

Sanford

Underground Research Facility

South Dakota Science and Technology Authority

Severe Weather Management Standard

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Revision History

Rev	Date	Section	Paragraph	Summary of Change	Authorized by
01	9/6/2022	NA	NA	Initial Release	CCR 604

1.0 Purpose

This document describes the processes to be implemented when severe weather is approaching or present at Sanford Underground Research Facility (SURF) to ensure that risks associated with severe weather to personnel and infrastructure are managed to the lowest practicable level.

SDSTA complies with the following regulations to fulfill this standard:

- <https://www.weather.gov/safety>
- https://www.osha.gov/dts/weather/winter_weather/windchill.html
- <https://www.nfpa-780-m.4.2>
- <https://www.nfpa-780-34> Standard 8: Protection of Structure Housing of Explosive Materials 8.1.3 (1,2)
- SDSTA-(Manual)-187303 SDSTA Policy and Policy-Procedure Manual

2.0 Scope

This document applies to all personnel when present on SURF property who may be impacted by severe weather.

3.0 Definitions

Acute – an event or condition having a sudden onset, sharp rise and short course.

Air Quality Index (AQI) – An index developed by the Environmental Protection Agency that is used for reporting air quality. The index runs on a scale from 0 to 500. The higher the AQI value, the greater the level of air pollution and the greater the health concern.

Advisory – An announcement or bulletin that serves to advise and usually warn the public as to a potential hazard.

Electrostatic discharge – Rapid discharge of electricity between two objects of a different charge.

Meteorological event – Changes and shifts in the temperature, air pressure and amount of water vapor in the atmosphere.

Particulate matter – A mixture of solid particles and liquid droplets suspended in the air. Some particles, such as dust, dirt, soot or smoke are large or dark enough to be seen with the naked eye.

Practicable – Able to be done or put into practice successfully.

Rainfall intensity – The ratio of the total amount of rain (rainfall depth) falling during a given period to the duration of the period it is expressed in depth units per unit time, usually as millimeters per hour (mm/h).

Relative humidity – The amount of water vapor present in air expressed as a percentage of the amount needed for saturation at the same temperature. Relative humidity is a function of both moisture content and temperature.

Risk – Potential to cause harm or damage to a person, property or environment.

Severe Weather – Any dangerous meteorological phenomenon with the potential to cause damage, serious social disruption or loss of human life.

Suspend – To temporarily pause an activity.

Trigger Action Response Plan (TARP) – A predetermined list of controls aligned with escalating levels of risk.

Watch – A watch is used when the risk of a hazardous weather or hydrologic event has increased significantly, but its occurrence, location and/or timing is still uncertain. It is intended to provide enough lead time so that those who need to set their plans in motion can do so.

Warning – A warning is issued when a hazardous weather or hydrologic event is occurring, is imminent or has a very high probability of occurring. A warning is used for conditions posing a threat to life or property.

Wind Chill – A quantity expressing the effective lowering of the air temperature caused by the wind, especially as affecting the rate of heat loss from an object or human body or as perceived by an exposed person.

Wind Gust – A brief increase in the speed of the wind, usually less than 20 seconds.

4.0 Responsibilities

4.1. Laboratory Director

- 4.1.1. Ensures that necessary processes, tools, resources and training regimes align with the risk profile.
- 4.1.2. Ensures accountability of the requirements of this document with direct reports.
- 4.1.3. Ensures training requirements are completed in a timely manner.
- 4.1.4. Approves and issues formal communication needs.
- 4.1.5. Supports communication efforts.

4.2. Operations Division Deputy Director

- 4.2.1. Follows all requirements as specified in this Standard.
- 4.2.2. Ensures direct reports and departmental staff follow the requirements as specified in this Standard.
- 4.2.3. Ensures training requirements are completed in a timely manner.
- 4.2.4. Ensures response equipment and resources are properly maintained for severe weather events.
- 4.2.5. Supports communication efforts.

4.3. Environment Safety & Health (ESH) Director

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- 4.3.1. Follows all requirements as specified in this Standard.
 - 4.3.2. Ensures direct reports and departmental staff follow the requirements as specified in this Standard.
 - 4.3.3. Develops and implements training requirements.
 - 4.3.4. Ensures training requirements are completed in a timely manner.
 - 4.3.5. Coordinates training resources and maintains associated records.
 - 4.3.6. Coordinates with Executive Director and Communications Director on formal communication requirements.
 - 4.3.7. Supports communication efforts.
- 4.4. Environmental Manager
- 4.4.1. Completes environmental inspections.
 - 4.4.2. Reports environmental issues to SDSTA management and project staff.
 - 4.4.3. Reports environmental issues in accordance with regulating agencies.
 - 4.4.4. Supports communication efforts.
- 4.5. Communications Director
- 4.5.1. Coordinates with Executive Director and ESH Director on formal communication requirements.
 - 4.5.2. Supports communication efforts.
- 4.6. Duty Officer/Security
- 4.6.1. Supports communication efforts.

