

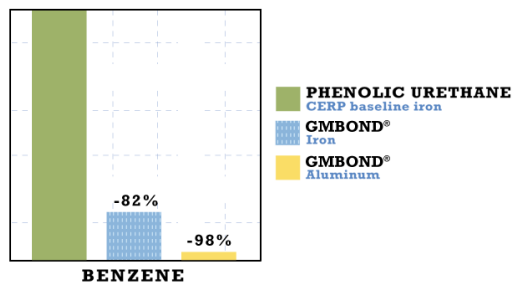
## Six Foundry Chemicals and Their Effects on Human Health

The metalcasting industry is one of the heaviest users of chemicals and other volatile substances. As a result, it releases hazardous pollutants and volatile organic compounds in the casting process. Below are some of the most common – and toxic – chemicals used and discharged into the air and water by foundries and their impact on human health. Benzene, for instance, makes up 97 percent of foundry emissions in Wisconsin<sup>1</sup> and is a known carcinogen. Most pose other potential health hazards.

The use of Hormel's new, protein-based GMBOND® Sand Binder in the casting process virtually eliminates the emissions of these compounds and drastically reduces dozens more. Comparisons with the widely used phenolic urethane binder are below.

### Benzene<sup>2</sup>

- State:** Liquid, widely used and ranks among the top 20 chemicals in terms of volume produced. It is used to make plastics, resins, synthetic fibers, pesticides, and lubricants. Industrial processes produce the main source of benzene in the environment.
- Foundry:** Benzene is found in the resins used in phenolic urethane sand binders and are released as a result of combustion during the casting process.
- Health hazards:** Drowsiness, dizziness, rapid heart rate, tremors, headaches, and unconsciousness; bone marrow and immune system damage, decreased red blood cells, excessive bleeding; leukemia, cancer, death.
- GMBOND®:** 82% to 98% reduction in benzene emissions.



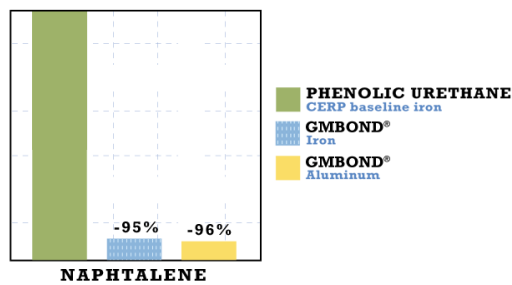
### Naphthalene<sup>3</sup>

**State:** Solid, found in fossil fuels and produced by burning tobacco and wood. It is used to make moth repellents, resins, and insecticides.

**Foundry:** Naphthalene is found in resins used in the sand binder and released as a result of evaporation and solvent processes and during combustion.

**Health hazards:** Damage or destroy red blood cells; fatigue, lack of appetite, restlessness, and pale skin; nausea, vomiting, diarrhea, blood in the urine, and a yellow tint to the skin. Naphthalene has caused cancer in female mice.

**GMBOND®:** 95% to 96% reduction in naphthalene emissions.



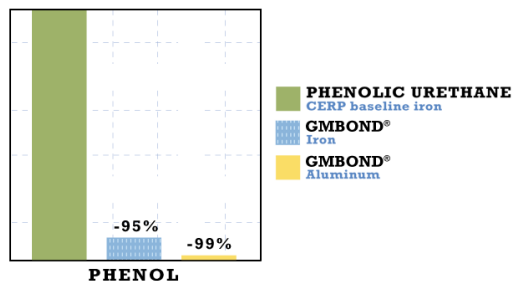
### Phenol<sup>4</sup>

**State:** Solid and liquid, highly corrosive, and moderately toxic. It is used to make plastics and in many manufacturing processes. Exposure may be higher inside than outside the workplace.

**Foundry:** Phenol is found in resins used in the sand binder and released as a result of evaporation and solvent processes and during combustion.

**Health hazards:** Irritant to skin, eyes, and mucous membranes. Drinking contaminated water can cause blood changes, liver and kidney damage, and cardiac toxicity. Repeated exposure to low levels of phenol in drinking water is linked with diarrhea and mouth sores. Eating 1 gram is lethal, with symptoms including muscle weakness and tremors, paralysis, convulsions, coma, and cardiac arrest. Phenol applied to the skin may promote tumors and be a weak skin carcinogen in mice.

**GMBOND®:** 95% to 99% reduction in phenol emissions.



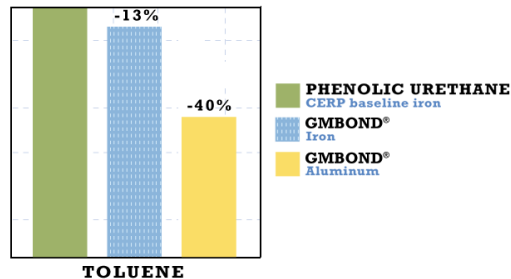
## Toluene<sup>5</sup>

State: Liquid, found in crude oil and the tolu tree. It is produced in the process of making gasoline and other fuels, coke, and as a byproduct in the making of styrene. It is used in making paints and paint thinners, fingernail polish, adhesives, and rubber.

