THE SENSE OF SMELL
SENSE OF SMELL

• Some materials can be detected with your nose while they are below a life threatening threshold[PEL, TLV, REL]; others cannot be detected until a life threatening threshold has been exceeded. Detecting chemicals with your nose is the least desirable method and should be avoided, **BUT** it can also be the first warning that something is wrong.
Objectives

Terminal Objective:

Why the sense of smell is not a good way to determine chemical exposure.

Enabling Objectives:

• Recognize the basic anatomy of the nose and how it works
• Recognize the meaning of olfactory fatigue and its effect
• Recognize the difference between odor threshold and PEL and TLV
Bears are thought to have the best sense of smell of any animal on earth. For example, the average dog’s sense of smell is 100 times better than a human’s. A blood hound’s is 300 times better. A bear’s sense of smell is 7 times better than a blood hound’s or 2,100 times better than a human’s.
The Olfactory System

1: Nasal Epithelium
2: Receptor Cells
3: Bone
4: Glomerulus
5: Mitral Cells
6: Olfactory Bulb
Nasal Epithelium

- The **Nasal Epithelium** is a specialized tissue inside the nasal cavity that is involved in smell.
Olfactory Receptor Cells

The **Receptor Cells** are contained within the Nasal Epithelium and are attached to the Glomerulus [plural Glomeruli] within the Olfactory Bulb. Receptor Cells can renew themselves on average every 30 days.
Olfactory Bulb

- In most vertebrates, the **olfactory bulb** is the most forward part of the brain. In humans, however, the olfactory bulb is on the bottom side of the brain.
The Olfactory Bulb—cont.

• Transmits smell information to the brain and is thus necessary for a proper sense of smell.

• Four General Categories:
  – Enhancing discrimination between odors
  – Enhancing sensitivity of odor detection
  – Filtering out background odors
  – Permitting higher brain areas involved in arousal and attention to modify detection or the discrimination of odors

*Olfactory Bulb contains the Glomeruli and Receptor Cells*
The glomerulus (plural glomeruli) is a structure in the olfactory bulb. Each odor activates a different pattern of glomeruli.
Mitral Cells

- **Mitral cells** are neurons and extend outward from the Glomeruli to various parts of the brain.
Mitral Cells

- Molecules must dissolve in watery mucous in order to bind to and stimulate the Mitral Cells
- Mitral Cells transmit messages to brain areas where we:
  - Perceive odors
  - Perceive tastes
  - Where we remember people, places, events
  - Associate smells and taste sensations
Detriments to Smell

The following items can hurt or eliminate a person’s ability to smell or detect odors:

• **Medical Conditions**—Head trauma, stroke, subdural hematoma, tumors, hemorrhage, infections, seizures and nerve damage, Parkinson’s and Alzheimer’s diseases

• **Physical Changes**—Stuffy nose, colds, allergies, mouth breathing, dentures

• **Aging and Genetics**—Bone deformities, cleft palate, loss of receptors

• **Toxic Damage**—Acids, solvents, insecticides, chemicals
Olfactory Fatigue

- Olfactory fatigue can commonly be defined as adaptation to constant stimulation of our sensory system for smell.
- The stimulus/odor causes a receptor cell to produce an electrical signal. After that signal is produced, the receptor cell soon stops the flow of ions, thus preventing any further signals and causing us not to “smell” any longer.
- **IN LAYMANS TERMS?**
  
  *The temporary normal inability to distinguish a particular odor after a prolonged exposure to that airborne compound.*

- *Can we think of any examples?*
Odor Threshold

• Odor Threshold—The minimum concentration of a substance at which a majority or at least 50% of test subjects can detect and identify the substance’s characteristic odor.
Brief Overview

• Sense of smell-brief overview (hyperlink removed-unaccessible)
EXPOSURE LIMITS

- OSHA  Occupational Safety Health Administration  PEL [Permissable Exposure Limit]
  \textbf{Only limit enforceable by law}

- ACGIH  American Conference Governmental Industrial Hygienists  TLV[Threshold Limit Value]

- NIOSH  National Institute Occupational Safety Health  REL[Recommended Exposure Limit]
Sense of Smell

• EXERCISE #1
Exercise #2

- EXERCISE #2
- New Jersey Fact Sheets / Right To Know[RTK]
- Search Engine: New Jersey Fact Sheets
Right to Know Hazardous Substance Fact Sheets

Right to Know Program

Workplace Health & Safety Home
RTK Home
RTK Survey
RTK Hazardous Substance List
Fact Sheets Home
RTK en español
Frequently Asked Questions
RTK County Lead Agencies
Download Forms
RTK Publications
Order Publications Online
Contact Us

Fact Sheets Links

- Search for a Fact Sheet
- Quick Listings (A-Z, new, revised, in Spanish, etc.)
- Sign Up To Receive Updates
- Order Fact Sheets on CD

Right to Know Hazardous Substance Fact Sheets

The Fact Sheets are prepared for substances on the New Jersey Right to Know Hazardous Substance List. More than 1,600 Fact Sheets have been completed and more than 900 have been translated into Spanish. The Fact Sheets are prepared on pure substances and contain information on health hazards, exposure limits, personal protective equipment, proper handling, first aid, and emergency procedures for fires and spills.

