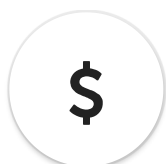




# Hydrogen Peroxide

[► Cite this Record](#)

STRUCTURE



VENDORS



DRUG INFO



PHARMACOLOGY



LITERATURE



PATENTS



BIOACTIVITIES

**PubChem CID:** 784**Chemical Names:** Hydrogen peroxide; Oxydol; Perhydrol; 7722-84-1; Superoxol; Interlox[More...](#)**Molecular Formula:**  $\text{H}_2\text{O}_2$ **Molecular Weight:** 34.014 g/mol**InChI Key:** MHAJPDPIQMAIIY-UHFFFAOYSA-N**Drug Information:**[Drug Indication](#)[Therapeutic Uses](#)[Clinical Trials](#)[FDA Orange Book](#)[FDA UNII](#)**Safety Summary:** [Laboratory Chemical Safety Summary \(LCSS\)](#)

Hydrogen peroxide is a strong oxidizing agent used in aqueous solution as a ripening agent, bleach, and topical anti-infective. It is relatively unstable and solutions deteriorate over time unless stabilized by the addition of acetanilide or similar organic materials.

[► from MeSH](#)

Hydrogen peroxide (H<sub>2</sub>O<sub>2</sub>) is a very pale blue liquid which appears colourless in a dilute solution, slightly more viscous than [water](#). It is a weak acid. It has strong oxidizing properties and is therefore a powerful bleaching agent that is mostly used for bleaching paper, but has also found use as a disinfectant and as an oxidizer. Hydrogen peroxide in the form of [carbamide peroxide](#) is widely used for tooth whitening (bleaching), both in professionally- and in self-administered products. Hydrogen peroxide (H<sub>2</sub>O<sub>2</sub>) is a well-documented component of living cells. It plays important roles in host defense and oxidative biosynthetic reactions. In addition there is growing evidence that at low levels, H<sub>2</sub>O<sub>2</sub> also functions as a signaling agent, particularly in higher organisms. H<sub>2</sub>O<sub>2</sub> has increasingly been viewed as an important cellular signaling agent in its own right, capable of modulating both contractile and growth-promoting pathways with more far-reaching effects. Due to the accumulation of hydrogen peroxide in the skin of patients with the depigmentation disorder vitiligo, the human epidermis cannot have the normal capacity for autocrine synthesis, transport and degradation of [acetylcholine](#) as well as the muscarinic (m<sub>1</sub>-m<sub>5</sub>) and nicotinic signal transduction in keratinocytes and melanocytes. Accumulating evidence suggests that hydrogen peroxide (H<sub>2</sub>O<sub>2</sub>) plays an important role in cancer development. Experimental data have shown that cancer cells produce high amounts of H<sub>2</sub>O<sub>2</sub>. An increase in the cellular levels of H<sub>2</sub>O<sub>2</sub> has been linked to several key

alterations in cancer, including DNA alterations, cell proliferation, apoptosis resistance, metastasis, angiogenesis and hypoxia-inducible factor 1 (HIF-1) activation. (PMID: [17150302](#), [17335854](#), [16677071](#), [16607324](#), [16514169](#)).

► *Metabolite Description from Human Metabolome Database (HMDB)*

---

Hydrogen peroxide is a colorless liquid at room temperature with a bitter taste. Small amounts of gaseous hydrogen peroxide occur naturally in the air. Hydrogen peroxide is unstable, decomposing readily to [oxygen](#) and [water](#) with release of heat. Although nonflammable, it is a powerful oxidizing agent that can cause spontaneous combustion when it comes in contact with organic material. Hydrogen peroxide is found in many households at low concentrations (3-9%) for medicinal applications and as a clothes and hair bleach. In industry, hydrogen peroxide in higher concentrations is used as a bleach for textiles and paper, as a component of rocket fuels, and for producing foam rubber and organic chemicals.

► *Hazards Summary from CDC-ATSDR Toxic Substances Portal*

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[PUBCHEM](#) ► [COMPOUND](#) ► HYDROGEN PEROXIDE

Modify Date: 2018-08-18; Create Date: 2004-09-16

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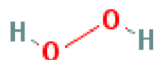
# 1 2D Structure

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 Search

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► from PubChem

## 2 3D Conformer

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fy

☒ Show Hydrogens

☒ Show Atoms

☐ Animate

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► *from PubChem*

## 3 Names and Identifiers

### 3.1 Computed Descriptors

#### 3.1.1 IUPAC Name

hydrogen peroxide

► *from PubChem*

#### 3.1.2 InChI

InChI=1S/H2O2/c1-2/h1-2H

► *from PubChem*

#### 3.1.3 InChI Key

MHAJPDPJQMAIIY-UHFFFAOYSA-N

► *from PubChem*

#### 3.1.4 Canonical SMILES

OO

► *from PubChem*

### 3.2 Molecular Formula

H<sub>2</sub>O<sub>2</sub>

► *from ILO-ICSC, OSHA Occupational Chemical DB, Wikipedia, PubChem*

### 3.3 Other Identifiers

#### 3.3.1 CAS

7722-84-1

► *from CAMEO Chemicals, ChemIDplus, DTP/NCI, DrugBank, EPA Chemicals under the TSCA, EPA DSStox, Europe...*

#### 3.3.2 EC Number

231-765-0

► *from European Chemicals Agency (ECHA)*

920-447-3

[▶ from European Chemicals Agency \(ECHA\)](#)

### 3.3.3 ICSC Number

0164

[▶ from ILO-ICSC](#)

### 3.3.4 NSC Number

19892

[▶ from DTP/NCI](#)

### 3.3.5 RTECS Number

MX0900000

[▶ from The National Institute for Occupational Safety and Health \(NIOSH\)](#)

### 3.3.6 UN Number

2015

[▶ from CAMEO Chemicals, ILO-ICSC, NJDOH RTK Hazardous Substance List](#)

2014

[▶ from CAMEO Chemicals, OSHA Occupational Chemical DB](#)

2984

[▶ from CAMEO Chemicals](#)

### 3.3.7 UNII

BBX060AN9V

[▶ from DrugBank, FDA/SPL Indexing Data](#)

### 3.3.8 Wikipedia

Title	<a href="#">hydrogen peroxide</a>
Title	<a href="#">dioxouranium</a> ;hydrogen peroxide
Description	chemical compound

[▶ from Wikipedia](#)

## 3.4 Synonyms

### 3.4.1 MeSH Entry Terms

1. Hydrogen Peroxide
2. Hydrogen Peroxide (H2O2)
3. Hydroperoxide
4. Oxydol
5. Perhydrol
6. Peroxide, Hydrogen
7. Superoxol

► from MeSH

### 3.4.2 Depositor-Supplied Synonyms

- |                                      |  |  |   |
|--------------------------------------|--|--|---|
| 1. <a href="#">hydrogen peroxide</a> | 11. <a href="#">Albone</a>             | 21. <a href="#">Albone 50</a>                | 31. <a href="#">Hydrogen peroxide, 30%</a>      |
| 2. <a href="#">oxydol</a>            | 12. <a href="#">Hioxyl</a>             | 22. <a href="#">Albone 70</a>                | 32. <a href="#">Hydrogen dioxide solution</a>   |
| 3. <a href="#">perhydrol</a>         | 13. <a href="#">Kastone</a>            | 23. <a href="#">Perone 50</a>                | 33. <a href="#">Hydrogen peroxide, 90%</a>      |
| 4. <a href="#">7722-84-1</a>         | 14. <a href="#">Albone 35</a>          | 24. <a href="#">Albone 35CG</a>              | 34. <a href="#">Perone 30</a>                   |
| 5. <a href="#">Superoxol</a>         | 15. <a href="#">Albone DS</a>          | 25. <a href="#">Albone 50CG</a>              | 35. <a href="#">Perone 35</a>                   |
| 6. <a href="#">Interox</a>           | 16. <a href="#">Dihydrogen dioxide</a> | 26. <a href="#">Albone 70CG</a>              | 36. <a href="#">Hydrogen peroxide, solution</a> |
| 7. <a href="#">Hydrogen dioxide</a>  | 17. <a href="#">T-Stuff</a>            | 27. <a href="#">H2O2</a>                     | 37. <a href="#">Waterstofperoxyde</a>           |
| 8. <a href="#">hydroperoxide</a>     | 18. <a href="#">Lensept</a>            | 28. <a href="#">Hydrogen peroxide (H2O2)</a> | 38. <a href="#">Hydrogen peroxide, 3%</a>       |
| 9. <a href="#">Inhibine</a>          | 19. <a href="#">Elawox</a>             | 29. <a href="#">Peroxide</a>                 | 39. <a href="#">Wasserstoffperoxid</a>          |
| 10. <a href="#">Peroxaan</a>         | 20. <a href="#">Perone</a>             | 30. <a href="#">Peroxan</a>                  | 40. <a href="#">Caswell No. 486AAA</a>          |

► from PubChem



## 4 Chemical and Physical Properties

### 4.1 Computed Properties

Property Name	Property Value
Molecular Weight	34.014 g/mol
Hydrogen Bond Donor Count	2
Hydrogen Bond Acceptor Count	2
Rotatable Bond Count	0
Complexity	0
CACTVS Substructure Key Fingerprint	AAADcQAAMAAAAAAAAAAAAAAAAAAAAAAAAAAAAA AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA = =
Topological Polar Surface Area	40.5 A <sup>2</sup>
Monoisotopic Mass	34.005 g/mol
Exact Mass	34.005 g/mol
XLogP3-AA	-0.9
Compound Is Canonicalized	true
Formal Charge	0
Heavy Atom Count	2
Defined Atom Stereocenter Count	0
Undefined Atom Stereocenter Count	0
Defined Bond Stereocenter Count	0
Undefined Bond Stereocenter Count	0
Isotope Atom Count	0
Covalently-Bonded Unit Count	1

► from PubChem

### 4.2 Experimental Properties

#### 4.2.1 Physical Description

HYDROGEN PEROXIDE, AQUEOUS SOLUTION, STABILIZED, WITH MORE THAN 60% HYDROGEN PEROXIDE is a colorless liquid. Vapors may irritate the eyes and mucous membranes. Under prolonged exposure to fire or heat containers may violently rupture due to decomposition. Used to bleach textiles and wood pulp, in chemical manufacturing and food processing.

► from CAMEO Chemicals

HYDROGEN PEROXIDE, AQUEOUS SOLUTION, WITH NOT LESS THAN 20% BUT NOT MORE THAN 60% HYDROGEN PEROXIDE (STABILIZED AS NECESSARY) is a colorless aqueous solution. Vapors may irritate the eyes and mucous membranes. Contact with most common metals and their compounds may cause violent decomposition, especially in the higher concentrations. Contact with combustible materials may result in spontaneous ignition. Prolonged exposure to fire or heat may cause decomposition and rupturing of the container. Used to bleach textiles and wood pulp, in chemical manufacturing and food processing.

► *from CAMEO Chemicals*

Hydrogen peroxide solution is the colorless liquid dissolved in [water](#). Its vapors are irritating to the eyes and mucous membranes. The material, especially the higher concentrations, can violently decompose in contact with most common metals and their compounds. Contact with combustible materials can result in spontaneous ignition. Under prolonged exposure to fire or heat containers may violently rupture due to decomposition of the material. It is used to bleach textiles and wood pulp, in chemical manufacturing and food processing.

► *from CAMEO Chemicals*

HYDROGEN PEROXIDE, STABILIZED is a crystalline solid at low temperatures. Has a slightly pungent, irritating odor. Used in the bleaching and deodorizing of textiles, wood pulp, hair, fur, etc. as a source of organic and inorganic peroxides; pulp and paper industry; plasticizers; rocket fuel; foam rubber; manufacture of [glycerol](#); antichlor; dyeing; electroplating; antiseptic; laboratory reagent; epoxidation; hydroxylation; oxidation and reduction; viscosity control for starch and [cellulose](#) derivatives; refining and cleaning metals; bleaching and oxidizing agent in foods; neutralizing agent in wine distillation; seed disinfectant; substitute for [chlorine](#) in [water](#) and sewage treatment. (EPA, 1998)

► *from CAMEO Chemicals*

1. CBI
2. DryPowder
3. Liquid

► *from EPA Chemicals under the TSCA*

Liquid

► *from Human Metabolome Database (HMDB)*

COLOURLESS LIQUID.

► *from ILO-ICSC*

Colorless liquid with a slightly sharp odor.

► *from OSHA Occupational Chemical DB*

Colorless liquid with a slightly sharp odor. [Note: The pure compound is a crystalline solid below 12°F. Often used in an aqueous solution.]

► *from The National Institute for Occupational Safety and Health (NIOSH)*

#### 4.2.2 Color

Colorless liquid

*Budavari, S. (ed.). The Merck Index - An Encyclopedia of Chemicals, Drugs, and Biologicals. Whitehouse Station, NJ: Merck and Co., Inc., 1996., p. 822*

► *from HSDB*

At low temperatures a crystalline solid

*Sax, N.I. Dangerous Properties of Industrial Materials. Vol 1-3 7th ed. New York, NY: Van Nostrand Reinhold, 1989., p. 1910*

► from HSDB

Colorless liquid ... [Note: The pure compound is a crystalline solid below 12 degrees F. Often used in an aqueous solution].

NIOSH. NIOSH Pocket Guide to Chemical Hazards. DHHS (NIOSH) Publication No. 97-140. Washington, D.C. U.S. Government Printing Office, 1997., p. 168

► from HSDB

### 4.2.3 Odor

ODORLESS, OR HAVING AN ODOR RESEMBLING THAT OF [OZONE](#)

Osol, A. and J.E. Hoover, et al. (eds.). Remington's Pharmaceutical Sciences. 15th ed. Easton, Pennsylvania: Mack Publishing Co., 1975., p. 1092

► from HSDB

... Slightly sharp odor ...

NIOSH. NIOSH Pocket Guide to Chemical Hazards. DHHS (NIOSH) Publication No. 97-140. Washington, D.C. U.S. Government Printing Office, 1997., p. 168

► from HSDB

### 4.2.4 Taste

SLIGHTLY ACID

Osol, A. and J.E. Hoover, et al. (eds.). Remington's Pharmaceutical Sciences. 15th ed. Easton, Pennsylvania: Mack Publishing Co., 1975., p. 1092

► from HSDB

Bitter

Budavari, S. (ed.). The Merck Index - An Encyclopedia of Chemicals, Drugs, and Biologicals. Whitehouse Station, NJ: Merck and Co., Inc., 1996., p. 822

► from HSDB

### 4.2.5 Boiling Point

302.4° F at 760 mm Hg (NTP, 1992)

► from CAMEO Chemicals

306° F at 760 mm Hg 258° F for concentrations greater than 52% (EPA, 1998)

► from CAMEO Chemicals

108

MSDS

► from DrugBank

152 deg C

Budavari, S. (ed.). The Merck Index - An Encyclopedia of Chemicals, Drugs, and Biologicals. Whitehouse Station, NJ: Merck and Co., Inc., 1996., p. 822

---

▸ from HSDB

---

141°C (90%)

---

▸ from ILO-ICSC

---

286°F

---

▸ from OSHA Occupational Chemical DB, The National Institute for Occupational Safety and Health (NIOSH)

---

#### 4.2.6 Melting Point

---

31.3° F (NTP, 1992)

---

▸ from CAMEO Chemicals

---

31 to 40° F for concentrations greater than 52% (EPA, 1998)

---

▸ from CAMEO Chemicals

---

-33

MSDS

---

▸ from DrugBank

---

-0.43 deg C

*Budavari, S. (ed.). The Merck Index - An Encyclopedia of Chemicals, Drugs, and Biologicals. Whitehouse Station, NJ: Merck and Co., Inc., 1996., p. 822*

---

▸ from HSDB

---

-0.43 °C

---

▸ from Human Metabolome Database (HMDB)

---

-11°C (90%), -39°C (70%)

---

▸ from ILO-ICSC

---

FRZ: 12°F

---

▸ from OSHA Occupational Chemical DB

---

12°F

---

▸ from The National Institute for Occupational Safety and Health (NIOSH)

---

#### 4.2.7 Solubility

---

greater than or equal to 100 mg/mL at 72° F (NTP, 1992)

---

▸ from CAMEO Chemicals

---

Miscible (NIOSH, 2016)

---

▸ from CAMEO Chemicals

---

#### Water Solubility

Soluble in cold water

## MSDS

▶ from DrugBank

Miscible with [water](#); sol in ether; insol in petroleum ether

*Budavari, S. (ed.). The Merck Index - An Encyclopedia of Chemicals, Drugs, and Biologicals. Whitehouse Station, NJ: Merck and Co., Inc., 1996., p. 822*

▶ from HSDB

Soluble in alcohol

*Lewis, R.J., Sr (Ed.). Hawley's Condensed Chemical Dictionary. 13th ed. New York, NY: John Wiley & Sons, Inc. 1997., p. 591*

▶ from HSDB

Hydrogen peroxide and highly concentrated aqueous solutions (>65 wt%) are soluble in a variety of organic solvents such as carboxylic esters.

*Gerhartz, W. (exec ed.). Ullmann's Encyclopedia of Industrial Chemistry. 5th ed. Vol A1: Deerfield Beach, FL: VCH Publishers, 1985 to Present., p. VA13 (89) 444*

▶ from HSDB

In [water](#), 1X10+6 mg/l @ 25 deg C

*Radding SB et al; Review of The Environmental Fate of Selected Chemicals. NTIS 68-01-2681 (1977)*

▶ from HSDB

1000 mg/mL at 25 °C

▶ from Human Metabolome Database (HMDB)

Solubility in [water](#): miscible

▶ from ILO-ICSC

Miscible

▶ from The National Institute for Occupational Safety and Health (NIOSH)

#### 4.2.8 Density

1.11 at 68° F (NTP, 1992)

▶ from CAMEO Chemicals

1.463 at 32° F 1.29/1.3 at 68F for concentrations greater than 52% (EPA, 1998)

▶ from CAMEO Chemicals

1.4425 @ 25 deg C

*Kirk-Othmer Encyclopedia of Chemical Technology. 4th ed. Volumes 1: New York, NY. John Wiley and Sons, 1991-Present., p. V13 (95) 962*

▶ from HSDB

Relative density ([water](#) = 1): 1.4 (90%)

▶ from ILO-ICSC

1.39

▶ from OSHA Occupational Chemical DB, The National Institute for Occupational Safety and Health (NIOSH)

#### 4.2.9 Vapor Density

---

1.02 calculated (EPA, 1998) (Relative to Air)

▸ from CAMEO Chemicals

Relative vapour density (air = 1): 1

▸ from ILO-ICSC

#### 4.2.10 Vapor Pressure

---

1 mm Hg at 59.5° F (NTP, 1992)

▸ from CAMEO Chemicals

1 mm Hg at 59.54° F (EPA, 1998)

▸ from CAMEO Chemicals

1.97 mm Hg @ 25 deg C

*Daubert, T.E., R.P. Danner. Physical and Thermodynamic Properties of Pure Chemicals Data Compilation. Washington, D.C.: Taylor and Francis, 1989.*

▸ from HSDB

#### Vapour Pressure

Vapour pressure, kPa at 20°C: 0.2 (90%)

▸ from ILO-ICSC

(86°F): 5 mmHg

▸ from OSHA Occupational Chemical DB, The National Institute for Occupational Safety and Health (NIOSH)

#### 4.2.11 LogP

---

-1.36

▸ from ILO-ICSC

#### 4.2.12 Stability

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HYDROGEN PEROXIDE IS A VERY UNSTABLE COMPOUND THAT BREAKS DOWN READILY TO FORM [MOLECULAR OXYGEN](#) AND [WATER](#).

*Gilman, A. G., L. S. Goodman, and A. Gilman. (eds.). Goodman and Gilman's The Pharmacological Basis of Therapeutics. 6th ed. New York: Macmillan Publishing Co., Inc. 1980., p. 974*

▸ from HSDB

Hydrogen peroxide topical solution deteriorates upon standing or upon repeated agitation, undergoes accelerated decomposition when exposed to light or when in contact with many oxidizing or reducing substances, and decomposes suddenly when heated. Hydrogen peroxide topical solution should be stored in tight, light-resistant containers at 15-30

deg C. To ensure greater stability, the inside surfaces of containers should be as free as possible from rough points since these promote decomposition.

McEvoy, G.K. (ed.). *American Hospital Formulary Service - Drug Information 2000*. Bethesda, MD: American Society of Health-System Pharmacists, Inc. 2000 (Plus Supplements), p. 2576

► from HSDB

PURE HYDROGEN PEROXIDE SOLN, COMPLETELY FREE FROM CONTAMINATION, ARE HIGHLY STABLE

Lewis, R.J., Sr (Ed.). *Hawley's Condensed Chemical Dictionary*. 12th ed. New York, NY: Van Nostrand Rheinhold Co., 1993, p. 617

► from HSDB

RELATIVELY STABLE SAMPLE OF HYDROGEN PEROXIDE TYPICALLY DECOMP @ THE RATE OF ABOUT 0.5%/YR @ ROOM TEMP

Lewis, R.J., Sr (Ed.). *Hawley's Condensed Chemical Dictionary*. 12th ed. New York, NY: Van Nostrand Rheinhold Co., 1993, p. 617

► from HSDB

SOLN OF H2O2 GRADUALLY DETERIORATE & ARE USUALLY STABILIZED BY ADDITION OF ACETANILIDE OR SIMILAR ORGANIC MATERIALS. AGITATION OR CONTACT WITH ROUGH SURFACES, METALS OR MANY OTHER SUBSTANCES ACCELERATES DECOMP. RAPIDLY DECOMP BY ALKALIES, FINELY DIVIDED METALS; PRESENCE OF MINERAL ACID RENDERS IT MORE STABLE.

Budavari, S. (ed.). *The Merck Index - Encyclopedia of Chemicals, Drugs and Biologicals*. Rahway, NJ: Merck and Co., Inc., 1989, p. 760

► from HSDB

#### 4.2.13 Auto-Ignition

Not flammable. (USCG, 1999)

► from CAMEO Chemicals

#### 4.2.14 Decomposition

Decomposition continuously occurs even at a slow rate when the compound is inhibited, and thus it must be stored properly and in vented containers. High-strength hydrogen peroxide is a very high-energy material. When it decomposes to oxygen and water, large amounts of heat are liberated, leading to an increased rate of decomposition, since decomposition is accelerated by increases in temperature. This rate increases about 2.2 times per 10 deg C temperature increase between 20 and 100 deg C.

International Labour Office. *Encyclopaedia of Occupational Health and Safety*. 4th edition, Volumes 1-4 1998. Geneva, Switzerland: International Labour Office, 1998, p. 104.350

► from HSDB

#### 4.2.15 Viscosity

1.245 centipoises (liquid)

Lewis, R.J., Sr (Ed.). *Hawley's Condensed Chemical Dictionary*. 13th ed. New York, NY: John Wiley & Sons, Inc. 1997, p. 591

► from HSDB

#### 4.2.16 Heat of Vaporization

1.517 kJ/g @ 25 deg C

*Kirk-Othmer Encyclopedia of Chemical Technology. 4th ed. Volumes 1: New York, NY. John Wiley and Sons, 1991-Present., p. V13 (95) 962*

► from HSDB

#### 4.2.17 pH

Weak acid; H<sub>2</sub>O<sub>2</sub> concn wt% = 35, 50, 70, 90; corresponding true pH: 4.6, 4.3, 4.4, 5.1

*Kirk-Othmer Encyclopedia of Chemical Technology. 4th ed. Volumes 1: New York, NY. John Wiley and Sons, 1991-Present., p. V13 (95) 962*

► from HSDB

#### 4.2.18 Surface Tension

80.4 dynes/cm @ 20 deg C

*Lewis, R.J., Sr (Ed.). Hawley's Condensed Chemical Dictionary. 13th ed. New York, NY: John Wiley & Sons, Inc. 1997., p. 591*

► from HSDB

#### 4.2.19 Ionization Potential

10.54 eV

► from OSHA Occupational Chemical DB, The National Institute for Occupational Safety and Health (NIOSH)

#### 4.2.20 Dissociation Constants

pK<sub>a</sub> = 11.75

*Kirk-Othmer Encyclopedia of Chemical Technology. 4th ed. Volumes 1: New York, NY. John Wiley and Sons, 1991-Present., p. V13 (95) 963*

► from HSDB

### 4.3 Spectral Properties

Index of refraction: 1.4061 @ 28 deg C

*Lide, D.R. (ed.). CRC Handbook of Chemistry and Physics. 79th ed. Boca Raton, FL: CRC Press Inc., 1998-1999., p. 4-136*

► from HSDB

#### 4.3.1 1D NMR Spectra

##### 1D NMR Spectra: 1 of 1 (170 NMR Spectra)

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**1D NMR Spectra: 1 of 1 (170 NMR Spectra)**

Thumbnail

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▶ *from SpectraBase*

## 4.3.2 Mass Spectrometry

### 4.3.2.1 GC-MS

[GC-MS Spectrum 3384 - GC-MS Ei Predicted by CFMID-EI, energy0](#)▶ *from Human Metabolome Database (HMDB)*

### 4.3.2.2 MS-MS

1. [MS-MS Spectrum 28757 - 10V Positive Predicted by CFM-ID](#)
2. [MS-MS Spectrum 28758 - 20V Positive Predicted by CFM-ID](#)
3. [MS-MS Spectrum 28759 - 40V Positive Predicted by CFM-ID](#)
4. [MS-MS Spectrum 35315 - 10V Negative Predicted by CFM-ID](#)
5. [MS-MS Spectrum 35316 - 20V Negative Predicted by CFM-ID](#)
6. [MS-MS Spectrum 35317 - 40V Negative Predicted by CFM-ID](#)

▶ *from Human Metabolome Database (HMDB)*

## 5 Related Records

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### 5.1 Related Compounds with Annotation

---

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▶ from PubChem

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### 5.2 Related Compounds

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Same Connectivity	<a href="#">7 records</a>
Mixtures, Components, and Neutralized Forms	<a href="#">1446 records</a>
Similar Compounds	<a href="#">30 records</a>
Similar Conformers	<a href="#">157 records</a>

▶ from PubChem

---

### 5.3 Substances

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#### 5.3.1 Related Substances

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All	<a href="#">2762 records</a>
Same	<a href="#">328 records</a>
Mixture	<a href="#">2434 records</a>

▶ from PubChem

---

#### 5.3.2 Substances by Category

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▸ *from PubChem*

5.4 Entrez Crosslinks

PubMed	<a href="#">922 records</a>
Protein Structures	<a href="#">167 records</a>
Taxonomy	<a href="#">33 records</a>
OMIM	<a href="#">2 records</a>
Gene	<a href="#">4188 records</a>

▸ *from PubChem*

## 6 Chemical Vendors

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▶ *from PubChem*

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## 7 Drug and Medication Information

### 7.1 Drug Indication

Indicated to be used as a disinfectant and sterilizer.

► *from DrugBank*

### 7.2 FDA Orange Book

#### 7.2.1 Prescription Drug Products

Prescription Drug Products: 1 of 1 (RX Drug Ingredient)	
Drug Ingredient	HYDROGEN PEROXIDE
Proprietary Name	ESKATA
Applicant	ACLARIS THERAPS INC (Application Number: <a href="#">N209305</a> . Patents: <a href="#">7381427</a> , <a href="#">9675639</a> , <a href="#">9980983</a> )

► *from FDA Orange Book*

### 7.3 Drug Labels for Ingredients

Drug Labels for Ingredients: 1 of 1 (Label Title)	
Label Information	<a href="#">Total 263 labels</a>
Drug Ingredient	HYDROGEN PEROXIDE
NDC Code(s)	0126-0083-16, 0126-0083-70, 0126-0083-99, 0363-0085-34, 0363-0267-08, 0363-0268-16, 0363-0268-32, 0363-0871-43, 0363-0871-45, 0363-0871-50 ... total 660.
Packagers	7-Eleven, Inc.; AMERICAN CONSUMER PRODUCTS LLC; AMERIFOODS TRADING COMPANY; ASSURED / DOLLAR TREE (Greenbrier International, Inc.); Accelerated Genetics; Aclaris Therapeutics, Inc.; Acme United Corp; Acme United Corp. ; Afassco Inc.; AgroChem Inc ... total 173.

► *from DailyMed*

### 7.4 Drugs at PubMed Health

Drugs at PubMed Health: 1 of 7 (PubMed Health Drug Name)	
Drug Name	<a href="#">Eskata</a>
Notes	<a href="#">See</a> Hydrogen Peroxide (Topical application route)

► *from PubMed Health*

Drugs at PubMed Health: 2 of 7 (PubMed Health Drug Name)	
Drug Name	Hydrogen Peroxide (Topical application route)
Drug Classes	Disinfectant

► from PubMed Health

Drugs at PubMed Health: 3 of 7 (PubMed Health Drug Name)	
Drug Name	<a href="#">Eskata</a>
Notes	<a href="#">See Hydrogen Peroxide</a>

► from PubMed Health

[View All 7 Drugs at PubMed Health](#)

## 7.5 Clinical Trials

Download

1 to 5 of 10	<a href="#">View More</a>		
Record ID	Title	Status	Phase
<a href="#">NCT00978861</a>	Clinical Study to Evaluate of The Whitening Efficacy and Safety of REMEWHITE	Completed	3
<a href="#">NCT02383992</a>	Postoperative Care of Sutured Wounds	Enrolling by invitation	
<a href="#">NCT02757651</a>	KORTUC: Intra-tumoural Hydrogen Peroxide as a Radiation Sensitizer in Patients With Locally Advanced/Recurrent Breast Cancer in Terms of Toxicity and Tumour Response	Recruiting	2
<a href="#">NCT02816593</a>	In-office and At-home Tooth Bleaching Using Low Concentration Peroxides.	Completed	
<a href="#">NCT02935114</a>	IN-OFFICE TOOTH BLEACHING WITH 37% <a href="#">CARBAMIDE PEROXIDE</a>	Completed	3

► from ClinicalTrials.gov

## 7.6 Therapeutic Uses

Anti-Infective Agents, Local; Oxidants

*National Library of Medicine's Medical Subject Headings online file (MeSH, 1999)*

► from HSDB

Hydrogen peroxide topical solution is used to cleanse wounds, suppurating ulcers, and local infections. Hydrogen peroxide topical solution has been used in the treatment of inflammatory conditions of the external auditory canal and as a mouthwash or gargle (eg, in the treatment of pharyngitis or Vincent's stomatitis). Hydrogen peroxide has also been applied in root canals of teeth or other dental pulp cavities.

