

# Industrial hygiene and toxicology term paper sample

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## **Formaldehyde**

### Chemical Concerns

According to the National Cancer Institute website, formaldehyde is a colorless, strong-smelling chemical compound used to manufacture building materials and other household products. Exposure of humans to formaldehyde levels exceeding 0.1 ppm may lead to short-term effects such as skin irritation, respiratory problems, nausea, wheezing, and inflammation of the mucus membrane. Formaldehyde is a probable carcinogen and long prolonged exposure to the chemical can lead to certain types of cancer.

### **Route to Exposure**

In most cases, people expose themselves to formaldehyde when using volatile organic compounds such as paints, pesticides, and building materials. When using these products, they emit organic compounds. Poor storage can also lead to emission of organic products, which may cause short-term health effects to store keepers and people with access to the storerooms.

### **Applicable Exposure Limits**

People working with formaldehyde products can be exposed to a maximum of 0.75 ppm over an 8-hour period. This is the Federal standard set by OSHA in May 1992. The maximum limit set by OSHA earlier on (1987) was 1 ppm.

### **Types of Industries to Find These Chemicals**

It is highly likely to find formaldehyde in industries that manufacture disinfectants, textiles, automobiles, glue and resins. Due to its superior

binding qualities, formaldehyde is used in the manufacture of glue and resins. It is also used to manufacture disinfectants since it controls the activities of bacteria, fungi and yeast. Formaldehyde also finds use in the textiles industry as a pigment to prevent colors from fading. Lastly, the automobile industry uses formaldehyde because the resins it forms with phenol are fire-resistant and can be used to make brake linings.

## **Types of PPE Required**

People working with formaldehyde solutions are required to wear safety goggles to protect their eyes; they are also required to wear gloves, aprons and boots to protect the skin from exposure. It is also advisable to wear NIOSH approved self-contained breathing equipment to provide respiratory protection.

## **NIOSH or Sampling Method & Number**

Sampling of formaldehyde can be done using NIOSH method number 2016. The most important equipment required when using this sampling method is the HPLC. The method uses cartridge containing silica gel coated with DPNH to collect gas-phase aldehydes and subsequently analyze samples using the HPLC.

## **Naphthalene**

### **Chemical Concerns**

Naphthalene is an odorous organic compound usually found in coal as well as petroleum products. Exposure to high levels of naphthalene or inhaling the chemical may lead to nausea, headaches, diarrhea and vomiting. Continued

exposure to naphthalene may cause long-term health effects such as hemolytic anemia (this is a condition whereby a person's red blood cells break down and die). Extreme reactions to naphthalene may involve liver and damage of the kidneys.

#### Route to Exposure

People who work in the coal-tar, fabric, and tanning industries are at a high risk of getting exposed to naphthalene. Once the chemical gets into the body, it is broken down into toxic compounds such as 1-naphthol. The toxic metabolites lead to the abnormal build-up of hemoglobin in the body. Young children may show signs of hemolytic anemia if they ingest mothballs or fabrics treated with naphthalene derivatives.

#### Applicable Exposure Limits

**NIOSH recommends TWA of 8 hours at 10 ppm (50 mg/m<sup>3</sup>) and 15 ppm (75 mg/m<sup>3</sup>) for STEL.**

#### Types of Industries to Find These Chemicals

Naphthalene is likely to be found in coal-tar production, tanning, ink, wood preservation and dye production industries. Naphthalene may also be found in places whereby coal and oil is burnt in large quantities.

#### Types of PPE Required

In order to protect against naphthalene, it is important to wear a face shield and safety goggles to protect the face and the eyes respectively. It is also important to wear a NIOSH approved breathing respirator and gloves. The recommended clothing should be resistant to chemicals.

## **NIOSH or Sampling Method & Number**

The sampling method for naphthalene is NIOSH IV number 1501. The equipment required includes carbon disulfide, charcoal tube and gas chromatography apparatus. The method 1501 requires the calibration of each sampling pump to be used, adding known amounts of the analyte and preparation of a calibration graph.

## **Hexavalent Chromium**

### Chemical Concerns

Hexavalent chromium is a natural metal containing the element chromium. Normally, the chromium is in the + 6 oxidation state. Hexavalent chromium is a probable carcinogen, and prolonged exposure can lead to cancer. Other health effects related to the exposure of Hexavalent chromium include: skin irritation, nose bleeding, kidney damage, liver damage, respiratory problems and eye irritation.

### Route to Exposure

People are exposed to Hexavalent chromium through breathing, drinking/eating and touching. Exposure through breathing is the source of the greatest concern. Eating fresh vegetables and all types of meat can expose one to Hexavalent chromium. Contact with contaminated soil also leads to Hexavalent chromium exposure.

### Applicable Exposure Limits

For drinking water, the recommend limit for chromium is 100 parts per billion. Levels exceeding this figure can be harmful to health. NIOSH recommends a limit of 0. 001 mg/m<sup>3</sup> TWA.

### Types of Industries to Find These Chemicals

Hexavalent chromium is likely to be found in the industries that make inks, dyes, paints, and surface coatings. Hexavalent chromium is useful in these industries because it is anti-corrosive and has a nice finishing quality.

### Types of PPE Required

When handling hexavalent chromium products, it is essential to have head protection tools such as hoods and hard hats. This protects the head against chemical splashes. The use of face shields and safety goggles is also advisable to protect the eyes and the face. The feet require to be protected with rubber boots, and aprons may be used to protect against dust and vapors.

### NIOSH or Sampling Method & Number

The tools required in sampling hexavalent chromium include an ion chromatograph with a UV detector and a PVC filter. The chemical is extracted from the PVC filter using a solution containing 10% sodium carbonate, 2% sodium bicarbonate and a mixture of phosphate buffer. The solution is then derivatized through a column containing 1, 5 - diphenyl and then analyzed using an ion chromatograph. This procedure is the NIOSH method number 7605.

## **Works Cited**

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