Is Lightning the Cause?
Several thousand claims are submitted every year involving lightning strikes. Lightning strike verification reports can be obtained, and in many cases the incurred damages are consistent with high-voltage surges that are caused by lightning. But what if the report comes back with no strikes near the insured’s location? What if no storms were present around the claimed date of loss? There may be other causes of electrical damages.

Electricity
When you turn on a light bulb, what is actually happening? Electricity is flowing through a wire to the light bulb, and then returning on a different wire. The return path is crucial, and without it there will be no electricity flow and the bulb won’t operate. This return path is typically referred to as a “neutral”.

What Happens if Your Neutral Connection is Compromised?
You can still have electricity flow through a circuit with a compromised neutral. Most residential homes have circuit breaker panels where the main feeds from the utility service enter the residence. These feeds consist of a ground wire, a neutral wire, and two 120-volt wires.

If one of the two 120-volt wires is damaged or cut, this will cut power to half of the circuits in the breaker panel (if the breakers are evenly distributed). The remaining circuits should still function properly. However, if the neutral connection is lost or cut, what happens?
Depending on how the circuits are distributed in the breaker panel, you may not even notice there is a problem. But what you have is an “open neutral”. If the “loads” (items that are plugged in and operating) are not evenly distributed, you can have between 0 and 240 volts at your outlets and throughout your residence. Any device that is supposed to operate at 120 volts may be subject to damage if operated at voltages well above or below normal.

There are telltale signs that an open neutral has occurred. If the lights are dimming, particularly when other appliances are turned on or off, this is an indication of a possible open neutral. If electronic devices are running hotter than normal or sound different, this is also an indication.

Power strips (re-locatable power taps) can be vulnerable to open neutrals as well. Many power strips offer “surge protection” in the form of MOV’s (metal oxide varistors). The MOV’s can “blow” (similar to a fuse, but based on voltage) when they experience high voltages, such as those instantaneously seen during a lightning strike. But we have investigated fires and performed lab studies to show that MOV’s can overheat if subjected to sustained voltages in the 160 volt to 180 volt range, which potentially mirrors the conditions experienced during an open neutral situation. The tolerance of the MOV is dependent on the size and type of varistor the manufacturer of the power strip uses.

Regardless, it is important to note that most consumer electronics and appliances are sensitive to voltage fluctuations, sustained spikes, and sustained sags. If sustained over-voltages (spikes) occur, you can experience damages similar to those seen from lightning strikes.
How Amset Can Assist
When evaluating claims involving alleged lightning damages, the following areas should be addressed:

- Lightning studies can be completed to determine if strikes were in the insured’s area on the claimed date of loss. Even if strikes are detected, further investigation should still be done.

- Outlets in the home can be inspected and measured to determine if they are supplying the correct voltages.

- The home’s electrical panel can be examined and tested to determine if the neutral connection is intact and if the panel and circuits are grounded properly.

- The local utility can be contacted to determine if recent service was completed at the location or if they have reports of downed lines or service outages.

Even if the neutral at the breaker panel is intact, there still may be open neutrals on the individual branch circuits. These open neutrals can cause electricity to flow through unintended paths (i.e. metal cases or grounding points) and can be potential shock hazards.

Although this paper typically refers to residences, these same principles are still applicable for commercial and industrial properties as well.

Amset has investigated thousands of claims involving alleged lightning damage, and we are also certified fire and explosion investigators (CFEI).

MATT THUROW is a Senior Technical Loss Consultant with Amset Technical Consulting and may be contacted at mthurow@amsetusa.com.