# *Regulatory Considerations for Chromium*

*This document was prepared by NASA's Principal Center for Regulatory Risk Analysis and Communication (RRAC PC). An archive of RRAC PC regulatory information may be accessed on the website at http://www.rracpc.org. If you have questions or need further assistance with this matter, please contact Sharon Scroggins/MSFC (256-544-7932, sharon.scroggins@nasa.gov).*

## Introduction

Space vehicle systems historically have used primers and conversion coatings containing chromium to inhibit corrosion on aluminum surfaces. Chromium inhalation exposures can occur when primers and other coatings are applied to metal surfaces. Additionally, parts that are plated with chromium sometimes are used in space vehicle systems.

Chromium may be regulated as total chromium, hexavalent chromium, trivalent chromium, or other forms, depending on the regulatory agency. Traditionally, hexavalent chromium is the form used in aerospace coating and electroplating materials. However, the use of trivalent chromium, as an alternative to hexavalent chromium, is increasing in certain applications.

Hexavalent chromium is a known carcinogen and its use is strictly regulated. Trivalent chromium is not known to be carcinogenic and, therefore, is not as strictly regulated. Because of its adverse effects on human health and the environment, use and exposure to hexavalent chromium represent potential occupational safety and environmental risks. Additionally, because of its relatively heavy regulatory burden, hardware designs incorporating hexavalent chromium may face future materials obsolescence risks if vendors should become unwilling or unable to supply parts or other products containing or manufactured using hexavalent chromium.

# Acronyms and Abbreviations

| | |
|---|---|
| ATSDR | Agency for Toxic Substances and Disease Registry |
| ACGIH | American Conference of Governmental Industrial Hygienists, Inc. |
| CAA | Clean Air Act |
| CCC | Criterion continuous concentration |
| CERCLA | Comprehensive Environmental Response, Compensation, and Liability Act |
| CFR | *Code of Federal Regulations* |
| Cr(III) | Trivalent Chromium |
| Cr(VI) | Hexavalent Chromium |
| CMC | Criterion maximum concentration |
| CWA | Clean Water Act |
| DOT | U.S. Department of Transportation |
| EPA | United States Environmental Protection Agency |
| EO | Executive Order |
| EPCRA | Emergency Planning and Community Right-To-Know Act |
| EU | European Union |
| FR | *Federal Register* |
| HAP | Hazardous air pollutant |
| IARC | International Agency for Research on Cancer |
| MCL | Maximum contaminant level |
| µg/m$^3$ | Micrograms per cubic meter |
| µg/L | Micrograms per liter |
| mg/L | Milligram per liter |
| mg/m$^3$ | Milligrams per cubic meter |
| NASA | National Aeronautics and Space Administration |
| NESHAP | National Emission Standards for Hazardous Air Pollutants |
| NIOSH | National Institute for Occupational Safety and Health |
| NPL | National Priorities List |
| NTP | National Toxics Program, part of the National Institutes of Health's National Institute of Environmental Health Sciences |
| OSHA | Occupational Safety and Health Administration |
| PEL | Permissible exposure limit |
| PPE | Personal protective equipment |
| ppm | Parts per million |
| RCRA | Resource Conservation and Recovery Act |
| REACH | Registration, Evaluation, and Authorisation of Chemicals |
| RoHS | Reduction of Hazardous Substances |
| RQ | Reportable quantity |
| SARA | Superfund Amendments and Reauthorization Act |
| SDWA | Safe Drinking Water Act |
| TCLP | Toxicity characteristic leaching procedure |
| TLV | Threshold limit value |
| TRI | Toxic Release Inventory |
| TWA | Time-weighted average |
| U.S. | United States |
| U.S.C. | United States Code |

# Chromium Regulatory Overview

Hexavalent chromium is considered a known human carcinogen by regulatory and advisory bodies. Exposure to Cr(VI) can cause a number of harmful health effects, including lung, kidney, and liver damage. Chronic exposure to trivalent chromium can affect the skin, liver, and kidneys; however, there is no evidence to suggest that Cr(III) compounds are carcinogenic.

Due to the hazardous nature of chromium, there are U.S. and international regulatory issues to consider when making the decision whether to use materials incorporating chromium, particularly hexavalent chromium. Exhibit 1 provides an overview of the regulatory requirements and limits regarding chromium, as well as supportability considerations related to the continued ability to purchase materials incorporating chromium as a corrosion inhibitor in primers and conversion coatings. Background information regarding many of these requirements is provided in Attachment 1. Other regulations may apply to uses of chromium in other industries and applications, such as steel manufacturing, dyes and pigments, and wood preserving.