5.0 Instructions

5.1. Introduction

- 5.1.1. Severe weather is a meteorological event that is caused by changes in the earth's atmosphere. These events are often associated with the various seasons although not necessarily confined to a specific time of the year. A consistent approach is necessary to mitigate the risks associated with these events.
- 5.1.2. This consistency is achieved using TARPs. The TARPs utilize three color-coded alert phases to address escalating and de-escalating levels of risk that include pre-determined trigger points that, when breached, are assigned a corresponding response associated with each color. The alert shall be cancelled once the threat no longer exists.
- 5.1.3. Color categories are comprised of blue, yellow and red, with blue being the least serious. Events can be initiated within any color category and can escalate or de-escalate depending on the severity. Specific responses are listed within each escalating level of risk category.
- 5.1.4. SDSTA utilizes eight TARPs found within this Standard that are designed to provide a proactive and consistent approach to protecting personnel and property in the event of severe weather and structured in the following order. These are the components evaluated to determine TARP events.
 - Air Quality
 - Allergens
 - Dust Storms
 - Fog
 - Smoke
 - Cold Temperatures
 - Ice Storms
 - Snow/Blizzard
 - Heat Index

- High Wind
- Lightning
- Thunderstorms
 - Hail
 - Heavy Rains
- Tornado
- Visibility
 - Dust Storms
 - Fog
 - Rain
 - Smoke
 - Snow/Blizzard
 - Wind

5.1.5. Individual TARPs may contain numerous subcomponents contributing to the TARP category. In addition, TARPS may interact with each other for a comprehensive response plan. For example, if the severe weather event is a blizzard, its components can be found in the Cold Temperatures and Visibility TARPs. Multiple TARPs may be utilized during severe weather event(s).

5.1.6. The SDSTA Work Planning and Control process has identified severe weather events and associated energies.

5.1.7. **NOTE:** Environmental conditions during workplace activities, not associated with severe weather, shall be addressed in a separate hazard analysis as part of the work planning and control process.

5.2. Air Quality

- 5.2.1.** Air Quality is a measure of the suitability of air for breathing by people, plants and animals.
- 5.2.2.** Poor air quality is responsible for an estimated 60,000 premature deaths in the United States each year. Costs from air pollution-related illness are estimated at \$150 billion per year. Common air pollutants like ozone and particulate matter may facilitate adverse health effects including asthma attacks; eye, nose and throat irritation; heart attacks; allergic reactions; and other respiratory and cardiovascular problems.
- 5.2.3.** Air quality has improved significantly since the passage of the Clean Air Act in 1970; still, there are many areas of the country where the public is exposed to unhealthy levels of air pollutants and sensitive ecosystems are damaged by air pollution. This air pollution can be generated by a variety of sources, including industrial processes, construction projects, dust, pollen, and smoke from fires.
- 5.2.4.** The AQI is measured on a scale from 1 – 500. A lower score indicates high-quality air, while a higher score indicates low-quality air. An AQI of 51 and above will initiate an alert for air quality.
- 5.2.5.** The TARP shown in Table 1: Air Quality TARP describes the specific response guidelines that shall be followed.

BLUE ALERT Air Quality: AQI 51-150	YELLOW ALERT Air Quality: AQI 151-200	RED ALERT Air Quality: AQI 201+
<ul style="list-style-type: none"> • Continuous monitoring of weather warning systems • AQI: https://www.airnow.gov/ https://denr.sd.gov/des/aq/aarealtime.aspx • NWS: https://www.weather.gov/ 	<ul style="list-style-type: none"> • Notifications made to affected personnel 	<ul style="list-style-type: none"> • Notifications made to affected personnel • Announce via sitewide communications
SURFACE		
<ul style="list-style-type: none"> • Assess all outdoor activity and evaluate appropriateness of initiating new tasks 	<ul style="list-style-type: none"> • Affected personnel to identify nearest safe location and be prepared to move inside • Limit outdoor tasks for workers. 	<ul style="list-style-type: none"> • Suspend all affected outdoor activities • All personnel to immediately move indoors
UNDERGROUND ACCESS		
<ul style="list-style-type: none"> • Check for sufficient air quality and ventilation for underground work areas, including underground shafts. 	<ul style="list-style-type: none"> • Evaluate underground work tasks until the alert is cancelled. 	<ul style="list-style-type: none"> • Evaluate suspending underground work and relocate to fresh air until the alert is cancelled.
BE AWARE	BE PREPARED	TAKE ACTION

Table 1: Air Quality TARP

Source: National Weather Service

5.2.6. Preventative Actions:

- Limit strenuous outdoor activity, particularly for individuals with pre-existing respiratory issues and workers 55 years or older.
- Remain in fresh air until the alert has been cancelled.

5.2.7. Event Follow-Up:

- Supervisor to account for their assigned personnel.
- Coordinate with external emergency support as needed.
- Perform Damage Assessment inspection across site as needed.
- All personnel shall report any injuries, illness or operational disruptions via the internal incident notification process (ESH-(3000-F)-173324 First Report and Incident Investigation).
- Evaluate and provide for formal communication needs. All formal communications are to be approved and issued by the Lab Director and/or Communications Director.
- Evaluate for external reporting requirements (e.g., Cooperative Agreement, LBNF/DUNE, LZ, etc.).

5.3. Cold Temperatures

- 5.3.1.** Wind Chill is based on the rate of heat loss from exposed skin caused by wind and cold. As the wind increases, it draws heat from the body, driving down skin temperature and eventually the internal body temperature. Therefore, the wind makes it feel much colder. The Cold Temperature TARP includes the effects of Wind Chill.
- 5.3.2.** The TARP shown in Table 2: Cold Temperatures TARP describes the specific response guidelines that shall be followed until the alert has been cancelled.

