessels and nerves occurs most frequently in the hands or feet.
- **Gangrene** – This is an interruption in blood flow (usually caused by frostbite) that causes decay or death of tissues

### Common Treatments for Hypothermia

<table>
<thead>
<tr>
<th>First Aid</th>
<th>Medical Treatment</th>
</tr>
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<tbody>
<tr>
<td>Provide warm beverages</td>
<td>Blood rewarming-Draw blood, warm, recirculate in the</td>
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<td>body</td>
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<tr>
<td>Share body heat</td>
<td>Warm intravenous fluids-Inject warmed solution of salt</td>
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<td>warm to warm blood</td>
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<tr>
<td>Move the person out of the cold</td>
<td>Airway rewarming-Humidified oxygen is administered via</td>
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<td>an nasal tube or a mask to warm the airways and raise</td>
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<td>the body temperature</td>
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<td>Use warm, dry compresses</td>
<td>Cavity lavage-Warm solution of salt water inserted in</td>
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<td>a tube down the throat to warm the colon, bladder and</td>
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<tr>
<td>Don’t apply direct heat</td>
<td>stomach</td>
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<td>Remove wet clothing</td>
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</table>

**Vulnerabilities or At-Risk Populations**

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• **Those who take sedatives and antipsychotic drugs** - These types of medication can negatively impact the body's ability to regulate its body temperature.

• **Those with certain medical conditions** - Individuals with health disorders that impair the body's ability to regulate body temperature are susceptible to hypothermia. Examples of these conditions include dehydration, nerve damage, diabetics, spinal cord injuries, burn victims, those with Parkinson's disease, hypothyroidism, stroke, and severe arthritis.

• **Alcohol and drug use** - Alcohol causes blood vessels to dilate (expand) resulting in rapid heat loss to the surface of the skin giving the perception of warmth. Alcohol and drug use impair decisions to seek warmth and warmer clothing. If an intoxicated person passes out in cold weather, it is probable the individual will develop hypothermia.

• **Mental impairment** - People who suffer from mental illnesses such as dementia have impaired judgment; as a result, they may not dress appropriately for severe weather. Additionally, dementia patients may get lost or wander from home, putting them at increased risk for being stranded in wet or cold conditions.

• **Children** - This group loses heat faster than adults due to their head to body ratio. Children may not have the judgment to dress appropriately for the weather or may not pay attention to weather conditions.

• **Older adults** - This group may be at risk for hypothermia due to a loss in the ability to sense cold and regulate body temperature. Additionally, they may be less mobile, able to communicate, or have a medical condition that affects temperature regulation.

**Operational Considerations**

- Promote and educate about the importance of emergency kits - It is important for individuals to have information about basic survival (shelter, food and water), first aid, and prevention of dangerous cold weather conditions, such as hypothermia, frostbite and snow blindness. Officials should provide citizens with possible preparedness measures, survival kit information, and guidance on what to be aware of and what to do if stranded.

- **Public Messaging** - During extreme weather conditions that will put individuals in possible danger of hypothermia, officials should disseminate preparedness messages to the public about these conditions and advising people to keep warm and stay inside.

- **Warming Centers** - If officials are not able to get people indoors (such as the homeless) during cold weather, they can bring people into warming centers to allow them to stay warm. A warming center is a short term emergency shelter that operates when temperatures or a combination of precipitation, wind chill, wind and temperature become dangerously inclement. Their paramount purpose is the prevention of mortality and morbidity related to exposure to the elements.

**References**


**Contributors**

Emmem Ekorikoh, MIS, MPH, Integrated Solutions Consulting
Introduction/Overview
Once the news of a disaster event has reached the public, there will be an urgent and increased demand for medical services and resources. People will rush to hospitals, clinics, and pharmacies for evaluations and treatment without awaiting instructions. Medical surge refers to all patients needing care during a mass casualty event. This includes the sick and injured as well as the worried well. Doctors, nurses, and staff at the health-care facilities will become overwhelmed with the influx of patients seeking their attention. It will be critical for the health-care providers to triage through the masses and provide treatment to those who truly need it and isolate the worried well to avoid wasting scarce resources and time.

Medical surge refers to the ability to rapidly expand the capacity of an existing healthcare system (public health department, alternate care facilities, acute care facilities, community health agencies, and long-term care facilities) for the triage and care of an influx of patients as a result of a disaster event. Mass casualty and/or mass effect incidents create demands that often challenge or exceed the medical infrastructure of an affected community. This ability to provide adequate medical care under such circumstances is known as medical surge. This care must be appropriate to the sustained injuries, be completed within a reasonable time frame, and reduce/minimize medical complications. The occurrence of a disaster event would increase the type and number of patients beyond day-to-day medical capacity. Medical surge includes the ability to rapidly recover/maintain compromised operations and survive a hazard impact. As a result of an increase in patient volume, the following resources will be in higher demand:

- Equipment
- Physical space (hospital beds and alternate care facilities)
- Personnel (clinical and non-clinical)
- Pharmaceuticals
- Secure and redundant communication systems
- Logistical support (clinical and non-clinical supplies and equipment)
- Support functions (laboratories and radiological)
- Personal protective equipment (PPE)

In turn, these resources have a direct effect on the following assets:

- Manage and support resources to maximize capacity
- Move resources based on patient need
- Identify resources to address the need in a timely manner
- Identify the medical need

To mitigate a surge at hospitals, clinics, and pharmacies, media messages will be used to inform citizens to report to the Point of Dispensing Centers (PODs) for medication if they are not exhibiting any symptoms associated with a disaster event. Surge can occur from any event. Examples include anthrax, tornadoes, plague, and explosion. There is an increased need for increased coordination between hospitals and public agencies to monitored bed availability and hospital surge. EMS can be redirected to hospitals that are less surged. Also, during a mass casualty event, it is hard for family to track where patients are. The American Red Cross (ARC) has a defined process called the ‘Patient Tracking System’ that establishes parameters on how hospitals communicate. Hospitals complete the ‘Patient Data Collection Form’ when the ARC requests patient information, a resource/POD hospital provides notice of an ‘incident’, and/or 10 or more patients have been received related to the same incident. Other options to combat medical surge include the option of opening satellite triage stations, temporary non urgent care alternate sites, or federal medical stations.

Symptomatic individuals should report to hospitals for a thorough evaluation and appropriate treatment. Health-care officials will be available at the PODs to answer questions and concerns. Hotlines will also be functioning to respond. Staff
at the healthcare facilities should direct non-symptomatic individuals to the PODs or refer them to the available hotlines for assistance.

