Common Name: **m-PHENYLENEDIAMINE**

Synonyms: 3-Aminoaniline; 1,3-Phenylenediamine

Chemical Name: 1,3-Benzenediamine

Date: August 1999          Revision: September 2010

**Description and Use**

*m-Phenylenediamine* is a white, crystalline (sand-like) solid that turns red on exposure to air. It is used to make dyes for textiles, fibers and leathers, as a polymer additive, and in hair dyes.

**Reasons for Citation**

- *m-Phenylenediamine* is on the Right to Know Hazardous Substance List because it is cited by ACGIH, DOT, DEP, IARC, IRIS and EPA.

**Hazard Summary**

<table>
<thead>
<tr>
<th>Hazard Rating</th>
<th>NJDOH</th>
<th>NFPA</th>
</tr>
</thead>
<tbody>
<tr>
<td>HEALTH</td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td>FLAMMABILITY</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>REACTIVITY</td>
<td>0</td>
<td>-</td>
</tr>
</tbody>
</table>

POISONOUS GASES ARE PRODUCED IN FIRE

**First Aid**

- **Eye Contact**
  - Immediately flush with large amounts of water for at least 15 minutes, lifting upper and lower lids. Remove contact lenses, if worn, while rinsing.

- **Skin Contact**
  - Quickly remove contaminated clothing. Immediately wash contaminated skin with large amounts of soap and water.

- **Inhalation**
  - Remove the person from exposure.
  - Begin rescue breathing (using universal precautions) if breathing has stopped and CPR if heart action has stopped.
  - Transfer promptly to a medical facility.

**Emergency Numbers**

- Poison Control: 1-800-222-1222
- CHEMTREC: 1-800-424-9300
- NJDEP Hotline: 1-877-927-6337
- National Response Center: 1-800-424-8802

**Workplace Exposure Limits**

- ACGIH: The threshold limit value (TLV) is **0.1 mg/m³** averaged over an 8-hour workshift.

- The above exposure limit is for air levels only. When skin contact also occurs, you may be overexposed, even though air levels are less than the limit listed above.
Determining Your Exposure

- Read the product manufacturer’s Material Safety Data Sheet (MSDS) and the label to determine product ingredients and important safety and health information about the product mixture.
- For each individual hazardous ingredient, read the New Jersey Department of Health Hazardous Substance Fact Sheet, available on the RTK website (www.nj.gov/health/eoh/rtkweb) or in your facility’s RTK Central File or Hazard Communication Standard file.
- You have a right to this information under the New Jersey Worker and Community Right to Know Act and the Public Employees Occupational Safety and Health (PEOSH) Act if you are a public worker in New Jersey, and under the federal Occupational Safety and Health Act (OSHA) if you are a private worker.
- The New Jersey Right to Know Act requires most employers to label chemicals in the workplace and requires public employers to provide their employees with information concerning chemical hazards and controls. The federal OSHA Hazard Communication Standard (29 CFR 1910.1200) and the PEOSH Hazard Communication Standard (N.J.A.C. 12:100-7) require employers to provide similar information and training to their employees.

Health Hazard Information

Acute Health Effects
The following acute (short-term) health effects may occur immediately or shortly after exposure to m-Phenylenediamine:

- Contact can irritate the skin and eyes.
- Inhaling m-Phenylenediamine can irritate the nose, throat and lungs causing coughing, wheezing and/or shortness of breath.
- High levels of this substance can reduce the blood’s ability to transport Oxygen causing headache, fatigue, dizziness, and a blue color to the skin and lips (methemoglobinemia). Exposure to very high levels can cause trouble breathing, collapse and even death.

Chronic Health Effects
The following chronic (long-term) health effects can occur at some time after exposure to m-Phenylenediamine and can last for months or years:

Reproductive Hazard
- There is no evidence that m-Phenylenediamine affects reproduction. This is based on test results presently available to the NJDOH from published studies.