BLUE ALERT Temperatures 32 to 15°F (0 to -10°C)	YELLOW ALERT Temperatures 15 to -15°F (-10 to -25°C)	RED ALERT Temperatures < -15 °F (<-25 °C)
<ul style="list-style-type: none"> • Continuous monitoring of weather warning systems 	<ul style="list-style-type: none"> • Notifications made to affected personnel 	<ul style="list-style-type: none"> • Notifications made to affected personnel • Announce via sitewide communications
<ul style="list-style-type: none"> • Evaluate clothing for environmental conditions 	<ul style="list-style-type: none"> • Dress in layers of warm, wind-resistant, waterproof clothing 	<ul style="list-style-type: none"> • Cover all exposed skin, particularly the face and hands
<ul style="list-style-type: none"> • Review activities for risk to frigid temperatures • Ensure shaft heating equipment is operational 	<ul style="list-style-type: none"> • Evaluate all outdoor activity and appropriateness of initiating new tasks • Ensure exposed personnel are not working alone • Inspect shaft infrastructure for possible ice buildup 	<ul style="list-style-type: none"> • Evaluate all activities and appropriateness of continuing tasks
<ul style="list-style-type: none"> • Ensure a heated environment is available within 30 minutes of the work location 	<ul style="list-style-type: none"> • Ensure a heated environment is available within 10 minutes of the work location 	<ul style="list-style-type: none"> • Ensure a heated environment is available within 5 minutes of the work location

Table 2: Cold Temperatures TARP

Source: National Weather Service

5.3.3. Preventative Actions:

- Wear appropriate workwear. Supplemental personal protective equipment (PPE) can be obtained by SDSTA procurement if needed.
 - Wear several layers of loose clothing.
 - Make sure to protect the head, ears, face, hands and feet in extremely cold weather.
 - Boots should be waterproof and insulated.
- Schedule work during the warmest part of the day.
- Avoid touching cold metal surfaces with bare skin.
- Periodically monitor workers' physical condition.
- Schedule frequent short breaks in warm dry areas to allow the body to warm up.
- Provide engineering controls such as radiant heaters, ensuring that all newly introduced heat sources are designed to prevent secondary hazards (e.g., fire, carbon monoxide, etc.).
- Evaluate mobile equipment requirements during extreme cold.

5.3.4. Event Follow-Up:

- The following actions are to be initiated once the alert has been cancelled:
 - Supervisors to account for their assigned personnel.
 - Coordinate with external emergency support if needed.
 - Perform Damage Assessment inspection across site as needed.
 - All personnel shall report any injuries, property damage or operational disruptions via the internal incident notification process (ESH-(3000-F)-173324 First Report and Incident Investigation).
 - Area Supervisors/Duty Officer to inspect for environmental loss including spills, chemical releases, etc. and immediately report to the ESH Department.
 - Evaluate and provide for formal communication needs. All formal communications are to be approved and issued by the Lab Director and/or Communications Director.
 - Evaluate for external reporting requirements (e.g., Cooperative Agreement, LBNF/DUNE, LZ, etc.).

5.4. Heat Index

- 5.4.1.** SDSTA recognizes the acute health risks associated with heat, both on the surface and in the underground facility. Primary engineering controls are supported by secondary administrative controls to provide a healthy environment for all SURF activities. Engineering controls are critical to maintaining a regulated environment in established, maintained and inspected areas within the underground facility. Physical requirements for the underground facility can be found in the Facility Access Standard.
- 5.4.2.** Heat-related illness can occur when the ability of the body to cool itself is challenged, or when there are insufficient levels of fluid or salt in the body due to sweating or dehydration. Heat-related illnesses increase as the combination of temperature and relative humidity increase. A combination of temperature and humidity is expressed as the heat index. Increases in the index can lead to heat-related illness, including heat cramps, heat exhaustion and heat stroke.
- 5.4.3.** The heat index in Figure 1, Heat Index is used to estimate heat-related risks to workers.

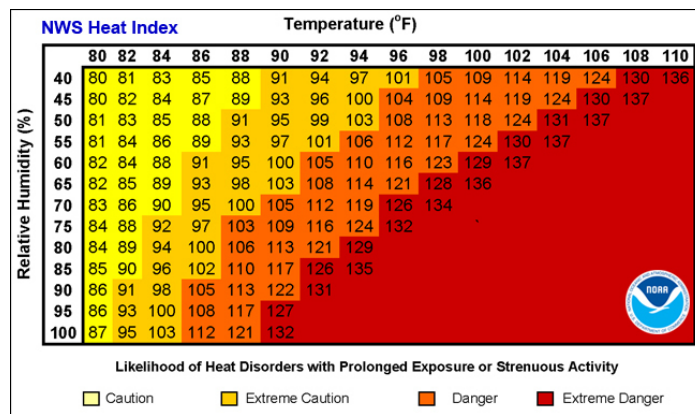


Figure 1: Heat Index

5.4.4. The TARP shown in Table 3: Heat Index TARP describes the specific response guidelines that shall be followed until the alert has been cancelled.