**Vulnerabilities or At-Risk Populations**

- **Doctors, Nurses, and Hospital Staff** - These healthcare workers may become overwhelmed by the influx of people seeking medical help and attention. Some may simply be the worried well individuals who are non-symptomatic and do not immediately need any medical assistance but are concerned and demand answers and evaluation amidst the chaos. Therefore, doctors, nurses, and hospital staff must carefully triage through the influx of people and treat those who truly need medical care and appropriately deal with others such as the worried well.

- **Pharmacists** - Many pharmacists will be overwhelmed with individuals rushing to their pharmacies for antibiotics once the attack has been publicized, especially before the PODs open. Within a short period of time, antibiotics for disaster related illnesses will be obsolete in many pharmacies.

- **Individuals with existing health conditions** - Many may have illnesses or disabilities that would be complicated by exposure to the hazard; these individuals may have a higher baseline level of anxiety due to their pre-existing condition. In an abundance of caution, they may be more likely to seek unneeded medical care.

**Operational Considerations**

During medical surge events, agencies should:

- Coordinate with hospital representatives and the EOC regarding hospital bypass, bed capacity (HAVbed), volunteer registries, alternate care facilities, and fatality management (if necessary)
- Coordinate with the local American Red Cross regarding the Patient Tracking System
- Coordinate with the EOC and JIC regarding public information to notify the public of the hazard, control rumors, and mitigate worried well
- Organizations should coordinate their efforts to determine the need (at-risk populations), the supply of vaccine, methods to disbursement, and communication with the public.
- The CDC recommends that public health departments coordinate with hospitals to properly manage medical surge operations. Points of Dispensing (POD) should be established and staffed, if necessary

**References**


**Contributors**

- Emmem Ekorikoh, MIS, MPH, Integrated Solutions Consulting
4.3.1.2.1.5.17 Hazard Impact: Mental Health - Psychological - Hazard Vulnerability
Analysis
Published 1/10/2019 10:18 by Jason Marks

Introduction/Overview
Some hazard agents, particularly in a man-made intentional release, will induce fear, confusion, and uncertainty in the minds of many citizens. Instilling fear and psychological distress to intimidate is the main goal of a terrorist and one of the main impacts of an intentionally released hazard. Natural hazards, whether they are biological or climatic, also have the ability to cause fear and psychological distress. Inflicted on a community wide basis, these hazards can lead to public unrest, posttraumatic stress disorder (PTSD), and mass sociogenic illness.

The impact of disaster related psychological distress can cause long-term disruption to the individual and cause societal impacts such as absenteeism, economic disruption, increased levels of worried well, medical surge, and increased false alarm calls for first responders. Factors including the severity of the incident, the nature of the hazard, and actions taken by local government such as shelter in place or quarantine of individuals can magnify psychological stress and increase the likelihood of mental illness in a community.

Individual mental health impacts after a disaster range from initial immediate alarm and anxiety and can eventually manifest into physical symptoms including nausea, fever, and headaches to long-term malaise, distrust of medical authorities, and in extreme cases, paranoia. Posttraumatic stress disorder is another mental health issues affecting disaster victims and first responders. Posttraumatic stress disorder occurs when an individual experiences trauma along with intense fear, helplessness or horror and then develop intrusive symptoms (such as flashbacks or nightmares). Historical data suggests PTSD may affect individuals who were impacted by a disaster and survived, were the relative of a loved one who died in the disaster, or in some instances, individuals with an underlying mental health condition who may have been directly affected by the disaster. Public debate over the chronic health effects of certain levels of exposure to the agent or hazard will further cause the victim to relive the incident, exacerbate anxiety in the community, and cause a greater probability for the PTSD phenomenon.

Treating mass psychological illness will be a challenging long-term process since the general level of malaise, fear, and anxiety may remain high for years. Public health officials and medical practitioners must closely work with social workers, psychologists, psychiatrists, and those trained in psychological first aid to ease the concerns and fears of the general population and to heal psychological illnesses resulting from the disaster. Mental health professional will be active in multiple areas of a response including:

- Administering psychological counseling to the public and health care workers
- Assisting in the development of messages to deflect panic cause by rumors (which will likely be rampant)
- Disseminating messages that teach coping skills after a disaster
- Promoting support groups for survivors

Vulnerabilities or At-Risk Populations

- Individuals suffering from mental health illnesses such as PTSD, obsessive-compulsive disorder, hypochondria, or general anxiety- these conditions may be complicated by the extra stress caused by disaster events.

- Individuals with existing health conditions that would be complicated by exposure to the hazard- these individuals may have a higher baseline level of anxiety due to their pre existing condition. A disaster event that will threaten to exacerbate this condition will lead to higher stress and psychological distress levels.

Operational Considerations

- Organizations should conduct a public information dissemination campaigns to the population in general and focus on
at risk population messaging

- Organizations should coordinate with the healthcare system and mental health support system to address special populations who may be affected by the hazard
- Organizations should coordinate with advocate groups for the above identified at risk populations

References


Contributors

- Paul DeLuca, MPH, Integrated Solutions Consulting
- Su Aung, MPH, Integrated Solutions Consulting
Introduction/Overview

Overexertion can result from excessive or repetitive physical activity in a variety of scenarios. Activities that cause excessive strain or stress on the body such as shoveling snow, debris removal, prolonged movement with heavy personal protective equipment (PPE), and search and rescue activities can lead to overexertion.

Rhabdomyolysis is a medical term used to define the altered metabolic relationship between energy production and energy consumption in muscles as a direct result of muscle injury. This condition can lead to physical exertion, muscle trauma, and heat stress.

<table>
<thead>
<tr>
<th>Primary Features of Rhabdomyolysis</th>
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<td><strong>Muscular Symptoms and Signs</strong></td>
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Overexertion injuries are commonly the result of repetitive, long-term physical activities. Movements that include reaching, carrying, pulling/pushing, twisting, bending, and lifting are typically associated with overexertion. Overexertion can also occur while walking through loose surfaces such as snow, mud, and sand. Signs include:

- Lack of coordination
- Blue lips and fingers
- Low abdominal pain
- Sweating profusely/feeling hot
- Chest pain
- Nausea
- Fluttering or irregular heart beat
- Sore and painful muscles
- Extreme shortness of breath
- Dizziness
On average, over 30% of non-fatal work-related occupational illnesses and injuries (resulting in days away from the workplace) are caused by repetitive motion and overexertion. According to data from the Liberty Mutual Research Institute for Safety, overexertion was the leading cause of disabling work related injuries, accounting for 25.7%.

Overexertion is especially dangerous in the elderly, smokers, and those with respiratory conditions. This risk is exacerbated in cold temperatures. Cold temperatures stress the circulatory system by making the heart pump harder to warm the extremities. This can result in a heart attack, which is the main cause of death in overexertion.

Stretching prior to strenuous physical activity and proper lifting techniques lessens the risk of injury due to overexertion. Remaining hydrated, eating healthy foods high in energy, and getting adequate sleep and rest increase stamina and awareness and mitigate the risk of overexertion.