EXHIBIT 1
Summary of Significant Regulations Applicable to Chromium

| Regulatory or Advisory Body | Regulatory Posture | | NASA Operational Considerations |
|---|---|---|---|
| OSHA | Occupational Safety and Health Act | Cr(VI):<br>29 CFR 1910.1026<br>PEL = 5 µg/m$^3$ airborne concentration of Cr(VI), 8-hour TWA<br>Action level = 2.5 µg/ m$^3$ airborne concentration of Cr(VI), 8-hour TWA<br>Cr(III):<br>29 CFR 1910.1000, Table Z-1<br>PEL = 500 µg/m$^3$ airborne concentration of Cr(III), 8-hour TWA<br>Action level = 250 µg/m$^3$ airborne concentration of Cr(III) compounds (as Cr), 8-hour TWA<br>Cr(II):<br>29 CFR 1910.1000, Table Z-1<br>PEL = 500 µg/m$^3$ airborne concentration of Cr(II) compounds (as Cr), 8-hour TWA<br>Action level = 250 µg/m$^3$ airborne concentration of Cr(II) compounds (as Cr), 8-hour TWA<br>Chromium metal and insoluble salts:<br>29 CFR 1910.1000, Table Z-1<br>PEL = 500 µg/m$^3$ airborne concentration of chromium metal and insoluble salts (as Cr), 8-hour TWA<br>Action level = 250 µg/m$^3$ airborne concentration of chromium metal and insoluble salts (as Cr), 8-hour TWA | Direct: requires PPE and work process and engineering controls. For Cr(VI), the work process and engineering controls are not required for processes or tasks that the employer can demonstrate do not result in employee exposure above the PEL for 30 or more days per year (12 consecutive months).<br>Indirect: increased safety requirements could reduce vendor willingness to supply products in the future. |
| EPA | Carcinogen | Cr(VI): Known Human Carcinogen (Inhalation), Group A<br>Cr(III): Not Classifiable as to Human Carcinogenicity, Group D | Environmental and safety regulations are sometimes more stringent for carcinogens than for noncarcinogens. |
| | CAA | Regulated as an inorganic Hazardous Air Pollutant by EPA regulations under 42 U.S.C. 85.7412, including NESHAPs for Source Categories (40 CFR 63). For example, a NESHAP exists for Chromium Emissions from Hard and Decorative Chromium Electroplating and Chromium Anodizing Tanks (40 CFR 63, Subpart N). Additionally, chromium may be regulated in other industrial source categories, such as Aerospace Manufacturing and Rework Facilities (40 CFR 63, Subpart GG).<br>NESHAPs limit air emissions of HAPs such as chromium. Requirements vary depending on the regulated operation, but can include limitations on the use of materials in specific applications, institution of work practices, or control equipment.<br>Chromium compounds are also on the list of 33 HAPs that present the greatest threat to public health in urban areas. These 33 HAPs are the primary focus of regulations under the Urban Air Toxics Strategy. | EPA is reviewing some NESHAPs for effectiveness, as required by the CAA. If revisions are deemed necessary, additional restrictions could reduce materials availability or vendor willingness to supply products. |