BLUE ALERT	YELLOW ALERT	RED ALERT
Risk Level: Lower (Caution) Heat Index: < 91°F	Risk Level: Moderate to High Heat Index: 91°F to 115°F	Risk Level: Very High to Extreme Heat Index: > 115°F
<ul style="list-style-type: none"> • Continuous monitoring of weather warning systems 	<ul style="list-style-type: none"> • Notifications made to affected personnel 	<ul style="list-style-type: none"> • Notifications made to affected personnel • Announce via sitewide communications
SURFACE		
<ul style="list-style-type: none"> • Monitor surface activities • Monitor cooling systems 	<ul style="list-style-type: none"> • Notify supervisory personnel to regulate outdoor surface activities 	
UNDERGROUND ACCESS		
<ul style="list-style-type: none"> • Monitor operability of the primary exhaust fans 	<ul style="list-style-type: none"> • Notify supervisory personnel to regulate activities in low ventilation areas 	<ul style="list-style-type: none"> • Remove personnel from low ventilation areas • Suspend access to low ventilation areas
BE AWARE	BE PREPARED	TAKE ACTION

Table 3: Heat Index TARP

Source: National Weather Service

5.4.5. Preventative actions:

- Provide workers with water, rest and a location to cool themselves.
- Allow workers more frequent breaks.
- Modify work schedules, as necessary.
- Train workers to recognize the signs and symptoms of heat-related illnesses and their prevention.
- Ensure ventilation systems in buildings and the underground facilities are designed and maintained to provide adequate airflows for environmental conditions.
- Follow the requirements of the Work Planning and Control process for any work activities when there is a Heat Index rating of 11500F or greater.

5.4.6. Event Follow-Up:

- The following actions may be initiated once the alert has been cancelled:
 - Supervisor to account for their assigned personnel.
 - Perform Damage Assessment inspection across site as needed.
 - Coordinate with external emergency support if needed.
 - Verify that critical cooling systems are operational (e.g., primary ventilation fans, air compressors, chillers, etc.).
 - All personnel shall report any injuries, property damage or operational disruptions via the internal incident notification process (ESH-(3000-F)-173324 First Report and Incident Investigation).
 - Evaluate and provide for formal communication needs. All formal communications are to be approved and issued by the Lab Director and/or Communications Director.
 - Evaluate for external reporting requirements (e.g., Cooperative Agreement, LBNF/DUNE, LZ, etc.).

5.5. High Winds

5.5.1. High winds can be associated with storms or may act as a single weather event. Wind measurements fall into two categories:

- Sustained Winds (for one hour or more)
- Wind Gusts (any duration)

5.5.2. The TARP shown in Table 4: High Wind TARP describes the specific response guidelines that shall be followed until the alert has been cancelled.

BLUE ALERT (Windy) 20-30 mph (32 kph – 48 kph)	YELLOW ALERT (Very Windy) 30-40 mph (48 kph – 64 kph)	RED ALERT (High Winds) > 40 mph/gust 58 mph (> 64 kph/gust 92 kph)
<ul style="list-style-type: none"> • Continuous monitoring of weather warning systems 	<ul style="list-style-type: none"> • Notifications made to affected personnel 	<ul style="list-style-type: none"> • Notifications made to affected personnel • Announce via sitewide communications
SURFACE		
<ul style="list-style-type: none"> • Review plan to secure mobile cranes and elevated work platforms 	<ul style="list-style-type: none"> • Regulate surface activities: <ul style="list-style-type: none"> · Suspend all mobile crane and aerial lift operations · Seek shelter away from elevated temporary structures (e.g., scaffolds) 	
<ul style="list-style-type: none"> • Assess all outdoor activity and evaluate appropriateness of initiating new tasks (e.g., loading loose material, etc.) • Monitor condition of nearby surface infrastructure for impacts from wind 	<ul style="list-style-type: none"> • Affected personnel to identify nearest safe location and be prepared to move inside 	<ul style="list-style-type: none"> • All personnel to immediately move indoors
<ul style="list-style-type: none"> • Identify unsecured materials and tools susceptible to wind (e.g. plywood, sheeting, ladders, etc.) 	<ul style="list-style-type: none"> • Secure materials and tools susceptible to wind 	
UNDERGROUND ACCESS		
<ul style="list-style-type: none"> • Evaluate shaft hoisting activities 	<ul style="list-style-type: none"> • Be prepared to suspend personnel hoisting operations 	<ul style="list-style-type: none"> • Suspend all shaft work and move workers to a safe location • Suspend personnel hoisting operations <ul style="list-style-type: none"> · Any active trips are to be completed · Emergency availability for egress purposes only

BE AWARE

BE PREPARED

TAKE ACTION

Table 4: High Wind TARP

Source: National Weather Service

5.5.3. Preventative Actions:

- Be aware of flying debris and wear appropriate eye protection and other suitable PPE.
- Personnel unable to access a designated storm shelter shall:
 - Stand clear of roadways as a gust may blow you into the path of an oncoming vehicle.
 - Shelter in a substantial building with at least normal headroom.
 - Take cover next to a building or under a shelter.
 - Avoid sheltering in or next to high profile vehicles.
 - Use handrails where available on outdoor walkways.
 - Avoid elevated areas such as roofs.
- Avoid driving if possible. When driving is necessary:
 - Ensure headlights are on.
 - Keep both hands on the wheel and slow down.
 - Watch for objects blowing across the roadway and into your path.
 - Increase the distance from cars in adjacent lanes as strong gusts could push a car outside its lane of travel.
 - Take extra care in high-profile vehicles such as trucks, vans, SUVs or when towing a trailer, as these are more prone to be pushed or even flipped by high wind gusts.
 - Get onto the shoulder of the road and stop if winds are severe enough to prevent safe driving.
- Remain sheltered until the alert has been cancelled.

