METRIC

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MILITARY STANDARD

INORGANIC PEROXIDES, TECHNICAL GRADE

AMSC N/A

FSC 6810

FOREWORD

Inorganic Peroxides, Technical Grade

1. This Military Standard is approved for use by all Departments and Agencies of the Department of Defense.

2. Beneficial comments (recommendations additions deletions) and any pertinent data which may be of use in improving this document should be addressed to Technical Director, U.S. Army Edgewood Research, Development and Engineering Center, Attn: SCBRD-ENE (STD/SPECS/PKG), Aberdeen Proving Ground, MD 21010-5423, by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

3. This standard is approved for use by all Departments and Agencies of the Department of Defense in the selection of items for application. It is intended to prevent the entry of unnecessary items (sizes, types, varieties) into the Department of Defense logistics system. This document is not intended to restrict any service in selecting new items resulting from state-of-the-art changes.

CONTENTS

CONTENTS

LIST OF TABLES

1. SCOPE

1.1 Coverage. This standard is a presentation of nomenclature, Chemical Abstracts Service Registry Numbers, symbols, physical and chemical properties and requirements, military and typical commercial uses, directions for use, packaging data, labeling, general safety precautions, storage information, and shelf life of all military standard technical grade, Inorganic Peroxides. This standard does not necessarily include all classifications of the items represented by the title or those which are commercially available. It does contain items preferred for use in the selection of technical grade, Inorganic Peroxides for application by the Department of Defense.

1.2 Application. Inorganic metal peroxides, technical grade, are used mainly as oxidants for application in pyrotechnic mixtures, bleaching agents, and rubber curing agents. Hydrogen peroxide, technical grade, is mainly used for application in propulsion systems.

1.3 Classification. The items in this standard are classified on the basis of chemical composition as inorganic peroxides, technical grade.

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation.

SPECIFICATIONS

FEDERAL

PPP-C-2020(1)	-	Chemicals, Liquid, Dry and Paste, Packaging Of

MILITARY

MIL-B-153A(1)	-	Barium Peroxide
MIL-S-612B(12)	-	Strontium Peroxide
MIL-H-22868	-	Hydrogen Peroxide, E-Stabilized, 70% and 90% (For Torpedo Use)

STANDARDS

FEDERAL

FED-STD-313C	-	Material Safety Data Sheets, Preparation And Submission Of

MILITARY

MIL-STD-12D	-	Abbreviations For Use On Drawings, And In Specifications, Standards And Technical Documents

(Unless otherwise indicated, copies of Federal and military specifications, standards, and handbooks are available from (ATTN: DODSSP) - Customer Service, Standardization Documents Order Desk, 700 Robbins Avenue, Bldg. 4D, Philadelphia, PA 19111-5094.)

2.1.2 Other Government documents, drawings, and publications. The following other Government documents, drawings, and publications form a part of this document to the extent specified herein. Unless otherwise specified, the issues are those cited in the solicitation.

CODE OF FEDERAL REGULATIONS (CFR)

Title 29 -	Department of Labor, Occupational Safety and Health Administration (OSHA)
Title 40 -	Environmental Protection Agency (EPA); Hazardous Waste And Consolidated Permit Regulations
Title 48 -	Federal Acquisition Regulations System; Chapter 1, Federal Acquisition Regulation
Title 49 -	Department Of Transportation; Hazardous Materials Regulations (DOT)

DEPARTMENT OF DEFENSE PUBLICATIONS

AFMM TM 38-410	-	Storage And Materials Handling
DOD 4160.21-M	-	Defense Utilization And Disposal Manual
DOD 6050.5	-	DOD Hazardous Materials Information System, Hazardous Item Listing
AR 11-34	-	Respiratory Protection Program (under revision)
TB MED 502 (DLAM 1000.2)	-	Occupational And Environmental Health Respiratory Protection Program (under revision)
TB MED 506	-	Occupational And Environmental Health Occupational Vision
TM 38-250	-	Packaging, Materials Handling-Preparation Of Hazardous Materials For Military Air Shipment

PUBLIC LAW (PL)

PL 94-580	-	Resource Conservation and Recovery Act (as amended)

NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH (NIOSH)

Registry of Toxic Effects of Chemical Substances
Recommendation for Environmental Exposure Limits

(Copies of specifications, standards, handbooks, drawings, and publications required by contractors in connection with specific acquisition functions should by obtained from the contracting activity or as directed by the contracting officer.)

2.2 Non-Government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of the documents which are DOD adopted are those listed in the issue of the DODISS cited in the solicitation. Unless otherwise specified, the issues of documents not listed in the DODISS are the issues of the documents cited in the solicitation.

AMERICAN CONFERENCE OF GOVERNMENT INDUSTRIAL HYGIENISTS (ACGIH)

Threshold Limit Values (TLVs) for Chemical Substances in the Work Environment Adopted by the American Conference of Governmental Industrial Hygienists (ACGIH) with Intended Changes.

(Application for copies should be addressed to American Conference of Governmental Industrial Hygienists, 6500 Glenway Avenue, Bldg. D-7, Cincinnati, OH 45211-4438.)

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z358.1-1990 for Emergency Eyewash and Shower Equipment.

(Application for copies should be addressed to American National Standards Institute, 1430 Broadway, New York, NY 10018.)

AMERICAN SOCIETY FOR TESTING MATERIALS (ASTM)

ASTM E 11-81	-	Standard Specification for Wire-Cloth Sieves For Testing Purposes
ASTM E 380A-91	-	Standard For Metric Practice

(Application for copies should be addressed to ASTM, 1916 Race Street, Philadelphia, PA 19103.)

CHEMICAL ABSTRACTS SERVICE REGISTRY

The Chemical Abstracts Service (CAS) Registry number provides a key to access the wealth of information available through CAS.

(For details on how to search the CAS files and database using the registry number, contact Chemical Abstracts Services, Customer Service, P.O. Box 3012, Columbus, OH 43210.)

