

Hexavalent Chromium

GENERAL

Hexavalent chromium is a toxic form of the metal chromium. It is widely used in many industries. Occupational exposure occurs mainly in workers who handle dry chromate-containing pigments, spray chromate-containing paints and coatings, operate chrome plating baths, and weld or cut chromium-containing metals such as stainless steel.

HEALTH HAZARDS

The following health effects are associated with exposure to high levels of hexavalent chromium:

CANCER

Hexavalent chromium causes lung cancer in humans. An individual worker's actual risk depends on how much hexavalent chromium is in the workplace air and how long the exposure goes on. The lower and briefer the exposure, the less the risk of lung cancer.

RESPIRATORY TRACT

Hexavalent chromium can irritate the nose, throat, and lungs. Repeated or prolonged exposure can damage the mucous membranes of the nasal passages and cause ulcers to form. In some cases, the damage is so severe that the septum (the wall separating the nasal passages) develops holes.

Some workers develop a sensitization to hexavalent chromium, and once this occurs inhaling chromate compounds can cause an allergic reaction with asthma symptoms such as wheezing and shortness of breath.

SKIN

Hexavalent chromium is very irritating to the skin and prolonged contact can cause ulcers. Some workers develop an allergic sensitization to chromium. In sensitized workers, contact with even very tiny amounts can cause a serious skin rash.

EYES

Hexavalent chromium is an eye irritant. Direct eye contact with chromic acid or chromate dusts can cause permanent eye damage.

SOURCES OF CHROMIUM EXPOSURE

The most common employee exposure to hexavalent chromium occurs from the following:

PIGMENTS

Dusts are formed in the production of chromium-containing compounds such as chromate pigments and powders, chromic acid, chromium catalysts, dyes and coatings. Dusts are also released when the same chemicals are used in a manufacturing process. These dusts can be inhaled, and handling of the powders can cause contact with the skin.

SPRAYING

In spraying anti-corrosion coatings, a liquid that contains zinc chromate or lead chromate is applied to metal surfaces through a high-pressure spray gun. The spray nozzle creates a mist that can be inhaled or come in contact with the skin.

PLATING

In chrome plating, metal parts are immersed in a liquid solution of chromic acid through which an electric current flows. The electroplating process creates gases

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that bubble to the tank surface and carry liquid particles of chromic acid solution into the air. This mist can be inhaled, and the plating solution can come in contact with the skin. Hard chrome plating, which uses a stronger electric current and a higher tank temperature than bright chrome plating, creates the most chromic acid mist.

WELDING

In welding or cutting, the intense heat of the arc or flame vaporizes the base metal and/or the electrode coating. This vaporized metal condenses into tiny particles called fumes. These fume particles can be inhaled. Chromium fume is created by welding or cutting on stainless steel or metals that are coated with a chromium material.

USES	TYPES OF HEXAVALENT CHROMIUM CHEMICALS
pigments for paints, inks, and plastics	lead chromate (chrome yellow, chrome green, molybdenum orange), zinc chromate, barium chromate, calcium chromate, potassium dichromate, sodium chromate
anti-corrosion coatings (chrome plating, spray coatings)	chromic trioxide (chromic acid), zinc chromate, barium chromate, calcium chromate, sodium chromate, strontium chromate
stainless steel or other non-ferrous chromium alloys	hexavalent chromium is given off when stainless steel is cast, welded, or torch cut, or during smelting of ferro-chromium ore
textile dyes	ammonium dichromate, potassium chromate, potassium dichromate, sodium chromate
wood preservation	chromium trioxide
leather tanning	ammonium dichromate

WORKPLACE EXPOSURE LIMITS

Several workplace exposure limits exist for hexavalent chromium. Exposure limits specified by OSHA are regulatory, but other non-regulatory exposure limits are set by other organizations, such as the American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Value (TLV) and the National Institute for Occupational Safety and Health (NIOSH) Recommended Exposure Limit (REL). Although the non-regulatory limits are not required by law, they are generally accepted as reflective of current research on levels necessary to prevent illness. Additional exposure limits exist for other forms of chromium, including metallic and trivalent chromium. Air monitoring can be conducted to determine whether levels of any materials present a health hazard.

WORKPLACE CONTROLS

To adequately protect workers from levels of hexavalent chromium which exceed established occupational exposure limits, a control program should be established. This includes:

ENGINEERING CONTROLS

The two best ways to prevent inhaling or ingesting chromium-containing particles are substituting with chromium-free materials and using local exhaust ventilation. If a substitute cannot be found, a mechanically powered local exhaust hood should be placed at the point where chromium is released into the air, or the entire process should be contained within the hood. Properly designed and maintained local exhaust ventilation draws off most of the chromium before it can be inhaled.

RESPIRATORY PROTECTION

Wearing an air-purifying respirator is the least effective way to control exposure, and should be used only if other controls are not feasible. If respirators are used, a written respirator program addressing selection, use, care, and maintenance should be implemented. The elements are outlined in Risk Management Bulletin # 12, Establishing a Respirator Program.

OTHER CONDITIONS

In addition to those above, other elements of a control program include:

- Monitor the environment to determine exposure levels and maintain them below established exposure limits
- Provide appropriate personal protective equipment when skin or eye contact is likely to occur
- Make medical examinations available to employees who are overexposed or who experience adverse health effects associated with hexavalent chromium exposure
- Good hygiene and housekeeping practices
- Train employees to recognize the sources, health effects and prevention of exposure

For further information or assistance, contact your Zenith Safety & Health Consultant.