Risk Management and Local Governance Strategies to Prevent and Control Hexavalent Chromium Exposures with Public Health-based Air Standards

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Abstract

In the wake of discovering hexavalent chromium air emissions in excess of 400 times typical ambient levels in a small urban community, local government agencies launched investigations to uncover the breadth of chromium-emitting industrial facilities near sensitive land uses across Los Angeles County. Faced with a mounting inventory of chromium-emitting facilities and a dearth of air exposure data, public health officials have conducted a rapid review of available environmental and health data and proposed systemwide changes. We set forth two key recommendations to prevent and control hexavalent chromium exposures: (1) Implement a public health air monitoring plan that increases the reach and permanence of air monitoring stations to ensure that policy and regulatory measures are being effective in controlling harmful emissions, especially near schools and residential areas; (2) Adopt a public health-based risk management action algorithm, consisting of four tier levels. The importance of these recommendations is underscored by the fact that studies have consistently shown that hexavalent chromium compounds increase lung and nasal cancer risks in humans when inhaled, and the lack of existing state or federal hexavalent chromium enforceable standards to protect public health.

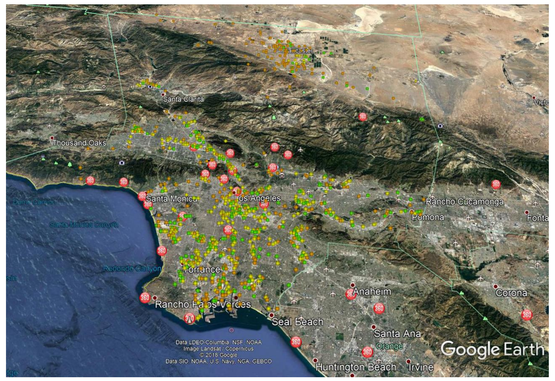
Objective

To examine existing environmental data on hexavalent chromium emissions into outdoor air from industrial sources, and to provide recommendations for action to reduce adverse health impacts among workers that use hexavalent chromium and communities near hexavalent chromium-emitting facilities.

Background:

Hexavalent chromium is a man-made chemical emitted into the air, primarily as fine dust particles, by a variety of industries (e.g. chrome plating, leather tanning, and welding.)1 When these industrial sources are near homes, schools and daycare centers, the hexavalent chromium emissions can worsen existing medical conditions and increase the rates of lung and nasal cancers among those who are exposed. The Los Angeles County Department of Public Health has identified chromium-emitting facilities located in densely populated urban areas, many of which are disproportionately low-income communities of color. Addressing this public health threat will require extensive collaboration across government, industry and community stakeholders to monitor and control hexavalent chromium emissions.

Figure 1. Hexavalent Chromium Emitting Plating Facilities in Los Angeles County



Dot Color Symbology: Orange = Negligible (emissions below the 0.002 lbs./year threshold set by SCAQMD Rule 1402), Yellow = Suspect (The facility could have significant hexavalent chromium emissions based on industrial activities), Green = Confirmed (the facility has significant hexavalent chromium emissions).

Methods

A review of the health effects of inhalation of hexavalent chromium, environmental sources of hexavalent chromium emissions, current regulatory landscape was conducted. Additionally, action steps for reducing airborne exposure to hexavalent chromium based on best-available evidence are presented.

Would you like more information?

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References

1. Jacobs, J. and Testa, S.M. Overview of chromium (VI) in the environment: background and history.
2. United States Department of Labor, Occupational Safety and Health Administration. Fact Sheet – Health Effects of Hexavalent Chromium.
3. Office of Environmental Health Hazard Assessment – Health Effects if Hexavalent Chromium, A Fact Sheet. Available from: https://oehha.ca.gov/media/downloads/faqs/hexchromiumairfact111616.pdf

Findings

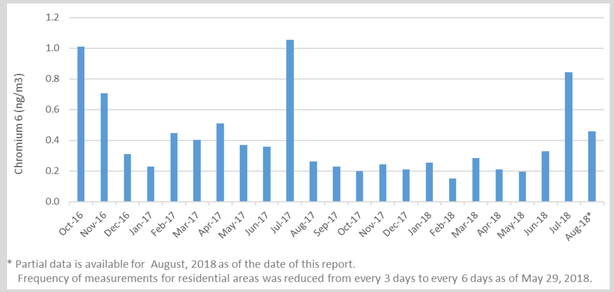
Health Effects[2,3]

- Breathing high levels of hexavalent chromium can cause irritation of the nose, throat, and respiratory tract.
- Very high airborne exposures can also result in nasal sores and perforation of the membrane separating the nostrils.
- Some workers exposed to hexavalent chromium may develop asthma symptom such as wheezing and shortness of breath.
- Breathing airborne hexavalent chromium over a long period of time increases the risk of lung and nasal cancers.
- Factors that determine whether an individual will be harmed include the dose of the exposure, duration, and nature of the contact (e.g. home versus workplace).