At-Risk Populations

- **First responders (fire fighters, police, and EMS) and search and rescue personnel** - these individuals can work long hours/days in extreme temperatures for days or weeks at a time. Improper rest periods can increase the possibility of injury. Strenuous activity with heavy (PPE) can also lead to overexertion.

- **Elderly** - fifty percent of exposure related deaths occur in the elderly with overexertion being a major cause. The elderly may not be use to physically activity and are prone to physical injury from over activity.

- **Individuals with health conditions such as heart disease and asthma** - the added stress of overexertion can lead to heart complications and heart attacks in indivuals with respiratory conditions. Respiratory illnesses such as asthma can be aggravated by overexertion.

- **Smokers** - smoking constricts blood vessels which puts extra stress on the heart. The added stress of physical activities can lead to serious health complications.

Operational Considerations

- Coordinate with hospitals to assist in managing medical surge operations
- Conduct public information dissemination campaigns for the general population and pay special attention to the at risk populations
- Coordinate with advocate groups for at-risk populations to disseminate messages about overexertion prevention.

References


Contributors

Emmem Ekorikoh, MIS, MPH, Integrated Solutions Consulting
Introduction/Overview
(also see Hazard Profile: Power Outage)

During any given emergency or disaster, there may be widespread and/or prolonged electric power failure, which is a significant, but all too common disruption. In the United States, the risk of large-scale electrical failures from extreme hazard events is increasing because rising demand has not been met by sufficient capacity, leaving these systems more vulnerable to any kind of system disturbance. For example, in the last couple decades, consumer demand in the US has increased nearly 35%; however capacity has increased less than 20% in that same time period. This discrepancy has resulted in many more large outages.

Because it is considered one of the key lifeline systems, having electric power is vital to communications, transportation, health care, business, education, banking, and infrastructure, and ensures many other vital services in a community function effectively. Because the provisions of electric power and other critical infrastructure systems are highly interconnected and mutually interdependent, disruptions in one system or sector will have multi-causal effects in the others, which is undoubtedly the case for electric power failure. For example, the disruption to electric power during a disaster is significant not only for its direct impacts on a community, but also in triggering disruptions to water, transportation, and other systems, that in turn, causes further challenges and concerns with respect to life safety issues.

Common causes of power failure may include the following:

- Lightning
- High Winds
- Ice Storms
- Heavy Rains
- Extreme Heat
- Falling Trees and Tree Limbs
- Vehicle and Construction Accidents
- Small Animals
- Equipment Failure
- Metal Foil Balloons
- Faulty or Loose Wiring in a Home or Business

At-Risk Populations & Vulnerabilities

Commuters - Traffic-control devices may go offline and consequently cause an increase in motor vehicle crashes. Also previous power outage incidents show that mass transit commuters (i.e. subway, commuter trains, etc.) may become stranded for prolonged periods of time. This is also true for individuals stranded at airports.

Individuals with Medical Conditions - Individuals dependent on a dialysis machine or other life-sustaining equipment or treatment are especially vulnerable during a power failure incident. Furthermore, home medical devices such as oxygen concentrators, ventilators, and nebulizers can also be a major concern as many of these devices are dependent on electrical power and have limited backup capabilities. Also, due to the "just-in-time" strategy employed by many medical care facilities, shortages of essential medical supplies and medicine may result following a power failure incident.

Individuals with Special Dietary Needs - Because food supply and storage issues are exacerbated during a prolonged power failure incident, individuals with special dietary needs are especially vulnerable and inconvenienced.

Socioeconomically Disadvantaged - These individuals are more likely to have inadequate resources and supplies to
cope with a prolonged power failure incident. Power failure may also incapacitate their heating or cooling systems creating life safety concerns.

**General Public** - General health and safety concerns may become exacerbated during a prolonged power failure incident, especially as it relates to food and water safety.

**Individuals in Elevators or other Confined Spaces** - Although many elevators have backup power, individuals may find themselves trapped in elevators during a power outage. Prolonged periods pose risks due to the lack of food, water, and sanitation.

**Operational Considerations**

Activate the Emergency Operations Center (EOC) if the situation necessitates.

- Ensure the EOC has backup generation.
- Due to the interdependent nature of the power failure impact, planning and preparedness is most effective and vital when done in concert with all key sectors, including the private and public sectors. Identify key stakeholders (i.e. utility company) that should be involved in the management of the incident.

Activate continuity of operations plans (COOP)

- Stockpile appropriate supplies and equipment, especially miniscule items such as: food, water, flashlights, charged batteries, etc.
- Emphasize personal staff readiness, which would include their ability to get to work and family care plans.

Activate plans and/or procedures to address the welfare and safety of functional needs populations.

- Create and maintain a special needs information registry. Efforts should be made to register as many special needs individuals prior to an incident occurring. This registry could be used to identify special needs populations vulnerable to an incident resulting in power failure, such as those dependent on medical devices.
- Plans or procedures should be in place and activated to conduct welfare checks on vulnerable populations, especially for those populations that are dependent on medical devices.

Emergency Management officials should work closely with Power Utility companies.

- Regular contact with a liaison from the power utility organization should be maintained on a 24-hour-a-day basis.
- During events where power failure can be anticipated, power utility companies should activate Load Shedding Plans which reduce demand and energy consumption, first by voluntary conservation, then by predetermined selective load shedding. It should be noted that most utility companies have Load Shedding Plans and are primarily designed to be implemented in capacity deficiency emergencies requiring a fast drop in load levels to prevent the failure of the entire system. The components of a typical Load Shedding Plan may include the following:
  - Should it become necessary to curtail electricity usage, the utilities will typically implement their electric energy emergency conservation plans. These emergency procedures will be put into operation when the public health, safety, and welfare are threatened.
  - If voluntary and mandatory conservation actions do not sufficiently reduce the use of electricity, then electricity supplies may be cut off to certain users in order to preserve electricity for higher priority users. The discontinuation of electricity could include places of amusement, non-essential public places, schools not being used for sheltering, commercial wholesale and retail establishments, and office buildings not engaged in public safety and welfare.

Activate Emergency Public Information Plan and Joint Information Center.
Develop pre-scripted public information materials for the public in order to quickly disseminate important life-safety concerns and guidance to the public. These pre-scripted messages should be formatted so they can be quickly modified to meet the needs of the event.

Coordinate with local, state, and federal agencies in providing energy emergency information, education and conservation guidance to the public, as needed.

Mass media may be limited to radio communications during a power failure situation, so messages should be tailored for this medium.

Utilize the media to provide information.

Work closely with the Utility companies to ensure accurate and timely information is being communicated to the public.

