

The Overlooked Use Ban

On a chromate that is already subject to authorisation today, the coming ban on the use of almost all chromium(VI) compounds, and what this means for the use of high-temperature insulation

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Scope. This analysis examines which use bans and obligations in force today are to be applied to Chromium(VI) compounds that form on chromium-alloyed hot parts under insulation containing basic oxides, and what the restriction in procedure under Annex XVII to the REACH Regulation changes about that.

Introduction

The preceding analysis *The Overlooked Ingredient* describes how calcium and sodium chromate form on chromium-alloyed hot parts under insulation containing calcium and sodium oxide, why this was not treated as a subject of its own for decades, and which occupational protection obligations attach to it. It ends at the question of how the finding is to be dealt with.

This analysis starts there and asks a different question. It does not ask what is to be done when chromate is found, but which use bans the compound that has formed is already subject to today.

The finding on this is inconspicuous and has been public for years. Sodium chromate is listed as entry 22 in Annex XIV to the REACH Regulation. The sunset date for that entry was 21 September 2017. Since then the substance may no longer be placed on the market for use, or used, under Article 56(1) of the Regulation, for as long as no authorisation has been granted for the use in question.

The high-temperature insulation sector has never applied that entry to itself. There is an understandable reason for this. The authorisation requirement is built around deliberate industrial use, and nobody in this sector uses sodium chromate deliberately. The compound forms at the interface between the component and the insulation material, without an order and without a purpose of use.

Whether a use within the meaning of the Regulation is present is governed by Article 3(24). Storing, keeping and treating are expressly named there. The provision does not require a function of the substance. This raises the question whether the handling of contaminated components during maintenance, removal and reinstallation falls under the ban. This analysis works it through.

Part A clarifies the substance and its listing. Part B deals with the law as it stands. Part C with the restriction in procedure. Part D with the consequences for capital goods. Part E with what is overlooked in this. Part F draws the conclusion.

The evidence for the formation of the compounds is set out in the preceding analysis and is not repeated here. Where it is needed for understanding, the relevant section there is named.

Finding

Once the restriction enters into force, the fallback on substance identity ceases to be available. The designation column of the proposed entry covers the group of Cr(VI) compounds with the exception of the lead chromates, the salt clause covers the salts with a different stoichiometry, the threshold for mixtures is 0.01 % by weight, and maintenance on insulated hot parts does not appear in the list of exempted uses. From the tipping point onwards, the opening of the insulation, a use without authorisation can then practically no longer be ruled out. Which compound has formed is of no significance from that point on.

To date no market-leading manufacturer of high-temperature insulation materials has announced that it will make its products free of alkali and alkaline earth metal oxides. This concerns mineral wool, calcium silicate, the E-glass products and the aerogel products, to the extent that they contain these oxides. The manufacturers' notices on Cr(VI) formation on insulated hot parts have been updated since November 2020, and none of them mentions Annex XIV or Article 56 of the REACH Regulation.

An insulation element that may not be reinstalled after the first maintenance does not reach the service life for which it was purchased. The residual value is lost, and the replacement falls due again at every further maintenance interval. What this means for the existing stock of plants, ships and vehicles that is already insulated cannot be estimated, because that stock has never been recorded with the question of chromate formation in view.

If the authorisation question is set aside entirely, the same facts lead directly into occupational and environmental protection. There the substitution obligation under Article 4 of Directive 2004/37/EC applies, which attaches to the classification and does not presuppose a listing. Both routes end at the same decision, the oxide composition of the insulation material that is placed on the chromium-alloyed hot part.

Sections 39 to 42 set this out in detail. Section 38 deals with the legal position in force today.

“New ideas are frightening. Yet the outdated ideas are far more dangerous.”

Gerhard Kocher

A. The substance and its listing

1. Relationship to the preceding analysis

The two works deal with the same facts under different legal questions. The separation is maintained throughout.

Question	The Overlooked Ingredient	The Overlooked Use Ban
Subject matter	Formation of the chromates and their detection	Legal status of the compound that has formed
Governing provision	Directive 2004/37/EC, German GefStoffV, German TRGS 561	REACH Regulation, Annex XIV and Annex XVII
Point of attachment	Activity and exposure	Substance and use
Relevant point in time	Service and work on the plant	Removal and everything that happens to the material afterwards
Knowledge of the substance required	none, the fact that it cannot be ruled out is sufficient	Identity of the listed substance

The structure of this analysis follows from the last row. Occupational protection law attaches to the activity and does not require any determination of the individual compound. Section 5.9.3 of the German TRGS 561 in its version of 4 May 2026 already triggers the protective measures where a Chromium(VI) contamination cannot be ruled out. The authorisation requirement under Article 56 of the REACH Regulation, by contrast, attaches to a substance designated by name. It requires that it can be stated which compound is present.

That requirement is the reason why Part A deals with the substance before the law. Without a sound statement as to which compound forms at which material pairing, the second part does not hold.

2. Sodium chromate: identity, classification, listing

Sodium chromate, Na_2CrO_4 , is the sodium salt of chromic acid. It is listed as entry 22 in Annex XIV to the REACH Regulation, the list of substances subject to authorisation.

Item	Sodium chromate
EC number	231-889-5
CAS number	7775-11-3
Annex XIV	entry 22
Properties under Article 57	point (a) carcinogenic category 1B, point (b) germ cell mutagenic category 1B, point (c) toxic for reproduction category 1B
Latest application date	21 March 2016
Sunset date	21 September 2017
Exempted uses	none in the entry

Source: Authorisation List of the European Chemicals Agency, entry Sodium chromate. For the spare part and repair uses the entry lists later dates. [1, 2]

The sunset date is the point that matters. Under Article 56(1) of the REACH Regulation, manufacturers, importers and downstream users may no longer place a substance listed in Annex XIV on the market for use, and may no longer use it themselves, after that date. The provision names five exceptions, among them the authorisation granted under Articles 60 to 64 and the use exempted in the Annex itself. For entry 22 no use is exempted. [3]

Annex XIV also lists, as entry 17, the acids generated from chromium trioxide and their oligomers. For the situation dealt with here that entry is not relevant; section 4 deals with the reason. [2]

3. The source in the insulation material

Sodium chromate forms at the interface only where sodium is available at that interface. The source is the insulation material itself.

Mineral wool made from glass wool or stone wool contains sodium oxide as a constituent of the glass batch. For the variants with a stainless steel wire mesh, Rockwool states in the safe use instruction sheet for ProRox WM, issue of 1 January 2025, a content of basic oxides of more than 18 % by weight, taken together as Na₂O, K₂O, CaO, MgO and BaO. The same instruction sheet describes Cr(VI) deposits on and in mineral wool after high-temperature service, names yellowish deposits as an indication and gives requirements for protection and disposal. [4]

In TechInfo 28, status August 2025, Frenzelit names four conditions for Chromium(VI) formation: chromium-alloyed steel, alkali and alkaline earth oxides with express mention of calcium oxide, oxygen and temperatures above 350 °C. The manufacturer's statement records that its own insulation products contain calcium oxide in varying proportions and that their use can lead to Chromium(VI) formation. [5]

For the listing question the distinction by type of insulation material is decisive, because it determines which chromate is to be expected.

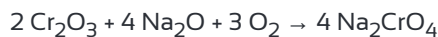
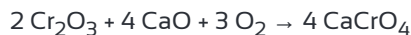
Type of insulation material	Governing basic oxide	Chromate to be expected
Mineral wool	Na ₂ O and CaO	Sodium chromate and calcium chromate
Calcium silicate	CaO, high proportion	Calcium chromate
AES wools and mats	CaO, high proportion	Calcium chromate
E-glass, fabrics and needle mats	CaO, lower proportion	Calcium chromate
Insulation mattress with a mineral wool core and an E-glass casing	Na ₂ O and CaO	Sodium chromate and calcium chromate

The assignment follows the composition and not the product designation. An insulation mattress with an E-glass casing is, by virtue of its mineral wool core, a mineral wool product by construction and combines both cases.

4. Formation route and the role of chromic acid

For the listing question two formation routes are to be distinguished. Both run at the same surface, but they lead to different compounds and thus to different entries of Annex XIV.

Solid-state reaction at the hot interface. The chromium oxide layer of the component reacts in the presence of oxygen with the basic oxides of the insulation material to form thermally stable, solid chromates. This route explains the load that can be picked up and wiped off, which accumulates within the service temperature window. It is described for calcium oxide and for sodium compounds and is documented from about 300 °C upwards.



Reactive evaporation of the chromium oxide layer. Irrespective of the chemistry of the insulation material, chromium oxide on hot stainless steel in an oxidising atmosphere forms volatile Cr(VI) species.



Which of the two volatile species occurs is determined by the humidity. In ambient air with about one percent water vapour, $\text{CrO}_2(\text{OH})_2$ is the main species below 900 °C. CrO_3 is negligible below 800 °C. Within the temperature window of insulated hot parts the chromium oxyhydroxide is therefore the governing volatile compound. [6]

In its molecular formula $\text{CrO}_2(\text{OH})_2$ corresponds to H_2CrO_4 . An assignment to entry 17 of Annex XIV does not follow from this. According to its designation the entry covers the acids that are generated from chromium trioxide, and the volatile species described here is generated from chromium oxide with oxygen and water vapour. It is moreover a gas phase species of the service condition and not a material that is handled.

The evaporation route therefore carries no listing of its own. It carries the finding that Cr(VI) forms at the surface irrespective of the chemistry of the insulation material, and it supplies the chromium that the basic oxides then bind as chromate.

