

This Technical Note reviews some common best practices and design considerations to use when considering installation of Lightning Protection equipment in Hazardous Environments, as defined in the National Electric Code (NEC) and other similar documents.

General Information on Hazardous Environments

In many SCADA applications lightning protection is needed for coaxial cables in hazardous environments. In the United States, hazardous locations are defined as part of the National Electric Code definitions of location, risk, and protection techniques. The location code includes both the type of flammable material type and likelihood of risk.

The three Hazardous Location Classes define the general form of combustible material hazard; referring to gas, dust, or flyings. These Classes are broken down into letter Groups which further define specific chemical or materials. In general, the lower the Class number indicates a greater tendency of the substance to penetrate enclosures. The group letter codes start with generally higher risk material, which is easier to ignite or is more energetic.

The two Hazardous Location Divisions define whether the condition exists during normal operation (Division 1), or by abnormal condition such as a leak or failure (Division 2).

The matrix of possible Class and Division codes are summarized below. Note that higher class and divisions are not normally used since dust and fibers do not easily dissipate as a gas does. So any location once exposed would tend to be division 1 until thoroughly cleaned, including after the failure is repaired.

Explosive Material Class	Explosive Presence Division	
	Division 1 (Normally Present)	Division 2 (Under abnormal conditions)
I (Combustible Gas or Vapor)	Class I Division 1	Class I Division 2
II (Combustible Dust)	Class II Division 1	Class II Division 2
III (Ignitable Fibers or Flyings)	Class III Division 1	Class III Division 2

Lightning Protection in or near Hazardous Areas

When wiring enters a hazardous area, intrinsically safe barriers are usually used to limit the energy to levels less than that required to ignite the material. Coaxial cables are sometimes part of the cabling system, and can be used for data or wireless transmission links. Since many SCADA applications are outside, lightning energy can also couple onto these coaxial cables.

Intrinsic safety barriers protect against reasonable faults and failures of the power and signaling systems, and prevent higher than expected voltages from passing from the outside to within the hazardous location. These barriers also limit current flow in case of faults within the hazardous location. A coaxial protector is not a substitute for any required barrier. Electronic equipment should be Class and Division rated for the location.

Coaxial protectors are considered passive devices, similar to cables and connectors and are not normally rated. These protectors can play an important role in reducing unwanted electrical energy, particularly due to lightning activity. The operation of a coaxial protector can include shunting exceptionally high currents to ground. In extreme cases it is possible to exceed the current capacity of a coaxial cable, connector and ground wire, regardless of the operation of a protector. High risk applications using coaxial protectors in conjunction with hazardous locations should consider the protector, the incoming coaxial cable and ground current path (conductors) as potential sources of excessive electrical energy. To determine if your antenna or cable has exceptionally high exposure, use the 150' radius rolling ball model.

GUIDELINES FOR INSTALLING LIGHTNING/SURGE PROTECTION IN A HAZARDOUS ENVIRONMENT

- Install the antenna, *exposed* portion of the coaxial cable, coaxial protector, ground connections and ground wire(s) outside of the Class I (Division 1 and 2) locations.
- Install the antenna, *exposed* portion of the coaxial cable, coaxial protector, ground connections and ground wire(s) protector, exposed coaxial cable, ground connections and ground wire(s) outside of Class II or III Division 1 locations.
- It is preferred to keep the antenna, exposed portion of the coaxial cable, coaxial protector, ground connections and ground wire(s) protector, exposed coaxial cable, ground connections and ground wire(s) out of Class II and Class III Division 2 locations, particularly for high exposure locations.
- In addition to lightning protection and grounding, use any intrinsic safety barriers specified for the location.
- It is best practice to avoid lightning conductors in hazardous locations, particularly class I division 1. It is wise to use redundant and welded grounding or lightning current flow paths for the structure through hazardous locations.