TECHNICAL INFORMATION BULLETIN

Updated 03/16

Oxidizing Agents by NFPA Classification

Oxidizers

In terms of chemistry, oxidation is a process by which one atom, compound, or molecule loses electrons to another atom, compound, or molecule. Therefore, there are two species involved: the oxidizing specie that loses electrons and the reducing specie which gains them. A more general use of the term is any material that readily yields oxygen or other oxidizing gas, or that readily reacts to promote or initiate combustion of combustible materials and can undergo a vigorous self-sustained decomposition due to contamination or heat exposure.

Typically, oxidation-reduction reactions are exothermic, meaning that they release heat. Such emissions of heat in addition to tendencies of certain reactions to undergo phase change to gaseous byproducts implicating potentially substantial pressure increases in closed systems require careful management of oxidizing materials, so that safety to the community and the environment is maintained.

As an industry that markets and merchandises oxidizers for their beneficial impact to water sanitization, we harness the oxidizing capacity of certain materials and apply them in ways that maintain a healthy swimming environment for our customers. However, in doing so, we must be aware of the practical impact of oxidizing materials and the requirements of safe handling and storage.

NFPA

The National Fire Protection Association (NFPA) is a non-profit organization that is the world's leading advocate of fire prevention and an authoritative source on public safety. The organization assists regulators and the consuming public through the development and dissemination of standards intended to minimize the possibility and effects of fire and other risks when storing or handling certain materials. Essentially, NFPA writes standardized guidelines for fire safety and prevention through a cooperation of cross-functional involvement of committee stakeholder members; so that they can be implemented by regulators into appropriate jurisdictional fire code throughout the country.

It was mentioned above that oxidation reactions typically liberate heat. Thus, the perspective through which NFPA classifies oxidizers is their ability to cause other materials to combust more readily as a direct result of contact or exposure to the oxidizer, or the ability of a material to undergo self sustained, exothermic decomposition.

The degree of hazard of oxidizing agents may be evaluated by consideration of the National Fire Protection Association (NFPA) classification for oxidizers. NFPA identifies four classes of oxidizers with Class 1 nominally the least hazardous and Class 4 the most hazardous. The four classes of oxidizers are defined as follows:

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Class 1 Oxidizer: An oxidizing material whose primary hazard is that it may increase the burning rate of combustible material with which it comes in contact.

- Industry Examples: Hydrogen Peroxide (28%), Trichloroisocyanurate, Dichloroisocyanurate Dihydrate (56%)

Class 2 Oxidizer: An oxidizing material that will moderately increase the burning rate or that may cause spontaneous ignition of combustible material with which it comes in contact.

- Industry Examples: Lithium Hypochlorite, BCDMH, Calcium Hypochlorite (<50% by wt)

Class 3 Oxidizer: An oxidizing material that will cause a severe increase in the burning rate of combustible material with which it comes in contact or that will undergo vigorous self-sustained decomposition when catalyzed or exposed to heat.

- Industry Examples: Calcium Hypochlorite (>50% by wt), Dichloroisocyanurate Anhydrous (62%)

Class 4 Oxidizer: An oxidizing material that can undergo an explosive reaction when catalyzed or exposed to heat, shock, or friction.

- Industry Examples: None

The relative degree of hazard decreases in the following order for oxidizers:

4 > 3 > 2 > 1

Notice above that NFPA distinguishes the Calcium Hypochlorite classification as to whether it is above or below 50% by weight, with Class 3 obviously being above 50%. Because, technically speaking, BurnOut[3] contains greater than 50% by weight, it would fit under the Class 3 category. However, burn study data shows it to behave as a Class 1 oxidizer would, which is due to the patented formulation. Therefore, it is technically a Class 3 oxidizer (by how NFPA distinguishes cal-hypo) that exhibits the characteristics of a Class 1 oxidizer when it comes to contribution to combustibility of materials. As such, it is designated as a Class 1 on the SDS, but cannot specifically be called out as Class 1 because it would contradict how NFPA designates the classification for the material. Therefore, when we refer to the NFPA designation for BurnOut[3] we always want to properly reference the material by specifically stating that it, "exhibits the characteristics of a Class 1 Oxidizer," rather than classifying it distinctly as a Class 1 Oxidizer. In comparison, BurnOut 73 contains greater than 50% by weight of calcium hypochlorite and is classified as a Class 3 oxidizer by the NFPA as well as on the SDS. All Class 3 storage and handling restrictions and regulations apply to BurnOut 73.

NFPA Classifications for oxidizers can be found in section 16 of the SDS, under specific hazards. Shipping information can be found in Section 14 of the SDS.

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Impact to the Dealer

The guidelines put forth by NFPA distinguish proper storage and handling procedures for oxidizing materials of different oxidizer classifications. Standards such as NFPA 430, and NFPA 400, list maximum allowable quantity limits that decrease drastically as you move up in classification. Therefore, local jurisdictional authorities are encouraged to enforce more stringent building requirements to address the increased hazard associated with storing products of higher oxidizer classifications. Restrictions on how materials can be merchandised on the same floor with incompatible materials are also outlined. If the language within the standard is adopted by local fire code, Class 3 oxidizers are limited to quantities that equate to less than a pallet, as opposed to nearly limitless restrictions on Class 1 oxidizers. In addition, Class 3 oxidizers are recommended to be separated from incompatible materials on the show floor by a non-combustible partition. If a dealer needs to accommodate Class 3 oxidizer quantities above the recommended limit stipulated in the standard, the local authority may require capital expenditure for safety equipment such as a fire sprinkler system to be installed throughout the building. Recommendations of bulk storage of Class 3 oxidizers in segregated or detached warehouses are also outlined.

In addition to the increased restrictions for storing and handling Class 3 oxidizers as opposed to Class 1 oxidizers, dealers may find themselves in a regulatory quandary where they cannot be fully confident of perpetual compliance. Fire codes are updated every several years, where final discretion of compliance is up to the local jurisdiction having authority. Therefore, a dealer may be operating within the guidelines of an outdated standard, and upon annual review, find themselves suddenly out of compliance. Or, they may find themselves under different jurisdictional authority that can regulate oxidizer storage more stringently at their sole discretion. Merchandising products that are within the most hazardous classification in the industry leaves general uncertainty of future code enforcement. If a dealer wants to minimize such risk they can offer products that exhibit the characteristics of the least hazardous classification.

Storage and Shipping Information

Where NFPA distributes standards that address fire safety and prevention in the storage and handling of oxidizers, the US Department of Transportation (DOT) under Title 49 of the US Code of Federal Regulations regulates transportation. DOT requires the use of hazardous materials placards when shipping hazardous materials cargo and dangerous goods throughout the United States. Like NFPA, DOT defines oxidizers by their ability to yield oxygen or enhance the combustibility of other materials. To identify whether oxidizing materials require designation, DOT conducts certain tests in accordance with the UN Manual of Tests and Criteria. Subsequent materials that fall within a certain data range resulting from the test are designated as Division 5.1 Oxidizers. As such, outside packaging materials are required to show a 5.1 Oxidizer diamond with the specific UN number and description identifying the material in the case of an emergency. Therefore, DOT designations are exclusive from NFPA, and are regulated only according to transport and shipping.

The process of determining and designating whether materials fit the definition of 5.1 Oxidizer status according to DOT begins with 3rd party burn studies. The studies are conducted in adherence to the tests required by DOT which are developed and published in the UN Manual of Tests and Criteria. The resulting data then signifies whether a material must be designated as a 5.1 Oxidizer for shipping. BurnOut 73 and BurnOut^3 must both print the 5.1 Oxidizer diamond on its packaging and shipping containers.

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