List Fact Sheets:

- Alphabetical Listing
- New and Revised
- Carcinogens
- Available in Spanish

Emergency Responders Quick Reference
Right to Know Program

Search for a Fact Sheet

Search By

- DOT No
- CAS No
- Chemical Name
- RTK Substance No

(4 digits - eg: 0001)

Search
Common Name: CARBON TETRACHLORIDE
Synonyms: Tetrachlorocarbon, Perchloromethane, Carbon Tet
CAS No.: 56-23-5
Molecular Formula: CCl₄
RTK Substance No.: 0347
Description: Colorless liquid with an Ether-like odor

<table>
<thead>
<tr>
<th>Hazard Rating</th>
<th>Firefighting</th>
<th>Reactivity</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 - Health</td>
<td>Extinguish fire using an agent suitable for type of surrounding fire. Carbon Tetrachloride itself does not burn.</td>
<td>Carbon Tetrachloride reacts with CHEMICALLY-ACTIVE METALS (such as SODIUM, POTASSIUM and MAGNESIUM); ZINC, ALUMINUM, POWDERED BERYLLIUM; FLUORINE; DIMETHYLFORMAMIDE; CALCIUM DISILICIDE; CALCIUM HYPOCHLORITE; and mixtures of ETHYLENE and BENZOYL PEROXIDE to cause fires and explosions. Carbon Tetrachloride is not compatible with OXIDIZING AGENTS (such as PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE).</td>
</tr>
<tr>
<td>0 - Fire</td>
<td>POISONOUS GASES ARE PRODUCED IN FIRE, or when in contact with hot surfaces, including Phosgene and Hydrogen Chloride. Use water spray to keep fire-exposed containers cool.</td>
<td></td>
</tr>
<tr>
<td>0 - Reactivity</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

DOT#: UN 1848
ERG Guide #: 151
Hazard Class: 0, 1 (Poisonous)

**HAZARD DATA**

**SPILL/LEAKS**

- Isolation Distance:
  - Small Spill: 60 meters (200 feet)
  - Large Spill: 270 meters (900 feet)
- Absorb liquids in vermiculite, dry sand, earth, or a similar material and deposit in sealed containers.
- DO NOT wash into sewer.
- Carbon Tetrachloride is harmful to aquatic organisms and is hazardous to the environment and ozone layer.

**PHYSICAL PROPERTIES**

- Odor Threshold: >10 ppm
- Flash Point: Non-combustible
- Vapor Density: 5.3 (air = 1)
- Vapor Pressure: 91 mm Hg at 68°F (20°C)
- Specific Gravity: 1.50 (water = 1)
- Water Solubility: Very slightly soluble
- Boiling Point: 169°F (76°C)
- Ionization Potential: 11.47 eV
- Molecular Weight: 153.8

**EXPOSURE LIMITS**

- OSHA: 10 ppm, 8-hr TWA; 25 ppm, 15-min Ceiling; and 200 ppm, as a 5-min maximum peak in any 4-hr work period
- NIOSH: 5 ppm, 60-min STEL
- ACGIH: 5 ppm, 8-hr TWA; 10 ppm, 15-min STEL
- IDLH: 200 ppm

**HEALTH EFFECTS**

- Eyes: Severe irritation, burns
- Skin: Severe irritation, burns, rash with blisters
- Inhalation: Headache, nausea, vomiting, diarrhea, dizziness, lightheadedness and passing out
- Chronic: Carcinogen (liver) in animals. Limited evidence that it may damage the developing fetus and male reproductive glands (testes)

**PROTECTIVE EQUIPMENT**

- Gloves: Silver Shield®/V4H8, Viton, Viton/Butyl and Nitrile (>8-hr breakthrough)
- Coveralls: DuPont Tychem® BR and LV, Responder® and TK; ONE-piece TEC; and Kappler Zytex® 300, 400 and 500 (>8-hr breakthrough)
- Respirator: >2 ppm - Supplied air

**FIRST AID AND DECONTAMINATION**

- Remove the person from exposure.
- Flush eyes with large amounts of water for at least 15 minutes.
- Remove contact lenses if worn. Seek medical attention immediately.
- Quickly remove contaminated clothing and wash contaminated skin with large amounts of soap and water. Seek medical attention.
- Begin artificial respiration if breathing has stopped and CPR if necessary.
- Transfer to a medical facility.
Hazard Rating | Firefighting | Reactivity
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3 - Health 0 - Fire 0 - Reactivity | Extinguish fire using an agent suitable for type of surrounding fire. Carbon Tetrachloride itself does not burn. POISONOUS GASES ARE PRODUCED IN FIRE, or when in contact with hot surfaces, including Phosgene and Hydrogen Chloride. Use water spray to keep fire-exposed containers cool. | Carbon Tetrachloride reacts with CHEMICALLY-ACTIVE METALS (such as SODIUM, POTASSIUM and MAGNESIUM); ZINC; ALUMINUM; POWDERED BERYLLIUM; FLUORINE; DIMETHYLFORMAMIDE; CALCIUM DISILICIDE; CALCIUM HYPOCHLORITE; and mixtures of ETHYLENE and BENZOYL PEROXIDE to cause fires and explosions. Carbon Tetrachloride is not compatible with OXIDIZING AGENTS (such as PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE). |
DOT#: UN 1846 ERG Guide #: 151 Hazard Class: 6.1 (Poisonous) |

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- **ACGIH:** 5 ppm, 8-hr TWA; 10 ppm, 15-min STEL
- **IDLH:** 200 ppm

### Physical Properties
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SENSE OF SMELL

Can we always trust our nose?

Trust your nose
THE SENSE OF SMELL

• QUESTIONS?
• DISCUSSIONS?