<table>
<tr><th>Regulatory or Advisory Body</th><th colspan="2">Regulatory Posture</th><th>NASA Operational Considerations</th></tr>
<tr><td></td><td>CWA</td><td>Cr(VI) and Cr(III) are regulated as Priority Pollutants by EPA regulations under 33 U.S.C.1251, found at 40 CFR Part 131.36:<br>Cr(VI)<br><table><tr><th></th><th>CMC (max) (µg/L)</th><th>CCC (continuous) (µg/L)</th></tr><tr><td>Freshwater</td><td>15</td><td>10</td></tr><tr><td>Saltwater</td><td>1,100</td><td>50</td></tr></table>Cr(III)<br><table><tr><th></th><th>CMC (max) (µg/L)</th><th>CCC (continuous) (µg/L)</th></tr><tr><td>Freshwater</td><td>550</td><td>180</td></tr><tr><td>Saltwater</td><td>--</td><td>--</td></tr></table>In addition, EPA also publishes criteria intended to accurately reflect the latest scientific knowledge. EPA's national recommended water quality criteria are guidance to states and authorized tribes in adopting water quality standards in support of the CWA. States may adopt the criteria when implementing state regulations or setting discharge limits.<br>Recommended Water Quality Criteria:<br>Cr(VI)<br><table><tr><th></th><th>CMC (acute) (µg/L)</th><th>CCC (chronic) (µg/L)</th></tr><tr><td>Freshwater</td><td>16</td><td>11</td></tr><tr><td>Saltwater</td><td>1,100</td><td>50</td></tr></table>Cr(III)<br><table><tr><th></th><th>CMC (acute) (µg/L)</th><th>CCC (chronic) (µg/L)</th></tr><tr><td>Freshwater</td><td>570</td><td>74</td></tr><tr><td>Saltwater</td><td>--</td><td>--</td></tr></table></td><td></td></tr>
<tr><td></td><td>RCRA</td><td>Regulated as a hazardous constituent of waste. At 40 CFR 261.24, EPA lists the maximum concentration of contaminants for the toxicity characteristic leaching procedure as 5 mg/L for chromium*.<br>*Waste that contains Cr(III) and no other form of chromium is not hazardous.<br>Hazardous waste codes in which the listing is based wholly or partly on chromium (40 CFR 261, Appendix VII):<br><table><tr><th></th><th>Non-specific Sources (F Codes)</th><th>Specific Sources (K Codes)</th></tr><tr><td>Cr(VI)</td><td>F006, F019</td><td>K002 – K008, K048 – K051, K061, K062, K069, K086, K100</td></tr><tr><td>Cr(III)</td><td>F032, F034, F035, F037, F038</td><td>K090</td></tr></table></td><td>Potential cost impact for disposal of hazardous waste versus nonhazardous waste.</td></tr>
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| Regulatory or Advisory Body | Regulatory Posture | | NASA Operational Considerations |
|---|---|---|---|
| | CERCLA/ SARA | 40 CFR Part 302<br>Spill reporting RQ = 5,000 pounds (total chromium)<br>Facilities that release quantities of total chromium greater than or equal to the RQ must report the release to the state and national response centers. There is no reporting required for pieces of solid metal that are 0.004 inch in diameter or larger.<br>If hazardous waste is released, the RQ is based on the waste code:<br>F006, F019, – 10 pounds<br>F032, F034, F035, F037, F038 – 1 pound<br>K002, K008, K048, K051, K061, K062, K069, K086, K090, K100 – 10 pounds | Potential additional administrative burden. |
| | | 40 CFR Part 370<br>Tier II reporting and MSDS submittal threshold – 10,000 pounds | Potential additional administrative burden. |
| | EPCRA | TRI: Chromium and chromium compounds are listed substances (40 CFR Part 372.65) subject to reporting requirements (40 CFR Part 372.65).<br>Threshold quantities:<br>Manufacture or process: 25,000 pounds<br>Otherwise use: 10,000 pounds<br>Facilities that release quantities of chromium and chromium compounds above the threshold quantities during a calendar year may be required to submit TRI reports.<br>EPCRA Section 313 chemical categories are subject to the 1% *de minimis* concentration unless the substance involved meets the definition of an OSHA carcinogen, in which case the 0.1% *de minimis* concentration applies.<br>*De minimis* concentrations:<br>Cr(VI) = 0.1%<br>Cr(III) = 1% | Potential additional administrative burden. |
| | SDWA | 40 CFR Part 141<br>MCL = 0.1 mg/L (total chromium) | |
| NTP | Carcinogenic | Cr(VI) - Known Human Carcinogen | Environmental and safety regulations are sometimes more stringent for carcinogens than for noncarcinogens. |
| IARC | Carcinogenic | Cr(VI) - Carcinogenic to Humans, Group 1<br>Cr(III) - Not Classifiable as to Carcinogenicity to Humans, Group 3 | |
| NIOSH | Carcinogenic<br>Exposure (Guideline) | Cr(VI) - Potential Occupational Carcinogen<br>Immediately Dangerous to Life and Health:<br>Cr(VI) - 15 mg/m$^3$<br>Cr(III) - 25 mg/m$^3$<br>Cr(II) - 250 mg/m$^3$ | |
| ACGIH | Exposure (Guideline) | TLV-TWA Limit<br>Cr(VI) = 0.05 mg/m$^3$<br>Cr(III) = 0.5 mg/m$^3$ | |

