

Alkenes are unsaturated hydrocarbons containing at least one carbon-carbon double bond (C=C). The high electron density of the pi-bond makes them far more chemically reactive than alkanes, serving as fundamental feedstocks in organic synthesis.

Major Applications

- **Polymers & Plastics:** Polymerization of lower alkenes yields vast commercial materials, including polyethylene (packaging, containers) from ethene and polypropylene (textiles, automotive components) from propene.
- **Industrial Chemical Feedstocks:** Ethene converts to ethanol via hydration and to ethylene glycol (antifreeze) via oxidation. Halogenated derivatives like vinyl chloride ($\text{CH}_2=\text{CHCl}$) yield PVC.
- **Agriculture & Food:** Ethene serves as a natural plant hormone to trigger controlled fruit ripening post-harvest. Catalytic hydrogenation converts unsaturated alkenes in vegetable oils into saturated solid fats (margarine).
- **Solvents & Synthetics:** Alkene intermediates feed the production of synthetic detergents, lubricants, and high-octane gasoline additives.

Dangers & Health Hazards

- **High Flammability & Explosion Risk:** Lower alkenes (ethene, propene, butene) are extremely flammable gases that form explosive mixtures with air over wide concentration ranges.
- **Asphyxiation & Toxicity:** In confined spaces, gaseous alkenes act as simple asphyxiants by displacing oxygen. Inhalation of higher concentrations causes central nervous system depression, dizziness, and headache.
- **Environmental Persistence (Polymers):** Non-biodegradable polyalkene plastics accumulate in ecosystems, degrading into microplastics and causing aquatic mortality.
- **Combustion Byproducts:** Incomplete combustion releases toxic carbon monoxide (CO) and soot, while atmospheric release of volatile alkenes contributes to ground-level ozone formation and photochemical smog.

Mitigation & Safety Measures

- **Explosion & Storage Control:** Store gaseous alkenes in pressure vessels equipped with flame arrestors and static-grounding systems. Use spark-proof electrical equipment in handling zones.

- **Ventilation & Monitoring:** Deploy localized exhaust ventilation and continuous hydrocarbon vapor detectors in industrial and laboratory settings.
- **Personal Protective Equipment (PPE):** Wear self-contained breathing apparatus (SCBA) or organic vapor respirators when handling high concentrations, alongside nitrile or neoprene gloves to prevent liquid contact.
- **Environmental Management:** Implement mechanical recycling, chemical depolymerization, and controlled high-temperature incineration for polyalkene wastes to prevent environmental accumulation.