INTERNATIONAL AIR TRANSPORT ASSOCIATION (IATA)

Dangerous Goods Regulations

(Application for copies should be addressed to the Publications Assistant, International Air Transport Association, 2000 Peel Street, Montreal, Quebec, Canada H3A 2R4.)

INTERNATIONAL CIVIL AVIATION ORGANIZATION (ICAO)

Technical Instructions for the Safe Transport of Dangerous Goods by Air, DOC 9284-AN/905.

(Application for copies should be addressed to the Document Sales Unit, International Civil Aviation Organization, 1000 Sherbrooke Street West, Suite 400, Montreal, Quebec, Canada H3A 2R2.)

INTERNATIONAL MARITIME ORGANIZATION (IMO)

International Maritime Dangerous Goods Code (IMDG), Publication 200 89.10E, Vols. I-IV.

(Application for copies should be addressed to the International Maritime Organization, 4 Albert Embankment, London SEI 7SR.)

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

National Fire Codes

(Application for copies should be addressed to National Fire Protection Association, Battery March Park, Quincy, MA 02269.)

(Non-Government standards and other publications are normally available from the organizations that prepare or distribute the documents. These documents also may be available in or through libraries or other informational services.

2.3 Order of precedence. In the event of a conflict between the text of this standard and the references cited herein, the text of this standard shall take precedence.

Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. DEFINITIONS

3.1 Definitions of Technical Terms.

3.1.1 Decomposition - The chemical separation of a substance into two or more simpler substances, which differ from each other and from the original substance.

3.1.2 Explosive limits - When combustible vapor is mixed with air in the proper proportions, ignition will produce an explosion. This proper proportion is called the explosive range. The explosive range includes all concentrations of a mixture of flammable vapor or gas in air, in which a flash will occur or a flame will travel if the mixture is ignited. The lowest percentage at which this occurs is the lower explosive limit; and the highest percentage, the upper explosive limit. Explosive limits are expressed in percent by volume of vapor in air and, unless otherwise specified, under normal conditions of temperature and pressure.

3.1.3 Flash point - The temperature to which a substance must be heated under specific conditions to give off sufficient vapor to form a mixture with air that can be ignited momentarily by a specified flame.

3.1.4 Formula weight - The sum of the atomic weights of all the atoms appearing in a chemical formula. In this standard, it is computed according to international atomic weight values of 1961.

3.1.5 Hazardous substance - Any substance or mixture of substances which is (1) toxic; (2) corrosive; (3) an irritant; (4) a strong sensitizer; (5) flammable, or which (6) generates pressure through decomposition, heat or other means, if such substance or mixture of substances may cause substantial personal injury or substantial illness during or as a direct result of any customary or reasonably anticipated handling or use.

3.1.6 Melting point - The temperature at which the liquid and solid phases of a substance exist together in equilibrium, and transition from the solid to the liquid occurs.

3.1.7 Oxidizing agent - A substance that gains electrons as a result of an oxidation-reduction reaction. It causes an increase in the oxidation state of another substance.

3.1.8 pH - A numerical measure of the hydrogen ion concentration, indicating degree of acidity or alkalinity of a solution. It is expressed as $pH=-\log_{10}[H^+]$. At the neutral point, pH=7. At a pH lower than 7, a solution is acidic. At a pH higher than 7, a solution is basic.

3.1.9 Reducing agent - A substance that loses electrons during an oxidation-reduction reaction. It causes a decrease in the oxidation state of another substance.

3.1.10 Technical grade - Denotes a quality of chemicals which are generally used for industrial, solvent, and manufacturing applications. Generally, specific processes are not employed by the manufacturer to limit all the impurities, aside from the normal precautions which are taken in the manufacturing process. A technical grade chemical may be specially processed to reduce specific impurities so as to suit the chemical to a given industrial application. In such cases, the identification of the items must be further expanded to indicate the specific impurities limitation.

3.2 Definitions of abbreviations. The use of abbreviations shall be in accordance with MIL-STD-12 where applicable. Metric system abbreviations and symbols shall be in accordance with ASTM E 380.

Additional abbreviations are as follows:

CAS	- Chemical Abstracts Service Registry Number
DRMO	- Defense Reutilization and Marketing Office
FW	- Formula Weight
HMIS	- Hazardous Materials Information System
MSDS	- Material Safety Data Sheet
TLV	- Threshold Limit Value
PEL	- Permissible Exposure Limit

4. GENERAL REQUIREMENTS

4.1 Packaging data and labeling. All chemicals included in this standard shall be packaged in accordance with Federal Specification PPP-C-2020 and all applicable documents referenced therein. When the commodity is a hazardous material, the shipping containers for domestic shipments using commercial carriers shall be labeled in accordance with current Department of Transportation (DOT) Hazardous Materials Regulations applicable to each chemical. Likewise, shipping containers for international shipments using commercial carriers shall be labeled in accordance with the International Hazardous Materials Regulations appropriate for the mode of shipment used (see Para. 2.2 herein). When shipping hazardous material by military aircraft, the requirements of TM 38-250 shall apply. Additionally, each item shall be packaged and labeled as specified in the applicable contract or order. All labels shall comply with Hazard Communication Standard, 29 CFR 1910.1200 (f) and the appropriate domestic or international Hazardous Materials Regulations.

4.2 Hazardous materials information. DOD 6050.5, DOD Hazardous Materials Information System (HMIS) acquires, reviews, stores, and disseminates Material Safety Data Sheet (MSDS) information for all hazardous materials used by DOD. The contractual acquisition of an MSDS is accomplished through use of Federal Acquisition Regulation, 48 CFR 52.223-3, Hazardous Material Identification and Material Safety Data. The MSDS is prepared in accordance with the instructions in FED-STD-313 and shall comply with the requirements of Hazard Communication Standard, 29 CFR 1910.1200 (g).

4.3 Safety.

4.3.1 Personal protective measures. The necessary respiratory, eye and skin protection to be used when handling chemicals shall be prescribed by the responsible installation industrial hygiene, medical and safety authorities.