Foundry: Toluene is emitted during combustion of the binder system.

Health hazards: Light-headedness, dizziness, sleepiness, weakness, memory and hearing loss, decreased appetite; unconsciousness, permanent brain and speech damage, vision and hearing problems, loss of muscle control, memory loss, impaired mental ability, and death.

GMBOND®: 13% to 40% reduction in toluene emissions.



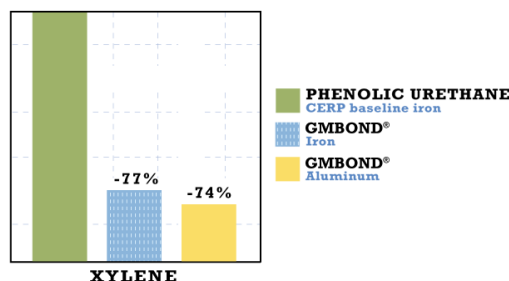
## Xylene<sup>6</sup>

State: Liquid, synthetic chemical produced from petroleum and ranks among the top 30 chemicals produced in terms of volume. It is used as a solvent, a cleaning agent, and found in paint thinner, paints, and varnishes. Because it stays in the air for several days, indoor levels of xylene can be higher than outdoor levels.

Foundry: Xylene is found in resins used in the sand binder and released as a result of evaporation and solvent processes and during combustion.

Health hazards: It affects the brain and central nervous system; irritation to the skin, eyes, nose, and throat, breathing difficulties, lung problems, impaired memory, stomach discomfort, liver, and kidney changes. Headaches, loss of muscle coordination, dizziness; unconsciousness and death.

GMBOND®: 74% to 77% reduction in xylene emissions.



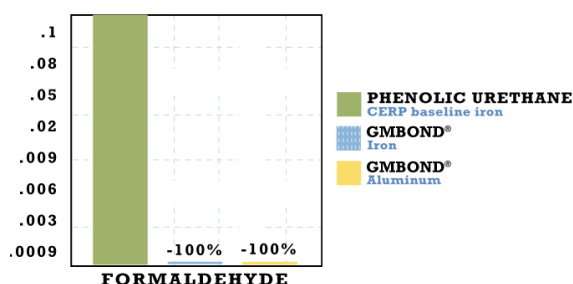
## Formaldehyde<sup>7</sup>

**State:** Colorless gas that is ranked among top 25 industrially-produced chemicals and is one of the most common in use today. It is used as a part of glues and adhesives, a preservative in paints and coatings, insulation, and is an intermediate in the production of resins.

**Foundry:** Formaldehyde is found in phenol resins used in several sand binders and released as a result of evaporation and solvent processes and during combustion.

**Health hazards:** Watery eyes, burnings eyes, nose and throat; nausea and wheezing; skin rashes; cancer.

**GMBOND®:** 100% reduction in formaldehyde emissions.



<sup>1</sup> Wisconsin Department of Natural Resources data.

<sup>2</sup> Agency for Toxic Substances and Disease Registry, Division of Toxicology, U.S. Dept. of Health and Human Service, September 1997; “The Comparison of Aluminum and Iron Metal Systems Using GM Bond Resins,” Casting Emission Reduction Program, U.S. Department of Defense and the U.S. Council for Automotive Research, February, 2001.

<sup>3</sup> Agency for Toxic Substances and Disease Registry, Division of Toxicology, U.S. Dept. of Health and Human Service, September 1996; “The Comparison of Aluminum and Iron Metal Systems Using GM Bond Resins,” Casting Emission Reduction Program, U.S. Department of Defense and the U.S. Council for Automotive Research, February, 2001.

<sup>4</sup> Agency for Toxic Substances and Disease Registry, Division of Toxicology, U.S. Dept. of Health and Human Service, September 1989; Office of Air Quality Planning & Standards, EPA; “The Comparison of Aluminum and Iron Metal Systems Using GM Bond Resins,” Casting Emission Reduction Program, U.S. Department of Defense and the U.S. Council for Automotive Research, February, 2001.

<sup>5</sup> Agency for Toxic Substances and Disease Registry, Division of Toxicology, U.S. Dept. of Health and Human Service, September 1995; “The Comparison of Aluminum and Iron Metal

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Systems Using GM Bond Resins,” Casting Emission Reduction Program, U.S. Department of Defense and the U.S. Council for Automotive Research, February, 2001.

<sup>6</sup> Agency for Toxic Substances and Disease Registry, Division of Toxicology, U.S. Dept. of Health and Human Service, September 1996; Hazard Evaluation System and Information Service, California Dept. of Health Services; “The Comparison of Aluminum and Iron Metal Systems Using GM Bond Resins,” Casting Emission Reduction Program, U.S. Department of Defense and the U.S. Council for Automotive Research, February, 2001.

<sup>7</sup> U.S. Consumer Product Safety Commission, 1997; Occupational Safety & Health Administrators, U.S. Department of Labor, August, 1999; Casting Emission Reduction Program, U.S. Department of Defense and the U.S. Council for Automotive Research, February 2000.