Other Effects
- m-Phenylenediamine may cause a skin allergy. If allergy develops, very low future exposure can cause itching and a skin rash.
- Repeated high exposure to m-Phenylenediamine can irritate the lungs and may cause bronchitis to develop with coughing, phlegm, and/or shortness of breath.
- Long-term exposure may damage the liver and kidneys.

Medical Testing

Medical Testing
For frequent or potentially high exposure (half the TLV or greater), the following are recommended before beginning work and at regular times after that:

- Liver and kidney function tests
- Blood methemoglobin level
- Evaluation by a qualified allergist can help diagnose skin allergy.

Any evaluation should include a careful history of past and present symptoms with an exam. Medical tests that look for damage already done are not a substitute for controlling exposure.

Request copies of your medical testing. You have a legal right to this information under the OSHA Access to Employee Exposure and Medical Records Standard (29 CFR 1910.1020).

Mixed Exposures

- Smoking can cause heart disease, lung cancer, emphysema, and other respiratory problems. It may worsen respiratory conditions caused by chemical exposure. Even if you have smoked for a long time, stopping now will reduce your risk of developing health problems.
- More than light alcohol consumption can cause liver damage. Drinking alcohol can increase the liver damage caused by m-Phenylenediamine.

Cancer Hazard
- While m-Phenylenediamine has been tested, it is not classifiable as to its potential to cause cancer.
**Workplace Controls and Practices**

Very toxic chemicals, or those that are reproductive hazards or sensitizers, require expert advice on control measures if a less toxic chemical cannot be substituted. Control measures include: (1) enclosing chemical processes for severely irritating and corrosive chemicals, (2) using local exhaust ventilation for chemicals that may be harmful with a single exposure, and (3) using general ventilation to control exposures to skin and eye irritants. For further information on workplace controls, consult the NIOSH document on Control Banding at [www.cdc.gov/niosh/topics/ctrlbanding/](http://www.cdc.gov/niosh/topics/ctrlbanding/).

The following work practices are also recommended:

- Label process containers.
- Provide employees with hazard information and training.
- Monitor airborne chemical concentrations.
- Use engineering controls if concentrations exceed recommended exposure levels.
- Provide eye wash fountains and emergency showers.
- Wash or shower if skin comes in contact with a hazardous material.
- Always wash at the end of the workshift.
- Change into clean clothing if clothing becomes contaminated.
- Do not take contaminated clothing home.
- Get special training to wash contaminated clothing.
- Do not eat, smoke, or drink in areas where chemicals are being handled, processed or stored.
- Wash hands carefully before eating, smoking, drinking, applying cosmetics or using the toilet.

In addition, the following may be useful or required:

- Use a vacuum or a wet method to reduce dust during clean-up. **DO NOT DRY SWEEP.**

**Personal Protective Equipment**

The OSHA Personal Protective Equipment Standard (29 CFR 1910.132) requires employers to determine the appropriate personal protective equipment for each hazard and to train employees on how and when to use protective equipment.

The following recommendations are only guidelines and may not apply to every situation.

**Gloves and Clothing**

- Avoid skin contact with m-Phenylenediamine. Wear personal protective equipment made from material which cannot be permeated or degraded by this substance. Safety equipment suppliers and manufacturers can provide recommendations on the most protective glove and clothing material for your operation.
- The recommended glove materials for m-Phenylenediamine are Silver Shield®/4H® and Barrier® for Amines, aromatic, primary.
- The recommended protective clothing material for solid m-Phenylenediamine is Tyvek® and Tychem® BR and TK for Amines, aromatic, primary.
- All protective clothing (suits, gloves, footwear, headgear) should be clean, available each day, and put on before work.

**Eye Protection**

- Wear eye protection with side shields or goggles.
- If additional protection is needed for the entire face, use in combination with a face shield. A face shield should not be used without another type of eye protection.

**Respiratory Protection**

**Improper use of respirators is dangerous.** Respirators should only be used if the employer has implemented a written program that takes into account workplace conditions, requirements for worker training, respirator fit testing, and medical exams, as described in the OSHA Respiratory Protection Standard (29 CFR 1910.134).