5.5.4. Event Follow-Up:

- The following actions are to be initiated once the alert has been cancelled:
 - Account for affected personnel.
 - Coordinate with external emergency support if needed.
 - Stay away from downed power lines.
 - Report damaged utilities to appropriate provider.
 - Perform Damage Assessment inspection across site as needed.
 - Physical observations shall be performed in the individual work areas and at select remote locations. Observations shall include:
 - ◆ damaged infrastructure
 - ◆ downed powerlines
 - ◆ environmental damage
 - Area Supervisors/Duty Officer shall report any property damage or operational disruptions via the internal incident notification process (First Report & Incident Investigation).
 - Area Supervisors/Duty Officer to inspect for environmental loss including spills, erosion, chemical releases, etc. and immediately report to the Environmental Manager.
 - Evaluate for external reporting requirements (e.g., Cooperative Agreement, LBNF/DUNE, LZ, etc.).
 - Evaluate and provide for crisis communication needs (internally/externally).

5.6. Thunderstorms

- 5.6.1.** Thunderstorms are rain-bearing clouds that are always accompanied by lightning and thunder. The typical thunderstorm is 15 miles in diameter and lasts an average of 30 minutes. Other associated hazards of thunderstorms include lightning, tornadoes, strong winds, hail and heavy rains.
- 5.6.2.** Thunderstorm risk categories include:
- **Thunderstorm Watch (Slight Risk):** Thunderstorms are expected to be few or isolated. Thunderstorms with large hail, damaging winds and/or tornadoes are possible, but the exact time and location of storm development is still uncertain. A watch means, be prepared for storms.
 - **Thunderstorm Warning (Moderate Risk):** Thunderstorms are expected to be more organized, numerous or widespread. A thunderstorm is imminent or occurring. A thunderstorm wind equal to or greater than 40 miles per hour (mph) (64 kilometers/hour [km/hr]) and/or hail of at least a half-inch diameter is defined as approaching severe.
 - **Severe Thunderstorm (High Risk):** Severe thunderstorms with the potential for tornadoes, damaging windstorms and/or large hail are expected. A thunderstorm is occurring. A severe thunderstorm is one that produces winds of 58 mph (93 km/h) or stronger and/or hail of at least one-inch diameter or larger.
- 5.6.3.** The Thunderstorm TARP below includes hail, heavy rains and lightning; any one of which may trigger a change in alert status.
- 5.6.4.** Hail:
- Hail is a form of precipitation consisting of solid ice that forms inside thunderstorm updrafts. Hail can cause harm to people, property and the environment. Most hailstones are made up of a mix of different sizes. Dependent upon size, shape, density and fall orientation, hail can fall with a great deal of force and pose severe risk when greater than a half-inch diameter.
- 5.6.5.** Heavy Rains
- Heavy rains can create hazardous conditions for personnel working outside or driving in areas subject to flash flooding. Sometimes floods develop slowly; forecasters can anticipate where a flood will happen days or weeks before it occurs. During heavy rains, flash floods can occur within minutes and sometimes without any sign of rain.
 - Heavy Rains may saturate surrounding soils, destabilizing hillsides, resulting in falling rock and debris. In some cases, they may result in landslides or mudslides.
 - The Open Cut provides a direct connection for surface water to enter the underground. As a result, a one-inch heavy rain event introduces approximately 1-2 million gallons of water into the underground.
 - The volume of water that translates to the underground workings is dependent on two main factors:
 - o Rainfall intensity – classified according to the rate of rainfall which depends on how quickly a defined amount of rain has fallen (move to definitions) and saturation of soils due to recent rainfall.
- 5.6.6.** Lightning
- Lightning is a sudden electrostatic discharge most commonly associated with thunderstorms. On average, in the United States, 500 people are struck by lightning each year, 10 percent of which are fatal. Lightning can travel extreme distances in the atmosphere, along the ground and in the water. Lightning can strike more than 10 miles away from the storm and more than 50 percent of lightning deaths occur after the storm has passed. Lightning typically occurs in the warmer months of the year; however, it

should also be recognized that lightning is not limited to the summertime and can occur during rain, snow or sleet events.

- Lightning can exist independently or as a component of a thunderstorm. Lightning also presents unique hazards associated with explosive materials.
- The following 3 separate TARPs address these risks, albeit color-coded risk levels and associated controls are universal.
 - Lightning as a component of a thunderstorm (See Table 5: Thunderstorm TARP)
 - Lightning by itself (See Table 6: Lightning TARP)
 - Lightning hazards associated with explosives (ESH-(5000-S)-73375 Explosive Material Management Standard)

5.6.7. The TARP shown in Table 5: Thunderstorm TARP, describes the specific response guidelines that shall be followed until the alert has been cancelled.

