Chromates in the Workplace

Further observations on chromium(VI) formation by the use of alkali and/or alkaline earth metal containing insulation materials on chromium-containing metal hot parts on engines and turbines

Further observations on chromates in the workplace

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Summary

The present collection is to be seen as a supplement to the Field Study given in the cover page and is intended to show that the

Field Study Chromates in the Workplace

Field Observation FB01: insulation cassettes

Field Observation FB02: handling and storage

The presence of carcinogenic and chronically environmentally harmful chromium(VI) compounds (chromates), in particular calcium chromate, and the associated dust generation and (background) pollution (inhalable, inhalable fraction) is not an isolated case.

The authors have been observing the presence of chromates for several years and have documented their experiences photographically and textually from the very first moment, but the detection methods were initially limited.

On the one hand, they were sometimes denied access, analysis was made more difficult, and on the other hand, testing options were only possible through rapid tests.

It was only through the purchase of the mobile Cr(VI) test kit TK01 (manufacturer: SEEF B.V., NL) that positive rapid tests could be scientifically verified more deeply.

With the use of the laboratory analyses with analysis report by SEEF B.V., the actual chromium(VI) dust load can now also be determined in reliable figures and chemical analyses.

In December 2024, the SG 10-2 filter pump from the German company GSA mbH was purchased and air measurements could be carried out for the first time according to "Measurement method recognised by the accident insurance institutions for the determination of the concentrations of carcinogenic, germ cell mutagenic or reprotoxic substances in the air in work areas" ("Method for the determination of hexavalent chromium" of the German Social Accident Insurance (DGUV); Information 231-505).

The measurement results were determined as a background concentration in the Field Study, the Field Observation FB02 investigated the inhalation risk for chromium(VI) compounds during the mere handling/storage of contaminated insulation elements.

In both investigations, chromium(VI) concentrations were determined with a standard method and are to be regarded as minimum values; during handling/storage, the minimum value already exceeded the assessment benchmark of 0.001 mg/m³.

The air sample was evaluated by GSA Schadstoffanalyse mbH using a standard method. The recovery of this method for calcium-containing insulation dust has not been determined. For standard methods applied to calcium-containing insulation materials, SEEF B.V. reports underestimates ranging from 20 to 30 percent in mild cases to more than 90 percent; according to the same source, the method developed by SEEF B.V. for this matrix achieves recoveries of more than 80 percent. The measured air concentrations are therefore to be understood as minimum values. The dust samples of the total dust analysis were analyzed in the SEEF B.V. laboratory. (Source: SEEF B.V., knowledge base, seefbv.com, accessed November 2026)

In the conservative consideration of the main dust generation in the load corridor during disinstallation work, the derived loading of the breathing area was almost 700% above the tolerance value specified in TRGS 910 in Germany.

Further measurements are pending, but even higher readings are expected, as the number of removable insulation elements in the Field Study was extremely low and the chromium(VI) load of the contaminated elements, which were merely stacked and manipulated, was rather moderate.

This elaboration shows the extract from many years of research on pictures with references to the insulation material used and the place of use or the designation of the thermally insulated apparatus.

The content of chapters 1-11 from the main and secondary studies listed above remains unaffected and applies to all subsequent observations.

The energy producers examined often form the "heart" of large power plants with all inlets and outlets, but also combined heat and power plants or plants of the so-called "combined heat and power" (CHP) in continuous or flexible operation, as well as emergency power and drive units in public buildings such as

- Hospitals and care facilities
- Swimming pools and other recreational facilities
- Residential blocks with decentralised energy supply and

engines (units) for the

- Shipping, in the
- Rail transport and to some extent also
- Road traffic on vehicles with exhaust gas aftertreatment systems of the latest emission standards

are or will be part of the investigations.

Pages 3 and 4 show the different material classes of alkaline and/or alkaline earth metal oxide-containing insulation materials, which account for more than 90% of today's insulation market, depending on the location of use and structural conditions, supported by two warnings from manufacturers of the different material classes, also representative of the industry.

Pages 5 and 6 look at chromate-contaminated application examples on engines and turbines from well-known manufacturers, also supplemented by two warnings from selective suppliers.

Insulation materials:



