### Sources of Exposure

**General Populations**
- Exposure to nitrobenzene may occur through contaminated air, water, or soil as a result of releases from industrial sources.
- General exposure of the population to nitrobenzene is limited to variable concentrations in air and possibly drinking water.
- Levels of nitrobenzene in air may be higher near manufacturing facilities, especially petroleum refineries, leather finishing facilities, and some chemical manufacturers.

**Occupational Populations**
- Occupational exposure can be significantly higher than the exposure of the general population.
- Occupational exposure is most likely to occur through inhalation or dermal contact.
- Nitrobenzene is readily absorbed through the skin and lungs. Workers that may be exposed to this chemical should wear personal protective equipment.
- Populations working in explosive, pharmaceutical, aniline, pesticide, and dye-stuff manufacturing are at a higher risk of exposure to nitrobenzene.

### Toxicokinetics and Biomonitoring

#### Toxicokinetics
- Nitrobenzene may be absorbed after oral, inhalation, or dermal exposure.
- Nitrobenzene is believed to be widely distributed throughout the body after absorption. There is indication that nitrobenzene is lipophilic and therefore is easily absorbed by fatty tissues.
- Nitrobenzene undergoes metabolism through reduction and oxidation reactions. The metabolites of nitrobenzene, including aniline, are likely associated with many toxicological effects.
- Urinary excretion is the main route of removal of nitrobenzene from the body.

#### NHANES Biomonitoring
- Nitrobenzene in blood is measured in the U.S. National Health and Nutrition Examination Survey. However, the prevalence of nitrobenzene in blood is below the detection limit of 0.320 ng/mL for all demographics (NHANES 2011-2016).

### Biomarkers/Environmental Levels

#### Biomarkers
- Nitrobenzene in the blood is indicative of recent exposure. Urinalysis of metabolites including p-nitrophenol and p-aminophenol can also be used to indicate potential exposure to nitrobenzene. However, these metabolites are not specific to nitrobenzene.

#### Environmental Levels
- **Air:**
  - Range 0.02–14.48 ppb
- **Water:**
  - Municipal wastewater effluent range 10-20 ppb
- **Soil:**
  - Limited measurements exist, but a concentration of 8 ppm was detected in soil at one sampling site.

### Reference
Nitrobenzene is found either in crystal form or as an oily liquid.

- Nitrobenzene is colorless to pale yellow.
- Nitrobenzene is a synthetic chemical, and it does not occur naturally in the environment.
- It is sparingly soluble in water and most organic solvents.
- Nitrobenzene is volatile and flammable.

**Chemical and Physical Information**

**Routes of Exposure**

- Inhalation – Inhalation exposure from nitrobenzene released into the atmosphere or volatilized from water may occur near hazardous waste sites or near industries where nitrobenzene is released. Inhalation is a primary route of exposure for the general population and workers.
- Oral – Exposure may occur through ingestion of contaminated water, but this is less likely than inhalation or dermal exposure.
- Dermal – Dermal contact is a potential route of exposure for workers. Nitrobenzene is readily absorbed through the skin.

**Nitrobenzene in the Environment**

- Nitrobenzene exists in the atmosphere as a vapor. The half-life of nitrobenzene in air has been estimated as 115 days.
- In water, photolysis and biodegradation are significant degradation pathways. The half-life of nitrobenzene in water has been estimated as 17 hours to 6 days. Nitrobenzene does not hydrolyze.
- Nitrobenzene is likely to migrate through the soil and into groundwater.
- Once in the environment, nitrobenzene may be degraded by atmospheric photochemical decomposition in air, and by direct photolysis or by biodegradation mediated by microorganisms found in sediment, soils, and water.
- Nitrobenzene is not likely to bioaccumulate in fish or other aquatic species.

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

**Minimal Risk Levels (MRLs)**

**Inhalation**

- An acute-duration (≤14 days) inhalation MRL of 0.04 ppm was derived for nitrobenzene.
- An intermediate-duration (15-364 days) inhalation MRL of 0.003 ppm was derived for nitrobenzene.
- A chronic-duration (≥365 days) inhalation MRL of 0.001 ppm was derived for nitrobenzene.

**Oral**

- No chronic-duration oral MRL was derived for nitrobenzene.
- An acute-duration oral MRL of 0.05 mg/kg/day was derived for nitrobenzene.
- An intermediate-duration oral MRL of 0.02 mg/kg/day was derived for nitrobenzene.

**Health Effects**

- Respiratory effects have been observed in animal studies. Specifically, chronic exposure to nitrobenzene has resulted in bronchiolization of the alveoli and degeneration of the olfactory epithelium.
- There is limited evidence that the liver is a target for nitrobenzene toxicity in humans. However, animal studies have demonstrated that nitrobenzene may adversely affect the liver.
- Animal studies show that kidneys may also be a target for nitrobenzene toxicity.
- Nitrobenzene is a known male reproductive toxicant based on animal studies. These effects occur at higher levels than the hematological and respiratory effects observed with nitrobenzene exposure.
- The National Toxicology Program has determined that nitrobenzene is reasonably anticipated to be a human carcinogen (causing cancer).
- The U.S. Environmental Protection Agency has classified nitrobenzene as a likely human carcinogen.
- The International Agency for Research on Cancer has determined that nitrobenzene is possibly carcinogenic to humans.

**Children’s Health**

- In the first six months of life there is increased risk of methemoglobinemia. Older children would be expected to experience similar effects as adults.