| Regulatory or Advisory Body | Regulatory Posture | | NASA Operational Considerations |
|---|---|---|---|
| Office of the President<br>Office of the Federal Environmental Executive | Executive Order | EO 13423, Strengthening Federal Environmental, Energy, and Transportation Management, Section 2(e)<br>Implementation instructions for federal facilities | Federal agencies must reduce the quantity of toxic and hazardous chemicals and materials acquired, used, or disposed. |
| DOT | Hazardous Material | 49 CFR 172<br>Chromium-containing wastes that are hazardous under RCRA are considered hazardous materials and special requirements have been set for marking, labeling, and transporting these materials. | Could affect training and record-keeping requirements. |
| EU | EU Directive 2002/95/EC | Restriction on Hazardous Substances<br>Bans Cr(VI) and other substances in most electrical and electronic products in the EU. | Could affect vendor willingness to supply products if a significant portion of their market is in Europe. |
| | EU Regulation 1907/2006/EC | REACH Regulation)<br>Places restrictions on the manufacture, placing on the market, and use of numerous chromium compounds in the EU. | |

# Discussion of Recent and Emerging Regulatory Issues Regarding Chromium

Numerous regulatory requirements apply to the manufacture, use, and disposal of materials containing chromium and chromium compounds. In the U.S., CAA regulations tend to be the most prescriptive regarding the operational usage of specific materials and processes. CAA-related regulatory activities are in progress that could place further restrictions on operations that use materials containing HAPs, including chromium and chromium compounds.

On 29 March 2007, EPA issued an advance notice of proposed rulemaking asking for public comment regarding HAP emissions and other model input data from existing regulatory data sources. EPA intends to use these data to assess the remaining, or "residual," risk from 22 industrial major source categories, including Aerospace Manufacturing and Rework Facilities, as required by the CAA. EPA is evaluating the data sets for each of the 22 source categories to assess potential human health risks, particularly through emissions of persistent and bioaccumulative HAP, such as chromium (see 72 FR 14734 ; 29 March 2007). This rulemaking is especially significant to NASA space vehicle programs because the coating, cleaning, and depainting of space vehicle hardware are regulated under the Aerospace Manufacturing and Rework NESHAP. If additional restrictions are imposed on this source category to address residual risk, space vehicle operations-related materials and processes could be affected. This regulation could affect the use of coatings containing chromium; however, it is unlikely that changes to this regulation would affect the manufacturing or refurbishment operations related to chromium-plated parts.

On 16 July 2007, EPA finalized NESHAPs for seven area source categories, including facilities that manufacture chromium compounds. These final rules include emission standards that

reflect the generally available control technologies or management practices in each of these area source categories (see 72 FR 38863 ; 16 July 2007). Because these area source standards are based on generally available techniques, this final rule is not anticipated to act as a significant driver for materials obsolescence.

In addition to the CAA regulations, OSHA has adopted new standards that limit occupational exposure to Cr(VI). On 28 February 2006, OSHA reduced the 8-hour TWA exposure limit to 5 μg of Cr(VI) per $m^3$ of air (see 71 FR 10099 ; 28 February 2006). The final rule contains ancillary provisions for worker protection such as the following:

- Requirements for exposure determination
- Preferred exposure control methods
- Respiratory protection
- Protective clothing and equipment
- Hygiene areas and practices
- Medical surveillance
- Record keeping
- Startup dates that include 4 years for the implementation of engineering controls to meet the PEL

In addition, the final rule requires implementation of engineering and work practice controls to ensure that employee exposure to Cr(VI) remains at or below the PEL. When the employer can demonstrate that a process or task does not expose employees to Cr(VI) levels above the PEL for 30 or more days per year (12 consecutive months), the engineering and work practice control requirements do not apply to that activity. However, where painting of aircraft or large aircraft parts is performed in the aerospace industry, engineering and work practice controls are required to reduce and maintain employee exposure to Cr(VI) to or below 25 $\mu g/m^3$ unless these controls are not feasible.

The final standard separately regulates general industry, construction, and shipyards in order to tailor requirements to the unique circumstances found in each of these sectors. On 30 October 2006, OSHA published an amendment to the final rule that created an optional, alternative compliance timetable for metal- and surface-finishing operations at eligible facilities (see 71 FR 63238). Eligible facilities must implement engineering controls for electroplating operations on an expedited schedule (by 31 December 2008), and are granted relief from certain respirator requirements in the interim.

The reduction of the exposure limit may require some facilities to install additional control measures to protect workers or elect to eliminate use of Cr(VI), potentially affecting materials' availability.