- Where the potential exists for exposure over 0.1 mg/m³, use a NIOSH approved respirator with an organic vapor cartridge and particulate P100 prefilters. Increased protection is obtained from full facepiece powered-air purifying respirators.
- Leave the area immediately if (1) while wearing a filter or cartridge respirator you can smell, taste, or otherwise detect m-Phenylenediamine, (2) while wearing particulate filters abnormal resistance to breathing is experienced, or (3) eye irritation occurs while wearing a full facepiece respirator. Check to make sure the respirator-to-face seal is still good. If it is, replace the filter or cartridge. If the seal is no longer good, you may need a new respirator.
- Consider all potential sources of exposure in your workplace. You may need a combination of filters, prefilters or cartridges to protect against different forms of a chemical (such as vapor and mist) or against a mixture of chemicals.
- Where the potential for high exposure exists, or when m-Phenylenediamine is heated, use a NIOSH approved supplied-air respirator with a full facepiece operated in a pressure-demand or other positive-pressure mode. For increased protection use in combination with an auxiliary self-contained breathing apparatus or an emergency escape air cylinder.

**Fire Hazards**

If employees are expected to fight fires, they must be trained and equipped as stated in the OSHA Fire Brigades Standard (29 CFR 1910.156).

- m-Phenylenediamine may burn, but does not readily ignite.
- Use dry chemical or water as extinguishing agents.
- POISONOUS GASES ARE PRODUCED IN FIRE, including Nitrogen Oxides.
- Use water spray to keep fire-exposed containers cool.
Spills and Emergencies
If employees are required to clean-up spills, they must be properly trained and equipped. The OSHA Hazardous Waste Operations and Emergency Response Standard (29 CFR 1910.120) may apply.

If m-Phenylenediamine is spilled, take the following steps:

- Evacuate personnel and secure and control entrance to the area.
- Eliminate all ignition sources.
- Moisten spilled material first or use a HEPA-filter vacuum for clean-up and place into sealed containers for disposal.
- Ventilate and wash area after clean-up is complete.
- DO NOT wash into sewer.
- It may be necessary to contain and dispose of m-Phenylenediamine as a HAZARDOUS WASTE. Contact your state Department of Environmental Protection (DEP) or your regional office of the federal Environmental Protection Agency (EPA) for specific recommendations.

Handling and Storage
Prior to working with m-Phenylenediamine you should be trained on its proper handling and storage.

- m-Phenylenediamine reacts with OXIDIZING AGENTS (such as PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE); STRONG ACIDS (such as HYDROCHLORIC, SULFURIC and NITRIC); ACID ANHYDRIDES; ACID CHLORIDES; and CHLOROFORMATES.
- Store in tightly closed containers in a cool, well-ventilated area and protect from SUNLIGHT.
- Sources of ignition, such as smoking and open flames, are prohibited where m-Phenylenediamine is used, handled, or stored in a manner that could create a potential fire or explosion hazard.

Occasional Health Information Resources
The New Jersey Department of Health offers multiple services in occupational health. These services include providing informational resources, educational materials, public presentations, and industrial hygiene and medical investigations and evaluations.

For more information, please contact:

New Jersey Department of Health
Right to Know
PO Box 368
Trenton, NJ 08625-0368
Phone: 609-984-2202
Fax: 609-984-7407
E-mail: rtk@doh.state.nj.us
Web address: http://www.nj.gov/health/eoh/rtkweb

The Right to Know Hazardous Substance Fact Sheets are not intended to be copied and sold for commercial purposes.
GLOSSARY

ACGIH is the American Conference of Governmental Industrial Hygienists. They publish guidelines called Threshold Limit Values (TLVs) for exposure to workplace chemicals.

Acute Exposure Guideline Levels (AEGs) are established by the EPA. They describe the risk to humans resulting from once-in-a-lifetime, or rare, exposure to airborne chemicals.

