

## KENNECOTT UTAH COPPER

SAFETY AND HEALTH STANDARD			
RTKC LIGHTNING SAFETY STANDARD			
Effective Date: 11/9/2016	Standard: 16.25	Document Number: KUCSH0072	Rev: 0

16.25.1 **INTRODUCTION**

Lightning is the second leading cause of storm related deaths in the United States. Most lightning fatalities and injuries occur when people are caught outdoors with no shelter. The risk of damage due to a lightning strike is a low probability/high consequence event. Lightning strikes are random, irregular and unpredictable.

This standard is applicable to all sites across Rio Tinto Kennecott Copper (RTKC), and provides the minimum requirements to be contained in Site Specific SOP's. It is at the discretion of individual sites to establish rules and procedures that exceed these requirements. If these requirements cannot be met, deviations can be approved by the site General Manager and work crew General Manager.

16.25.2 **DEFINITIONS**

- 16.25.2.1 **Lightning:** An Electrical discharge caused when static electricity builds up between positively and negatively charged areas such as between thunderclouds, or thunderclouds and the ground. Lightning can occur from cloud-to-cloud, within a cloud, cloud-to-ground, or cloud-to-air.
- 16.25.2.2 **Alert Level:** The current alert level designated by the proximity of the Electrical Storm.
- 16.25.2.3 **Alert Level Red:** Lightning has been recorded within a radius of less than 10 miles of the workplace, within the last 30 minutes
- 16.25.2.4 **Alert Level Orange:** Lightning has been recorded within a radius of more than 10 miles, but less than 20 miles, of the place of work, within the last 30 minutes
- 16.25.2.5 **Alert Level Green:** No lightning has been recorded within a radius of 20 miles of the place of work for the last 30 minutes, but there are thunderstorms in the area
- 16.25.2.6 **Thunderstorm:** A turbulent weather event accompanied by thunder and lightning

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- 16.25.2.7 **Outdoor Environment:** An open area or any structure that does not include a solid roof.
- 16.25.2.8 **At Risk Personnel:** Personnel engaged in work in an outdoor environment that may be exposed to the risk of lightning.
- 16.25.2.9 **Safe Area:** Areas identified in the site SOP, or during the daily job briefing, as a safe refuge area during a thunderstorm. One of the best shelters commonly available for lightning is a large fully enclosed building with wiring and plumbing. A vehicle with a solid metal roof and metal sides can also offer adequate protection.
- 16.25.3 **REQUIREMENTS**
- 16.25.3.1 All sites across RTKC need to develop and implement SOP's that adequately deal with the risk posed by lightning.
- 16.25.3.2 All outdoor activities should be risk assessed, and the SOP's developed will be commensurate with the risk.
- 16.25.3.3 All sites shall employ a system for detecting lightning within a minimum of a 30 mile radius of the place of work.
- 16.25.3.4 Daily weather forecasts will be considered when scheduling outdoor environment work.
- 16.25.3.5 No outdoor environment work will take place when any site is under an Alert Level Red, and personnel will be relocated to a safe area.
- 16.25.3.6 Any outdoor environment exposure not considered work (walking between buildings, from vehicle to buildings etc), will be limited to reduce exposure time.

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- 16.25.3.7 Based on the outcomes of paragraph 16.25.3.2, sites will develop a list of employees that are classified as “At Risk Personnel”.
- 16.25.3.8 All “At Risk Personnel” shall be trained on the site SOP at least once a year, and a record of the training will be maintained.
- 16.25.3.9 The SOP will address the following:
- Method of lightning detection.
  - Method of Alert Level Communication.
  - Method and frequency of detection system functionality verification.
  - Actions to be taken for various Alert Levels
  - Identified safe areas to be used when the workplace is under an Alert Level Red state
  - Immediate actions to be taken if evacuation to a safe area is not possible under an Alert Level Red state.
- 16.25.3.10 Contractors engaged in work classified as “Outdoor Environment” work shall either comply with the site SOP, or their own SOP as long as the SOP meets or exceed the minimum requirements as laid out in this Standard.
- 16.25.3.11 Should a vehicle be struck by lightning, a full mechanical inspection is required before its next use. Pay particular attention to tires, which may explode if struck. All heavy mobile equipment will be stood down and barricaded for at least 24 hours as per paragraph 15.3.3.4 of the Rio Tinto Kennecott safety and Health Standard 15.3 (Document KUCSH0032).
- 16.25.3.12 Any person is able to declare an Alert Level Red, regardless of whether a detection systems is used or not. This declaration will be communicated through approved channels, and will be treated the same as any other Alert Level red.
- 16.25.3.13 Where a new structure is to be erected, the matter of lightning protection should be considered in the planning stage, and the building will comply with all applicable standards with regards to lightning protection.

