

these facilities. However, to the extent the adverse effects do occur, and today's final rule reduces emissions, subsequent exposures will be reduced.

Following is a discussion of the health effects of seven HAP: ethylene glycol, formaldehyde, HF, HCl, methanol, phenol, and POM. Although today's rule will reduce emissions of HF and HCl from any new clay refractory product kilns that emit these HAP, it will not reduce emissions of these HAP from existing kilns. We estimate that emissions of methanol from affected existing thermal process sources of organic HAP (*i.e.*, shape dryers, curing ovens, and kilns) also will not be reduced by today's final rule. However, methanol is a constituent of some resins used in resin-bonded refractory production, and today's final rule will regulate methanol emissions from any affected source that produces refractory products made with resins that contain methanol.

#### Ethylene Glycol

Acute (short-term) exposure of humans to ethylene glycol by ingesting large quantities causes central nervous system depression (including drowsiness and respiratory failure), gastrointestinal upset, cardiopulmonary effects, and renal damage. The only effects noted in the one available study of humans acutely exposed to low levels of ethylene glycol by inhalation were throat and upper respiratory tract irritation. Rats and mice exposed chronically (long-term) to ethylene glycol in their diet exhibited signs of kidney toxicity and liver effects. No information is available on the reproductive or developmental effects of ethylene glycol in humans, but several studies of rodents have shown ethylene glycol to be fetotoxic. The EPA has not classified ethylene glycol for carcinogenicity.

#### Formaldehyde

Both acute and chronic exposure to formaldehyde irritates the eyes, nose, and throat, and may cause coughing, chest pains, and bronchitis. Reproductive effects, such as menstrual disorders and pregnancy problems, have been reported in female workers exposed to formaldehyde. Limited human studies have reported an association between formaldehyde exposure and lung and nasopharyngeal cancer. Animal inhalation studies have reported an increased incidence of nasal squamous cell cancer. The EPA considers formaldehyde a probable human carcinogen (Group B2).

#### Hydrogen Fluoride

Acute inhalation exposure to gaseous HF can cause severe respiratory damage in humans, including severe irritation and pulmonary edema. Chronic exposure to fluoride at low levels has a beneficial effect of dental cavity prevention and may also be useful for the treatment of osteoporosis. Exposure to higher levels of fluoride may cause dental fluorosis or mottling, while very high exposures through drinking water or air can result in crippling skeletal fluorosis. One study reported menstrual irregularities in women occupationally exposed to fluoride. The EPA has not classified HF for carcinogenicity.

#### Hydrogen Chloride

Hydrogen chloride, also called hydrochloric acid, is corrosive to the eyes, skin, and mucous membranes. Acute inhalation exposure may cause eye, nose, and respiratory tract irritation and inflammation and pulmonary edema in humans. Chronic occupational exposure to HCl has been reported to cause gastritis, bronchitis, and dermatitis in workers. Prolonged exposure to low concentrations may also cause dental discoloration and erosion. No information is available on the reproductive or developmental effects of HCl in humans. In rats exposed to HCl by inhalation, altered estrus cycles have been reported in females, and increased fetal mortality and decreased fetal weight have been reported in offspring. The EPA has not classified HCl for carcinogenicity.

#### Methanol

Acute or chronic exposure of humans to methanol by inhalation or ingestion may result in blurred vision, headache, dizziness, and nausea. No information is available on the reproductive, developmental, or carcinogenic effects of methanol in humans. Birth defects have been observed in the offspring of rats and mice exposed to methanol by inhalation. A methanol inhalation study using rhesus monkeys reported a decrease in the length of pregnancy and limited evidence of impaired learning ability in offspring. The EPA has not classified methanol with respect to carcinogenicity.

#### Phenol

Acute inhalation and dermal exposure to phenol is highly irritating to the skin, eyes, and mucous membranes in humans. Oral exposure to small amounts of phenol may cause irregular breathing, muscular weakness and tremors, coma, and respiratory arrest at lethal concentrations. Anorexia, progressive weight loss, diarrhea,

vertigo, salivation, and a dark coloration of the urine have been reported in chronically exposed humans. Gastrointestinal irritation and blood and liver effects have also been reported. No studies of developmental or reproductive effects of phenol in humans are available, but animal studies have reported reduced fetal body weights, growth retardation, and abnormal development in the offspring of animals exposed to phenol by the oral route. The EPA has classified phenol in Group D, not classifiable as to human carcinogenicity.

#### Polycyclic Organic Matter

The term polycyclic organic matter defines a broad class of compounds that includes the polycyclic aromatic hydrocarbon (PAH) compounds, of which benzo[a]pyrene is a member. Dermal exposures to mixtures of PAH cause skin disorders in humans and animals. No information is available on the reproductive or developmental effects of POM in humans, but animal studies have reported that oral exposure to benzo[a]pyrene causes reproductive and developmental effects. Human studies have reported an increase in lung cancer in humans exposed to POM-bearing mixtures including coke oven emissions, roofing tar emissions, and cigarette smoke. Animal studies have reported respiratory tract tumors from inhalation exposure to benzo[a]pyrene and forestomach tumors, leukemia, and lung tumors from oral exposure to benzo[a]pyrene. The EPA has classified seven PAH compounds (benzo[a]pyrene, benz[a]anthracene, chrysene, benzo[b]fluoranthene, benzo[k]fluoranthene, dibenz[a,h]anthracene, and indeno[1,2,3-cd]pyrene) as Group B2, probable human carcinogens.

#### B. What Are the Air Emission Reduction Impacts?

At the current level of control and 1996 production levels, we estimate nationwide emissions of HAP from the refractory products manufacturing industry to be about 246 Mg/yr (271 tpy). For the eight refractory products facilities that we estimate to be major sources, baseline annual HAP emissions are about 153 Mg/yr (169 tpy). We estimate that today's final rule will reduce nationwide HAP emissions by about 124 Mg/yr (137 tpy).

Among the major sources, POM emissions account for approximately 60 percent of the total annual HAP emissions. Phenol, HF, HCl, and ethylene glycol account for 13 percent, 10 percent, 7 percent, and 7 percent of total annual HAP emissions,