No quantitative statement on the ratio of the two routes is possible within the scope of this analysis. The accumulating solid-state reaction is regarded as the route that explains the adhering load at the interface. Whether free chromic acid or chromium trioxide is present in the cooled powder alongside the fixed chromate is a question of measurement and is not decided here.

What is to be recorded is the finding and not its quantification. At the interface between chromium-alloyed steel and insulation material containing basic oxides, Cr(VI) forms within the service temperature window. Sodium-oxide-bearing insulation produces sodium chromate, which is listed as entry 22 of Annex XIV. Calcium-oxide-bearing insulation produces calcium chromate, which is not listed there. In both cases the evaporation route supplies the chromium.

5. Calcium chromate and the asymmetry of the listing

Calcium chromate, CaCrO_4 , CAS number 13765-19-0, is the calcium salt of chromic acid and has a harmonised classification as carcinogenic category 1B. It is not listed in Annex XIV to the REACH Regulation.

This gap can be explained. Annex XIV is formed from the substances of very high concern that are used industrially in the European Union and registered accordingly. Calcium chromate has no appreciable industrial use in the Union. It is employed to no appreciable extent as a pigment, as a corrosion protection agent or as an intermediate. What nobody manufactures and nobody uses does not reach the Annex by that route.

From this follows an asymmetry that has considerable consequences in practice and that is laid down in this form at no point in the body of rules.

Insulation material	Chromate	Annex XIV	Applicable regime
Mineral wool	Sodium chromate	entry 22, sunset date 21 September 2017	authorisation requirement and substitution obligation
Calcium silicate, AES, E-glass	Calcium chromate	not listed	substitution obligation, information obligation under Article 33
all types via the evaporation route	volatile Cr(VI) species as the source of chromium	not listed	what governs is the chromate that is bound at the surface

The substitution obligation under Article 4 of Directive 2004/37/EC applies to all three cases alike, because it attaches to the classification as carcinogenic and does not presuppose a listing. The authorisation requirement applies only to the listed substances. An operator who has installed calcium silicate is therefore in a different position today from an operator who has installed mineral wool, even though the hazard is the same and the formation route is the same.

The restriction in procedure under Annex XVII removes this asymmetry. According to the information note of the European Chemicals Agency, the substance scope of the restriction proposal covers, besides entries 16 to 22 and 28 to 31 of Annex XIV and barium chromate, expressly also any Cr(VI) salt with a different stoichiometry and a different hydration degree. Calcium chromate is covered by that wording. Part C deals with the details. [7]

For Part B the position in force today applies first. There a distinction is to be made between the types of insulation material, and the distinction determines which provision applies.

Sources for Part A

[1] European Chemicals Agency, Authorisation List, entry Sodium chromate, EC 231-889-5, CAS 7775-11-3, Annex XIV entry 22, latest application date 21 March 2016, sunset date 21 September 2017.

[2] Annex XIV to Regulation (EC) No 1907/2006, List of substances subject to authorisation, entries 16 to 22 and 28 to 31, inserted by Regulation (EU) No 348/2013 and later amendments.

[3] Regulation (EC) No 1907/2006, Article 2(2), Article 3(1), (2), (3), (12) and (24) and Article 56(1) and (6).

[4] Rockwool Technical Insulation, Safe Use Instruction Sheet ProRox WM, variants with a stainless steel wire mesh, version 1.1, issue of 1 January 2025. Manufacturer's statement on the content of basic oxides of more than 18 % by weight and on deposits after high-temperature service.

[5] Frenzelit GmbH, Chromium(VI)-Formation at High Temperature, TechInfo 28, status August 2025. Manufacturer's statement on the four conditions of formation and on the calcium oxide content of its own products.

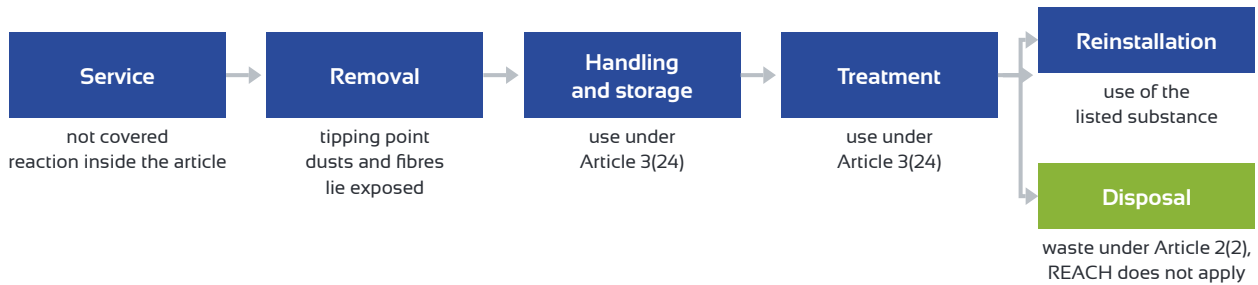
[6] On the reactive evaporation of the chromium oxide layer and on the ratio of CrO_3 and $\text{CrO}_2(\text{OH})_2$ in a humid atmosphere: Chalmers University of Technology, High-temperature corrosion properties of chromia, with the reaction equations and the statement that $\text{CrO}_2(\text{OH})_2$ is the main species below 900 °C and CrO_3 is negligible below 800 °C.

[7] European Chemicals Agency, Information Note on Restriction Report on certain chromium(VI) oxides, oxyacids and salts. Wording on the substance scope: "The substances in the scope of the restriction include as well any chromium (VI) salts with a different stoichiometry and hydration degree."

The evidence on the formation of the chromates, on the analytical methods and on the state of industrial knowledge is set out in the analysis The Overlooked Ingredient, version 1.11, sections 7 to 19.

B. The ban in force

The legal status of the chromate that has formed changes several times in the course of a maintenance operation. The overview below names the stages and the connecting factor decisive in each case. Sections 6 to 14 work through them in turn.



Two outcomes stand at the end. Only one of the two leads out of the REACH Regulation.

6. The concept of use

Article 3(24) of the REACH Regulation defines use as “processing, formulating, consuming, storing, keeping, treating, filling into containers, transfer from one container to another, mixing, production of an article or any other utilisation”. [3]

Three features of this definition are decisive for the situation dealt with here.

- Storing and keeping are expressly named. Consumption of the substance is not required.
- Treating is expressly named. Applying a reducing agent to chromate-bearing dusts and fibres is therefore a use of that substance.
- No function or purpose of the substance is required. The wording attaches to the act, not to the intention.

The last finding answers the objection that this is an unintended by-product. The objection concerns the formation. The concept of use concerns the handling. The two fall apart, and the Regulation attaches to the second.

7. Article, substance, mixture, waste

The Chromium(VI) compounds formed in situ are present in three forms. As pure, fully formed powder, as dust that is readily stirred up, and as contamination of the insulation fibre itself. Contamination with chromate in the insulation element cannot be ruled out.

Which provision applies depends on what the material counts as at the time in question. The REACH Regulation knows four categories, and an insulated component passes through three of them in the course of a maintenance operation.

Category	Definition	In the maintenance operation
Article	Article 3(3): an object which during production is given a special shape, surface or design which determines its function to a greater degree than does its chemical composition	the installed insulation element and the component, for as long as they are in service
Substance	Article 3(1): a chemical element and its compounds, including impurities resulting from the process used	the pure, fully formed chromate powder
Mixture	Article 3(2): a mixture or solution composed of two or more substances	chromate-bearing dusts with soot, fibre abrasion, corrosion products and oil residues, as well as the chromate-contaminated insulation fibre
Waste	Article 2(2): waste is not a substance, mixture or article within the meaning of Article 3	the material intended for disposal, from the point at which it is waste

Wording of Article 2(2) of the Regulation: waste as defined in Directive 2006/12/EC "is not a substance, mixture or article within the meaning of Article 3 of this Regulation". [3]

Loose powder and dust that can be stirred up do not meet the definition of an article. They lack the shape given during production, and their composition determines them completely. They are substance or mixture, depending on what is present alongside the chromate. Pure chromate powder is the substance on its own.

Basis of reference and threshold. Article 56(6) exempts the use of substances in mixtures from the authorisation requirement so long as the concentration is below the limits under point (a) or (b). For substances under Article 57(d), (e) and (f) the figure is 0.1 % by weight; for the others the values under Article 11(3) of the CLP Regulation apply. For the substance on its own there is no threshold. [3]

What matters is what the concentration is related to. The object of the use is the material that is stored, kept, treated or transferred from one container to another. That is the dusts and fibres which are in the hand at that moment, not the insulation element they come from. A calculation that relates a few grams of chromate to several kilograms of wool relates to an object that is not being used at that moment.

Article 56(6) is an exception to the authorisation requirement. Anyone invoking it demonstrates that it applies, and does so for the material he handles, using a method whose recovery rate for this matrix has been established. A standardised method for the insulation matrix does not exist.

8. Article 56 and 21 September 2017

Article 56(1) of the REACH Regulation prohibits manufacturers, importers and downstream users from placing a substance listed in Annex XIV on the market for a use or from using it themselves. The provision names five cases in which the ban does not apply.

- The use has been authorised under Articles 60 to 64.
- Annex XIV itself exempts the use from the authorisation requirement.
- The date under Article 58(1)(c)(i) has not yet been reached.
- The date has been reached, the application was made at least 18 months beforehand and has not yet been decided.
- An authorisation for that use has been granted to the immediate downstream user.