*McEvoy, G.K. (ed.). American Hospital Formulary Service - Drug Information 2000. Bethesda, MD: American Society of Health-System Pharmacists, Inc. 2000 (Plus Supplements),. p. 2576*

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► from HSDB

Hydrogen peroxide topical solution has also been used as a vaginal douche and, following rectal instillation of warm mineral oil, as a rectal enema in the treatment of fecal impaction. More potent solutions (eg, 20-30%) have been used as a hair bleach and as a tooth bleaching agent.

McEvoy, G.K. (ed.). *American Hospital Formulary Service - Drug Information 2000*. Bethesda, MD: American Society of Health-System Pharmacists, Inc. 2000 (Plus Supplements), p. 2576

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► from HSDB

Hydrogen peroxide topical gel is used to cleanse minor wounds or minor gum inflammation resulting from minor dental procedures, orthodontic appliances, denture irritations, accidental injury, and other mouth and gum irritations (eg, canker sores).

McEvoy, G.K. (ed.). *American Hospital Formulary Service - Drug Information 2000*. Bethesda, MD: American Society of Health-System Pharmacists, Inc. 2000 (Plus Supplements), p. 2576

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► from HSDB

A chemical agent that destroys microorganisms, but usually not bacterial spores; it does not necessarily kill all microorganisms, but reduces them to a level that is harmful neither to health nor the quality of perishable goods.  
/Antiseptics and disinfectants/

Ellenhorn, M.J., S. Schonwald, G. Ordog, J. Wasserberger. *Ellenhorn's Medical Toxicology: Diagnosis and Treatment of Human Poisoning*. 2nd ed. Baltimore, MD: Williams and Wilkins, 1997., p. 1204

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► from HSDB

Hydrogen peroxide is useful as a disinfectant that has also been used for removal of inspissated meconium, demonstrating rectovaginal fistulae and in the therapy of constipation or fecal impaction. Radiologists have employed H2O2 to aid in eliminating gas from the intestine during roentgenography of abdominal viscera and as a mixture with [barium](#) to identify the exact site of gastrointestinal hemorrhage under fluoroscopy ... It has been recommended as a disinfectant for tonometer tips, ophthalmic instruments, and trial contact lenses to prevent the transmission of viruses ...

Ellenhorn, M.J., S. Schonwald, G. Ordog, J. Wasserberger. *Ellenhorn's Medical Toxicology: Diagnosis and Treatment of Human Poisoning*. 2nd ed. Baltimore, MD: Williams and Wilkins, 1997., p. 1222

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► from HSDB

IT IS USED AS DISINFECTING GARGLE IN PHARYNGITIS & AS DEODORIZING MOUTH WASH IN STOMATITIS. ... IT IS ALSO EMPLOYED AS MEANS OF CLEANSING WOUNDS & SUPPURATING ULCERS. ... MAIN VALUE IS PROBABLY DUE TO ITS BUBBLING ACTION WHICH REMOVES ORGANIC DETRITUS THAN TO ANY ANTIBACTERIAL EFFECT.

*American Hospital Formulary Service. Volumes I and II. Washington, DC: American Society of Hospital Pharmacists, to 1984., p. 52:28*

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► from HSDB

Hydrogen peroxide(3%) or salt applied to the back of the pharynx will stimulate vomiting via the ninth cranial nerve. Small doses (5-10 ml) of hydrogen peroxide can be administered via oral syringe until emesis occurs. It should be administered cautiously, especially in cats, because aspiration of hydrogen peroxide foam causes severe aspiration pneumonia.

Aiello, S.E. (ed.). *The Merck Veterinary Manual*. 8th ed. Merck & Co., Inc., National Publishing Inc., Philadelphia, PA. 1998, p. 1681

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► from HSDB

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## 7.7 Drug Warning

Hydrogen peroxide topical solution /SRP: at concentrations higher than 3 percent/ is acidic to the taste and to litmus paper and produces a froth in the mouth; because hydrogen peroxide concentrate is /SRP: corrosive/, it should not be tasted undiluted.

McEvoy, G.K. (ed.). *American Hospital Formulary Service - Drug Information 2000*. Bethesda, MD: American Society of Health-System Pharmacists, Inc. 2000 (Plus Supplements), p. 2576





## 8 Food Additives and Ingredients

### 8.1 Food Additive Classes

#### JECFA Functional Classes

Food Additives: PRESERVATIVE

► *from FAO/WHO Food Additive Evaluations (JECFA)*

### 8.2 FDA Generally Recognized as Safe - GRAS Notices

FDA Generally Recognized as Safe - GRAS Notices: 1 of 1 (GRAS Substance)	
Substance	Hydrogen peroxide
GRN Number	<a href="#">14</a>
Intended Use	Use in the manufacture of dehydrated onions as a processing aid to extend their shelf life
FDA Letter	<a href="#">Notice does not provide a basis for a GRAS determination</a>
Notifier	Basic Vegetable Products, 700 Airport Drive; King City, CA 93930
Date of Filing	Feb 17, 1999
Date of Closure	May 26, 1999

► *from FDA Center for Food Safety and Applied Nutrition (CFSAN)*

### 8.3 FDA Inventory of Effective Food Contact Substance Notifications - FCN

FDA Inventory of Effective Food Contact Substance Notifications - FCN: 1 of 3 (FCN Number)	
FCN Number	<a href="#">1471</a>
Food Contact Substance	An aqueous solution of hydrogen peroxide (CAS Reg. No. 7722-84-1) containing hydrogen peroxide at levels of up to 50 percent, manufactured and characterized as further described in the notification.
Manufacturer	PeroxyChem LLC
Effective Date	Oct 30, 2014
Intended Use	As a sterilant/antimicrobial on (1) polymeric food packaging material, used in contact with infant formula and breast milk, and (2) surfaces of aseptic food packaging equipment for infant food-contact applications.
Limitations/Specifications	The concentration of hydrogen peroxide in distilled <a href="#">water</a> packaged under production conditions (assay to be performed immediately after packaging) must not exceed 0.5 parts per million (ppm) when the FCS is used as intended. Permitted uses: The FCS may be used in polymeric packaging material intended for contact with infant formula and breast milk and on the surfaces of aseptic food packaging equipment for infant food contact applications.

FDA Inventory of Effective Food Contact Substance Notifications - FCN: 1 of 3 (FCN Number)	
National Environmental Policy Act	<a href="#">Environmental Assessment (in PDF) (1.1 MB)</a>
FDA Decision	<a href="#">Finding of No Significant Impact (FONSI)</a>
Notification	According to Section 409(h)(1)(C) of the Federal Food, Drug, and Cosmetic Act, food contact substance notifications (FCNs) are effective only for the listed manufacturer and its customers. Other manufacturers must submit their own FCN for the same food contact substance and intended use.

► *from FDA Center for Food Safety and Applied Nutrition (CFSAN)*

FDA Inventory of Effective Food Contact Substance Notifications - FCN: 2 of 3 (FCN Number)	
FCN Number	<a href="#">1465</a>
Food Contact Substance	An aqueous mixture of <a href="#">peroxyacetic acid</a> (CAS Reg. <a href="#">79-21-0</a> ), hydrogen peroxide (CAS Reg. No. 7722-84-1), <a href="#">acetic acid</a> (CAS Reg. <a href="#">64-19-7</a> ), and 1-hydroxyethylidene-1,1-diphosphonic acid (CAS Reg. 02809-21-4).
Manufacturer	CraftChem, Inc.
Effective Date	Oct 22, 2014
Intended Use	As an antimicrobial to control microorganisms in process <a href="#">water</a> and <a href="#">ice</a> used in the production and preparation of fish and seafood, meat, and poultry.
Limitations/Specifications	The components of the FCS mixture will not exceed (1) 2000 parts per million (ppm) <a href="#">peroxyacetic acid</a> (PAA), 750 ppm hydrogen peroxide (HP), and 136 ppm l-hydroxyethylidene-1,1-diphosphonic acid ( <a href="#">HEDP</a> ) on poultry parts, organs, and carcasses. (2) 400 ppm PAA, 350 ppm HP, and 22.5 ppm <a href="#">HEDP</a> in process <a href="#">water</a> used for washing, rinsing, or cooling whole or cut meat including carcasses, parts, trim, and organs (3) 230 ppm PAA, 165 ppm HP, and 14 ppm <a href="#">HEDP</a> in process <a href="#">water</a> or <a href="#">ice</a> for washing, rinsing, storing or cooling of processed and pre-formed meat and poultry products. (4) 230 ppm PAA, 165 ppm HP, and 14 ppm <a href="#">HEDP</a> in process <a href="#">water</a> used to commercially prepare fish and seafood.
National Environmental Policy Act	<a href="#">Environmental Assessment (in PDF) (703 kB)</a>
FDA Decision	<a href="#">Finding of No Significant Impact (FONSI)</a>
Notification	According to Section 409(h)(1)(C) of the Federal Food, Drug, and Cosmetic Act, food contact substance notifications (FCNs) are effective only for the listed manufacturer and its customers. Other manufacturers must submit their own FCN for the same food contact substance and intended use.

► *from FDA Center for Food Safety and Applied Nutrition (CFSAN)*

FDA Inventory of Effective Food Contact Substance Notifications - FCN: 3 of 3 (FCN Number)	
FCN Number	<a href="#">1430</a>
Food Contact Substance	An aqueous solution of hydrogen peroxide (CAS Reg. No. 7722-84-1) containing hydrogen peroxide at levels of up to 50%, manufactured and characterized as further described in the notification.
Manufacturer	PeroxyChem, LLC

FDA Inventory of Effective Food Contact Substance Notifications - FCN: 3 of 3 (FCN Number)	
Effective Date	Jun 27, 2014
Intended Use	As a sterilant/antimicrobial on aseptic polymeric food packaging material and on surfaces of aseptic food packaging equipment, except the FCS is not intended for use on food packaging material and/or aseptic food packaging equipment used with infant formula or breast milk.
Limitations/Specifications	The concentration of hydrogen peroxide in distilled <a href="#">water</a> packaged under production conditions (assay to be performed immediately after packaging) must not exceed 0.5 parts per million (ppm) when the FCS is used as intended. The FCS is not intended for use on food packaging material and/or aseptic food packaging equipment used with infant formula or breast milk.
National Environmental Policy Act	<a href="#">Environmental Assessment (in PDF) (5.2 MB)</a>
FDA Decision	<a href="#">Finding of No Significant Impact (FONSI)</a>
Notification	According to Section 409(h)(1)(C) of the Federal Food, Drug, and Cosmetic Act, food contact substance notifications (FCNs) are effective only for the listed manufacturer and its customers. Other manufacturers must submit their own FCN for the same food contact substance and intended use.

► from FDA Center for Food Safety and Applied Nutrition (CFSAN)

## 8.4 FDA Indirect Additives used in Food Contact Substances

FDA Indirect Additives used in Food Contact Substances: 1 of 1 (Indirect Additives)	
Indirect Additives	HYDROGEN PEROXIDE SOLUTION
Title 21 of the U.S. Code of Federal Regulations (21 CFR)	178.1005

► from FDA Center for Food Safety and Applied Nutrition (CFSAN)

## 8.5 Food Additive Status

### FDA Food Additive Status

Hydrogen peroxide - MISC, REG, Used in combination with [acetic acid](#) to form [peroxyacetic acid](#) 59 ppm in wash [water](#) for fruits and vegetables that are not raw agricultural commodities- 173.315.

► from FDA Center for Food Safety and Applied Nutrition (CFSAN)

## 8.6 Evaluations of the Joint FAO/WHO Expert Committee on Food Additives - JECFA

Evaluations of the Joint FAO/WHO Expert Committee on Food Additives - JECFA: 1 of 1 (JECFA Chemical)	
Chemical Name	HYDROGEN PEROXIDE
ADI	NOT SPECIFIED

Evaluations of the Joint FAO/WHO Expert Committee on Food Additives - JECFA: 1 of 1 (JECFA Chemical)	
Evaluation Year	2004
Comments	Small residues of hydrogen peroxide on food (which has been treated with antimicrobial washing solutions) at the time of consumption would not pose a safety concern.
Report	<a href="#">TRS 928-JECFA 63/26</a>

► *from FAO/WHO Food Additive Evaluations (JECFA)*

## 9 Agrochemical Information

### 9.1 Agrochemical Category

Microbiocide

▸ *from EPA Office of Pesticide Programs*

### 9.2 EU Pesticides Data

EU Pesticides Data: 1 of 1 (EU Pesticides Substance)	
Substance	hydrogen peroxide
Status	Date of Approval: 29/03/2017

▸ *from EU Pesticides Database*

## 10 Pharmacology and Biochemistry

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### 10.1 Pharmacology

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Hydrogen peroxide exhibits antimicrobial properties against most forms of microorganisms, including dormant forms with known high resistance profiles, such as bacterial spores and protozoal cysts. It acts as an oxidative biocide to generate free radical species to induce DNA, protein and membrane lipid damage via oxidation.

▸ *from DrugBank*

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### 10.2 MeSH Pharmacological Classification

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#### **Oxidants**

Electron-accepting molecules in chemical reactions in which electrons are transferred from one molecule to another (OXIDATION-REDUCTION).

[See a list of PubChem compounds matching this category.](#)

▸ *from MeSH*

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#### **Anti-Infective Agents, Local**

Substances used on humans and other animals that destroy harmful microorganisms or inhibit their activity. They are distinguished from DISINFECTANTS, which are used on inanimate objects.

[See a list of PubChem compounds matching this category.](#)

▸ *from MeSH*

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### 10.3 ATC Code

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A - Alimentary tract and metabolism

A01 - Stomatological preparations

A01A - Stomatological preparations

A01AB - Antiinfectives and antiseptics for local oral treatment

A01AB02 - Hydrogen peroxide

[More information...](#)

▸ *from WHO ATC*

---

D - Dermatologicals

D08 - Antiseptics and disinfectants

D08A - Antiseptics and disinfectants

D08AX - Other antiseptics and disinfectants

D08AX01 - Hydrogen peroxide

▸ *from WHO ATC*

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S - Sensory organs

S02 - Otologicals

S02A - Antiinfectives

S02AA - Antiinfectives

S02AA06 - Hydrogen peroxide

▸ *from WHO ATC*

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## 10.4 Absorption, Distribution and Excretion

### Absorption

It is reported that hydrogen peroxide is decomposed before absorption in the intestine. Solutions of hydrogen peroxide displays poor penetration when applied to tissue [L2024].

▸ from DrugBank

### Volume of Distribution

Target organs affected by hydrogen peroxide include the lungs, intestine, thymus, liver, and kidney [L2024].

▸ from DrugBank

There are no procedures that will enhance the elimination of hydrogen peroxide except for those surgical procedures required after vascular occlusion by the peroxide.

*Ellenhorn, M.J., S. Schonwald, G. Ordog, J. Wasserberger. Ellenhorn's Medical Toxicology: Diagnosis and Treatment of Human Poisoning. 2nd ed. Baltimore, MD: Williams and Wilkins, 1997., p. 1223*

▸ from HSDB

WHEN ... APPLIED TO TISSUE ... SOLUTIONS OF HYDROGEN PEROXIDE HAVE POOR PENETRABILITY.

*Gilman, A. G., L. S. Goodman, and A. Gilman. (eds.). Goodman and Gilman's The Pharmacological Basis of Therapeutics. 6th ed. New York: Macmillan Publishing Co., Inc. 1980., p. 974*

▸ from HSDB

## 10.5 Metabolism/Metabolites

### Metabolism

Hydrogen peroxide is reduced by [glutathione](#) peroxidase, which is an endogenous enzyme in human tissue. It is rapidly decomposed to [oxygen](#) and [water](#) when in contact with catalase, an enzyme found in blood and most tissues [L2024].

▸ from DrugBank

WHEN HYDROGEN PEROXIDE COMES IN CONTACT WITH CATALASE, AN ENZYME FOUND IN BLOOD AND MOST TISSUES, IT IS RAPIDLY DECOMPOSED INTO [OXYGEN](#) AND [WATER](#) ... IN WOUNDS & ON MUCOUS MEMBRANES.

*American Medical Association. AMA Drug Evaluations Annual 1991. Chicago, IL: American Medical Association, 1991., p. 1438*

▸ from HSDB

## 10.6 Mechanism of Action

The production of free [hydroxyl](#) radicals in the Fenton reaction is thought to be the basis of biocidal actions of hydrogen peroxide. Free radicals eventually lead to oxidative damage proteins and membrane lipids *\_in vivo\_* [A32371]. The oxidizing radical as the ferryl radical induces DNA oxidation [A32371].

▸ from DrugBank

The "snow white" color change (mucosal whitening and frothy bubbles) in the colonic mucosa seen after topical application arise secondary to penetration by hydrogen peroxide into the epithelial interstices and capillaries, with the subsequent production of microbubbles of [molecular oxygen](#) causing the blanching. Blood is forced out of the intramural vasculature and replaced by [oxygen](#) in a reaction mediated by tissue catalase.

*Ellenhorn, M.J., S. Schonwald, G. Ordog, J. Wasserberger. Ellenhorn's Medical Toxicology: Diagnosis and Treatment of Human Poisoning. 2nd ed. Baltimore, MD: Williams and Wilkins, 1997., p. 1222*

At the cellular level, hydrogen peroxide-induced DNA damage appears to involve a role for transition metal ions bound to DNA, which may interact with H<sub>2</sub>O<sub>2</sub> resulting in the production of a reactive radical species, most likely OH. This radical species found close to the DNA interacts with DNA forming [purine](#) and [pyrimidine](#) products characteristic of those found after the exposure of aqueous DNA solutions to ionizing radiation.

Ellenhorn, M.J., S. Schonwald, G. Ordog, J. Wasserberger. *Ellenhorn's Medical Toxicology: Diagnosis and Treatment of Human Poisoning*. 2nd ed. Baltimore, MD: Williams and Wilkins, 1997., p. 1222

The pharmacologic activity of the drug depends on the release of nascent [oxygen](#) which has a powerful oxidizing effect that destroys some microorganisms and chemically alters many organic substances. When hydrogen peroxide topical solution comes in contact with tissues that contain the enzyme catalase, the solution releases [oxygen](#) which exerts antibacterial action; the mechanical effect of effervescence loosens tissue debris and pus. The release of nascent [oxygen](#) and effervescence is more rapid on wounds, denuded areas, and mucous membranes than on unbroken skin. The presence of reactive organic material such as pus and blood diminishes the efficiency of hydrogen peroxide. The antibacterial activity of hydrogen peroxide is relatively weak and slow and the drug exhibits poor tissue and wound penetration. Hydrogen peroxide's mechanical effect of effervescence and resultant removal of tissue debris is probably a more effective means of reducing the bacterial content of wounds, denuded areas, and mucous membranes than actual antibacterial activity. The drug also appears to have a styptic effect when applied topically to minor wounds. Concentrated solutions of hydrogen peroxide have a bleaching effect on hair and may injure tissue.

McEvoy, G.K. (ed.). *American Hospital Formulary Service - Drug Information 2000*. Bethesda, MD: American Society of Health-System Pharmacists, Inc. 2000 (Plus Supplements), p. 2576

Hydrogen peroxide solution (3%) liberates [oxygen](#) when in contact with catalase present on wound surfaces and mucous membranes. The effervescent action mechanically helps remove pus and cellular debris from the wounds and is valuable for cleaning and deodorizing infected tissue. The antimicrobial action is of short duration and is limited to the superficial layer of the applied surface because there is no penetration of the tissue.

Aiello, S.E. (ed). *The Merck Veterinary Manual*. 8th ed. Merck & Co., Inc., National Publishing Inc., Philadelphia, PA. 1998., p. 1848

## 10.7 Human Metabolite Information

### 10.7.1 Metabolite Description

#### Description

Hydrogen peroxide (H<sub>2</sub>O<sub>2</sub>) is a very pale blue liquid which appears colourless in a dilute solution, slightly more viscous than [water](#). It is a weak acid. It has strong oxidizing properties and is therefore a powerful bleaching agent that is mostly used for bleaching paper, but has also found use as a disinfectant and as an oxidizer. Hydrogen peroxide in the form of [carbamide peroxide](#) is widely used for tooth whitening (bleaching), both in professionally- and in self-administered products. Hydrogen peroxide (H<sub>2</sub>O<sub>2</sub>) is a well-documented component of living cells. It plays important roles in host defense and oxidative biosynthetic reactions. In addition there is growing evidence that at low levels, H<sub>2</sub>O<sub>2</sub> also functions as a signaling agent, particularly in higher organisms. H<sub>2</sub>O<sub>2</sub> has increasingly been viewed as an important cellular signaling agent in its own right, capable of modulating both contractile and growth-promoting pathways with more far-reaching effects. Due to the accumulation of hydrogen peroxide in the skin of patients with the depigmentation disorder vitiligo, the human epidermis cannot have the normal capacity for autocrine synthesis, transport and degradation of [acetylcholine](#) as well as the muscarinic (m1-m5) and nicotinic signal transduction in keratinocytes and melanocytes. Accumulating evidence suggests that hydrogen peroxide (H<sub>2</sub>O<sub>2</sub>) plays an important role in cancer development. Experimental data have shown that cancer cells produce high amounts of H<sub>2</sub>O<sub>2</sub>. An increase in the cellular levels of H<sub>2</sub>O<sub>2</sub> has been linked to several key alterations in cancer, including DNA alterations, cell proliferation, apoptosis

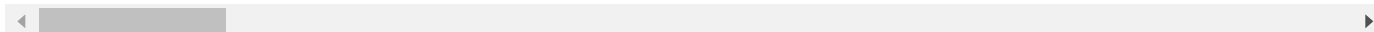


resistance, metastasis, angiogenesis and hypoxia-inducible factor 1 (HIF-1) activation. (PMID: [17150302](#), [17335854](#), [16677071](#), [16607324](#), [16514169](#)).

► *from Human Metabolome Database (HMDB)*

### 10.7.2 Metabolite Pathways

- |   |   |
|---|---|
| 1. <a href="#">2-aminoadipic 2-oxoadipic aciduria</a>                     | 11. <a href="#">5-oxoprolinase deficiency</a>                           |
| 2. <a href="#">2-Methyl-3-Hydroxybutyryl CoA Dehydrogenase Deficiency</a> | 12. <a href="#">5-Oxoprolinuria</a>                                     |
| 3. <a href="#">3-Hydroxy-3-Methylglutaryl-CoA Lyase Deficiency</a>        | 13. <a href="#">Acute Intermittent Porphyria</a>                        |
| 4. <a href="#">3-hydroxyisobutyric acid dehydrogenase deficiency</a>      | 14. <a href="#">Adenine phosphoribosyltransferase deficiency (APRT)</a> |
| 5. <a href="#">3-hydroxyisobutyric aciduria</a>                           | 15. <a href="#">Adenosine Deaminase Deficiency</a>                      |
| 6. <a href="#">3-Methylcrotonyl Coa Carboxylase Deficiency Type I</a>     | 16. <a href="#">Adenylosuccinate Lyase Deficiency</a>                   |
| 7. <a href="#">3-Methylglutaconic Aciduria Type I</a>                     | 17. <a href="#">AICA-Ribosiduria</a>                                    |
| 8. <a href="#">3-Methylglutaconic Aciduria Type III</a>                   | 18. <a href="#">Alkaptonuria</a>  |
| 9. <a href="#">3-Methylglutaconic Aciduria Type IV</a>                    | 19. <a href="#">Arachidonic Acid Metabolism</a>                         |
| 10. <a href="#">3-Phosphoglycerate dehydrogenase deficiency</a>           | 20. <a href="#">Arginine and Proline Metabolism</a>                     |



► *from Human Metabolome Database (HMDB)*

### 10.7.3 Associated Disorders and Diseases

#### Coronary heart disease

Kazmierczak M, Wysocki H, Wykretowicz A, Minczykowski A: Estimation of hydrogen peroxide plasma levels in patients evaluated for coronary heart disease using [dipyridamole](#) infusion followed by SPECT. *Coron Artery Dis.* 1995 Jan;6(1):65-9. [PMID:[7767505](#)]

Akimova EV: [Prostacyclin](#) and [thromboxane A2](#) levels in children and adolescents with an inherited predisposition to coronary heart disease: a family study. *Coron Artery Dis.* 1994 Sep;5(9):761-5.[PMID:[7858766](#)]

► *from Human Metabolome Database (HMDB)*

## 11 Use and Manufacturing

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### 11.1 Uses

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#### EPA Safer Chemical Functional Use Classes

Antimicrobial Actives;Oxidants and Oxidant Stabilizers

► *from EPA Safer Choice*

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#### JECFA Functional Classes

Food Additives: PRESERVATIVE

► *from FAO/WHO Food Additive Evaluations (JECFA)*

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#### 11.1.1 Industry Uses

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1. Agricultural chemicals (non-pesticidal)
2. Bleaching agents
3. Blended as inert ingredient in a registered pesticide for [water](#) treatment
4. Cleaner/polymer removing
5. Intermediates
6. Not known or reasonably ascertainable
7. Oxidizing/reducing agents
8. Plating agents and surface treating agents
9. Solvents (for cleaning and degreasing)
10. Surface active agents

► *from EPA Chemicals under the TSCA*

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#### 11.1.2 Consumer Uses

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- |  |  |
|--|--|
| 1. Chemical is used a cleaning agent in the semi-conductor industry. | 11. Water treatment products                       |
| 2. Cleaning and furnishing care products                             | 12. used in products for a variety of applications |
| 3. Electrical and electronic products                                |  |
| 4. Fabric, textile, and leather products not covered elsewhere       |  |
| 5. Food packaging  |  |
| 6. Laundry and dishwashing products                                  |  |
| 7. Metal products not covered elsewhere                              |  |
| 8. Not known or reasonably ascertainable                             |  |
| 9. Paper products  |  |
| 10. Personal care products   |  |

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► *from EPA Chemicals under the TSCA*

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## 11.2 Methods of Manufacturing

### CYCLIC REDUCTION AND OXIDATION OF ALKYL ANTHRAQUINONES

SRI

► from HSDB

Prepd by treating [barium peroxide](#) with acid.

Budavari, S. (ed.). *The Merck Index - An Encyclopedia of Chemicals, Drugs, and Biologicals*. Whitehouse Station, NJ: Merck and Co., Inc., 1996, p. 822

► from HSDB

Prod'n of anhydrous hydrogen peroxide by continuous fractional crystallization.

Budavari, S. (ed.). *The Merck Index - An Encyclopedia of Chemicals, Drugs, and Biologicals*. Whitehouse Station, NJ: Merck and Co., Inc., 1996, p. 822

► from HSDB

Autoxidation of an alkyl anthrahydroquinone, such as the 2-ethyl derivative, in a cyclic continuous process in which the quinone formed in the oxidation step is reduced to the starting material by [hydrogen](#) in the presence of a supported [palladium](#) catalyst; by electrolytic processes in which aqueous [sulfuric acid](#) or acidic [ammonium bisulfate](#) is converted electrolytically to the [peroxydisulfate](#), which is then hydrolyzed to form hydrogen peroxide; by autoxidation of isopropyl alc.

Lewis, R.J., Sr (Ed.). *Hawley's Condensed Chemical Dictionary*. 13th ed. New York, NY: John Wiley & Sons, Inc. 1997., p. 591

► from HSDB

Electrolysis of [potassium bisulfate](#) solution to form the corresponding [persulfate](#) radical, which was then heated and hydrolysed in an evaporator to remove [water](#) and hydrogen peroxide vapors

CHEMICAL PRODUCTS SYNOPSIS: *Hydrogen Peroxide*, 1984

► from HSDB

Oxidation of [isopropyl alcohol](#) to [acetone](#) and hydrogen peroxide

CHEMICAL PRODUCTS SYNOPSIS: *Hydrogen Peroxide*, 1984

► from HSDB

In practice, 100 wt% hydrogen peroxide is obtained by fractional crystallization of highly concentrated (ca. 90 wt%) aqueous solutions.

Gerhartz, W. (exec ed.). *Ullmann's Encyclopedia of Industrial Chemistry*. 5th ed. Vol A1: Deerfield Beach, FL: VCH Publishers, 1985 to Present., p. VA13 (89) 445

► from HSDB

## 11.3 Formulations/Preparations

USEPA/OPP PC Code 000595; Trade Names: Albone; Superoxol; [Actril](#), Component of (with 063201) (Cold Sterilant).

U.S. Environmental Protection Agency/Office of Pesticide Program's Chemical Ingredients Database on Hydrogen Peroxide (7722-84-1). Available from, as of June 14, 2000: <http://npispublic.ceris.purdue.edu/ppis/>

► from HSDB

Grades: USP (3%); technical (3, 6, 27.5, 30, 35, 50 & 90%); FCC. Most common commercial strengths are 27.5, 35, 50, and 70%.

Lewis, R.J., Sr (Ed.). *Hawley's Condensed Chemical Dictionary*. 13th ed. New York, NY: John Wiley & Sons, Inc. 1997., p. 591

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► from HSDB

Hydrogen peroxide soln 30% - contains 2.5-3.5% by wt of H2O2= 8-12 vol oxygen. ... Hydrogen peroxide soln 30% - contains 30% by wt of H2O2= 100 vol of oxygen. /3% ... 30% soln/

Budavari, S. (ed.). *The Merck Index - An Encyclopedia of Chemicals, Drugs, and Biologicals*. Whitehouse Station, NJ: Merck and Co., Inc., 1996., p. 823

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► from HSDB

HYDROGEN PEROXIDE SOLUTIONS CONTAIN 3% OF H2O2 IN WATER WITH 0.5% OF ACETANILID OR ACETOPHENETIDIN AS A STABILIZING AGENT.

