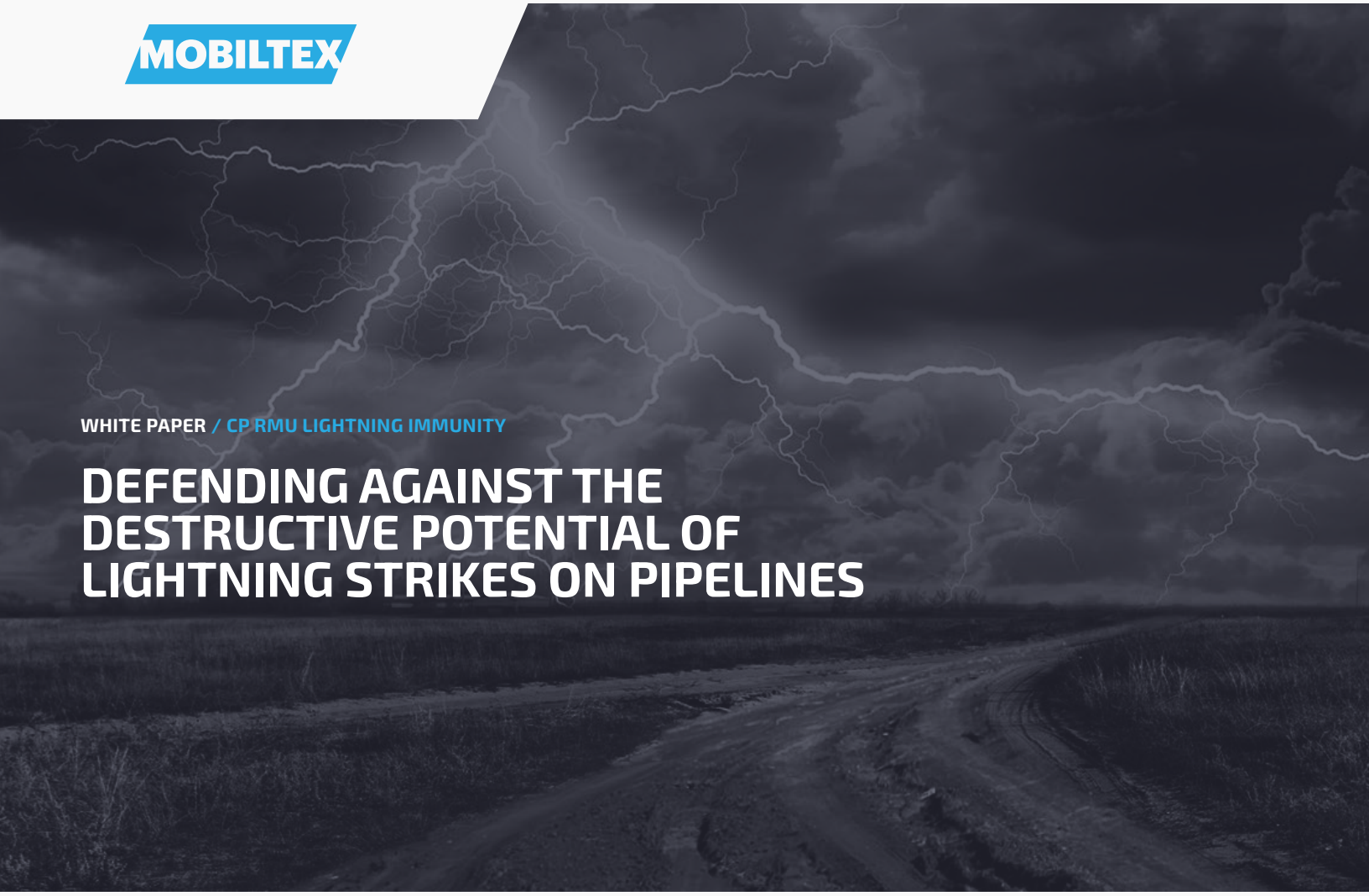
MOBILTEX



WHITE PAPER / CP RMU LIGHTNING IMMUNITY

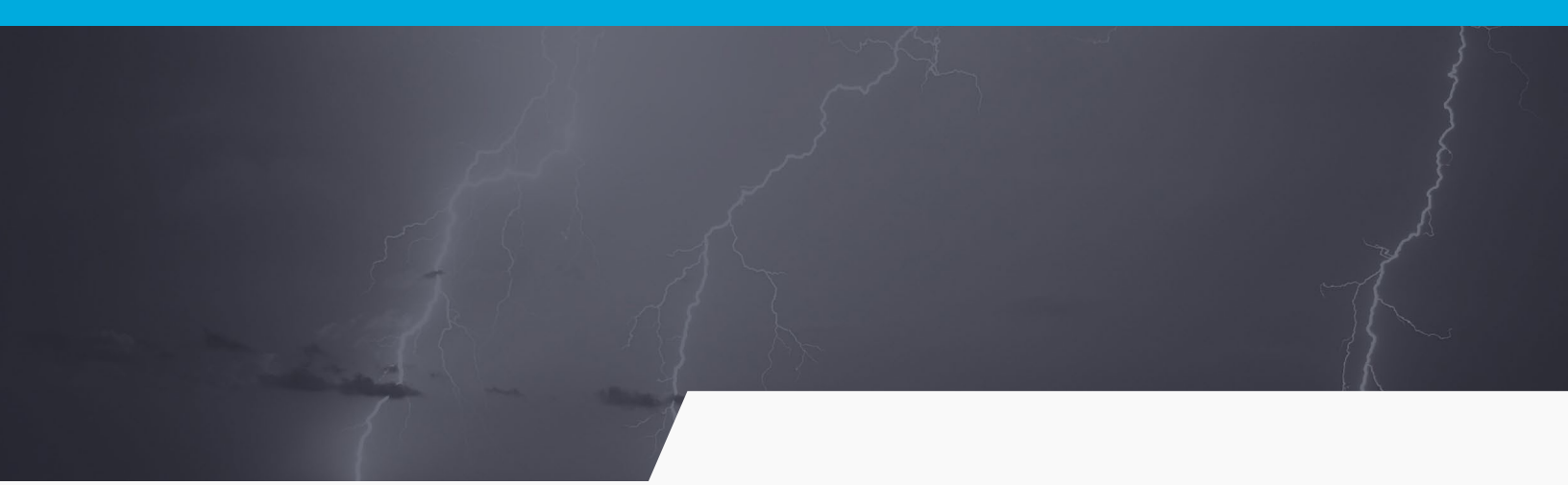
DEFENDING AGAINST THE DESTRUCTIVE POTENTIAL OF LIGHTNING STRIKES ON PIPELINES

Can lightning strikes cause corrosion in underground oil and gas pipelines? Not directly, but a powerful lightning strike could cause considerable damage to pipe coatings, pipe walls and cathodic protection (CP) systems leaving pipelines vulnerable

In North America alone, there are currently over two million milesi of oil and gas pipelines with more under construction and still more being planned. A significant portion of this extensive network, and the CP systems that protect it, are still manually inspected. Regulations require that technicians visit CP rectifiers at regular intervals to obtain performance measurements, but there may be several weeks or even months between visits. If a rectifier fails due to a lightning strike during that interval, there's no way to alert the technician, determine the length of downtime, or estimate how much corrosion the pipeline may have suffered.

How often does lightning strike underground oil and gas pipelines and CP equipment? It's a potential issue in just about every region but the severity and the frequency of potentially damaging lightning strikes to pipeline assets naturally is highest in Texas and Oklahoma, the primary hot spots for lightning strikes in the United States. In Texas, which also has one of the highest concentrations of oil and gas pipelines, some areas can experience nearly 30 strikes per square mile per yearil. Southern Ontario is another hot spot with lightning rates that almost rival those of Texas; reaching more than 25 strikes per square mile per year[iii].