For entry 22, sodium chromate, the latest application date was 21 March 2016 and the sunset date was 21 September 2017. The entry lists no exempted uses. For the situation dealt with here, none of the five cases applies. No one has applied for an authorisation for the handling of sodium chromate formed in situ, and the Annex provides for no exemption. [1, 2]

The evaporation route under section 4 does not give rise to a listing of its own. What matters is the chromate that is bound at the surface, and with it the oxide composition of the insulation material.

Since 21 September 2017 the use of sodium chromate in the European Union has been prohibited without a granted authorisation. If a contaminated insulation element is removed, stored, treated or reinstalled after that date, a use under Article 3(24) is present. Whether that operation is to be assessed as an infringement of Article 56(1) depends on the question whether the material handled contains sodium chromate. For the material pairing of chromium-alloyed steel and sodium-oxide-bearing mineral wool, its formation has been described.

This analysis sets out the facts. Whether an infringement exists in an individual case is a matter for determination by the competent authority and not the subject of this paper.

9. The substitution obligation under Directive 2004/37/EC

Irrespective of the listing in Annex XIV, Directive 2004/37/EC on the protection of workers from the risks related to exposure to carcinogens, mutagens or reprotoxic substances at work applies to all activities involving Chromium(VI) compounds.

- Article 4 requires replacement of the carcinogen by a less dangerous substance so far as is technically possible.
- Article 5 requires the closed system where replacement is not possible, and otherwise the minimisation of exposure.
- Annex III sets a binding limit value for Chromium(VI) of 0.005 mg/m³, in force since 17 January 2025.

For Germany a stricter requirement is added. Section 3.3.4(2) of the German TRGS 561 records that no exposure-risk relationship has so far been derived for Chromium(VI) compounds, and provides: "The concentration of 1 µg/m³ for the inhalable fraction is to be applied." For exposure at that level over an entire working life, the rule states an additional statistical lung cancer risk in the order of about 4:1000. Above that level, the same passage states, a high risk is present. The text closes with the sentence that this concentration is to be complied with and that further minimisation to the greatest possible extent is to be sought. [12]

The substitution obligation attaches to the classification and does not presuppose a listing. It therefore covers calcium chromate as well as sodium chromate. It is also the only one of the obligations dealt with here that addresses the source. All the others apply only once the contamination is already present.

For high-temperature insulation this means a check with three questions: Is a carcinogen foreseeably formed with the intended material pairing? Is a material available for which that is not the case? Is its use technically possible? If the check turns out that way, Article 4 requires the replacement.

10. The reuse ban

The model operating instruction "Removal of chromate-contaminated insulation materials", available through the hazardous substances information system WINGIS of the German statutory accident insurance institution for the construction industry, status 23 May 2026, classifies the activity as carcinogenic and prescribes the entire protective regime. It contains the sentence "Do not reuse mineral wool products which have been removed." [8]

The operating instruction is an employer requirement under section 14 of the German Hazardous Substances Ordinance and not a statutory use restriction. Its effect is nevertheless immediate, because the employer has to implement it and because it reflects the state of the art.

There is no tension between that requirement and the authorisation requirement. Both prohibit the same operation for different reasons. The operating instruction prohibits it as an occupational protection measure, the REACH Regulation as the use of a substance subject to authorisation. Anyone who complies with the operating instruction likewise does not breach the authorisation requirement in that respect.

Since mineral wool contains both sodium oxide and calcium oxide, the requirement covers mineral wool products which have been removed in full, including insulation mattresses with a mineral wool core and an E-glass casing. For the remaining chromate-contaminated insulation materials the same result follows from the substitution obligation.

11. The employment ban under the Maternity Protection Act

Section 11(1), first sentence, of the German Maternity Protection Act prohibits the employer from allowing a pregnant woman to carry out activities in which she is or can be exposed to hazardous substances to a degree that constitutes an unjustifiable risk for her or her child. The second sentence names as a standard example classification as toxic for reproduction, germ cell mutagenic or carcinogenic in categories 1A or 1B. [9]

Sodium chromate carries all three classifications in category 1B. Calcium chromate carries the classification as carcinogenic 1B.

The third sentence rules out the unjustifiable risk where two conditions are present together. The first requires compliance with the workplace requirements and, in addition, an assessment according to which the substance is regarded as safe with respect to harm to the unborn child where those requirements are complied with. No such assessment is available for the chromates dealt with here.

Where the presence cannot be ruled out, pregnant women may not carry out maintenance, removal, plant overhaul, cleaning and ash handling in the areas concerned.

12. Mixing ban and waste law

With the transition into waste the applicability of the REACH Regulation ends. That follows from Article 2(2). Waste law takes its place, and there a ban of its own applies to hazardous waste.

Section 9a(1) of the German Circular Economy Act declares the mixing of hazardous waste unlawful, both with other categories of hazardous waste and with other waste, substances or materials. The provision expressly also covers mixing by dilution. Subsection 2 permits exceptions only for permitted installations and subject to further conditions. Subsection 3 obliges producers and holders to separate the waste without delay where it has been mixed unlawfully. [10]

For practice this entails a reservation at the collection stage. To the extent that insulation material, cleaning cloths, filters, covering material and disposable protective clothing are to be assigned to different waste types, collecting them together in one container is a mixing of different categories of hazardous waste and therefore unlawful. The assignment is to be settled before collection and not afterwards.

The transition into waste is thus the only route by which the material leaves the use restrictions of the REACH Regulation. It is subject to the condition that the material actually becomes waste. Anyone who cleans, treats and reinstalls does not meet that condition.

13. Consequences for maintenance, removal and reinstallation

The preceding sections can be traced back to the five stages of the maintenance operation.

Stage	Legal classification	Consequence
Service	reaction inside an article during its use	no use within the meaning of the Regulation; the substitution obligation for the next choice of material applies nonetheless
Removal	dusts and fibres lie exposed as substance or mixture	from here the concept of use and the protective regime apply
Handling and storage	storing and keeping under Article 3(24)	use of a substance subject to authorisation, to the extent that sodium chromate is present
Treatment	treating under Article 3(24)	a use in its own right; the treatment does not remove the conditions of formation
Reinstallation	use in full	additionally prohibited by the model operating instruction for mineral wool products; contamination of the insulation element itself cannot be ruled out, so cleaning the surface does not establish freedom from chromate
Disposal	waste under Article 2(2)	REACH does not apply; mixing ban under section 9a(1) KrWG

Proper removal under containment, negative pressure and controlled disposal remains possible. What cannot be achieved under the provisions set out here is routine maintenance in open operation followed by reinstallation of the material that has been removed.

This finding concerns the existing stock and pre-installed new goods alike, to the extent that insulation materials bearing basic oxides are installed.

14. National variations

The REACH Regulation applies directly in all Member States and in Norway, Iceland and Liechtenstein. Directive 2004/37/EC is to be transposed nationally. The overview below names the transposition and, in each case, the particular feature decisive for the situation dealt with here.

Country	Transposition	Particular feature
Germany	Hazardous Substances Ordinance, TRGS 561 in its version of 4 May 2026	section 5.9.3 deals expressly with thermally stressed chromium-alloyed industrial components, see the following paragraph
Netherlands	Arbobesluit, SZW limit value list	a national limit value of its own at the prohibition risk level
Poland	occupational safety law with a dedicated regulation on carcinogens	obligation to keep a register of the activities and of the exposed employees
France	Code du travail, section on CMR substances	substitution obligation expressly anchored
Switzerland	ChemRRV, enforcement by SUVA and SECO	not an EEA member, the REACH restriction does not apply directly; a separate national regime applies

The authorisation requirement under Annex XIV applies in the same way in all EEA States. The differences concern occupational safety law, not the use restriction.

The information on the national transpositions outside Germany is given by way of overview. The respective language versions of this analysis carry a chapter of their own on the national regulatory framework of their country.

15. Section 5.9.3 of the German TRGS 561

The German TRGS 561 in its version of 4 May 2026 deals with the situation set out here in a section of its own. It is thus the only one of the sets of rules named here that addresses it expressly.

Section 5.9.3(2) records that Chromium(VI) compounds can form on thermally stressed chromium-alloyed industrial components such as steam pressure lines or turbines, that different compounds arise depending on the starting materials, some of which form visible yellow deposits, and that on thermally insulated components these compounds can deposit in the insulation materials or assembly pastes. During dismantling or maintenance work this can lead to exposure. [12]

Paragraph 3 names the factors that can influence the formation: steel temperature, chromium content in the steel alloy, reaction time, the presence of alkali and alkaline earth metal oxides, for example from insulation materials or assembly pastes, the presence of atmospheric oxygen and air humidity close to the steel surface. The same paragraph opens with the sentence "The formation mechanism has not yet been clarified at present." What follows from that and what does not is dealt with in Part E. [12]

Paragraph 4 records that workplace measurements indicate exposure above $1 \mu\text{g}/\text{m}^3$ and that exposure cannot be ruled out, in particular during plant overhauls, in dismantling and in fault clearance. [12]

Paragraph 5 defines the trigger. "For activities on industrial components where a chromium(VI) contamination is present or where it cannot be ruled out, there is a need to implement the protective measures in accordance with the requirements of chapters 4.1 and 4.2 and to supplement them by the following technical protective measures and personal protective equipment". [12]

The four supplementary measures read, in the wording of the rule: minimisation of the generation and spread of the dusts into other working areas, with covering of the grating, for example by sheeting; type 5 chemical protective suits to EN ISO 13982-1 with hood, nitrile-coated textile gloves and eye protection; suitable respiratory protection, at least FFP2 for short-term activities and half masks with P3 filters for activities of longer duration; disposal of contaminated disposable protective clothing. [12]

The trigger is the fact that it cannot be ruled out. The rule does not require a determination of the individual compound. In this it differs from the authorisation requirement under Article 56, and the two requirements exist side by side.