American Hospital Formulary Service. *Volumes I and II*. Washington, DC: American Society of Hospital Pharmacists, to 1984., p. 52:28

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► from HSDB

Now replacing the 3% soln for industrial uses; diluted to the required strength immediately before use. It also is used for making the 3% soln. /30% soln/

Budavari, S. (ed.). *The Merck Index - An Encyclopedia of Chemicals, Drugs, and Biologicals*. Whitehouse Station, NJ: Merck and Co., Inc., 1996., p. 823

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► from HSDB

DOSE: TOPICAL, FOR CLEANSING WOUNDS, 1.5-3% SOLN; AS A MOUTHWASH, 3% SOLN; INTRAVAGINAL, 2% SOLN.

Osol, A. and J.E. Hoover, et al. (eds.). *Remington's Pharmaceutical Sciences*. 15th ed. Easton, Pennsylvania: Mack Publishing Co., 1975., p. 1092

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► from HSDB

Hydrogen peroxide is available only as aqueous solutions containing 3-98% hydrogen peroxide.

IARC. *Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Humans*. Geneva: World Health Organization, International Agency for Research on Cancer, 1972-PRESENT. (Multivolume work). Available at: <http://monographs.iarc.fr/ENG/Classification/index.php>, p. V36 286 (1985)

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► from HSDB

Marketed as a soln in water in concentrations of 3-90% by wt.

Budavari, S. (ed.). *The Merck Index - An Encyclopedia of Chemicals, Drugs, and Biologicals*. Whitehouse Station, NJ: Merck and Co., Inc., 1996., p. 822

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► from HSDB

Common commercial strengths are 27.5%, 35%, 50%, 70%, 90%, and 98%. "High strength" means greater than 52%.

U.S. Coast Guard, Department of Transportation. *CHRIS - Hazardous Chemical Data. Volume II*. Washington, D.C.: U.S. Government Printing Office, 1984-5.

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► from HSDB

Topical concentrate: 30.5% (w/w) (available by nonproprietary name); Gel: 1.5% Peroxyl Oral Spot Treatment, Colgate Oral; Solution: 1.5% Peroxyl Mouthrinse (with alcohol 6%), Colgate Oral; 3% (available by nonproprietary name)

McEvoy, G.K. (ed.). *American Hospital Formulary Service - Drug Information 2000*. Bethesda, MD: American Society of Health-System Pharmacists, Inc. 2000 (Plus Supplements)., p. 2576

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► from HSDB

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## 11.4 Consumption

30% IN TEXTILES; 28% IN PLASTICIZERS & OTHER CHEMS; 9% FOR GLYCERIN; 8% FOR PULP & PAPER; 4% IN WASTEWATER TREATMENT; 21% IN MISC APPLICATIONS (1974).

SRI

▸ from HSDB

Pulp and paper, 25%; Chemical synthesis, 25%; Environmental, 20%; Textile, 10%; Mining and Uranium, 5%; Miscellaneous, 15% (1984).

CHEMICAL PRODUCTS SYNOPSIS: Hydrogen Peroxide (1984)

▸ from HSDB

CHEMICAL PROFILE: Hydrogen Peroxide. Chemical synthesis, 24%; pulp and paper, 23%; environmental uses (includes municipal and industrial water treatment and geothermal steam treatment), 18%; textiles, 14%; mining, 3%; electronics, 3%; miscellaneous (including food and cosmetic uses and the distribution market, 15%.

Kavaler AR; Chemical Marketing Reporter 230 (17): 58 (1986)

▸ from HSDB

CHEMICAL PROFILE: Hydrogen peroxide. Demand: 1985: 300 million lb; 1986: 320 million lb; 1990 /projected/: 410 million lb. (Canada and US)

Kavaler AR; Chemical Marketing Reporter 230 (17): 58 (1986)

▸ from HSDB

CHEMICAL PROFILE: Hydrogen peroxide. Pulp and paper, 38%; chemical synthesis, 18%; environmental uses (including municipal and industrial water treatment), 17%; textiles, 11%; exports, 5%; miscellaneous (including mining, electronic, food and cosmetic uses and distributor market), 11%.

Kavaler AR; Chemical Marketing Reporter 236 (14): 50 (1989)

▸ from HSDB

CHEMICAL PROFILE: Hydrogen peroxide. Demand: 1988: 425 million lb; 1989: 475 million lb; 1993 /projected/: 720 million lb (Includes net exports of 20 million lb). 1993 /projected/: 720 million lb (Includes net exports of 20 million lb).

Kavaler AR; Chemical Marketing Reporter 236 (14): 50 (1989)

▸ from HSDB

Demand: 1997: 1.19 billion lbs; 1998: 1.26 billion lbs; 2002: 1.55 billion lbs (demand is for Canada and U.S. and includes exports, but not imports)

Chemical Marketing Reporter; Chemical Profile Hydrogen Peroxide. August 24. NY, NY: Schnell Pub Co (1998)

▸ from HSDB

Pulp and paper, 56%; chemical synthesis, 12%; environmental uses, including water treatment, 12%; textiles, 10%; miscellaneous, including mining, electronics, food and cosmetic uses, and distributor market, 10%.

Chemical Marketing Reporter; Chemical Profile Hydrogen Peroxide. August 24. NY, NY: Schnell Pub Co (1998)

▸ from HSDB

## 11.5 U.S. Production

(1972) 6.83X10+10 GRAMS

SRI

▸ from HSDB

(1984) 1.26X10+11 g

BUREAU OF THE CENSUS. CURRENT INDUSTRIAL REPORTS: INORGANIC CHEMICALS 1984 p.9

▸ from HSDB

Fort Howard Corp.: 3X10+3 tons/year

*Kirk-Othmer Encyclopedia of Chemical Technology. 4th ed. Volumes 1: New York, NY. John Wiley and Sons, 1991-Present., p. V13 (95) 982*

► from HSDB

3.58X10+3 tons/yr (estimated US capacity)

*Kirk-Othmer Encyclopedia of Chemical Technology. 4th ed. Volumes 1: New York, NY. John Wiley and Sons, 1991-Present., p. V13 (95) 982*

► from HSDB

U.S. production: 1960: 26,000 tons/year; 1970: 55,700 tons/year; 1980: 105,800 tons/year; 1982: 98,500 tons/year; 1984: 12,600 tons/year; 1986: 138,000 tons/year; 1988: 161,000 tons/year; 1990: 216,600 tons/year; 1992: 271,800 tons/year; 1994: 360,000 (estimated) tons/year; 1996: 470,000 (estimated) tons/year; 1998: 580,000 (estimated) tons/year; 2000: 700,000 (estimated) tons/year

*Kirk-Othmer Encyclopedia of Chemical Technology. 4th ed. Volumes 1: New York, NY. John Wiley and Sons, 1991-Present., p. V13 (95) 981*

► from HSDB

Total annual capacity = 478,000 short tons

*SRI. 1999 Directory of Chemical Producers -United States. Menlo Park, CA. SRI Consulting 1999., p. 676*

► from HSDB

Total U.S. capacity: 1,656 million pounds per year (100% basis)

*Chemical Marketing Reporter; Chemical Profile. Hydrogen Peroxide. August 24. NY, NY: Schnell Pub Co (1998)*

► from HSDB

## 11.6 U.S. Imports

(1972) 3.84X10+9 GRAMS

*SRI*

► from HSDB

(1984) 1.74X10<sup>9</sup>+10 g

*BUREAU OF THE CENSUS. U.S. IMPORTS FOR CONSUMPTION AND GENERAL IMPORTS 1984 p.1-353*

► from HSDB

1996: 174 million lbs (includes U.S. and Canada)

*Chemical Marketing Reporter; Chemical Profile Hydrogen Peroxide. August 24. NY, NY: Schnell Pub Co (1998)*

► from HSDB

## 11.7 U.S. Exports

(1984) 2.32X10+10 g

*BUREAU OF THE CENSUS. U.S. EXPORTS, SCHEDULE E, 1984 p.2-94*

► from HSDB

1996: 60 million lbs (includes U.S. and Canada)



## 12 Identification

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### 12.1 Analytic Laboratory Methods

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An iodometric method for the flow injection amperometric determination of hydrogen peroxide in [water](#) is described. The range of  $1 \times 10^{-3}$  to  $1 \times 10^{-6}$  M for hydrogen peroxide. When this method was used to determine  $3 \times 10^{-6}$  M hydrogen peroxide in the presence of [chloride](#), [bromide](#), [sulfate](#) and [carbonate](#) ions, no interference from these ions was observed. In addition, organic peroxides present in a variety of natural [water](#) did not interfere with this method.

*Abdalla MA, Al-Swaidan HM; Anal Lett 22 (7): 1729-42 (1989)*

► *from HSDB*

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AOAC Method 957.08. Hydrogen peroxide in milk. Qualitative color test. Prepare reagent by dissolving 1 g vanadium oxide in 100 ml [sulfuric acid](#) (6 + 94). Add 10-20 drops reagent in ca 10 ml sample and mix. Pink or red indicates hydrogen peroxide.

*Association of Official Analytical Chemists. Official Methods of Analysis. 15th ed. and Supplements. Washington, DC: Association of Analytical Chemists, 1990, p. V2 1149*

► *from HSDB*

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### 12.2 OSHA Chemical Sampling

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[Hydrogen Peroxide](#)

► *from OSHA Chemical Sampling Information*

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## 13 Safety and Hazards

### 13.1 Hazards Identification

#### 13.1.1 GHS Classification



**Signal:** **Danger**

#### GHS Hazard Statements

Aggregated GHS information provided by 1754 companies from 66 notifications to the ECHA C&L Inventory. Each notification may be associated with multiple companies.

Reported as not meeting GHS hazard criteria by 2 of 1754 companies. For more detailed information, please visit [ECHA C&L website](#)

Of the 65 notification(s) provided by 1752 of 1754 companies with hazard statement code(s):

H271 (90.35%): May cause fire or explosion; strong Oxidizer [**Danger** Oxidizing liquids; Oxidizing solids]

H302+H332 (22.26%): Harmful if swallowed or if inhaled [**Warning** Acute toxicity, oral; acute toxicity, inhalation]

H302 (97.77%): Harmful if swallowed [**Warning** Acute toxicity, oral]

H314 (99.66%): Causes severe skin burns and eye damage [**Danger** Skin corrosion/irritation]

H318 (41.21%): Causes serious eye damage [**Danger** Serious eye damage/eye irritation]

H332 (94.06%): Harmful if inhaled [**Warning** Acute toxicity, inhalation]

H335 (37.84%): May cause respiratory irritation [**Warning** Specific target organ toxicity, single exposure; Respiratory tract irritation]

Information may vary between notifications depending on impurities, additives, and other factors. The percentage value in parenthesis indicates the notified classification ratio from companies that provide hazard codes. Only hazard codes with percentage values above 10% are shown.

#### Precautionary Statement Codes

P210, P220, P221, P260, P261, P264, P270, P271, P280, P283, P301+P312, P301+P330+P331, P303+P361+P353, P304+P312, P304+P340, P305+P351+P338, P306+P360, P310, P312, P321, P330, P363, P370+P378, P371+P380+P375, P403+P233, P405, and P501

(The corresponding statement to each P-code can be found [here](#).)

► from European Chemicals Agency (ECHA)

[View all \(4\) GHS Classification entries](#)

#### 13.1.2 EPA Safer Chemical

Hydrogen peroxide - Green circle - The chemical has been verified to be of low concern based on experimental and modeled data.

► from EPA Safer Choice

### 13.1.3 Health Hazard

Excerpt from ERG Guide 143 [Oxidizers (Unstable)]: TOXIC; inhalation, ingestion or contact (skin, eyes) with vapors, dusts or substance may cause severe injury, burns or death. Fire may produce irritating and/or toxic gases. Toxic fumes or dust may accumulate in confined areas (basement, tanks, hopper/tank cars, etc.). Runoff from fire control or dilution [water](#) may cause pollution. (ERG, 2016)

► from CAMEO Chemicals

Excerpt from ERG Guide 140 [Oxidizers]: Inhalation, ingestion or contact (skin, eyes) with vapors or substance may cause severe injury, burns or death. Fire may produce irritating, corrosive and/or toxic gases. Runoff from fire control or dilution [water](#) may cause pollution. (ERG, 2016)

► from CAMEO Chemicals

Strong irritant to skin, eyes, and mucous membranes. (EPA, 1998)

► from CAMEO Chemicals

Corrosive, Mutagen, Reactive - 3rd degree

► from NJDOH RTK Hazardous Substance List

### 13.1.4 Fire Hazard

Excerpt from ERG Guide 143 [Oxidizers (Unstable)]: May explode from friction, heat or contamination. These substances will accelerate burning when involved in a fire. May ignite combustibles (wood, paper, oil, clothing, etc.). Some will react explosively with hydrocarbons (fuels). Containers may explode when heated. Runoff may create fire or explosion hazard. (ERG, 2016)

► from CAMEO Chemicals

Excerpt from ERG Guide 140 [Oxidizers]: These substances will accelerate burning when involved in a fire. Some may decompose explosively when heated or involved in a fire. May explode from heat or contamination. Some will react explosively with hydrocarbons (fuels). May ignite combustibles (wood, paper, oil, clothing, etc.). Containers may explode when heated. Runoff may create fire or explosion hazard. (ERG, 2016)

► from CAMEO Chemicals

Spontaneous ignition may occur when contact with combustible materials is made. [Oxygen](#) released in decomposition will promote combustion. Fires can be of the flaring type but are not explosive unless confined. Vapor concentration greater than 40 percent by weight can be decomposed explosively at 1 atmosphere pressure. Severe explosion hazard when it is exposed to heat, mechanical impact, detonation of a blasting cap, or caused to decompose catalytically. Decomposition can build up large pressures of [oxygen](#) and [water](#) which may then burst explosively. Avoid oxidizable materials including [iron](#), [copper](#), brass, bronze, [chromium](#), [zinc](#), lead, [manganese](#), [silver](#), catalytic metals. Avoid mechanical impact, uncovering the container, contact with combustible materials, light, temperatures above 95F, hot wires, catalytic impurities. (EPA, 1998)

► from CAMEO Chemicals

Not combustible. The substance may ignite combustible materials. Many reactions may cause fire or explosion. Risk of fire and explosion on contact with heat or metal catalysts.

► from ILO-ICSC

### 13.1.5 Hazards Summary

Hydrogen peroxide is a colorless liquid at room temperature with a bitter taste. Small amounts of gaseous hydrogen peroxide occur naturally in the air. Hydrogen peroxide is unstable, decomposing readily to [oxygen](#) and [water](#) with release

of heat. Although nonflammable, it is a powerful oxidizing agent that can cause spontaneous combustion when it comes in contact with organic material. Hydrogen peroxide is found in many households at low concentrations (3-9%) for medicinal applications and as a clothes and hair bleach. In industry, hydrogen peroxide in higher concentrations is used as a bleach for textiles and paper, as a component of rocket fuels, and for producing foam rubber and organic chemicals.

► from CDC-ATSDR Toxic Substances Portal

### 13.1.6 Fire Potential

DANGEROUS/FIRE HAZARD/ BY CHEMICAL REACTION WITH FLAMMABLE MATERIALS. HYDROGEN PEROXIDE IS A POWERFUL OXIDIZER, PARTICULARLY IN THE CONCENTRATED STATE. IT IS IMPORTANT TO KEEP CONTAINERS ... COVERED BECAUSE UNCOVERED CONTAINERS ... MORE PRONE TO REACT WITH FLAMMABLE VAPORS, GASES, ETC.; ... IF UNCOVERED, THE [WATER](#) FROM HYDROGEN PEROXIDE SOLN CAN EVAPORATE, CONCENTRATING THE /REMAINING/ MATERIAL AND THUS INCREASING THE FIRE HAZARD.

*Lewis, R.J. Sax's Dangerous Properties of Industrial Materials. 9th ed. Volumes 1-3. New York, NY: Van Nostrand Reinhold, 1996., p. 1841*

► from HSDB

... SOLNS OF HYDROGEN PEROXIDE in CONC IN EXCESS OF 65 WT% HEAT UP SPONTANEOUSLY WHEN DECOMPOSING TO [WATER](#) + 1/2 [OXYGEN](#). THUS 90 WT% SOLN, WHEN CAUSED TO DECOMPOSE RAPIDLY DUE TO THE INTRODUCTION OF A CATALYTIC DECOMPOSITION AGENT, CAN GET QUITE HOT AND PERHAPS START FIRES.

*Lewis, R.J. Sax's Dangerous Properties of Industrial Materials. 9th ed. Volumes 1-3. New York, NY: Van Nostrand Reinhold, 1996., p. 1842*

► from HSDB

Since the compound is such a strong oxidizer, when spilled on combustible materials it can set fire to them. Detonation can occur if the peroxide is mixed with incompatible (most) organic compounds.

*International Labour Office. Encyclopaedia of Occupational Health and Safety. 4th edition, Volumes 1-4 1998. Geneva, Switzerland: International Labour Office, 1998., p. 104.350*

► from HSDB

Hydrogen peroxide is not itself flammable but can cause spontaneous combustion of flammable materials and continued support of the combustion because it liberates [oxygen](#) as it decomposes.

*International Labour Office. Encyclopedia of Occupational Health and Safety. Vols. I&II. Geneva, Switzerland: International Labour Office, 1983., p. 1089*

► from HSDB

Drying of concentrated product on clothing or other combustible material may cause fire.

*Armour, M.A. Hazardous Laboratory Chemicals Disposal Guide. Boca Raton, FL: CRC Press Inc., 1991., p. 181*

► from HSDB

Leakage from drums of 35% hydrogen peroxide onto a wooden pallet caused ignition of the latter when it was moved. Combustion, though limited in area, was fierce and took some time to extinguish. Leakage of 50% peroxide onto supporting pallets under polythene sheeting led to spontaneous ignition and a fierce fire. Contact of 50% peroxide with wood does not usually lead to spontaneous ignition, but hot weather, dry wood and the thermal insulation of the cover may have contributed to ignition.

*Bretherick, L. Handbook of Reactive Chemical Hazards. 4th ed. Boston, MA: Butterworth-Heinemann Ltd., 1990, p. 1214*

► from HSDB

### 13.1.7 Skin, Eye, and Respiratory Irritations

Marked irritation - eye, nose, throat, skin

Cralley, L.J., L.V. Cralley (eds.). *Patty's Industrial Hygiene and Toxicology. Volume III: Theory and Rationale of Industrial Hygiene Practice. 2nd ed., 3A: The Work Environment.* New York, NY: John Wiley Sons, 1985., p. 171

► from HSDB

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## 13.2 Safety and Hazard Properties

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### 13.2.1 Flammability

Noncombustible Liquid, but a powerful oxidizer.

► from *The National Institute for Occupational Safety and Health (NIOSH)*

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### 13.2.2 Critical Temperature

Critical temperature: 457 deg C; critical pressure: 20.99 Mpa

Gerhartz, W. (exec ed.). *Ullmann's Encyclopedia of Industrial Chemistry. 5th ed.* Vol A1: Deerfield Beach, FL: VCH Publishers, 1985 to Present., p. VA13 (89) 445

► from HSDB

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### 13.2.3 Critical Pressure

Critical temperature: 457 deg C; critical pressure: 20.99 Mpa

Gerhartz, W. (exec ed.). *Ullmann's Encyclopedia of Industrial Chemistry. 5th ed.* Vol A1: Deerfield Beach, FL: VCH Publishers, 1985 to Present., p. VA13 (89) 445

► from HSDB

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### 13.2.4 NFPA Reactivity Rating

3

► from CAMEO Chemicals

1

► from CAMEO Chemicals

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### 13.2.5 NFPA Health Rating

3

► from CAMEO Chemicals

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### 13.2.6 Chemical Dangers

75 ppm

NIOSH. *NIOSH Pocket Guide to Chemical Hazards.* DHHS (NIOSH) Publication No. 97-140. Washington, D.C. U.S. Government Printing Office, 1997., p. 168

▶ from HSDB

Decomposes under the influence of light. Decomposes on warming. This produces [oxygen](#). This increases fire hazard. The substance is a strong oxidant. It reacts violently with combustible and reducing materials. This generates fire and explosion hazard particularly in the presence of metals. Attacks many organic substances such as textiles and paper.

▶ from ILO-ICSC

### 13.2.7 Explosive Limits and Potential

Although pure hydrogen peroxide solutions are not usually explosive at atmospheric pressure, equilibrium vapor concentrations of hydrogen peroxide above 26 mol per cent (40 weight per cent) become explosive in a temperature range below the boiling point of the liquid.

*International Labour Office. Encyclopaedia of Occupational Health and Safety. 4th edition, Volumes 1-4 1998. Geneva, Switzerland: International Labour Office, 1998., p. 104.350*

▶ from HSDB

EXPLOSION HAZARD: SEVERE, WHEN HIGHLY CONCENTRATED OR PURE H2O2 IS EXPOSED TO HEAT, MECHANICAL IMPACT, DETONATION OF A BLASTING CAP, OR CAUSED TO DECOMPOSE CATALYTICALLY BY METALS & THEIR SALTS, DUSTS & ALKALIES.

*Martin, E. W. (ed.). Hazards of Medication. 2nd ed. Philadelphia: J.B. Lippincott Co., 1978., p. 730*

▶ from HSDB

ALTHOUGH MANY MIXTURES OF HYDROGEN PEROXIDE & ORG MATERIALS DO NOT EXPLODE UPON CONTACT, THE RESULTANT COMBINATION IS DETONATABLE EITHER UPON CATCHING FIRE OR BY IMPACT. DETONATION VELOCITY OF AQ SOLN ... FOUND TO BE ABOUT 6500 M/SEC FOR SOLN OF BETWEEN 96 WT% & 100 WT% HYDROGEN PEROXIDE.

*Lewis, R.J. Sax's Dangerous Properties of Industrial Materials. 9th ed. Volumes 1-3. New York, NY: Van Nostrand Reinhold, 1996., p. 1842*

▶ from HSDB

ANOTHER SOURCE OF HYDROGEN PEROXIDE EXPLOSIONS IS FROM SEALING THE MATERIAL IN STRONG CONTAINERS. UNDER SUCH CONDITIONS EVEN GRADUAL DECOMPOSITION OF HYDROGEN PEROXIDE TO [WATER](#) + 1/2 [OXYGEN](#) CAN CAUSE LARGE PRESSURES TO BUILD UP IN THE CONTAINERS WHICH MAY BURST EXPLOSIVELY.

*Lewis, R.J. Sax's Dangerous Properties of Industrial Materials. 9th ed. Volumes 1-3. New York, NY: Van Nostrand Reinhold, 1996., p. 1842*

▶ from HSDB

Soluble fuels ([acetone](#), [ethanol](#), [glycerol](#)) will detonate on admixture with peroxide of over 30% concentration, the violence increasing with concentration.

*Bretherick, L. Handbook of Reactive Chemical Hazards. 4th ed. Boston, MA: Butterworth-Heinemann Ltd., 1990, p. 1198*

▶ from HSDB

An organic [sulfur](#) compound containing an acetal function had been oxidized to the sulfone with 30% hydrogen peroxide in [acetic acid](#). After the liquor had been concentrated by vacuum distillation at 50-60 deg C, the residue exploded during handling. ... Interaction /with [acetaldehyde](#)/ gives the extremely explosive poly(ethylidene) peroxide.

*Bretherick, L. Handbook of Reactive Chemical Hazards. 4th ed. Boston, MA: Butterworth-Heinemann Ltd., 1990, p. 1200*

▶ from HSDB

[Acetone](#) and hydrogen peroxide readily form explosive dimeric and trimeric cyclic peroxides, particularly during evaporation of the mixture. Many explosions have occurred during work-up of peroxide reactions run in [acetone](#) solvent, including partial hydrolysis of a nitrile and oxidation of [2,2'-thiodiethanol](#) and of an unspecified material.

*Bretherick, L. Handbook of Reactive Chemical Hazards. 4th ed. Boston, MA: Butterworth-Heinemann Ltd., 1990, p. 1201*

▶ from HSDB

Homogeneous mixtures of concentrated peroxide with alcohols or other peroxide miscible organic liquids are capable of detonation by shock or heat. ... During conversion of alcohols to hydroperoxides, the order of mixing of reagents is important. Addition of concentrated acid to mixtures of an alcohol and concentrated peroxide almost inevitably leads to explosion, particularly if the mixture is inhomogeneous and the alcohol is a solid.

Bretherick, L. *Handbook of Reactive Chemical Hazards*. 4th ed. Boston, MA: Butterworth-Heinemann Ltd., 1990, p. 1202

► from HSDB

Conversion of the acid to [diperoxyazelaic acid](#) in hydrogen peroxide/[sulfuric acid](#) medium at 45-50 deg C was uncontrollably exothermic and led to explosion.

Bretherick, L. *Handbook of Reactive Chemical Hazards*. 4th ed. Boston, MA: Butterworth-Heinemann Ltd., 1990, p. 1203

► from HSDB

Evaporation of an ethereal solution of hydrogen peroxide gave a residue of which a drop on a [platinum](#) spatula exploded weakly on exposure to flame. When the sample (1-2 g) was stirred with a glass rod (not fire polished), an extremely violent detonation occurred.

Bretherick, L. *Handbook of Reactive Chemical Hazards*. 4th ed. Boston, MA: Butterworth-Heinemann Ltd., 1990, p. 1205

► from HSDB

Interaction gives a hydrated basic peroxide which decomposes explosively at 80-90 deg C.

Bretherick, L. *Handbook of Reactive Chemical Hazards*. 4th ed. Boston, MA: Butterworth-Heinemann Ltd., 1990, p. 1207

► from HSDB

Addition of 30% peroxide and [sulfuric acid](#) to [2-methylpyridine](#) and [iron\(II\) sulfate](#) caused a sudden exotherm, followed by a vapor phase explosion and ignition.

Bretherick, L. *Handbook of Reactive Chemical Hazards*. 4th ed. Boston, MA: Butterworth-Heinemann Ltd., 1990, p. 1208

► from HSDB

Interaction with excess [ketene](#) rapidly forms explosive [diacetyl peroxide](#).

Bretherick, L. *Handbook of Reactive Chemical Hazards*. 4th ed. Boston, MA: Butterworth-Heinemann Ltd., 1990, p. 1208

► from HSDB

Directions given for the preparation of 2-phenyl-1,1-dimethylethyl hydroperoxide by adding [sulfuric acid](#) to a mixture of the alcohol and 90% hydrogen peroxide are wrong and will lead to explosion.

Bretherick, L. *Handbook of Reactive Chemical Hazards*. 4th ed. Boston, MA: Butterworth-Heinemann Ltd., 1990, p. 1212

► from HSDB

Preparative reactions involving oxidation of [tetrahydrothiophene](#) to the sulfoxide by slow addition of 37% peroxide solutions exploded violently on 3 occasions. No explanation is apparent, and similar reactions had been run uneventfully over a period of 10 years.

Bretherick, L. *Handbook of Reactive Chemical Hazards*. 4th ed. Boston, MA: Butterworth-Heinemann Ltd., 1990, p. 1214

► from HSDB

It is not considered to be an explosive; however, when mixed with organic chemicals, hazardous impact-sensitive compounds may result. Materials with metal catalysts can cause explosive decomposition.

International Labour Office. *Encyclopaedia of Occupational Health and Safety*. 4th edition, Volumes 1-4 1998. Geneva, Switzerland: International Labour Office, 1998., p. 104.350

► from HSDB

### 13.2.8 OSHA Standards

Permissible Exposure Limit: Table Z-1 8-hr Time Weighted Avg: 1 ppm (1.4 mg/cu m).

29 CFR 1910.1000 (7/1/99)

► from HSDB

### 13.2.9 NIOSH Recommendations

Recommended Exposure Limit: 10 Hr Time-Weighted Avg: 1 ppm (1.4 mg/cu m).