Disruptions to water distribution systems may lead to the need to issue water safety advisories, such as the need for the public to boil water. In issuing these advisories, public health officials need to be explicit and clear in their recommendations. For example, past disasters have shown that public confusion oftentimes exist on which uses of water require boiling (i.e. cooking, drinking, bathing, etc).

Establish a call center or hotline during prolonged power failure incidents. Ensure dispatch is properly staffed to accommodate the influx of calls.

- Oxygen-dependent patients who require additional oxygen tanks but have no other health issues will typically account for a significant portion of the increased call volume during a power failure incident. Call centers should have information readily available regarding oxygen suppliers or should have plans in place to dispatch oxygen tanks to their location.
- Past disasters with power failure have shown that emergency medical service (EMS) related calls typically double during a power failure incident. EMS and emergency personnel/agencies should be prepared to meet the surge of calls. Calls typically are related to questions about anticipating medication storage and availability problems, oxygen supply, and patient home ventilators. Public health officials may consider issuing public information on these topics in order to reduce the number of calls and requests.
- Similarly, past disasters have shown that emergency-911 related calls will also double, especially during the first 24 hours of the power outage. Therefore, government officials and emergency agencies should anticipate this surge by ensuring staff and resources are increased to meet these needs.

Public Health officials should be prepared to address safety concerns during a power failure situation.

- Public health officials should be prepared to work with the Food-Service Industry that require modification in their operational procedures, such as the discontinuation of soda dispensers and ice making machines.
- Loss of refrigeration may create health risks from food spoilage in homes and restaurants. Officials need to clearly define the conditions in which food facilities are allowed to operate during a power failure.
- Inspections procedures and protocols should be activated to ensure foods have not reached unsafe temperature during the outage.
- Inadequate backup generators at some wastewater treatment plants results in release of sewage into surface waters. In such cases, beaches or other bodies of water may need to be closed.

Expand public health surveillance procedures

- Public Health officials should consider expanding routine surveillance to include potential health related problems related to the emergency, such as heat-related illness or carbon monoxide poisoning, which can be secondary effects of a power failure incident.

Ensure hospitals and other medical facilities are in a steady-state of readiness during a power failure incident.

- Hospitals and other medical facilities should anticipate an influx of people who need power for ventilator equipment or
oxygen, and victims from motor vehicle crashes caused by nonfunctioning traffic lights.

- For hospitals, ensure generators are hooked up to all essential systems, such as computers and laboratories.
- Recognize that just-in-time inventory methods will result in serious shortage of essential supplies. Anticipate shortages in supplies and, more importantly, anticipate medical supply needs.
- Consider including representatives from hospitals and long-term care facilities in the EOC.

Establish memorandums of understanding with key medical suppliers

- Prior to a disaster, consider establishing memorandums of understanding with oxygen supply distributors should the need arise to make mass deliveries of oxygen to homebound individuals.

Ensure redundancy in communication tools, such as fax, e-mail, cell phone, pagers, and text messaging, two-way radios. Past incidents have shown that, although many of these tools work at times, they cannot be entirely relied upon. Even landlines cannot be entirely relied upon. In the past, landline communications were inoperable because phone companies’ central offices were also without power. Cell phone and radios also fail if repeaters are not equipped with backup power or if batteries run out, which usually occurs after 4 or more hours.

Ensure critical systems are tied to backup power.

- Planning should address where backup generators should be deployed or staged. For example, in order to keep emergency vehicles in operation, backup power may be essential at fueling facilities.
- Regularly maintain equipment, such generators to ensure they are operationally in a steady-state of readiness.
- Test and exercise backup generating capacities. Past disasters have shown that many organizations have been surprised by what was not covered by their backup systems.
- Consider that oftentimes air conditioning is not tied to backup power because it consumes large amounts of energy; however, determine if critical technologies such as computers or servers need to be cooled so they do not overheat.
- Items oftentimes left off of backup power supply, but should be included are:
  - Electronic keyed door entry systems
  - Network-based telephone systems
  - Fueling systems for public and private vehicles
  - Sump pumps for tunnels or roadway sections that are prone to flooding
  - Spare outlets for small appliances (such as battery chargers)
  - Air-conditioning for equipment rooms
  - Internet servers hosting e-mail systems
  - Radio communication systems
  - Building security systems

Activate Mass Care Plans or Annexes

- Emergency planners might consider activating cooling or heating centers in generator-powered buildings for the general public if the situation necessitates.
- During prolonged power failure situations, shelters may be activated.

Transportation and Traffic control procedures and protocols should be activated to address safety concerns during power failure situations.

- Because traffic-control devices may go offline and consequently cause an increase in motor vehicle crashes, communities may consider adding battery backup to signals at critical intersections.
- Communities may consider using traffic lights that use light-emitting diode displays instead of incandescent lamps, which require less power to operate.
- Response plans for priority intersections should be developed, and should consider factors such as intersection...
safety, sight distance, and traffic volume.

- Standard Operating Procedures for resetting traffic signal controllers should be activated as needed.
- Once power has been restored, officials should inspect all traffic lights to ensure they are functioning properly.
- For large metropolitan communities with mass transit systems, such as subways, operational-level plans need to consider the movement of pedestrians as well as vehicles. Stranded commuters can oftentimes disrupt emergency vehicles from entering critical sites if they are walking through highway tunnels or across bridges. Public address system should be utilized to tell pedestrians where to catch transportation out of the impacted area.

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Contributors
Daiko Abe, Integrated Solutions Consulting, Inc.
Introduction/Overview

Panic can be defined as an acute fear reaction marked by a loss of self-control which is followed by non-social and non-rational flight. Unfortunately, a common myth that many people appear to believe is that people respond to disasters in a socially disorganized and even personally disoriented manner. While such panic flight is a staple of horror books and movies, and periodically is mentioned in connection with crowd behavior (for example, in riots after soccer games), it is a rare response to natural or technological disasters. In fact, doing nothing at all is a much common reaction to a disaster.

In a study, that analyzed seven hundred disasters, concluded that the behavior was mostly rational, sometimes altruistic, and never about the bad within someone when disasters occurred, because to do so was not in their interest.

Observers often interpret any attempt to flee the scene or area where a hazard is present as evidence of panic. Yet, in light of our definition of panic, it is difficult to see why anyone would assume that it is not rational to want to put distance between oneself and a fire, or to move quickly to leave the vicinity of crumbling buildings following an earthquake or terrorist bombing. Indeed, most citizens do not develop shock reactions, panic flight occurs only rarely and people tend to act in what they believe is their best interest, given their limited understanding of the situation. Victims of most disasters quickly tend to regain a collective sense of determination and rapidly immerse themselves in the processes of aiding others.

