

Tire Dangers after Equipment Lightning Strike or Electric Transmission Line Contact

Do you and your team know what to do if a piece of equipment is struck by lightning or comes in contact with an electric transmission line?

Quick and proper action could save serious injury or even loss of life.

Since mine sites are often at high altitudes and have no trees, mining equipment is often the highest point and a target for lightning. It is also common for truck beds and crane booms to accidentally contact electric lines.

Lightning and high voltage transmission lines contain an enormous amount of electrical energy. When equipment is energized by a lightning strike or contact with a transmission line, that energy goes to ground through the tires, the path of least resistance being the ply cords which in most radial tires are steel. The very large surge of electricity through the ply cord material creates heat that can weaken the bond between the ply and the surrounding rubber. Since an inflated tire and wheel assembly is a pressure vessel, any compromise of the integrity of the vessel could lead to a catastrophic event. Further, the heat created causes expansion of the gases and can turn any moisture inside the tire into steam which can very quickly increase the inflation pressure beyond the capacity of the now damaged tire, causing a rapid air loss event. This however is only half the story.

The Hidden Danger

Heat can also initiate a process that is called pyrolysis which you could roughly think of as “de-vulcanization,” in other words, the chemical bonds in the strong tire rubber compounds begin to break down. Pyrolysis is exothermic meaning it generates heat and this heat speeds the process of breaking down and weakening the rubber compounds while also heating up the gas and moisture in the tire/wheel assembly, causing an exponential rise in inflation pressure. Pyrolysis can take place very quickly or, it can take several hours to reach the point where the inflation pressure exceeds the strength of the now weakened casing. A tire that is undergoing pyrolysis gives no outward sign and that is the hidden danger after equipment is energized with electricity!



27.00R49 tires after a lightning strike. The four rear tires blew out immediately. The left rear out tire was propelled 820 ft and the wheel 985 ft. The “hidden danger” is in the front tires.

What to do:

- 1] Get everyone away from the equipment immediately and create a safety barrier around it as large tires, wheels and hubs have been found over 300 meters from the equipment after these events. The most critical areas are those 45 degrees outward from the end of the axle.
- 2] Stay away for at least 24 hours as there are records of large tires having catastrophic air loss up to 21.5 hours after electrical contact as a result of pyrolysis.
- 3] After at least 24 hours, scrap all tires on the equipment. The tires may look OK but they may have damage to the chemical bonds which cannot be seen.

On the first page, we discussed the hidden dangers of tires on heavy equipment if the machine is struck by lightning or comes into contact with electric transmission lines. Now, let's discuss what to do to protect your personal safety in these situations.

The obvious dangers from lightning strike or vehicle contact with electrical transmission lines are the potential for fire or possible electrical shock. Your first instinct may be to get off the truck as quickly as possible, but first there are important considerations to think about.

- 1] Is electric current still running through the vehicle?
- 2] Is the vehicle still running?
- 3] Is the vehicle on fire?
- 4] Assume the process of pyrolysis started in one or all of the tires.
- 5] Has heat generated inside the tires, resulting in increased air pressure and potentially rapid air loss?

Personal safety procedures may vary depending upon the nature of electrical current passing through the vehicle. In the case of a vehicle coming into contact with electric transmission lines, the truck operator must determine if the vehicle is still in contact with the transmission lines.

Electrical Transmission Line Contact

WHAT YOU SHOULD NOT DO:

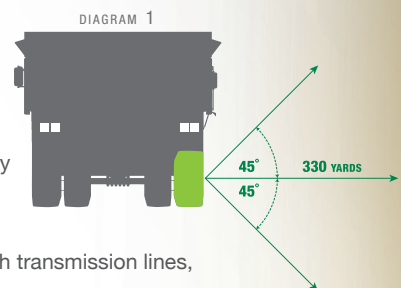
- 1] Don't assume everything is okay.
- 2] Don't open the cab of the vehicle until you know you are not in contact with live electrical lines.
- 3] Don't move the vehicle if there is danger of coming in contact with other vehicles or persons by dragging the transmission lines.