NIOSH. NIOSH Pocket Guide to Chemical Hazards. DHHS (NIOSH) Publication No. 97-140. Washington, D.C. U.S. Government Printing Office, 1997., p. 168

► from HSDB

## 13.3 First Aid Measures

### 13.3.1 First Aid

Excerpt from ERG Guide 143 [Oxidizers (Unstable)]: Ensure that medical personnel are aware of the material(s) involved and take precautions to protect themselves. Move victim to fresh air. Call 911 or emergency medical service. Give artificial respiration if victim is not breathing. Administer [oxygen](#) if breathing is difficult. Remove and isolate contaminated clothing and shoes. Contaminated clothing may be a fire risk when dry. In case of contact with substance, immediately flush skin or eyes with running [water](#) for at least 20 minutes. Keep victim calm and warm. (ERG, 2016)

► from CAMEO Chemicals

EYES: First check the victim for contact lenses and remove if present. Flush victim's eyes with [water](#) or normal saline solution for 20 to 30 minutes while simultaneously calling a hospital or poison control center. Do not put any ointments, oils, or medication in the victim's eyes without specific instructions from a physician. IMMEDIATELY transport the victim after flushing eyes to a hospital even if no symptoms (such as redness or irritation) develop. SKIN: IMMEDIATELY flood affected skin with [water](#) while removing and isolating all contaminated clothing. Gently wash all affected skin areas thoroughly with soap and [water](#). IMMEDIATELY call a hospital or poison control center even if no symptoms (such as redness or irritation) develop. IMMEDIATELY transport the victim to a hospital for treatment after washing the affected areas. INHALATION: IMMEDIATELY leave the contaminated area; take deep breaths of fresh air. If symptoms (such as wheezing, coughing, shortness of breath, or burning in the mouth, throat, or chest) develop, call a physician and be prepared to transport the victim to a hospital. Provide proper respiratory protection to rescuers entering an unknown atmosphere. Whenever possible, Self-Contained Breathing Apparatus (SCBA) should be used; if not available, use a level of protection greater than or equal to that advised under Protective Clothing. INGESTION: DO NOT INDUCE VOMITING. Corrosive chemicals will destroy the membranes of the mouth, throat, and esophagus and, in addition, have a high risk of being aspirated into the victim's lungs during vomiting which increases the medical problems. If the victim is conscious and not convulsing, give 1 or 2 glasses of [water](#) to dilute the chemical and IMMEDIATELY call a hospital or poison control center. IMMEDIATELY transport the victim to a hospital. If the victim is convulsing or unconscious, do not give anything by mouth, ensure that the victim's airway is open and lay the victim on his/her side with the head lower than the body. DO NOT INDUCE VOMITING. Transport the victim IMMEDIATELY to a hospital. (NTP, 1992)

► from CAMEO Chemicals

Excerpt from ERG Guide 140 [Oxidizers]: Ensure that medical personnel are aware of the material(s) involved and take precautions to protect themselves. Move victim to fresh air. Call 911 or emergency medical service. Give artificial respiration if victim is not breathing. Administer [oxygen](#) if breathing is difficult. Remove and isolate contaminated clothing and shoes. Contaminated clothing may be a fire risk when dry. In case of contact with substance, immediately flush skin or eyes with running [water](#) for at least 20 minutes. Keep victim calm and warm. (ERG, 2016)

► from CAMEO Chemicals



Signs and Symptoms of Acute Hydrogen Peroxide Exposure: Signs and symptoms of acute exposure to hydrogen peroxide may be severe and include irritation or burns to the skin, eyes, respiratory tract, mouth, esophagus, stomach, and intestines. Distension or rupture of the stomach and other hollow viscera may occur; vomiting is common. Corneal ulceration may develop. Emergency Life-Support Procedures: Acute exposure to hydrogen peroxide may require decontamination and life support for the victims. Emergency personnel should wear protective clothing appropriate to the type and degree of contamination. Air-purifying or supplied-air respiratory equipment should also be worn, as necessary. Rescue vehicles should carry supplies such as plastic sheeting and disposable plastic bags to assist in preventing spread of contamination. Inhalation Exposure: 1. Move victims to fresh air. Emergency personnel should avoid self-exposure to hydrogen peroxide. 2. Evaluate vital signs including pulse and respiratory rate, and note any trauma. If no pulse is detected, provide CPR. If not breathing, provide artificial respiration. If breathing is labored, administer [oxygen](#) or other respiratory support. 3. Obtain authorization and/or further instructions from the local hospital for administration of an antidote or performance of other invasive procedures. 4. Transport to a health care facility. Dermal/Eye Exposure: 1. Remove victims from exposure. Emergency personnel should avoid self-exposure to hydrogen peroxide. 2. Evaluate vital signs including pulse and respiratory rate, and note any trauma. If no pulse is detected, provide CPR. If not breathing, provide artificial respiration. If breathing is labored, administer [oxygen](#) or other respiratory support. 3. Remove contaminated clothing as soon as possible. 4. If eye exposure has occurred, eyes must be flushed with lukewarm [water](#) for at least 15 minutes. 5. Wash exposed skin areas THOROUGHLY with soap and [water](#). 6. Obtain authorization and/or further instructions from the local hospital for administration of an antidote or performance of other invasive procedures. 7. Transport to a health care facility. Ingestion Exposure: 1. Evaluate vital signs including pulse and respiratory rate, and note any trauma. If no pulse is detected, provide CPR. If not breathing, provide artificial respiration. If breathing is labored, administer [oxygen](#) or other respiratory support. 2. DO NOT induce vomiting or attempt to neutralize! 3. Obtain authorization and/or further instructions from the local hospital for administration of an antidote or performance of other invasive procedures. 4. Activated [charcoal](#) is of no value. 5. Give the victims [water](#) or milk: children up to 1 year old, 125 mL (4 oz or 1/2 cup); children 1 to 12 years old, 200 mL (6 oz or 3/4 cup); adults, 250 mL (8 oz or 1 cup). [Water](#) or milk should be given only if victims are conscious and alert. 6. Transport to a health care facility. (EPA, 1998)

► from CAMEO Chemicals

Move victim to fresh air. Call emergency medical care. Apply artificial respiration if victim is not breathing. Administer [oxygen](#) if breathing is difficult. Remove and isolate contaminated clothing and shoes. In case of contact with substance, immediately flush skin or eyes with running [water](#) for at least 20 minutes. Keep victim warm and quiet. Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves. (DOT, 1996)

► from OSHA Occupational Chemical DB

(See procedures)

**Eye:**Irrigate immediately

**Skin:**[Water](#) flush immediately

**Breathing:**Respiratory support

**Swallow:**Medical attention immediately

► from The National Institute for Occupational Safety and Health (NIOSH)

### 13.3.2 Inhalation First Aid

Fresh air, rest. Half-upright position. Refer for medical attention.

► from ILO-ICSC

### 13.3.3 Skin First Aid

First rinse with plenty of [water](#) for at least 15 minutes, then remove contaminated clothes and rinse again. Refer for medical attention .

► from ILO-ICSC



### 13.3.4 Eye First Aid

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First rinse with plenty of [water](#) for several minutes (remove contact lenses if easily possible), then refer for medical attention.

► from ILO-ICSC

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### 13.3.5 Ingestion First Aid

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Rinse mouth. Do NOT induce vomiting. Refer for medical attention .

► from ILO-ICSC

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## 13.4 Fire Fighting Measures

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Fires caused by the compound are best controlled by large amounts of [water](#). Chemical extinguishers should be used as they hasten decomposition of the peroxide. Fire fighters should wear goggles and self contained breathing apparatus.

*International Labour Office. Encyclopedia of Occupational Health and Safety. Vols. I&II. Geneva, Switzerland: International Labour Office, 1983., p. 1089*

► from HSDB

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[Water](#) for fires resulting from spillage.

*U.S. Coast Guard, Department of Transportation. CHRIS - Hazardous Chemical Data. Volume II. Washington, D.C.: U.S. Government Printing Office, 1984-5.*

► from HSDB

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If material involved in fire: use [water](#) in flooding quantities as fog. Cool all affected containers with flooding quantities of [water](#). Apply [water](#) from as far a distance as possible.

*Association of American Railroads. Emergency Handling of Hazardous Materials in Surface Transportation. Washington, DC: Association of American Railroads, Bureau of Explosives, 1994., p. 585*

► from HSDB

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Evacuation: If fire becomes uncontrollable - consider evacuation of one-half (1/2) mile radius.

*Association of American Railroads. Emergency Handling of Hazardous Materials in Surface Transportation. Washington, DC: Association of American Railroads, Bureau of Explosives, 1994., p. 585*

► from HSDB

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In case of fire, [water](#) should be applied by the sprinkler system or by hose from a safe distance, preferably with a fog nozzle. Foam may be necessary instead if the peroxide is diluted in a low density flammable solvent. Portable extinguishers should not be used except for very small fires. Peroxides threatened by fire should be wetted from a safe distance for cooling. /Peroxides, Organic and Inorganic/

*International Labour Office. Encyclopaedia of Occupational Health and Safety. 4th edition, Volumes 1-4 1998. Geneva, Switzerland: International Labour Office, 1998., p. 104.350*

► from HSDB

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### 13.4.1 Fire Fighting

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Excerpt from ERG Guide 143 [Oxidizers (Unstable)]: SMALL FIRE: Use [water](#). Do not use dry chemicals or foams. CO2 or [Halon](#)® may provide limited control. LARGE FIRE: Flood fire area with [water](#) from a distance. Do not move cargo or

vehicle if cargo has been exposed to heat. Move containers from fire area if you can do it without risk. Do not get [water](#) inside containers: a violent reaction may occur. FIRE INVOLVING TANKS OR CAR/TRAILER LOADS: Cool containers with flooding quantities of [water](#) until well after fire is out. Dike fire-control [water](#) for later disposal. ALWAYS stay away from tanks engulfed in fire. For massive fire, use unmanned hose holders or monitor nozzles; if this is impossible, withdraw from area and let fire burn. (ERG, 2016)

► from CAMEO Chemicals

Excerpt from ERG Guide 140 [Oxidizers]: SMALL FIRE: Use [water](#). Do not use dry chemicals or foams. CO2 or [Halon](#)® may provide limited control. LARGE FIRE: Flood fire area with [water](#) from a distance. Do not move cargo or vehicle if cargo has been exposed to heat. Move containers from fire area if you can do it without risk. FIRE INVOLVING TANKS OR CAR/TRAILER LOADS: Fight fire from maximum distance or use unmanned hose holders or monitor nozzles. Cool containers with flooding quantities of [water](#) until well after fire is out. ALWAYS stay away from tanks engulfed in fire. For massive fire, use unmanned hose holders or monitor nozzles; if this is impossible, withdraw from area and let fire burn. (ERG, 2016)

► from CAMEO Chemicals

Keep unnecessary people away; isolate hazard area and deny entry. Stay upwind; keep out of low areas. Wear self-contained (positive pressure if available) breathing apparatus and full protective clothing. Move container from fire area if you can do it without risk. Cool containers that are exposed to flames with [water](#) from the side until well after fire is out. For massive fire in cargo area, use unmanned hose holder or monitor nozzles; if this is impossible, withdraw from area and let fire burn. Not flammable. Fires should be fought with [water](#) since the use of chemical extinguishants may accelerate decomposition. Small fires: [water](#) only; no dry chemical or [carbon dioxide](#). Large fires: flood fire area with [water](#). (EPA, 1998)

► from CAMEO Chemicals

In case of fire in the surroundings, use appropriate extinguishing media. In case of fire: keep drums, etc., cool by spraying with [water](#).

► from ILO-ICSC

Use [water](#) in flooding quantities as fog. Cool all affected containers with flooding quantities of [water](#). Apply [water](#) from as far a distance as possible. (AAR, 1999)

► from OSHA Occupational Chemical DB

## 13.5 Accidental Release Measures

### 13.5.1 Isolation and Evacuation

Excerpt from ERG Guide 143 [Oxidizers (Unstable)]: As an immediate precautionary measure, isolate spill or leak area in all directions for at least 50 meters (150 feet) for liquids and at least 25 meters (75 feet) for solids. SPILL: Increase, in the downwind direction, as necessary, the isolation distance shown above. FIRE: If tank, rail car or tank truck is involved in a fire, ISOLATE for 800 meters (1/2 mile) in all directions; also, consider initial evacuation for 800 meters (1/2 mile) in all directions. (ERG, 2016)

► from CAMEO Chemicals

Excerpt from ERG Guide 140 [Oxidizers]: As an immediate precautionary measure, isolate spill or leak area in all directions for at least 50 meters (150 feet) for liquids and at least 25 meters (75 feet) for solids. LARGE SPILL: Consider initial downwind evacuation for at least 100 meters (330 feet). FIRE: If tank, rail car or tank truck is involved in a fire, ISOLATE for 800 meters (1/2 mile) in all directions; also, consider initial evacuation for 800 meters (1/2 mile) in all directions. (ERG, 2016)

► from CAMEO Chemicals

### 13.5.2 Spillage Disposal

Personal protection: chemical protection suit including self-contained breathing apparatus. Ventilation. Do NOT let this chemical enter the environment. Wash away spilled liquid with plenty of [water](#). Do NOT absorb in saw-dust or other combustible absorbents.

► from ILO-ICSC

### 13.5.3 Cleanup Methods

Dilute and drain into the sewer with abundant [water](#).

*ITII. Toxic and Hazardous Industrial Chemicals Safety Manual. Tokyo, Japan: The International Technical Information Institute, 1988., p. 278*

► from HSDB

### 13.5.4 Disposal Methods

SRP: At the time of review, criteria for land treatment or burial (sanitary landfill) disposal practices are subject to significant revision. Prior to implementing land disposal of waste residue (including waste sludge), consult with environmental regulatory agencies for guidance on acceptable disposal practices.

► from HSDB

Wear [butyl rubber](#) gloves, eye protection, and laboratory coat. A body shield should be available. In the fume hood, prepare a dilute solution (5%) of peroxide by cautiously adding to a large volume of [water](#). Gradually, with stirring, add to a 50% excess of aqueous [sodium metabisulfite](#) in a round bottom flask equipped with a thermometer. An increase in temperature indicates that the reaction is taking place. Acidify the reaction if it does not proceed spontaneously. Neutralize the reaction mixture and wash down the drain with at least 50 times its volume of [water](#).

*Armour, M.A. Hazardous Laboratory Chemicals Disposal Guide. Boca Raton, FL: CRC Press Inc., 1991., p. 183*

► from HSDB

Dilute and drain with abundant [water](#). Recommended method: Discharge to sewer. Recommendable method: Discharge to sewer. Not recommendable methods: Evaporation & oxidation. Peer-review: Extreme caution - potentially explosive. Strong oxidizing agent. Handle in new glass or polished clean [aluminum](#). Avoid inhalation. Highly unstable material. (Peer-review conclusions of an IRPTC expert consultation (May 1985))

*United Nations. Treatment and Disposal Methods for Waste Chemicals (IRPTC File). Data Profile Series No. 5. Geneva, Switzerland: United Nations Environmental Programme, Dec. 1985., p. 191*

► from HSDB

### 13.5.5 Other Preventative Measures

THE BASIC VENTILATION METHODS ARE LOCAL EXHAUST VENTILATION AND DILUTION OR GENERAL VENTILATION.

*Sax, N.I. Dangerous Properties of Industrial Materials. 5th ed. New York: Van Nostrand Reinhold, 1979., p. 730*

► from HSDB

... SUBSTITUTION OF LESS IRRITATING SUBSTANCES ... REDESIGN OF OPERATIONS ... PREVENT CONTACT, PROVISION OF A PHYSICAL BARRIER AGAINST CONTACT, PROPER WASHING FACILITIES, WORK CLOTHING AND STORAGE FACILITIES, PROTECTIVE CLOTHING, AND BARRIER CREAMS. MEDICAL CONTROL ...

*Sax, N.I. Dangerous Properties of Industrial Materials. 4th ed. New York: Van Nostrand Reinhold, 1975., p. 819*

► from HSDB

SRP: The scientific literature for the use of contact lenses in industry is conflicting. The benefit or detrimental effects of wearing contact lenses depend not only upon the substance, but also on factors including the form of the substance, characteristics and duration of the exposure, the uses of other eye protection equipment, and the hygiene of the lenses. However, there may be individual substances whose irritating or corrosive properties are such that the wearing of contact lenses would be harmful to the eye. In those specific cases, contact lenses should not be worn. In any event, the usual eye protection equipment should be worn even when contact lenses are in place.

▸ from HSDB

SRP: Contaminated protective clothing should be segregated in such a manner so that there is no direct personal contact by personnel who handle, dispose, or clean the clothing. Quality assurance to ascertain the completeness of the cleaning procedures should be implemented before the decontaminated protective clothing is returned for reuse by the workers. Contaminated clothing should not be taken home at end of shift, but should remain at employee's place of work for cleaning.

▸ from HSDB

SRP: Local exhaust ventilation should be applied wherever there is an incidence of point source emissions or dispersion of regulated contaminants in the work area. Ventilation control of the contaminant as close to its point of generation is both the most economical and safest method to minimize personnel exposure to airborne contaminants.

▸ from HSDB

The worker should immediately wash the skin when it becomes contaminated.

*NIOSH. NIOSH Pocket Guide to Chemical Hazards. DHHS (NIOSH) Publication No. 97-140. Washington, D.C. U.S. Government Printing Office, 1997., p. 169*

▸ from HSDB

Work clothing that becomes wet or significantly contaminated should be removed and replaced.

*NIOSH. NIOSH Pocket Guide to Chemical Hazards. DHHS (NIOSH) Publication No. 97-140. Washington, D.C. U.S. Government Printing Office, 1997., p. 169*

▸ from HSDB

If material not involved in fire: Keep material out of [water](#) sources and sewers. Build dikes to contain flow as necessary.

*Association of American Railroads. Emergency Handling of Hazardous Materials in Surface Transportation. Washington, DC: Association of American Railroads, Bureau of Explosives, 1994., p. 585*

▸ from HSDB

Personnel protection: Avoid breathing vapors. Keep upwind. ... Avoid bodily contact with the material. If contact with the material anticipated, wear appropriate chemical protective clothing. Do not handle broken packages unless wearing appropriate personal protective equipment. Wash away any material which may have contacted the body with copious amounts of [water](#) or soap and [water](#).

*Association of American Railroads. Emergency Handling of Hazardous Materials in Surface Transportation. Washington, DC: Association of American Railroads, Bureau of Explosives, 1994., p. 585*

▸ from HSDB

Compatible protective equipment construction materials include: [Butyl rubber](#), [neoprene](#), [neoprene](#)/styrene-butadiene rubber, nitrile rubber, [polyurethane](#), [polyvinyl chloride](#), vitan.

*Association of American Railroads. Emergency Handling of Hazardous Materials in Surface Transportation. Washington, DC: Association of American Railroads, Bureau of Explosives, 1994., p. 585*

▸ from HSDB

## 13.6 Handling and Storage

### 13.6.1 Nonfire Spill Response

Excerpt from ERG Guide 143 [Oxidizers (Unstable)]: Keep combustibles (wood, paper, oil, etc.) away from spilled material. Do not touch damaged containers or spilled material unless wearing appropriate protective clothing. Use [water](#) spray to reduce vapors or divert vapor cloud drift. Prevent entry into waterways, sewers, basements or confined areas. SMALL SPILL: Flush area with flooding quantities of [water](#). LARGE SPILL: DO NOT CLEAN-UP OR DISPOSE OF, EXCEPT UNDER SUPERVISION OF A SPECIALIST. (ERG, 2016)

► from CAMEO Chemicals

Excerpt from ERG Guide 140 [Oxidizers]: Keep combustibles (wood, paper, oil, etc.) away from spilled material. Do not touch damaged containers or spilled material unless wearing appropriate protective clothing. Stop leak if you can do it without risk. Do not get [water](#) inside containers. SMALL DRY SPILL: With clean shovel, place material into clean, dry container and cover loosely; move containers from spill area. SMALL LIQUID SPILL: Use a non-combustible material like vermiculite or sand to soak up the product and place into a container for later disposal. LARGE SPILL: Dike far ahead of liquid spill for later disposal. Following product recovery, flush area with [water](#). (ERG, 2016)

► from CAMEO Chemicals

Caution : Explosion potential is high. Hydrogen peroxide may ignite combustible materials. Keep unnecessary people away; isolate hazard area and deny entry. Stay upwind; keep out of low areas. Keep combustibles (wood, paper, oil, etc.) away from spilled material. Do not touch spilled material; stop leak if you can do it without risk. Use [water](#) spray to reduce vapors; do not get [water](#) inside container. Small dry spills: with clean shovel place material into clean, dry container and cover; move containers from spill area. Small spills: flush area with flooding amounts of [water](#). Large spills: dike far ahead of spill for later disposal. (EPA, 1998)

► from CAMEO Chemicals

Keep material out of [water](#) sources and sewers. Build dikes to contain flow as necessary. Land spill: Dig a pit, pond, lagoon, holding area to contain liquid or solid material. Dike surface flow using soil, sand bags, foamed [polyurethane](#), or foamed concrete. Dilute slowly with [water](#). Absorb bulk liquid with fly ash or cement powder. (AAR, 1999)

► from OSHA Occupational Chemical DB

### 13.6.2 Safe Storage

Separated from combustible substances, reducing agents, strong bases, metals and food and feedstuffs. Cool. Keep in the dark. Store in vented containers. Store only if stabilized.

► from ILO-ICSC

### 13.6.3 Storage Conditions

STORE IN ORIGINAL CLOSED CONTAINER. BE SURE THAT CONTAINER VENT IS WORKING... DO NOT ADD ANY OTHER PRODUCT TO CONTAINERS. WHEN EMPTY, RINSE THOROUGHLY WITH CLEAN [WATER](#). /30% SOLN/

*The Merck Index. 9th ed. Rahway, New Jersey: Merck & Co., Inc., 1976., p. 633*

► from HSDB

Storage tanks should be constructed of high-purity [aluminium](#) alloy. Undesirable contaminants must not become imbedded in the [aluminium](#) surface, and extreme care should be taken to ensure proper welding techniques. Hydrogen peroxide should be stored only in original containers or in containers of compatible materials which have been properly designed and thoroughly passivated.

*International Labour Office. Encyclopedia of Occupational Health and Safety. Vols. I&II. Geneva, Switzerland: International Labour Office, 1983., p. 1089*

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► from HSDB

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STORAGE: IN SMALL PACKAGES, SOLN OF H2O2 ARE ALWAYS KEPT IN TIGHT, LIGHT-RESISTANT BOTTLES & PREFERABLY NOT ABOVE 35 DEG C. ... HIGH CONCEN OF H2O2 ARE BEST PRESERVED IN PLASTIC (POLYETHYLENE) CONTAINERS, EQUIPPED WITH A PRESSURE RELEASE VALVE IN THE STOPPER, TO MINIMIZE EXPLOSION DUE TO DECOMPOSITION.

*Osol, A. and J.E. Hoover, et al. (eds.). Remington's Pharmaceutical Sciences. 15th ed. Easton, Pennsylvania: Mack Publishing Co., 1975., p. 376*

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► from HSDB

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Storage Temperature: Ambient; Venting: Safety relief or pressure-vacuum.

*U.S. Coast Guard, Department of Transportation. CHRIS - Hazardous Chemical Data. Volume II. Washington, D.C.: U.S. Government Printing Office, 1984-5.*

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► from HSDB

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Once removed from the original container, the hydrogen peroxide must not be returned to it. Storage containers should be properly vented and kept away from direct heat and sun and combustible materials.

*International Labour Office. Encyclopedia of Occupational Health and Safety. Vols. I&II. Geneva, Switzerland: International Labour Office, 1983., p. 1089*

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► from HSDB

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## 13.7 Exposure Control and Personal Protection

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### 13.7.1 REL

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TWA 1 ppm (1.4 mg/m<sup>3</sup>)

► from The National Institute for Occupational Safety and Health (NIOSH)

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### 13.7.2 PEL

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TWA 1 ppm (1.4 mg/m<sup>3</sup>)

► from The National Institute for Occupational Safety and Health (NIOSH)

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### 13.7.3 PEL-TWA

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1 ppm

► from OSHA Occupational Chemical DB

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1.4 mg/m<sup>3</sup>

► from OSHA Occupational Chemical DB

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### 13.7.4 REL-TWA

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1 ppm

► from OSHA Occupational Chemical DB

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1.4 mg/m<sup>3</sup>

▸ from OSHA Occupational Chemical DB

### 13.7.5 IDLH

75 ppm (NIOSH, 2016)

▸ from CAMEO Chemicals

75 ppm

▸ from OSHA Occupational Chemical DB

75 ppm

See: [772841](#)

▸ from The National Institute for Occupational Safety and Health (NIOSH)

### 13.7.6 Threshold Limit Values

8 hr Time Weighted Avg (TWA): 1 ppm

*American Conference of Governmental Industrial Hygienists TLVs and BEIs. Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices. Cincinnati, OH, 2008, p. 34*

▸ from HSDB

Excursion Limit Recommendation: Excursions in worker exposure levels may exceed 3 times the TLV-TWA for no more than a total of 30 minutes during a work day, and under no circumstances should they exceed 5 times the TLV-TWA, provided that the TLV-TWA is not exceeded.

*American Conference of Governmental Industrial Hygienists TLVs and BEIs. Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices. Cincinnati, OH, 2008, p. 5*

▸ from HSDB

A3; Confirmed animal carcinogen with unknown relevance to humans.

*American Conference of Governmental Industrial Hygienists TLVs and BEIs. Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices. Cincinnati, OH, 2008, p. 34*

▸ from HSDB

1 ppm as TWA; A3 (confirmed animal carcinogen with unknown relevance to humans).

▸ from ILO-ICSC

0.71 mg/m3, 0.5 ppm; peak limitation category: I(1); carcinogen category: 4; pregnancy risk group: C

▸ from ILO-ICSC

### 13.7.7 Other Occupational Permissible Levels

Emergency Response Planning Guidelines (ERPG): ERPG(1) 10 ppm (no more than mild, transient effects) for up to 1 hr exposure; ERPG(2) 50 ppm (without serious, adverse effects) for up to 1 hr exposure; ERPG(3) 100 ppm (not life threatening) up to 1 hr exposure.

*American Industrial Hygiene Association. The AIHA 1999 Emergency Response Planning Guidelines and Workplace Environmental Exposure Level Guides Handbook. American Industrial Hygiene Association. Fairfax, VA 1999., p. 26*

▸ from HSDB



### 13.7.8 Inhalation Risk

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A harmful contamination of the air can be reached rather quickly on evaporation of this substance at 20°C.

► *from ILO-ICSC*

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### 13.7.9 Effects of Short Term Exposure

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The substance is corrosive to the eyes and skin. The vapour is irritating to the respiratory tract. Ingestion of this substance may produce [oxygen](#) bubbles (embolism) in the blood, resulting in shock.

► *from ILO-ICSC*

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### 13.7.10 Effects of Long Term Exposure

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Repeated or prolonged inhalation of high concentrations may cause effects on the lungs. The substance may have effects on the hair. This may result in bleaching.

► *from ILO-ICSC*

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### 13.7.11 Allowable Tolerances

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An exemption from the requirement of a tolerance is established for residues of hydrogen peroxide in or on all food commodities at the rate of less than or equal to 1% hydrogen peroxide per application on growing crops and post harvest potatoes when applied as an algicide, fungicide and bactericide.

*40 CFR 180.1197 (7/1/99)*

► *from HSDB*

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### 13.7.12 Personal Protection

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([See protection codes](#))

**Skin:**Prevent skin contact

**Eyes:**Prevent eye contact

**Wash skin:**When contaminated

**Remove:**When wet or contaminated

**Change:**No recommendation

**Provide:**Eyewash, Quick drench

► *from The National Institute for Occupational Safety and Health (NIOSH)*

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### 13.7.13 Respirator Recommendations

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#### NIOSH/OSHA

##### Up to 10 ppm:

(APF = 10) Any supplied-air respirator\*

##### Up to 25 ppm:

(APF = 25) Any supplied-air respirator operated in a continuous-flow mode\*



**Up to 50 ppm:**

(APF = 50) Any self-contained breathing apparatus with a full facepiece

(APF = 50) Any supplied-air respirator with a full facepiece

**Up to 75 ppm:**

(APF = 2000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

**Emergency or planned entry into unknown concentrations or IDLH conditions:**

(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**

(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern

Any appropriate escape-type, self-contained breathing apparatus

[Important additional information about respirator selection](#)

► *from The National Institute for Occupational Safety and Health (NIOSH)*

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### 13.7.14 Fire Prevention

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NO contact with combustible substances or reducing agents. NO contact with hot surfaces.

► *from ILO-ICSC*

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### 13.7.15 Exposure Prevention

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PREVENT GENERATION OF MISTS! AVOID ALL CONTACT! IN ALL CASES CONSULT A DOCTOR!

► *from ILO-ICSC*

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### 13.7.16 Inhalation Prevention

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Use ventilation, local exhaust or breathing protection.

► *from ILO-ICSC*

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### 13.7.17 Skin Prevention

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Protective gloves. Protective clothing.

► *from ILO-ICSC*

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### 13.7.18 Eye Prevention

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Wear safety goggles or face shield.

► *from ILO-ICSC*

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### 13.7.19 Ingestion Prevention

Do not eat, drink, or smoke during work.

▸ from ILO-ICSC

### 13.7.20 Protective Equipment and Clothing

Excerpt from ERG Guide 143 [Oxidizers (Unstable)]: Wear positive pressure self-contained breathing apparatus (SCBA). Wear chemical protective clothing that is specifically recommended by the manufacturer. It may provide little or no thermal protection. Structural firefighters' protective clothing provides limited protection in fire situations ONLY; it is not effective in spill situations where direct contact with the substance is possible. (ERG, 2016)

▸ from CAMEO Chemicals

Excerpt from ERG Guide 140 [Oxidizers]: Wear positive pressure self-contained breathing apparatus (SCBA). Wear chemical protective clothing that is specifically recommended by the manufacturer. It may provide little or no thermal protection. Structural firefighters' protective clothing will only provide limited protection. (ERG, 2016)

▸ from CAMEO Chemicals

Skin: Wear appropriate personal protective clothing to prevent skin contact. Eyes: Wear appropriate eye protection to prevent eye contact. Wash skin: The worker should immediately wash the skin when it becomes contaminated. Remove: Work clothing that becomes wet or significantly contaminated should be removed and replaced. Change: No recommendation is made specifying the need for the worker to change clothing after the work shift. Provide: Eyewash fountains should be provided in areas where there is any possibility that workers could be exposed to the substance; this is irrespective of the recommendation involving the wearing of eye protection. Facilities for quickly drenching the body should be provided within the immediate work area for emergency use where there is a possibility of exposure. [Note: It is intended that these facilities provide a sufficient quantity or flow of [water](#) to quickly remove the substance from any body areas likely to be exposed. The actual determination of what constitutes an adequate quick drench facility depends on the specific circumstances. In certain instances, a deluge shower should be readily available, whereas in others, the availability of [water](#) from a sink or hose could be considered adequate.] (NIOSH, 2016)

▸ from CAMEO Chemicals

Wear appropriate personal protective clothing to prevent skin contact.

*NIOSH. NIOSH Pocket Guide to Chemical Hazards. DHHS (NIOSH) Publication No. 97-140. Washington, D.C. U.S. Government Printing Office, 1997., p. 169*

▸ from HSDB

Wear appropriate eye protection to prevent eye contact.

*NIOSH. NIOSH Pocket Guide to Chemical Hazards. DHHS (NIOSH) Publication No. 97-140. Washington, D.C. U.S. Government Printing Office, 1997., p. 169*

▸ from HSDB

Eyewash fountains should be provided in areas where there is any possibility that workers could be exposed to the substance; this is irrespective of the recommendation involving the wearing of eye protection.