4.3.1.1 Respiratory protection. Respirators, approved by the National Institute for Occupational Safety and Health (NIOSH) or the Mine Safety and Health Administration (MSHA) or by particular respiratory schedules of the Bureau of Mines (BM) for the compounds being used, may be employed for intermittent, non-routine exposure (i.e., not exceeding 1 hour/day for 1 day/week), when the installation medical authority determines that there are no feasible engineering or work practice controls, during interim periods when engineering controls are being designed and/or installed, during emergencies, or for supplementing other control measures (refer to TB MED 502 or DLAM 1000.2). Ventilation containment, process controls, or other feasible engineering controls shall be adequate to remove hazardous concentrations.

4.3.1.2 Skin protection. Personnel using these compounds shall be provided with and required to use impervious gloves, sleeves, aprons, and boots whenever indicated. Protective creams and ointments commonly known as "barrier creams" may be of value in certain cases. However, barrier creams shall not be used to replace protective clothing. During use, avoid contact with eyes, skin and clothing. Wash with soap and water after handling. When not in use, keep in a tightly closed container. In case of contact with the eyes, remove any contact lenses and irrigate with copious amounts of water for at least 20-30 minutes, and obtain medical attention. Eye lavages and emergency showers shall be located where there is a potential for direct contact with harmful chemicals. All emergency eyewashes and emergency showers shall be activated weekly to flush the line and to verify proper operation in accordance with ANSI standard Z-358-1-1990.

4.3.1.3 Face and eye protection. Personnel using these compounds shall be provided with and required to wear chemical splash-proof safety goggles. In addition, face shields shall be provided and worn over the goggles if splashing could occur. In case of contact with the eyes, immediately irrigate with copious amounts of water for at least 20-30 minutes, and obtain medical attention. (Refer to TB MED 506.)

4.3.1.4 Training. Employers shall provide employees with training and information, including MSDSs, on all chemical items in their work area, in accordance with 29 CFR 1910.1200 (h) and, 49 CFR 172 Subpart H, as may be applicable, to ensure that employees know potential hazards of the chemicals with which they come in contact and the symptoms of exposure, as well as how these chemicals affect the body and bodily functions. Employees shall be adequately trained to render first aid. Additionally, any employee involved with the packaging, preparation, handling or causing a hazardous material to be shipped or transported, shall be provided with all of the training specified in 49 CFR 172 Subpart H.

4.3.1.5 Exercises. Participation in training exercises shall be stressed to demonstrate skills in the use of personal protective equipment and emergency response equipment.

4.3.2 Storage conditions. DOD 4145.19-R-1 describes general storage practices and requirements for hazardous materials in the DOD supply system. Specific requirements provided in the following paragraphs are supplementary in nature and shall be observed in consonance with the DOD storage regulations.

4.3.2.1 Flammable, combustible, pyrophoric and ignitable materials. A flammable material is generally any solid, liquid, vapor or gas that ignites easily and burns rapidly. Combustible materials are generally those that are difficult to ignite and burn slowly. The

DOT, in Part 173, Subpart D, Section 173.115 of 49 CFR, defines a flammable liquid as one having a closed cup flash point below 37.8°C (100°F). In the DOT's Final Rule to Docket HM-181, the flash point for a flammable liquid was raised from below 37.8°C (100°F) to not more than 60.5°C (141°F). A combustible liquid is defined, by DOT in the above reference, as one having a closed cup flash point at or above 60.5°C (141°F) and below 93.3°C (200°F). A pyrophoric liquid is defined, by DOT in the above reference, as one that ignites spontaneously in dry or moist air at or below 54.5°C (130°F). Materials with flash points of 93.3°C (200°F) or higher are to be considered as burnable. The DOT has permitted, for domestic shipments only and except for shipments by air or water, that "...a flammable liquid with a flash point at or above 38°C (100°F)..." and which does not meet the definition of any other hazard class as defined in 49 CFR, may be re-classed as a combustible liquid. The Environmental Protection Agency (EPA), in Part 261, Subpart C, Section 261.21 of 40 CFR*, designates the criteria for flammable and combustible materials and oxidizers that exhibit the characteristic of ignitability (I). Liquids with closed cup flash points of less than 60°C (140°F) are defined by EPA as ignitable. The autoignition point (temperature) of a substance is generally defined as the minimum temperature required to initiate or cause self-sustained combustion in the absence of a spark or flame. Materials that ignite easily under normal industrial conditions are considered to be dangerous fire hazards. Such materials shall be stored in a manner to prevent ignition and combustion. Easily ignitable substances, such as reducing agents, shall be kept away from strong oxidizing agents. All containers shall be tightly sealed. It is important to provide adequate ventilation in storage areas, and to locate the storage areas of these items away from fire hazards. Ample fire-control equipment shall be easily accessible. Storage buildings, rooms and cabinets shall comply with provisions of the National Fire Codes. The building shall be electrically grounded and signs posted to prevent the lighting of matches or smoking in the area. Flammable storage areas shall be equipped with smoke or fire detection equipment.

4.3.2.2 Water-sensitive fire and explosive hazardous materials. These are materials that react on contact with water or steam to ignite or evolve heat or explosive gases. Such materials exhibit the characteristic of reactivity (R) as designated by the EPA in Section 261.23 of the above reference.* These materials shall be stored in well-ventilated, cool, dry areas. All containers shall be tightly sealed. These materials are a fire hazard in contact with water or moisture; therefore, it is essential that no sprinkler be used. Otherwise, the building shall conform to that required for storage of flammable materials. The building shall be waterproof, located on high ground, separated from other storage areas and meet National Fire Codes.

* Refers to materials that have become hazardous waste.

