Phenol (C_6H_5OH)
CAS 108-95-2; UN 1671 (solid), 2312 (molten), 2821 (solution)

Synonyms include carbolic acid, hydroxybenzene, monohydroxybenzene, benzenol, monophenol, phenyl hydroxide, phenyl alcohol, phenic acid, phenylic acid, and phenylic alcohol.

- **Persons exposed only to phenol vapor do not pose substantial risks of secondary contamination. Persons whose clothing or skin is contaminated with liquid phenol can secondarily contaminate personnel by direct contact or through off-gassing vapor.**
- **Phenol is a flammable, highly corrosive chemical with a sickeningly sweet, acrid odor. Phenol's odor generally provides adequate warning of hazardous concentrations.**
- **Phenol is well absorbed by all routes of exposure. Exposure by any route can cause systemic effects.**

Description

At room temperature, phenol is a translucent, colorless, crystalline mass, white powder, or thick, syrupy liquid. The crystals are hygroscopic and turn pink to red in air. When pure, phenol has a sweet, tar-like odor that is readily detected at low concentrations (0.05 ppm in air). Phenol is soluble in alcohol, glycerol, petroleum, and, to a lesser extent, water. Phenol is designated as "Poison B" by the Department of Transportation (DOT), but no special containers are required due to its modest fire hazard and low reactivity.

Routes of Exposure

Inhalation

Phenol is absorbed rapidly from the lungs. However, because of its low volatility, inhalation hazard is limited. The odor threshold of phenol is about 100 times lower than the OSHA PEL; therefore, it provides adequate warning of hazardous concentrations. Phenol vapor is heavier than air.

Children exposed to the same levels of phenol vapor as adults may receive larger doses because they have greater lung surface area:body weight ratios and increased minute volumes:weight ratios. Children may be more vulnerable to corrosive agents than adults because of the relatively smaller diameter of their airways. In addition, they may be exposed to higher levels than adults in the same location because of their short stature and the higher levels of phenol vapor found nearer to the ground.

Skin/Eye Contact

All forms of phenol cause irritation, and acute toxic effects of phenol most often occur by skin contact. Even dilute solutions (1% to 2%) may cause severe burns if contact is prolonged. Systemic

toxicity can result from skin or eye exposures. Phenol vapor and liquid penetrate the skin with an absorption efficiency approximately equal to the absorption efficiency by inhalation. In one case, death occurred within 30 minutes after skin contact.

Children are more vulnerable to toxicants absorbed through the skin because of their relatively larger surface area:body weight ratio.

Ingestion

Accidental and intentional ingestions of phenol have been reported. As little as 50 to 500 mg has been fatal in infants. Deaths in adults have resulted after ingestions of 1 to 32 g.

Sources/Uses

Phenol is obtained by fractional distillation of coal tar and by organic synthesis. By far, its largest single use is in manufacture of phenolic resins and plastics. Other uses include manufacture of explosives, fertilizers, paints, rubber, textiles, adhesives, drugs, paper, soap, wood preservatives, and photographic developers. When mixed with slaked lime and other reagents, phenol is an effective disinfectant for toilets, stables, cesspools, floors, and drains.

Phenol was once an important antiseptic and is still used as a preservative in injectables. It also is used as an antipruritic, a cauterizing agent, a topical anesthetic, and as a chemical skin-peeler (chemexfoliant). It can be found in low concentrations in many over-the-counter products including preparations for treatment of localized skin disorders (Castellani's paint, PRID salve, CamphoPhenique lotion), in topical preparations (Sting-Eze), and in throat sprays and lozenges (Chloraseptic, Ambesol, Cepastat, Cheracol).

Standards and Guidelines

OSHA PEL (permissible exposure limit) = 5 ppm (skin) (averaged over an 8-hour workshift)

NIOSH IDLH (immediately dangerous to life or health) = 250 ppm

AIHA ERPG-2 (emergency response planning guideline) (maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to 1 hour without experiencing or developing irreversible or other serious health effects or symptoms which could impair an individual's ability to take protective action) = 50 ppm

Physical Properties

Description: Colorless to pink crystalline mass or white powder, syrupy liquid when mixed with water.