Although, panic is rare in most disaster circumstances, it doesn’t mean it does not happen. Panic is the worst-case scenario in the human imagination. All norms of behavior, all the things that make us human, dissolve, and all that remains is chaos. Panic can occur if three conditions are present. First, people must feel that they may be trapped. Second, panic requires a sensation of great helplessness – which often grows from interaction with others. Third, one must feel profound isolation.

Panic can produce more than just emotional distress: It has been linked directly to catastrophe. Panicking crowds can stampede, which can result in people being trampled, crushed, or suffocated, which occurred at a Chicago nightclub in 2003. The history of mass panic indicates that they are caused by the perception of a life-threatening situation in conjunction with limited life safety resources.

It also should be remembered that even in cases where conditions for panic flight exist, it does not always materialize. The evacuation of the World Trade Center in 1993 was tense but orderly, with no reports of panic flight. Panic is not entirely unheard of in response to natural or technological disasters, but it is not a common or frequently observed reaction to any type of disaster. When panic flight is observed, it seems to involve a relatively small proportion of the people exposed to the threat and does not usually persist for any period of time.

Vulnerabilities or At-Risk Populations

- Children are dependent on adults security, and the younger they are, the truer this is. Children lack the authority and ability to control their environment and they lack the maturity to understand certain circumstances.

- Elderly populations demonstrate increased needs and physical limitations as a result of the natural aging process. They may not have the physical ability to withstand certain situations that occur with mass panic (e.g., stampedes)

- Non-English speaking persons may be more susceptible to mass panic because of their limited ability to understand directions and information pertaining to the disaster.

Operational Considerations
• Disseminate Accurate Information - In midst of chaos, people feel grounded by knowledge. It can be that the antidote for chaos is accurate information. It is important to address fears as soon as an incident has taken place by disseminating information about the hazard and recommended protective actions. Officials should focus on defining the threat, explaining its human consequences, and explaining what can be done to minimize negative consequences. If the actions to minimize the consequences cannot be undertaken by individuals, but must be executed by authorities, then one explains what is being done. Contrary to popular fiction, the road to anxiety reduction is through providing - not withholding - information.

• Recommend Actions - Authorities need to understand that people who are informed of a danger will undertake any feasible actions that they believe will reduce that danger. National opinion polling following the September 11 attacks indicated there was a substantial increase in levels of “trust in government”. It is therefore important that official messages include recommended actions. A message not accompanied by constructive suggestions for action simply enhances fear, which itself cannot be salved without information and action.

• Rumor Control - Officials should not spread rumors or allegations about possible mass panic until they are confirmed to be true and announcing so will be beneficial to the community in some way. These rumors or allegations can prove to cause more harm than good, as seen in Hurricane Katrina.

• Public Safety/Emergency Response - Law enforcement and emergency response officers should be aware of the possibility of mass panic after a disaster has occurred. However, officials need to recognize that this does not always occur and should understand the differences between fear and panic flight.

The expectation that regular people will panic leads to all kinds of distrust on the part of neighbors, elected officials, and law enforcement officers. The idea of panic grips the imagination. The fear of panic can actually be more dangerous than panic itself. Many Americans have died because someone thought they would panic if given a warning on a specific threat – the basic tools of their own survival.

References


Contributors

• Tom Russell, Consultant, Integrated Solutions Consulting
Introduction/Overview

When temperatures plummet and heavy snow falls occur, most people try to stay home and avoid the frigid weather and slick roads. However, sometimes an unexpected storm strikes or people try and venture outside, cars fail, slide-off occurs, and roads become blocked, causing even the most seasoned motorist to become stranded. In other hazards, debris can cause major road blocks making it difficult for emergency workers to rescue motorist.

When motorist are stranded they have been known to walk away from their vehicles and get lost. During dangerous cold weather conditions, stranded motorist must be prepared to withstand below zero wind chills, for an extended period. During these conditions motorist may experience hypothermia, frostbite, and snow blindness.

At-Risk Populations

- Any Age Group – Although certain populations such as children and the elderly may be more at risk for injuries or cold temperatures, all populations will be affected by harsh conditions. More information on vulnerable populations can be found in each related impact section (e.g., hypothermia, frostbite).

Operational Considerations

- Preparedness Measures - Winter weather survival can test the limits of human endurance and stamina. Those unprepared and untrained often surrender to the harsh circumstances. Just an hour of prep time packing a survival kit, and gaining awareness can be life saving during a frozen encounter in a stranded vehicle. Along with basic survival (shelter, food and water) understanding first aid and prevention of dangerous cold weather conditions, such as hypothermia, frostbite and snow blindness, is essential. Officials should provide citizens with possible preparedness measures, survival kit information, and guidance on what to be aware of and what to do if stranded.

- Public Messaging - During extreme weather conditions that will put motorists in possible danger of being stranded, officials should put preparedness messages out to the public about these conditions and advising motorist to avoid traveling.

- Warming Stations – If officials are not able to get vehicles off the road during cold winter weather, they can bring people into warming stations to allow them to stay warm. A warming center is a short term emergency shelter that operates when temperatures or a combination of precipitation, wind chill, wind and temperature become dangerously inclement. Their paramount purpose is the prevention of mortality and morbidity related to exposure to the elements.

- Increase Patrolling – Officials may want to increase police patrolling on major highways and roads to ensure stranded motorist get assistance.

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Contributors

- Tom Russell, Integrated Solutions Consulting
Introduction/Overview
Sunburn causes inflammation to the skin due to overexposure to the sun’s Ultraviolet radiation (both UVA and UVB). Ultra violet radiation from the sun, in the form of UVA and UVB rays, reaches the earth through the atmosphere and can have negative effects on our skin.

UVA radiation is more common than UVB and primarily causes long-term skin damage and premature aging of the skin. UVB radiation is chiefly responsible for sunburn, which damaging the skin’s epidermal layers and causing a reddish appearance followed by pain, the degree of which depends on the duration and intensity of exposure to the sun’s rays. Additional symptoms may include fatigue and mild dizziness. Although many people may suffer from varying degrees of sunburn during summertime, extreme and prolonged exposure to the sun’s UV radiation may be life-threatening due to the development of skin cancer. In fact, excessive UV-radiation is the leading cause of skin cancer.

Sunburn is triggered by direct damage to the skin’s DNA after prolonged exposure to UV-radiation. When the skin cells’ DNA is damaged, type-I cell death is triggered by the skin’s repair mechanisms, and the damaged skin is replaced. However, malignant melanoma may result if the repair is not proper when the cells have undergone indirect DNA damage. Still, the majority of the damaged DNA is appropriately repaired, which is why cancer does not always result from UV exposure. Currently, the only cure for sunburn is slow healing. Some over-the-counter creams may alleviate symptoms such as peeling of the epidermis and irritation.