WHAT YOU SHOULD DO:

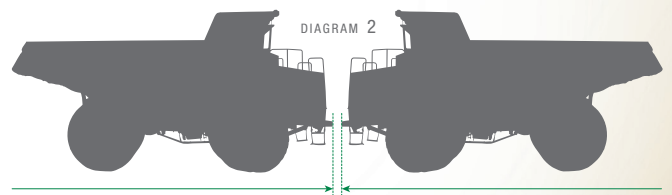
- 1] Remember safety is the prevailing directive according to Richard Kithill, Jr., founder and CEO of the National Lightning Safety Institute, <http://www.lightningsafety.com/>
- 2] Stay in the cab of your truck and call for assistance.

- 3] If your mine has safety protocols and procedures for this type of emergency, follow that protocol.
- 4] If your mine does not have safety protocols and procedures for this type of emergency, immediately contact designated emergency personnel to safely

determine whether or not the truck is still in contact with the transmission lines. These personnel / vehicles should stay out of the **tire danger zone**.



- 5] If the truck is not in contact with transmission lines, as quickly as possible pull to the side of haul road if this can be done safely and turn engine off.
- 6] Operator should exit the cab and vacate the vehicle as quickly as possible. Remember the hidden tire danger should be a primary concern. At this point electrical current is no longer running through the truck, but the operator and nearby personnel should still exercise caution and take the following steps.
 - A. Egress ladders on many haul trucks are within the tire danger zone. Alternative procedures should be used to vacate vehicles.
 - B. Position a similar size vehicle nose-to-nose (but not touching) with the affected truck [SEE DIAGRAM 2].
 - C. Operator should carefully step from his / her vehicle to the unaffected vehicle.



- 7] All personnel should promptly move 330 YARDS (300 METERS) away from the truck and maintain that distance for at least 24 hours in case there is unseen pyrolysis occurring in the tires.
- 8] After at least a 24 hour period remove and scrap all tires.

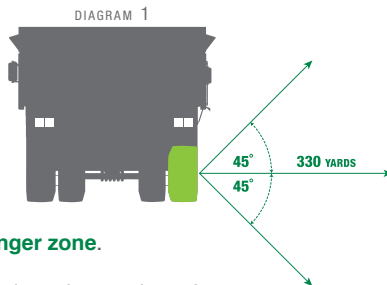
Lightning Strikes Haulage Truck

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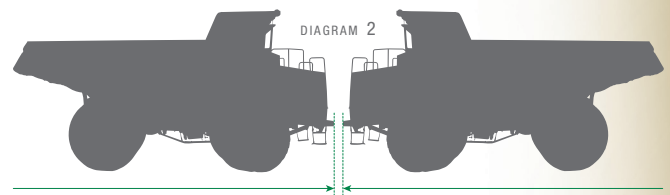
- 1] Don't assume everything is okay.
- 2] Don't open the cab of the vehicle if there is still a danger of lightning strikes. The cab creates a Faraday-like cage and is safe, assuming there are no other dangers present as a consequence of the lightning strike.

WHAT YOU SHOULD DO:

- 1] Remember the dangers relating to lightning strikes often cannot be seen, especially pyrolysis in tires.
- 2] Stay in the cab of your truck and call for assistance. Emergency vehicles and personnel should approach the vehicle cautiously and only from the front or back to avoid getting in the **tire danger zone**.
- 3] If your mine has safety protocols and procedures for this type of emergency, follow that protocol.
- 4] As quickly as possible pull to side of haul road if this can be done safely and **turn engine off**.
- 5] Operator should exit the cab and vacate the vehicle as quickly as possible. Remember the hidden tire danger should be a primary concern. At this point electrical current is no longer running through the truck, but the operator and nearby personnel should still exercise caution and take the following steps.



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- 7] After at least a 24 hour period all tires should be removed and scraped.

LIGHTNING IS AN UNPREDICTABLE ACT OF NATURE AND MAY CAUSE SERIOUS INJURY, DAMAGE OR DEATH DESPITE FOLLOWING THESE PROCEDURES OR OTHER SAFETY MEASURES.

We appreciate your interest in maintaining a safe operation. Watch for additional tips on the proper use and maintenance of your heavy equipment tires. At BKT Tires, Inc., we're interested in your safety and profitability.



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