Warning properties: Adequate; sweet, acrid odor at > 0.05 ppm

Molecular weight: 94.1 daltons

Boiling point (760 mm Hg): 359 °F (182 °C)

Freezing point: 104.9 °F (43 °C)

Specific gravity: 1.06 at 68 °F (20 °C) (water = 1)

Vapor pressure: 0.36 mm Hg at 68 °F (20 °C)

Gas density: 3.24 (air = 1)

Water solubility (9% at 77 °F) (25 °C); hygroscopic

Flammability: 175 °F (79 °C)

Flammable range: 1.7% to 8.6% (concentration in air)

Incompatibilities

Phenol reacts with strong oxidizers, calcium hypochlorite, aluminum chloride, and acids.

Health Effects

Exposure to phenol by any route can produce systemic poisoning. Phenol is corrosive and causes chemical burns at the contact site.

Symptoms of systemic poisoning often involve an initial, transient CNS stimulation, followed rapidly by CNS depression. Coma and seizures can occur within minutes or may be delayed up to 18 hours after exposure.

Other symptoms include nausea, vomiting, diarrhea, methemoglobinemia, hemolytic anemia, profuse sweating, hypotension, arrhythmia, pulmonary edema, and tachycardia.

Acute Exposure

As a corrosive substance, phenol denatures proteins and generally acts as a protoplasmic poison. Phenol may also cause peripheral nerve damage (i.e., demyelination of axons). Systemic poisoning can occur after inhalation, skin contact, eye contact, or ingestion. Typically, transient CNS excitation occurs, then profound CNS depression ensues rapidly. Damage to the nervous system is the primary cause of death from phenol poisoning. However, damage to other organ systems (e.g., acid-base imbalance and acute kidney failure) may complicate the condition. Symptoms may be delayed for up to 18 hours after exposure.

Children do not always respond to chemicals in the same way that adults do. Different protocols for managing their care may be needed.

CNS

Initial signs and symptoms may include nausea, excessive sweating, headache, dizziness, and ringing in the ears. Seizures, loss of consciousness, coma, respiratory depression, and death may ensue. Coma and seizures usually occur within minutes to a few hours after exposure but may be delayed up to 18 hours.

Cardiovascular

Phenol exposure causes initial blood pressure elevation, then progressively severe low blood pressure and shock. Cardiac arrhythmia and bradycardia have also been reported following dermal exposure to phenol.

Respiratory

Mild exposure may cause upper respiratory tract irritation. With more serious exposure, swelling of the throat, inflammation of the trachea, tracheal ulceration, and an accumulation of fluid in the lungs can occur. Ingestion may lead to death from respiratory failure.

Children may be more vulnerable to corrosive agents than adults because of the relatively smaller diameter of their airways.

Children may be more vulnerable because of relatively increased minute ventilation per kg and failure to evacuate an area promptly when exposed.

Gastrointestinal

Nausea, vomiting, abdominal pain, and diarrhea are common symptoms after exposure to phenol by any route. Ingestion of phenol can also cause severe corrosive injury to the mouth, throat, esophagus, and stomach, with bleeding, perforation, scarring, or stricture formation as potential sequelae.

Renal

Renal failure has been reported in acute poisoning. Urinalysis may reveal the presence of protein (i.e., albuminuria), casts, and a green-to-brown discoloration of the urine.

Hematologic

Components of the blood and blood-forming organs can be damaged by phenol.

Most hematologic changes (e.g., hemolysis, methemoglobinemia, bone marrow suppression, and anemia) can be detected by blood tests or simply by the color or appearance of the blood.

Methemoglobinemia is a concern in infants up to 1 year old. Children may be more vulnerable to loss of effectiveness of hemoglobin because of their relative anemia compared to adults.

Ocular

Contact with concentrated phenol solutions can cause severe eye damage including clouding of the eye surface, inflammation of the eye, and eyelid burns.