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16.25.4 **REFERENCE MATERIAL**

16.25.4.1 The following material can be used in developing the site SOP.

- Appendix 1: National Geographic Flash Facts About Lightning
- Appendix 2: Reference Websites
- Appendix 3: Lightning Detection Systems

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## APPENDIX 1 – NATIONAL GEOGRAPHIC FLASH FACTS ABOUT LIGHTNING

### Flash Facts About Lightning

National Geographic News  
Updated June 24, 2005

*Organized by the National Oceanic and Atmospheric Administration (NOAA) and other partners, Lightning Safety Week is held the last full week of June each year.*

Lightning is one of the leading weather-related causes of death and injury in the United States. Most people do not realize that they can be struck by lightning even when the center of a thunderstorm is 10 miles (16 kilometers) away and there are blue skies overhead.

Did you know that rubber shoes do nothing to protect you from lightning? That talking on the telephone is the leading cause of lightning injuries inside the home? That standing under a tall tree is one of the most dangerous places to take shelter?

And what does it mean if your hair starts to stand on end during a thunderstorm?

Scroll down for the answers to these and other questions—and for tips and procedures to protect yourself and your property against one of nature's most lethal phenomena.

- Lightning is a **giant discharge of electricity** accompanied by a brilliant flash of light and a loud crack of thunder. The spark can reach over five miles (eight kilometers) in length, raise the temperature of the air by as much as 50,000 degrees Fahrenheit (27,700 degrees Celsius), and contain a hundred million electrical volts.
- Some scientists think that **lightning may have played a part in the evolution of living organisms**. The immense heat and other energy given off during a stroke has been found to convert elements into compounds that are found in organisms.
- Lightning detection systems in the United States monitor an average of 25 million strokes of lightning from clouds to ground during some 100,000 thunderstorms every year. It is estimated

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that Earth as a whole is struck by an average of more than **a hundred lightning bolts every second.**

- **The odds** of becoming a lightning victim in the U.S. in any one year is 1 in 700,000. The odds of being struck in your lifetime is 1 in 3,000.

- **Lightning can kill people** (3,696 deaths were recorded in the U.S. between 1959 and 2003) or cause cardiac arrest. Injuries range from severe burns and permanent brain damage to memory loss and personality change. About 10 percent of lightning-stroke victims are killed, and 70 percent suffer serious long-term effects. About 400 people survive lightning strokes in the U.S. each year.

- Lightning is not confined to thunderstorms. It's been seen in **volcanic eruptions**, extremely intense **forest fires**, surface **nuclear detonations**, heavy **snowstorms**, and in large **hurricanes**.

- Ice in a cloud may be key in the development of lightning. Ice particles collide as they swirl around in a storm, causing a separation of electrical charges. Positively charged ice crystals rise to the top of the thunderstorm, and negatively charged ice particles and hailstones drop to the lower parts of the storm. **Enormous charge differences develop.**

A moving thunderstorm also gathers positively **charged particles along the ground that travel with the storm.** As the differences in charges continue to increase, positively charged particles rise up tall objects such as trees, houses, and telephone poles—and people.

- The negatively charged bottom part of the storm sends out an invisible charge toward the ground. When the charge gets close to the ground, it is **attracted by all the positively charged objects**, and a channel develops. The subsequent electrical transfer in the channel is lightning.

- **If your hair stands up** in a storm, it could be a bad sign that positive charges are rising through you, reaching toward the negatively charged part of the storm. That's not a good sign! Your best bet is to get yourself immediately indoors.

- The **rapid expansion of heated air causes the thunder.** Since light travels faster than sound, the thunder is heard after the lightning. If you see lightning and hear thunder at the same time,

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that lightning is in your neighborhood. If you see successive strokes of lightning in the same place on the horizon then you are in line with the storm, and it may be moving toward you.

