The Future of Perkadox 16

New NFPA Fire Regulations to Change the Storage Classifications for Perkadox 16 - Effective January 1, 2016

One of the most effective organic peroxides for elevated temperature applications is Di-(4-tert butylcyclohexyl) peroxydicarbonate (BCHPC), commonly known to the market as Perkadox 16. The National Fire Protection Association (NFPA) will issue its revised Code 400 in 2016 with the marked change of moving BCHPC from a Class III to a Class I Organic Peroxide based upon recommendation and input from the Organic Peroxide Producers Safety Division (OPPSD) of the Society of the Plastics Industry (SPI). The change in class will prove a challenge for storage, handling, flammability, and mixing in unsaturated polyester resin to manufacturers using the product and to distributors who store the product for the manufacturer. The National Fire Protection Association (NFPA) will change the status of Perkadox 16 (BCHPC powder) officially on January 1, 2016, to Class I as part of the next revision of NFPA Code 400. If you are a manufacturer of cured-in-place-pipe (CIPP) this news is for you and others that use this product.

What Is Perkadox 16 Di-(4-tert-butylcyclohexyl) Peroxydicarbonate, and How Is It Important?

Perkadox 16 is an organic peroxide that is a highly effective initiator for creating composite materials from polymers such as polyacrylates, polystyrene, polyvinylchloride and unsaturated polyesters. This peroxide is used in elevated temperature conditions to start the polymerization process.

Perkadox 16 is often used as the primary initiator in the creation of a polymer composite. Most times used in tandem with other organic peroxides, Perkadox 16 is a key to providing a completely cured piece at the end of the production run. Just a small amount of energy is required to slightly elevate the resin temperature and activate this peroxide. As Perkadox 16 reacts in a resin system, it generates heat and free radicals that start polymerizing the resin and the reactions of the other peroxides in the system. So for a small amount of energy input, this peroxide delivers the key to making simple and complex composites quickly and efficiently.
By itself, the Perkadox 16 powder can also react by decomposition if exposed to just enough heat to bring the temperature to 104 degrees Fahrenheit (40 degrees Celsius). This temperature for Perkadox 16 is called the self-accelerating decomposition temperature (SADT). When Perkadox 16 exposed to the SADT or higher temperature, the molecule decomposes, which produces more heat. As decomposition generates heat, it speeds up the rate of decomposition. The reactions continue until there is no organic peroxide left to react. For Perkadox 16, this reaction happens so fast that decomposition appears to happen nearly spontaneously. The heat emitted, along with the fast generation of decomposition products, can be so intense that a fire can result. The heat from a 20-watt light bulb held next to a box of Perkadox 16 can be enough to start the decomposition of the peroxide.

*Basis for the proposed reclassification is spelled out in the following OPPSD statement from 2012:*

The current classification of the products being changed was found to be incorrect and non-conservative based on the latest testing and other information on these materials. The incorrect classifications result in inconsistent ranking when compared with listings by other international code organizations resulting in confusion for the users. Since all changes are in the direction of higher hazard, improvements on individual sites may be required to safely store the affected materials.

Previously, the storage classification for organic peroxide formulations was based upon consideration of incidents involving said formulations, along with expert opinion of technically oriented individuals from the NFPA committee. The Organic Peroxide Producers Safety Division (OPPSD) now recommends a more objective and globally consistent method for such classification. The Dutch Code PG S8 (Organic peroxides: Storage, Guideline for the labor-safe, environment safe and fire-safe storage of organic peroxides, December 2011) and similar European classification systems are based on transport classification (United Nations Guideline) in addition to burning rate measured using either large or small scale burning tests.

With the Dutch PGS-8 standard issued in December 2011, the recommended Storage Group 1 for BCHPC powder was established. The National Fire Protection Association (NFPA) will change the status of Organic Peroxide Producers Safety Division powder officially on January 1, 2016, to Class I as part of the next revision of NFPA Code 400.

The NFPA Class I definition is “an unstable, reactive material.” “The material that in itself is normally stable that can become unstable at elevated temperature and pressure.” This storage classification would require Perkadox 16 (BCHPC) to be in refrigerated storage within a separate building, with limited quantity storage, independent of a manufacturing building. All requirements can be referenced in the current NFPA 400 Hazardous Materials Code (2013 edition) recommendations.

*NFPA Compliance Will Force An Expensive Investment To Modify Existing Production Facilities - Revised NFPA Code 400 Requirements*
CIPP industries will likely be the most affected by the change in NFPA classification. The CIPP manufacturers that utilize Perkadox 16 will find compliance to the NFPA Code 400 difficult and costly.

The proposed change to the current status of Perkadox 16 in the NFPA Code 400 will require considerable changes for Perkadox 16 storage & handling for manufacturing facilities.

Listed below are some of the many of the changes that will be needed to be compliant for NFPA Class I storage.*

1. Not more than 3 pounds (1350 grams) of any type Class 1 peroxide is allowed to be stored inside a manufacturing control area. An approved, explosion-proof, safety refrigerator in a room with an approved automatic sprinkler system is required.

2. Larger quantities of any type Class 1 peroxide must be stored in a detached building with an Organic Peroxide diamond placard on each exterior wall.

3. Minimum requirements for an outside detached storage building are:
   a. 50 feet (15.5 meters) from lot line or other buildings.
   b. Redundant alarms and refrigeration.
   c. Maximum Allowable Quantity (MAQ) for storage:
      i. 1,000 pounds (454 kilograms) maximum allowed if building does not possess a sprinkler system.
      ii. 2,000 pounds (907 kilograms) maximum allowed if building possesses a sprinkler system.
   d. Equipped with safety release door that opens with pressure.
   e. “Flammable Storage — Keep Fire Away” and “No Smoking” placards on outside of building.
   f. Explosion-proof electrical equipment is required (outside and inside).
   g. Temperature recorder and temperature alarm system (visual and audio).
   h. Metal portions of building should be grounded.
      i. Refrigeration units; main and emergency backup systems (fluorocarbon type) must be located outside or away from building.
   j. Interior and exterior walls must be made of corrosion resistant design. Minimum insulation should be 3 inches of urethane for walls, ceiling and floor.
   k. Weatherproof covering and sun-shield are required on top of building.
   l. Inside evaporators, main and emergency backup systems.
   m. Corrugated fiberglass on walls, pallets on floor and spacing between rows of cartons are required for air circulation.

*Consult the NFPA Code 400 for complete requirements, including usage levels in closed and open systems. The requirements stated above are used for illustration of the current code requirements for storage of Class I organic peroxides and does not represent the entire set of requirements.

After January 1, 2016, continued use of Perkadox 16 will require updating local requirements for emergency action plans submitted to local fire & emergency authorities.
Transportation & Shipping Costs
With the revised regulations for Perkadox 16 classification to Class1, shipping manifests and costs for shipping of Perkadox 16 will increase. Increased shipping costs will be a continuing manufacturing cost for cured-in-place pipe liners if Perkadox 16 is continued to be used.