Fig.1 Mineral wool

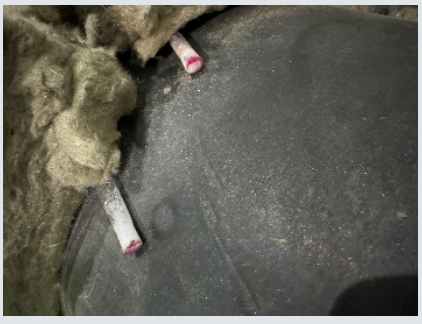


Fig.2 Mineral wool



Fig. 3 Mineral wool



Fig. 4 Glass fabric



Fig.5 Glass fabric



Fig. 6 Glass fabric



Fig. 7 Fiberglass needle mats



Fig.8 Glass fibre needle mats

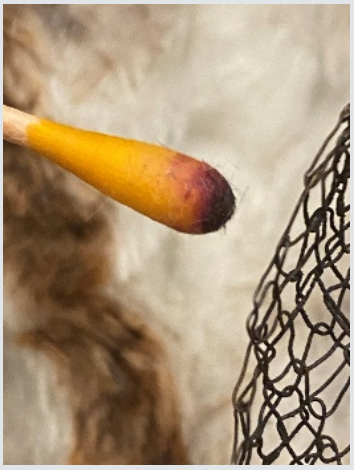


Fig. 9 Fiberglass needle mats



Fig.10 Microtherm products



Fig.11 Microtherm products

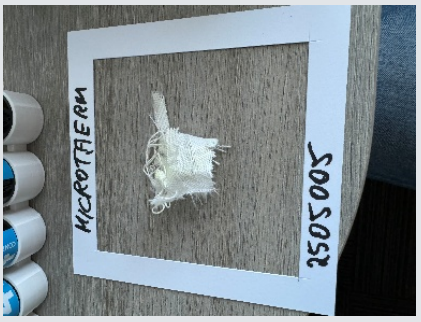


Fig.12 Microtherm products



Fig.13 Superwool/AES



Fig.14 Superwool AES



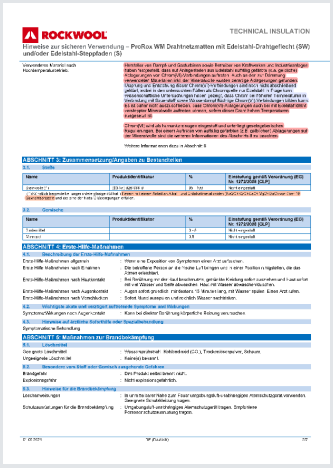
Fig.15 Superwool/AES

Figures 1-15 show the most common insulation materials that have consistently tested positive for chromium(VI) compounds within the last five years or so if they have been in use for a certain period of time and have had direct contact with the chromium-containing hot part.

All materials have in common a content of alkali and/or alkaline earth metal oxides, especially calcium oxide (CaO), sometimes also sodium oxide (Na_{2O}) from over 10% to almost 50%:

Material	CaO grade and/or	Na2O content	Remark
Mineral wool	approx. 18%		Soda-lime glass (recycled)/ mineral fibre
Glass	10-20%		E-Glass
Fiberglass needle mat	10-20%		E-Glass
Microtherm	10-20%		E-glass sheathing
AES/Superwool	45-50%		Alkaline earth silicate fiber

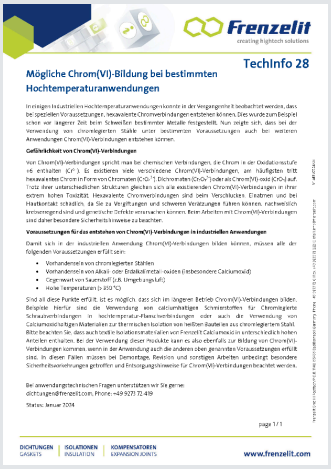
Both the manufacturers of mineral fibre products (in particular the companies Rockwool and Saint Gobain) and the manufacturers of glass fabrics and glass fibre needle mats (including Frenzelit) warn in their data sheets against the formation of chromium(VI) compounds:


ROCKWOOL

TECHNICAL INSULATION

Hinweise zur sicheren Verwendung - ProRox WM Drahtnetzmatten mit Edelstahl-Drahtgeflecht (SW) und/oder Edelstahl-Steppdecken (S)

Fig. 13 Data sheet of Rockwool, manufacturer of mineral wool products for industry


Frenzelit

creating hightech solutions

TechInfo 28

Mögliche Chrom(VI)-Bildung bei bestimmten Hochtemperaturanwendungen

Fig. 14 Technical information of Frenzelit, manufacturer of E-glass fabrics and E-glass fibre needle mats and seals

Engine and turbine manufacturers – examples of chromate contamination:

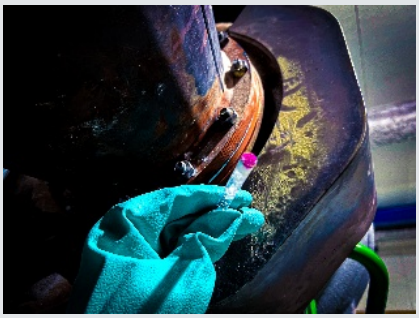


Fig.15 Innio Jenbacher

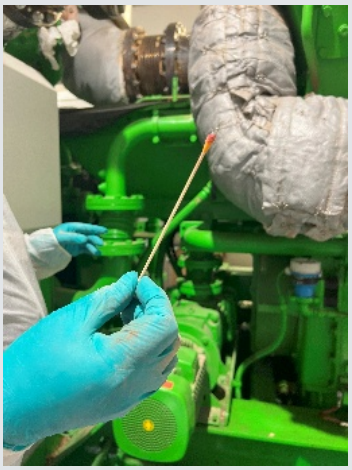


Fig.16 Innio Jenbacher



Fig.17 Innio Jenbacher



Fig.18 Innio Jenbacher



Fig.19 Innio Jenbacher



Fig.20 Innio Jenbacher

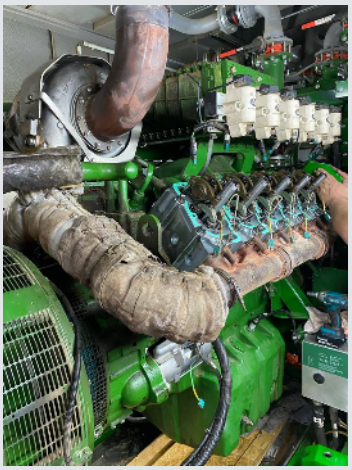

Fig.21 2G Energy


Fig.22 Liebherr

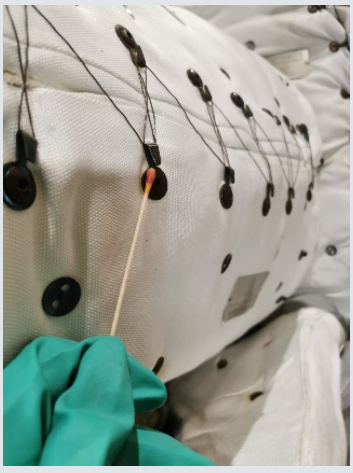

Fig.23 Caterpillar

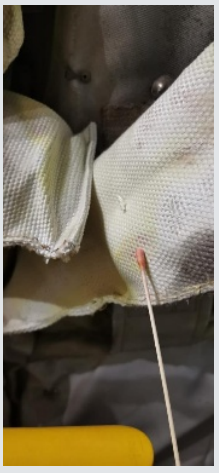

Fig.24 Caterpillar


Fig.25 MAN


Fig.26 MWM


Fig.27 Siemens gas turbine


Fig.28 Siemens steam turbine

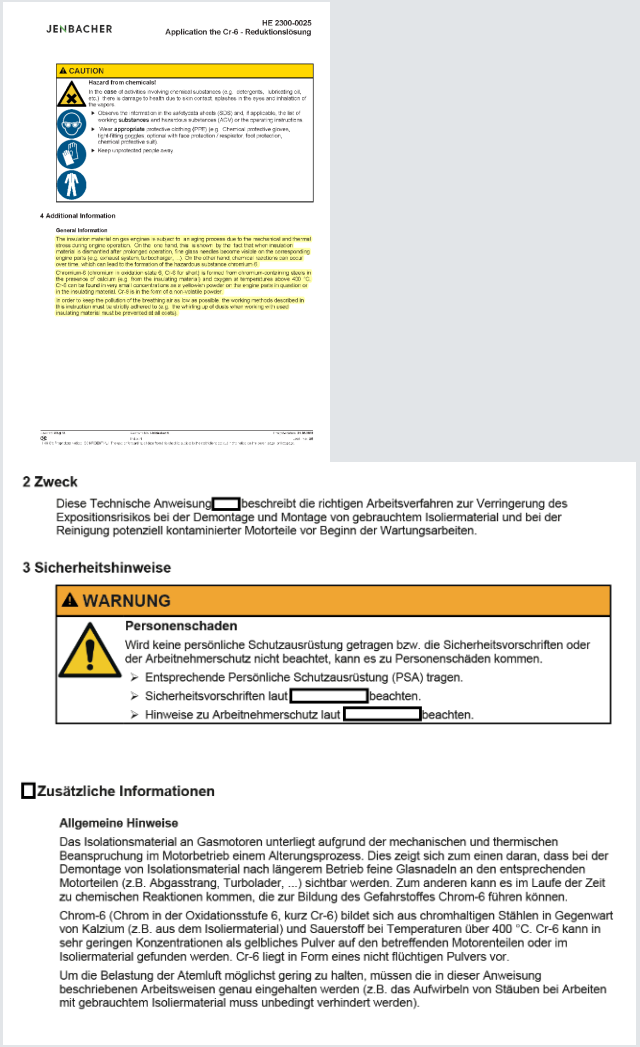

Fig.29 Siemens Gas Turbine

In all the examples of images shown, there is a direct thermochemical relationship between

- Chromium-containing stainless steel hot part, with an operating temperature >300°C
- Calcium and/or sodium oxide-containing insulation material/insulation system in
- Oxygen-open environment

As you can easily see, all types of energy generators and also all different forms of today's thermal insulation concepts are affected.

The two selectively selected warnings from engine manufacturers who already sell their energy generators with alkaline and/or alkaline earth metal insulation materials at the factory report on the formation of calcium chromate through the use of calcium-containing insulation systems:



JENBACHER HE 2300-0025
Application the Cr-6 - Reduktionslösung

⚠ CAUTION
Hazard from chemicals!