BLUE ALERT	YELLOW ALERT	RED ALERT
<u>Thunderstorm Watch:</u> Lightning: 40 - 20 miles (64-32 km/h) Hail: Expected Heavy Rains: Expected	<u>Thunderstorm Warning:</u> Lightning: 20 – 10 miles (32-16 km/h) Hail: ½” in diameter Heavy Rains: ½”	<u>Severe Thunderstorm:</u> Lightning: 10 – 0 miles (16-0 km/h) Hail: 1” in diameter Heavy Rains: 1”
<ul style="list-style-type: none"> • Continuous monitoring of weather warning systems 	<ul style="list-style-type: none"> • Notifications made to affected personnel • Assess hazardous processes to be made secure (e.g., fuel distribution; LN transfers and other chemical processes, etc.) 	<ul style="list-style-type: none"> • Notifications made to affected personnel • Announce via sitewide communications • Suspend hazardous processes
SURFACE		
<ul style="list-style-type: none"> • Assess all outdoor activity and evaluate appropriateness of initiating new tasks 	<ul style="list-style-type: none"> • Affected personnel to identify nearest safe location and be prepared to move inside. 	<ul style="list-style-type: none"> • All personnel to immediately move indoors • All personnel to remain off structural steel above surface collar area within the headframe
<ul style="list-style-type: none"> • Review plan to suspend and secure mobile cranes and elevated work platforms 	<ul style="list-style-type: none"> • Prepare to suspend all mobile crane and aerial lift operations and secure equipment • Ensure no work is taking place in low-lying areas subject to flooding. • Seek shelter with overhead protection and away from windows. 	<ul style="list-style-type: none"> • Regulate surface activities <ul style="list-style-type: none"> · Suspend all mobile crane and aerial lift operations · Seek shelter away from elevated structures (e.g., scaffolds, walkways, conveyors) · Shelter in place with overhead protection and away from windows. · Remove all personnel from low-lying areas subject to flooding.
UNDERGROUND ACCESS		
<ul style="list-style-type: none"> • Evaluate shaft hoisting activities 	<ul style="list-style-type: none"> • Be prepared to suspend personnel hoisting operations 	<ul style="list-style-type: none"> • At 10 miles, ESH Director and Operations Division Deputy Director will be notified. • If lightning is within 5 miles, suspend shaft work, move workers to a safe location and suspend all personnel hoisting. <ul style="list-style-type: none"> · Any active trips are to be completed · Emergency availability for egress purposes only • If lightning is within 2 miles: <ul style="list-style-type: none"> · All hoisting activities shall cease.
BE AWARE	BE PREPARED	TAKE ACTION

Table 5: Thunderstorm TARP

Source: National Weather Service

5.6.8. Preventative Actions:

- Shelter in a substantial building with at least normal headroom.
- Avoid taking shelter in equipment with tall attachments such as cranes.
- Avoid taking shelter inside a truck or vehicle carrying hazardous materials such as explosive materials, fuel, chemicals, etc.
- Seek a low-lying (not subject to flooding) open place away from trees, poles or metallic infrastructure if you are caught outside.
- Position yourself away from windows, doors and skylights to avoid broken glass.
- Shield head and body with protective covering if caught outdoors.
- Remain sheltered until the alert has been cancelled.
- If you come upon a flowing stream where water is above your ankles, stop, turn around and go another way. Never try to walk, swim or drive through swift water.
- If you are in a piece of mobile equipment and unable to seek shelter in a substantial building:
 - Park in a safe location.
 - Close the windows.
 - Do not touch the metal frame.

5.6.9. Event Follow-Up:

- The following actions are to be initiated once the alert has been cancelled:
 - Supervisor to account for their assigned personnel.
 - Coordinate with external emergency support if needed.
 - Perform Damage Assessment inspection across site as needed.
 - All personnel shall report any injuries, property damage or operational disruptions via the internal incident notification process (ESH-(3000-F)-173324 First Report and Incident Investigation).
 - Area Supervisors/Duty Officer to inspect for environmental loss including spills, erosion, chemical releases, etc. and immediately report to the ESH Department.
 - ◆ Duty Officer to inspect unpaved roadways for damage after a half-inch of heavy rains when threat has passed.
 - ◆ A precipitation event of one inch or more within a 24-hour period triggers a Storm Water Pollution Prevention Plan (SWPPP) inspection.
 - Evaluate and provide for formal communication needs. All formal communications are to be approved and issued by the Lab Director and/or Communications Director.
 - Evaluate for external reporting requirements (e.g., Cooperative Agreement, LBNF/DUNE, LZ, etc.)

5.6.10. The TARP shown in Table 6: Lightning TARP, describes the specific response guidelines that shall be followed until the alert has been cancelled.

BLUE ALERT 40-20 miles (64-32 km)	YELLOW ALERT 20-10 miles (32-16 km)	RED ALERT 10-0 miles (16-0 km)
<ul style="list-style-type: none"> Continuous monitoring of weather warning systems 	<ul style="list-style-type: none"> Notifications made to affected personnel 	<ul style="list-style-type: none"> Notifications made to affected personnel Announce via sitewide communications
	<ul style="list-style-type: none"> Assess hazardous processes to be made secure (e.g., fuel distribution, LN transfers, explosive material handling and other chemical processes, etc.) 	<ul style="list-style-type: none"> Suspend hazardous processes
SURFACE		
<ul style="list-style-type: none"> Assess all outdoor activity and evaluate appropriateness of initiating new tasks 	<ul style="list-style-type: none"> Affected personnel to identify nearest safe location and be prepared to move inside 	<ul style="list-style-type: none"> All personnel to immediately move indoors All personnel to remain off structural steel above surface collar area within the headframe
<ul style="list-style-type: none"> Review plan to suspend and secure mobile cranes and elevated work platforms 	<ul style="list-style-type: none"> Prepare to suspend all mobile crane and aerial lift operations and secure equipment 	<ul style="list-style-type: none"> Regulate surface activities Suspend all mobile crane and aerial lift operations Seek shelter away from elevated structures (e.g., scaffolds, walkways, conveyors)
UNDERGROUND ACCESS		
<ul style="list-style-type: none"> Evaluate shaft hoisting activities 	<ul style="list-style-type: none"> Be prepared to suspend personnel hoisting operations 	The following will occur if lightning is within 5 miles of SURF: <ul style="list-style-type: none"> Suspend shaft work and move workers to a safe location Suspend personnel hoisting operations Any active trips are to be completed Emergency availability for egress purposes only At 2 miles, suspend all hoisting operations
BE AWARE	BE PREPARED	TAKE ACTION