4.3.2.3 Incompatible materials. Materials that are chemically incompatible shall be segregated in the storage of both serviceable and unserviceable items. The degree of segregation will depend upon DOD 4145.19-R-1 and local supplementary requirements that insure safe storage conditions. Hazardous storage compatibility codes are provided in the HMIS referred to in 4.2. Hazardous material storage compatibility may also be determined through use of the EPA Hazardous Materials Compatibility Chart. This chart determines reactions of most binary combinations of hazardous wastes by assigning Reactivity Group Numbers (RGNs) based on chemical classes and general chemical reactivities.

4.3.3 Hazardous chemical exposure limits. Hazardous chemical exposure limits for airborne concentrations of substances are obtained from the current TLVs in Threshold Limit Values for Chemical Substances in the Work Environment adopted by the American Conference of Governmental Industrial Hygienists (ACGIH); current Occupational Safety and Health Administration (OSHA) Permissible Exposure Limits (PEL), 29 CFR, Part 1910, Section 1910.1000; and NIOSH Recommendation for Environmental Exposure Limits. Such information is also shown in MSDSs and the HMIS referred to in 4.2.

Carcinogenic substances are listed by OSHA in Category I for confirmed carcinogens, and in Category II for suspected carcinogens. Category I substances have standard exposure limits set at the lowest possible levels. Category II substances have standard exposure limits set to prevent acute or chronic effects.

4.3.4 Toxicity. Toxicity information for chemical compounds is available from various publications and from MSDSs, which are collected in DOD 6050.5-LR Hazardous Materials Information System.

4.3.4.1 EPA Toxic (T). Some chemical compounds have been designated by the EPA as toxic (T) in accordance with the criteria shown in Part 261, Subpart B, Section 261.11(a)(3) of 40 CFR.* Some commercial chemical products are listed as toxic under Subpart D, Section 261.33 (f).

4.3.4.2 EPA Acute Hazardous Toxicity (H). Some chemical compounds have been designated by the EPA as acutely hazardous (H) in toxicity in accordance with the criteria shown in Subpart B, Section 261.11(a)(2) of the above reference.* Some commercial chemical products are listed as acutely hazardous in toxicity under Subpart D, Section 261.33(e).

* Refers to materials that have become hazardous waste.

4.3.4.3 EPA Toxicity Characteristic Leaching Procedure (TCLP). This is a procedure used to determine the properties of a waste that are directly related to the potential of the waste to pose a hazard to groundwater when disposed of in a landfill environment. It replaces the EPA EP toxicity test. The TCLP procedure is contained in EPA Method No. 1311, SW-846. Some 40 chemical contaminants have been designated by EPA as being a hazard to groundwater in a landfill environment. (See Section 261.24 of 40 CFR.)*

4.4 Pollution and disposal.

4.4.1 Pollution potential. All items described in this standard shall be assumed to have a pollution potential. However, to minimize this potential, the proper use, storage and disposal methods shall be strictly followed.

4.4.2 Disposal of excess or unserviceable material. To minimize disposal problems, it is recommended that no more than a one year's supply of each item listed in this standard be stocked. When stocks have been declared excess or unserviceable, they will be disposed of in accordance with the Defense Utilization and Disposal Manual, DOD 4160.21-M, and applicable DOD Policy Memoranda. Guidance can be obtained from your servicing Defense Reutilization and Marketing Office (DRMO) on procedures required for proper reporting and turn-in.

4.4.3 Disposal and storage of hazardous wastes. Items are classified and managed as hazardous wastes as defined by the Resource Conservation and Recovery Act (RCRA) (Public Law 94-580). Items have been identified as meeting the characteristics (i.e., ignitable, corrosive, reactive or are subject to Toxicity Characteristic Leaching Procedure (TCLP)) or are listed (i.e., toxic or acutely hazardous) according to Identification and Listing of Hazardous Waste, Part 261, 40 CFR; or have been determined to be hazardous wastes by declaration of the Defense Reutilization and Marketing Service (DRMS) in accordance with procedures set forth in DOD 4160.21-M. Disposal of such items shall be managed in accordance with the Installation Environmental Office, the DRMO, or the Safety and Health Office to insure proper reporting of disposal and treatment actions to the US EPA and State, and shall be managed in accordance with Federal, State and local laws. The three main disposal methods are turn-in to the DRMO, on-post disposal by installation personnel, or disposal by commercial contract. Hazardous wastes which cannot be disposed of as stated in 4.4.3.2 shall be stored under environmentally safe conditions until suitable methods of disposal are determined. Short-term storage (less than 90 days) requires proper containment (i.e., packaging and facilities) in accordance with 40 CFR, 262.34. Long-

* Refers to materials that have become hazardous waste.

term storage (greater than 90 days) requires permitting by the EPA or by the State under Public Law 94-580 (RCRA), in compliance with the requirements of 40 CFR, Parts 264 and 265. Physical custody will be accomplished by the activity with conforming storage or most nearly conforming storage. When physical custody is in question, the Post Commander will make the final decision. In all cases where the wastes are to be collected, stored, transported and disposed of at a State or local permitted disposal facility, the identity and description of the waste shall be maintained and recorded in accordance with Part 262 of the above reference. Transportation of the waste must be in accordance with Part 263 of the above reference, Standards Applicable to Transporters of Hazardous Waste. State and/or local regulations may be more stringent than Federal requirements. It is essential that the installation Environmental Office review all disposal actions for compliance with all applicable regulations.