4 Additional Information
General Information

2 Zweck

Diese Technische Anweisung [redacted] beschreibt die richtigen Arbeitsverfahren zur Verringerung des Expositionsrisikos bei der Demontage und Montage von gebrauchtem Isoliermaterial und bei der Reinigung potenziell kontaminierter Motorteile vor Beginn der Wartungsarbeiten.

3 Sicherheitshinweise

⚠ WARNUNG

Personenschaden

Wird keine persönliche Schutzausrüstung getragen bzw. die Sicherheitsvorschriften oder der Arbeitnehmerschutz nicht beachtet, kann es zu Personenschäden kommen.

- Entsprechende Persönliche Schutzausrüstung (PSA) tragen.
- Sicherheitsvorschriften laut [redacted] beachten.
- Hinweise zu Arbeitnehmerschutz laut [redacted] beachten.

☐ Zusätzliche Informationen

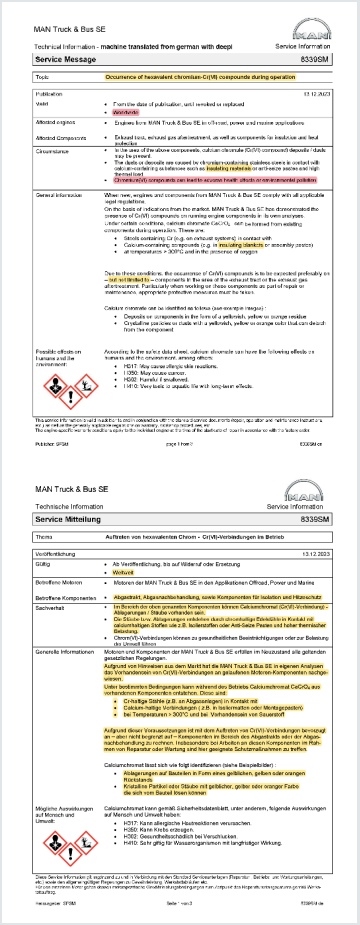
Allgemeine Hinweise

Das Isolationsmaterial an Gasmotoren unterliegt aufgrund der mechanischen und thermischen Beanspruchung im Motorbetrieb einem Alterungsprozess. Dies zeigt sich zum einen daran, dass bei der Demontage von Isolationsmaterial nach längerem Betrieb feine Glasnadeln an den entsprechenden Motorteilen (z.B. Abgasstrang, Turbolader, ...) sichtbar werden. Zum anderen kann es im Laufe der Zeit zu chemischen Reaktionen kommen, die zur Bildung des Gefahrstoffes Chrom-6 führen können.

Chrom-6 (Chrom in der Oxidationsstufe 6, kurz Cr-6) bildet sich aus chromhaltigen Stählen in Gegenwart von Kalzium (z.B. aus dem Isoliermaterial) und Sauerstoff bei Temperaturen über 400 °C. Cr-6 kann in sehr geringen Konzentrationen als gelbliches Pulver auf den betreffenden Motorenteilen oder im Isoliermaterial gefunden werden. Cr-6 liegt in Form eines nicht flüchtigen Pulvers vor.

Um die Belastung der Atemluft möglichst gering zu halten, müssen die in dieser Anweisung beschriebenen Arbeitsweisen genau eingehalten werden (z.B. das Aufwirbeln von Stäuben bei Arbeiten mit gebrauchtem Isoliermaterial muss unbedingt verhindert werden).

Fig. 30 Warning message from the Austrian company Innio Jenbacher about insulation elements contaminated with calcium chromate



MAN Truck & Bus SE
Technical Information - machine translated from german with deepl
Service Information
Service Message 8339SM

Topic: Occurrence of hexavalent chromium-Cr(VI) compounds during operation

MAN Truck & Bus SE
Technische Information
Service Information
Service Mitteilung 8339SM

Thema: Auftreten von hexavalentem Chrom - Cr(VI)-Verbindungen im Betrieb

Fig. 31 Warning message from the German company MAN Truck & Bus SE about calcium-containing insulation elements and/or assembly pastes

Summary | further outlook

This summary "Reports from Practice" complements the already mentioned Field Study and Field Observations of the authors and is continuously supplemented with continued measurements, analysis results from them, and the latest findings and developments.

The number of experiences made, the documentation with photos, films and literature references show that the formation of carcinogenic and chronically environmentally harmful chromates is by no means - as often wrongly claimed - just isolated incidents, but a problem that has been completely underestimated worldwide so far, and it is also evident that this problem has been on the agenda for decades, correctly assessed since the beginning of the substitution of asbestos-containing chromates. insulation materials and systems, exists.

The measurements and their results are no longer based solely on locally made rapid tests, which above all often lead to "false-negative" results.