Dermal

When phenol is applied directly to the skin, a white covering of precipitated protein forms. This soon turns red and eventually sloughs, leaving the surface stained slightly brown. If phenol is left on the skin, it will penetrate rapidly and lead to cell death and gangrene. If more than 60 square inches of skin are affected, there is risk of imminent death. Phenol appears to have local anesthetic properties and can cause extensive damage before pain is felt.

Because of their relatively larger surface area:body weight ratio, children are more vulnerable to toxicants absorbed through the skin.

Potential Sequelae

Chronic nerve damage has been reported due to acute exposure. Chemical burns may result in chronic skin and eye effects. Phenol

ingestion may lead to narrowing of the esophagus, and cardiac and renal damage.

Chronic Exposure

Repeated phenol exposure in the workplace has caused renal damage including kidney inflammation, swelling in the kidney tubules and cells, and degenerative changes in glomeruli. Liver damage and pigment changes of the skin have been noted in some workers. Chronic exposure has also been correlated with an increased risk of coronary artery disease and insufficient blood supply to the heart in workers.

Chronic exposure may be more serious for children because of their potential longer latency period.

Carcinogenicity

Phenol has not been classified for carcinogenic effects. Phenol is, however, a known promoter of tumors.

Reproductive and Developmental Effects

Phenol is not included in *Reproductive and Developmental Toxicants*, a 1991 report published by the U.S. General Accounting Office (GAO) that lists 30 chemicals of concern because of widely acknowledged reproductive and developmental consequences. No reports were located of developmental or reproductive effects of phenol in humans. In animal studies phenol has been reported to be embryotoxic and fetotoxic, but not teratogenic. In experimental animals, phenol has generally not caused developmental effects except at doses that also caused maternal toxicity.

Special consideration regarding the exposure of pregnant women is warranted, since phenol has been shown to be genotoxic at high doses; thus, medical counseling is recommended for the acutely exposed pregnant woman. No known teratogenic effects from acute exposure are known.

Prehospital Management

Victims exposed only to phenol vapor do not pose substantial risks of secondary contamination. Victims whose clothing or skin is contaminated with liquid phenol can secondarily contaminate response personnel by direct contact or through off-gassing vapor from heavily soaked clothing. Protect rescue personnel with butyl rubber gloves and aprons. Phenol vapor may also off-gas from the toxic vomitus of victims who have ingested phenol.

Phenol is corrosive and causes severe chemical burns on contact. Systemic effects can occur from all routes of exposure and may include convulsions, sudden collapse, coma, nausea, vomiting, diarrhea, methemoglobinemia, hemolytic anemia, profuse sweating, hypotension, arrhythmia, pulmonary edema, and tachycardia.

There is no antidote for phenol. Rapid decontamination may greatly affect the odds of survival. Treatment consists of support of respiratory and cardiovascular functions.

Hot Zone

Rescuers should be trained and appropriately attired before entering the Hot Zone. If the proper equipment is not available, or if rescuers have not been trained in its use, assistance should be obtained from a local or regional HAZMAT team or other properly equipped response organization.

Rescuer Protection

Phenol is a severe irritant and highly toxic systemic poison that is absorbed well by inhalation and through the skin.

Respiratory Protection: Positive-pressure, self-contained breathing apparatus (SCBA) is recommended in response situations that involve exposure to potentially unsafe levels of phenol vapor.

Skin Protection: Chemical-protective clothing (butyl rubber gloves and aprons) is recommended because phenol liquid and vapor can be quickly absorbed through the skin and may contribute to systemic toxicity. Contact with liquid phenol can cause severe skin burns.

ABC Reminders

Quickly access for a patent airway, ensure adequate respiration and pulse. If trauma is suspected, maintain cervical immobilization manually and apply a cervical collar and a backboard when feasible.

Victim Removal

If victims can walk, lead them out of the Hot Zone to the Decontamination Zone. Victims who are unable to walk may be removed on backboards or gurneys; if these are not available, carefully carry or drag victims to safety.

Consider appropriate management of chemically contaminated children, such as measures to reduce separation anxiety if a child is separated from a parent or other adult.

