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Morenci Safe Production Standard	Standard 2.10	
Lightning Monitoring and Notification	OHSAS 18001:2007	4.4.6
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	Document Owner	Information Services
Approvals:		
<i>Senior VP Morenci Operations:</i>	<i>Safety Steering Committee: 06/28/2013</i>	

1.0 PURPOSE:

This standard applies administrative controls for the protection of personnel from greater than normal hazards due to lightning activity and is designed to establish regularity for lightning monitoring and communication.

2.0 SCOPE:

This standard applies to all Freeport-McMoRan employees and contractors working within mining, processing and town site operations.

3.0 TERMS, DEFINITIONS AND ABBREVIATIONS

Mine: This is the boundary for all Morenci operations, both mine and processing.

High Risk Lightning Areas: As used in this standard, refers to Identified areas or activities where the existence of lightning clearly poses greater than normal hazards. Examples include, but are not limited to, blasting zones, conveyor towers, rooftops, work in elevated mining locations, substations, storage areas for flammable/combustible material, and work involving cranes/mobile personnel platforms.

Low Risk Areas: As used in this standard, refers to all locations that do not meet the characteristics of high risk areas, but could still require seeking shelter when there is lightning activity.

Affected Individual: As used in this standard, refers to anyone working in an area/conducting an activity evaluated as high risk for lightning.

Competent Individual: As used in this standard, refers to an individual with the technical knowledge, training and/or experience required to monitor the sites lightning detection system.

Lightning Detection System: A system, utilizing both satellite imagery and localized monitoring, that is capable of detecting lightning produced by thunderstorms or lightning potential in the atmosphere. The system is capable of identifying how far activity is from an established central location.

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- The Lightning Detection System used at the Morenci site shall be comprised of three different components:
 1. Workstations running TWX300 software gathering real-time lightning events from a provider's data server. This is the primary lightning detection component that is viewed by a dispatcher. It can display defined zones and lightning strikes, and must be monitored 24/7.
 2. **Electric Field Mills (EFMs):** A physical unit that measures electrostatic charge in the local atmosphere and can be used to identify if lightning has the potential to exist.
 3. **Remote Alarm Display (RAD):** A device that display the three warning levels in red, amber, and green LED arrays and sound an audio alarms to indicate the existence of a warning.

Yellow Alert: In general, lightning is identified as striking in a 7 to 15 mile radius from an established reference point in the Mine, or a 4 to 15 mile radius in Processing. Caution is strongly advised when working in identified High Risk Lightning Areas when in a Yellow Alert.

- a. Sufficient preparation must be made in a Yellow Alert to allow immediate evacuation of High Risk Lightning Areas when the property goes into a Red Alert.
- b. Some areas may require removing workers from exposure when lightning is still in the Yellow Alert phase so as not to have any workers present/exposed when advancing to a Red Alert. Refer to specific division requirements.

Red Alert: In general, lightning is striking within a 0 to 7 mile radius from an established reference point in the Mine, and a 0 to 4 mile radius in Processing. Work is prohibited in high risk areas when in a Red Alert.

(See Appendix 8.1 - Recommended Safe Work Practices for Lightning)

Green Alert: In general, the system is in green state when there is neither a yellow nor a red alert or when the lightning activities are outside the 20 miles radius from the center point of the system.

- a. It is safe for individuals to perform work in identified high risk areas when lightning is in the Green Alert phase.
- b. Communication of lightning activity in the Green Alert phase begins when lightning enters a 20 mile radius.

Dispatcher: The individual communicating the presence of lightning to the workforce when in Green, Yellow, and Red Alert conditions.

- a. Initial monitoring of the lightning detection system can only be conducted by someone who has received appropriate task training and who is familiar with the system.
- b. The primary dispatchers who are responsible for the overall communication of the presence of lightning to the worksite are as follows:
 1. The mine's 402 dispatcher will communicate the presence of lightning to all mine personnel via radio. **The mine's 402 dispatcher will communicate the presence of lightning to Security dispatch.**
 2. The 662 security dispatcher will communicate the presence of lightning to all processing personnel via radio. **The 662 Security Dispatcher will communicate the presence of lightning to all processing and mine operations personnel identifying which group is affected by the presence.**

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3. A Power House dispatcher will physically monitor the Lightning Detection System for Processing and will relay information to the Security 662 dispatcher and to pertinent processing control rooms for communication.