Both the investigations carried out with the mobile laboratory "Chromium(VI) Test Kit TK01" of the company SEEF B.V., as well as the material samples examined in recognized test laboratories, as well as the air tests carried out with the filter pump "SG 10-2" by the company GSA mbH paint a consistently worrying overall picture, namely the regular danger to humans and the environment from carcinogenic dusts (inhalable fraction), which pose a high health risk both inhaled and dermal.

In the analyses, even the limit values that have not yet been adjusted in some countries and are therefore significantly higher than the low values already set in Germany, France and the Netherlands were exceeded.

Since there are no threshold values for CMR substances such as chromium(VI) compounds in the workplace that accept a certain level of pollutants, no acceptance concentration has been specified for chromates; the minimization requirement of EU Directive 2004/37/EC is decisive.

As soon as chromates are present as solids or dust, a "medium risk" danger zone already applies, from an air concentration of

0.001 mg/m³

one is in the "high risk" range, which makes normal work in the vicinity of the exposure impossible and de facto excludes further work until the source is eliminated.

Unfortunately, neither the industry nor the authorities have yet understood how high the danger to people and the environment actually is.

May these studies and extended observations lead to a change in thinking so that the exposure-risk relationship of 1:250 (fatal) cancers is not fulfilled at an exposure of 0.001 mg/m³.

The series of studies will be continued and continuously supplemented.

Wrocław, February 2025

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Supplements | Updates

Revision: 1.xDate __.___.____

5. Recommendations for action

The area of recommendations for action outlines the prescribed measures to be applied if contact with so-called "CMR substances" (carcinogenic, mutagenic and reprotoxic substances) by employees cannot be excluded and is mainly implemented in national regulations by EU Directive 2004/37/EC.

The following points are derived from the German Hazardous Substances Ordinance (GefStoffV) and various Technical Rules for Hazardous Substances (TRGS).

The list clearly shows the immense influence that the presence of hexavalent chromium compounds will have on previous work processes.

If the findings from this Field Observation are understood, the entire energy-generating industry is facing a true paradigm shift.

It should be noted that all measures only take into account the control of the contamination that has already taken place in order to control the demonstrably existing risk to humans and the environment and to prevent further damage.

In the long term, the so-called "minimisation requirement" must be applied, i.e . **hazardous substances must be replaced by substances that are less dangerous or, at best, not dangerous at all** (substitution (5.2.1)).

Since chromates are not present before the thermally insulated systems are commissioned, but only during and after commissioning, the priority in the long term is to replace the source of chromate formation, i.e. the calcium-containing insulation. Calcium-free insulation systems are already available and have better properties than the current state of the art.

Another approach would be the use of hot parts that do not contain chromium, but such a change could only be made in new buildings as part of further developments in engine technology.

From today's perspective, the only option for the thousands and thousands of plants already in operation is the removal of today's insulation materials, a deep cleaning of the plant (decontamination) and the subsequent application of said (earth) alkaline metal oxide-free insulation.

Even if these new insulation systems are somewhat more expensive to purchase for the first time and the decontamination and disposal of the old thermal insulation also generates short-term additional costs, these expenses - even if not planned - are still likely to be cheaper than permanently continuing to operate the affected systems after the measures listed below.

In this respect, history will repeat itself, as it is already known from the times of asbestos removal. For the complete package of measures, their planning, implementation and monitoring, it is recommended to be supervised by expert safety officers who also have the necessary contacts to external companies that are necessary for the implementation of the measures.

5.1 Immediate measures

5.1.1 Technical measures

Enclosure and extraction

- Installation of fully enclosed workspaces
- Negative pressure maintenance with at least 20 Pascal

- Multi-stage filter systems with HEPA H13/H14
- Air exchange rate > 10 times per hour
- Separate supply and exhaust air ducting

Dust minimization

- Use of low-dust dismantling processes
- Humidification of the work areas where possible
- Special tools for gentle work
- Dust extraction directly at the point of origin
- Regular surface cleaning

Workplace design

- Setting up black and white areas
- Professional decontamination sluices
- Separate material transport routes
- Marking of contaminated areas
- Specially equipped cleaning zones

5.1.2 Organisational measures

Access restrictions

- Access only for trained personnel
- Documentation of all persons present
- Time limitation of working hours
- Rotation principle for exposed activities
- Coordination of parallel work

Workflows

- Detailed work instructions
- Risk assessment for every step of the process
- Determination of emergency procedures
- Regular workplace monitoring
- Documentation of all activities

Hygiene measures

- Strict separation of work and private clothing
- Regular change of protective clothing
- Shower facilities after work
- Ban on eating/drinking in the work area
- Regular cleaning of the work areas

5.1.3 Personal protective equipment

Respiratory

- Blower Assisted Full Face Masks
- P3 filter for suspended solids
- Regular maintenance and testing
- Individual adjustment, leak fit test before each use

Protective clothing

- Disposable Protective Suits Category III Type 5/6
- Chemical-resistant gloves
- Special safety shoes with overcoats
- Safety goggles with side protection
- Head and neck protection

Accessories

- Communications
- Personal Measuring Devices
- Emergency equipment
- Cleaning material
- First aid kit