Sources for Part B

[8] German statutory accident insurance institution for the construction industry, hazardous substances information system WINGIS, model operating instruction "Removal of chromate-contaminated insulation materials", status 23 May 2026.

[9] Maternity Protection Act of 23 May 2017, section 11(1), sentences 1 to 3.

[10] Circular Economy Act, section 9a(1) to (3).

[11] Directive 2004/37/EC in its consolidated version, Article 4, Article 5 and Annex III. The binding limit value for chromium(VI) of 0.005 mg/m³ has applied since 17 January 2025.

[12] Technical Rules for Hazardous Substances 561, Activities involving carcinogenic metals and their compounds, version of 4 May 2026, Committee on Hazardous Substances at the German Federal Institute for Occupational Safety and Health. Relied on are section 3.3.4(1), (2) and (5) and section 5.9.3(1) to (5).

C. The restriction in procedure

Part B deals with the law that applies today. This part deals with the proposal that is intended to replace the authorisation requirement for the Chromium(VI) compounds. It has been available since April 2025, is published in full and is in committee evaluation. All information in this part is taken from the restriction report itself, from the accompanying information note and from the webinar of the European Chemicals Agency of 18 June 2025. [13, 7, 14]

The account keeps to the wording of the proposal. A proposal in procedure is not applicable law, and the draft may change in the course of the committee evaluation. What it provides in the present version can nevertheless be read today and is relevant to the choice of material made today, because the service life of the plants concerned considerably exceeds the transition period.

16. Procedural status and mandate

On 27 September 2023 the European Commission mandated the Chemicals Agency to prepare a restriction proposal under Annex XV for chromium trioxide and the acids generated from it, Annex XIV entries 16 and 17. The reason was the number of applications for authorisation. Since 2015 several hundred had been received, far more than had been expected when they were included in Annex XIV. The report names as consequences that the evaluation of and decision on all applications takes too long, that effective risk management is not implemented in time and that the functioning of the internal market is impaired. [13]

In April 2024 the Commission extended the mandate. Since then all Chromium(VI) compounds listed in Annex XIV are covered with the exception of the lead chromates, together with barium chromate, which was included as a possible substitute with a comparable hazard profile. The report introduces the term for this itself: regrettable substitution, the replacement of a substance by one that is equally of concern. [13, 14]

Date	Step
11 April 2025	Submission of the report under Annex XV to the Agency
29 April 2025	Publication on the Agency's website
18 June 2025	Start of the public consultation over six months, accompanied by an online information event
thereafter	Evaluation by the committees of the Agency, scheduled at twelve months
after that	Adoption of the opinions, consultation on the opinion of the Committee for Socio-economic Analysis over 60 days
finally	Transmission of the opinions to the European Commission

The impact assessment of the report assumes entry into force in 2028 and uses that year as its base year. [13]

17. The scope of substances and the salt clause

Table I of the report lists the substances in the scope. There are twelve entries, which appear in the designation column of the proposed Annex XVII entry as thirteen designations, because the acids generated from chromium trioxide are listed there separately as chromic acid and dichromic acid. Eleven of these thirteen designations carry an addition. In the original it reads "as well as any salt with a different stoichiometry and hydration degree". Chromic acid and dichromic acid do not carry it. [13]

For sodium chromate the addition is of no consequence, because the substance appears in the designation column by name, with EC number 231-889-5 and CAS number 7775-11-3. For calcium chromate it is the decisive point, because that substance is not named.

The report states the purpose of the addition in section 1.2.1 and repeats it in the justification for Tables 37 and 38. The purpose is to avoid replacement by a substance that is equally of concern. According to that justification, paragraph 1 of the proposed entry is to make clear that all uses of the designated substances are covered, including the uses of Cr(VI) salts with a different stoichiometry and hydration degree. [13]

The information note for the consultation states the scope without tying it back to an individual listed substance. It states there that the substances in the scope also include "any chromium (VI) salts with a different stoichiometry and hydration degree". [7]

Calcium chromate is a salt of chromic acid. Under the wording of the information note it is therefore covered. The only exclusions are the lead chromates, and they are excluded by the mandate and not by a derogation in the entry.

The example that the report gives to explain the addition runs counter to its wording. It stays within one cation family and names, alongside pentazinc chromate octahydroxide, three further zinc compounds. On that basis it is objected against the reading set out here that the addition covers only compounds of the same cation. The objection and its treatment are in Part E.

For the situation dealt with here the question is of secondary importance in any case. If sodium chromate forms, the entry applies by way of the name. If calcium chromate forms, it applies, under the wording of the information note, by way of the salt clause. Both routes lead into the scope.

18. The structure of the proposed entry

The entry consists of four paragraphs. The report presents two versions, Option A for restriction option RO1 and Option B for RO2. They differ in the numerical values and in the allocation of the uses, not in their structure. [13]

Paragraph	Content	Significance for high-temperature insulation
1	The designated substances shall not be used on their own and shall not be used in a mixture in a concentration of 0.01 % by weight or more	Prohibition of use; for the substance on its own without a threshold, for mixtures with a threshold that is one tenth of the threshold under Article 56(6)
2	Derogation for uses as an intermediate within the meaning of Article 3(15) of the REACH Regulation	not applicable; a chromate formed in situ is not an intermediate of a synthesis
3	Derogation where the emission limit values are met and at the same time only for the individually listed uses, subject to compliance with the respective occupational limit value	doubly conditional; the condition of a listed use cannot be met for maintenance and removal, see section 19
4	Where several use categories apply at one site, the strictest limit value applies, unless the activities are strictly segregated	not applicable as long as no derogation under paragraph 3 is available

Two points are to be recorded. The first concerns the threshold. Paragraph 1 prohibits the use of the substance on its own without any concentration threshold and the use in a mixture from 0.01 % by weight. The value is a factor of ten below the threshold that Article 56(6) provides today for substances under Article 57(d) to (f). Pure chromate powder is not covered by that in any case, because it is the substance on its own. For chromate-bearing dusts and fibres the burden of demonstration described in section 7 shifts further against whoever relies on the threshold, because the limit of quantification of the method has to be lower by the same factor.

The second concerns the construction of paragraph 3. The report gives express reasons for it. The list of uses is deliberately kept narrow so that uses that have already been phased out are not covered by any derogation. The report summarises the result with the sentence that this approach makes it possible to replicate the scope of the authorisation requirement. [13]

The derogation under paragraph 3 requires both. The emission limit values have to be met, and the use has to be one of those listed. Compliance with an occupational limit value alone does not open the derogation.

19. The closed list of uses

The Agency describes the scope of the derogation in its own presentation as a closed list of six use categories. The proposal, it states, prohibits the uses of the substances unless they fall within that list and at the same time meet the limit values for the exposure of workers and for emissions. [14]

No.	Use category under Table 4 of the report
UC 1	Formulation of mixtures, that is the manufacture of chromic acids and specialty mixtures from Cr(VI) substances for the remaining categories
UC 2	Electroplating onto plastic substrate
UC 3	Electroplating onto metal substrate, including site-bound electroplating near airports, freight ports and steel works
UC 4	Use of primers and other slurries, predominantly in aerospace and in the defence sector
UC 5	Other surface treatments requiring no or low currents, including passivation, anodising, conversion coating, etching, cleaning and sealing
UC 6	Specialty uses as a functional additive or as a processing aid, itself again framed as a closed list of uses

Paragraph 3 of the proposed entry turns these six categories into twelve individually designated uses. The wording is the same in both options. It reads “for companies that use the substances”, followed by the list. The following overview gives the twelve uses with the occupational limit value allocated to them in each option. [13]

Use under paragraph 3	Option A	Option B
Formulation of Cr(VI)-containing mixtures within the meaning of Article 3(2)	5 µg/m³	1 µg/m³
Electroplating, deposition of a chromium layer onto a metal substrate from an electrolytic solution	5 µg/m³	1 µg/m³
Coating of objects with a paint or a primer in a mixture	5 µg/m³	0.5 µg/m³
other surface treatments requiring no or low currents, including passivation, anodising, conversion coating, chromate rinsing, etching, pickling, stripping, deoxidising, desmutting, cleaning, sealing and insulation coating for the manufacture of grain-oriented electrical steel	5 µg/m³	0.5 µg/m³
Machining of articles that contain Cr(VI) in their coatings	5 µg/m³	5 µg/m³
Electroplating, deposition of a chromium layer onto a plastic substrate from an electrolytic solution	1 µg/m³	0.5 µg/m³
as an alkali metal dispenser in the manufacture of photocathodes	1 µg/m³	0.5 µg/m³
as a corrosion or scaling inhibitor in cooling or heating systems in various applications	1 µg/m³	0.5 µg/m³
as a catalyst or processing aid in the electrolytic manufacture of various chemicals or in ore processing	1 µg/m³	0.5 µg/m³
as a photosensitizer in UV lithography for the manufacture of microstructured components	1 µg/m³	0.5 µg/m³
as a colour indicator in single-use breathalysers	1 µg/m³	0.5 µg/m³
in pyrotechnic compositions for the defence sector	1 µg/m³	0.5 µg/m³

The emission limit values that have additionally to be met under paragraph 3 are in Option A 2.5 kg Cr(VI) per year to air and 15 kg per year to water, and in Option B 0.25 kg and 1.5 kg. [13]

All twelve uses describe the deliberate application of a purchased substance in a manufacturing process. None of them describes the handling of dusts and fibres that have formed on a component. The machining of articles with Cr(VI)-containing coatings is the only use that starts from an existing component, and it presupposes a coating that contains the substance because it was manufactured with it.