Individuals of all ages can suffer from sunburn and any part of the body is subject to sunburn, especially they eyes. Individuals can be exposed to sunburn while partaking in activities such as visiting a beach, fishing, tanning, working outdoors, and simply being out in the sun. Individuals can also receive sunburn in non heat related activities such as the sun being reflected from snow during skiing and other winter related events.

Protective clothing and sunscreen can be used to protect against sunburn. However, sunscreen can protect the skin only to a certain degree against sunburn. The best protection is to avoid prolonged exposure to the sun, especially during extreme heat conditions.

Vulnerabilities or At-Risk Populations
- Individuals of Any Age- can suffer from sunburn. The degree of inflammation and pain will depend on duration and exposure to the sun.
  - Certain lighter complexion individuals are at greater risk of sunburn injury.
- Homeless- individuals, especially, are at risk for sunburn since they lack shelters and proper clothing to protect them against the sun.
- Outdoor Workers- who work long hours in direct sunlight without adequate protection are prone to sunburn.

Operational Considerations
- Support Emergency Operations Center operations
- Conduct public information dissemination campaigns for the general population and pay special attention to the at risk populations

References
- Center of Disease Control and Prevention. (2009). Extreme heat: A prevention guide to promote your personal health


Contributors

- Paul DeLuca, MPH, Integrated Solutions Consulting
- Su Aung, MPH, Integrated Solutions Consulting
Introduction/Overview
The psychological and sociological effects of disasters play a key role in preparing, mitigating, responding, and recovering from disasters. The phenomenon of the "worried well" is no exception. The worried well are a subset of a population who seek medical treatment to a disease or event even though they have limited or no exposure to the agent in question. The worried well can stress a community’s healthcare infrastructure and lead to medical surge. Historical occurrences of worried well during disasters have measured the impact ranging from fifty percent to over ninety-nine percent of all patients. During medical surge events, a community’s healthcare system must provide adequate treatment and medical care when demand for services overwhelms the existing capability to respond. During disaster events, health systems may already be surged; worried well will add to this problem.

The scope of magnitude of the worried well phenomenon cannot easily be measured but is affected by several factors:

- **Media** - the internet and cable TV have fueled a competitive news environment. Media increasingly is concerned with being the first outlet to produce information on a story. Unfortunately, this competition has contributed to misinformation and sensationalism. This has lead to increased confusion among the public. Considering the inaccurate or even misleading information a hazard can cause, the public can react by seeking medical consult for information on how they will be affected by the hazard.

- **Government messaging** - after disaster events, the public looks to the government to provide official information of health risks and hazard impacts. It is imperative governmental authorities act as the definitive and expert voice on the disaster. However, even if done well, subtle cues in messaging can lead to increased panic and uncertainty in the public. Individuals involved in disasters have reported increased concern when higher-level officials participate in messaging. Messages that urge those affected by the disaster to seek medical care will be taken literally and could contribute to the worried well phenomenon. Finally, erroneous messaging will foment suspicion and rumoring and will contribute to the public seeking expertise through medical consultation.

- **Uncertainty of hazards effects** - when a hazard’s effects are uncertain or foreign to an individual, they will likely seek out an expert’s opinion. It is innate in humans to fear what they can not perceive or do not understand. Information allows individuals to assess their situation and practice coping mechanisms. Without this information, individuals are at the mercy of the hazard and will not know how to cope with its effects.

Since the basis of the worried well phenomenon is rooted in the sociological and psychological conventions, there is no defined method to eliminate it. However, certain mitigation strategies have been identified:

- Public information about the hazard should be timely and accurate and from an expert voice in government. Studies suggest people will contact the health system for information even if they are not symptomatic. Providing expert and accurate information will lessen this action.

- Involve community groups and volunteers in preparedness planning and exercises to the extent possible. Community involvement will not only produce stronger plans but it will build familiarity and lessen confusion in the event of a disaster.

- Develop strong relationships with the media. Keeping the media informed will reduce speculation and help get accurate messages to the public.

- Use alternate communication methods- information transmitted through alternate modalities such as web logs and social media sites can spread quickly and lead to rumoring. Disseminating hazard related messages through these
modalities will help control rumors and reach a larger audience.

- Guidance: health-care facilities (e.g., hospitals, ambulatory medical care centers, and primary care clinics) should work during the preparedness phase with professionals and/or professional associations in psychology, psychiatry, social work, and public health to develop guidance on addressing the issues associated with the worried well. This guidance should include procedures for psychological first aid as well as a training initiative on:
  - How staff should interact with people arriving at the hospital
  - Questions staff should ask during their first encounter with this type of individual
  - Primary messages to be delivered and how to deliver them
  - Ways staff can manage the public’s fear and anxiety

Vulnerabilities or At-Risk Populations

- Individuals suffering from mental health illnesses—such as post-traumatic stress disorder (PTSD), obsessive compulsive disorder, hypochondria, or general anxiety—will be more susceptible to the worried well phenomenon.

- Individuals with existing health conditions that would be complicated by exposure to the hazard; these individuals may have a higher baseline level of anxiety due to their pre-existing condition. In an abundance of caution, they may be more likely to seek unneeded medical care.

- Non exposed individuals in close proximity to the hazard event—previous disasters, have seen increased level of patients seeking care that were unexposed but in close proximity to a disaster. In highly populated urban areas, this can lead to the healthcare system being overwhelmed by demand.

Operational Considerations

- Organizations should conduct a public information dissemination campaign to the population in general and focus on at-risk population messaging.

- Preparedness and response operations should coordinate with the healthcare system to address special populations who may be affected by hazard events that contribute to the worried well phenomenon.

- Organizations should coordinate with advocate groups for identified at-risk populations to assist in the public information process.

References


Contributors

- Paul DeLuca, MPH, Integrated Solutions Consulting
4.3.1.2.1.5.24 Hazard Impact: Water Infrastructure Failure - Hazard Vulnerability Analysis

Introduction/Overview

Water infrastructure systems include:

- Surface and groundwater sources of untreated water used for municipal, industrial, agricultural, and household needs
- Dams, reservoirs, aqueducts and pipes that contain and transport raw water
- Treatment facilities that remove raw water contaminants
- Finished water reservoirs
- Systems that distribute water to users
- Wastewater collection and treatment facilities

Nationwide, these water infrastructure systems include more than 75,000 dams and reservoirs, 16,000 publicly-owned wastewater treatment facilities, more than 54,000 community water facilities that provide service to customers year-round, and more than 116,000 water facilities that serve customers on a less than year-round basis. A relatively small number of large drinking water and wastewater facilities (15%), mostly located in urban areas, provide water services to almost two-thirds of the U.S. population. Ownership and management of these systems is both public and private. However, while the federal government has oversight responsibility for many of the dams and diversion structures, the vast majority of the nation’s water infrastructure is owned by local and state jurisdictions or non-governmental entities.

