In December 1992, a flashlight exploded during a firefighter training exercise. The injuries to the firefighter involved in the incident were minor, but could have been worse.

Anyone who works in locations where accidental fire or explosion are safety concerns knows that all equipment used in such locations must be tested and approved as safe to operate. Flashlights fall under this category, as they are potential ignition sources. Flashlights can generate heat and their batteries are an energy source. They must be contained in a safe manner before use in a hazardous environment. When air and flammable materials are introduced to a heat source, a fire or explosion can occur. Flashlights intended for use in hazardous environments must, therefore, be designed specifically to reduce the potential for ignition.

Hazardous locations are defined by the presence of flammable gases, vapors or liquids, combustible dusts or ignitable fibers or flyings that pose a risk of fire or explosion. Petroleum and chemical processing plants, for example, contain hazardous and flammable materials, as do certain healthcare facilities and local marinas. NFPA’s National Electric Code (NEC), articles 500-506, classify hazardous locations by the properties of the hazardous materials present, as well as by the likelihood of flammable concentrations. These articles also stipulate safety requirements for all equipment used in these areas.

OSH professionals must understand the nature of the ignition risk in the hazardous location to select the appropriate model. For example, it is critical for a worker to know the ignition risk in the location if they are working inside an oil tank or a grain silo. It can also be important if a worker drops a part in a vehicle painting booth. Using the following guidelines will help to ensure selection of the correct device for the environment.

In North America, NEC classifies hazardous locations by four criteria: class, division, group and ignition temperature.

Class
Class defines the nature of the potentially hazardous materials present at the location. There are three classes.

Class I: Flammable Gases, Vapors or Liquids (e.g., gasoline). Locations where a worker would typically encounter class I materials such as oil refineries, offshore oil rigs, paint warehouses and spray booths.

Class II: Combustible Dusts (e.g., metallic dusts, flour and cornstarch). Class II materials are typically found in locations such as coal mines, munitions factories, grain silos and hay storage facilities.

Class III: Ignitable Fibers and Flyings (e.g., rayon, nylon, cotton, sawdust and wood chips). Class III materials are typically found in locations such as paper mills, woodworking facilities, textile mills and cotton gins.

Division
Division describes the likelihood of sufficient hazardous material concentrations to exist at the location to create fire or explosion risk. There are two divisions.

Division 1: An ignitable concentration of the hazardous material is present under normal operating conditions. "Hazard likely" is the shorthand description for division 1. The interior of an oil or gas tank is an example of a division 1 location.

Division 2: An ignitable concentration of the hazardous material is present only under abnormal operating conditions. The shorthand description for this division is "hazard not likely." For example, the area around a fuel tank is likely a division 2 location.

Group
Group classifies hazardous materials within a class by the similarity of their properties, especially their ignition-related properties. While class categorizes materials by their physical characteristics, group categorizes them by their flammable or explosive characteristics.

The NEC specifies seven groups, each of which falls under a specific class’ umbrella.

Class I Groups
- Group A (e.g., acetylene);
- Group B (e.g., butadiene, ethylene oxide, hydrogen);
- Group C (e.g., carbon monoxide, ethyl sulfide, hydrogen sulfide);
- Group D (e.g., acetone, ammonia, gasoline, ethanol).

Class II Groups
- Group E (e.g., combustible metal dusts such as aluminum and magnesium);
- Group F (e.g., carbonaceous dusts such as coal, charcoal and coke);
- Group G (e.g., dusts not included in Groups E and F such as wood, plastics, flour, starch and chemical dusts).

Class III materials are not subdivided into groups.
**Ignition Temperature**

The maximum surface temperature of any equipment that will be used in a hazardous location must be below the minimum ignition temperature of all hazardous materials present at that location. Ignition temperatures vary, so an OSH professional must verify that the temperature rating is appropriate for the hazardous materials present.

The temperature rating indicates the maximum allowable surface temperature of the equipment being used during operation. It is divided into six ratings:

- T1: 450 °C (842 °F)
- T2: 300 °C (572 °F)
- T3: 200 °C (392 °F)
- T4: 135 °C (275 °F)
- T5: 100 °C (212 °F)
- T6: 85 °C (185 °F)

When choosing a flashlight, ensure that its maximum surface temperature is less than the ignition temperature of all hazardous materials present in the target work area.

**The Zone System**

Most countries outside North America use a different system, which is called the zone system. Zones differ from divisions in that they categorize locations based on how often (frequency and duration) hazardous materials are present.

The zone system also classifies hazardous materials into groups, but there are some superficial differences between zone system groups and NEC groups.

The zone system overlaps relatively neatly with NEC classifications. NEC recognizes the zone system and allows the use of zone-certified equipment in division-classified areas on a limited basis.

**Test Labs**

A recognized and accredited test lab must certify flashlights that are intended for use in hazardous locations. A certified flashlight will bear the mark of one of these entities. Reputable bodies include:

- Underwriters Laboratory;
- Canadian Underwriters Laboratory;
- Intertek;
- SGS;
- Factory Mutual Research Corp.

**Flashlight Selection**

The first step to select an appropriate flashlight is to determine the class, division and group of the work location and the ignition temperatures of all hazardous materials present at the location.

After safety requirements are met, several design and feature options are available, such as:

- handheld;
- headlamp (hands free);
- right angle (hands free);
- rechargeable;
- battery level indication;
- multiple modes (high/low/flash);
- various light output levels;
- various run times;
- various sizes;
- variety of colors;
- Manufacturers guarantee.

With these guidelines, OSH professionals can provide a lighting tool to help workers perform their jobs safely and effectively.

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