Decontamination Zone

Patients exposed only to phenol vapor who have no skin or eye irritation may be transferred immediately to the Support Zone. Other patients will require decontamination as described below.

Rescuer Protection

If exposure levels are determined to be safe, decontamination may be conducted by personnel wearing a lower level of protection than that worn in the Hot Zone (described above).

ABC Reminders

Quickly access for a patent airway, ensure adequate respiration and pulse. Stabilize the cervical spine with a collar and a backboard if trauma is suspected. Administer supplemental oxygen as required. Assist ventilation with a bag-valve-mask device if necessary.

Basic Decontamination

Rapid skin decontamination is critical. Patients who are able may assist with their own decontamination.

Rescuers should wear protective clothing and gloves while treating patients whose skin is contaminated with phenol. Remove contaminated clothing rapidly and either irrigate or wipe exposed areas immediately and repeatedly with low-molecular-weight polyethylene glycol (PEG 300 or PEG 400) which can be diluted to 50% for easier application. Treatment should be continued until there is no detectable odor of phenol. If PEG is not available, a glycerine solution can be used instead. If neither of these are available, irrigation with a high-density shower will reduce phenol uptake, but lesser amounts of water will merely dilute the phenol and expand the area of exposure. After treatment with the high pressure shower, the skin should be washed with soap and water for at least 15 minutes. **Decontamination must begin as soon as possible to minimize phenol absorption.** Double-bag contaminated clothing and personal belongings.

Use caution to avoid hypothermia when decontaminating children or the elderly. Use blankets or warmers when appropriate.

Flush exposed or irritated eyes with copious amounts of water or saline for at least 15 minutes. Remove contact lenses if easily removable without additional trauma to the eye. If a corrosive material is suspected or if pain or injury is evident, continue irrigation while transferring the victim to the Support Zone.

In cases of ingestion, **do not induce emesis**. If the victim is alert, asymptomatic, and has a gag reflex, administer a slurry of activated

charcoal at 1 gm/kg (usual adult dose 60–90 g, child dose 25–50 g). A soda can and straw may be of assistance when offering charcoal to a child.

Victims who are conscious and able to swallow should be given 4 to 8 ounces of milk, egg whites, or gelatin solution; if the patient is symptomatic, delay decontamination until other emergency measures have been instituted.

Consider appropriate management of chemically contaminated children at the exposure site. Provide reassurance to the child during decontamination, especially if separation from a parent occurs.

Transfer to Support Zone

As soon as basic decontamination is complete, move victims to the Support Zone.

Support Zone

Be certain that victims have been decontaminated properly (see *Decontamination Zone* above). Victims who have undergone decontamination or who have been exposed only to vapor generally pose no serious risks of secondary contamination. In such cases Support Zone personnel require no specialized protective gear.

ABC Reminders

Quickly access for a patent airway. If trauma is suspected, maintain cervical immobilization manually and apply a cervical collar and a backboard when feasible. Ensure adequate respiration and pulse. Administer supplemental oxygen as required and establish intravenous access if necessary. Place on a cardiac monitor.

Additional Decontamination

Continue irrigating exposed skin and eyes, as appropriate.

In cases of ingestion, **do not induce emesis**. If the victim is alert, asymptomatic, and has a gag reflex, administer a slurry of activated charcoal at 1 gm/kg (usual adult dose 60–90 g, child dose 25–50 g), if it has not been given previously. A soda can and straw may be of assistance when offering charcoal to a child.

Victims who are conscious and able to swallow should be given 4 to 8 ounces of milk, egg whites, or gelatin solution if this has not been given previously; or, if the patient is symptomatic, delay decontamination until other emergency measures have been instituted.

Advanced Treatment

In cases of respiratory compromise secure airway and respiration via endotracheal intubation. If not possible, perform cricothyroidotomy if equipped and trained to do so.

Treat patients who have bronchospasm with aerosolized bronchodilators. The use of bronchial sensitizing agents in situations of multiple chemical exposures may pose additional risks. Consider the health of the myocardium before choosing which type of bronchodilator should be administered. Cardiac sensitizing agents may be appropriate; however, the use of cardiac sensitizing agents after exposure to certain chemicals may pose enhanced risk of cardiac arrhythmias (especially in the elderly).