In these highly active zones with population concentrations and many collocated HVPLs and pipelines, it becomes increasing likely that pipelines, and the CP systems protecting them from corrosion, will experience potentially damaging lightning strikes.



WHAT HAPPENS TO PIPELINES WHEN LIGHTNING STRIKES?

When lightning does strike a pipeline directly or nearby, the electrical energy almost always exceeds the dielectric strength of the flange inserts that are used to isolate CP current within pipeline sections and to separate underground pipes from those that are above ground at pipe stations. If the high voltage is able to arc across the pipe flanges or exits to ground through a coating holiday, it can cause severe damage to the insulation as well as pitting or melting of the pipe wall. To prevent this, devices such as cathodic isolators, decouplers, or isolating spark gaps can be used to direct the lightning energy from the pipeline to ground, thereby offering a measure of protection for the infrastructure as well as for workers.

Pipeline CP systems also rely on these protective components to divert lightning to ground and prevent damage to rectifiers. But a powerful lighting strike can overwhelm these devices and send a crippling jolt of electricity to the rectifier, causing circuit breakers to trip, diodes to overload or even destroying everything in the cabinet.

Similarly, a lightning strike to a high voltage power line could overload a pole-mounted transformer and then damage or destroy the rectifier that is connected to that source. Such strikes can also cause a phase-to-ground fault and produce a flashover, or arc, to an adjacent pipeline. Unlike a short-lived lightning strike, a flashover can be sustained for a much longer period and cause much more damage to pipelines, rectifiers and other equipment[iv].



Too often such failures are not discovered for many weeks because many rectifiers still rely on corrosion specialists to visit the site and manually collect performance data. During that time, the pipeline is unprotected and is vulnerable to corrosion.

SURVIVAL OF THE FITTEST

Remote CP monitoring systems are increasingly being installed by pipeline operators to provide an efficient and reliable way to collect near real-time measurement data from CP rectifiers and detect failures or changes in performance almost as soon as they occur.

A device such as a Remote Monitoring Unit (RMU) uses satellite or cellular networks to transmit performance data, which enables it to reliably operate in the most remote locations. The data can be collected in a cloud-based platform that can also trigger alerts to corrosion technicians when CP performance parameters are not within an optimum range. More advanced RMUs also add remote interruption functionalities enabling technicians to use it for annual level of protection surveys or closeinterval surveys without the need to install a temporary interrupter device.

Remote CP monitoring devices are typically installed on the outside or inside of a CP rectifier and are powered directly from AC line power via a step-down transformer. But this arrangement can also leave the remote CP monitoring device vulnerable to lightning strikes. To mitigate the impact of lightning, be sure to confirm your RMU of choice is equipped to absorb transient currents and should not be bonded to earth ground.

This type of design provides a high level of lightning immunity; increasing the chances that the device can survive a lightning strike and also improving the likelihood that it will remain operational



without the need to reset breakers or replace overloaded components. These same principles also apply for remote CP monitoring devices at test stations for bonds and coupons.



SIGNALING FOR HELP

Once damaged by lightning, a CP system might operate at reduced efficiency or it might fail entirely. But systems that are equipped with a robust, lightning-resistant remote CP monitoring device have the means to alert corrosion specialists of the situation within hours and enable a much faster response for repair. The most advanced RMUs also offer two-way communication enabling technicians to remotely connect with the device and request data at any time, rather than only receiving it at pre-set intervals.

The nature of the damage can often be determined in the data that is received from the CP monitoring device. A corrosion specialist may receive data showing that the CP monitoring device is not able to detect any CP current at all or that the current is above or below the required levels, indicating that the rectifier may have sustained damage and potentially the pipeline too.

The unit may also detect substantial changes in current density at coupons. A large drop could indicate that there has been damage to the pipeline coating and that a significant amount of current is leaking into the surrounding soil through holidays. With this preliminary information, the corrosion specialist can assess the potential risk of corrosion to the pipeline and make better decisions to prepare for and prioritize repairs.