4.0 RESPONSIBILITIES:

- 4.1 **Management** will understand the requirements of this standard and how those requirements apply to their respective divisions. Management is responsible for developing a list of high risk lightning areas and activities that will require immediate actions during specified lightning alert conditions. In addition, management shall determine the method of effectively communicating lightning alert status within each division.
- 4.2 **Employees** will comply with this standard as it pertains to their division or any other division that they may perform work in. Employees shall make reasonable attempts to protect themselves from lightning risks independent of the lightning detection system.
- 4.3 **Supervisors** will understand this standard, train to it, and enforce it with respect to any additional division requirements in their areas.
- 4.4 **Health & Safety** will audit to ensure compliance to this standard.
- 4.5 **Information Services:** will periodically inspect technical aspects of the sites lightning detection system and respond to functional problems with the system and its core components. In addition the MIS department is responsible for providing initial training to employees who will be assigned to monitor the lightning detection system.

5.0 STANDARDS OF PERFORMANCE

5.1 Lightning Detection Equipment Inspection Requirements

- a. The functionality of the Lightning Detection System shall be tested by the console operator at the beginning of each shift.
- b. If defects are found with the TWX300 software, the Electric Field Mills, Remote Alarm Display or the means of notification, a priority work order must be submitted in a timely manner.
- c. When the Lightning Detection System remains in an out-of-order condition, all groups affected will exercise reasonable judgment to ensure their safety in the event of lightning activity.
- d. At least once a month, the notification system must be tested for functionality by the MIS Department.

5.2 Monitoring and Communication

If any component of the lightning detection system shows that lightning is present, or there is an obvious potential for lightning to exist in the atmosphere the following actions must take place:

- a. An alert shall be disseminated in a manner that provides communication of the lightning status to all affected working groups, and
- b. The lightning activity must be continually monitored so that changes in the Lightning Detection System can be appropriately communicated to the affected work groups.

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1. In the Mine, the 402 dispatcher is the only individual that will initiate Mine-wide communications via radio of lightning status.
2. In Processing, the Power House dispatcher will monitor the Lightning Detection System and will relay the presence of lightning immediately to the Security 662 dispatcher for Processing-wide radio broadcast.

5.3 Divisional Responsibilities

- a. Those workgroups that may become affected by lightning must have the ability to monitor the radio and receive appropriate communication if lightning enters prescribed zones or if lightning has potential to exist in the atmosphere.
- b. All respective workgroups within Morenci are responsible for establishing their own list of high risk activities where the presence of lightning will require those activities to stop.
- c. Additionally, all workgroups who may be affected by lightning must understand the specific risks in their areas when lightning is present, and specific procedures to follow that will reduce the likelihood of being negatively affected by the lightning.

5.4 Evacuation Requirements When Lightning Is In the Red:

- a. When lightning readings are communicated, all affected areas must respond according to their respective plans.
- b. At minimum, appropriate shelter from hazards must be taken in High Risk Areas when lightning in Red Alert conditions. An appropriate shelter may be as simple as removing employees from high risk areas when lightning is present. Depending on the work being performed, it is the decision of division management to understand, communicate, and enforce specific procedures for lightning hazards associated with their areas.
- c. Effective means of keeping people out of high risk areas when an evacuation of the area has taken place must be exercised.
- d. Workers in high risk lightning areas will be allowed to return to normal operations when the following conditions are met:
 1. Red Alert conditions no longer exist,
 2. The area is verified as being safe by a competent individual, and
 3. Established department procedures permit re-entry into the area.
- e. If lightning activity is not detected by a lightning detection system, and lightning activity is prevalent, reasonable judgment must be made to ensure employees are safe.