## Potential Impact to NASA Programs

Environmental and safety regulations related to highly hazardous substances such as chromium may be expected to become more restrictive over time. Onsite worker exposure to hexavalent chromium can occur through inhalation when primers, conversion coatings, and other materials containing chromium are applied. Additionally, when chromium-plating processes are

conducted offsite by vendors, potential onsite worker exposure issues could result from sanding, blasting, or other mechanical abrasion of plated surfaces.

Environmental requirements abroad probably will continue to drive the replacement of highly hazardous materials, including chromium and chromium compounds. Even though requirements such as the EU's *Restriction on Hazardous Substances* and *Registration, Evaluation, Authorisation and Restriction of Chemicals* regulations do not affect U.S. manufacturing directly, they may reduce vendors' willingness to continue production of materials or components for which the international market is limited or eliminated. Such regulations also may provide suppliers with an incentive to redesign components or reformulate materials to reduce the use of hazardous substances such as Cr(VI). Either of these supplier responses could result in a materials obsolescence risk for NASA programs, especially in cases where only one flight-qualified material, process, or component exists.

NASA programs should be aware that these and other environmental and safety regulations may drive vendor efforts to replace or eliminate hexavalent chromium in primers and conversion coatings, potentially posing a significant materials obsolescence risk in the future.

# Attachment 1
# Background on Statutes and Regulations

# Attachment 1: Background on Statutes and Regulations

Chromium and chromium compounds are addressed by various national and international laws, regulations, and guidelines. Background information regarding the most significant of these is provided in the following paragraphs.

## Occupational and Safety Health Act - 29 CFR 1910.1026 (Cr(VI)) & 29 CFR 1910.1000 (Cr(III))

OSHA establishes the federal regulatory framework for the control of workplace safety. As part of that framework, OSHA develops PELs to regulate workplace exposure to air contaminants. The PEL for Cr(VI) is 5 $\mu g/m^3$ of air, calculated as an 8-hour TWA exposure (29 CFR 1910.1026). This standard also requires that employers conduct employee training and monitoring, notify employees of their chromium exposures, implement medical surveillance of employees, provide examining physicians with specific information, ensure that employees receive a copy of their medical surveillance results, maintain employees' exposure records for specific periods, and implement engineering and work practice controls to reduce and maintain employee exposure to Cr(VI) at or below the PEL.

In cases where the employer can demonstrate that a process or task does not result in employee exposure to chromium (VI) above the PEL for 30 or more days per year (12 consecutive months), the requirement to implement engineering and work practice controls to achieve the PEL does not apply to that process or task.

Additionally, these engineering and work practice controls are not required for processes or tasks for which the employer can demonstrate that such controls are not feasible. Wherever feasible engineering and work practice controls are implemented, but are not sufficient to maintain employee exposure levels at or below the PEL, the employer must supplement them by the use of respiratory protection.

Where painting of aircraft or large aircraft parts is performed in the aerospace industry, the employer must use engineering and work practice controls to reduce and maintain employee exposure to Cr(VI) to or below 25 $\mu g/m^3$ unless the employer can demonstrate that such controls are not feasible. The employer must supplement such engineering and work practice controls with the use of respiratory protection to achieve the PEL.

The PEL for Cr(III) is 500 µg/m3 of air, calculated as an 8-hour TWA exposure (29 CFR 1910.1000). This standard also requires that employers must first implement administrative or engineering controls, when feasible, to reduce levels of Cr(III) to below the PEL. If these controls are not feasible to achieve full compliance, PPE or any other protective measures must be used to keep the exposure of employees below the PEL.

## Clean Air Act–40 CFR 63

The U.S. CAA addresses a large number of air pollutants that are known to cause or may reasonably be anticipated to cause adverse effects to human health or the environment. A total of 188 specific pollutants and chemical groups, including chromium compounds, initially were identified as HAPs; the list has been modified over time. Section 112 of the CAA governs the federal control program for HAPs. NESHAPs for Source Categories are issued to limit the release of specified HAPs from specific industrial sectors. These standards are "technology-

based," meaning that they represent the maximum achievable control technology for the specific industrial sector. The CAA does not establish air quality standards for HAPs that define legally acceptable concentrations of these pollutants in ambient air.