*NIOSH. NIOSH Pocket Guide to Chemical Hazards. DHHS (NIOSH) Publication No. 97-140. Washington, D.C. U.S. Government Printing Office, 1997., p. 169*

▸ from HSDB

Facilities for quickly drenching the body should be provided within the immediate work area for emergency use where there is a possibility of exposure. [Note: It is intended that these facilities provide a sufficient quantity or flow of [water](#) to quickly remove the substance from any body areas likely to be exposed. The actual determination of what constitutes an

adequate quick drench facility depends on the specific circumstances. In certain instances, a deluge shower should be readily available, whereas in others, the availability of [water](#) from a sink or hose could be considered adequate.]

*NIOSH. NIOSH Pocket Guide to Chemical Hazards. DHHS (NIOSH) Publication No. 97-140. Washington, D.C. U.S. Government Printing Office, 1997., p. 169*

► from HSDB

Recommendations for respirator selection. Max concn for use: 10 ppm. Respirator Class(es): Any supplied-air respirator. May require eye protection.

*NIOSH. NIOSH Pocket Guide to Chemical Hazards. DHHS (NIOSH) Publication No. 97-140. Washington, D.C. U.S. Government Printing Office, 1997., p. 169*

► from HSDB

Recommendations for respirator selection. Max concn for use: 25 ppm. Respirator Class(es): Any supplied-air respirator operated in a continuous flow mode. May require eye protection.

*NIOSH. NIOSH Pocket Guide to Chemical Hazards. DHHS (NIOSH) Publication No. 97-140. Washington, D.C. U.S. Government Printing Office, 1997., p. 169*

► from HSDB

Recommendations for respirator selection. Max concn for use: 50 ppm. Respirator Class(es): Any self-contained breathing apparatus with a full facepiece. Any supplied-air respirator with a full facepiece.

*NIOSH. NIOSH Pocket Guide to Chemical Hazards. DHHS (NIOSH) Publication No. 97-140. Washington, D.C. U.S. Government Printing Office, 1997., p. 169*

► from HSDB

Recommendations for respirator selection. Max concn for use: 75 ppm. Respirator Class(es): Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode.

*NIOSH. NIOSH Pocket Guide to Chemical Hazards. DHHS (NIOSH) Publication No. 97-140. Washington, D.C. U.S. Government Printing Office, 1997., p. 169*

► from HSDB

Recommendations for respirator selection. Condition: Emergency or planned entry into unknown concn or IDLH conditions: Respirator Class(es): Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive pressure mode. Any supplied-air respirator with a full facepiece and operated in pressure-demand or other positive pressure mode in combination with an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive pressure mode.

*NIOSH. NIOSH Pocket Guide to Chemical Hazards. DHHS (NIOSH) Publication No. 97-140. Washington, D.C. U.S. Government Printing Office, 1997., p. 169*

► from HSDB

Recommendations for respirator selection. Condition: Escape from suddenly occurring respiratory hazards: Respirator Class(es): Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern. Any appropriate escape-type, self-contained breathing apparatus.

*NIOSH. NIOSH Pocket Guide to Chemical Hazards. DHHS (NIOSH) Publication No. 97-140. Washington, D.C. U.S. Government Printing Office, 1997., p. 169*

► from HSDB

Protective garments, both outer and inner, made of a woven polyester fabric or of modacrylic or polyvinylidene fabrics; impermeable apron made of [polyvinyl chloride](#) or [polyethylene](#) film; [neoprene](#) gloves and boots; goggles.

*U.S. Coast Guard, Department of Transportation. CHRIS - Hazardous Chemical Data. Volume II. Washington, D.C.: U.S. Government Printing Office, 1984-5.*

► from HSDB

Persons handling peroxides should use safety glasses with side shields, goggles or face shield for eye protection. Emergency eyewash facilities should be provided. Gloves, aprons and other protective clothing as necessary should be used to prevent skin contact. Clothing and equipment that generate static electricity should be avoided. Smoking should be prohibited. /Peroxides, Organic and Inorganic/

*International Labour Office. Encyclopaedia of Occupational Health and Safety. 4th edition, Volumes 1-4 1998. Geneva, Switzerland: International Labour Office, 1998., p. 104.350*

► from HSDB

## 13.8 Stability and Reactivity

### 13.8.1 Air and Water Reactions

An aqueous solution.

► from CAMEO Chemicals

An aqueous solution that is readily diluted.

► from CAMEO Chemicals

Water soluble.

► from CAMEO Chemicals

### 13.8.2 Reactive Group

Oxidizing Agents, Strong  
[Water](#) and Aqueous Solutions

► from CAMEO Chemicals

Oxidizing Agents, Strong

► from CAMEO Chemicals

### 13.8.3 Reactivity Alerts

Explosive  
Strong Oxidizing Agent

► from CAMEO Chemicals

Strong Oxidizing Agent

► from CAMEO Chemicals

#### 13.8.3.1 Pistoia Alliance CSL Reactivity Alerts

Pistoia Alliance CSL Reactivity Alerts: 1 of 5 (Pistoia Alliance CSL Reaction Information)	
CSL No	CSL00009
Reactants/Reagents	<a href="#">ACETONE</a> ; Hydrogen peroxide

Pistoia Alliance CSL Reactivity Alerts: 1 of 5 (Pistoia Alliance CSL Reaction Information)	
GHS Category	Explosive
Warning Message	Formation of <a href="#">acetone peroxides</a> possible. Try to avoid combination or check for peroxides
Source Reference	ACS Safety Letters
CSL Status	Approved
Modified Date	12/12/2017

► *from Pistoia Alliance Chemical Safety Library*

Pistoia Alliance CSL Reactivity Alerts: 2 of 5 (Pistoia Alliance CSL Reaction Information)	
CSL No	CSL00021
Reactants/Reagents	<a href="#">Acetic anhydride</a> ; Hydrogen peroxide
Reaction Class	oxidation
GHS Category	Explosive
Warning Message	explosion hazard: anhydride could have combined with <a href="#">peracetic acid</a> to form <a href="#">diacetyl peroxide</a> . This organic peroxide is known to be a shock-sensitive explosive
Source Reference	C&EN
CSL Status	Approved
Modified Date	12/12/2017

► *from Pistoia Alliance Chemical Safety Library*

Pistoia Alliance CSL Reactivity Alerts: 3 of 5 (Pistoia Alliance CSL Reaction Information)	
CSL No	CSL00022
Reactants/Reagents	Hydrogen peroxide; DMSO
GHS Category	Gas Under Pressure
Warning Message	Overpressurization Hazard if heated above 150 degrees C
Source Reference	C&EN
CSL Status	Approved
Modified Date	12/12/2017

► *from Pistoia Alliance Chemical Safety Library*

[View All 5 Pistoia Alliance CSL Reactivity Alerts](#)

### 13.8.4 Reactivity Profile

HYDROGEN PEROXIDE, AQUEOUS SOLUTION, STABILIZED, WITH MORE THAN 60% HYDROGEN PEROXIDE is a powerful oxidizing agent. Will react or decompose violently and exothermically with readily oxidizable materials or alkaline

substances. May decompose violently in contact with [iron](#), [copper](#), [chromium](#), and most other metals or their salts, which act as catalysts for this reaction, and with ordinary dust (which frequently contain rust, also a catalyst for this reaction). Stabilization operates against such reactions, but does not eliminate their possibility. Contact with combustible materials may result in their spontaneous ignition. Solutions containing over 30% hydrogen peroxide can detonate when mixed with organic solvents (such as [acetone](#), [ethanol](#), [glycerol](#)); the violence of the explosion increases with increasing concentration of the hydrogen peroxide. Concentration of solutions of hydrogen peroxide under vacuum led to violent explosions when the concentration was sufficiently high (>90%) [Bretherick 2nd ed., 1979]. Mixtures of aqueous hydrogen peroxide with 1-phenyl-2-methyl propyl alcohol tend to explode if acidified with 70% [sulfuric acid](#) [Chem. Eng. News 45(43):73(1967); J. Org. Chem. 28:1893(1963)]. [Hydrogen selenide](#) and hydrogen peroxide undergo a very rapid reaction [Mellor 1:941(1946-1947)].

► from CAMEO Chemicals

The hazards associated with the use of HYDROGEN PEROXIDE (especially highly concentrated solutions) are well documented. There is a release of enough energy during the catalytic decomposition of 65% peroxide to evaporate all [water](#) and ignite nearby combustible materials. Most [cellulose](#) materials contain enough catalyst to cause spontaneous ignition with 90% peroxide. Contamination of concentrated peroxide causes the possibility of explosion. Readily oxidizable materials, or alkaline substances containing heavy metals may react violently. Solvents([acetone](#), [ethanol](#), [glycerol](#)) will detonate on mixture with peroxide of over 30% concentration, the violence increasing with concentration. Concentrated peroxide may decompose violently in contact with [iron](#), [copper](#), [chromium](#), and most other metals or their salts, and dust(which frequently contain rust). During concentration under vacuum of aqueous or of aqueous-alcoholic solutions of hydrogen peroxide, violent explosions occurred when the concentration was sufficiently high(>90%), [Bretherick 2nd ed., 1979]. Mixtures of alcohols with concentrated [sulfuric acid](#) and strong hydrogen peroxide can cause explosions. Example: An explosion will occur if [dimethylbenzylcarbinol](#) is added to 90% hydrogen peroxide then acidified with concentrated [sulfuric acid](#). Mixtures of [ethyl alcohol](#) with concentrated hydrogen peroxide form powerful explosives. Mixtures of hydrogen peroxide and 1-phenyl-2-methyl propyl alcohol tend to explode if acidified with 70% [sulfuric acid](#), [Chem. Eng. News 45(43):73(1967); J. Org. Chem. 28:1893(1963)]. [Hydrogen selenide](#) and hydrogen peroxide undergo a very rapid decomposition, [Mellor 1:941(1946-1947)].

► from CAMEO Chemicals

The hazards associated with the use of HYDROGEN PEROXIDE(especially highly concentrated solutions) are well documented. There is a release of enough energy during the catalytic decomposition of 65% peroxide to evaporate all [water](#) and ignite nearby combustible materials. Most [cellulose](#) materials contain enough catalyst to cause spontaneous ignition with 90% peroxide. Contamination of concentrated peroxide causes the possibility of explosion. Readily oxidizable materials, or alkaline substances containing heavy metals may react violently. Solvents([acetone](#), [ethanol](#), [glycerol](#)) will detonate on mixture with peroxide of over 30% concentration, the violence increasing with concentration. Concentrated peroxide may decompose violently in contact with [iron](#), [copper](#), [chromium](#), and most other metals or their salts, and dust(which frequently contain rust). During concentration under vacuum of aqueous or of aqueous-alcoholic solutions of hydrogen peroxide, violent explosions occurred when the concentration was sufficiently high(>90%), [Bretherick 2nd ed., 1979]. Mixtures of alcohols with concentrated [sulfuric acid](#) and strong hydrogen peroxide can cause explosions. Example: An explosion will occur if [dimethylbenzylcarbinol](#) is added to 90% hydrogen peroxide then acidified with concentrated [sulfuric acid](#). Mixtures of [ethyl alcohol](#) with concentrated hydrogen peroxide form powerful explosives. Mixtures of hydrogen peroxide and 1-phenyl-2-methyl propyl alcohol tend to explode if acidified with 70% [sulfuric acid](#), [Chem. Eng. News 45(43):73(1967); J. Org. Chem. 28:1893(1963)]. [Hydrogen selenide](#) and hydrogen peroxide undergo a very rapid decomposition, [Mellor 1:941(1946-1947)].

► from CAMEO Chemicals

### 13.8.5 Reactivities and Incompatibilities

Oxidizable materials, [iron](#), [copper](#), brass, bronze, [chromium](#), [zinc](#), lead, [silver](#), [manganese](#) [Note: Contact with combustible material may result in SPONTANEOUS combustion].

NIOSH. NIOSH Pocket Guide to Chemical Hazards. DHHS (NIOSH) Publication No. 97-140. Washington, D.C. U.S. Government Printing Office, 1997., p. 168

► from HSDB



Most [cellulose](#) materials contain enough catalyst to cause spontaneous ignition with 90% peroxide. Soluble fuels ([acetone](#), [ethanol](#), [glycerol](#)) will detonate on admixture with peroxide of over 30% concentration, the violence increasing with concentration. Handling systems must exclude fittings of [iron](#), brass, [copper](#), Monel, and screwed joints caulked with red lead. /Explosive with acetic acid, acetic anhydride, [acetone](#), alcohols, carboxylic acids, [nitrogen](#)-containing bases, organic compounds./ Addition of [charcoal](#) to concentrated peroxide results in violent decomposition.

*Armour, M.A. Hazardous Laboratory Chemicals Disposal Guide. Boca Raton, FL: CRC Press Inc., 1991., p. 181*

► from HSDB

The solid peroxide produced by action of hydrogen peroxide and [nitric acid](#) on [thiourea](#) (and possibly a [hydrogen peroxide](#) of [thiourea dioxide](#)) decomposed violently on drying in air, with evolution of [sulfur dioxide](#) and free [sulfur](#).

*Bretherick, L. Handbook of Reactive Chemical Hazards. 4th ed. Boston, MA: Butterworth-Heinemann Ltd., 1990, p. 1211*

► from HSDB

Concentrated peroxide may decompose violently in contact with [iron](#), [copper](#), [chromium](#) and most other metals and their salts, and dust.

*Bretherick, L. Handbook of Reactive Chemical Hazards. 4th ed. Boston, MA: Butterworth-Heinemann Ltd., 1990, p. 1199*

► from HSDB

The violent decomposition observed on adding [charcoal](#) to concentrated hydrogen peroxide is mainly owing to catalysis by metallic impurities present and the active surface of the [charcoal](#), rather than to direct oxidation of the [carbon](#).

*Bretherick, L. Handbook of Reactive Chemical Hazards. 4th ed. Boston, MA: Butterworth-Heinemann Ltd., 1990, p. 1204*

► from HSDB

CHEMICAL PROFILE: The hazards associated with the use of hydrogen peroxide (especially highly concentrated solutions) are well documented. There is a release of enough energy during the catalytic decomposition of 65% peroxide to evaporate all [water](#) and ignite nearby combustible materials. Most [cellulose](#) materials contain enough catalyst to cause spontaneous ignition with 90% peroxide. Contamination of concentrated peroxide causes the possibility of explosion. Readily oxidizable materials, or alkaline substances containing heavy metals may react violently. Solvents ([acetone](#), [ethanol](#), [glycerol](#)) will detonate on mixture with peroxide of over 30% concentration, the violence increasing with concentration. Concentrated peroxide may decompose violently in contact with [iron](#), [copper](#), [chromium](#), and most other metals or their salts, and dust (which frequently contain rust). During concentration under vacuum of aqueous or of aqueous-alcoholic solutions of hydrogen peroxide, violent explosions occurred when the concentration was sufficiently high (>90%), Bretherick 2nd ed., 1979. Mixtures of alcohols with concentrated [sulfuric acid](#) and strong hydrogen peroxide can cause explosions. Example: An explosion will occur if [dimethylbenzylcarbinol](#) is added to 90% hydrogen peroxide then acidified with concentrated [sulfuric acid](#). Mixtures of [ethyl alcohol](#) with concentrated hydrogen peroxide form powerful explosives. Mixtures of hydrogen peroxide and 1-phenyl-2-methyl propyl alcohol tend to explode if acidified with 70% [sulfuric acid](#), Chem. Eng. News 45(43):73(1967); J. Org. Chem. 28:1893(1963). [Hydrogen selenide](#) and hydrogen peroxide undergo a very rapid decomposition, Mellor 1:941(1946-1947). (REACTIVITY, 1999)

► from OSHA Occupational Chemical DB

Oxidizable materials, [iron](#), [copper](#), brass, bronze, [chromium](#), [zinc](#), lead, [silver](#), [manganese](#). [Note: Contact with combustible material may result in SPONTANEOUS combustion.]

► from The National Institute for Occupational Safety and Health (NIOSH)

## 13.9 Transport Information

### 13.9.1 DOT Emergency Guidelines

/GUIDE 140: OXIDIZERS/ Fire or Explosion: These substances will accelerate burning when involved in a fire. Some may decompose explosively when heated or involved in a fire. May explode from heat or contamination. Some will react

explosively with hydrocarbons (fuels). May ignite combustibles (wood, paper, oil, clothing, etc.). Containers may explode when heated. Runoff may create fire or explosion hazard. /Hydrogen peroxide, aqueous solution, with not less than 8% but less than 20% Hydrogen peroxide; Hydrogen peroxide, aqueous solution, with not less than 20% but not more than 60% Hydrogen peroxide (stabilized as necessary)/

*U.S. Department of Transportation. 2004 Emergency Response Guidebook. A Guide book for First Responders During the Initial Phase of a Dangerous Goods/Hazardous Materials Incident. Washington, D.C. 2004*

► from HSDB

/GUIDE 140: OXIDIZERS/ Health: Inhalation, ingestion or contact (skin, eyes) with vapors or substance may cause severe injury, burns or death. Fire may produce irritating, corrosive and/or toxic gases. Runoff from fire control or dilution [water](#) may cause pollution. /Hydrogen peroxide, aqueous solution, with not less than 8% but less than 20% Hydrogen peroxide; Hydrogen peroxide, aqueous solution, with not less than 20% but not more than 60% Hydrogen peroxide (stabilized as necessary)/

*U.S. Department of Transportation. 2004 Emergency Response Guidebook. A Guide book for First Responders During the Initial Phase of a Dangerous Goods/Hazardous Materials Incident. Washington, D.C. 2004*

► from HSDB

/GUIDE 140: OXIDIZERS/ Public Safety: CALL Emergency Response Telephone Number ... . As an immediate precautionary measure, isolate spill or leak area in all directions for at least 50 meters (150 feet) for liquids and at least 25 meters (75 feet) for solids. Keep unauthorized personnel away. Stay upwind. Keep out of low areas. Ventilate closed spaces before entering. /Hydrogen peroxide, aqueous solution, with not less than 8% but less than 20% Hydrogen peroxide; Hydrogen peroxide, aqueous solution, with not less than 20% but not more than 60% Hydrogen peroxide (stabilized as necessary)/

*U.S. Department of Transportation. 2004 Emergency Response Guidebook. A Guide book for First Responders During the Initial Phase of a Dangerous Goods/Hazardous Materials Incident. Washington, D.C. 2004*

► from HSDB

/GUIDE 140: OXIDIZERS/ Protective Clothing: Wear positive pressure self-contained breathing apparatus (SCBA). Wear chemical protective clothing that is specifically recommended by the manufacturer. It may provide little or no thermal protection. Structural firefighters' protective clothing will only provide limited protection. /Hydrogen peroxide, aqueous solution, with not less than 8% but less than 20% Hydrogen peroxide; Hydrogen peroxide, aqueous solution, with not less than 20% but not more than 60% Hydrogen peroxide (stabilized as necessary)/

*U.S. Department of Transportation. 2004 Emergency Response Guidebook. A Guide book for First Responders During the Initial Phase of a Dangerous Goods/Hazardous Materials Incident. Washington, D.C. 2004*

► from HSDB

/GUIDE 140: OXIDIZERS/ Evacuation: Large spill: Consider initial downwind evacuation for at least 100 meters (330 feet). Fire: If tank, rail car or tank truck is involved in a fire, ISOLATE for 800 meters (1/2 mile) in all directions; also, consider initial evacuation for 800 meters (1/2 mile) in all directions. /Hydrogen peroxide, aqueous solution, with not less than 8% but less than 20% Hydrogen peroxide; Hydrogen peroxide, aqueous solution, with not less than 20% but not more than 60% Hydrogen peroxide (stabilized as necessary)/

*U.S. Department of Transportation. 2004 Emergency Response Guidebook. A Guide book for First Responders During the Initial Phase of a Dangerous Goods/Hazardous Materials Incident. Washington, D.C. 2004*

► from HSDB

/GUIDE 140: OXIDIZERS/ Fire: Small fires: Use [water](#). Do not use dry chemicals or foams. CO<sub>2</sub>, or [Halon](#) may provide limited control. Large fires: Flood fire area with [water](#) from a distance. Move containers from fire area if you can do it without risk. Do not move cargo or vehicle if cargo has been exposed to heat. Fight fire from maximum distance or use unmanned hose holders or monitor nozzles. Cool containers with flooding quantities of [water](#) until well after fire is out. ALWAYS stay away from tanks engulfed in fire. For massive fire, use unmanned hose holders or monitor nozzles; if this is impossible, withdraw from area and let fire burn. /Hydrogen peroxide, aqueous solution, with not less than 8% but less than 20% Hydrogen peroxide; Hydrogen peroxide, aqueous solution, with not less than 20% but not more than 60% Hydrogen peroxide (stabilized as necessary)/

*U.S. Department of Transportation. 2004 Emergency Response Guidebook. A Guide book for First Responders During the Initial Phase of a Dangerous Goods/Hazardous Materials Incident. Washington, D.C. 2004*



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▶ from HSDB

/GUIDE 140: OXIDIZERS/ Spill or Leak: Keep combustibles (wood, paper, oil, etc.) away from spilled material. Do not touch damaged containers or spilled material unless wearing appropriate protective clothing. Stop leak if you can do it without risk. Do not get [water](#) inside containers. Small dry spills: With clean shovel place material into clean, dry container and cover loosely; move containers from spill area. Small liquid spills: Use a non-combustible material like vermiculite or sand to soak up the product and place into a container for later disposal. Large spills: Dike far ahead of liquid spill for later disposal. Following product recovery, flush area with [water](#). /Hydrogen peroxide, aqueous solution, with not less than 8% but less than 20% Hydrogen peroxide; Hydrogen peroxide, aqueous solution, with not less than 20% but not more than 60% Hydrogen peroxide (stabilized as necessary)/

*U.S. Department of Transportation. 2004 Emergency Response Guidebook. A Guide book for First Responders During the Initial Phase of a Dangerous Goods/Hazardous Materials Incident. Washington, D.C. 2004*

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▶ from HSDB

/GUIDE 140: OXIDIZERS/ First Aid: Move victim to fresh air. Call 911 or emergency medical service. Give artificial respiration if victim is not breathing. Administer [oxygen](#) if breathing is difficult. Remove and isolate contaminated clothing and shoes. Contaminated clothing may be a fire risk when dry. In case of contact with substance, immediately flush skin or eyes with running [water](#) for at least 20 minutes. Keep victim warm and quiet. Ensure that medical personnel are aware of the material(s) involved and take precautions to protect themselves. /Hydrogen peroxide, aqueous solution, with not less than 8% but less than 20% Hydrogen peroxide; Hydrogen peroxide, aqueous solution, with not less than 20% but not more than 60% Hydrogen peroxide (stabilized as necessary)/

*U.S. Department of Transportation. 2004 Emergency Response Guidebook. A Guide book for First Responders During the Initial Phase of a Dangerous Goods/Hazardous Materials Incident. Washington, D.C. 2004*

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▶ from HSDB

/GUIDE 143: OXIDIZERS (UNSTABLE)/ Fire or Explosion: May explode from friction, heat or contamination. These substances will accelerate burning when involved in a fire. May ignite combustibles (wood, paper, oil, clothing, etc.). Some will react explosively with hydrocarbons (fuels). Containers may explode when heated. Runoff may create fire or explosion hazard. /Hydrogen peroxide, aqueous solution, stabilized, with more than 60% Hydrogen peroxide; Hydrogen peroxide, stabilized/

*U.S. Department of Transportation. 2004 Emergency Response Guidebook. A Guide book for First Responders During the Initial Phase of a Dangerous Goods/Hazardous Materials Incident. Washington, D.C. 2004*

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▶ from HSDB

/GUIDE 143: OXIDIZERS (UNSTABLE)/ Health: TOXIC; inhalation, ingestion or contact (skin, eyes) with vapors, dusts or substance may cause severe injury, burns, or death. Fire may produce irritating and/or toxic gases. Toxic fumes or dust may accumulate in confined areas (basement, tanks, hopper/tank cars, etc.). Runoff from fire control or dilution [water](#) may cause pollution. /Hydrogen peroxide, aqueous solution, stabilized, with more than 60% Hydrogen peroxide; Hydrogen peroxide, stabilized/

*U.S. Department of Transportation. 2004 Emergency Response Guidebook. A Guide book for First Responders During the Initial Phase of a Dangerous Goods/Hazardous Materials Incident. Washington, D.C. 2004*

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▶ from HSDB

/GUIDE 143: OXIDIZERS (UNSTABLE)/ Public Safety: CALL Emergency Response Telephone Number ... . As an immediate precautionary measure, isolate spill or leak area in all directions for at least 50 meters (150 feet) for liquids and at least 25 meters (75 feet) for solids. Keep unauthorized personnel away. Stay upwind. Keep out of low areas. Ventilate closed spaces before entering. /Hydrogen peroxide, aqueous solution, stabilized, with more than 60% Hydrogen peroxide; Hydrogen peroxide, stabilized/

*U.S. Department of Transportation. 2004 Emergency Response Guidebook. A Guide book for First Responders During the Initial Phase of a Dangerous Goods/Hazardous Materials Incident. Washington, D.C. 2004*

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▶ from HSDB

/GUIDE 143: OXIDIZERS (UNSTABLE)/ Protective Clothing: Wear positive pressure self-contained breathing apparatus (SCBA). Wear chemical protective clothing that is specifically recommended by the manufacturer. It may provide little or

no thermal protection. Structural firefighters' protective clothing provides limited protection in fire situations ONLY; it is not effective in spill situations where direct contact with the substance is possible. /Hydrogen peroxide, aqueous solution, stabilized, with more than 60% Hydrogen peroxide; Hydrogen peroxide, stabilized/

*U.S. Department of Transportation. 2004 Emergency Response Guidebook. A Guide book for First Responders During the Initial Phase of a Dangerous Goods/Hazardous Materials Incident. Washington, D.C. 2004*

► from HSDB

/GUIDE 143: OXIDIZERS (UNSTABLE)/ Evacuation: ... Fire: If tank, rail car or tank truck is involved in a fire, ISOLATE for 800 meters (1/2 mile) in all directions; also, consider initial evacuation for 800 meters (1/2 mile) in all directions. /Hydrogen peroxide, aqueous solution, stabilized, with more than 60% Hydrogen peroxide; Hydrogen peroxide, stabilized/

*U.S. Department of Transportation. 2004 Emergency Response Guidebook. A Guide book for First Responders During the Initial Phase of a Dangerous Goods/Hazardous Materials Incident. Washington, D.C. 2004*

► from HSDB

/GUIDE 143: OXIDIZERS (UNSTABLE)/ Fire: Small fires: Use [water](#). Do not use dry chemicals or foams. CO2 or [Halon](#) may provide limited control. Large fires: Flood fire area with [water](#) from a distance. Do not move cargo or vehicle if cargo has been exposed to heat. Move containers from fire area if you can do it without risk. Do not get [water](#) inside containers: a violent reaction may occur. Cool containers with flooding quantities of [water](#) until well after fire is out. Dike fire-control [water](#) for later disposal. ALWAYS stay away from tanks engulfed in fire. For massive fire, use unmanned hose holders or monitor nozzles; if this is impossible, withdraw from area and let fire burn. /Hydrogen peroxide, aqueous solution, stabilized, with more than 60% Hydrogen peroxide; Hydrogen peroxide, stabilized/

*U.S. Department of Transportation. 2004 Emergency Response Guidebook. A Guide book for First Responders During the Initial Phase of a Dangerous Goods/Hazardous Materials Incident. Washington, D.C. 2004*

► from HSDB

/GUIDE 143: OXIDIZERS (UNSTABLE)/ Spill or Leak: Keep combustibles (wood, paper, oil, etc.) away from spilled material. Do not touch damaged containers or spilled material unless wearing appropriate protective clothing. Use [water](#) spray to reduce vapors or divert vapor cloud drift. Prevent entry into waterways, sewers, basements or confined areas. Small spills: Flush area with flooding quantities of [water](#). Large spills: DO NOT CLEAN-UP OR DISPOSE OF, EXCEPT UNDER SUPERVISION OF A SPECIALIST. /Hydrogen peroxide, aqueous solution, stabilized, with more than 60% Hydrogen peroxide; Hydrogen peroxide, stabilized/

*U.S. Department of Transportation. 2004 Emergency Response Guidebook. A Guide book for First Responders During the Initial Phase of a Dangerous Goods/Hazardous Materials Incident. Washington, D.C. 2004*

► from HSDB

/GUIDE 143: OXIDIZERS (UNSTABLE)/ First Aid: Move victim to fresh air. Call 911 or emergency medical service. Give artificial respiration if victim is not breathing. Administer [oxygen](#) if breathing is difficult. Remove and isolate contaminated clothing and shoes. Contaminated clothing may be a fire risk when dry. In case of contact with substance, immediately flush skin or eyes with running [water](#) for at least 20 minutes. Keep victim warm and quiet. Ensure that medical personnel are aware of the material(s) involved and take precautions to protect themselves. /Hydrogen peroxide, aqueous solution, stabilized, with more than 60% Hydrogen peroxide; Hydrogen peroxide, stabilized/

*U.S. Department of Transportation. 2004 Emergency Response Guidebook. A Guide book for First Responders During the Initial Phase of a Dangerous Goods/Hazardous Materials Incident. Washington, D.C. 2004*

► from HSDB

## 13.9.2 Shipment Methods and Regulations

No person may /transport,/ offer or accept a hazardous material for transportation in commerce unless that person is registered in conformance ... and the hazardous material is properly classed, described, packaged, marked, labeled, and in condition for shipment as required or authorized by ... /the hazardous materials regulations (49 CFR 171-177)./

49 CFR 171.2; U.S. National Archives and Records Administration's Electronic Code of Federal Regulations. Available from, as of February 15, 2006: <http://www.ecfr.gov>

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► *from HSDB*

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The International Air Transport Association (IATA) Dangerous Goods Regulations are published by the IATA Dangerous Goods Board pursuant to IATA Resolutions 618 and 619 and constitute a manual of industry carrier regulations to be followed by all IATA Member airlines when transporting hazardous materials.