- Not all lightning forms in the negatively charged area low in the thunderstorm cloud. Some lightning originates in the top of the thunderstorm, the area carrying a large positive charge. Lightning from this area is called positive lightning.

**Positive lightning is particularly dangerous**, because it frequently strikes away from the rain core, either ahead or behind the thunderstorm. It can strike as far as 5 or 10 miles (8 or 16 kilometers) from the storm, in areas that most people do not consider to be a lightning-risk area.

- During a thunderstorm, **each flash of cloud-to-ground lightning is a potential killer**. The determining factor on whether a particular flash could be deadly depends on whether a person is in the path of the lightning discharge.

In addition to the visible flash that travels through the air, the current associated with the lightning discharge travels along the ground. Although some victims are struck directly by the main lightning stroke, **many victims are struck as the current moves in and along the ground**.

- **If you can hear thunder**, you are within 10 miles (16 kilometers) of a storm—and can be struck by lightning. Seek shelter and avoid situations in which you may be vulnerable.
- **Use the 30-30 rule**, when visibility is good and there is nothing obstructing your view of the thunderstorm. When you see lightning, count the time until you hear thunder. If that time is 30 seconds or less, the thunderstorm is within six miles (ten kilometers) of you and is dangerous. Seek shelter immediately.

The threat of lightning continues for a much longer period than most people realize. Wait at least 30 minutes after the last clap of thunder before leaving shelter. **Don't be fooled by sunshine or blue sky!**

- Most lightning deaths and injuries in the United States occur during the summer months, when the **combination of lightning and outdoor activities** reaches a peak. People involved in activities such as boating, swimming, fishing, bicycling, golfing, jogging, walking, hiking, camping,

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or working outdoors all need to take the appropriate actions in a timely manner when thunderstorms approach.

- The **Fourth of July is historically one of the most deadly times** of the year for lightning in the U.S.. In summer, especially on a holiday, more people are outside, on the beach, golf course, mountains, or ball fields. Outdoor jobs such as construction and agriculture, and outdoor chores such as lawn mowing or house painting are at their peak, putting people involved in danger.

Where organized sports activities take place, coaches, umpires, referees, or camp counselors must **protect the safety of the participants** by stopping the activities sooner, so that the participants and spectators can get to a safe place before the lightning threat becomes significant.

- People on or in or near water are among those most at risk during thunderstorms. **Swimming is particularly dangerous**, as not only do swimmers protrude from the water, presenting a potential channel for electrical discharge, but also because water is a good conductor of electricity.

- Inside homes, people must also avoid activities which put their lives at risk from a possible lightning strike. As with the outdoor activities, these activities should be avoided before, during, and after storms.

In particular, people should **stay away from windows and doors and avoid contact with anything that conducts electricity, including landline telephones**. Most people hurt by lightning while inside their homes are talking on the telephone at the time.

- People may also want to take certain actions well before the storm to protect property within their homes, such as electronic equipment. **Surge protectors do not protect against direct lightning strikes**. Unplug equipment such as computers and televisions.

- If a person is struck by lightning, medical care may be needed immediately to save the person's life. Cardiac arrest and irregularities, burns, and nerve damage are common in cases where people are struck by lightning. However, with proper treatment, including CPR if necessary, **most victims survive a lightning strike**, although the long-term effects on their lives and the lives of family members can be devastating.



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- A house or other substantial building offers the best protection from lightning. For a shelter to provide protection from lightning, it **must contain a mechanism for conducting the electrical current** from the point of contact to the ground. These mechanisms may be on the outside of the structure, may be contained within the walls of the structure, or may be a combination of the two.

On the outside, lightning can travel along the outer shell of the building or may follow metal gutters and downspouts to the ground. Inside a structure, lightning can follow conductors such as the electrical wiring, plumbing, and telephone lines to the ground.

- Unless specifically designed to be lightning safe, **small structures do little, if anything, to protect** occupants from lightning. Many small open shelters on athletic fields, on golf courses, in parks, at roadside picnic areas, in school yards, and elsewhere are designed to protect people from rain and sun, but not lightning.

A shelter that does not contain plumbing or wiring throughout or some other mechanism for grounding from the roof to ground is not safe. Small wooden, vinyl, or metal sheds offer little or no protection from lightning and should be avoided during thunderstorms.

