Protection Against Ignitions Arising Out of Static, Lightning, and Stray Currents

API RECOMMENDED PRACTICE 2003
SEVENTH EDITION, JANUARY 2008

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Downstream Segment

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Foreword

This updated publication was prepared under the direction of the API Safety and Fire Protection Subcommittee. The first edition was published in 1956 with subsequent editions in 1967, 1974, 1982, 1991 and 1998. This seventh edition builds on the technically sound work presented in prior editions. It emphasizes the need to maintain awareness and the continuing need to develop and use sound procedures for controlling hazards and minimizing the possible static ignition risks associated with handling hydrocarbons.

Producing fuel with low sulfur content typically requires increased processing. One example of a low sulfur specification is the regulatory requirements for reduced sulfur content of Diesel fuel (15 ppm max effective in mid-2006 in the USA). Similar regulations exist in the European Community. Severe hydroprocessing can remove natural constituents of the fuel and result in very much lower conductivity, often below 2 C.U. at field conditions This in turn enhances the ability of the fuel to generate and accumulate static charges while simply flowing through pipes. While there is not a direct correlation between sulfur level and conductivity, current data shows that most highly processed low sulfur hydrocarbons fuels have low conductivity. (European experience suggests that some highly processed fuels may also have a greater charging tendency than fuels subjected to less severe processing.) This edition of API Standard 2003 defines a new third “ultra-low conductivity” classification for hydrocarbons. This is included in the definitions and used when discussing residence times in Section 4.

The advent of “Ultra-low Sulfur Diesel” ULSD fuel into the marketplace reinforces the need to understand and use good operating procedures with regards to “switch loading.” The precautionary advice provided in this seventh edition of API Std 2003 is essentially the same as in prior editions. Further, the safe operations challenge increases to the extent that ULSD products have lower conductivities than conventional diesel fuels. Inclusion of the third “ultra-low conductivity” classification should help those handling bulk products safely meet that challenge.

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1 Scope

This recommended practice presents the current state of knowledge and technology in the fields of static electricity, lightning, and stray currents applicable to the prevention of hydrocarbon ignition in the petroleum industry and is based on both scientific research and practical experience. Furthermore, the principles discussed in this recommended practice are applicable to other operations where ignitable liquids and gases are handled. Their use should lead to improved safety practices and evaluations of existing installations and procedures. When the narrow limits of static electricity ignition are properly understood, fire investigators should be encouraged to search more diligently for the true ignition sources in instances where static ignition is unlikely or impossible.

This recommended practice is not required under the following conditions:

a) Static discharges may occur, but flammable vapors are always excluded by gas freeing or inerting the atmosphere in the area of discharge.

b) Product handling occurs in a closed system, and oxygen in that system is always below the minimum concentration required to support combustion, such as in the handling of liquefied petroleum gas (LPG).

c) The flammable concentration is always above the upper flammable limit (UFL).

This document does not address electrostatic hazards relating to solids handling. (See [4], [5], and [15] in the bibliography.) Vehicle fueling (truck or passenger car) is also outside the scope of this document.

1.1 Concept of Hazard vs. Risk

Hazards are situations or properties of materials with the inherent ability to cause harm. Flammability, toxicity, corrosivity, stored electrical, chemical or mechanical energy all are hazards associated with various industrial materials or situations. Charge separation and the accumulation of a static charge are inherent properties of low conductivity hydrocarbon fluids.

Risk requires exposure. A hot surface or material can cause thermal skin burns or a corrosive acid can cause chemical skin burns, but these can occur only if there is contact exposure to skin. An accumulated static charge can be a source of ignition only if exposed to a flammable fuel-air mixture under conditions where a discharge is possible. There is no risk when there is no potential for exposure to all the required elements of charge accumulation, flammable mixture and spark discharge.

Determining the level of risk involves estimating the probability and severity of exposure events that could lead to harm, and the resulting consequences. While the preceding examples relate hazards to the risk to people, the same principles are valid for evaluating risks to people, property or the environment. For instance, hydrocarbon vapors in a flammable mixture with air can ignite if exposed to a source of ignition (such as a static discharge) resulting in a fire which could injure people or damage property.

1.2 Units of Measurement

Values for measurements used in this document are generally provided in both U.S. customary and SI (metric) units. To avoid implying a level of precision greater than intended, the second cited value may be rounded to a more appropriate number. Where specific code or test criteria are involved, an exact mathematical conversion is used. Some conversions are included in Annex D.