Consider racemic epinephrine aerosol for children who develop stridor. Dose 0.25–0.75 mL of 2.25% racemic epinephrine solution in 2.5 cc water, repeat every 20 minutes as needed, cautioning for myocardial variability.

Patients who are comatose, hypotensive, or are having seizures or cardiac arrhythmias should be treated according to advanced life support (ALS) protocols.

Transport to Medical Facility

Only decontaminated patients or patients not requiring decontamination should be transported to a medical facility. “Body bags” are not recommended.

Report to the base station and the receiving medical facility the condition of the patient, treatment given, and estimated time of arrival at the medical facility.

If a chemical has been ingested, prepare the ambulance in case the victim vomits toxic material. Have ready several towels and open plastic bags to quickly clean up and isolate vomitus.

Multi-Casualty Triage

Consult with the base station physician or the regional poison control center for advice regarding triage of multiple victims.

Patients with significant exposures, skin burns over a large body-surface area, who have ingested phenol, or who have experienced serious symptoms such as syncope or convulsions should be transported to a medical facility for evaluation. (The severity of exposure can be estimated by the concentration of phenol and the amount and duration of contact.)

Persons who have been exposed only to phenol vapor and are asymptomatic are not likely to develop complications. After their names, addresses, and telephone numbers are recorded, these patients may be released from the scene with instructions to seek medical care promptly if symptoms develop (see *Patient Information Sheet* below).

Emergency Department Management

Hospital personnel can be secondarily contaminated by direct contact or from vapor off-gassing from heavily soaked clothing or from the vomitus of victims who have ingested phenol. Protect hospital personnel with butyl gloves and aprons. Patients do not pose contamination risks after contaminated clothing is removed and the skin is thoroughly washed.

Phenol is corrosive and causes severe chemical burns on contact. Systemic effects can occur from all routes of exposure and may include convulsions, sudden collapse, coma, nausea, vomiting, diarrhea, methemoglobinemia, hemolytic anemia, profuse sweating, hypotension, arrhythmia, pulmonary edema, and tachycardia.

There is no antidote for phenol. Rapid decontamination may greatly affect the odds of survival. Treatment consists of support of respiratory and cardiovascular functions.

Decontamination Area

Unless previously decontaminated, all patients suspected of contact with liquid phenol and all victims with skin or eye irritation require decontamination as described below. Because phenol is absorbed through the skin, don butyl rubber gloves and apron before treating patients. Phenol readily penetrates most rubbers and barrier fabrics or creams, but butyl rubber provides good skin protection. All other patients may be transferred to the Critical Care area.

Be aware that use of protective equipment by the provider may cause fear in children, resulting in decreased compliance with further management efforts.

Because of their relatively larger surface area:body weight ratio, children are more vulnerable to toxicants absorbed through the skin. Also, emergency room personnel should examine children's mouths because of the frequency of hand-to-mouth activity among children.

ABC Reminders

Evaluate and support airway, breathing, and circulation. Children may be more vulnerable to corrosive agents than adults because of the relatively smaller diameter of their airways. In cases of respiratory compromise secure airway and respiration via endotracheal intubation. If not possible, surgically create an airway.

Treat patients who have bronchospasm with aerosolized bronchodilators. The use of bronchial sensitizing agents in situations of multiple chemical exposures may pose additional risks. Consider the health of the myocardium before choosing which type of bronchodilator should be administered. Cardiac sensitizing agents

may be appropriate; however, the use of cardiac sensitizing agents after exposure to certain chemicals may pose enhanced risk of cardiac arrhythmias (especially in the elderly).

Consider racemic epinephrine aerosol for children who develop stridor. Dose 0.25–0.75 mL of 2.25% racemic epinephrine solution in 2.5 cc water, repeat every 20 minutes as needed, cautioning for myocardial variability.

Patients who are comatose, hypotensive, or have seizures or ventricular arrhythmias should be treated in the conventional manner.