For maintenance, removal and reinstallation on insulated hot parts this leads to a clear result. The activity is not contained in the list. The derogation under paragraph 3 is therefore not available, irrespective of the exposure values measured at the plant concerned and of how low the emissions of the site are. Paragraph 1 remains, and it prohibits the use.

This legal consequence would be stricter than the present one. Today the operation is prohibited under Article 56(1) as long as no authorisation has been granted, and an application is possible. Under the draft restriction there is no route to apply for a use outside the list. The report describes this as intended and calls it a narrow list of conditionally exempted uses. [13]

One qualification is to be named. The list covers the uses that were covered in the authorisation procedure, and it was compiled from applications for authorisation, registration data, downstream user notifications and two targeted calls for evidence. A use that nobody reported could not enter the list. This applies to the situation dealt with here to a particular degree, because to date nobody has assigned the term use to it.

20. Transition period and entry into force

The report proposes a uniform transition period of 18 months, for all restriction options and all use categories. It is intended to be sufficient for companies to retrofit their protective measures where the limit values are not yet met. [13]

The reasoning given for that period is directly relevant to the choice of insulation material. The report sets out that risk control and substitution are economically opposed, because a company that substitutes does not additionally invest in protective technology, and vice versa. It concedes that a short period does not encourage substitution and records that, with that objective, the period would have to be longer than five years to allow technical maturity and requalification of the alternatives. The decision went against that objective and in favour of the short period, because otherwise a lasting regulatory gap would remain. [13]

After the period expires, compliance with the limit values is to be demonstrated by measurements at least once a year. The measurement programmes are to be based on standardised methods, to reflect the operating conditions and protective measures of the site and to have a limit of quantification that allows compliance to be demonstrated. [13]

The transition period is tailored to sites that know they use the substance and that adapt their protective technology accordingly. Anyone who does not know that the substance forms at his plant derives no benefit from that period, because it runs from entry into force and not from knowledge.

For the choice of material this yields a timescale that begins today. The impact assessment of the report takes 2028 as its base year and thereby assumes entry into force in that year. [13] The procedural steps set out in section 16 allow for an earlier date. The consultation ended in mid-December 2025, the committee evaluation is scheduled at twelve months, and the consultation on the opinion of the Committee for Socio-economic Analysis lasts sixty days. If the opinions are with the Commission in the course of 2026, adoption in 2027 is possible.

In my assessment this is to be expected. That is to be read as an assessment and not as a statement of the report.

With the uniform transition period of 18 months this yields a span. The early end falls in the second half of 2028, the late end in early 2030. High-temperature insulation installed today will be in the plant at both of those dates, and its service life extends beyond them. The decision on the material is taken in the procurements that are running today.

21. What the dossier does not address

The restriction report runs to 104 pages and addresses in detail the uses that are covered in the authorisation procedure. High-temperature insulation does not appear in it. The word insulation occurs three times in the entire report. All three occurrences concern the same phrase, the insulation coating for the manufacture of grain-oriented electrical steel. That is an electrical insulating layer on electrical steel and has nothing to do with thermal insulation. [13]

None of the six use categories, none of the twelve uses in paragraph 3 and none of the sectors named in the report covers the handling of chromate-contaminated insulation materials on thermally stressed chromium-alloyed components.

The formation of Cr(VI) without purchase is addressed at three points in the report. The introduction states that Cr(VI) can form during industrial activities such as welding or grinding of chromium metal, because the energy introduced oxidises inert chromium to the hexavalent state. Footnote 27 records that a restriction under the REACH Regulation would not apply to Cr(VI) exposure resulting from the process used; welding, grinding and scraping of inert chromium layers, where Cr(VI) forms through heat, are named as examples. Section 3.1 states the same as a delimitation of the scope. [13]

Section 3.1 of the report, in translation: activities in which exposure to Cr(VI) substances arises from the physical or chemical modification of the surface of articles that do not themselves contain Cr(VI), for example through grinding, scraping or welding, are not covered by this proposal, because they lie outside the scope of the restriction title of the Regulation. The report goes on to state that the restriction does apply to self-healing and sacrificial coatings that contain Cr(VI) and are covered by a stable chromium oxide layer, so that exposure can occur only when the surface is modified. [13]

This delimitation is the pivotal point. It distinguishes by the material on which the activity is carried out. If the article itself contains no Cr(VI) and the compound forms only through the activity, the case lies outside the proposal. If the material already contains the substance and it is released by the activity, the case lies inside.

The chromate-bearing dusts and fibres under insulation fall into neither of the two case groups described in the report. They do not form through the maintenance activity but in service, over months or years, and are present as a finished compound when the insulation is opened. That is what distinguishes them from the first case group. From the second they are distinguished by the fact that the substance is not held in any coating. It is present openly as powder and dust before anyone touches the component.

The report does not decide the case. It does not name it and does not exclude it by name. Which of the two case groups applies depends on the question whether the time of formation or the time of the activity is decisive. Part E deals with that question and with the objections based on it.

22. The consequence for substance identity

Section 5 described the asymmetry of the present listing. Sodium chromate is subject to authorisation, calcium chromate is not. It follows today that the legal consequence under Article 56 depends on the material pairing and thus on the question which compound has formed on the surface concerned.

The draft restriction ends that dependence, for two reasons. The first is the salt clause, which under the wording of the information note covers the Cr(VI) salts without naming them individually. The second is the threshold of 0.01 % by weight for the mixture. A dust containing sodium and calcium chromate in an unknown ratio no longer has to be apportioned by individual compound.

The distinction between insulation materials containing sodium oxide and those containing calcium oxide thereby loses its legal significance. What remains is the distinction between insulation materials that contain alkali and alkaline earth metal oxides and those that do not. The first group leads to formation, the second does not. Section 3 listed the sources of both oxide groups in the insulation materials installed today.

The substitution obligation under Article 4 of Directive 2004/37/EC has never needed that distinction. It is linked to the classification, and both compounds are classified as carcinogenic category 1B. It applies today and is not affected by the draft restriction. Anyone who carries it out today already takes now the decision on material that will be required in 2030.

Sources for Part C

[13] European Chemicals Agency, Annex XV Restriction Report, Proposal for a Restriction, Certain Chromium(VI) Substances, public version, submitted on 11 April 2025, 104 pages. Relied on are section 1.1 on the mandate, section 1.2.1 with Table 1 and the salt clause, section 1.3.2 with Table 4 on the use categories, section 2.3 on the transition period, section 3.1 on the scope of the impact assessment including the delimitation from chromium(VI) resulting from the process used and footnote 27, section 5 on the demonstration obligations, and Annex A with Tables 37 and 38 and the associated justification for paragraphs 1 to 4.

[14] European Chemicals Agency, webinar Restriction proposal for certain Chromium (VI) oxides, oxyacids and salts, 18 June 2025, slide set. Relied on are the slides on the mandate, on the scope with the designation "closed list" of six use categories and on the timeline of the procedure.

The numerical values of the limit values and emission limit values are taken from Tables 37 and 38 of the report. Option A corresponds to restriction option RO1, Option B to option RO2.

D. Consequences for capital goods

Parts B and C deal with the substance. This part deals with the object on which it forms. The ban is not directed at the component, and a contaminated component is not prohibited. It is affected nonetheless, because its value depends on acts that are restricted under Part B and Part C.

This analysis does not value any individual capital good and gives neither legal nor investment advice. It assigns to the provisions the operations that an insulated hot part passes through in the course of its use.

23. The transition from substance to object

Article 56(1) of the REACH Regulation prohibits two things, the placing on the market for use of a substance listed in Annex XIV and the use itself. Article 3(12) defines placing on the market as "supplying or making available, whether in return for payment or free of charge, to a third party", with import counting as placing on the market. [3]

Section 13 has assigned the stages of a maintenance operation to the provisions. Four of these stages are uses under Article 3(24), removal, handling and storage, treatment and reinstallation. The supply of the removed component to a third party is added as an operation in its own right.

Over its service life a capital good is maintained, repaired, supplied with spare parts, resold and finally recovered. Each of these operations presupposes that the acts required for it are permitted. Where they are restricted, the effort shifts, and where they cannot be carried out, the operation falls away.

The account that follows stays with the provisions and with what the manufacturers of the goods concerned have themselves recorded on the matter. It contains no quantification of economic consequences.

24. The classes of goods concerned

Which goods are concerned follows from the conditions of formation. Chromium-alloyed steel, a material containing alkali or alkaline earth metal oxides in contact, sufficient temperature and oxygen. The overview that follows names the classes of goods and the components that are expressly named in the notices of the manufacturers and in the sets of rules.