Table 6: Lightning TARP

Source: National Weather Service

5.6.11. Preventative Actions:

- Shelter in a substantial building with at least normal headroom.
- Avoid taking shelter in equipment with tall attachments such as cranes.
- Avoid taking shelter inside a truck or vehicle carrying hazardous materials such as explosive materials, fuel, chemicals, etc.
- Seek a low-lying (not subject to flooding) open place away from trees, poles or metallic infrastructure if you are caught outside.
- Position yourself away from windows, doors and skylights to avoid broken glass.
- Shield head and body with protective covering if caught outdoors.
- Remain sheltered until the alert has been cancelled.
- If you come upon a flowing stream where water is above your ankles, stop, turn around and go another way. Never try to walk, swim or drive through swift water.
- If you are in a piece of mobile equipment and unable to seek shelter in a substantial building:
 - Park in a safe location.
 - Close the windows.
 - Do not touch the metal frame.

5.6.12. Event Follow-Up:

- Supervisor to account for their assigned personnel.
- Coordinate with external emergency support if needed.
- Perform Damage Assessment inspection across site as needed.
- All personnel shall report any injuries, property damage or operational disruptions via the internal incident notification process (ESH-(3000-F)-173324 First Report and Incident Investigation).
- Area Supervisors/Duty Officer to inspect for environmental loss including spills, erosion, chemical releases, etc. and immediately report to the ESH Department.
 - Duty Officer to inspect unpaved roadways for damage after a half inch of heavy rains when threat has passed.
 - A precipitation event of one inch or more within a 24-hour period triggers a Storm Water Pollution Prevention Plan (SWPPP) inspection.
- Evaluate and provide for formal communication needs. All formal communications are to be approved and issued by the Lab Director and/or Communications Director.
- Evaluate for external reporting requirements (e.g., Cooperative Agreement, LBNF/DUNE, LZ, etc.).

5.7. Tornado

- 5.7.1.** A tornado is a violently rotating column of air extending from the base of a thunderstorm down to the ground. Tornadoes are capable of destroying structures, uprooting trees and projecting objects through the air. Tornadoes can occur at any time of the day or night and at any time of the year. Although tornadoes are most common in the Central Plains and the southeastern United States, they have been reported in all 50 states.
- 5.7.2.** The TARP shown in Table 7: Tornado TARP, describes the specific response guidelines that shall be followed until the alert has been cancelled.

BLUE ALERT Active weather in the area	YELLOW ALERT Tornado Watch Tornadoes are possible in and near your area	RED ALERT Tornado Warning A Tornado is sighted or indicated by weather radar in your area
<ul style="list-style-type: none"> • Continuous monitoring of weather warning systems 	<ul style="list-style-type: none"> • Notifications made to affected personnel 	<ul style="list-style-type: none"> • Notifications made to affected personnel • Announce via sitewide communications
SURFACE		
<ul style="list-style-type: none"> • Review plan to secure mobile cranes and elevated work platforms 	<ul style="list-style-type: none"> • Regulate surface activities: <ul style="list-style-type: none"> · Suspend all mobile crane and aerial lift operations · Seek shelter away from elevated temporary structures, e.g., scaffolds 	
<ul style="list-style-type: none"> • Familiarize the location of designated shelter areas 	<ul style="list-style-type: none"> • Affected personnel to identify nearest safe location and be prepared to move to designated shelter areas 	<ul style="list-style-type: none"> • All personnel to immediately move to designated shelter areas
<ul style="list-style-type: none"> • Assess all outdoor activity and evaluate appropriateness of initiating new tasks (e.g., loading loose material, etc.) • Monitor condition of nearby surface infrastructure for impacts from wind • Identify unsecured materials susceptible to wind (e.g. plywood, sheeting, etc.) 	<ul style="list-style-type: none"> • Secure materials susceptible to wind 	
UNDERGROUND ACCESS		
<ul style="list-style-type: none"> • Evaluate shaft hoisting activities 	<ul style="list-style-type: none"> • Be prepared to suspend personnel hoisting operations 	<ul style="list-style-type: none"> • Suspend all shaft work and move workers to a safe location • Suspend personnel hoisting operations <ul style="list-style-type: none"> · Any active trips are to be completed · Emergency availability for egress purposes only
BE AWARE	BE PREPARED	TAKE ACTION

Table 7: Tornado TARP

Source: National Weather Service

5.7.3. Preventative Actions:

- Seek shelter in designated shelter areas.
- Position yourself away from vehicles, windows, doors and skylights to avoid broken glass.
- If caught outdoors:
 - Shield head and body with protective covering.
 - Seek a low-lying (not subject to flooding) open place away from trees, poles or metallic infrastructure.
- Remain sheltered until the alert has been cancelled

5.7.4. Event Follow-Up:

- The following actions are to be initiated once the alert has been cancelled:
 - Supervisors to account for their assigned personnel.
 - Coordinate with external emergency support if needed.
 - Perform Damage Assessment inspection across site as needed.
 - All personnel shall report any injuries, property damage or operational disruptions via the internal incident notification process (ESH-(3000-F)-173324 First Report and Incident Investigation).
 - Area Supervisors/Duty Officer to inspect for environmental loss including spills, erosion, chemical releases, etc. and immediately report to the ESH Department.
 - Evaluate and provide for formal communication needs. All formal communications are to be approved and issued by the Lab Director and/or Communications Director.
 - Evaluate for external reporting requirements (e.g., Cooperative Agreement, LBNF/DUNE, LZ, etc.).