### Resource Conservation and Recovery Act–40 CFR 261.24

RCRA is the primary environmental law governing the proper disposal of hazardous wastes. To determine if a waste is a characteristic hazardous waste under RCRA, the TCLP usually is used. The TCLP is designed to determine the mobility of both organic and inorganic analytes present in liquid, solid, and multiphasic wastes. Chromium-containing waste with a TCLP greater than or equal to 5 ppm or mg/L carries a D007 hazardous waste code. Waste that contains Cr(III) only is considered nonhazardous. Other chromium-containing wastes are "listed" hazardous wastes; these wastes are generated by certain processes, including metal plating. Wastewater treatment sludges containing chromium from electroplating operations carry an F006 hazardous waste code.

### Superfund Amendments and Reauthorization Act–40 CFR Parts 302, 355, and 372.

SARA reauthorized the CERCLA to continue administering the Superfund Program to clean up uncontrolled or abandoned hazardous waste sites and to respond to accidents, spills, and other emergency releases of pollutants and contaminants. CERCLA defines a list of hazardous chemicals for which EPA must establish regulations. Releases of CERCLA hazardous substances in amounts greater than their "RQ" must be reported to the National Response Center and to state and local government officials. The RQ for chromium is 5,000 pounds.

CERCLA requires the ATSDR and EPA to prepare a list, in order of priority, of substances that are most commonly found at facilities on the NPL and that are determined to pose the most significant potential threat to human health due to their known or suspected toxicity and potential for human exposure at these NPL sites. This CERCLA priority list is revised and published on a biannual basis, with a yearly informal review and revision. Currently, Cr(VI) is ranked 18th, chromium is ranked 77th, and chromium (VI) oxide and chromium trioxide are ranked 66th and 218th, respectively, out of the 275 substances on this list. It should be noted that this priority list is not a list of "most toxic" substances, but rather a prioritization of substances based on a combination of their frequency, toxicity, and potential for human exposure at NPL sites.

Title III of SARA, also known as EPCRA, was enacted by Congress as the national legislation on community safety. This law was designated to help local communities protect public health, safety, and the environment from chemical hazards. EPCRA established the TRI, which requires companies in certain industrial sectors to publicly report environmental releases and transfers of listed toxic chemicals. Chemicals are listed if they are known to cause or can reasonably be anticipated to cause significant adverse acute effects on health at concentrations likely beyond the facility boundaries; cancer, teratogenic effects, reproductive effects, neurological effects, heritable genetic mutations, or other chronic effects on health; or significant damage to the environment. Chromium is on the list of chemicals to be reported.

### Safe Water Drinking Act–40 CFR Parts 141 and 143

The SDWA was enacted to protect the quality of drinking water in the U.S. The SWDA requires EPA to establish primary drinking water regulations for contaminants in public water systems

that may have adverse effects on human health. Such regulations typically include a media quality standard that defines legally allowable concentrations of toxic chemicals, called MCLs. MCLs are established to be as close to a level that is without known or anticipated adverse health effects as is technically or economically feasible. The MCL for chromium is 0.1 mg/L.

### Clean Water Act–40 CFR 122 and 403

The federal CWA establishes the basic structure for regulating discharges of pollutants into the waters of the U.S. The CWA defines a list of priority pollutants for which EPA must establish ambient water quality criteria, which are the basis of state water quality standards; and effluent limitations, which are rules controlling environmental releases from specific industrial categories based on the "best available technology economically achievable."

### Reduction of Hazardous Substances (European Union)

The RoHS Directive 2002/95/EC is a European initiative intended to reduce the environmental impact of electrical or electronic products in the waste stream and to improve the recyclability of that waste. Under RoHS, electrical and electronic products sold in Europe must be free of six hazardous substances, one of which is Cr(VI). As of 1 July 2006, most electrical and electronic products manufactured or sold in the EU may not contain Cr(VI).

### Registration, Evaluation, Authorisation and Restriction of Chemicals Regulation (European Union)

The EU's Council of Environment Ministers adopted the REACH on 18 December 2006. REACH is designed to be an integrated approach to the control of the production, import, and use of chemicals in Europe. It aims to create a system of information about chemicals, and to ensure that useful chemical safety information is provided to chemical users. REACH requires the registration, over a period of 11 years, of approximately 30,000 chemical substances currently in use and also has placed restrictions on the manufacture, placing on the market, and use of certain dangerous substances, preparations, and articles. Restrictions will apply to numerous chromium compounds. As suitable alternatives are identified, REACH calls for the progressive replacement of hazardous substances with lower-hazard chemicals. The use of hazardous substances, including many chromium compounds, will be assessed at regular intervals.