5.2 Long-term measures

5.2.1 Substitution

Alternative materials

- Development of chrome-free insulation solutions
- Use of Cleansulation products
- Innovative fastening systems
- Improved coating technologies
- Mechanically more stable constructions

Design changes

- Optimization of insulation geometries
- Improved accessibility for maintenance
- Modular design
- Integrated monitoring systems
- Temperature-optimized design

Process adjustments

- Revision of maintenance intervals

- Preventive replacement of endangered parts
- Optimization of operating parameters
- Adaptation of cleaning procedures
- Development of special tools

5.2.2 Monitoring

Metrological monitoring

- Continuous air measurements
- Regular wipe tests
- Personal dosimetry
- Biomonitoring
- Material analyses

Documentation

- Digital maintenance management
- Complete exposure documentation
- Recording of material changes
- Logging of incidents, long-term archiving of all data

Quality assurance

- Regular audits
- Certification of processes
- Review of protective measures
- Validation of measurement methods
- Documentation control

5.2.3 Qualification

Basic training

- Hazard potential of chromium(VI)
- Occupational health and safety measures
- Emergency behavior
- Documentation obligations
- Legal basis

Hands-on training

- Handling of PPE
- Decontamination process
- Sampling techniques
- Cleaning methods
- Emergency drills

Further education

- Regular refresher courses
- Updates on new regulations
- Exchange of experience
- Best Practice Workshops
- Certified training courses

5.2.4 Prevention

Health care

- Regular occupational medical examinations
- Biomonitoring programs
- Psychological support
- Ergonomic workplace design
- Occupational health management

Environmental protection

- Disposal concepts
- Emission minimization
- Resources
- Recycling strategies
- Environmental monitoring

Economy

- Cost assessment of the measures
- Investment
- Insurance aspects
- Liability minimization
- Image protection

6. Conclusions

6.1 Exposure risks

The measured values determined from a mix of different insulation materials and systems prove a systematic and significant exceedance of the applicable occupational exposure limits:

- **The measured chromium(VI) concentrations of 2.33-6.99 µg/m³ in the direct working area exceed many national limit values several times over**
- **Even for the background exposure (0.526-0.556 µg/m³, minimum values), exceeding the assessment benchmark of 1 µg/m³ cannot be ruled out**
- **The hazard affects not only directly exposed employees, but also people in the extended work environment**
- **The vertical distribution of the load shows an effective spread of the contaminated dusts throughout the entire work area**

6.2 Systemic problems

The Field Observation reveals fundamental weaknesses in previous practice:

- **The historical development of insulation materials has led to an inherent problem**
- **The combination of calcium-containing insulation materials with chromium-containing components creates ideal conditions for chromate formation**
- **Mechanical stress and aging increase the formation and subsequent release of chromates**
- **Existing protection concepts are inadequate for the identified hazards**

6.3 Risks of carry-over

The Field Observation shows multiple ways of carry-over:

- **Primary dust release due to direct work on the insulation**
- **Secondary contamination through stirring up and distribution**
- **Carry-over via tools, work equipment and personal protective equipment**
- **Spread via ventilation systems and structural openings**

6.4 Economic implications

The necessary measures have a significant economic impact:

- **Direct investment in protective equipment and technical facilities**
- **Increased personnel and time required for maintenance work**
- **Additional costs for monitoring and documentation**
- **Long-term expenditure on substitution and prevention**

6.5 Paradigm shift needed

The results illustrate the need for a fundamental rethink:

- **Previous practices are no longer up-to-date and legally questionable**
- **Immediate technical and organizational measures are essential**
- **There is no alternative to long-term substitution of chromate-forming materials**
- **Holistic prevention strategies must be developed**

7. Recommendations

Based on the study results, the following recommendations are made:

7.1 Strategic orientation

The industry should take a coordinated approach:

- **Development of a common strategy to address the chromate problem**
- **Establish industry standards for non-chromate-forming insulation solutions**
- **Establishment of competence networks for the exchange of experience**
- **Coordinated research and development initiatives**

7.2 Technical innovation

Focus on future-proof solutions:

- **Accelerated development of (earth) alkaline metal-free or low-alkaline metal insulation materials**
- Optimization of processing and assembly techniques
- **Integration of monitoring systems into new plant concepts**
- **Improving decontamination and cleaning technologies**

7.3 Organizational realignment

Adaptation of operational structures:

- **Implementation of systematic risk assessments**
- **Establishment of professional training and qualification programs**
- **Establishment of effective documentation and verification systems**
- **Development of specific emergency and intervention plans**

7.4 Regulatory measures

Recommendations for the regulatory framework:

- **Tightening monitoring and control**
- **Standardization of measurement methods and documentation**
- **Harmonization of international limit values and standards**
- **Development of specific guidelines for the industry**

7.5 Preventive strategies

Long-term prevention approaches:

- **Systematic substitution of chromate-forming materials (insulation, seals, pastes)**

- **Implementation of preventive maintenance concepts**
- **Development of improved occupational health and safety strategies**
- **Establishment of continuous improvement processes**

7.6 Need for research

Identified research interests:

- **Further development of measurement technology and analysis methods**
- **Investigation of long-term effects and chronic effects**
- **Optimization of decontamination and cleaning methods**
- **Development of innovative protection concepts**

7.7 Economic aspects

Recommendations for cost optimization:

- **Development of cost-effective protective measures**
- **Optimization of workflows and processes**
- **Use of synergy effects during implementation**
- **Consideration of life cycle costs in investments**

These recommendations are to be understood as guidelines for the future development of the industry and should serve as a basis for the development of specific action plans.