If evidence of shock or hypotension is observed begin fluid administration. For adults, bolus 1,000 mL/hour intravenous saline or lactated Ringer's solution if blood pressure is under 80 mm Hg; if systolic pressure is over 90 mm Hg, an infusion rate of 150 to 200 mL/hour is sufficient. For children with compromised perfusion administer a 20 mL/kg bolus of normal saline over 10 to 20 minutes, then infuse at 2 to 3 mL/kg/hour.

Basic Decontamination

Rapid skin decontamination is critical. Patients who are able may assist with their own decontamination.

Rescuers should wear protective clothing and gloves while treating patients whose skin is contaminated with phenol. Remove contaminated clothing rapidly and either irrigate or wipe exposed areas immediately and repeatedly with low-molecular-weight polyethylene glycol (PEG 300 or PEG 400) which can be diluted to 50% for easier application. Treatment should be continued until there is no detectable odor of phenol. If PEG is not available, a glycerine solution can be used instead. If neither of these are available, irrigation with a high-density shower will reduce phenol uptake, but lesser amounts of water will merely dilute the phenol and expand the area of exposure. After treatment with the high pressure shower, the skin should be washed with soap and water for at least 15 minutes. **Decontamination must begin as soon as possible to minimize phenol absorption.** Double-bag contaminated clothing and personal belongings.

Use caution to avoid hypothermia when decontaminating children or the elderly. Use blankets or warmers when appropriate.

Flush exposed or irritated eyes with copious amounts of water or saline for at least 15 minutes. Remove contact lenses if easily removable without additional trauma to the eye. If a corrosive

material is suspected or if pain or injury is evident, continue irrigation while transferring the patient to the Critical Care Area.

In cases of ingestion, **do not induce emesis**. If the victim is alert, asymptomatic, and has a gag reflex, administer a slurry of activated charcoal at 1 gm/kg (usual adult dose 60–90 g, child dose 25–50 g), if it has not been previously given. A soda can and straw may be of assistance when offering charcoal to a child.

Victims who are conscious and able to swallow should be given 4 to 8 ounces of milk, egg whites, or gelatin solution if this has not been given previously; if the patient is symptomatic delay decontamination until other emergency measures have been instituted.

Critical Care Area

Be certain that appropriate decontamination has been carried out (see *Decontamination Area* above).

ABC Reminders

Evaluate and support airway, breathing, and circulation as in ABC Reminders above. Children may be more vulnerable to corrosive agents than adults because of the relatively smaller diameter of their airways. Establish intravenous access in seriously ill patients if this has not been done previously. Continuously monitor cardiac rhythm.

Patients who are comatose, hypotensive, or have seizures or cardiac arrhythmias should be treated in the conventional manner.

Inhalation Exposure

Administer supplemental oxygen by mask to patients who have respiratory symptoms. Treat patients who have bronchospasm with aerosolized bronchodilators. The use of bronchial sensitizing agents in situations of multiple chemical exposures may pose additional risks. Consider the health of the myocardium before choosing which type of bronchodilator should be administered. Cardiac sensitizing agents may be appropriate; however, the use of cardiac sensitizing agents after exposure to certain chemicals may pose enhanced risk of cardiac arrhythmias (especially in the elderly).

Consider racemic epinephrine aerosol for children who develop stridor. Dose 0.25–0.75 mL of 2.25% racemic epinephrine solution in 2.5 cc water, repeat every 20 minutes as needed, cautioning for myocardial variability.

Patients in respiratory distress or who have abnormal pulmonary examinations may require chest radiography and pulse oximetry (or ABG measurements). Beta-blockers may be more effective than lidocaine in treating patients who have arrhythmias.

Skin Exposure

If liquid phenol came in contact with the skin, chemical burns may result; treat as thermal burns.

Because of their relatively larger surface area:body weight ratio, children are more vulnerable to toxicants absorbed through the skin.

Eye Exposure

Continue irrigation for at least 15 minutes. Test visual acuity. Examine the eyes for corneal damage and treat appropriately. Immediately consult an ophthalmologist for patients who have severe corneal injuries.

