### Sources of Exposure

#### General Populations
- Exposure may occur by inhalation of low levels in air or ingestion of low levels in water. These levels may be higher for people living near hazardous waste sites.
- Exposure will occur by using consumer products that contain phenol such as throat lozenges, mouthwashes, antiseptic lotions, and toilet and floor disinfectants and cleaners.
- Exposure can occur by ingestion of minute amounts present in certain foods.
- Phenol is utilized in some medical procedures to remove skin lesions or in injections to alleviate chronic pain.
- Smoke from cigarettes is a source of phenol for smokers and for those who inhale second hand smoke.

#### Occupational Populations
- Exposure can occur during the manufacture of phenol or of consumer products that contain phenol.

### Toxicokinetics and Normal Human Levels

#### Toxicokinetics
- Phenol is well absorbed by the inhalation, oral, and dermal routes of exposure. Phenol in air also is well-absorbed through the skin.
- Once absorbed, phenol is widely distributed throughout the body and the liver and kidneys generally have the greatest amount of phenol-derived products.
- In mammals, phenol undergoes direct sulfation and glucuronidation, and phenol that is not directly conjugated can be the substrate of oxidative metabolism, principally by cytochrome P4502E1. The metabolism of phenol is saturable.
- Data in humans and laboratory animals indicate that phenol is rapidly eliminated, primarily in the urine as sulfate and glucuronide; phenol does not accumulate in the body.

#### Normal Human Levels
- Usually <10 mg/L in urine of persons not exposed to phenol or benzene.

### Biomarkers/Environmental Levels

#### Biomarkers
- No studies were located regarding levels of phenol or its metabolites in human tissues and fluids associated with effects.
- Phenol and phenol metabolites are not specific biomarkers of exposure to phenol.

#### Environmental Levels

**Air**
- Median concentration of 0.03 ppb in 7 samples from urban/suburban U.S. air; data from 1982. More recent data are not available.

**Sediment and Soil**
- Range from 0.07 to 0.7 mg/kg in a small percentage of U.S. sediment samples; data from 2006.

**Water**
- Up to 1 ppb in unpolluted groundwater and 0.01–1 ppb in unpolluted rivers; data from 1985.
- Range of 2–56 ppb in waterways in Chicago, IL; data from 2006.

### Reference
# Chemical and Physical Information

## Phenol is a Solid
- Phenol is a colorless-to-white solid when pure; the commercial product is liquid.
- Phenol has a sickeningly sweet and tarry odor.
- Phenol is flammable.
- Phenol is moderately soluble in water; it evaporates slower than water.
- Phenol is primarily used in the production of phenolic resins and in the manufacture of nylon and other synthetic fibers.
- Phenol is also used as a general disinfectant and antiseptic in various products, including toilet and floor disinfectants and medicinal preparations such as throat lozenges and sprays, and antiseptic lotions.

## Routes of Exposure
- **Inhalation** – Important route of exposure for those living near coal and petroleum fueled facilities and municipal waste incinerators. Significant exposure route for workers that manufacture phenol.
- **Oral** – Use of medicinal products such as throat lozenges and mouthwashes. Also, predominant route of exposure at or near waste sites via ingestion of contaminated water.
- **Dermal** – Use of ointments and cleaners containing phenol. Also, bathing or showering with water contaminated with phenol. Significant exposure route for workers in contact with phenol vapors or liquid phenol.

## Phenol in the Environment
- Phenol enters the air, water, and soil as a result of its manufacture and use.
- Phenol has a short half-life in air, less than 1 day. In air, it reacts with photochemically-produced hydroxyl radicals.
- Phenol generally remains in soil only about 2–5 days. In soil, phenol biodegrades under both aerobic and anaerobic conditions.
- Phenol is rapidly degraded in water, but it can remain in water for a week or more if present in high concentrations.
- Phenol does not accumulate in fish, other animals, or in plants.

## Relevance to Public Health (Health Effects)

### Health effects are determined by the dose (how much), the duration (how long), and the route of exposure.

<table>
<thead>
<tr>
<th>Health Effects</th>
<th>Minimal Risk Levels (MRLs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Pheno is an irritating and corrosive substance by all routes of exposure.</td>
<td>- No acute-, intermediate- or chronic-duration inhalation MRLs were derived for phenol.</td>
</tr>
<tr>
<td>- High concentrations of phenol in the air cause respiratory irritation.</td>
<td>- Oral</td>
</tr>
<tr>
<td>- Ingestion of high concentrations of phenol can produce internal burns.</td>
<td>- An MRL of 1 mg/kg/day has been derived for acute-duration oral exposure (≤14 days).</td>
</tr>
<tr>
<td>- Application of phenol to the skin can cause dermal inflammation and necrosis.</td>
<td>- No intermediate- or chronic-duration oral MRLs were derived for phenol.</td>
</tr>
<tr>
<td>- Ingestion of high amounts of phenol or application of high amounts on the skin can cause cardiac arrhythmias and may produce tremors and seizures.</td>
<td></td>
</tr>
<tr>
<td>- Based on inadequate evidence from studies in humans and animals, the EPA considers phenol not classifiable as to human carcinogenicity.</td>
<td></td>
</tr>
</tbody>
</table>

## Children's Health
- Vomiting and lethargy are common signs of toxicity observed in children that ingest products containing phenol and are treated at poison control centers.
- It is not known whether children are more susceptible to phenol poisoning than adults.