4.4.3.1 Cleanup of liquid spills. To control the migration of spilled or leaking liquids, dike around the item with an inert, dry absorbent (e.g., clay sawdust or vermiculite) or follow installation spill plans (Spill Prevention Control and Countermeasure Plan and Installations Spill Contingency Plan). Control entry to the spill site and segregate salvageable materials away from the spill area. Initiate waste cleanup operations immediately in accordance with local procedures. The residue shall be safely handled and transported to an approved or permitted disposal or storage facility. Packaging, labeling, transportation and record-keeping requirements for this waste material are determined by the appropriate Federal and State agencies and local procedures. It is recommended that all activities involving disposal preparation and transportation to commercial facilities be properly coordinated with the appropriate Federal and State agencies responsible for health and environmental aspects of hazardous materials. It is imperative that the proper description of waste accompany the packaged item at all times. Final disposal of the waste item shall be accomplished by reutilization, transfer, donation or sales by DRMS in accordance with DOD 4160.21-M or by ultimate disposal as described in 4.4.3.2. Spill residue, including contaminants, to be turned into the DRMO shall first be properly identified, containerized, and labeled. For large scale spills that grossly contaminate the environment, the Chemical Transportation Emergency Center (CHEMTREC) can be called for assistance (1-800-424-9300). Applicable procedures of the local spill control plan shall be followed. Necessary respiratory, eye, and skin protection measures are to be used while performing cleanup operations.

4.4.3.2 Ultimate disposal. Ultimate disposal shall be accomplished at a permitted or approved hazardous waste treatment or disposal facility designated by the Installation Environmental Office, DRMO, or Safety and Health Offices.

* Refers to materials that have become hazardous waste.

4.4.4 DISCLAIMER. RECOMMENDED DISPOSAL INSTRUCTIONS ARE FORMULATED FOR USE BY ELEMENTS OF THE DEPARTMENT OF DEFENSE. THE UNITED STATES OF AMERICA IN NO MANNER WHATSOEVER, EITHER EXPLICITLY OR IMPLICITLY, WARRANTS, STATES, OR INTENDS SAID INSTRUCTION TO HAVE ANY APPLICATION, USE OR VIABILITY BY OR TO ANY PERSON OR PERSONS CONTRACTING OUTSIDE THE DEPARTMENT OF DEFENSE OR ANY PERSON OR PERSONS CONTRACTING WITH ANY INSTRUMENTALITY OF THE UNITED STATES OF AMERICA, AND DISCLAIMS ALL LIABILITY FOR SUCH USE. ANY PERSON USING THESE INSTRUCTIONS WHO IS NOT A MILITARY OR CIVILIAN EMPLOYEE OF THE UNITED STATES OF AMERICA SHOULD SEEK COMPETENT PROFESSIONAL ADVICE TO VERIFY AND ASSUME RESPONSIBILITY FOR THE SUITABILITY OF THESE INSTRUCTIONS TO HIS PARTICULAR SITUATION, REGARDLESS OF SIMILARITY TO A CORRESPONDING DEPARTMENT OF DEFENSE OR OTHER GOVERNMENT SITUATION.

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5. DETAILED REQUIREMENTS

5.1 Name: Barium Peroxide — BaO_2 — CAS 1304-29-6
Barium binoxide — BaOO — FW 169.34
Barium dioxide
Barium superoxide

5.1.1 Technical description. Barium peroxide (pure) is a white-gray powder with a density of 4.96 g/cm^3. It has a melting point of 450°C, and a boiling point of 800°C with decomposition and loss of oxygen. It is very slightly soluble in cold water and decomposes in hot water. It is insoluble in acetone. It decomposes by dilute acids with formation of hydrogen peroxide.

5.1.2 Specification. Military, MIL-B-153, Barium Peroxide.

5.1.2.1 Requirements: The military specification describes Grade A, Classes 1 and 2; and Grade B barium peroxide. The barium peroxide shall be grayish-white or tan-white in color. The Grade A barium peroxide shall be manufactured by a dry process to be an anhydrous material consisting essentially of barium peroxide with some barium monoxide and barium carbonate. Grade B barium peroxide shall be manufactured by a wet precipitation method and shall consist of anhydrous barium peroxide. The chemical and physical requirements are shown in Table I. The granulation requirements are shown in Table II.

TABLE I. Barium peroxide - chemical and physical requirements.

Requirements	Grade A		Grade B
	Class 1	Class 2	
Moisture, % max	--	--	0.3
Apparent density, g/cm^3, min	--	--	1.3
Available oxygen, % min	8.5	8.5	8.8
Total iron, % max	--	--	0.03
Strontium, % max	--	--	0.85
Calcium, % max	--	--	0.15
Magnesium, % max	--	--	0.02
Sodium, % max	--	--	0.05
Aluminum, % max	--	--	0.05

* Refers to materials that have become hazardous waste.

TABLE I. Barium peroxide - chemical and physical requirements (continued).

Requirements	Grade A		Grade B
	Class 1	Class 2	
Chlorides (as barium chloride), % max	--	--	0.1
Nitrate (as barium chloride), % max	1/	1/	0.1
Insoluble matter, % max	2.0	2.0	--
Grit, % max	0.005	--	--
Barium content, % min	76.0	76.0	--

1/ To be specified by interested agency.

TABLE II. Barium peroxide - granulation requirements.

US Standard Sieves†	Grade A		Grade B
	Class 1	Class 2	
Passing through	Percent by weight, min		
150 micrometer (No. 100)	99.9	--	100
106 micrometer (No. 140)	--	--	95
90 micrometer (No. 170)	98.0	--	--
75 micrometer (No. 200)	--	99.9	--
45 micrometer (No. 325)	90.0	--	--

† Standard sieve designations in accordance with ASTM E 11.

5.1.3 Use. Barium peroxide is used as an oxidizer (oxidizing agent). Grade A is intended for use in pyrotechnic mixtures. Grade B is intended for use in ignition and tracer compositions. Commercial uses are as a bleaching agent for materials of vegetable and animal origin. It is used for the production of hydrogen peroxide by reaction with sulfuric acid. A byproduct of this reaction is barium sulfate (blanc fixe).

5.1.4 Safety. Barium peroxide is a strong oxidizer. Mixtures with reducing agents or combustible organic material are explosive and can be ignited easily by friction or contact with a small amount of water. It reacts with water to generate heat. As a soluble

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barium compound, barium peroxide is toxic when ingested. The PEL and TLV is 0.5 mg/m^3, as Ba, and breathing of dust shall be avoided. It is an irritant to skin, eyes, mucous membranes, and respiratory tract. In case of contact with the skin, flush affected areas with water for at least 20 minutes and obtain medical attention. (Refer to 4.3.1.)

