TABLE 1: Properties of Common Confined Space Air Contaminants

Test	Safe Limits	Physical Properties	Symptoms and Effects of Exposure
Oxygen (O_2)	>19.5% to <23.5%	Colorless, odorless gas; Non-flammable; >23% creates serious fire hazard	Increased heart rate and depth of breathing, dizziness & headaches Can cause death due to simple asphyxiation
Carbon Monoxide (CO)	<35 PPM	Colorless, odorless gas; Flammability range is 12% to 74%	Dizziness, confusion, nausea & headaches Can cause death by prohibiting blood from carrying oxygen
Hydrogen Sulfide (H_2S)	<10 PPM	Colorless, foul smelling gas, smells like sewer or rotten eggs; Flammability range is 4% to 44%. Heavier than air.	Eye irritation Can cause death due to paralysis of the respiratory system
Ammonia (NH_3)	<25 PPM	Colorless, pungent smelling gas; Flammability range is 15% to 28%. Lighter than air.	Eye and respiratory system irritation Can cause death from pulmonary edema
Sulfur Dioxide (SO_2)	<2 PPM	Colorless, pungent smelling gas; Non-flammable Heavier than air	Eye and respiratory system irritation Can cause death from pulmonary edema or paralysis of the respiratory system
Nitrogen Dioxide (NO_2)	<1 PPM	Yellowish-brown liquid or reddish-brown gas (above 70 degrees) with a pungent, acrid odor.	Inhalation hazard. Irritation to eyes, throat Can cause chest pains and pulmonary edema at higher concentrations.

TABLE 2: Air Contaminant Testing Required Prior to Issuance of Permit

Test	Safe Limits	What To Test	Examples
Oxygen (O_2)	>19.5% to <23.5%	All Vessels	
Carbon Monoxide (CO)	<35 PPM	All Vessels that are part of or connected to a combustion process	Burners, Dryers, Furnaces
Hydrogen Sulfide (H_2S)	<10 PPM	All sulfur, water, or sewage containing vessels and manholes, spillways	Sulfur Pits, Water Tanks, Lift Stations, hydraulic stations, spillways, large water piping (Minerals)
Ammonia (NH_3)	<25 PPM	All Ammonia containing vessels	Bullets, Reactors, Granulators
Sulfur Dioxide (SO_2)	<2 PPM	All Vessels that are part of or connected to a sulfur burning process	Furnaces, Converters, Acid Towers
Nitrogen Dioxide (NO_2)	<1 PPM	All vessels and equipment associate with gas conversion in the sulfuric acid plants	Converter, economizer, associated ductwork
Combustibles	<10% LEL	All Vessels	
Other	Consult Safety	Vessels where carcinogenic or other chemicals which produce non-reversible health effects are used	Trichlorethylene when using Tip-Top Cement

TABLE 3: Guidelines for Continuous Testing of Confined Spaces

Test	When To Test	When To Test	Examples
Oxygen (O_2)	Required	When entering manholes or other vessels that could become oxygen deficient	Sewage Lift Station, Neutralizing the Sulfuric Plant Economizers
CO NH_3 NO_2 SO_2	Designated Permit Person / Entry Supervisor Discretion	Whenever Designated Permit Person / Entry Supervisor feels that there is a possibility that contaminant could become present at any time during entry	When there is potential for accumulation of gasses or IDLH conditions
H_2S	Required	When entering manholes, spillways	Gyp Stack pump manholes, spillways if H2S is detected, sewage lift station
Combustibles	Required	When using flammable liquids or gasses inside vessels	Rubber lining using flammable solvents or adhesive, applying flammable based coatings
Other	Designated Permit Person / Entry Supervisor Discretion	Whenever Designated Permit Person / Entry Supervisor feels that there is a possibility that contaminant could become present at any time during entry	When carcinogenic or other chemicals (e.g. Tip-Top Rubber Cement) are used which produce non-reversible health effects or IDLH conditions