- There are **three main ways lightning enters homes** and buildings: a direct strike, through wires or pipes that extend outside the structure and into the ground. Regardless of the method of entrance, once in a structure, the lightning can travel through the electrical, phone, plumbing, and radio or television reception systems. Lightning can also travel through any metal wires or bars in concrete walls or flooring.

- **Phone use is the leading cause of indoor lightning injuries** in the United States. Lightning can travel long distances in both phone and electrical wires, particularly in rural areas.

Do not lie on the concrete floor of a garage as it likely contains a wire mesh. In general, basements are a safe place to go during thunderstorms. However, avoid contact with concrete walls, which may contain metal reinforcing bars.

Avoid washers and dryers, since they not only have contacts with the plumbing and electrical systems but also contain an electrical path to the outside through the dryer vent.

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Avoid contact with electrical equipment or cords. If you plan to unplug any electronic equipment, do so well before the storm arrives.

Avoid contact with plumbing. Do not wash your hands, do not take a shower, do not wash dishes, and do not do laundry.

- **Victims of lightning do not retain the charge** and are not "electrified." It is safe to help them.
- **Rubber shoes will not give you any meaningful protection** from lightning.
- **Lightning can—and often does—strike in the same place twice.** Tall buildings and monuments are frequently hit by lightning.
- A motor **car with a metal top can offer you some protection**—but keep your hands from the metal sides.
- **An umbrella can increase your chances of being struck** by lightning if it makes you the tallest object in the area.
- **Always avoid being the highest object anywhere**—or taking shelter near or under the highest object, including tall trees. Avoid being near a lightning rod or standing near metal objects such as a fence or underground pipes.

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## APPENDIX 2 – REFERENCE WEBSITES

- [HTTP://WWW.LIGHTNINGSAFETY.COM/](http://WWW.LIGHTNINGSAFETY.COM/)
- [http://www-public.tnb.com/eel/docs/furse/BS\\_EN\\_IEC\\_62305\\_standard\\_series.pdf](http://www-public.tnb.com/eel/docs/furse/BS_EN_IEC_62305_standard_series.pdf)
- [https://www.dehn-international.com/sites/default/files/uploads/dehn/pdf/blitzplaner/bpl2\\_015/lpg\\_2015\\_e\\_complete.pdf](https://www.dehn-international.com/sites/default/files/uploads/dehn/pdf/blitzplaner/bpl2_015/lpg_2015_e_complete.pdf)
- [http://obo-bettermann.com/documents/Blitzschutz\\_Leitfaden\\_EN\\_web\\_8730033\\_snapshot.pdf](http://obo-bettermann.com/documents/Blitzschutz_Leitfaden_EN_web_8730033_snapshot.pdf)
- [http://www.enertec.co.nz/product/img/fields/1383\\_A\\_Practical\\_Guide\\_to\\_Lightning\\_Protection\\_and\\_Australia\\_and\\_NZ.pdf](http://www.enertec.co.nz/product/img/fields/1383_A_Practical_Guide_to_Lightning_Protection_and_Australia_and_NZ.pdf)

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**APPENDIX 3 – LIGHTNING DETECTION SYSTEMS**

- <https://www.amazon.com/StrikeAlert-Personal-Lightning-Detector-Pager/dp/B00CX2ITCY>
- <http://www.ambientweather.com/skp5completekit.html> - One currently being used by the mine blasting crew, as well as north and south end line crews
- [https://www.scientificsales.com/ProductDetails.asp?ProductCode=SP2-Y&gdffi=15f47aa7ad2740ba9cc6a0e20f2bcdaf&gdfms=D1AEBA90B7664DF490A7841B7583BD62&qclid=CN\\_15b-N6tECFYuLswod7IMA4A](https://www.scientificsales.com/ProductDetails.asp?ProductCode=SP2-Y&gdffi=15f47aa7ad2740ba9cc6a0e20f2bcdaf&gdfms=D1AEBA90B7664DF490A7841B7583BD62&qclid=CN_15b-N6tECFYuLswod7IMA4A)
- Free app by weather bug for all personnel with cell phones that can be very helpful – (have for IOS and android)  
<http://weather.weatherbug.com/spark-alert.html>  
<http://www.weathertap.com/> - used by north end RTKC plants as a satellite based lightning detection system

**REVISION HISTORY:**

MOC#	Description of Change	Prepared By	Date
42172	Creation of new document	David van Hees	5-9-17

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