5.1.5 Storage. Barium peroxide shall be stored in tightly sealed containers in a cool dry place away from heat sources, direct sunlight, and oxidizable materials. (Refer to 4.3.2.)

5.1.6 Disposal. In case of spills, recover in dry state. For appropriate procedures, contact the Installation Environmental Office, the DRMO, or Safety and Health Offices. (Refer to 4.4.) The EPA hazardous waste number for barium peroxide is D004.

Barium is listed in 40 CFR Section 261.24, Table 1 for toxicity characteristics. Barium peroxide will exhibit the characteristic of toxicity for barium. Specific State and local regulations may treat barium peroxide as a corrosive waste. Designations of toxic and corrosive hazardous waste apply only to material declared as waste.

5.2	Name: Calcium Peroxide	CaO_2	CAS 1305-79-9
	Calcium binoxide	CaOO	FW 72.00
	Calcium dioxide		
	Calcium superoxide		

5.2.1 Technical description. Calcium peroxide (pure) is in the form of white tetragonal crystals with a density of 2.92 g/cm^3. It melts at 275°C with decomposition. It is slightly soluble in cold water and soluble in alcohol. It is decomposed by dilute acids with formation of hydrogen peroxide.

5.2.2 Specification. Manufacturer's requirements (no Government specification).

5.2.2.1 Requirements. The commercial specification requirements are for a material with a composition, as CaO_2, of 60 percent by weight minimum, and an active oxygen content of 13.3 percent by weight minimum.

5.2.3 Use. Calcium peroxide is used as a curing agent for certain rubber compounds, a starch modifier, a high temperature oxidant, and as a dough conditioner in the baking industry.

* Refers to materials that have become hazardous waste.

5.2.4 Safety. Calcium peroxide is a strong oxidizer. Mixtures with reducing agents or combustible organic material are explosive and can be ignited easily by friction or contact with a small amount of water. Contact with catalytically active metals shall be avoided. There is no PEL or TLV referenced for this compound. Calcium peroxide is an irritant to the skin, eyes, mucous membranes, and respiratory tract, and breathing of dust shall be avoided. In case of contact with the skin, flush affected areas with water. In case of contact with the eyes, flush with water for at least 20 minutes and obtain medical attention. (Refer to 4.3.1.)

5.2.5 Storage. Calcium peroxide shall be stored in tightly sealed containers in a cool dry place away from heat sources, direct sunlight, and oxidizable material. (Refer to 4.3.2.)

5.2.6 Disposal. In case of spills, recover in dry state. For appropriate procedures, contact the Installation Environmental Office, the DRMO, or Safety and Health Offices. (Refer to 4.4.)

Calcium peroxide has an EPA Hazardous Waste Classification - Ignitable, Waste No. D001.

5.3	Name. Hydrogen Peroxide	H_2O_2	CAS 7722-84-1
	Hydrogen dioxide	HOOH	FW 34.01

5.3.1 Technical description. Hydrogen peroxide (pure) is a colorless liquid with a slightly acid odor. It has a density of 1.422 g/cm^3 at 25°C and an index of refraction 1.414 at 22°C. It has a melting point of -0.41°C, and a boiling point of 150.2°C at 760 mm Hg. It is miscible with water, alcohol, and ether. Hydrogen peroxide is an active oxidizing agent with strong reducing agents, and is reduced to water by such reactions. Hydrogen peroxide is also a reducing agent with strong oxidizing agents, and evolves oxygen by such reactions. Hydrogen peroxide is a weak acid in aqueous solutions. Hydrogen peroxide is thermally unstable, and decomposes to water and oxygen with the evolution of heat. The decomposition is catalyzed by bases and heavy metal ions. Hydrogen peroxide decomposition can be slowed by means of stabilizer compounds.

5.3.2 Specification. Military, MIL-H-22868, Hydrogen Peroxide, E-Stabilized, 70 percent and 90 percent (for torpedo use).

5.3.2.1 Requirements. The military specification covers aqueous solutions of hydrogen peroxide in which additives have been dissolved to impart a low decomposition

* Refers to materials that have become hazardous waste.

rate, to repress the effect of accidental catalytic contamination, and to prevent corrosion of aluminum containers. Such hydrogen peroxide solutions are designated as "E" stabilized. The stabilized hydrogen peroxide shall be of two grades:

Grade 70E - 70 percent hydrogen peroxide by weight
Grade 90E - 90 percent hydrogen peroxide by weight

Both grades shall be clear, colorless solutions of hydrogen peroxide and additives in water. The concentrations specified shall not vary by more than plus 1.0 or minus 0.5 percent. The stabilized solutions shall contain the following additives:

Sodium stannate ($Na_2SnO \cdot {}_3H_2O$) to provide a tin (Sn) concentration of 32±4 mg/L.
Sodium phosphate, dibasic ($Na_2HPO_4 \cdot 12H_2O$) to provide a phosphate (PO_4) concentration of 29±mg/L.
Sodium nitrate ($NaNO_3$) and nitric acid to provide a nitrate (NO_3) concentration of 110±20 mg/L, and for pH adjustment.

The acidity (apparent pH) of the stabilized hydrogen peroxide solution shall be 1.4±0.2 for Grade 70E and 0.2±0.2 for grade 90E. If necessary, hydroxide solutions in pure water. The stability of the stabilized hydrogen peroxide solutions shall be such that the active oxygen content loss shall be not more than 2 percent by weight (maximum) when tested as specified at 100°C for 24 hours. The surface tension of the stabilized hydrogen peroxide solution shall be no less than 72 dynes/cm for Grade 70E and 74 dynes/cm for Grand 90E at 20°C when tested as specified. Objectionable impurities and evaporation residue shall be limited to the chemical requirements shown in Table III when tested as specified.

TABLE III. Stabilized hydrogen peroxide - chemical requirements.