Boiling point is the temperature at which a substance can change its physical state from a liquid to a gas.

A carcinogen is a substance that causes cancer.

The CAS number is unique, identifying number, assigned by the Chemical Abstracts Service, to a specific chemical.

CFR is the Code of Federal Regulations, which are the regulations of the United States government.

A combustible substance is a solid, liquid or gas that will burn.

A corrosive substance is a gas, liquid or solid that causes destruction of human skin or severe corrosion of containers.

The critical temperature is the temperature above which a gas cannot be liquefied, regardless of the pressure applied.

DEP is the New Jersey Department of Environmental Protection.

DOT is the Department of Transportation, the federal agency that regulates the transportation of chemicals.

EPA is the Environmental Protection Agency, the federal agency responsible for regulating environmental hazards.

ERG is the Emergency Response Guidebook. It is a guide for emergency responders for transportation emergencies involving hazardous substances.

Emergency Response Planning Guideline (ERPG) values provide estimates of concentration ranges where one reasonably might anticipate observing adverse effects.

A fetus is an unborn human or animal.

A flammable substance is a solid, liquid, vapor or gas that will ignite easily and burn rapidly.

The flash point is the temperature at which a liquid or solid gives off vapor that can form a flammable mixture with air.

IARC is the International Agency for Research on Cancer, a scientific group.

Ionization Potential is the amount of energy needed to remove an electron from an atom or molecule. It is measured in electron volts.

IRIS is the Integrated Risk Information System database on human health effects that may result from exposure to various chemicals, maintained by federal EPA.

LEL or Lower Explosive Limit, is the lowest concentration of a combustible substance (gas or vapor) in the air capable of continuing an explosion.

mg/m³ means milligrams of a chemical in a cubic meter of air. It is a measure of concentration (weight/volume).

A mutagen is a substance that causes mutations. A mutation is a change in the genetic material in a body cell. Mutations can lead to birth defects, miscarriages, or cancer.

NFPA is the National Fire Protection Association. It classifies substances according to their fire and explosion hazard.

NIOSH is the National Institute for Occupational Safety and Health. It tests equipment, evaluates and approves respirators, conducts studies of workplace hazards, and proposes standards to OSHA.

NTP is the National Toxicology Program which tests chemicals and reviews evidence for cancer.

OSHA is the federal Occupational Safety and Health Administration, which adopts and enforces health and safety standards.

PEOSHA is the New Jersey Public Employees Occupational Safety and Health Act, which adopts and enforces health and safety standards in public workplaces.

Permeated is the movement of chemicals through protective materials.

ppm means parts of a substance per million parts of air. It is a measure of concentration by volume in air.

Protective Action Criteria (PAC) are values established by the Department of Energy and are based on AEGs and ERPGs. They are used for emergency planning of chemical release events.

A reactive substance is a solid, liquid or gas that releases energy under certain conditions.

STEL is a Short Term Exposure Limit which is usually a 15-minute exposure that should not be exceeded at any time during a work day.

A teratogen is a substance that causes birth defects by damaging the fetus.

UEL or Upper Explosive Limit is the highest concentration in air above which there is too much fuel (gas or vapor) to begin a reaction or explosion.

Vapor Density is the ratio of the weight of a given volume of one gas to the weight of another (usually Air), at the same temperature and pressure.

The vapor pressure is a force exerted by the vapor in equilibrium with the solid or liquid phase of the same substance. The higher the vapor pressure the higher concentration of the substance in air.
**Common Name:** m-PHENYLENEDIAMINE  
**Synonyms:** 3-Aminoaniline; 1,3-Benzenediamine; 1,2-Phenylenediamine  
**CAS No:** 108-45-2  
**Molecular Formula:** C₆H₈N₂  
**RTK Substance No:** 1316  
**Description:** White, crystalline solid that turns red on exposure to air