Ingestion Exposure

Do not induce emesis. If the patient is alert, administer a slurry of activated charcoal at 1 gm/kg (usual adult dose 60–90 g, child dose 25–50 g), if not done previously. A soda can and straw may be of assistance when offering charcoal to a child.

Victims who are conscious and able to swallow should be given 4 to 8 ounces of milk, egg whites, or gelatin solution if this has not been given previously; if the patient is symptomatic, delay decontamination until other emergency measures have been instituted.

Consider endoscopy to evaluate the extent of gastrointestinal tract injury. Extreme throat swelling may require endotracheal intubation or cricothyroidotomy. Gastric lavage is useful in certain circumstances to remove caustic material and prepare for endoscopic examination. Consider gastric lavage with a small nasogastric tube if: (1) a large dose has been ingested; (2) the patient's condition is evaluated within 30 minutes; (3) the patient has oral lesions or persistent esophageal discomfort; and (4) the lavage can be administered within 1 hour of ingestion. Care must be taken when placing the gastric tube because blind gastric-tube placement may further injure the chemically damaged esophagus or stomach.

Because children do not ingest large amounts of corrosive materials, and because of the risk of perforation from NG intubation, lavage is discouraged in children unless performed under endoscopic guidance.

Toxic vomitus or gastric washings should be isolated (e.g., by attaching the lavage tube to isolated wall suction or another closed container).

Antidotes and

Other Treatments

There is no antidote for phenol. Although charcoal hemoperfusion can remove free phenol from the blood and exchange transfusion has been suggested for phenol poisoning, the clinical value of these procedures is unproven.

Patients should be checked for methemoglobinemia. Symptomatic patients should be treated by slowly administering 1 to 2 mg/kg of 1% methylene blue intravenously. Further doses may be required.

Laboratory Tests

The diagnosis of acute phenol toxicity is primarily clinical based on CNS depression and other symptoms such as skin burns, nausea, profuse sweating, and cardiac arrhythmia. Routine laboratory studies for all exposed patients include CBC, glucose, and electrolyte determinations. Depending on the initial evaluation, additional studies for patients exposed to phenol include ECG monitoring and kidney-function tests. Laboratory tests to determine hemolysis include peripheral blood smear, urinalysis, and plasma free hemoglobin and haptoglobin analyses. Chest radiography and pulse oximetry (or ABG measurements) are also recommended for severe inhalation exposure or if pulmonary aspiration is suspected.

Urinary phenol levels above 81.5 mg/L or creatinine levels above 250 mg/g suggest overexposure.

Disposition and Follow-up

Consider hospitalizing patients who have evidence of systemic toxicity from any route of exposure.

Delayed Effects

Because pulmonary edema or CNS effects may be delayed, patients who have suspected serious exposure should be observed and reexamined periodically for 18 to 24 hours.

Patient Release

Patients who have mild exposure and remain asymptomatic for 2 to 4 hours may be discharged with instructions to seek medical care promptly if symptoms develop (see the *Phenol—Patient Information Sheet* below).

Follow-up

Obtain the name of the patient's primary care physician so that the hospital can send a copy of the ED visit to the patient's doctor.

Patients who have skin or eye burns should be reexamined in 24 hours. Patients with significant phenol intoxication may be at risk and should be monitored for long-term CNS (peripheral neuropathy) gastrointestinal, and cardiac and renal damage.

Reporting

If a work-related incident has occurred, you may be legally required to file a report; contact your state or local health department.

Other persons may still be at risk in the setting where this incident occurred. If the incident occurred in the workplace, discussing it with company personnel may prevent future incidents. If a public health risk exists, notify your state or local health department or other responsible public agency. When appropriate, inform patients that they may request an evaluation of their workplace from OSHA or NIOSH. See Appendices III and IV for a list of agencies that may be of assistance.

Phenol
Patient Information Sheet

This handout provides information and follow-up instructions for persons who have been exposed to phenol.

What is phenol?
Phenol may be found as a translucent, clear, or light-pink crystalline mass; a white powder, or a clear liquid. It has a sweet, sharp odor. Phenol is used in many commercially available products including plastics, resins, fertilizers, paints, photographic developers, and some medicines.