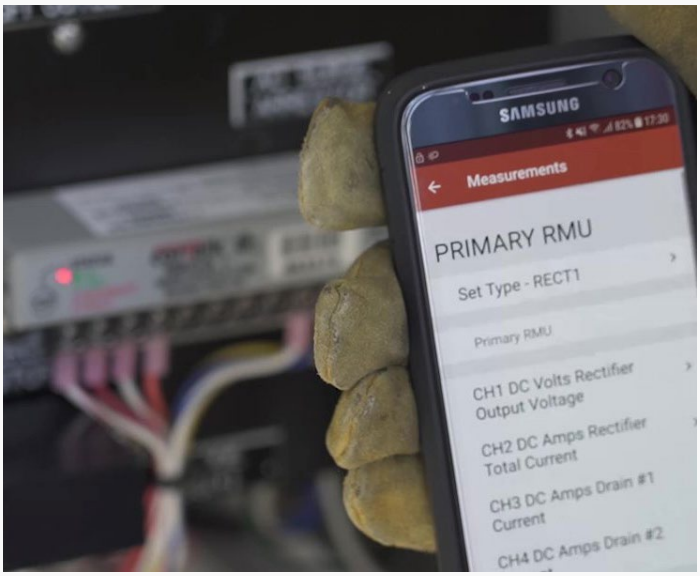
A PROVEN RECORD OF LIGHTNING IMMUNITY

MOBILTEX CorTalk RMU devices have continually proven themselves to provide the highest level of lightning resistance, surviving powerful strikes and continuing to transmit data—even when the rectifier is damaged, inoperable or destroyed.

In some of these situations, the MOBILTEX RMU may also suffer damage and show heavy scoring on the measurement block and melting of the antenna housing. MOBILTEX incorporates a two-piece design in the RMU2 and RMU3 devices, comprised of a measurement block that is installed inside the rectifier, and a compact, discrete antenna that is mounted on top. But in many instances following a lightning strike, the RMU is still functioning and transmitting accurate data at the scheduled intervals—the observed damage is cosmetic. Once the devices are retrieved by a technician, they can be

returned to MOBILTEX for testing and cost effective refurbishment, then returned to the field for many more years of service.

The separate measurement and transmission components of the RMU also provide a high level of future proofing. For example, technicians can easily replace the antenna to upgrade the device to new satellite or cellular communication protocols to ensure reliable, uninterrupted transmission of critical CP data. This occurred a few years ago as the industry advanced to the 4G network. Fortunately, the LTE-M protocols that are used for 4G networks are being adopted for the incoming 5G network. This means that



any MOBILTEX remote monitoring device that is equipped with 4G LTE-M capability—either from the factory or through an antenna upgrade—will not require any hardware modification to transition to the 5G network.

CONCLUSION

It is not possible to predict when and where lightning will occur, how strong the strike will be or how much damage it could cause to pipelines and CP rectifiers. But pipeline operators continue to prudently equip assets with the best available lightning protection equipment to prevent damage, downtime and unintended environmental impact.

The inclusion of near-real-time remote CP monitoring is the next logical step in improving the management of oil and gas pipeline assets, enhancing corrosion protection and accelerating the response to lightning damage or other potential CP problems such as induced AC interference. Selecting remote CP monitoring devices with a high level of lightning resistance increases the likelihood that the devices can survive a strike, alert technicians to a rectifier issue and provide important preliminary data about the nature of the damage.

MOBILTEX offers a full suite of lightning resistant, fit-for-purpose remote CP monitoring devices that include the RMU1+INT1 and RMU1-LITE for test stations and the RMU2 and RMU3 for rectifiers and the CorView cloudbased software platform.



CONTACT US

TO LEARN MORE AND TO DISCUSS YOUR REMOTE CATHODIC PROTECTION AND PIPELINE INTEGRITY MONITORING REQUIREMENTS.

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