8. Bibliography (Sources/Reference)

See document "Safety for people and the environment" of 06.12.2024

Additionally: TRGS 561, version of 4 May 2026; SEEF B.V., knowledge base on Cr(VI) analysis in thermal insulation, seefbv.com, accessed November 2026.

9. Test and measurement methodology (total dust analysis)



9.1 Chromium(VI) Swab Test ST01



9.2 Cr(VI) Test Kit TK01



9.3 Cr(VI) Laboratory Analysis

9.1 "Chromium(VI) Rapid Tests"

In all previous investigations and investigations, so-called "rapid tests" have been used for the initial detection and identification of chromium(VI) compounds.

In this procedure, a test tip soaked in DPC described below is wiped or dabbed over a surface to be tested in order to induce a colorimetric reaction in the presence of chromium(VI).

The operation of the rapid tests, which are offered by different companies (e.g. product "HexChecks" (Figure Engineering Ltd. USA) or product "TK11" (MATInspired NL)), is based on a "colorimetric method"; the test procedure uses a chemical reaction with 1,5-diphenylcarbazide (DPC), which oxidizes to 1,5-diphenylcarbazone in the presence of chromium(VI) and produces a violet to pink coloration.

The intensity of the color is proportional to the chromium(VI) concentration and can be evaluated visually or with a colorimeter.

The test results are quite reliable, **false positive results are very rare, but false negative results are, because it can happen that dusts and deposits, but also oily surfaces, can prevent the reaction between chromium(VI) and the DPC from taking place during the swab**.

Since 2023, the Dutch company "SEEF B.V." has been offering a rapid test system "Chromate Speedtest" specially developed for chromate-contaminated thermal insulation, which is also designed according to the above-mentioned methods, but is somewhat less sensitive to dust deposits, but still cannot prevent them completely.

Field tests have shown that the **swab tests have a "true positive" hit rate of over 99%** and a **"false negative" rate of less than 50%,** so it was decided to keep this test method in the future.

It is advantageous to mention in the selection of test methods that SEEF has developed a mobile laboratory for relatively simple but deeper Cr6 analysis, which can also be used stationary and offers a relatively fast laboratory-like test for material samples.

9.2 "Mobile laboratory" Cr(VI) test kit TK01 (SEEF B.V.)

The TK01 Chromium-6 test kit enables fast and reliable on-site analysis of chromium-6 and has been developed for the measurement of calcium chromate in insulation, assembly pastes, lubricants and stainless steel parts, among other things.
The analysis takes place within 45 minutes and allows the simultaneous analysis of 6

samples.
The patented process prevents the reduction of chromium-6 to chromium-3 during the analysis process and at the same time minimizes interference from zinc and aluminum.

Smaller material samples or so-called wipe swabs are pre-treated with certain chemical substances and heated in test tubes, so that an almost 100% safe colorimetry can be performed.

In practice, further tests according to this procedure could, for example, heavily dust-covered or otherwise soiled areas be detected as positive and thus chromate-containing despite a negative rapid test.

9.3 Laboratory analysis (wipe test | Material samples) (SEEF B.V.)

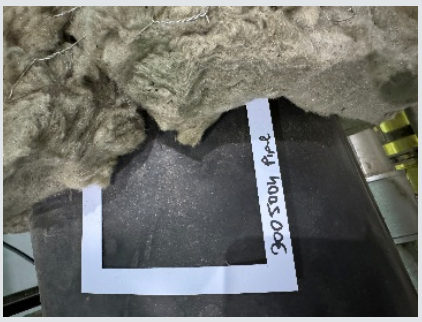
In the so-called "wiping test", a spatially defined area of 10 x 10 cm is wiped diagonally and horizontally with a cloth in order to absorb the surface dust and bind it in the cloth.

Subsequently, if the cloth is not examined using the mobile laboratory method, it is sent to the laboratory for analysis of the chromium(VI) load for the tested area. A few days later, the exact contamination in ppm | mg/kg in writing; the wipe sample is also tested for other heavy metals.

In the case of material samples, samples of fibre dust or other deposits are sent to the laboratory and then analysed and evaluated according to the same procedure, as in the wipe test.