Class of goods	Components named	Reference
Large four-stroke engines, stationary and marine	exhaust system, panels of the insulation boxes, turbocharger components, screws, sealing rings, nuts, exhaust pipe flanges and expansion joints	[15]
Engines in off-road, power and marine applications	exhaust gas tract, exhaust gas aftertreatment and components for insulation and heat protection	[17]
Engines and gensets	exhaust and heat shield systems, exhaust manifolds and exhaust insulation	[20]
Gas turbines	all core engine components downstream of the low-pressure compressor, even without visible residue	[19]
Industrial steam turbines	casings, screws, bolts, nuts, heating wires, stainless steel foils and stainless steel meshes, threads and turbine heating systems	[22]
Power plants, heating plants and biogas plants	industrial insulation	[28]
Steam pressure lines and turbines	insulation materials and assembly pastes on thermally stressed chromium-alloyed industrial components	[8]
Exhaust gas aftertreatment systems	insulated stainless steel exhaust systems, heat shields and insulation mats	[23, 24]
Road vehicles	see Section 29	[16, 17, 18]

The material pairings named are the same in all classes. They differ in the temperature, in the operating period and in the accessibility of the component, not in the chemistry.

Combustion residues and ashes are a field of application of their own with their own routes of formation and are not the subject of this analysis.

25. What the manufacturers' notices govern

The notices are independent of one another, come from different countries and concern different product groups. They agree on the conditions of formation and differ in the temperature threshold.

Issuer	Document	Key statement
Wärtsilä Finland	Service Bulletin WS00Q563, Issue 4 of 20 June 2024, Issue 1 of 9 November 2020	three conditions, a calcium-bearing product from assembly paste or calcium-based insulation, above 400 °C, chromium steel in contact; test kits must be on site when work begins
Mercedes-Benz	Service Information SI00.10-P-0054A of 7 August 2025	formation from 300 °C on exhaust-carrying components; neutralisation and visible marking on return and scrapping
MAN Truck & Bus	Service Information 8339SM of 13 December 2023, valid worldwide	calcium chromate from 300 °C out of insulation materials or assembly pastes; demonstrated in its own analyses on components that have been in service
Rolls-Royce	Notice to Suppliers NTS 559, Issue 1 of 3 September 2022	Cr(VI) can be present even without visible residue; assume the components concerned to be contaminated until they have been cleaned
Caterpillar	Technical Bulletin 2175/00 of 23 August 2021 and Service Information 0019com of 4 November 2020	confirmed by independent laboratory tests; as the formation is stated not yet to be understood, residues cannot be ruled out
Siemens	technical information on Chromium(VI) on industrial steam turbines	four conditions, chromium-bearing and calcium-bearing material in contact, above 400 °C, oxygen; the calcium sources are assembly pastes, insulation and heat-conducting cement
HUG Engineering	Chromium (VI) Precautionary Notice, no date	the operator tests before the insulation is removed; testing, decontamination and remediation are not part of the service agreement
Proventia	Information Bulletin 2/2025	risk during assembly, disassembly, maintenance and end-of-life recycling; no risk for the operator in regular service; recommendation of calcium-free assembly pastes

To these are added the warning notices of a German distribution partner for engine work of 10 November 2021, the technical instruction of an Austrian engine manufacturer on the application of a reducing solution during the disassembly and assembly of used insulation material, the risk analysis of a French service partner on heat shield disassembly, cleaning, transport and disposal and the Safety Alert of Energy Safety Canada from 2022. [21, 25, 26, 27]

All of these documents govern occupational protection at the moment of the activity. They require personal protective equipment, prohibit compressed air and brushing, and call for HEPA extraction and separate disposal. Two of them name the substitution of the calcium-bearing material. [15, 24]

None of these documents mentions Annex XIV to the REACH Regulation, the authorisation requirement or Article 56. The earliest of the notices examined here dates from 9 November 2020. The sunset date for sodium chromate was 21 September 2017. The question whether this connection ought to have been seen arises.

For the assignment to the concept of use the documents are material nonetheless. They describe the activities to which Article 3(24) attaches, and they do so in the language of the operating site. Disassembly, cleaning, transport, storage, treatment and reinstallation are named there in turn.

26. Stock, new goods and the spare parts store

Formation presupposes service at temperature. From this follows a distinction that is decisive for inventory management.

- An insulation element that has never been in service carries no chromate. Article 56 does not apply to it. The substitution obligation under Article 4 of Directive 2004/37/EC nonetheless governs the decision on its material, and it does so before installation.
- A removed component held as an exchange part is to be treated as contaminated under the notices of the manufacturers for as long as nothing to the contrary has been established. The notice to suppliers of a gas turbine manufacturer formulates this as an assumption that applies until cleaning. [19]

Storing and keeping are expressly named in Article 3(24). On that basis a store of used, contaminated components is a continuing use of the substance contained in them. It does not end when the material is placed in store, and it continues for as long as the material is held.

Three arrangements customary in industry are therefore affected. The exchange part pool, in which used components flow back against a deposit. The overhaul store of a repair business. And the used parts store that is held in the interim for return or recovery.

The manufacturers have issued requirements of their own for transport. Contaminated parts are to be placed in plastic bags or wrapped securely in film and marked clearly as a possible Cr(VI) hazard. A French service partner expressly requires sealed packaging in order to avoid contamination of the service vehicle. [15, 27]

27. Supply to third parties

In addition to use, Article 56(1) covers the placing on the market for use. Under Article 3(12) the supply to a third party or the making available to a third party is sufficient for this, in return for payment or free of charge. [3]

The question therefore arises for every operation in which a contaminated component changes hands. Return of a used part to the manufacturer, sale of a removed component, supply to a repairer, sale of a used plant with the insulation installed, sale of a used vehicle.

Two manufacturers have already issued requirements of their own for this operation. On return or scrapping of removed components the Cr(VI) compounds are to be neutralised, and the neutralised parts are to be marked visibly from the outside. If contaminated parts are moved or transported, they are to be packaged and marked as a possible Cr(VI) hazard. [15, 16]

Both requirements presuppose that the party making the supply knows the condition. That leads to the question whether, and to what extent, information about the condition is to be given on supply. It is to be answered under national law and is not for decision here. What can be recorded is that the manufacturers themselves require marking and thereby proceed on the basis of disclosure.

With the transition into waste the applicability of the REACH Regulation ends, under Article 2(2). Supply for recovery is therefore the route that leads out of the use restriction, and at the same time the route that ends the object as a capital good. Section 12 deals with the waste law obligations that then take their place.

28. Repair, regeneration and the limits of treatment

Several business models rest on a component being refurbished after service and put into use again. The overhaul of turbochargers, the regeneration of particulate filters and SCR components, the refurbishment of exhaust manifolds and the exchange part business as a whole. The components concerned are exactly those that the manufacturers' notices name.

Treating is expressly named in Article 3(24). The refurbishment step itself is therefore a use of the substance, irrespective of whether it removes it.

Two manufacturers have independently of one another made findings on the reach of treatment.

On treatment with citric acid solution it is stated that the procedure reduces the risk of airborne dust but does not guarantee that the area is free of Cr(VI). [15]

On neutralisation before return or scrapping it is stated that a component subjected to thermal stress again no longer counts as neutralised. [16]

The second finding concerns the core of the refurbishment business. A component is refurbished in order to go back into service. Once it goes into service, it is subjected to thermal stress again. If the material pairing stays the same, the conditions of formation run afresh.

The treatment therefore establishes a condition at a point in time. It does not remove the cause. Section 13 derived this from the subject matter. The two passages quoted are findings of the manufacturers themselves.

For the repairer this results in a situation that repeats with every refurbishment. He treats, tests, installs and faces the same finding at the next interval for as long as the insulation material installed stays the same.

29. Road vehicles

A heat shield is high-temperature insulation. The conditions of formation are the same as on the industrial plant, chromium-alloyed steel, a calcium-bearing material in contact, temperature and oxygen. What differs is the size of the components, the number of units and the fact that maintenance takes place in a workshop and not during a plant overhaul.

The service information of a German vehicle manufacturer of 7 August 2025 applies to all models, including light commercial vehicles and small cars. On its wording the components concerned are the exhaust gas turbocharger, exhaust gas recirculation with valve, cooler and associated metal lines, the exhaust manifold, SCR catalytic converter, oxidation catalytic converter, diesel particulate filter and the connecting clamps between these components. As the condition it names the specific chromium-bearing steel alloy and surface temperatures above 300 °C in service. [16]

Three stipulations in this document are material beyond occupational protection.

- For overhead work it requires respiratory protection of class FFP3 from a vehicle mileage of more than 20,000 kilometres. The manufacturer thereby sets a mileage from which it assumes contamination.
- Removed components are to be neutralised and marked visibly on return or scrapping.
- A component subjected to thermal stress again no longer counts as neutralised.

On the passenger compartment the same document records that, through the air ducting of the interior ventilation, a health risk inside the cabin can effectively be ruled out. It makes no statement on the engine bay outside workshop activity. [16]

The service information of a German commercial vehicle and engine manufacturer of 13 December 2023 applies worldwide to its engines in off-road, power and marine applications. It names the exhaust gas tract, exhaust gas aftertreatment and components for insulation and heat protection and records that the manufacturer, acting on indications from the market, has demonstrated the presence of Cr(VI) compounds in its own analyses on engine components that have been in service. It describes the identification as yellowish, yellow or orange residues and as crystalline particles or dusts of the same colour that can come loose from the component. [17]

The aftersales bulletin of a British sports car manufacturer of 27 August 2025 applies to all models and names the heat shields of the link pipes, exhaust manifolds, the exhaust side of the turbocharger, V-band clamps, mufflers and the outer surfaces of the joint between muffler and trim panel. It records that this is an industry-wide and regulated matter that is not confined to this manufacturer. [18]

The German statutory accident insurance institution for the transport sector sets out the four conditions in its information on Cr(VI) exposure, status August 2026, and names as an example for the chromium content the alloy V2A with 17 to 19 per cent, together with steel temperatures of about 350 to 800 °C. On vehicles it records that it is still being investigated whether insulation work on thermally stressed stainless steel components in the engine rooms of shipyards or on car engines in vehicle workshops causes relevant exposures, and that measurements under realistic working conditions are being carried out for that purpose. [28]

This investigation concerns the level of the exposure. The trigger of the protective regime under section 5.9.3(5) of the German TRGS 561 is the fact that it cannot be ruled out, and not the measured value. [8] Article 56 of the REACH Regulation asks whether the listed substance is present, and not what the air concentration is. An ongoing measurement programme therefore provides no relief in either respect.