	GRADE 70E	GRADE 90E
Impurities		
Chloride (as Cl), mg/L, max	1	1
Sulfate (as So_4), mg/L, max	10	10
Evaporation residue, mg/L, max	325	325

* Refers to materials that have become hazardous waste.

5.3.3 Use. The E-stabilized hydrogen peroxide solutions are intended for military use as oxidizers in the propulsion systems of chemically powered torpedoes. These solutions are also useful in the propulsion systems of rockets and missiles, and in space vehicle attitude control systems. As monopropellants they catalytically decompose to generate steam; and as bipropellant components, they are oxidants for liquid fuels. Commercial uses include use as a blowing agent for foam rubber, as a bleaching agent for a variety of materials, and as an oxidant in organic synthesis.

5.3.4 Safety. Hydrogen peroxide is an oxidizer that is very reactive. In concentrations of 65 percent or greater, it can cause fires on contact with combustible material. Explosive compositions can be formed by dissolving certain combustible materials in concentrated hydrogen peroxide that can detonate violently under the proper stimulus. Concentrated hydrogen peroxide solutions, above 30 percent, must be protected against contamination to prevent decomposition at a dangerously high rate. Concentrated hydrogen peroxide is not considered to be an explosive, but small amounts of materials containing catalysts (silver, lead, copper, chromium, mercury, and iron rust) can cause decomposition and explosive rupture of a containing vessel if it is not properly vented. Alkaline substances can also react violently with concentrated hydrogen peroxide. Fires caused by hydrogen peroxide can be controlled by using large quantities of water. Hydrogen peroxide solutions are irritating to the skin, eyes, mucous membranes, and respiratory tract. The solutions at moderate concentrations can cause whitening of the skin which gradually returns to normal without any damage. Highly concentrated solutions can cause blistering if left on the skin and can cause severe eye damage. The PEL for hydrogen peroxide (90 percent) is 1 ppm (1.4 mg/m^3), and the TLV for hydrogen peroxide is 1 ppm (1.5 mg/m^3). The vapor causes discomfort of the eyes and nose. In case of contact with the skin flush affected areas with water. In case of contact with the eyes, flush with water for at least 20 minutes and obtain medical attention. (Refer to 4.3.1)

5.3.5 Storage. Hydrogen peroxide solutions shall be stored only in approved original containers or in containers of compatible materials which have been properly designed and thoroughly passivated. All containers shall be properly vented and stored in a cool place protected from direct sunlight and away from heat sources, combustible materials, and powdered metals. The storage areas shall be well ventilated, fireproof, and provided with a source of water to wash away spillage. Hydrogen peroxide solutions, once removed from the original containers, shall not be returned to them. (Refer to 4.3.2.)

* Refers to materials that have become hazardous waste.

5.3.6 Disposal. In case of spills or leaks, dilute with a large quantity of water and flush into drains. For appropriate procedures, contact the Installation Environmental Office, the DRMO, or Safety and Health Offices. (Refer to 4.4.)

Hydrogen peroxide has an EPA Hazardous Waste Classification - Ignitable, Waste No. D001.

5.4 Name. Lithium Peroxide, Anhydrous Li_2O_2 CAS 12031-80-0
LiOOLi FW 45.88

5.4.1 Technical description. Lithium peroxide (pure) is a fine white powder with a density of 2.14 to 2.36 g/cm^3 at 20°C. It decomposes to Li_2O and 0_2 at 340°C. It is moderately soluble in water (8 percent at 20°C and 9 percent at 25°C). It is insoluble in absolute alcohol. Its theoretical active oxygen yield is 34.87 percent.

5.4.2 Specification. Manufacturer's requirements (no Government specification).

5.4.2.1 Requirements. The commercial specification requirements are for a light yellow or tan powder with a typical analysis composition for Li_2O_2 of 94 to 96 percent by weight, and an active oxygen content of 33 percent by weight. The impurities are LiOH and Li_2CO_3.

5.4.3 Use. Lithium peroxide is used as an atmosphere regenerant and chemical oxidant.

5.4.4 Safety. Lithium peroxide is a strong oxidizer and mixtures with organic material are explosive, and can be ignited by friction or contact with a small amount of water. As a soluble lithium compound, lithium peroxide is toxic when ingested since the lithium ion has a high central nervous system toxicity. There is no PEL or TLV referenced for lithium peroxide, but it is an irritant to skin, eyes, mucous membranes, and respiratory tract at low concentrations. After reaction with water, the lithium hydroxide that is formed is very caustic, and can cause chemical burns at high concentrations. In case of contact with the skin, flush affected areas with water. In case of contact with the eyes, flush with water for at least 20 minutes and obtain medical attention. (Refer to 4.3.1.)

5.4.5 Storage. Lithium peroxide shall be stored in tightly sealed containers in a cool dry place away from heat sources, direct sunlight, and oxidizable material. (Refer to 4.3.2)

* Refers to materials that have become hazardous waste.

5.4.6 Disposal. In case of spills, recover in dry state. For appropriate procedures, contact the Installation Environmental Office, the DRMO, or Safety and Health Offices. (Refer to 4.4.)

Lithium peroxide has an EPA Hazardous Waste Classification - Ignitable, Waste No. D001.

5.5 Name: Strontium Peroxide, Anhydrous — SrO_2 — CAS 1314-18-7
Strontium dioxide — SrOO — FW 119.62

5.5.1 Technical description. Strontium peroxide (pure) is a white powder with a density of 4.56 g/cm^3. It has a melting point of 215°C at 760 mm Hg with decomposition. Its solubility in water is 0.018 g/100 mL at 20°C, and it decomposes in hot water. It is very soluble in alcohol and in ammonium chloride solution. It is insoluble in acetone. It is decomposed by dilute acids with formation of hydrogen peroxide.