9.3 Wipe Test



9.3 Wipe Test


9.3 Wipe Test Analysis with TK01



9.3 Material sample



9.3 Material sample


9.3 Material Sample Analysis with TK01

10. Test and measurement methodology (background loading)



10.1 Sampling Device



10.1 Pumping head



10.1 Measuring principle

10.1 "Sampling Device SG 10-2 (GSA)"

The **SG10-2 sampling device** incl. charger for **the personal** and **stationary** sampling of hazardous substances up to 12 l/min in accordance with EN 481.

The **SG10-2 sampling device** was developed for the measurement of hazardous substances, especially when **high volume flows** are required.

The SG10-2 offers a volume flow of 1-12 l/min and thus enables significantly shorter measurement times.

The various sampling heads licensed by IFA allow the measurement of inhalable dust (**E-dust, total dust**) and/or the alveolar dust fraction (A-dust, fine dust).

For the determination of chromium(VI) compounds in the air we breathe, a volume flow rate of 10 l/min is preset.

The measurements were carried out on base bearings of the DGUV (German Social Accident Insurance) in accordance with Information 213-505 as a recognised measurement method for determining the concentration of hexavalent chromium in the air in working areas.

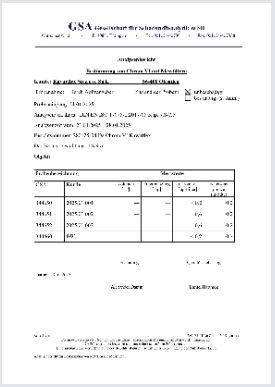
A few days after the filter dissolved in the analysis solution has been sent, the result is given in micrograms/filters, followed by conversion and evaluation (total amount of air, derived from this micrograms/cubic meter).



10.2 Resolved filter in solution



10.2 Analysis Solution



10.2 Certificate of Analysis

11. Outlook and further investigations

11.1 Status of this Field Observation

The Field Study on the chromium(VI) problem forms the basis of the study series.
It forms the scientific and methodological basis for all further investigations. The observations from the Field Observation FB01 and measurements and analyses from the Field Observation FB02 broaden the perspective. Future and past measurements and empirical values are used as a supplementary data collection ("observations from practice"), whereby the established methods and parameters of the Field Study serve as a standard.

11.2 Representativeness and transferability

It should be expressly pointed out that the MWM engine examined in the Field Study was coincidentally the first unit to be analyzed using state-of-the-art measurement technology.

It is noteworthy that this engine has a relatively small amount of textile insulation compared to other manufacturers. The insulation cassettes examined are professional and of high quality, but do not take into account the formation of chromates. Many other engine manufacturers use significantly more textile insulation technology and significantly inferior cassettes, which could potentially lead to even higher loads.

11.3 Extended findings

The significant chromium(VI) concentrations detected in removable metal cassettes are produced according to the clear thermochemical pattern in areas where calcium-containing insulation materials with air supply ("oxygen-open") have been installed. This observation once again supports the theoretical considerations on the formation mechanism of chromates in a practical way.

11.4 Automotive sector

Initial preliminary investigations have also detected chromates in the engine compartment of various car models (especially Mercedes and Audi). Further dedicated studies are currently being prepared for this purpose. The possible implications of these findings for the automotive sector are the subject of ongoing investigations.

11.5 Social relevance

The scope of the problem becomes particularly clear when one considers the diverse areas of application of the motors concerned. Aggregates of the type studied can be found in, among others:

- hospitals, public buildings (energy supply | Emergency power generators)
- Liners
- Power plants
- Industrial plants

This underlines the need for further systematic investigations and preventive measures.

11.6 Outlook

The available findings mark only the beginning of a comprehensive inventory. The identified exposure risks and their potential impact on occupational safety and public health require further detailed investigations. Based on the methods and standards developed here, further application areas and scenarios are systematically analyzed.

The results of this Field Observation suggest that a cross-industry reassessment of the use of calcium-containing high-temperature insulation is urgently needed. The protection of exposed workers and the development of safe alternatives should be in the foreground.

11.7 Further documentation

This Field Observation and all subsequent evaluations will be carried out on the basis of the Field Study and differ in notes on 2.1 (working situation and environment, condition of the insulation), 2.2 (measurement methods and implementation), as well as 2.2.2 (total dust analysis), as well as the measurement results; all other information can be treated and interpreted in the same context, albeit with minor variations.

Version history

Version	Date	Change
1.0	January 2025	First edition
1.1	November 2026	New layout in the design system of the Chromate Experts; spelling of chromium(VI) standardized. Update: assessment against the benchmark of 1 µg/m³ (TRGS 910, TRGS 561), no acceptance concentration; air measurements (standard method, GSA) marked as minimum values, with SEEF B.V. information on recovery; British limit value corrected (EH40: 0.01 mg/m³); Dutch limit value according to the Arbobesluit; TRGS 561 in the version of 4 May 2026 added; cross-references changed to Field Study and Field Observations; Technical Rules for Hazardous Substances.