6.0 REFERENCE DOCUMENTS

- 6.1 Mine Safety and Health Administration (MSHA) Regulation: 56.6604(a)
- 6.2 Morenci Site Safe Operating Procedure: "Clearing Blasting Area for Lightning"
- 6.3 National Weather Service: [NWS Lightning Safety](#)

7.0 RECORDS

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Name of the Document	Responsible for Control	Records Retention
Lightning Monitoring and Notification Standard	Safety	Permanent
Evacuation Plan for Affected Areas	Division Management	Permanent
Evacuation Documentation	Division Management	10 years
Inspection Records	MIS	10 years

8.0 APPENDICES

- 8.1 Recommended Safe Work Practices for lightning
- 8.2 Snapshot of High Risk Area Inventory Form

9.0 REVIEW AND CHANGE

All changes, modifications and/or revisions must be documented on the table below:

<i>Description of Changes to this Document</i>
Updated dispatcher communication practices due to Hydromet identified gap – BL 7/16/2013

Appendix 8.1 - Recommended Safe Work Practices for Lightning

Staying Ahead of the Storm

- Monitor local weather reports each day and prior to significant shut down activities or outdoor work.
- Be diligently aware of potential thunderstorms that may form during scheduled shutdown, outdoor maintenance activities and other planned events.
- Weather information can be found through various means via local television news coverage, the Internet, cable and satellite weather programming, or the National Weather Service (NWS) Web site at www.weather.gov.

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Knowing Your Area: Know where the closest “safer structure or location” is to the workplace and know how long it takes to get to that location. A safer structure or location is defined as:

- Any building normally occupied or frequently used by people, i.e., a building with plumbing and/or electrical wiring that acts to electrically ground the structure.
 - Avoid using the shower or plumbing facilities and contact with electrical appliances during a thunderstorm.
- In the absence of a sturdy, frequently inhabited building, any vehicle with a hard metal roof (neither an ATV nor exposed equipment) with the windows shut provides a measure of safety.
 - The hard metal frame and roof, not the rubber tires, are what protects occupants by dissipating lightning current around the vehicle and not through the occupants. It is important not to touch the metal framework of the vehicle.
- In the absence of safe shelters readily available to outdoor workers, leadership personnel shall make available adequate safe shelters to house all required personnel when lightning storms are reasonably likely to occur.

Dangerous Locations: Lightning has caused an average of 67 deaths per year, over the past 30 years, in the United States alone. Good judgment must be exercised to avoiding taking shelter in dangerous locations during a lightning storm.

- Small covered shelters are not safe from lightning.
- Trenches, rain shelters, outdoor awnings and trees, even if they are properly grounded for structural safety, are usually not properly grounded from the effects of lightning and side flashes to people. They are usually very unsafe and may actually increase the risk of lightning injury.
- Other dangerous locations include areas connected to, or near, light poles, towers and fences that can carry a nearby strike to people.
- Also dangerous is any location that makes the person the highest point in the area.

Lightning Detection: If you hear thunder as a storm approaches and the alarm system has not yet activated, prudent judgment must be made considering the leeway time used to organize the workgroup to safety.

- Use the ‘30-30 Rule’: after you see lightning, count the seconds until you hear thunder. If this time is 30 seconds or less, seek shelter. Stay inside until 30 minutes after the last strike of thunder.
 - The existence of blue sky and absence of rain are not protection from lightning. Lightning can and does strike as far as ten (10) miles away from the rain shaft. It does not have to be raining for lightning to strike. Many lightning casualties occur in the beginning, as the storm approaches, because many people ignore initial precursors of high winds, some rainfall and cloud cover. Generally, the lightning threat diminishes with time after the last sound of thunder, but may persist for more than thirty (30) minutes.

APPENDIX 8.2 – Snapshot of HS-SPS-2.10-001 - High Risk Areas and Activities – Lightning Events Inventory Form (use optional)

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High Risk Areas and Activities - Lightning Events

Task or Area	Department	Control Measures
i.e. Overhead Crane Operation (Ball Mill Lifts)	Mill Maintenance	Procedure restricting lifting of a call mill during significant weather events, primary/auxiliary braking system, protocol for providing temporary/relief power.