Hydrocarbons/Solvents/Fuels

2.2.5 Hydrocarbons/Solvents/Fuels

2.2.5.1 Aldehydes

2.2.5.2 Alcohols & glycols
  2.2.5.2.1 Diethylene glycol
  2.2.5.2.2 Ethylene glycol
  2.2.5.2.3 Glycol ethers
  2.2.5.2.4 Isopropanol
  2.2.5.2.5 Methanol

2.2.5.3 Aliphatic hydrocarbons
  2.2.5.3.1 Hexane and congeners
  2.2.5.3.2 Mixtures (e.g., gasoline and kerosene)

2.2.5.4 Aromatic hydrocarbons
  2.2.5.4.1 Benzene
  2.2.5.4.2 Polycyclic aromatic hydrocarbons
  2.2.5.4.3 Toluene

2.2.5.5 Halogenated hydrocarbons
  2.2.5.5.1 Carbon tetrachloride
  2.2.5.5.2 Chloroform
  2.2.5.5.3 Methylene chloride
  2.2.5.5.4 Perchloroethylene
  2.2.5.5.5 Trichloroethylene
  2.2.5.5.6 Vinyl chloride

2.2.5.6 Hydrazines

2.2.5.7 Ketones

2.2.5.8 Peroxides

2.2.5.9 Terpenes
Hydrocarbons

- Hydrocarbon
  - Organic compound made up primarily of carbon and hydrogen atoms
- 2 basic types
  - Aliphatic - straight or branched chain
  - Cyclic - closed ring

Hydrocarbons

- Miscellany
  - Many products are mixtures of hydrocarbon (e.g., gasoline)
  - More lipid-soluble products cause more CNS depression
  - Aromatic, aliphatic, chlorinated

<table>
<thead>
<tr>
<th>Hydrocarbon Name</th>
<th>Boiling Point (°C)</th>
<th>M.p. (°C)</th>
<th>Density (g/cm³)</th>
<th>Viscosity (mm²/s)</th>
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</thead>
<tbody>
<tr>
<td>Methane</td>
<td>-167</td>
<td>-183.3</td>
<td>0.717</td>
<td>50.2</td>
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<tr>
<td>Ethane</td>
<td>-89</td>
<td>-112.9</td>
<td>0.637</td>
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<td>Propane</td>
<td>-47.8</td>
<td>-150.6</td>
<td>0.595</td>
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<td>Butane</td>
<td>-1.4</td>
<td>-121.7</td>
<td>0.514</td>
<td>7.9</td>
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<td>Pentane</td>
<td>36.1</td>
<td>-79.8</td>
<td>0.467</td>
<td>5.3</td>
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<tr>
<td>Hexane</td>
<td>68.7</td>
<td>-53.1</td>
<td>0.448</td>
<td>4.8</td>
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</tbody>
</table>

Goldfrank’s Toxicologic Emergencies, 8th ed
Pathophysiology

- Pulmonary toxicity
- Mechanism unclear
- Aspiration pneumonitis
- 3 risk factors
- Viscosity, surface tension, volatility

Pathophysiology

- Pulmonary
- Absence of tachypnea on initial evaluation has an 80% negative predictive value for aspiration pneumonitis
Pathophysiology

- Cardiotoxicity
- Halogenated hydrocarbons, benzene, and toluene are more frequently implicated
- Tachydysrhythmias
- Sudden sniffing death syndrome

Pathophysiology

- CNS
  - CNS depression with acute toxicity
  - Irreversible damage with chronic use
    - White matter degeneration (leukoencephalopathy)

Pathophysiology

- Peripheral nervous system
- Peripheral neuropathy
  - n-hexane, methyl-n-butyl ketone, carbon disulfide, acrylamide, ethylene oxide, trichloroethylene
Pathophysiology

- Hepatotoxicity
  - Mainly with chlorinated hydrocarbons
- Nephrotoxicity
  - Halogenated hydrocarbons
  - Chloroform, carbon tetrachloride, ethylene dichloride, tetrachloroethane, 1,1,1 trichloroethane

n-Hexane

- 6 carbon simple aliphatic hydrocarbon
- Used in
  - Brake cleaning fluid, rubber cement, glues, spray paint, silicones

n-Hexane

- Produces “dying back” peripheral neuropathy
- Begins in stocking glove distribution
  - (Methyl-n-butyl ketone also produces similar neuropathy)
  - Toxicity is from metabolic intermediate
    - 2,5-hexadione
**Methylene Chloride**

- Found in paint removers, cleaning & degreasing agents, aerosol propellants
- Metabolized by CYP2E1 to CO
- Significant, delayed, and prolonged carboxyhemoglobinemia

**Carbon Tetrachloride**

- Industrial solvent and reagent
- Undergoes Phase I dehalogenation in the liver, produces free radicals causing lipid peroxidation
- Centrilobular hepatic necrosis
- Suspected carcinogen
Hydrocarbons

Vinyl Chloride

- Hepatic angiosarcoma
- Acroosteolysis

Trichloroethylene

- Solvent, previously used as general anesthetic
- In presence of CO₂, produces phosgene
- CNS depression
- Cardiotoxic and hepatotoxic

Camphor

- Monoterpenes ketone
- Inhibits cellular respiration, mainly in CNS
- N/V, headache, agitation, and seizures
Other Monoterpene Ketones

- All produce CNS depression
- Oil of wormwood
- Oil of Clove
- Oil of eucalyptus
- Oil of pennyroyal

Pennyroyal Oil

- Main component
- Pulegon
- Hepatotoxic—centrilobular necrosis

Chloroform

- Also known as
  - Trichloromethane and methyltrichloride
- Once used as general anesthetic
- Currently used as intermediary in industry
- Cardiotoxic, hepatotoxic (centrilobular necrosis)