5.5.2 Specification. Military, MIL-STD-612, Strontium Peroxide.

5.5.2.1 Requirements. The military specification describes Grade B and C strontium peroxide in the form of free-flowing white powders. The Grade B strontium peroxide shall be manufactured by the wet precipitation method and shall consist of anhydrous strontium peroxide. The Grade C strontium peroxide shall be manufactured by the wet precipitation method and shall consist of anhydrous strontium peroxide of a definite hygroscopicity requirement to control the stability of the material. The chemical and physical requirements are shown in Table IV, and the granulation requirements are shown in Table V.

* Refers to materials that have become hazardous waste.

TABLE IV. Strontium peroxide - chemical and physical requirements.

Requirements	Grade B	Grade C
Available oxygen, % min	12.3	12.3
Moisture, % max	–	0.1
Hygroscopicity, % max	–	0.25
Apparent density, g/mL min	1.30 - 2.00	0.85
Barium, % max	1.0	0.45
Calcium, % max	0.3	0.15
Magnesium, % max	0.05	0.02
Sodium, % max	0.1	0.05
Iron, % max	0.09	0.03
Aluminum, % max	0.1	0.05
Nitrate, calculated as $Sr(NO_3)_2$, % max	0.1	0.05
Chloride, calculated as $SrCl_2$, % max	0.1	0.10
Total impurities other than SrO_2, % max	–	–

TABLE V. Strontium peroxide - granulation requirements.

US Standard Sieves †	Grade B	Grade C
Passing through		
180 micrometer (No. 80)	–	100
150 micrometer (No. 100), min	98	98
100 micrometer (No. 140), min	80	80

† Standard sieve designations in accordance with ASTM E 11.

5.5.3 Use. Strontium peroxide is intended for military use primarily in tracer ignites and to a lesser extent in basic tracer formulations. Commercially, it is used as a bleaching agent, and in fireworks compositions.

5.5.4 Safety. Strontium peroxide is a strong oxidizer. Mixtures with reducing agents or combustible organic materials are explosive and can be ignited easily by friction or contact with a small amount of water. It reacts with water to generate heat. there is no PEL or TLV referenced for strontium peroxide, but it is an irritant to eyes, skin,

* Refers to materials that have become hazardous waste.

mucous membranes, and respiratory tract. In case of contact with the skin, flush affected areas with water. In case of contact with the eyes, flush with water for at least 20 minutes and obtain medical attention. (Refer to 4.3.1.)

5.5.5 Storage. Strontium peroxide shall be stored in tightly sealed containers in a cool dry place away from heat sources, direct sunlight, and oxidizable material. (Refer to 4.3.2.)

5.5.6 Disposal. In case of spills, recover in dry state. For appropriate procedures, contact the Installation Environmental Office, the DRMO, or Safety and Health Offices. (Refer to 4.4.)

Strontium peroxide has an EPA Hazardous Waste Classification - Ignitable, Waste No. D001.

5.6 Name: Zinc Peroxide, Anhydrous — ZnO_2 — CAS 1314-22-3
Zinc dioxide — $ZnOO$ — FW 97.38

5.6.1 Technical description. Zinc peroxide, anhydrous, (pure) is a yellowish powder with a density of 1.57 g/cm^3. It decomposes explosively at 212°C. It is very slightly soluble in cold water (0.0022 g/100 mL). It dissolves in acid solutions with decomposition and formation of hydrogen peroxide.

5.6.2 Specification. Manufacturer's requirements (no Government specification).

5.6.2.1 Requirements. The commercial specification requirements are for a yellow-white power with a composition, as ZnO_2, of 55 percent minimum, and an active oxygen content of 9.0 percent by weight minimum.

5.6.3 Use. Zinc peroxide is used as a curing agent for certain rubber compounds.

5.6.4 Safety. Zinc peroxide is a strong oxidizer. Mixtures with reducing agents or combustible organic material can be ignited by friction or grinding. Contact with catalytically active metals shall be avoided, and apparatus and equipment for handling shall be made of catalytically inactive materials such as aluminum, stainless steel, ceramics, and glass. There is no PEL or TLV referenced for zinc peroxide, but it is an irritant to eyes, skin, mucous membranes, and respiratory tract. In case of contact with the skin, flush affected areas with water. In case of contact with the eyes, flush with water for at least 20 minutes and obtain medical attention. (Refer to 4.3.1.)

* Refers to materials that have become hazardous waste.

5.6.5 Storage. Zinc peroxide shall be stored in tightly sealed containers in a cool dry place away from heat sources, direct sunlight, and oxidizable material. (Refer to 4.3.2.)

5.6.6 Disposal. In case of spills, recover in dry state. For appropriate procedures, contact the Installation Environmental Office, the DRMO, or Safety and Health Offices. (Refer to 4.4.)

Zinc peroxide has an EPA Hazardous Waste Classification - Ignitable, Waste No. D001.

* Refers to materials that have become hazardous waste.

6. NOTES

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory).

6.1 Intended use. This standard is intended to cite nomenclature, Chemical Abstracts Service Registry Numbers, formulas, physical and chemical properties, specification requirements, military and typical commercial uses, safety information storage information and disposal information for Inorganic Peroxides, Technical Grade, preferred for application by the Department of Defence.

6.2 Subject term (key word) listing.

Barium peroxide
Calcium peroxide
Disposal, hazardous chemicals
Exposure limits, hazardous chemicals
Hydrogen peroxide
Lithium peroxide, anhydrous
Safety, hazardous chemicals
Strontium peroxide, anhydrous
Zinc peroxide, anhydrous

6.3 Changes from previous issue. Asterisks or vertical lines are not used in this revision to identify changes with respect to the pervious issue due to the extensiveness of the changes.

* Refers to materials that have become hazardous waste.

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1. DOCUMENT NUMBER: MIL-STD-1442A

2. DOCUMENT DATE (YYMMDD): 940309

3. DOCUMENT TITLE: INORGANIC PEROXIDES, TECHNICAL GRADE

4. NATURE OF CHANGE (*Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed.*)

5. REASON FOR RECOMMENDATION

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