

PROPERTIES OF OZONE

Ozone (O₃) is the triatomic, allotropic form of oxygen (O₂). It is an unstable gas with a pungent odor. Since ozone is unstable, it must be generated at the point of application.

The Ozone molecule, having a molecular weight of 48, is made up of three oxygen atoms bound by equal oxygen-oxygen bonds at an obtuse angle of 116°49'. This structure is inherently unstable and is the reason for ozone's powerful oxidizing ability. Ozone has approximately 150% the oxidizing potential of chlorine. The physical properties of ozone and comparative oxidizing potentials for other chemical oxidants are presented in Table 1 and Table 2, respectively.

Table 1 Physical Constants of Ozone	
Molecular weight, g/g-mol	48.0
Boiling point, °C	-111.9
Melting point, °C	-193.0
Gas density, 0°C grams/liter	2.144
Critical temperature, °C	-12.1
Critical pressure, atm.	54.6
Critical volume, cc/mol	147.1

Table 2 Comparative Oxidizing Potentials, 25°C Volts	
Fluorine (F ₂)	2.87
Ozone (O ₃)	2.07
Hydrogen Peroxide (H ₂ O ₂)	1.78
Potassium Permanganate (KMnO ₄)	1.70
Hyprobromous Acid (HOBr)	1.59
Hypochlorous Acid (HOCl)	1.49
Chlorine (Cl ₂)	1.36
Chlorine dioxide (ClO ₂)	1.27
Oxygen (O ₂)	1.23
Chromic Acid (H ₂ CrO ₄)	1.21
Bromine (Br ₂)	1.09
Nitric Acid (HNO ₃)	0.94
Iodine (I ₂)	0.54

HEALTH EFFECTS OF OZONE

	Concentration (ppm)	Duration of Exposure	Effect
ACCEPTABLE ZONE	0.01-0.04	-	Odor threshold.
	0.1	-	Minor eye, nose and throat irritation.
	0.1	<i>8 hour average exposure limit</i>	
HAZARDOUS ZONE	>0.1	few minutes	Continuous headache, shortness of breath.
	0.25-0.5	2-5 hours	Reduction in lung function and the ability to do physical work (for persons with a history of heart or lung disease).
	0.3	<i>15 minute exposure limit</i>	
	0.4	2 hours	Reduction in lung function during moderate work for all persons.
	>0.6	1-2 hours	Chest pain, dry cough.
	1	1-2 hours	Lung irritation (coughing), severe fatigue.
	>1.5	2 hours	Reduced ability to think clearly. Continuing cough and extreme tiredness maybe lasting for 2 weeks.
CRITICAL ZONE	9	intermittent	Severe lung irritation with fluid build-up. Severe pneumonia (arc welders).
	10	<i>Immediately dangerous to life & health</i>	
	11	15 minutes	Rapid unconsciousness.
	50	30 minutes	Expected to be fatal.