Water infrastructure systems play an important role in communities. Water treatment systems, including distribution mechanisms, and wastewater systems serve a critical purpose in sanitation and disease prevention by removing harmful viruses, bacteria, and parasites. Keeping water supplies clean of contaminants results in reduced sickness and associated health care costs, which in turn, contributes to reduced absenteeism in the workforce and increased worker productivity. Providing sufficient water supplies to industries that rely on pure water for processing, cooling, or product manufacturing means that these systems generate direct economic value across many sectors of the economy across the country. Storage reservoirs and water towers help ensure this continued availability of clean water, providing additional water resources during peak demand time. Dams can supply hydropower for generating mechanical and electrical energy, protect against flood threats, gradually release water downstream for navigation to ensure adequate minimum water flow, and deliver sufficient amounts of process water and drinking water for industry and population. Further applications of dams include irrigation in agricultural endeavors as well as the accumulation of ground water and creation of fish farms.

While it is feasible that water infrastructure disruption could occur due to an internal failure within the system, it is considered more likely that a failure would ensue as a resulting impact from another hazard. For example, water infrastructure could sustain physical damage inflicted by a natural hazard such as a flood, fire, or tornado. Water infrastructure disruption could also be the result of a manmade hazard, with the system potentially being targeted for intentional physical destruction or contamination through chemical attack or bioterrorism attack. Physical damage sustained by water infrastructure could result in the destruction or disruption of operating systems or distribution components, power or telecommunications systems, electronic control systems, raw water reservoirs, aqueducts, and pumping stations, or water treatment chemical containers.

Health and other risks associated with water infrastructure damage could include:

- Illness and increased risk of disease from using water for drinking, bathing, or other hygiene activities due to contamination by livestock waste, human sewage, chemicals, microbiological organisms, and other contaminants
- Hindrance to firefighting operations from loss of water pressure
- Economic loss due to lack of water supply for manufacturing and other processes
Back up of sewage could create environmental hazards
Loss of life and significant flooding from dam failure, as well as potential loss of hydroelectric power when applicable

Strategies to mitigate water infrastructure disruption include:

- Identifying emergency operations and cleanup crews and resources in advance
- Pre-arranging the purchase of materials and supplies and the borrowing/leasing of heavy equipment needed to make repairs to the water system, possible including piping, valves, chemical feed-line tubing, and hydrants.
- Preparing and maintaining emergency response plans and current contact lists
- Creating mutual aid and assistance agreements to facilitate expedited access to the specialized resources needed to recover from water infrastructure disruptions
- Establishing in advance the appropriate media for customers to access information and press advisories
- Ensuring all essential personnel are trained to shut down and start up system in case of emergency
- Stocking up on first-aid supplies, batteries, flashlights, and cellular phones or other wireless communication devices, as well as non-perishable food and water for any essential persons that remain on site or are considered first responders to the water system
- Establishing alternative transportation strategies for rotating in core employees to the facility if road conditions prevent travel
- Reviewing distribution maps to ensure they are up-to-date with isolation valves properly identified and having extra copies on hand for staff working in the field
- Making arrangements with the local power utility to be prepared to restore power to the water system as a priority customer

Vulnerabilities or At-Risk Populations

- **General Public** - General health and safety concerns may become exacerbated during a prolonged water infrastructure systems disruption, especially as it relates to drinking water, hygiene, and sanitation issues
- **Infants and young children** - Infants and young children may be more susceptible to the risk of infection, especially bacterial, associated with the contamination of the water supply system.
- **Elderly** - Elderly individuals may be more susceptible to the risk of infection, especially bacterial, associated with the contamination of the water supply system
- **Immuno-compromised individuals** - Individuals already suffering from a compromised immune system may be more susceptible to the risk of infection, especially bacterial, associated with the contamination of the water supply system
- **Low socio-economic status** - Individuals with a low socio-economic status may not have the resources to purchase bottled drinking water or take other precautionary measures to protect against water-borne illness

Operational Considerations

- Sample appropriate system elements (storage tanks, filters, sediment basins, solids handling) to determine if residual contamination exists.
- Activate the Emergency Operations Center (EOC) if the situation necessitates.
- Activate continuity of operations plans (COOP) if the situation necessitates
  - Stockpile appropriate supplies and equipment, especially miniscule items such as: food, water, flashlights, charged batteries, etc.
  - Emphasize personal staff readiness, which would include their ability to get to work and family care plans.
- Activate plans and/or procedures to address the welfare and safety of functional needs populations, if the situation necessitates.
- Contact public health/safety officials and state primacy agency to determine proper health notifications and water advisories for the public (e.g., boil water, do not drink, etc.)
- Request an emergency water supply, if necessary
• Conduct a public information dissemination campaign to the population in general and focus on at risk population messaging, including the development of pre-scripted public information materials that allow for quickly dissemination of important life-safety concerns and guidance to the public.
• Coordinate with local, state, and federal agencies in providing water emergency information, education and conservation guidance to the public, as needed.
• Consider expanding routine surveillance of public health officials to include potential health related problems related to the water-borne illness and sanitation issues if situation dictates.
• Ensure hospitals and other medical facilities are in a state of readiness during a water infrastructure failure incident, if necessary.
• Close necessary beaches or other bodies of water in situations where release of sewage has occurred due to wastewater treatment plant issues.
• Ensure that any chemicals used in treatment processes are kept in a safe place.

References


Contributors

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4.3.1.2.1.5.25 Hazard Impact: Transportation Failure - Hazard Vulnerability Analysis

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Introduction/Overview

The nation’s transportation system is a vast, open, interdependent networked system that moves people and goods throughout the country and overseas. This safe, efficient, and secure movement of people and goods through the transportation is critical to the nation’s way of life and its economy. Every day, the transportation system connects cities, producers, manufacturers, and retailers, moving substantial quantities of people and goods through six different subsections, or modes. These different modes include:

- **Aviation**– Incorporates aircraft, air traffic control systems, and approximately 450 commercial airports and 19,000 additional airfields. This mode includes civil and joint use military airports, heliports, short takeoff and landing ports, and seaplane bases.
- **Highway**- Encompasses more than 4 million miles of roadways and supporting infrastructure. Vehicles include automobiles, buses, motorcycles, and all types of trucks.
- **Maritime Transportation System**- Consists of about 95,000 miles of coastline, 361 ports, over 10,000 miles of navigable waterways, 3.4 million square miles of Exclusive Economic Zone to secure, and intermodal landside connections, which allow the various modes of transportation to move people and goods to, from, and on the water.
- **Mass Transit**- Incorporates multiple-occupancy vehicles, such as transit buses, trolleybuses, vanpools, ferryboats, monorails, heavy (subway) and light rail, automated guideway transit, inclined planes, and cable cars designed to transport customers on local and regional routes.
- **Pipeline Systems** -Encompasses vast networks of pipeline that traverse hundreds of thousands of miles throughout the country, carrying nearly all of the Nation's natural gas and about 65 percent of hazardous liquids, as well as various chemicals.
- **Rail**- Consists of hundreds of railroads, more than 143,000 route-miles of track, more than 1.3 million freight cars, and roughly 20,000 locomotives.

