Material Safety Data Sheet

Chemical Name: Hydroxyl Radical (Atmospheric)	**Date:** 10/26/2009	**Other Names**:
Chemical Formula: •OH /or/ HO•	**CAS**: 3352-57-6	
Manufacturer: HGI Industries, Inc. 2055 High Ridge Road Boynton Beach, FL 33426	**Contact Info:** (561) 735-3701 (877) 735-3701 www.hgiind.com	**Contact Person:** Ralph Kubitzki, Director of Research

Physical Properties

Molecular Mass:17.01g mol^{-1} Melting Point: N/A Boiling Point: N/A Flashpoint: N/A Density (@ 20 C): N/A Vapor Pressure: N/A Vapor Density: N/A Concentration: 4 ppt /or/ 0.000000000004	Water Solubility: N/A pH in Solution: N/A Dissociation Constant: N/A Oxidation Reduction Potential: N/A Corrosivity to Material: N/A Reactivity to Container Material: N/A Auto-Ignition Temperature: N/A	Explosive Properties: N/A Oxidizing Properties: N/A Surface Tension: N/A Viscosity: N/A Thermal Stability: N/A Other Physical Property: N/A

Exposure Limits

ACGIH: N/A	NIOSH: N/A	Comment: See note below on naturally occurring and generated concentrations of hydroxyl radicals.

Physical Properties Notes: This MSDS was developed for atmospheric (tropospheric) hydroxyl radicals. Hydroxyl radicals are unstable. They are formed and exist for less than one second; with a half-life in nanoseconds. They are naturally occurring from the sun's ultraviolet light imparting energy on water vapor molecules. Hydroxyl radicals are abundant in the outdoors during daylight hours. They have no known adverse human effects and are not considered a hazardous chemical. Hydroxyl radicals are produced in-situ by means of a photolysis process. They are not packaged, stored or transported in containers.

The outside environment has average concentrations of atmospheric hydroxyl molecules in the order of $2X10^{6}$ cm^{-3}. That figure equates to trillions of hydroxyls within the size of a sugar cube. Concentrations of hydroxyl radicals formed in the troposphere on sunny days are on the order of 1,000 times greater than the concentrations produced by UV based hydroxyl generating equipment. Specific hydroxyl radical concentrations vary across the Earth based on the location's latitude (amount of the Sun's energy) and the local relative humidity.

Note: There are biological or "in-vivo" hydroxyl radicals that may be formed inside the human body. Biological hydroxyl radicals cannot be formed through photo-catalytic mechanisms. Biological hydroxyl radicals are formed by chemical reactions inside the body. Those hydroxyl radicals can only travel a few angstroms in distance from where they are formed.

Atmospheric hydroxyl radicals have no known adverse affect on humans or animals.

Carcinogenicity

None	Comment: Not listed as carcinogen in National Toxicology Program (NTP), International Agency for Research on Cancer (IARC), or OSHA.

Acute Toxicity	
Comment: No known acute toxicity	
Effects on Eyes and Skin	
None	Comment: Hydroxyl radicals are prevalent in the natural environment. There are no known human or animal toxicity from atmospheric hydroxyl radicals. Equipment designed for generating hydroxyl radicals by photo-catalytic processes (through UV radiation) must be designed to keep unprotected eyes and skin shielded from the UV radiation while device is in operation. Odorox® Hydroxyl Generators are certified to provide shielded protection. The only identified physical hazard associated with this equipment comes from the irradiation of the ultraviolet source. The irradiation field strength at 1 meter from the reaction vessel is under 200 μwatts/cm^2 which corresponds to less than 45% of the Occupational Health and Safety Act's exposure limit for an eight hour day at a wavelength of 350 nm (and is about one-seventh of the intensity experienced during a sunny summer day). NOTE: During routine maintenance UV rated eye protection is required; see ANSI Z87.1-2003. Do not look directly at UV optics while in operation, and do not expose skin to UV irradiation.
Irritation to Respiratory Tract	
None	Comment: Hydroxyl radicals are prevalent in the natural environment. No known human or animal toxicity from atmospheric hydroxyl radicals.
Repeated Dose Toxicity	
None	Comment: Hydroxyl radicals are prevalent in the natural environment. No known human or animal toxicity from atmospheric hydroxyl radicals.
Chronic and Long Term Toxicity	
None	Comment: Hydroxyl radicals are prevalent in the natural environment. No known human or animal toxicity from atmospheric hydroxyl radicals.
Mutagenicity / Genotoxicity	
None	Comment: Atmospheric hydroxyl radicals do not penetrate skin, eyes, or blood stream through the respiratory system. As discussed in the physical properties section, there are data referring to biological (in-vivo) hydroxyl radical mechanisms that are not generated by photo-catalytic processes. Biological hydroxyl radicals are suspected of having effects on lipids and DNA within close proximity of biological hydroxyl radicals, NOT atmospheric hydroxyl radicals.
Developmental and Reproductive Toxicity	
None	Comment: Hydroxyl radicals are prevalent in the natural environment. No known human or animal toxicity from atmospheric hydroxyl radicals.

Toxicokinetics	
None	Comment: Hydroxyl radicals are prevalent in the natural environment. No known human or animal toxicity from atmospheric hydroxyl radicals.
Emergency First Aid	
None	
Conclusions from Health Hazard Assessment	
Human beings are designed to be in a hydroxyl-rich environment; atmospheric hydroxyls do not pass into human, animal or plant cells. Atmospheric hydroxyls therefore do not affect human internal cells in the way that biological hydroxyls effect internal cells (see the discussion on biological hydroxyls above).	
Summary of Risks to Exposed Personnel	
No known health risks	Comment: Atmospheric hydroxyl radicals are produced in-situ. No packaging, transportation or storage of this substance is required. Hydroxyl radicals are naturally occurring; humans, plants and animals thrive in a hydroxyl rich environment.
Environmental Risks	
Persistence	None
Bioaccumulation	None
Toxicity	None
No known health risks	Comment: Hydroxyl radicals are known to be created in nature by the ultraviolet (UV) energy from the Sun. The Sun's energy reduces atmospheric water molecules (water vapor in the air; measured as relative humidity). The reduction of water molecules results in one hydrogen atom (H) and one negative oxygen-hydrogen molecule (•OH). The •OH molecule is the hydroxyl radical. It is the action of atmospheric hydroxyls that naturally cleans the air that we all breathe. Only a few compounds in the troposphere do not react at all or react only very slowly with the hydroxyl radical. These include the chlorofluorocarbons (CFC's), nitrous oxide (N_2O) and carbon dioxide (CO_2). The rate of methane (CH_4) oxidation by •OH is also very slow, between 100 and 1000 times slower than other organic compounds. This is why methane concentrations in the atmosphere can reach around 1.77 ppm; a value significantly higher than the concentrations of other organic trace gas concentrations present which are generally below 1 ppb.