*International Air Transport Association. Dangerous Goods Regulations. 47th Edition. Montreal, Quebec Canada. 2006., p. 203*

► *from HSDB*

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The International Maritime Dangerous Goods Code lays down basic principles for transporting hazardous chemicals. Detailed recommendations for individual substances and a number of recommendations for good practice are included in the classes dealing with such substances. A general index of technical names has also been compiled. This index should always be consulted when attempting to locate the appropriate procedures to be used when shipping any substance or article.

*International Maritime Organization. International Maritime Dangerous Goods Code. London, UK. 2004., p. 98, 144*

► *from HSDB*

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### 13.9.3 DOT ID and Guide

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2984 140(8-20% solution)

2014 140(20-60% solution)

2015 143(>60% solution)

► *from The National Institute for Occupational Safety and Health (NIOSH)*

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### 13.9.4 DOT Label

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Oxidizer Corrosive

► *from CAMEO Chemicals*

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Oxidizer

► *from CAMEO Chemicals*

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### 13.9.5 Packaging and Labelling

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Special material.

► *from ILO-ICSC*

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### 13.9.6 EC Classification

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Symbol: O, C; R: 5-8-20/22-35; S: (1/2)-17-26-28-36/37/39-45; Note: B

► *from ILO-ICSC*

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### 13.9.7 UN Classification

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UN Hazard Class: 5.1; UN Subsidiary Risks: 8; UN Pack Group: I

► *from ILO-ICSC*

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## 13.10 Regulatory Information

### 13.10.1 DOT Emergency Response Guide

**140 OXIDIZERS POTENTIAL HAZARDS FIRE OR EXPLOSION** \* These substances will accelerate burning when involved in a fire. \* Some may decompose explosively when heated or involved in a fire. \* May explode from heat or contamination. \* Some will react explosively with hydrocarbons (fuels). \* May ignite combustibles (wood, paper, oil, clothing, etc.). \* Containers may explode when heated. \* Runoff may create fire or explosion hazard. **HEALTH** \* Inhalation, ingestion or contact (skin, eyes) with vapors or substance may cause severe injury, burns or death. \* Fire may produce irritating, corrosive and/or toxic gases. \* Runoff from fire control or dilution [water](#) may cause pollution. **PUBLIC SAFETY** \* CALL Emergency Response Telephone Number on Shipping Paper first. If Shipping Paper not available or no answer, refer to appropriate telephone number listed on the inside back cover. \* As an immediate precautionary measure, isolate spill or leak area in all directions for at least 50 meters (150 feet) for liquids and at least 25 meters (75 feet) for solids. \* Keep unauthorized personnel away. \* Stay upwind. \* Keep out of low areas. \* Ventilate closed spaces before entering.

**PROTECTIVE CLOTHING** \* Wear positive pressure self-contained breathing apparatus (SCBA). \* Wear chemical protective clothing that is specifically recommended by the manufacturer. It may provide little or no thermal protection. \* Structural firefighters' protective clothing will only provide limited protection. **EVACUATION Large Spill** \* Consider initial downwind evacuation for at least 100 meters (330 feet). **Fire** \* If tank, rail car or tank truck is involved in a fire, ISOLATE for 800 meters (1/2 mile) in all directions; also, consider initial evacuation for 800 meters (1/2 mile) in all directions. **EMERGENCY RESPONSE FIRE Small Fire** \* Use [water](#). Do not use dry chemicals or foams. CO2 or [Halon](#) may provide limited control.

**Large Fire** \* Flood fire area with [water](#) from a distance. \* Do not move cargo or vehicle if cargo has been exposed to heat. \* Move containers from fire area if you can do it without risk. **Fire involving Tanks or Car/Trailer Loads** \* Fight fire from maximum distance or use unmanned hose holders or monitor nozzles. \* Cool containers with flooding quantities of [water](#) until well after fire is out. \* ALWAYS stay away from tanks engulfed in fire. \* For massive fire, use unmanned hose holders or monitor nozzles; if this is impossible, withdraw from area and let fire burn. **SPILL OR LEAK** \* Keep combustibles (wood, paper, oil, etc.) away from spilled material. \* Do not touch damaged containers or spilled material unless wearing appropriate protective clothing. \* Stop leak if you can do it without risk. \* Do not get [water](#) inside containers. **Small Dry Spill** \* With clean shovel place material into clean, dry container and cover loosely; move containers from spill area. **Small Liquid Spill** \* Use a non-combustible material like vermiculite or sand to soak up the product and place into a container for later disposal. **Large Spill** \* Dike far ahead of liquid spill for later disposal. \* Following product recovery, flush area with [water](#). **FIRST AID** \* Move victim to fresh air. \* Call 911 or emergency medical service. \* Give artificial respiration if victim is not breathing. \* Administer [oxygen](#) if breathing is difficult. \* Remove and isolate contaminated clothing and shoes. \* Contaminated clothing may be a fire risk when dry. \* In case of contact with substance, immediately flush skin or eyes with running [water](#) for at least 20 minutes. \* Keep victim warm and quiet. \* Ensure that medical personnel are aware of the material(s) involved and take precautions to protect themselves.

► from OSHA Occupational Chemical DB

### 13.10.2 CERCLA Reportable Quantities

Releases of CERCLA hazardous substances are subject to the release reporting requirement of CERCLA section 103, codified at 40 CFR part 302, in addition to the requirements of 40 CFR part 355. Hydrogen peroxide (Conc >52%) is an extremely hazardous substance (EHS) subject to reporting requirements when stored in amounts in excess of its threshold planning quantity (TPQ) of 1,000 lbs.

40 CFR 355 (7/1/99)

► from HSDB

### 13.10.3 FIFRA Requirements

As the federal pesticide law FIFRA directs, EPA is conducting a comprehensive review of older pesticides to consider their health and environmental effects and make decisions about their future use. Under this pesticide reregistration program,

EPA examines health and safety data for pesticide active ingredients initially registered before November 1, 1984, and determines whether they are eligible for reregistration. In addition, all pesticides must meet the new safety standard of the Food Quality Protection Act of 1996. Pesticides for which EPA had not issued Registration Standards prior to the effective date of FIFRA, as amended in 1988, were divided into three lists based upon their potential for human exposure and other factors, with List B containing pesticides of greater concern and List D pesticides of less concern. Hydrogen peroxide is found on List D. Case No: 4072; Pesticide type: Fungicide, Herbicide, Rodenticide, and Antimicrobial; Case Status: RED Approved 12/93; OPP has made a decision that some/all uses of the pesticide are eligible for reregistration, as reflected in a Reregistration Eligibility Decision (RED) document.; Active ingredient (AI): Hydrogen peroxide; AI Status: OPP has completed a Reregistration Eligibility Decision (RED) document for the case/AI.

*USEPA/OPP; Status of Pesticides in Registration, Reregistration and Special Review p.330 (Spring, 1998) EPA 738-R-98-002*

► from HSDB

An exemption from the requirement of a tolerance is established for residues of hydrogen peroxide in or on all food commodities at the rate of less than or equal to 1% hydrogen peroxide per application on growing crops and post harvest potatoes when applied as an algacide, fungicide and bactericide.

*40 CFR 180.1197 (7/1/99)*

► from HSDB

### 13.10.4 FDA Requirements

Hydrogen peroxide is an indirect food additive for use only as a component of adhesives.

*21 CFR 175.105 (4/1/99)*

► from HSDB

Substance added directly to human food affirmed as generally recognized as safe (GRAS) only when used to treat the following food within /specific/ limitations: milk, whey, dried eggs, tripe, beef feet, herring, wine, starch, instant tea, corn syrup, colored (annatto) cheese whey, wine [vinegar](#), and emulsifiers containing fatty acid esters.

*21 CFR 184.1366 (4/1/99)*

► from HSDB

Hydrogen peroxide used as a bleaching agent in animal drugs, feeds, and related products is generally recognized as safe when used in accordance with good manufacturing or feeding practice.

*21 CFR 582.1366 (4/1/99)*

► from HSDB

## 14 Toxicity

### 14.1 Toxicological Information

#### 14.1.1 NIOSH Toxicity Data

 Download

1 to 5 of 385 [View More](#)

Measurement	System	Route/Organism	Dose	Effect	Date
Skin and Eye Irritation		eye /rabbit	1 mg	severe	October 2017
Mutation Data	Cytogenetic Analysis	Ascites tumor/mouse	10 mmol/L		October 2017
Mutation Data	Cytogenetic Analysis	embryo/mouse	10 µmol/L		October 2017
Mutation Data	Cytogenetic Analysis	ovary/hamster	1 mmol/L		October 2017
Mutation Data	Cytogenetic Analysis	lung/hamster	100 µmol/L		October 2017

► from *The National Institute for Occupational Safety and Health (NIOSH)*

#### 14.1.2 Carcinogen

Evaluation: There is inadequate evidence in humans for the carcinogenicity of hydrogen peroxide. There is limited evidence in experimental animals for the carcinogenicity of hydrogen peroxide. Overall evaluation: Hydrogen peroxide is not classifiable as to its carcinogenicity to humans (Group 3).

*IARC. Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Humans. Geneva: World Health Organization, International Agency for Research on Cancer, 1972-PRESENT. (Multivolume work). Available at: <http://monographs.iarc.fr/ENG/Classification/index.php>, p. 71 683 (1999)*

► from *HSDB*

A3. Confirmed animal carcinogen with unknown relevance to humans.

*American Conference of Governmental Industrial Hygienists TLVs and BEIs. Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices. Cincinnati, OH, 2008, p. 34*

► from *HSDB*

IARC-3, TLV-A3

► from *OSHA Occupational Chemical DB*

#### 14.1.3 Health Effects

Irritation-Eye, Nose, Throat, Skin---Marked (HE14); Acute lung damage (HE11); Mutagen (HE2)

► from *OSHA Chemical Sampling Information*

#### 14.1.4 Exposure Routes



The substance can be absorbed into the body by inhalation of its vapour and by ingestion.

▸ *from ILO-ICSC*

inhalation, ingestion, skin and/or eye contact

▸ *from The National Institute for Occupational Safety and Health (NIOSH)*

#### 14.1.5 Symptoms

Eye, nose, throat irritation; sore throat, cough, shortness of breath, pulmonary edema; dizziness; headache; blurred vision, corneal ulcer; redness, pain, vesicles on skin; bleaching of hair; Ingestion Acute: Sore throat; abdominal pain, distention; nausea, vomiting; possible embolism ([oxygen](#) bubbles) in the blood resulting in shock or symptoms of a stroke

▸ *from OSHA Chemical Sampling Information*

irritation eyes, nose, throat; corneal ulcer; erythema (skin redness), vesiculation skin; bleaching hair

▸ *from The National Institute for Occupational Safety and Health (NIOSH)*

#### 14.1.6 Inhalation Symptoms

Sore throat. Cough. Dizziness. Headache. Nausea. Shortness of breath.

▸ *from ILO-ICSC*

#### 14.1.7 Skin Symptoms

Transient white spots. Redness. Skin burns. Pain.

▸ *from ILO-ICSC*

#### 14.1.8 Eye Symptoms

Redness. Pain. Blurred vision. Severe deep burns.

▸ *from ILO-ICSC*

#### 14.1.9 Ingestion Symptoms

Sore throat. Abdominal pain. Abdominal distension. Nausea. Vomiting.

▸ *from ILO-ICSC*

#### 14.1.10 Target Organs

Eyes, skin, respiratory system

▸ *from OSHA Chemical Sampling Information, The National Institute for Occupational Safety and Health (NIOSH)*

### 14.1.11 Toxicity Summary

#### Toxicity

Oral LD50 in mouse is 2000 mg/kg, and dermal LD50 is 4060 mg/kg in rat and 2000 mg/kg pig. LC50 of hydrogen peroxide vapours in rat is 2000 mg/m at 4 hours [MSDS]. Oral ingestion of high dose hydrogen peroxide may cause chest and stomach pain, loss of consciousness, motor disorders, microhemorrhages and moderate leucocytosis in humans. Inhalation of highly concentrated vapours causes extreme irritation of nose and throat [L2024]. Hydrogen peroxide has no known carcinogenic potential. It was shown to be mutagenic to bacteria (*Salmonella typhimurium*) and the fungi, *Neurospora crassa* and *Aspergillus chevallieri*, and induced DNA damage in *Escheria coli* [L2024]. It also caused sister chromatid exchanges and chromosomal aberrations in mammalian cells *in vitro* [L2024].

► from DrugBank

IDENTIFICATION: Hydrogen peroxide is a colorless liquid. It is an odorless substance with a bitter taste. It is an oxidizing agent which in the presence of organic matter or if permitted to become alkaline vigorously decomposes to [oxygen](#) and [water](#). Hydrogen peroxide is used as a 6% solution for bleaching hair and some disinfectant solutions for contact lenses contain a 3% hydrogen peroxide. [Chlorine](#) free bleaches contain 6% hydrogen peroxide. Some newer fabric stain removers and bleaches contain 5% to 15% hydrogen peroxide. Industrial strengths of hydrogen peroxide are manufactured up to 90%. They are used mainly as bleaching and oxidizing agents. Solutions of 90% are used as rocket fuel. HUMAN EXPOSURE: The dissociation of hydrogen peroxide is violent and exothermic reaction. Ingestion results in gastrointestinal irritation, the severity of which depends on the concentration of the solution. There is also a risk for a gas embolism. A number of deaths have been reported in the literature. In most cases the exposure where to concentrated solutions of 30% to 40%. Vomiting (the vomitus may be frothy due to the liberation of [oxygen](#) runs the risk of aspiration), hematemesis, burning of the throat and gastric distension due to the release of [oxygen](#). Lethargy, coma, convulsions, shock and respiratory arrest have been reported. Gastrointestinal bleeding and burns to the stomach and duodenum may occur. Gas embolism has been reported in adults and children. In severe cases ischemic ECG changes and EMD (electromechanical dissociation) may be observed because of embolization of the heart restricting blood flow. Transient dyspnea and cough, with concentrated solutions there may be more severe irritation and inflammation of the respiratory tract. Irritant to the skin with paraesthesia, blistering and whitening; solutions >10% may cause burns. Hydrogen peroxide is irritating to the eyes with a burning sensation, conjunctival hyperemia, lacrimation and severe pain which resolves within a few hours. There are rare cases of temporary corneal injury resulting from the application of 3% solution to the eye on contact lenses including punctuate staining of the cornea, decreased vision, corneal opacity and edema. After an iv dose of hydrogen peroxide, vomiting, pain at the injection site, ventricular fibrillation, embolism of the heart and lung tissue, hemolytic anemia, renal failure and death. Rectal administration has caused rectal bleeding, nausea, distension and difficulty urinating. Cerebral infarction resulted from gas embolization of the cerebral vasculature has been reported in an 84 year old man. Multiple brain embolisms occurred in a 63 year old who ingested hydrogen peroxide.

*World Health Organization/International Programme on Chemical Safety; Poisons Information Monograph 946 Hydrogen peroxide pp. 1-20 (1997)*

► from HSDB

### 14.1.12 Antidote and Emergency Treatment

Basic treatment: Establish a patent airway. Suction if necessary. Watch for signs of respiratory insufficiency and assist ventilations if necessary. Administer [oxygen](#) by nonrebreather mask at 10 to 15 L/min. Monitor for pulmonary edema and treat if necessary ... . Monitor for shock and treat if necessary ... . For eye contamination, flush eyes immediately with [water](#). Irrigate each eye continuously with normal saline during transport ... . Do not use emetics. For ingestion, rinse mouth and administer 5 ml/kg up to 200 ml of [water](#) for dilution if the patient can swallow, has a strong gag reflex, and does not drool ... . Do not attempt to neutralize because of exothermic reaction. Cover skin burns with dry, sterile dressings after decontamination ... . /Oxidizers/

*Bronstein, A.C., P.L. Currance; Emergency Care for Hazardous Materials Exposure. 2nd ed. St. Louis, MO. Mosby Lifeline. 1994., p. 133*

► from HSDB



Advanced treatment: Consider orotracheal or nasotracheal intubation for airway control in the patient who is unconscious, has severe pulmonary edema, or is in, respiratory arrest. Early intubation, at the first sign of upper airway obstruction, may be necessary. Positive pressure ventilation techniques with a bag valve mask device may be beneficial. Monitor cardiac rhythm and treat arrhythmias as necessary ... . Start an IV with [D5W](#) /SRP: "To keep open", minimal flow rate/. Use lactated Ringer's if signs of hypovolemia are present. Watch for signs of fluid overload. Consider drug therapy for pulmonary edema ... . For hypotension with signs of hypovolemia, administer fluid cautiously. Watch for signs of fluid overload ... . Use [proparacaine hydrochloride](#) to assist eye irrigation ... . /Oxidizers/

Bronstein, A.C., P.L. Currance; *Emergency Care for Hazardous Materials Exposure*. 2nd ed. St. Louis, MO. Mosby Lifeline. 1994., p. 133

► from HSDB

Hydrogen peroxide poisoning is generally treated with symptomatic and supportive measures.

Ellenhorn, M.J., S. Schonwald, G. Ordog, J. Wasserberger. *Ellenhorn's Medical Toxicology: Diagnosis and Treatment of Human Poisoning*. 2nd ed. Baltimore, MD: Williams and Wilkins, 1997., p. 1223

► from HSDB

Peroxides should be washed promptly from the skin to prevent irritation. In the case of eye contact, the eyes should be flushed immediately with large amounts of [water](#), and medical attention should be obtained. ... Medical attention should also be obtained in case of accidental ingestion. ... /Peroxides, Organic and Inorganic/

International Labour Office. *Encyclopaedia of Occupational Health and Safety*. 4th edition, Volumes 1-4 1998. Geneva, Switzerland: International Labour Office, 1998., p. 104.350

► from HSDB

#### 14.1.13 Human Toxicity Excerpts

Large doses presumably produce gastritis and esophagitis. Cases of rupture of the colon, proctitis and ulcerative colitis have been reported following hydrogen peroxide enemas.

Gosselin, R.E., R.P. Smith, H.C. Hodge. *Clinical Toxicology of Commercial Products*. 5th ed. Baltimore: Williams and Wilkins, 1984., p. II-107

► from HSDB

THE CONTINUED USE OF HYDROGEN PEROXIDE SOLUTION AS A MOUTHWASH, EVEN IN HALF STRENGTH, MAY CAUSE HYPERTROPHIED FILIFORM PAPILLAE OF THE TONGUE ("HAIRY TONGUE") BUT THESE DISAPPEAR AFTER DRUG IS DISCONTINUED.

Gilman, A. G., L. S. Goodman, and A. Gilman. (eds.). *Goodman and Gilman's The Pharmacological Basis of Therapeutics*. 6th ed. New York: Macmillan Publishing Co., Inc. 1980., p. 974

► from HSDB

Although ingestion is unlikely to occur, if it does the hydrogen peroxide will cause irritation of the upper GI tract. Decomposition results in rapid liberation of [oxygen](#), leading to distension of the esophagus or stomach, and possibly severe damage and internal bleeding.

International Labour Office. *Encyclopedia of Occupational Health and Safety*. Vols. I&II. Geneva, Switzerland: International Labour Office, 1983., p. 1089

► from HSDB

FOR HYDROGEN PEROXIDE, INHALATION OF 7 PPM CAUSES LUNG IRRITATION.

Thienes, C., and T.J. Haley. *Clinical Toxicology*. 5th ed. Philadelphia: Lea and Febiger, 1972., p. 191

► from HSDB

HEMIPLEGIA HAS FOLLOWED ITS USE TO IRRIGATE THE PLEURAL CAVITY; PRESUMABLY ... BY THE PASSAGE OF THE GAS INTO THE VASCULAR SYSTEM, RESULTING IN CEREBRAL EMBOLISM.

American Medical Association. *AMA Drug Evaluations Annual 1991*. Chicago, IL: American Medical Association, 1991., p. 1439

► from HSDB

MAY IRRITATE TONGUE & BUCCAL MUCOSA /WHEN USED TO TREAT STOMATITIS & GINGIVITIS/.

American Medical Association. *AMA Drug Evaluations Annual 1991*. Chicago, IL: American Medical Association, 1991., p. 1439

► from HSDB

WORKERS EXPOSED TO VAPORS FROM 90% H2O2 HAVE NOTED PRIMARILY RESP IRRITATION, BUT SPLASH OF SUCH HIGH CONCEN IS GENERALLY FEARED AS POTENTIAL CAUSE OF SEVERE CORNEAL DAMAGE.

Grant, W.M. *Toxicology of the Eye*. 3rd ed. Springfield, IL: Charles C. Thomas Publisher, 1986., p. 492

► from HSDB

The effect of Co(II) ion on the reaction of hydrogen peroxide with DNA was investigated by a DNA sequencing technique using (32)P-5'-end-labeled DNA fragments obtained from human c-Ha-ras-1 protooncogene. 20 uM Co(II) (as cobalt chloride, CoCl<sub>2</sub>) induced strong DNA cleavage in the presence of 0.4 mM hydrogen peroxide even without alkali treatment. Guanine residues were the most alkali-labile site, and the extent of cleavages at the positions of thymine and cytosine was dependent on the sequence. Adenine residues were relatively resistive. Neither Co(II) nor hydrogen peroxide alone caused DNA cleavage. Diethylenetriaminepentaacetic acid, present in excess over Co(II), inhibited DNA cleavage. Singlet oxygen scavengers (dimethylfuran, 0.05 M sodium azide, 0.05 M 1,4-diazabicyclo(2.2.2)octane, 0.025 M dGMP), sulfur compounds (methional, methionine), and superoxide dismutase inhibited DNA cleavage completely. Hydroxyl radical scavengers, such as dimethyl sulfoxide and sodium formate, were not so effective as singlet oxygen scavengers. Electron spin resonance studies performed in the presence of ADP using 2,2,6,6-tetramethyl-4-piperidone as a singlet oxygen trap suggest that Co(II) reacts with hydrogen peroxide to produce singlet oxygen or its equivalent. Electron spin resonance studies using 5,5-dimethylpyrroline N-oxide showed that the hydroxyl radical adduct of 5,5-dimethylpyrroline N-oxide was also formed.

Yamamoto K et al; *Chem Res Toxicol* 4 (2): 234-9 (1989)

► from HSDB

A 33 yr old woman unintentionally ingested a 1 pint bottle of 35% hydrogen peroxide. She vomited, collapsed, and experienced a brief tonic-clonic seizure within minutes. On examination, the patient was intermittently seizing and markedly cyanotic and had copious white foam emanating from her mouth. Vital signs were blood pressure 156/118 mm Hg; pulse, 126; respirations, 32; and temp, 38.2 deg C. Pupils were 6 mm and weakly reactive to light. The heart was rapid and regular, and no SC emphysema was noted. Deep tendon reflexes were 2/4, and plantar responses were flexor. The patient was given 5 mg diazepam, 4 mg naloxone hydrochloride, 100 mg thiamine, and 50 ml of 50% dextrose iv. Within 30 sec after nasotracheal intubation, the patient became apneic and dependent on mechanical ventilation. Gastric lavage was performed. Preoperative esophagogastroduodenoscopy showed mild erythema of the distal esophagus and diffuse hemorrhages and edema of the gastric mucosa. Recurrent postoperative seizures were well controlled with phenytoin therapy. Bilateral cerebral hemisphere swelling was determined; intracranial pressure of 30 cm H<sub>2</sub>O responded to hyperventilation. Later neurologic examination demonstrated patchy areas of weakness in the upper and lower extremities and truncal ataxia with inability to maintain a sitting position. After 9 days, the patient was transferred to a rehabilitation facility.

Abstract: PubMed

Giberson TP et al; *Ann Emerg Med* 18 (7): 778-9 (1989)

► from HSDB

Respiratory effects - Acute lung damage/edema.

Cralley, L.J., L.V. Cralley (eds.). *Patty's Industrial Hygiene and Toxicology. Volume III: Theory and Rationale of Industrial Hygiene Practice*. 2nd ed., 3A: The Work Environment. New York, NY: John Wiley Sons, 1985., p. 171

► from HSDB

If swallowed, the sudden evolution of oxygen may cause injury by acute distension of the stomach and also nausea, vomiting, and internal bleeding.

Armour, M.A. *Hazardous Laboratory Chemicals Disposal Guide*. Boca Raton, FL: CRC Press Inc., 1991., p. 183

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► from HSDB

Repeated use of hydrogen peroxide topical solution as a mouthwash or gargle may produce a condition known as "hairy tongue" or may cause irritation of the buccal mucous membrane. Concentrated solutions (20-30% or more) of hydrogen peroxide are strongly irritating to skin or mucous membranes and should be handled cautiously. When used rectally in a colonic lavage, the drug has caused gas embolism, rupture of the colon, proctitis, ulcerative colitis, and gangrene of the intestine.

McEvoy, G.K. (ed.). *American Hospital Formulary Service - Drug Information 2000*. Bethesda, MD: American Society of Health-System Pharmacists, Inc. 2000 (Plus Supplements), p. 2576

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► from HSDB

In treatment of corneal ulcerations, particularly in herpetic dendritic keratitis, 20% solution has been applied, after local anesthetic, every two hr as a localized cautery to the ulcer, and has been reported to have had good effect in numerous patients. In one instance a 10% solution was dropped on one eye of a patient after application of [cocaine](#), and this eye was normal by the next day.

Grant, W.M. *Toxicology of the Eye*. 3rd ed. Springfield, IL: Charles C. Thomas Publisher, 1986., p. 492

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► from HSDB

Dropping 1 to 3% hydrogen peroxide solution on the human eye causes severe pain, but this soon subsides.

Grant, W.M. *Toxicology of the Eye*. 3rd ed. Springfield, IL: Charles C. Thomas Publisher, 1986., p. 493

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► from HSDB

DNA strand breaks and chromosomal aberrations were studied in human cells treated with hydrogen peroxide or with ionizing radiation. DNA strand breaks could be produced at dose levels of hydrogen peroxide much lower than those which induced chromosomal aberrations. Doses as low as 0.5 mM of hydrogen peroxide produced about as many DNA strand breaks as 2 Gy of (60)Co gamma-radiation. On the other hand, as much as 20 mM hydrogen peroxide produced only half as many chromosomal aberrations as 1 Gy of (60)Co gamma-radiation.

Abstract: [PubMed](#)

Rueff J et al; *Mutat Res* 289 (2): 197-204 (1993)

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► from HSDB

Large ingestions may produce a mild gastritis from the decomposition of peroxide, which releases large volumes of [oxygen](#) and causes gastric distension.

Ellenhorn, M.J., S. Schonwald, G. Ordog, J. Wasserberger. *Ellenhorn's Medical Toxicology: Diagnosis and Treatment of Human Poisoning*. 2nd ed. Baltimore, MD: Williams and Wilkins, 1997., p. 1102

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► from HSDB

Ingestion of concentrations greater than 10% can result in dangerous sequelae.

Ellenhorn, M.J., S. Schonwald, G. Ordog, J. Wasserberger. *Ellenhorn's Medical Toxicology: Diagnosis and Treatment of Human Poisoning*. 2nd ed. Baltimore, MD: Williams and Wilkins, 1997., p. 1221

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► from HSDB

Seventy-five ppm is considered immediately dangerous to life and health. Concentrated hydrogen peroxide is a superficially corrosive agent with a pH of 8.0.

Ellenhorn, M.J., S. Schonwald, G. Ordog, J. Wasserberger. *Ellenhorn's Medical Toxicology: Diagnosis and Treatment of Human Poisoning*. 2nd ed. Baltimore, MD: Williams and Wilkins, 1997., p. 1221

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► from HSDB

Ingestions of industrial strength peroxides can result in severe burns of the oropharynx and gastrointestinal tract, with the possibility of rupture of the hollow viscous secondary to the liberation of [oxygen](#). The foam may cause obstruction of the respiratory tract and may result in mechanical asphyxia. Respiratory failure has been the alleged cause of death in fatalities reported after oral ingestion of industrial strength (over 10%) hydrogen peroxide.

Ellenhorn, M.J., S. Schonwald, G. Ordog, J. Wasserberger. *Ellenhorn's Medical Toxicology: Diagnosis and Treatment of Human Poisoning*. 2nd ed. Baltimore, MD: Williams and Wilkins, 1997., p. 1223

► from HSDB

Men accidentally exposed to 90% H2O2 vapor experienced an increased flow of saliva, scratchy feeling of the throat, and respiratory passage inflammation.

Ellenhorn, M.J., S. Schonwald, G. Ordog, J. Wasserberger. *Ellenhorn's Medical Toxicology: Diagnosis and Treatment of Human Poisoning*. 2nd ed. Baltimore, MD: Williams and Wilkins, 1997., p. 1222

► from HSDB

... Hydrogen peroxide leads to genetic damage in vitro through the formation of free radicals.

American Conference of Governmental Industrial Hygienists, Inc. *Documentation of the Threshold Limit Values and Biological Exposure Indices*. 6th ed. Volumes I, II, III. Cincinnati, OH: ACGIH, 1991., p. 782

► from HSDB

Although ingestion is unlikely to occur, if it does the hydrogen peroxide will cause irritation of the upper gastrointestinal tract. Decomposition results in rapid liberation of O2, leading to distension of the esophagus or stomach, and possibly severe damage and internal bleeding.

International Labour Office. *Encyclopaedia of Occupational Health and Safety*. 4th edition, Volumes 1-4 1998. Geneva, Switzerland: International Labour Office, 1998., p. 104.350

► from HSDB

Human exposure by inhalation may result in extreme irritation and inflammation of nose, throat and respiratory tract; pulmonary edema, headache, dizziness, nausea, vomiting, diarrhea, irritability, insomnia, hyper-reflexia; and tremors and numbness of extremities, convulsions, unconsciousness and shock. The latter symptoms are a result of severe systemic poisoning.

International Labour Office. *Encyclopaedia of Occupational Health and Safety*. 4th edition, Volumes 1-4 1998. Geneva, Switzerland: International Labour Office, 1998., p. 104.350

► from HSDB

Exposure to mist or spray may cause stinging and tearing of the eyes. If hydrogen peroxide is splashed into the eye, severe damage such as ulceration of the cornea may result; sometimes, though rarely, this may appear as long as a week after exposure.