While it is feasible that disruption of the transportation system could occur due to an internal failure within the system, i.e. bridge collapse or train derailment, it is considered more likely that a failure would ensue as a resulting impact from another hazard. For example, transportation infrastructure could sustain physical damage inflicted by a natural hazard such as a flood, earthquake, or hurricane. The nation’s transportation system could also be disrupted as the result of a manmade hazard, with the system potentially being targeted for intention physical destruction by individuals or groups that seek to attack the nation.

A significant disaster or event can create a dual set of challenges for the transportation system. Routine transportation activities could be hampered during the event by damage to facilities, equipment, or the infrastructure itself, requiring repairs or replacements to occur before that component of the system becomes useable thereby creating a situation of diminished capacity. At the same time that the system may be facing diminished capacity, there may also be a heightened level of demand on transportation assets. The transportation system may be required to bring in necessary response and recovery assets in the form of personnel, equipment, and supplies to assist in providing relief. Thus, the transportation system may be faced with both the challenge of returning to normal operating capabilities while concurrently attempting to move critical goods and people into the disaster area.

Strategies to mitigate transportation infrastructure disruption include:

- Understand capacity and limits of all levels of public and private transportation systems.
- Maintain a credible, reliable, and easily maintained communication platform that provides accurate and up-to-date information, (i.e. real-time traffic website, 5-1-1 system, highway message boards, etc.)
Plan and prepare the notification systems (i.e. 5-11 system, press releases, highway message boards, etc.) to support an emergency/disaster response. The systems should address evacuation orders (voluntary or to compel), local emergency declarations (to include the closures of roads and bridges, suspension of construction and maintenance, activation of transportation traffic counters, and the lifting of tolls on evacuation routes).

- Encourage the development of business continuity plans that specifically address transportation systems disruption.
- Create detailed response plans for respective transportation systems and recovery following the framework of Emergency Support Function (ESF) #1 – Transportation and ESF #14 – Long Term Recovery.
- Create a plan for Freight System Resilience, including pertinent private and public sector stakeholders in its formation.
- Construct alternate routes to and from key infrastructure and maintain excess highway capacity.
- Build relationships between the public and private sector, especially between public works, department of transportation, and emergency management personnel and the members of the private transportation sector.

Vulnerabilities or At-Risk Populations

**Commuters or other travelers** – Stranded commuters or travelers can become a significant problem in the event of a transportation system breakdown. Mass care and sheltering may become necessary in the event of a transportation system disruption of significant magnitude and/or duration.

**Emergency responders and public safety personnel** – Damage or disruption to the transportation infrastructure, especially the roadway system, can create threats to rescuer safety when transiting to and from events. The inability or delay of rescue vehicles reach the scene of an event could potentially postpone critical treatment to the injured and therefore could increase potential life loss.

**Evacuees** – Damage or disruption to the transportation infrastructure, especially the roadway system, could create potential challenges with evacuating individuals out of impacted areas, especially in the aftermath of an event with a fast onset that allowed for little to no evacuation time prior to its occurrence. It may also delay re-entry into disaster areas which has implications for mass care and sheltering.

**Businesses and other commercial ventures** - Depending on the magnitude of the transportation system disturbance, economic disruption might occur ranging from limited to severe. Impassible roads, rail ways, and transportation corridors will impact delivery and services of goods. Lost worker time also needs to be considered from transportation disruption. Businesses in the immediate vicinity of an event that rely on the shipment of goods either in or out of their location could be potentially impacted the most. However, businesses not in the immediate impact area, but that either transit good or people through the impacted area or have a significant customer base in the immediate impact area might also be negatively affected.

**Energy services** – The energy sector leverages the transportation system to move crude oil, petroleum products, coal, and natural gas products throughout the country. The inability to transport these goods through the system due to damage or disruption could have a negative effect on the capacity to generate energy in the affected area, as well as a larger impact on the price of energy commodities.

**Hospitals and public health facilities** – Hospitals and other public health facilities rely on the transportation network for delivery of critical supplies such as medicine, supplies, and equipment for patient care. These facilities and their patients could be facing a shortage of necessary supplies in the event of a transportation disruption of significant duration or magnitude.

**Institutions with large numbers of people** – In addition to hospitals, other institutions that serve large numbers of people, such as nursing homes, universities, or prisons, may face the potential of supply shortage of food and other necessary commodities to care for the people who reside in the facility in the event of a transportation disruption of significant duration or magnitude.
Hazardous materials - Hazardous materials are often moved throughout the nation through the transportation system, especially the highway, rail, pipeline, and maritime modes. A disruption or damage to the system may result in the release of hazardous materials. Disruption to the system may also require unscheduled hazardous materials offloading, storage, and/or disposal.

Operational Considerations

- Assess the damage to transportation infrastructure and analyze the impact of the incident on transportation operations locally, regionally, and nationally. Include industry partners in assessment.
- Activate the Emergency Operations Center (EOC) if the situation necessitates.
- Activate plans and/or procedures to address the welfare and safety of functional needs populations, if the situation necessitates.
- Prioritize and initiate emergency work to clear debris and obstructions from, and make emergency repairs to, the multi-modal transportation infrastructure.
- Conduct a public information dissemination campaign to the population in general and focus on at risk population messaging, including the development of pre-scripted public information materials that allow for quick dissemination of important life-safety concerns and guidance to the public on transportation related issues.
- Implement appropriate air space and air traffic management, if applicable. Anticipate, evaluate, and respond to all requests for temporary flight restrictions according to established procedures.
- Coordinate the monitoring, control, and coordination of vehicular traffic flow.
- Coordinate public transportation assets needed to manage the movement of people and resources.
- Provide suggested highway route alternate/detour plans which provide the best option for emergency traffic management.
- Coordinate the flow of land, air, rail, and marine traffic in and to the disaster area for the effective movement of relief supplies, personnel, and equipment. Alternate transportation resources and routes may need to be considered in response to certain types of infrastructure system failures. For example, in instances where flooding has damaged or destroyed road infrastructure, watercraft, such as canoes and powerboats, can be useful means of transportation during the event.
- Liaison with commercial transportation providers concerning significant interruptions of services.
- Coordinate hazardous material response and movement, if necessary.
- Support evacuation operations and re-entry operations for impacted areas.
- Coordinate the restoration and recovery of transportation infrastructure.
- Provide alternative transportation routes if long term repairs are estimated to transportation system and infrastructure

References

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