### HAZARD DATA

<table>
<thead>
<tr>
<th>Hazard Rating</th>
<th>Firefighting</th>
<th>Reactivity</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 - Health</td>
<td>m-Phenylenediamine may burn, but does not readily ignite. Use dry chemical or water as extinguishing agents. POISONOUS GASES ARE PRODUCED IN FIRE, including Nitrogen Oxides. Use water spray to keep fire-exposed containers cool.</td>
<td>m-Phenylenediamine reacts with OXIDIZING AGENTS (such as PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE); STRONG ACIDS (such as HYDROCHLORIC, SULFURIC and NITRIC); ACID ANHYDRIDES; ACID CHLORIDES; and CHLOROFORMATES. Protect from SUNLIGHT.</td>
</tr>
<tr>
<td>1 - Fire</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0 - Reactivity</td>
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<td></td>
</tr>
</tbody>
</table>

**DOT#:** UN 1673  
**ERG Guide #:** 153  
**Hazard Class:** 6 (Toxic)

### SPILL/LEAKS

**Isolation Distance:**  
Spill: 25 meters (75 feet)  
Fire: 800 meters (1/2 mile)  
Moisten spilled material first or use a HEPA-filter vacuum for clean-up and place into sealed containers for disposal.  
DO NOT wash into sewer.  
m-Phenylenediamine is very toxic to aquatic organisms.

### PHYSICAL PROPERTIES

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flash Point</td>
<td>280° to 369°F (138° to 187°C)</td>
</tr>
<tr>
<td>LEL:</td>
<td>1.3%</td>
</tr>
<tr>
<td>UEL:</td>
<td>9.8%</td>
</tr>
<tr>
<td>Auto Ignition Temp</td>
<td>1,040°F (560°C)</td>
</tr>
<tr>
<td>Vapor Density</td>
<td>3.7 (air = 1)</td>
</tr>
<tr>
<td>Vapor Pressure</td>
<td>0.62 mm Hg at 212°F (100°C)</td>
</tr>
<tr>
<td>Specific Gravity</td>
<td>1.1 (water = 1)</td>
</tr>
<tr>
<td>Water Solubility</td>
<td>Very slightly soluble</td>
</tr>
<tr>
<td>Boiling Point</td>
<td>540° to 543°F (282° to 284°C)</td>
</tr>
<tr>
<td>Melting Point</td>
<td>145° to 147°F (63° to 64°C)</td>
</tr>
<tr>
<td>Molecular Weight</td>
<td>108.2</td>
</tr>
</tbody>
</table>

### EXPOSURE LIMITS

**ACGIH:** 0.1 mg/m³, 8-hr TWA  
The Protective Action Criteria values are:  
PAC-1 = 0.3 mg/m³  
PAC-2 = 10 mg/m³  
PAC-3 = 125 mg/m³

### PROTECTIVE EQUIPMENT

**Gloves:** Butyl, SilverShield®/4H®, Barrier (>8-hr breakthrough for Amines, aromatic, primary)  
**Coveralls:** Tyvek® (solid m-Phenylenediamine); Tychem® BR and TK (>8-hr breakthrough for Amines, aromatic, primary)  
**Respirator:** >0.1 mg/m³ - Full facepiece APR with Organic vapor cartridges and P100 prefilters  
>10 mg/m³ - SCBA

### HEALTH EFFECTS

<table>
<thead>
<tr>
<th>Body Part</th>
<th>Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eyes</td>
<td>Irritation</td>
</tr>
<tr>
<td>Skin</td>
<td>Irritation</td>
</tr>
<tr>
<td>Inhalation</td>
<td>Nose, throat and lung irritation, with coughing, wheezing and shortness of breath. Headache, fatigue and blue color to the skin and lips (methemoglobinemia)</td>
</tr>
</tbody>
</table>

### FIRST AID AND DECONTAMINATION

Remove the person from exposure.  
Flush eyes with large amounts of water for at least 15 minutes. Remove contact lenses if worn.  
Quickly remove contaminated clothing and wash contaminated skin with large amounts of soap and water.  
Begin artificial respiration if breathing has stopped and CPR if necessary.  
Transfer promptly to a medical facility.