International Labour Office. *Encyclopaedia of Occupational Health and Safety*. 4th edition, Volumes 1-4 1998. Geneva, Switzerland: International Labour Office, 1998., p. 104.350

► from HSDB

Skin contact with hydrogen peroxide liquid will result in temporary whitening of the skin; if the contamination is not removed, erythema and vesicle formation may occur.

International Labour Office. *Encyclopaedia of Occupational Health and Safety*. 4th edition, Volumes 1-4 1998. Geneva, Switzerland: International Labour Office, 1998., p. 104.350

► from HSDB

The main toxic effect of most peroxides is irritation of skin, mucous membranes and eyes. Prolonged or intense skin contact or splashes in the eyes may cause severe injury. Some organic peroxide vapors are irritating and may also cause headaches, intoxication similar to alcohol, and lung edema in inhaled in high concentrations. Some are ... skin sensitizers. Dialkyl peroxides are generally not as strongly irritating, and the diacyl peroxides are the least irritating of the peroxides. Hydroperoxides, peroxyacids and particularly [methyl ethyl ketone peroxide](#) are much more severe. They are extremely irritating and corrosive to the eyes, with risk of blindness, and may cause serious injury or death if ingested in sufficient quantity. /Peroxides, Organic and Inorganic/

International Labour Office. *Encyclopaedia of Occupational Health and Safety*. 4th edition, Volumes 1-4 1998. Geneva, Switzerland: International Labour Office, 1998., p. 104.349

[▶ from HSDB](#)

Fanconi's anemia cells are highly susceptible to both reactive oxygen species and [mitomycin C](#), a DNA cross-linking agent. In this study we have determined the amounts of [8-hydroxydeoxyguanosine](#), typical of oxidative DNA damage, in Epstein-Barr virus transformed lymphoblasts from Fanconi's anemia patients and normal controls. Fanconi's anemia cells (HSC72 and 99 cells being assigned to Fanconi's anemia complementation group A) formed 2-3 times more [8-hydroxydeoxyguanosine](#) than control cells after incubation with 20 mM hydrogen peroxide at 37 deg C for 30 min. Fanconi's anemia cells also formed more [8-hydroxyguanosine](#), typical of oxidative RNA damage, than control cells. Fanconi's anemia cells showed decreased activity to decompose hydrogen peroxide. Although the activity in Fanconi's anemia cells was only 20-30% less than control cells, the remaining, undecomposed hydrogen peroxide concn was almost twice as much in Fanconi's anemia cells as in control cells, and the remaining hydrogen peroxide concn correlated well with the amounts of [8-hydroxydeoxyguanosine](#) formation. The hydrogen peroxide decomposing activity was almost completely inhibited by [sodium azide](#) or [aminotriazole](#), both catalase inhibitors. With these inhibitors the amounts of [8-hydroxydeoxyguanosine](#) formation were much higher than in those cells without inhibitors, and were almost the same in control cells as in Fanconi's anemia cells. Catalase activity in Fanconi's anemia cell lysates was 70-80% of controls.

Abstract: [PubMed](#)

*Takeuchi T, Morimoto K; Carcinogenesis 14 (6): 1115-20 (1993)*

[▶ from HSDB](#)

...MAY CAUSE CHEMICAL BURNS OF SKIN & MUCOUS MEMBRANES, ALTHOUGH BURNS CAUSED BY HYDROGEN PEROXIDE ARE LESS SERIOUS THAN THOSE CAUSED BY [SODIUM PEROXIDE](#).

*International Labour Office. Encyclopedia of Occupational Health and Safety. Vols. I&II. Geneva, Switzerland: International Labour Office, 1983., p. 299*

[▶ from HSDB](#)

#### 14.1.14 Non-Human Toxicity Excerpts

DOGS /EXPOSED/ 6 HR/DAY; 5 DAYS/WK FOR 6 MO AT AN AVG VAPOR CONCEN OF 7 PPM OF 90% HYDROGEN PEROXIDE ... DEVELOPED skin IRRITATION, SNEEZING, LACRIMATION, AND BLEACHING OF THE HAIR. /90% SOLN/

*American Conference of Governmental Industrial Hygienists, Inc. Documentation of the Threshold Limit Values and Biological Exposure Indices. 6th ed. Volumes I, II, III. Cincinnati, OH: ACGIH, 1991., p. 782*

[▶ from HSDB](#)

DOGS /WERE EXPOSED/ 6 HR/DAY, 5 DAYS PER WEEK FOR 6 MO @ AVG VAPOR CONCEN OF 7 PPM OF 90% HYDROGEN PEROXIDE. ... AUTOPSY DISCLOSED GREATLY THICKENED SKIN BUT NO HAIR FOLLICLE DESTRUCTION. THE LUNGS WERE FOUND TO BE IRRITATED. NO SIGNIFICANT CHANGES IN BLOOD OR URINARY CONSTITUENTS WERE OBSERVED. /90% SOLN/

*American Conference of Governmental Industrial Hygienists, Inc. Documentation of the Threshold Limit Values and Biological Exposure Indices. 6th ed. Volumes I, II, III. Cincinnati, OH: ACGIH, 1991., p. 782*

[▶ from HSDB](#)

RABBITS EXPOSED DAILY FOR 3 MONTHS @ 22 PPM SHOWED NO EYE INJURY, ALTHOUGH THE HAIR WAS BLEACHED AND IRRITATION WAS NOTED AROUND NOSE. /90% SOLN/

*American Conference of Governmental Industrial Hygienists, Inc. Documentation of the Threshold Limit Values and Biological Exposure Indices. 6th ed. Volumes I, II, III. Cincinnati, OH: ACGIH, 1991., p. 782*

[▶ from HSDB](#)

DROP APPLICATION OF 0.5% SOLN ON RABBIT CORNEA CAUSES DISTURBANCES OF EPITHELIUM, BUT EYE RETURNS TO NORMAL WITHIN 24 HR. HOWEVER, INTRACORNEAL INJECTION OF 0.1%-0.3% SOLN CAUSES RATHER SEVERE REACTION.

*Grant, W.M. Toxicology of the Eye. 3rd ed. Springfield, IL: Charles C. Thomas Publisher, 1986., p. 493*



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▶ from HSDB

A DROP OF 5%-30% H2O2 APPLIED TO RABBIT EYES HAVING NORMAL EPITHELIUM CAUSES SUPERFICIAL CLOUDING, WHICH IS PERSISTENT WHEN GREATER THAN 10% IS APPLIED. EVEN 5% SOLN HAS BEEN OBSERVED TO CAUSE SEVERE CORNEAL EDEMA, FLARE IN AQUEOUS, INTENSE CONGESTION OF IRIS, & VASCULARIZATION OF CORNEA IN RABBITS ...

Grant, W.M. *Toxicology of the Eye*. 3rd ed. Springfield, IL: Charles C. Thomas Publisher, 1986., p. 493

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▶ from HSDB

SINGLE STRAND SCISSIONS WERE PRODUCED IN T7 DNA UPON INCUBATION WITH H2O2 IN AQ SOLN @ NEUTRAL PH. INHIBITION OF SCISSIONS BY HYDROXYL RADICAL SCAVENGERS INDICATES INTERMEDIACY OF HYDROXYL RADICALS.

Abstract: [PubMed](#)

LESKO SA ET AL; *BIOCHEMISTRY* 19 (13): 3023 (1980)

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▶ from HSDB

Pregnant rats were fed a diet containing up to 10% hydrogen peroxide. Maternal and fetal weights were reduced but no significant malformations were reported.

Shepard, T.H. *Catalog of Teratogenic Agents*. 5th ed. Baltimore, MD: The Johns Hopkins University Press, 1986., p. 296

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▶ from HSDB

In rabbits and cats that died after iv administration of hydrogen peroxide, the lungs were found to be pale and emphysematous, with considerable amounts of gas in the great veins and in the right side of the heart.

IARC. *Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Humans*. Geneva: World Health Organization, International Agency for Research on Cancer, 1972-PRESENT. (Multivolume work). Available at: <http://monographs.iarc.fr/ENG/Classification/index.php> , p. V36 297 (1985)

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▶ from HSDB

After ip injection of 0.5 ml of 5% hydrogen peroxide into adult mice, a radiation like effect was observed; pyknotic nuclei were induced in the intestine and thymus within 2 hr and persisted for up to 24 hr.

IARC. *Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Humans*. Geneva: World Health Organization, International Agency for Research on Cancer, 1972-PRESENT. (Multivolume work). Available at: <http://monographs.iarc.fr/ENG/Classification/index.php> , p. V36 297 (1985)

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▶ from HSDB

Prophages are induced by treatment of lysogenized bacteria with hydrogen peroxide. In Escherichia coli, hydrogen peroxide induced single strand breaks in DNA and was positive in DNA repair assays.

IARC. *Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Humans*. Geneva: World Health Organization, International Agency for Research on Cancer, 1972-PRESENT. (Multivolume work). Available at: <http://monographs.iarc.fr/ENG/Classification/index.php> , p. V36 300 (1985)

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▶ from HSDB

Hydrogen peroxide was mutagenic to Salmonella typhimurium TA92 and TA102 and was positive in a forward mutation test in Salmonella typhimurium SV50.

IARC. *Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Humans*. Geneva: World Health Organization, International Agency for Research on Cancer, 1972-PRESENT. (Multivolume work). Available at: <http://monographs.iarc.fr/ENG/Classification/index.php> , p. V36 301 (1985)

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▶ from HSDB

Experiments on rabbit eyes ... showed corneal injury from dropped application to depend not only on the conc of hydrogen peroxide, but also on the integrity of the corneal epithelium, which had a protective influence. Application of a drop of 10 to 30% caused superficial corneal haze, and, if there were defects in the epithelium, could cause localized swelling and opacities in the corneal stroma. Also, 5% solution caused superficial corneal haze and much conjunctival

reaction, but these effects were gone in 24 hr. The effect of 10% solution usually took longer to disappear, and occasionally could result in lasting localized opacities.

*Grant, W.M. Toxicology of the Eye. 3rd ed. Springfield, IL: Charles C. Thomas Publisher, 1986., p. 493*

► from HSDB

The effect of hydrogen peroxide on perfusion flow, airway conductance and dynamic compliance of isolated perfused and ventilated guinea pig lungs was investigated. Hydrogen peroxide (50  $\mu$ M in the perfusion buffer) induced a decrease in airway conductance and dynamic compliance and perfusion flow during 5 min. of exposure. Hydrogen peroxide also caused an increase in the levels of [thromboxane](#) in the perfusate of the lung. The constrictor effects as well as the formation of [thromboxane](#) were inhibited by the cyclooxygenase inhibitor [ibuprofen](#) (50  $\mu$ M). The [thromboxane](#)/prostaglandin endoperoxide receptor antagonist [L-670,596](#) (1  $\mu$ M) abolished the effects of hydrogen peroxide on perfusion flow, airway conductance and dynamic compliance, but did not affect the formation of [thromboxane](#). The [thromboxane](#) synthetase inhibitor [carboxyheptylimidazole](#) (100  $\mu$ M) reduced both the hydrogen peroxide induced formation of [thromboxane](#) and vaso and bronchoconstriction, suggesting a predominant role for [thromboxane A2](#) versus [prostaglandin H2](#) in these effects. A role for [platelet activating factor](#) in mediating the effect of hydrogen peroxide could not be supported, as the [platelet activating factor](#) receptor antagonist WEB 2086 (10  $\mu$ M) did not affect hydrogen peroxide induced vaso and bronchoconstriction. Hydrogen peroxide induces [thromboxane A2](#) mediated vaso and bronchoconstriction in the isolated perfused and ventilated guinea pig lung. [Platelet activating factor](#) does not appear to play a significant role in the hydrogen peroxide induced vaso and bronchoconstriction. The perfused guinea pig lung is more sensitive to hydrogen peroxide than the perfused rat lung.

*Bannenberg G et al; Pharmacol Toxicol 72 (4-5): 1993 314-20 (1993)*

► from HSDB

Hydrogen peroxide resistant sublines of Chinese hamster ovary cells were isolated by in vitro exposure to the oxidant (treatment for 1 hr followed by 3 days of growth in peroxide free medium). Stepwise increase in low level hydrogen peroxide concn produced variants which were progressively more resistant to the growth inhibitory effect elicited by the oxidant. Removal from hydrogen peroxide decreased resistance and the curve describing this process was biphasic in nature. The protein content constantly increased during the adaptation process and decreases upon removal from hydrogen peroxide. Catalase activity did not show large variations in resistant sublines with respect to the parental cell line, and these changes were at least partially related to differences in cell size/amount of total cell proteins of the sublines. In addition, the minor changes observed for catalase activity did not correlate with the degree of resistance to growth inhibition elicited by the oxidant.

Abstract: [PubMed](#)

*Cantoni O et al; Biochem Pharmacol 45 (11): 2251-57 (1993)*

► from HSDB

To understand the role of protein-thiol mixed disulfide formation in relation to the sequence of events during cataract induction, we conducted a long term hydrogen peroxide exposure study for up to 96 hr to monitor the dynamic changes in [glutathione](#) and protein-[glutathione](#) mixed disulfide levels, the formation of protein-protein disulfide aggregate, protein solubility, and the progression in lens opacity. Rat lenses were cultured in 0.5 mM hydrogen peroxide and harvested at intervals of 24, 48, 72 and 96 hr for the examination of morphological and biochemical changes. Contralateral lenses cultured in hydrogen peroxide free media were used as controls. It was found that the lenses had only patchy opacity at the equator after 24 hr, but became hydrated suddenly at 48 hr (31% heavier than the control), with an opacity which involved the entire outer cortical region. By 72 hr incubation, the nucleus was opacified. Lens [glutathione](#) progressively decreased with time of hydrogen peroxide exposure, 40% was lost by 24 hr and over 95% by 48 hr. There was a concomitant elevation of protein-[glutathione](#) mixed disulfide, 16 fold over the controls by 24 hr and 45 fold by 48 hr followed by a decline to 34 fold after 72 hr. In addition, the level of protein-[cysteine](#) mixed disulfide was elevated after 48 hr incubation in hydrogen peroxide. At this time, protein-protein disulfide aggregates began to appear both in [water](#) soluble and [urea](#) soluble fractions along with a drastic reduction in protein solubility. Western blot analysis of the protein fractions identified beta and gamma, but not alpha-crystallin in the disulfide containing aggregates. The lens clarity and biochemical changes partially recovered if the oxidant was removed within 24 hr, indicating a potential therapeutic role for antioxidants.

Abstract: [PubMed](#)

*Cui XL, Lou MF; Exp Eye Res 57 (2): 157-67 (1993)*

DNA damage induced by oxidants includes formation of DNA strand breaks as well as oxidative damage to DNA bases. Both forms of DNA damage were measured concurrently in two model human breast epithelial cell lines treated with hydrogen peroxide to compare the dose-dependent induction of each form of DNA damage with growth inhibition. MCF-7 breast cancer cells had relatively higher levels of non-protein thiols, oxidized glutathione (GSSG) reductase, catalase, and superoxide dismutase than did the MCF-10A line of immortalized, but not transformed human breast epithelial cells. The levels of antioxidant defenses were not predictive of endogenous oxidative DNA damage levels nor of toxicity and DNA damage induced by hydrogen peroxide. The endogenous levels of 5-hydroxymethyl-2'-deoxyuridine were higher in MCF-7 than MCF-10A cells. The cells were treated with 10-200  $\mu$ M hydrogen peroxide for 15 min at 37 C in complete media. Low concn of hydrogen peroxide were growth stimulatory to both cell lines. At higher concn, growth inhibition by hydrogen peroxide was greater in MC-7 than in MCF-10A cells. Accordingly, induction of both single-strand DNA breaks and 5-hydroxymethyl-2'-deoxyuridine in DNA was greater in MCF-7 than MCF-10A cells. In both cell lines, the dose-dependent induction of single-strand breaks paralleled growth inhibition more closely than did formation of 5-hydroxymethyl-2'-deoxyuridine.

Djuric Z et al; *Free Radical Biol Med* 14 (5): 541-7 (1993)

An oxidant burden established by hydrogen peroxide overload may elicit postischemic myocardial damage. Exposure of neonatal rat cardiomyocytes to 50  $\mu$ M-1.0 mM hydrogen peroxide bolus rapidly shifted their pyridine-nucleotide redox balance toward oxidation. At least 30% of the observed NADPH oxidation was independent of glutathione cycle activity and appeared chemical in nature with hydrogen peroxide itself, and not a radical metabolite, acting as oxidant. Cell exposure to hydrogen peroxide also depleted cardiomyocyte pyridine nucleotides as a consequence of enhanced utilization. The oxidative stress activated one major route of pyridine nucleotide catabolism (i.e., protein ADP-ribosylation) without acute inhibitory effect upon the other (cleavage by NAD glycohydrolase). The limited NAD sparing by metal chelators and inhibitors of ADP-ribosylation reflected pyridine nucleotide utilization for repair of single-strand DNA breaks caused by hydroxyl-like radicals formed intracellularly through iron-dependent hydrogen peroxide reduction. Cardiomyocyte NAD depletion during hydrogen peroxide induced oxidative stress was independent of cell integrity and lipid peroxidation. The NAD lost after a discrete hydrogen peroxide pulse was only partly replenished over a 24 hr postinjury period. Cardiomyocyte pyridine nucleotide metabolism is a nonperoxidative injury target that is chronically affected by hydrogen peroxide overload.

Janero DR et al; *Am J Physiol* 264 (6 Pt 1): C1401-10 (1993)

The effect of the oxidant hydrogen peroxide on the vulnerability of the myocardium to reperfusion induced arrhythmias following global ischemia was investigated. After a 15 min equilibration period with or without experimental intervention, isolated perfused rat hearts were made globally ischemic for 5 min by cross-clamping the aortic line. No dysrhythmias were evoked upon reperfusion at the 5 min global ischemia time period. Hydrogen peroxide was added to the perfusate 5 min into the equilibration period with a total exposure of 10 min. Global ischemia was then induced for 5 min followed by 10 min of reperfusion. All hearts exposed to 200  $\mu$ M hydrogen peroxide developed ventricular dysrhythmias during the reperfusion period. Coronary flow increased after 5 min of exposure to 200  $\mu$ M hydrogen peroxide and remained elevated during reperfusion. Toxic oxygen derived products are capable of increasing the susceptibility of the myocardium to reperfusion induced arrhythmias.

Abstract: [PubMed](#)

Okabe E et al; *Eur J Pharmacol* 248 (1): 33-9 (1993)

The superoxide dismutase mimic, 4-hydroxy TEMPO (TEMPOL), was used to investigate the mechanism by which hydrogen peroxide damages cultured rabbit lens epithelial cells and to identify some of the targets of hydrogen peroxide insult. Most studies aimed at determining the mechanism by which hydrogen peroxide exerts its cytotoxic effect have used iron chelators to prevent the generation of the damaging hydroxyl radical. TEMPOL does not chelate transition metals. Cells at low or high density were cultured in MEM containing 5 mM TEMPOL and exposed to a single sub-lethal dose of 0.05 or 0.5 mM hydrogen peroxide, respectively. Analysis of EPR spectra indicated that TEMPOL was stable in MEM, did not destroy hydrogen peroxide and penetrated the intracellular fluid. TEMPOL prevented or curtailed the hydrogen peroxide induced inhibition of cell growth, blebbing of the cell membrane, the decrease in NAD<sup>+</sup>, the activation



of poly ADP-ribose polymerase, an enzyme involved in DNA repair, and limited the induction of single strand breaks in DNA normally brought about by hydrogen peroxide. [TEMPOL](#) did not prevent the hydrogen peroxide induced decrease in reduced glutathione, [lactate](#) production, and the activity of [glyceraldehyde 3-phosphate](#) dehydrogenase, or the hydrogen peroxide induced increases in oxidized glutathione and [hexose monophosphate](#) shunt activity. Addition of [TEMPOL](#) 1-15 min after exposure of cells to hydrogen peroxide offered partial protection from the inhibition of cell division. [TEMPOL](#) at 5 mM did not inhibit cell growth. Some of the hydrogen peroxide induced damage in cultured rabbit LECs is mediated by intracellular redox-active metals involved in the Haber-Weiss cycle. Cellular changes not protected by [TEMPOL](#), including attack of hydrogen peroxide on the thiol groups of [glutathione](#) (mediated through [glutathione](#) peroxidase) and G3PDH, are likely brought about by hydrogen peroxide itself and not by reactions of [oxygen](#) free-radicals generated from hydrogen peroxide.

Abstract: [PubMed](#)

*Reddan JR et al; Exp Eye Res 56 (5): 543-54 (1993)*

► from [HSDB](#)

The effect of extracellular acidosis on different types of cell injury and death was examined using suspensions of rabbit renal proximal tubules. Cell death produced by the mitochondrial inhibitors [rotenone](#), [antimycin A](#), [carbonyl cyanide p-trifluoromethoxyphenylhydrazine](#) and oligomycin and by the ion exchangers [valinomycin](#), [nigericin](#) and [monensin](#) was ameliorated by reducing extracellular pH from 7.4 to 6.4. The protection lasted for more than 5 hr and was not due to the release of mitochondrial inhibition or to the maintenance of tubular [ATP](#) levels. In contrast, extracellular acidosis potentiated the cell injury and death produced by the oxidants [t-butyl hydroperoxide](#), hydrogen peroxide and ochratoxin A. Because a decrease in extracellular pH resulted in an increase in lipid peroxidation and in [glutathione disulfide](#) formation, and caused a decrease in [glutathione](#) peroxidase and [glutathione](#) reductase activities, the mechanism of this potentiation is most likely the result of an increase in free-radical production or a decrease in free-radical detoxification. The findings with the oxidants are in marked contrast to those in hepatocytes.

Abstract: [PubMed](#)

*Rodeheaver DP, Schnellmann RG; J Pharmacol Exp Ther 265 (3): 1355-60 (1993)*

► from [HSDB](#)

Hydrogen peroxide induced contractions of isolated rabbit intrapulmonary arteries mounted in standard tissue baths were studied. All vessels were pretreated with a [thromboxane A2/prostaglandin H2](#) receptor antagonist, [SQ 29,548](#), to block immediate transient contractions to hydrogen peroxide and to isolate slowly developing sustained contractions. When exposed to hydrogen peroxide (0.1, 0.2, 0.3, 0.6, and 1.0 mM) for 30 min, vessels contracted in a concn-dependent fashion between 0.1 and 0.3 mM hydrogen peroxide; contractions at 0.6 and 1.0 mM hydrogen peroxide were not significantly different from those at 0.3 mM hydrogen peroxide. During recovery (90 min) from hydrogen peroxide exposures, baseline tension was significantly greater, but active tension (10 uM [phenylephrine](#)) was significantly less for vessels previously exposed to 0.6 and 1.0 mM hydrogen peroxide.

*Sheehan DW et al; Am J Physiol 264 (5 PART 2): H1542-H1547 (1993)*

► from [HSDB](#)

Free radical generation from hydrogen peroxide and lipid hydroperoxides in the presence of [chromium\(III\)](#) was investigated by electron spin resonance spin trapping methodology. Incubation of [chromium\(III\)](#) with hydrogen peroxide at physiological pH generated [hydroxyl](#) radical, the yield of which reached saturation level in about 6 min. [Deferoxamine](#) reduced the [hydroxyl](#) radical yield by only about 20%, [diethylenetriamine pentaacetic acid](#) reduced it by about 70%, while [cysteine](#), [glutathione](#), and [NADH](#) exhibited no significant effect. The yield of [hydroxyl](#) radical formation also depended on the pH being 15 times higher at pH 10 than that at pH 7.2. At pH 3.0, [hydroxyl](#) radical generation became nondetectable, and addition of hydrogen peroxide to [chromium\(III\)](#) solution did not affect the intensity of the [chromium\(III\)](#) electron spin resonance signal while at pH 10, addition of hydrogen peroxide reduced the [chromium\(II\)](#) intensity by about 40%, showing that reaction of [chromium\(III\)](#) with hydrogen peroxide occurred only at higher pH. [Chromium\(III\)](#) is capable of producing free radicals from hydrogen peroxide and lipid hydroperoxides.

Abstract: [PubMed](#)

*Shi X et al; Arch Biochem Biophys 302 (1): 294-99 (1993)*

► from [HSDB](#)

Electron spin resonance spin trapping was utilized to investigate the generation of free radicals from [cumene hydroperoxide](#), [tert-butyl hydroperoxide](#), and hydrogen peroxide at pH 7.2 by cobalt(II) in the presence of cysteinyl and histidyl chelating agents. Incubation of cobalt(II) with [cumene hydroperoxide](#) or [tert-butyl hydroperoxide](#) did not generate any detectable amounts of free radicals. However, in the presence of [glutathione](#), [cysteine](#), [penicillamine](#), or [N-acetylcysteine](#), cobalt(II) generated [cumene hydroperoxide](#)-derived carbon-centered radicals, [cumene](#) alkoxyl radicals, and [hydroxyl](#) radicals. Oxidized glutathione and [cysteine](#) used instead of reduced glutathione or [cysteine](#) did not generate any free radical, indicating an important role of the -SH group in radical generation. While the addition of [diethylenetriamine pentaacetic acid](#) prevented radical generation, [deferoxamine](#) had only a slightly inhibitory effect. Incubation of cobalt(II) with hydrogen peroxide produced only a small amount of [hydroxyl](#) radicals. Addition of [glutathione](#) to the mixture of cobalt(II) and hydrogen peroxide resulted in generation of both glutathionyl and [hydroxyl](#) radicals, which could be inhibited by [diethylenetriamine pentaacetic acid](#) and [deferoxamine](#). Under the same experimental conditions, [cysteine](#), [penicillamine](#), and [N-acetylcysteine](#) inhibited free radical generation from the reaction of cobalt(II) with hydrogen peroxide. [Histidine](#) and histidyl oligopeptides, [homocarnosine](#), and [carnosine](#) did not have a significant effect. However, [anserine](#) enhanced the [hydroxyl](#) radical generation from this reaction. Cobalt(II) is capable of generating free radicals from lipid hydroperoxides and hydrogen peroxide in the presence of certain chelating agents.

Abstract: [PubMed](#)

*Shi X et al; Chem Res Toxicol 6 (3): 277-83 (1993)*

► from HSDB

A comparison was made between the house mouse (*Mus musculus*) and the white-footed mouse (*Peromyscus leucopus*): the latter has > 2 fold greater life span and metabolic potential than the former. Longe life span and higher metabolic potential of *Peromyscus* were associated with low rates of mitochondrial superoxide radical and hydrogen peroxide generation, higher activities of catalase and [glutathione](#) peroxidase and low levels of protein oxidative damage as well as low susceptibility to oxidative damage in response to experimental oxidative stress. Results support the role of oxidative stress in aging.

Abstract: [PubMed](#)

*Sohal RS et al; Biochem Biophys Res Commun 196 (1): 7-11 (1993)*

► from HSDB

Energy transduction, as measured by myocyte respiration, was inhibited by hydrogen peroxide, but the mitochondrial membrane potential was relatively unaffected. In mitochondrial energy transduction by measuring the sensitivity to hydrogen peroxide of [NADH-CoQ reductase](#), [ATP synthase](#), and adenine nucleotide translocase in situ in myocytes. Adult rat heart cells were isolated and incubated in the presence of 0.1-10 mM hydrogen peroxide for 30 min. The [NADH-CoQ reductase](#) and [ATP synthase](#) activities were inhibited to 77% and 67% of control, respectively, following an exposure to 10 mM hydrogen peroxide for 30 min. The adenine nucleotide translocase activities were inhibited in a concn- and time-dependent manner and by 10 mM hydrogen peroxide to 44% of control. The dose-response relationship indicated that the translocase was the most susceptible to hydrogen peroxide among the three enzymes studied. Combined treatment of myocytes with [3-amino-1,2,4-triazole](#), [1,3-bis\(2-chloroethyl\)-1-nitrosourea](#) and [diethyl maleate](#) (to inactivate catalase, to inhibit [glutathione](#) reductase activity, and to deplete [glutathione](#), respectively) enhanced the sensitivity of translocase to hydrogen peroxide. Hydrogen peroxide can cause dysfunction in mitochondrial energy transduction, principally as the result of inhibition of adenine nucleotide translocase.

Abstract: [PubMed](#)

*Tatsumi T, Kako KJ; Basic Res Cardiol 88 (3): 199-211 (1993)*

► from HSDB

Inhalation of 90% hydrogen peroxide induces lung inflammation in animals.

*Ellenhorn, M.J., S. Schonwald, G. Ordog, J. Wasserberger. Ellenhorn's Medical Toxicology: Diagnosis and Treatment of Human Poisoning. 2nd ed. Baltimore, MD: Williams and Wilkins, 1997., p. 1222*

► from HSDB

### 14.1.15 Populations at Special Risk

Individuals with eye, skin, and chronic respiratory diseases /may be/ at an increased risk.

*Mackison, F. W., R. S. Stricoff, and L. J. Partridge, Jr. (eds.). NIOSH/OSHA - Occupational Health Guidelines for Chemical Hazards. DHHS(NIOSH) Publication No. 81-123 (3 VOLS). Washington, DC: U.S. Government Printing Office, Jan. 1981., p. 1*

► from HSDB

## 14.2 Ecological Information

### 14.2.1 EPA Ecotoxicity

Download

1 to 5 of 18 <a href="#">View More</a>				
Record ID	Pesticide Type	Organism	Dose Type	Toxicity
<a href="#">9134</a>	Microbiocide	Water flea	EC50	4.3 PPM
<a href="#">9135</a>	Microbiocide	Rainbow trout	LC50	5.0 PPM
<a href="#">9136</a>	Microbiocide	Bluegill sunfish	LC50	20.7 PPM
<a href="#">9137</a>	Microbiocide	Water flea	EC50	24 PPM
<a href="#">9138</a>	Microbiocide	Bluegill sunfish	LC50	26.7 PPM

► from EPA Office of Pesticide Programs

### 14.2.2 ICSC Environmental Data

The substance is toxic to aquatic organisms.