For the workshop the same sequence of stages follows as for plant maintenance. The vehicle in service is an article. Once the connecting clamps are loosened and the heat shield is taken off, dusts and fibres lie exposed. The interim storage of the removed part is storing and keeping, the neutralisation is treating, and the return to the manufacturer or the supply to a refurbisher is a supply to a third party. To the extent that sodium chromate is present, the findings from Part B apply unchanged.

The particular feature of the vehicle sector lies in the distribution of the activity. Plant maintenance takes place in defined overhauls carried out by named businesses. Vehicle maintenance takes place in authorised workshops, independent workshops, reconditioning businesses and at recovery operators. The manufacturers' notices reach the first group through the service organisation. The same provisions apply to the others, without the same chain of information being in place.

The refurbishment chain is a further factor. Turbochargers, particulate filters and SCR components are handled as exchange parts on a large scale. They are the same components that the service information documents named above list. Section 28 applies to them unchanged.

On the supply of used vehicles the question arises that Section 27 raises in general terms. One manufacturer already requires visible marking of the condition for removed components. Whether, and to what extent, information about the condition is to be given on supply of the entire vehicle is governed by national law and is not for decision here.

30. Today's procurement decision

Section 20 set out the timing of the draft restriction. The early end of the span falls in the second half of 2028, the late end in early 2030.

The service life of the goods concerned is longer than that. A combined heat and power unit, a steam line, a turbine and a commercial vehicle stay in service longer. The insulation that is installed today will be in the plant at both of those dates, and by then it will have operating hours at temperature behind it.

The substitution obligation under Article 4 of Directive 2004/37/EC does not depend on the restriction procedure. It applies today, it attaches to the classification, and it requires replacement of the carcinogen by a less dangerous substance so far as that is technically possible. For high-temperature insulation this leads to the oxide composition of the insulation material.

Two of the manufacturers examined have already taken this step for their part. The one requires for assembly pastes a replacement product that contains no calcium compounds in reactive form, and names calcium oxide, calcium hydroxide and calcium fluoride as the forms to be avoided. The other recommends calcium-free assembly pastes. [15, 24]

For the insulation material the same consideration applies with the same point of attachment. What the reactive calcium compound is for the assembly paste, the content of alkali and alkaline earth metal oxides is for the insulation material.

The decision on which material will be in the plant in 2030 is taken in the procurement of the years before.

Sources for Part D

[15] Wärtsilä Finland Oy, Vaasa, Service Bulletin WS00Q563, Exhaust gas system, Risk of hexavalent chromium residue, Issue 4 of 20 June 2024, marked For immediate attention, distributed to operators and owners of the installations concerned. Issue 1 of 9 November 2020, Issue 2 of 19 February 2021, Issue 3 of 21 April 2022. Chapters 1 to 5 were used.

[16] Mercedes-Benz AG, Service Information S100.10-P-0054A, Arbeiten an abgasführenden Bauteilen mit Chrom(VI), of 7 August 2025, applies to all models.

[17] MAN Truck & Bus SE, Service Information 8339SM, Auftreten von hexavalenten Chrom-Cr(VI)-Verbindungen im Betrieb, published on 13 December 2023, valid worldwide until revoked.

[18] Aftersales bulletin of a British sports car manufacturer of 27 August 2025, applies to all models. The document is marked confidential; I hold the original and it is evaluated without naming the manufacturer.

[19] Rolls-Royce, Notice to Suppliers NTS 559, HSE impact of Hexavalent Chromium, Issue 1 of 3 September 2022, addressed to all suppliers and partners who handle engine-run hardware.

[20] Caterpillar Energy Solutions GmbH, Mannheim, Technical Bulletin 2175/00 EN, Hexavalent Chromium, of 23 August 2021, applies to all engines and gensets, together with Caterpillar Motoren GmbH & Co. KG, Service Information 0019com, Issue 1 of 4 November 2020.

[21] Warning notices for work on the exhaust systems of combustion engines of a German distribution and service partner, status 10 November 2021, with the requirement of separate disposal under the waste code AVV I60902.

[22] Siemens, technical information on Chromium(VI) on industrial steam turbines, version without a date given in the text scan available to me.

[23] HUG Engineering AG, Chromium (VI) Precautionary Notice, customer information without date or document reference.

[24] Proventia Group Oyj, Oulunsalo, Information Bulletin, Hexavalent Chromium Awareness and Safety Guidance, issue 2/2025.

[25] Energy Safety Canada, Safety Alert, Exposure Hazard: Hexavalent Chromium, Issue 05-2022.

[26] Technical instruction of an Austrian engine manufacturer on the application of a Cr-6 reducing solution during the disassembly and assembly of used insulation material, applies to five engine series. The document is marked confidential; I hold the original and it is evaluated without naming the manufacturer.

[27] Risk analysis of a French service partner on the chemical risk Chromium(VI), covering the activities of heat shield disassembly and assembly, cleaning, removal of contaminated manifold parts, installation after decontamination and the handling, storage and disposal of contaminated waste.

[28] German statutory accident insurance institution for the transport sector, information on Chromium(VI) exposure, status August 2026.

E. What is overlooked

Seven positions are put forward against parts B and C. Each of them relies on a passage that it reproduces in abridged form, or on a circumstance that it classifies wrongly. This part names them in turn.

31. The concept of use knows nothing of intent

Anyone objecting that the compound is not used but arises confuses formation and handling. Article 3(24) expressly names storing, keeping and treating and requires neither a function nor a purpose of the substance. The wording is set out in section 6. The Regulation attaches to the act.

Anyone invoking the statement that the substance is not contained in the materials and processes repeats a statement that an engine manufacturer makes in its own Technical Bulletin, and suppresses the sentence that immediately follows. That sentence states that, since formation on engines is generally not yet understood, Cr(VI)-bearing residues cannot be ruled out. [20] The same source that disputes the origin does not rule out the presence.

The distinction between intended employment and uninvited formation has its place in the question of responsibility for the formation. For the admissibility of the handling it is of no consequence, because the concept of use does not recognise it.

32. The chromate that has formed is a substance

Calcium chromate and sodium chromate are chemical compounds. What forms on the surface is the compound itself, in powder form. Article 3(1) of the REACH Regulation defines a substance as the chemical element and its compounds, including impurities resulting from the process used. The chromate that has formed falls under that definition. [3]

For the substance on its own, Article 56(6) states no concentration threshold, and paragraph 1 of the proposed Annex XVII entry states none either. The thresholds in both provisions apply to use in a mixture. For the compound that has formed, the question of 0.1 or 0.01 per cent does not arise.

Anyone who nevertheless raises it has changed the object. That party converts the chromate to the insulation element it came from and thereby refers to an object that is not being handled at that moment. The object of the use is the material that is stored, kept, treated or transferred. Section 7 sets this out.

If soot, fibre abrasion, corrosion products and oil residues are present alongside the chromate, a mixture exists, and the threshold applies to that mixture. Anyone invoking the exemption has to demonstrate compliance with it, and to do so with a method whose recovery rate for this matrix has been established. No standardised method for the insulation matrix exists.

The threshold is therefore no objection to the authorisation requirement. It is an exemption that can be invoked by anyone who shows that it applies.

33. The route of formation is of no consequence for the listing

Anyone submitting that the formation mechanism has not been clarified quotes correctly. The sentence appears in section 5.9.3, paragraph 3, of the German TRGS 561, and an engine manufacturer makes the same statement in its Technical Bulletin. [12, 20] The conclusion that the authorisation requirement does not apply without a clarified mechanism misses what the provision says.

Annex XIV lists substances by their identity, with designation, EC number and CAS number. Article 56(1) prohibits the placing on the market for use and the use of a substance listed in that way. Neither the entry nor the provision asks by which route the substance reached the place where it is handled. [1, 2, 3]

Article 3(1) expressly includes impurities resulting from the process used in the definition of a substance. The Regulation therefore does not make the origin a criterion even where it plainly has that origin in view. [3]

The same documents that describe the mechanism as not understood draw the opposite conclusion from it and prescribe extensive measures for handling the substance. [20, 21]

The unresolved mechanism makes it harder to predict how much forms under which operating conditions. About a substance that is present it says nothing.

34. The salt clause is not limited to one cation

Anyone submitting that the addition “as well as any salt with a different stoichiometry and hydration degree” covers only compounds of the same cation relies on an example and passes over the wording. The example in the restriction report illustrates the addition using a zinc compound. It does not state any limitation to the same cation family. [13]

The information note for the consultation states the scope without any tie-back to an individual listed substance. It says that the substances within the scope also include “any chromium (VI) salts with a different stoichiometry and hydration degree”. [7] Calcium chromate is a salt of chromic acid and is covered accordingly. The only exclusion is the lead chromates, and that exclusion follows from the Commission's mandate.