5.8. Reduced Visibility

- 5.8.1.** Visibility is a measure of the distance at which an object or light can be clearly discerned. Reduced visibility can affect multiple forms of transportation such as driving and aviation, as well as any outdoor activity.
- 5.8.2.** Common causes of reduced visibility include fog, wind, smoke, rain and blizzards.
- o Fog is water droplets and ice particles suspended in air that form a barrier restricting visibility.
 - o Wind, when combined with certain environmental conditions such as snow, rain, smoke and dust, can cause debris to be suspended in the atmosphere.
 - o Smoke can come from many sources such as wildfires (nearby and far away), prescribed fires and burning wood in fireplaces or stoves inside the home. In addition to possible health effects (see air quality), large quantities of smoke can generate visibility impacts to both the work environment and in nearby areas.
 - o Rainfall intensity can impact visibility and create travel conditions such as road glare or roadside hazards (e.g.: inundated potholes).
 - o Blizzards are severe winter storms which may include large amounts of snow and blowing snow that can result in whiteout conditions. A ground blizzard may develop with little or no concurrent (or new) snowfall.

5.8.3. The TARP shown in Table 8: Reduced Visibility TARP, describes the specific response guidelines that shall be followed until the alert has been cancelled.

BLUE ALERT Visibility 1 - 0.5 mile (1.6 - 0.8 km)	YELLOW ALERT Visibility < 0.5 – 0.25 mile (0.8 – 0.4 km)	RED ALERT Visibility < 0.25 mile (0.4 km) *Blizzard warning, dense fog advisory*
<ul style="list-style-type: none"> • Continuous monitoring of weather warning systems 	<ul style="list-style-type: none"> • Notifications made to affected personnel 	<ul style="list-style-type: none"> • Notifications made to affected personnel • Announce via sitewide communications
SURFACE		
<ul style="list-style-type: none"> • Assess all outdoor activity and evaluate appropriateness of initiating new tasks 	<ul style="list-style-type: none"> • Mobile equipment to operate with: <ul style="list-style-type: none"> · Headlights on · Rotating beacon and hazard lights, if equipped · Reduce speed - drive to conditions • Evaluate outdoor activities • Be prepared to suspend hazardous processes (e.g., explosive material handling, fuel distribution, LN transfers and other chemical processes) 	<ul style="list-style-type: none"> • Suspend: <ul style="list-style-type: none"> · Nonessential travel to/from site · Nonessential work outdoors · Hazardous activities and processes
UNDERGROUND ACCESS		
<ul style="list-style-type: none"> • Confirm adequate visibility in shafts 	<ul style="list-style-type: none"> • Be prepared to suspend use of cage hoist e.g. limiting scheduled trips, etc. 	<ul style="list-style-type: none"> • Evaluate providing earlier cage access and/or evacuation to the surface if an operational status change is anticipated
BE AWARE	BE PREPARED	TAKE ACTION

Table 8: Reduced Visibility TARP

Source: National Weather Service

5.8.4. Preventative Actions:

- Evaluate travel requirements.
- Avoid pedestrian travel on vehicular travel ways and in poorly illuminated areas. Use high visibility/reflective clothing or supplemental lighting as needed.

5.8.5. Event Follow-Up:

- The following actions are to be initiated once the alert has been cancelled:
 - Supervisors to account for their assigned personnel.
 - Coordinate with external emergency support if needed.
 - Perform Damage Assessment inspection across site as needed.
 - All personnel shall report any injuries, property damage or operational disruptions via the internal incident notification process (ESH-(3000-F)-173324 First Report and Incident Investigation).
 - Evaluate and provide for formal communication needs. All formal communications are to be approved and issued by the Lab Director and/or Communications Director.
 - Evaluate for external reporting requirements (e.g., Cooperative Agreement, LBNF/DUNE, LZ, etc.).

5.9. Monitoring and Notifications

5.9.1. The information sources that advise the TARP process will be nationally or regionally recognized services as well as the SURF onsite weather station. The monitoring of weather conditions will be performed by dedicated staff who have been trained in the use of the TARP's listed within this document. These same staff will also be responsible for ensuring timely notification to affected personnel. Standard communication means will be utilized (e.g., VOIP, Femco™, Radio, Digital Displays, SDSTA operations status phone number, email and text messaging).

5.10. Training

5.10.1. Personnel shall be provided with training in Severe Weather Management including:

- General Safety Basic Training: SDSTA employees, researchers, and contractors, who meet the training requirement, shall complete this training as part of General Safety Basic Training.
- Annual Refresher Training: SDSTA employees and researchers shall complete this training as part of the Annual Refresher Training.

6.0 Documented Information/Related Document

- 6.1.** ESH-(5000-S)-73375 Explosive Material Management Standard
- 6.2.** ESH-(3000-F)-173324 First Report and Incident Investigation
- 6.3.** <https://www.AirNow.gov>