

Alodine is a trade name (originally from Henkel) for a family of **chromate conversion coatings** used to protect aluminum and other metals from corrosion and to improve paint adhesion.

The proper chemical name depends on the specific product, but many traditional Alodine formulations contain:

- **Hexavalent chromium (Chromium VI, Cr(VI))** compounds
- Also known as **chromate conversion coating** or **chemical conversion coating**

Note: Many newer "Alodine" products are **trivalent chromium (Cr(III))** formulations, which are significantly less hazardous than traditional hexavalent chromium products.

Short-Term Health Effects (Acute Exposure)

Skin Contact

- Skin irritation
- Redness and itching
- Chemical burns with concentrated solutions
- Yellow or brown staining of the skin
- Skin ulcers ("chrome holes") after repeated contact

Eye Contact

- Severe eye irritation
- Burning sensation
- Redness
- Excessive tearing
- Possible corneal damage
- Temporary or permanent vision loss in severe cases

Inhalation

- Nose and throat irritation
- Coughing
- Shortness of breath

- Wheezing
- Chest tightness
- Headache
- Dizziness
- Lung irritation
- Nasal ulceration with significant exposure

Ingestion

- Burning of the mouth and throat
- Severe stomach pain
- Vomiting
- Diarrhea
- Kidney damage
- Liver damage
- Potentially life-threatening poisoning if swallowed in sufficient amounts

Long-Term Health Effects (Chronic Exposure)

Traditional **hexavalent chromium (Cr(VI))** Alodine products present the greatest long-term health risks.

Respiratory Effects

Repeated inhalation may cause:

- Chronic bronchitis
 - Reduced lung function
 - Asthma-like symptoms
 - Chronic irritation of the respiratory tract
 - Nasal septum perforation ("hole in the nasal septum")
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Skin Effects

Long-term contact may cause:

- Allergic contact dermatitis
 - Persistent skin ulcers
 - Chronic eczema
 - Skin sensitization (small future exposures may trigger severe reactions)
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Cancer Risk

Hexavalent chromium compounds are classified as:

- **Known human carcinogens**

Long-term occupational exposure has been associated with increased risk of:

- Lung cancer
- Nasal cavity cancer
- Sinus cancer

The cancer risk is primarily associated with repeated inhalation of airborne Cr(VI), especially in industrial settings without proper controls.

Kidney Damage

Chronic exposure may contribute to:

- Decreased kidney function
 - Kidney inflammation
 - Permanent kidney damage in severe cases
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Liver Effects

Possible:

- Liver inflammation

- Impaired liver function
 - Elevated liver enzymes
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Immune System Effects

Repeated exposure may result in:

- Chromium sensitization
 - Increased allergic reactions
 - Persistent dermatitis
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Reproductive Effects

Some animal studies suggest high levels of hexavalent chromium may affect:

- Fertility
- Fetal development

Human evidence is less conclusive, but minimizing exposure is recommended.

Occupational Exposure Limits

For airborne **hexavalent chromium**:

- **OSHA Permissible Exposure Limit (PEL):** 5 micrograms per cubic meter ($\mu\text{g}/\text{m}^3$) as an 8-hour time-weighted average.
 - Employers are required to implement engineering controls, exposure monitoring, and respiratory protection when exposures may exceed this limit.
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Symptoms That Require Immediate Medical Attention

Seek prompt medical evaluation if exposure results in:

- Difficulty breathing
- Chest pain
- Severe eye exposure

- Large chemical burns
- Persistent nosebleeds after repeated exposure
- Skin ulcers
- Accidental ingestion