► from ILO-ICSC

### 14.2.3 Natural Occurring Sources

Gaseous hydrogen peroxide is recognized to be a key component and product of the earth's lower atmospheric photochemical reactions, both in a clean and polluted atmosphere. Atmospheric hydrogen peroxide is believed to be generated exclusively by gas-phase photochemical reactions.

*IARC MONOGRAPHS 1972-PRESENT V36 p.291*

► from HSDB

### 14.2.4 Atmospheric Concentrations

Measurements of hydrogen peroxide concentrations in the gas-phase and in cloud [water](#) were obtained in the vicinity of the USA Carolinas coast between late Jan and early Mar 1986. Gas phase concentrations, determined by a fluorometric method, were always less than 2.4 ppb and generally less than 1 ppb. Vertical profiles of hydrogen peroxide in the clear air around clouds and storm systems were highly variable. Concentrations of hydrogen peroxide in cloud [water](#) ranged from the detection limit of 0.3 uM to 112 uM, with higher values generally occurring in the vicinity of lightning activity. Hydrogen peroxide concentrations in cloud [water](#) were well below those calculated to be in Henry's law equilibrium with gas-phase concentrations of hydrogen peroxide in the cloudy air.

*Barth MC et al; Tellus 41B (1): 61-9 (1989)*

► *from HSDB*

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### 14.2.5 Probable Routes of Human Exposure

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Inhalation of vapor or mist, ingestion, eye and skin contact.

*Sittig, M. Handbook of Toxic and Hazardous Chemicals and Carcinogens, 1985. 2nd ed. Park Ridge, NJ: Noyes Data Corporation, 1985., p. 510*

► *from HSDB*

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## 15 Literature

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### 15.1 Depositor Provided PubMed Citations

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### 15.2 NLM Curated PubMed Citations

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### 15.3 General References

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#### General Reference

Finnegan M, Linley E, Denyer SP, McDonnell G, Simons C, Maillard JY: Mode of action of hydrogen peroxide and other oxidizing agents: differences between liquid and gas forms. J Antimicrob Chemother. 2010 Oct;65(10):2108-15. doi: 10.1093/jac/dkq308. Epub 2010 Aug 16.  
Abstract: [PubMed](#)

▶ *from DrugBank*

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#### General Reference

Linley E, Denyer SP, McDonnell G, Simons C, Maillard JY: Use of hydrogen peroxide as a biocide: new consideration of its mechanisms of biocidal action. J Antimicrob Chemother. 2012 Jul;67(7):1589-96. doi: 10.1093/jac/dks129. Epub 2012 Apr 24.  
Abstract: [PubMed](#)

▶ *from DrugBank*

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### General Reference

HYDROGEN PEROXIDE - National Library of Medicine [HSDB](#) ... - Toxnet

► *from DrugBank*

### General Reference

Chemical Summary for Hydrogen Peroxide - SSWM

► *from DrugBank*

## 15.4 Metabolite References

Download

1 to 5 of 5	
PMID	Reference
<a href="#">17150302</a>	Lopez-Lazaro M: Dual role of hydrogen peroxide in cancer: possible relevance to cancer chemoprevention and therapy. <i>Cancer Lett.</i> 2007 Jul 8;252(1):1-8. Epub 2006 Dec 5.
<a href="#">17335854</a>	Schallreuter KU, Elwary S: Hydrogen peroxide regulates the cholinergic signal in a concentration dependent manner. <i>Life Sci.</i> 2007 May 30;80(24-25):2221-6. Epub 2007 Jan 25.
<a href="#">16677071</a>	Stone JR, Yang S: Hydrogen peroxide: a signaling messenger. <i>Antioxid Redox Signal.</i> 2006 Mar-Apr;8(3-4):243-70.
<a href="#">16607324</a>	Tredwin CJ, Naik S, Lewis NJ, Scully C: Hydrogen peroxide tooth-whitening (bleaching) products: review of adverse effects and safety issues. <i>Br Dent J.</i> 2006 Apr 8;200(7):371-6.
<a href="#">16514169</a>	Ardanaz N, Pagano PJ: Hydrogen peroxide as a paracrine vascular mediator: regulation and signaling leading to dysfunction. <i>Exp Biol Med (Maywood).</i> 2006 Mar;231(3):237-51.

► *from Human Metabolome Database (HMDB)*

## 15.5 Springer Nature References

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► *from Springer Nature*

## 15.6 Chemical Co-Occurrences in Literature

CLICK TO LOAD...

View More Chemical-Chemical Co-Occurrences and Evidence for Hydrogen Peroxide

► *from PubChem*

## 15.7 Chemical-Disease Co-Occurrences in Literature

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CLICK TO LOAD...

View More Chemical-Disease Co-Occurrences and Evidence for Hydrogen Peroxide

► *from PubChem*

## 15.8 Chemical-Gene Co-Occurrences in Literature

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CLICK TO LOAD...

View More Chemical-Gene Co-Occurrences and Evidence for Hydrogen Peroxide

► *from PubChem*

## 16 Patents

1. US7381427
2. US9675639

► *from DrugBank*

### 16.1 Depositor-Supplied Patent Identifiers

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► *from PubChem*

### 16.2 FDA Orange Book Patents

FDA Orange Book Patents: 1 of 3 (FDA Orange Book Patent ID)	
Patent	<a href="#">7381427</a>
Expiration	Jun 8, 2022
Applicant	ACLARIS THERAPS INC
Drug Application	<a href="#">N209305</a> (Prescription Drug: ESKATA. Ingredients: HYDROGEN PEROXIDE)

► *from FDA Orange Book*

FDA Orange Book Patents: 2 of 3 (FDA Orange Book Patent ID)	
Patent	<a href="#">9675639</a>
Expiration	Jul 4, 2035
Applicant	ACLARIS THERAPS INC
Drug Application	<a href="#">N209305</a> (Prescription Drug: ESKATA. Ingredients: HYDROGEN PEROXIDE)

► *from FDA Orange Book*

FDA Orange Book Patents: 3 of 3 (FDA Orange Book Patent ID)	
Patent	<a href="#">9980983</a>
Expiration	Apr 21, 2035



FDA Orange Book Patents: 3 of 3 (FDA Orange Book Patent ID)	
Applicant	ACLARIS THERAPS INC
Drug Application	<a href="#">N209305</a> (Prescription Drug: ESKATA. Ingredients: HYDROGEN PEROXIDE)

▶ *from FDA Orange Book*

# 17 Biomolecular Interactions and Pathways

## 17.1 Protein Bound 3-D Structures

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▸ from PDB

[View 167 proteins in NCBI Structure](#)

▸ from PubChem

## 17.2 Biosystems and Pathways

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▸ from PubChem

## 17.3 DrugBank Interactions

Enzyme	<a href="#">Glutathione peroxidase 1</a>
Action	substrate
PubChem Protein Target	<a href="#">P07203</a>
PubChem Gene Target	<a href="#">GPX1</a>
General	Sh3 domain binding

Function	
Specific Function	Protects the hemoglobin in erythrocytes from oxidative breakdown.
Reference	Gaetani GF, Galiano S, Canepa L, Ferraris AM, Kirkman HN: Catalase and <a href="#">glutathione</a> peroxidase are equally active in detoxification of hydrogen peroxide in human erythrocytes. Blood. 1989 Jan;73(1):334-9. Abstract: <a href="#">PubMed</a>
Reference	HYDROGEN PEROXIDE - National Library of Medicine <a href="#">HSDB</a> ... - Toxnet
Reference	<a href="#">Chemical Summary for Hydrogen Peroxide</a> - SSWM

► from DrugBank

Enzyme	<a href="#">Catalase</a>
Action	substrate
PubChem Protein Target	<a href="#">P04040</a>
PubChem Gene Target	<a href="#">CAT</a>
General Function	Receptor binding
Specific Function	Occurs in almost all aerobically respiring organisms and serves to protect cells from the toxic effects of hydrogen peroxide. Promotes growth of cells including T-cells, B-cells, myeloid leukemia cells, melanoma cells, mastocytoma cells and normal and transformed fibroblast cells.
Reference	Gaetani GF, Galiano S, Canepa L, Ferraris AM, Kirkman HN: Catalase and <a href="#">glutathione</a> peroxidase are equally active in detoxification of hydrogen peroxide in human erythrocytes. Blood. 1989 Jan;73(1):334-9. Abstract: <a href="#">PubMed</a>
Reference	HYDROGEN PEROXIDE - National Library of Medicine <a href="#">HSDB</a> ... - Toxnet
Reference	<a href="#">Chemical Summary for Hydrogen Peroxide</a> - SSWM

► from DrugBank

Enzyme	<a href="#">Alkaline phosphatase, placental-like</a>
Action	inhibitor
PubChem Protein Target	<a href="#">P10696</a>
PubChem Gene Target	<a href="#">ALPPL2</a>
General Function	Metal ion binding
Reference	Finnegan M, Linley E, Denyer SP, McDonnell G, Simons C, Maillard JY: Mode of action of hydrogen peroxide and other oxidizing agents: differences between liquid and gas forms. J Antimicrob Chemother. 2010 Oct;65(10):2108-15. doi: 10.1093/jac/dkq308. Epub 2010 Aug 16. Abstract: <a href="#">PubMed</a>



## 18 Biological Test Results

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### 18.1 BioAssay Results

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► *from PubChem*

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## 19 Classification

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### 19.1 Ontologies

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#### 19.1.1 MeSH Tree

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CLICK TO LOAD...

▶ *from MeSH*

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#### 19.1.2 ChEBI Ontology

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CLICK TO LOAD...

▶ *from ChEBI*

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#### 19.1.3 KEGG: Carcinogen

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CLICK TO LOAD...

[▶ from KEGG](#)

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#### 19.1.4 KEGG: Drug

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CLICK TO LOAD...

[▶ from KEGG](#)

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#### 19.1.5 KEGG: ATC

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CLICK TO LOAD...

[▶ from KEGG](#)

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#### 19.1.6 KEGG: JP15

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CLICK TO LOAD...

[▶ from KEGG](#)

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### 19.1.7 KEGG: Risk Category of Japanese OTC Drugs

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CLICK TO LOAD...

▶ *from KEGG*

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### 19.1.8 KEGG: OTC drugs

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CLICK TO LOAD...

▶ *from KEGG*

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### 19.1.9 KEGG: Animal Drugs

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CLICK TO LOAD...

▶ *from KEGG*

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### 19.1.10 WHO ATC Classification System

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▸ *from WHO ATC*

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#### 19.1.11 WIPO IPC

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CLICK TO LOAD...

▸ *from WIPO*

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#### 19.1.12 EPA Safer Choice

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CLICK TO LOAD...

▸ *from EPA Safer Choice*

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#### 19.1.13 ChemIDplus

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CLICK TO LOAD...

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▶ *from ChemIDplus*

#### 19.1.14 CAMEO Chemicals

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CLICK TO LOAD...

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▶ *from CAMEO Chemicals*

#### 19.1.15 Guide to PHARMACOLOGY Target Classification

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CLICK TO LOAD...

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▶ *from IUPHAR/BPS Guide to PHARMACOLOGY*

## 20 Information Sources

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### 1. CAMEO Chemicals /source/CAMEO Chemicals

HYDROGEN PEROXIDE, AQUEOUS SOLUTION, STABILIZED, WITH MORE THAN 60% HYDROGEN PEROXIDE

<https://cameochemicals.noaa.gov/chemical/19279> <https://cameochemicals.noaa.gov/chemical/19279>

HYDROGEN PEROXIDE, AQUEOUS SOLUTION, WITH NOT LESS THAN 20% BUT NOT MORE THAN 60% HYDROGEN PEROXIDE (STABILIZED AS NECESSARY)

<https://cameochemicals.noaa.gov/chemical/890> <https://cameochemicals.noaa.gov/chemical/890>

HYDROGEN PEROXIDE, AQUEOUS SOLUTION, WITH NOT LESS THAN 8% BUT LESS THAN 20% HYDROGEN PEROXIDE

<https://cameochemicals.noaa.gov/chemical/891> <https://cameochemicals.noaa.gov/chemical/891>

HYDROGEN PEROXIDE, STABILIZED

<https://cameochemicals.noaa.gov/chemical/5023> <https://cameochemicals.noaa.gov/chemical/5023>

CAMEO Chemical Reactivity Classification

<https://cameochemicals.noaa.gov/browse/react> <https://cameochemicals.noaa.gov/browse/react>

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### 2. ChemIDplus /source/ChemIDplus

Hydrogen peroxide [USP]

<https://chem.nlm.nih.gov/chemidplus/sid/0007722841> <https://chem.nlm.nih.gov/chemidplus/sid/0007722841>

ChemIDplus Chemical Information Classification

<https://chem.sis.nlm.nih.gov/chemidplus/chemidheavy.jsp> <https://chem.sis.nlm.nih.gov/chemidplus/chemidheavy.jsp>

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### 3. DTP/NCI /source/DTP/NCI

hydrogen peroxide

<https://dtp.cancer.gov/dtpstandard/servlet/dwindex?searchtype=NSC&outputformat=html&searchlist=19892>

<https://dtp.cancer.gov/dtpstandard/servlet/dwindex?searchtype=NSC&outputformat=html&searchlist=19892>

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### 4. DrugBank /source/DrugBank

Hydrogen peroxide

<http://www.drugbank.ca/drugs/DB11091> <http://www.drugbank.ca/drugs/DB11091>

<http://www.drugbank.ca/drugs/DB11091#enzymes> <http://www.drugbank.ca/drugs/DB11091#enzymes>

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### 5. EPA Chemicals under the TSCA /source/EPA Chemicals under the TSCA

Hydrogen peroxide (H2O2)

<http://www.epa.gov/chemical-data-reporting> <http://www.epa.gov/chemical-data-reporting>

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### 6. EPA DSStox /source/EPA DSStox

Hydrogen peroxide

<https://comptox.epa.gov/dashboard/dsstoxdb/results?search=DTXSID2020715> <https://comptox.epa.gov/dashboard/dsstoxdb/results?search=DTXSID2020715>

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### 7. European Chemicals Agency (ECHA) /source/European Chemicals Agency (ECHA)

Hydrogen peroxide

<https://echa.europa.eu/substance-information/-/substanceinfo/100.028.878> <https://echa.europa.eu/substance-information/-/substanceinfo/100.028.878>

Hydrogen peroxide

<https://echa.europa.eu/information-on-chemicals/cl-inventory-database/-/discli/details/53297> <https://echa.europa.eu/information-on-chemicals/cl-inventory-database/-/discli/details/53297>

Hydrogen Peroxide 35%

<https://echa.europa.eu/information-on-chemicals> <https://echa.europa.eu/information-on-chemicals>

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### 8. Human Metabolome Database (HMDB) /source/Human Metabolome Database (HMDB)

Hydrogen peroxide

<http://www.hmdb.ca/metabolites/HMDB0003125> <http://www.hmdb.ca/metabolites/HMDB0003125>

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### 9. ILO-ICSC /source/ILO-ICSC

HYDROGEN PEROXIDE (>60% SOLUTION IN WATER)

[http://www.ilo.org/dyn/icsc/showcard.display?p\\_version=2&p\\_card\\_id=0164](http://www.ilo.org/dyn/icsc/showcard.display?p_version=2&p_card_id=0164) [http://www.ilo.org/dyn/icsc/showcard.display?p\\_version=2&p\\_card\\_id=0164](http://www.ilo.org/dyn/icsc/showcard.display?p_version=2&p_card_id=0164)

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10. [OSHA Occupational Chemical DB /source/OSHA Occupational Chemical DB](#)

HYDROGEN PEROXIDE

<http://www.osha.gov/chemicaldata/chemResult.html?RecNo=630> <http://www.osha.gov/chemicaldata/chemResult.html?RecNo=630>

---

11. [The National Institute for Occupational Safety and Health \(NIOSH\) /source/The National Institute for Occupational Safety and Health \(NIOSH\)](#)

Hydrogen peroxide, 90%

<https://www.cdc.gov/niosh-rtecs/MXDBBA0.html> <https://www.cdc.gov/niosh-rtecs/MXDBBA0.html>

Hydrogen peroxide

<https://www.cdc.gov/niosh/npg/npgd0335.html> <https://www.cdc.gov/niosh/npg/npgd0335.html>

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12. [NJDOH RTK Hazardous Substance List /source/NJDOH RTK Hazardous Substance List](#)

hydrogen peroxide

<http://nj.gov/health/eoh/rtkweb/documents/fs/1015.pdf> <http://nj.gov/health/eoh/rtkweb/documents/fs/1015.pdf>

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13. [CDC-ATSDR Toxic Substances Portal /source/CDC-ATSDR Toxic Substances Portal](#)

Hydrogen Peroxide

<https://www.atsdr.cdc.gov/substances/toxsubstance.asp?toxid=55> <https://www.atsdr.cdc.gov/substances/toxsubstance.asp?toxid=55>

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14. [HSDB /source/HSDB](#)

HYDROGEN PEROXIDE

<https://toxnet.nlm.nih.gov/cgi-bin/sis/search/r?dbs+hsdb:@term+@rn+@rel+7722-84-1> <https://toxnet.nlm.nih.gov/cgi-bin/sis/search/r?dbs+hsdb:@term+@rn+@rel+7722-84-1>

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15. [ClinicalTrials.gov /source/ClinicalTrials.gov](#)

Hydrogen peroxide

<https://clinicaltrials.gov/> <https://clinicaltrials.gov/>

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16. [DailyMed /source/DailyMed](#)

HYDROGEN PEROXIDE

<https://dailymed.nlm.nih.gov/dailymed/search.cfm?labeltype=all&query=HYDROGEN+PEROXIDE>

<https://dailymed.nlm.nih.gov/dailymed/search.cfm?labeltype=all&query=HYDROGEN+PEROXIDE>

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17. [FDA/SPL Indexing Data /source/FDA/SPL Indexing Data](#)

BBX060AN9V

<https://www.fda.gov/ForIndustry/DataStandards/SubstanceRegistrationSystem-UniqueIngredientIdentifierUNII/>

<https://www.fda.gov/ForIndustry/DataStandards/SubstanceRegistrationSystem-UniqueIngredientIdentifierUNII/>

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18. [EPA Office of Pesticide Programs /source/EPA Office of Pesticide Programs](#)

The EPA OPP Pesticide Ecotoxicity Database, updated by the Ecological Fate and Effects Division of the EPA Office of Pesticide Programs, contains all EPA reviewed ecotoxicity endpoints for pesticides registered or previously registered in the U.S. Toxicity data.

Read more. <http://www.ipmcenters.org/Ecotox/index.cfm>

<http://www.ipmcenters.org/Ecotox/index.cfm> <http://www.ipmcenters.org/Ecotox/index.cfm>

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19. [EPA Safer Choice /source/EPA Safer Choice](#)

Hydrogen peroxide

<https://www.epa.gov/saferchoice/safer-ingredients> <https://www.epa.gov/saferchoice/safer-ingredients>

EPA Safer Chemical Ingredients Classification

<https://www.epa.gov/saferchoice> <https://www.epa.gov/saferchoice>

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20. [FAO/WHO Food Additive Evaluations \(JECFA\) /source/FAO/WHO Food Additive Evaluations \(JECFA\)](#)

HYDROGEN PEROXIDE

<http://apps.who.int/food-additives-contaminants-jecfa-database/chemical.aspx?chemID=2369> <http://apps.who.int/food-additives-contaminants-jecfa-database/chemical.aspx?chemID=2369>

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21. [EU Pesticides Database /source/EU Pesticides Database](#)

Hydrogen peroxide

<http://ec.europa.eu/food/plant/pesticides/eu-pesticides-database/public/?event=activesubstance.detail&language=EN&selectedID=1459>

<http://ec.europa.eu/food/plant/pesticides/eu-pesticides-database/public/?event=activesubstance.detail&language=EN&selectedID=1459>

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22. [EU REGULATION \(EC\) No 1272/2008 /source/EU REGULATION \(EC\) No 1272/2008](#)

hydrogen peroxide solution ... %

[http://ec.europa.eu/growth/sectors/chemicals/classification-labelling/index\\_en.htm](http://ec.europa.eu/growth/sectors/chemicals/classification-labelling/index_en.htm)

[http://ec.europa.eu/growth/sectors/chemicals/classification-labelling/index\\_en.htm](http://ec.europa.eu/growth/sectors/chemicals/classification-labelling/index_en.htm)

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23. [NITE-CMC /source/NITE-CMC](#)

Hydrogen peroxide

<http://www.safe.nite.go.jp/english/ghs/13-mhlw-2044e.html> <http://www.safe.nite.go.jp/english/ghs/13-mhlw-2044e.html>

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24. [Safe Work Australia - HCIS /source/Safe Work Australia - HCIS](#)

hydrogen peroxide solution ... %

<http://hcis.safeworkaustralia.gov.au/HazardousChemical/Details?chemicalID=2530>

<http://hcis.safeworkaustralia.gov.au/HazardousChemical/Details?chemicalID=2530>

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25. [FDA Center for Food Safety and Applied Nutrition \(CFSAN\) /source/FDA Center for Food Safety and Applied Nutrition \(CFSAN\)](#)

HYDROGEN PEROXIDE SOLUTION

<https://www.accessdata.fda.gov/scripts/fdcc/index.cfm?set=IndirectAdditives&id=HYDROGENPEROXIDESOLUTION>

<https://www.accessdata.fda.gov/scripts/fdcc/index.cfm?set=IndirectAdditives&id=HYDROGENPEROXIDESOLUTION>

FCN Number 1471

<https://www.accessdata.fda.gov/scripts/fdcc/index.cfm?set=fcn&id=1471> <https://www.accessdata.fda.gov/scripts/fdcc/index.cfm?set=fcn&id=1471>

set=fcn&id=1471

FCN Number 1465

<https://www.accessdata.fda.gov/scripts/fdcc/index.cfm?set=fcn&id=1465> <https://www.accessdata.fda.gov/scripts/fdcc/index.cfm?set=fcn&id=1465>

set=fcn&id=1465

FCN Number 1430

<https://www.accessdata.fda.gov/scripts/fdcc/index.cfm?set=fcn&id=1430> <https://www.accessdata.fda.gov/scripts/fdcc/index.cfm?set=fcn&id=1430>

set=fcn&id=1430

Hydrogen peroxide

<https://www.fda.gov/Food/IngredientsPackagingLabeling/FoodAdditivesIngredients/ucm091048.htm>

<https://www.fda.gov/Food/IngredientsPackagingLabeling/FoodAdditivesIngredients/ucm091048.htm>

Hydrogen peroxide

<https://www.accessdata.fda.gov/scripts/fdcc/?set=GRASNotices&id=14> <https://www.accessdata.fda.gov/scripts/fdcc/?set=GRASNotices&id=14>

set=GRASNotices&id=14

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26. [FDA Orange Book /source/FDA Orange Book](#)

Patent:9980983

<https://www.fda.gov/Drugs/InformationOnDrugs/ucm129662.htm> <https://www.fda.gov/Drugs/InformationOnDrugs/ucm129662.htm>

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27. [Wikipedia /source/Wikipedia](#)

hydrogen peroxide

[https://en.wikipedia.org/wiki/Hydrogen\\_peroxide](https://en.wikipedia.org/wiki/Hydrogen_peroxide) [https://en.wikipedia.org/wiki/Hydrogen\\_peroxide](https://en.wikipedia.org/wiki/Hydrogen_peroxide)

dioxouranium;hydrogen peroxide

<https://www.wikidata.org/wiki/Q26840928> <https://www.wikidata.org/wiki/Q26840928>

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28. [OSHA Chemical Sampling Information /source/OSHA Chemical Sampling Information](#)

Hydrogen Peroxide

[https://www.osha.gov/dts/chemicalsampling/data/CH\\_246600.html](https://www.osha.gov/dts/chemicalsampling/data/CH_246600.html)

[https://www.osha.gov/dts/chemicalsampling/data/CH\\_246600.html](https://www.osha.gov/dts/chemicalsampling/data/CH_246600.html)

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**29. PDB /source/PDB**

The Protein Data Bank (PDB) is a crystallographic database for the three-dimensional structural data of large biological molecules, such as proteins and nucleic acids

<http://www.rcsb.org/ligand/PEO> <http://www.rcsb.org/ligand/PEO>

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**30. Pistoia Alliance Chemical Safety Library /source/Pistoia Alliance Chemical Safety Library**

Hydrogen peroxide

<http://www.pistoiaalliance.org/projects/chemical-safety-library/> <http://www.pistoiaalliance.org/projects/chemical-safety-library/>

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**31. PubMed Health /source/PubMed Health**

Hydrogen Peroxide (Topical application route)

<http://www.ncbi.nlm.nih.gov/pubmedhealth/PMHT0031026/> <http://www.ncbi.nlm.nih.gov/pubmedhealth/PMHT0031026/>

Hydrogen Peroxide

<http://www.ncbi.nlm.nih.gov/pubmedhealth/PMHT0000894/> <http://www.ncbi.nlm.nih.gov/pubmedhealth/PMHT0000894/>

Hydrogen Peroxide (On the skin)

<http://www.ncbi.nlm.nih.gov/pubmedhealth/PMHT0010610/> <http://www.ncbi.nlm.nih.gov/pubmedhealth/PMHT0010610/>

Hydrogen Peroxide (By mouth)

<http://www.ncbi.nlm.nih.gov/pubmedhealth/PMHT0010609/> <http://www.ncbi.nlm.nih.gov/pubmedhealth/PMHT0010609/>

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**32. SpectraBase /source/SpectraBase**

<https://spectrabase.com/compound/lhEsGwLnqFp#3TOrgVKeyW> <https://spectrabase.com/compound/lhEsGwLnqFp#3TOrgVKeyW>

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**33. Springer Nature /source/Springer Nature**

Literature references related to scientific contents from Springer Nature journals and books. Read more ... <https://link.springer.com/>

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**34. WHO ATC /source/WHO ATC**

<https://www.whocc.no/atc/> <https://www.whocc.no/atc/>

ATC Code

[https://www.whocc.no/atc\\_ddd\\_index/](https://www.whocc.no/atc_ddd_index/) [https://www.whocc.no/atc\\_ddd\\_index/](https://www.whocc.no/atc_ddd_index/)

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**35. PubChem**

Data deposited in or computed by PubChem

<https://pubchem.ncbi.nlm.nih.gov> <https://pubchem.ncbi.nlm.nih.gov>

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**36. MeSH /source/MeSH**

Hydrogen Peroxide

<https://www.ncbi.nlm.nih.gov/mesh/68006861> <https://www.ncbi.nlm.nih.gov/mesh/68006861>

MeSH Tree

<http://www.nlm.nih.gov/mesh/meshhome.html> <http://www.nlm.nih.gov/mesh/meshhome.html>

Oxidants

<https://www.ncbi.nlm.nih.gov/mesh/68016877> <https://www.ncbi.nlm.nih.gov/mesh/68016877>

Anti-Infective Agents, Local

<https://www.ncbi.nlm.nih.gov/mesh/68000891> <https://www.ncbi.nlm.nih.gov/mesh/68000891>

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**37. ChEBI /source/ChEBI**

ChEBI Ontology

<http://www.ebi.ac.uk/chebi/userManualForward.do#ChEBI%20Ontology>

<http://www.ebi.ac.uk/chebi/userManualForward.do#ChEBI%20Ontology>

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**38. KEGG /source/KEGG**

Carcinogens

[http://www.genome.jp/kegg-bin/get\\_htext?br08008.keg](http://www.genome.jp/kegg-bin/get_htext?br08008.keg) [http://www.genome.jp/kegg-bin/get\\_htext?br08008.keg](http://www.genome.jp/kegg-bin/get_htext?br08008.keg)

Therapeutic category of drugs in Japan

[http://www.genome.jp/kegg-bin/get\\_htext?br08301.keg](http://www.genome.jp/kegg-bin/get_htext?br08301.keg) [http://www.genome.jp/kegg-bin/get\\_htext?br08301.keg](http://www.genome.jp/kegg-bin/get_htext?br08301.keg)

Anatomical Therapeutic Chemical (ATC) classification

[http://www.genome.jp/kegg-bin/get\\_htext?br08303.keg](http://www.genome.jp/kegg-bin/get_htext?br08303.keg) [http://www.genome.jp/kegg-bin/get\\_htext?br08303.keg](http://www.genome.jp/kegg-bin/get_htext?br08303.keg)

Drugs listed in the Japanese Pharmacopoeia

[http://www.genome.jp/kegg-bin/get\\_htext?br08311.keg](http://www.genome.jp/kegg-bin/get_htext?br08311.keg) [http://www.genome.jp/kegg-bin/get\\_htext?br08311.keg](http://www.genome.jp/kegg-bin/get_htext?br08311.keg)

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*Risk category of Japanese OTC drugs*

[http://www.genome.jp/kegg-bin/get\\_htext?br08312.keg](http://www.genome.jp/kegg-bin/get_htext?br08312.keg) [http://www.genome.jp/kegg-bin/get\\_htext?br08312.keg](http://www.genome.jp/kegg-bin/get_htext?br08312.keg)

*Classification of Japanese OTC drugs*

[http://www.genome.jp/kegg-bin/get\\_htext?br08313.keg](http://www.genome.jp/kegg-bin/get_htext?br08313.keg) [http://www.genome.jp/kegg-bin/get\\_htext?br08313.keg](http://www.genome.jp/kegg-bin/get_htext?br08313.keg)

*Animal drugs in Japan*

[http://www.genome.jp/kegg-bin/get\\_htext?br08331.keg](http://www.genome.jp/kegg-bin/get_htext?br08331.keg) [http://www.genome.jp/kegg-bin/get\\_htext?br08331.keg](http://www.genome.jp/kegg-bin/get_htext?br08331.keg)

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### 39. [WIPO /source/WIPO](#)

*International Patent Classification*

<http://www.wipo.int/classifications/ipc/> <http://www.wipo.int/classifications/ipc/>

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### 40. [IUPHAR/BPS Guide to PHARMACOLOGY /source/IUPHAR/BPS Guide to PHARMACOLOGY](#)

*Target Classification*

<http://www.guidetopharmacology.org/> <http://www.guidetopharmacology.org/>

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