What immediate health effects can result from exposure to phenol?
Poisoning can occur when phenol gets on the skin or in the eyes, when it is inhaled, or when it is swallowed. Skin and eyes can be mildly or severely burned, depending on how much and how long the phenol was in contact with them. Breathing phenol vapors can burn the lining of the nose, throat, and lungs, just as it burns the skin. Severe injury to the lungs can cause them to fill with fluid, making breathing difficult. Swallowing phenol burns the lining of the digestive tract and can result in internal bleeding. Generally, the more serious the exposure, the more severe the symptoms. Phenol is absorbed easily into the body through the skin, lungs, and stomach. The brain is very sensitive to phenol. Phenol can cause seizures and coma and may interfere with the brain's control of regular breathing patterns. It can cause dangerous rhythm changes in the heart.

Can phenol poisoning be treated?
There is no antidote for phenol, but its effects can be treated, and most exposed persons do get well. Persons who have had a serious exposure may need to be hospitalized. If phenol got in your eyes, the doctor may put a special dye in your eyes and examine them with a magnifying device. If you swallowed phenol, you may have been given a solution containing charcoal, which will soak up phenol in your stomach.

Are any future health effects likely to occur?
A single small exposure from which a person recovers quickly is not likely to cause delayed or long-term effects. After a severe exposure, you may not notice any symptoms for up to 24 hours.

What tests can be done if a person has been exposed to phenol?
Depending on the severity of symptoms, the doctor may order blood tests, urine tests, chest x-ray, and a heart monitoring test. These tests may show whether damage has been done to the heart, kidneys, lungs, or nervous system, Abnormally high amounts of phenol may be found in the urine if exposure was severe. Testing is not needed in every case.

Where can more information about phenol be found?
More information about phenol can be obtained from your regional poison control center; your state, county, or local health department; the Agency for Toxic Substances and Disease Registry (ATSDR); your doctor; or a clinic in your area that specializes in occupational and environmental health. If the exposure happened at work, you may wish to discuss it with your employer, the Occupational Safety and Health Administration (OSHA), or the National Institute for Occupational Safety and Health (NIOSH). Ask the person who gave you this form for help in locating these telephone numbers.

Follow-up Instructions

Keep this page and take it with you to your next appointment. Follow *only* the instructions checked below.

[ ] Call your doctor or the Emergency Department if you develop any unusual signs or symptoms within the next 24 hours, especially:
coughing or wheezing
difficulty breathing, shortness of breath or chest pain
irregular heartbeats, pounding or fluttering in your chest
increased pain, swelling, redness, or a pus-like discharge where skin is burned
unexplained drowsiness, dizziness, headache, or fainting

[ ] No follow-up appointment is necessary unless you develop any of the symptoms listed above.
[ ] Call for an appointment with Dr. _____ in the practice of _____.
When you call for your appointment, please say that you were treated in the Emergency Department at _____ Hospital by _____ and were advised to be seen again in _____ days.
[ ] Return to the Emergency Department/ _____ Clinic on (date) _____at __ _____ AM/PM for a follow-up examination.
[ ] Do not perform vigorous physical activities for 1 to 2 days.
[ ] You may resume everyday activities including driving and operating machinery.
[ ] Do not return to work for _____ days.
[ ] You may return to work on a limited basis. See instructions below.
[ ] Avoid exposure to cigarette smoke for 72 hours; smoke may worsen the condition of your lungs.
[ ] Avoid drinking alcoholic beverages for at least 24 hours; alcohol may worsen injury to your stomach or have other effects.
[ ] Avoid taking the following medications: _____
[ ] You may continue taking the following medication(s) that your doctor(s) prescribed for you: __
_____
_____
[ ] Other instructions: _____
_____
_____

- Provide the Emergency Department with the name and the number of your primary care physician so that the ED can send him or her a record of your emergency department visit.

- You or your physician can get more information on the chemical by contacting: _____ _____ or _____, or by checking out the following Internet Web sites: _____; _____.

Signature of patient _____ Date _____

Signature of physician _____ Date _____