Environmental Sources of Hexavalent Chromium Emissions

- Airborne exposures typically occur due to releases from industrial areas or hazardous waste facilities and workplace air.
- The major use of chromium is in the steel industry, especially stainless and heat-resisting steel.
- It is also used in the production of items such as treated wood, tanned leather, and stainless-steel cookware.
- Additional sources of hexavalent chromium include chromate pigments in dyes, paints, inks, plastics, anti-corrosive agents, primers, and surface coatings, including chrome plating.
- Particles released during the smelting of ferrochromium, welding, and Portland cement can also contain hexavalent chromium.

Figure 2. Hexavalent Chromium in Outdoor Air (ng/m³), Residential and School Areas



* Partial data is available for August, 2018 as of the date of this report.
Frequency of measurements for residential areas was reduced from every 3 days to every 6 days as of May 29, 2018.

Case Study

City of Paramount, California

The City of Paramount is home to multiple companies that use hexavalent chromium in metal finishing operations. The SCAQMD began monitoring air in the City of Paramount in August 2013. In October 2016, monitoring near the intersection of Minnesota and Madison streets found much higher hexavalent chromium levels than in other areas of Los Angeles County. As a result, air monitoring was expanded to the City's southeast industrial area and school zones in 2017. The Southeastern industrial area has shown hexavalent chromium levels up to 50 times greater than levels in other areas of Los Angeles County, with the highest recorded levels reaching 9 ng/m³. Levels across Paramount have generally decreased since last year but remain higher than ambient levels in other areas of the region which range from 0.04 to 0.1 ng/m³ .

Conclusion

Progressive emission control policies appear to have been partially effective in reducing hexavalent chromium emissions from stationary sources. However, ambient levels in critical areas are still above Los Angeles basin background levels, resulting in long-term elevated cancer risk for populations living near hexavalent chromium-emitting facilities. A factor that complicates emission control measures is that the capacity of regional and local agencies to conduct air monitoring activities is limited, and temporary in some cases, making it difficult to determine the need to take corrective action when necessary. Any immediate plans to further decrease exposure to hexavalent chromium emissions would not be possible without an adequate capacity to conduct air quality monitoring activities over extended periods of time.

Recommendations

Short-Term

Implement a public health air monitoring plan that increases the reach and permanence of air monitoring stations to ensure that policy and regulatory measures are being effective in controlling harmful emissions, especially near schools and residential areas.

Establish a more stringent risk management action algorithm, consisting of four tier levels (see Table 1.)

Table 1. Proposed Risk Management Tiers

Tier Level	Description	Action Step
Tier 1	> 0.02 ng/m³ to < 0.2 ng/m³	Robust air monitoring program needed
Tier 2	> 0.2 ng/m³ and < 2 ng/m³	Mitigation controls needed
Tier 3	> 2 ng/m³ and < 20 ng/m³	Temporary curtailment of operations
Tier 4	> 20 ng/m³	Facility shut-down

Long-Term

The above control policies and risk management plan would not be possible without an adequate capacity to conduct air quality monitoring activities over extended periods of time as needed. While more permanent solutions are being developed, it would be necessary to increase the reach and permanence of air monitoring stations to ensure that policy and regulatory measures are being effective in controlling harmful emissions, especially near schools and residential areas.

Future steps to eliminate the use of hexavalent chromium in metal finishing operations should include the adoption of more environmentally friendly technologies such as the use of trivalent chromium and/or replacement by other compounds and/or finishing types. Lastly, reducing, and eventually eliminating, airborne emissions of hexavalent chromium and reducing the health risks of workers and residents will require the concerted efforts of regulators, public health agencies, local governments, school officials, residents, scientists, industry and their customers.