Anyone making this question the pivotal point also overestimates its reach. It concerns calcium chromate and nothing else. Sodium chromate appears in the designation column of the proposed entry by name, with EC number 231-889-5 and CAS number 7775-11-3, and the acids derived from chromium trioxide appear there as chromic acid and dichromic acid. [13]

It also concerns the draft alone. For the law as it stands today under Annex XIV the salt clause plays no part, because calcium chromate is not listed there. Section 5 deals with this asymmetry and its consequences.

35. The exclusion of process-generated formation does not apply to this case

Section 3.1 of the restriction report excludes activities in which the exposure arises from altering the surface of articles that themselves contain no Cr(VI). Grinding, scraping and welding are named. Footnote 27 of the same report records that a restriction under the REACH Regulation does not apply to Cr(VI) exposure generated by the process. [13] Section 21 reproduces both passages.

Anyone concluding from this that the chromate formed underneath the insulation is also excluded equates two situations that the report keeps apart.

- Both passages concern exposure that the activity itself generates, and does so from material that contains no Cr(VI). The chromate-bearing dusts and fibres underneath insulation form in service, over months or years, and are present as a fully formed compound when the insulation is opened.
- The sentence that immediately follows in the report assigns self-healing and sacrificial coatings that contain Cr(VI) and release it only when the surface is altered to the restriction. The report therefore distinguishes according to the material and not according to the activity. [13]
- An engine manufacturer draws the same distinction in its own Service Bulletin. It describes residue formation from calcium contact above 400 °C and warns separately that hot work such as welding and grinding can also lead to Cr(VI) formation. [15]

Both passages moreover concern the scope of the restriction title. They do not affect the authorisation requirement under Annex XIV. Anyone citing them against the law as it stands today under Article 56 invokes a provision that is not yet in force and draws from its draft a conclusion for a different provision.

36. A missing method does not prove absence

For the insulation matrix no standardised analytical method with an established recovery rate exists. Anyone inferring from this that without a determination there is no obligation attributes to the provision a criterion that it does not contain. Article 56(1) prohibits the use of a substance listed in Annex XIV. It does not list any proof as an element of the prohibition. [3]

The only place in the authorisation law where a concentration determination acquires significance is Article 56(6), and that is an exemption. Section 32 sets out who bears the burden of demonstrating it. A method that does not exist closes this exemption and does not open it.

Several manufacturers proceed without proof in their own requirements. One Service Bulletin requires test kits to be available on site when work begins and treats an unverified result as a positive one. [15] A gas turbine manufacturer treats the components concerned as contaminated until they have been cleaned and records that Cr(VI) can be present even without a visible residue. [19]

A documented determination assigns the material being handled to a listed substance and with it to the use restriction. If no such determination is made, that assignment remains open. Whether the reticence towards a verifiable determination rests on this is a question that arises.

A method that does not exist cannot produce a negative result. Anyone presenting the absence of a method as an all-clear turns an open question into an answered one.

37. The absence of a practice is not the state of the law

Anyone pointing out that to date no authority has treated maintenance on insulated hot parts as the use of a listed substance and that nobody has applied for an authorisation for it describes a state of affairs and establishes no legal position.

How the list of uses in the draft restriction came about is set out in section 19. It was compiled from applications for authorisation, registration data, notifications from downstream users and two targeted calls for evidence. A use that nobody reported could not appear in it. Absence from the list reflects what has been reported.

The sequence of events is a matter of record.

Date	Event
17 April 2013	inclusion of sodium chromate in Annex XIV, entry 22, together with entries 16 to 21
21 March 2016	latest application date for these entries
21 September 2017	sunset date; from this point use only with a granted authorisation
from 9 November 2020	first of the manufacturer information documents evaluated here on Cr(VI) formation on insulated hot parts
11 April 2025	submission of the restriction report to the Agency
4 May 2026	version of the German TRGS 561 containing section 5.9.3

The manufacturer information documents begin three years after the sunset date and have been updated since. They describe the conditions of formation, name the components concerned and prescribe protective measures. None of them mentions Annex XIV or Article 56. The question whether this connection ought to have been seen arises.

Sources for Part E

Part E relies on the references cited in parts A to D and introduces no new sources. In detail, the following are drawn on: [12] for the sentence from section 5.9.3, paragraph 3, of the German TRGS 561 quoted in section 33, [13] for section 1.2.1, section 3.1 and footnote 27 of the restriction report as well as for the designation column of tables 37 and 38, [7] for the wording of the information note on the substance scope, [15] for the separation of the two routes of formation and the treatment of unverified test results, [19] for the assumption of contamination until cleaning, [20] for the statements on materials, processes and route of formation, and [21] for the protective measures prescribed.

The dates in the overview accompanying section 37 come from [1] and [2] for the inclusion in Annex XIV and the deadlines, from [15] for the first manufacturer information document evaluated, from [13] and [11] for the submission of the report, and from [12] for the version of the German TRGS 561.

F. Conclusion

38. The position today

Anyone working on a thermally stressed chromium-alloyed component that is fitted with insulation containing alkali or alkaline earth metal oxides has to check whether sodium chromate is being handled in the process. If it is present, the handling is a use within the meaning of Article 3(24), and that use has been prohibited since 21 September 2017 without a granted authorisation under Article 56(1).

Certainty exists only where the presence of sodium chromate can be ruled out on a sound basis. Ruling it out is difficult. It requires knowledge of the oxide composition of the installed insulation over the entire service history of the component, and it requires a method whose recovery rate for this matrix has been established. In most cases neither is available.

Where it cannot be ruled out, the question remains open. It remains open to the detriment of whoever handles the component, because Article 56(1) attaches to the presence of the substance and the exemptions in paragraph 6 have to be demonstrated by whoever invokes them.

That check therefore stands at the beginning of every maintenance operation on a component that meets the conditions of formation.

39. The position after the restriction enters into force

With the entry into force of the restriction the retreat to substance identity falls away. The designation column of the proposed entry covers the group of Cr(VI) compounds with the exception of the lead chromates, the salt clause covers the salts with a different stoichiometry, the threshold for mixtures is 0.01 % by weight, and the list of exempted uses does not include maintenance on insulated hot parts.

From that point on, from the tipping point, the opening of the insulation, a use without authorisation can no longer be ruled out in practice. Which compound has formed is then of no consequence. Section 22 sets this out.

40. The position of the insulation industry

As far as I can see, to date no leading manufacturer of high-temperature insulation materials has announced that it will make its products free of alkali and alkaline earth metal oxides. Products without these oxides are offered by few suppliers.

This concerns mineral wool, calcium silicate, the E-glass products and the aerogel products, to the extent that they contain these oxides. Section 3 lists the oxide sources in the insulation materials installed today.

For E-glass a distinction has to be drawn. Specification ASTM D578/D578M-23 states for E-glass an alkali metal oxide content of 0 to 2 % by weight and at the same time a calcium oxide content of 16 to 25 % by weight, and for general applications calcium and magnesium oxide together of 16 to 30 % by weight. [29] European E-glass is therefore largely free of sodium oxide and carries the alkaline earth side in full.

In recent years E-glass products have increasingly been imported from the Far East. In my experience the data sheet does not in every case reflect the actual composition.

Safety data sheets take this question no further. For the basic oxides there are hardly any in this context, because the starting materials themselves present hardly any hazards. The preceding analysis sets this out.

The model operating instruction of the German statutory accident insurance institution for the construction industry refers throughout to mineral wool products in the WINGIS hazardous substance information system. [8] This category also includes the insulation mattresses widely used in industry, whose casing is made of E-glass and whose filling is made of sodium-oxide-bearing mineral wool. Minor damage to the outer casing is enough for the formation of sodium chromate to be impossible to rule out.

In my assessment this industry is heading towards a situation whose implications have so far not been recognised or not been stated. The assessment rests on two circumstances that are documented in this analysis. The first is the way the draft restriction is drawn, its list of uses having arisen from reported uses and not covering the activity dealt with here. The second is the finding in section 25 that the manufacturer notices have been updated since November 2020 and that none of them mentions Annex XIV or Article 56.

41. The installed base

An insulation element that may not be reinstalled after the first maintenance does not reach the service life for which it was purchased. That service life ends when the insulation is opened for the first time. The residual value falls away, disposal takes the place of reuse, and replacement arises again at every further maintenance interval. The basis for this is set out in section 10 for the requirement not to reuse and in section 28 for the limits of treatment that two manufacturers have themselves named.

What this means for the already insulated base of plants, ships and vehicles cannot be estimated. That base has never been recorded with chromate formation in view. As long as its extent is not narrowed down, nothing can be quantified or prioritised.

42. The second route

If the authorisation question is set aside entirely, the same facts lead directly into occupational and environmental protection. There the substitution obligation under Article 4 of Directive 2004/37/EC applies. It attaches to the classification, requires no listing and covers calcium chromate and sodium chromate alike. Section 9 sets it out.

Both routes end at the same decision, the oxide composition of the insulation that is placed on the chromium-alloyed hot part.

[29] ASTM D578/D578M-23, Standard Specification for Glass Fiber Strands, approved on 1 June 2023, sections 4.2.1 and 4.2.2 on the chemical composition of E-glass.

For the rest, this conclusion relies on the references cited in parts A to E. The paragraphs that give an assessment or an experience of my own are marked as such and are to be distinguished from the findings.