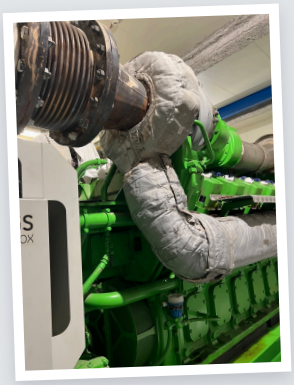
HIGH-TEMPERATURE INSULATION ON CHROMIUM-ALLOYED HOT PARTS

Removing the Known Flaw Restoring Compliance

Because heat met the wrong thing

One exhaust system, four steps · gas engine CHP plant, exhaust manifold and turbocharger outlet



1 BEFORE

Insulation with basic oxides on the chromium-alloyed hot parts: the known flaw, still in place.



2 DEINSTALLATION

Work area covered with protective sheeting, team in protective suits and respirators, low-dust removal.



3 REMOVED · DECONTAMINATED

Insulation dismantled, hot-part surfaces decontaminated.



4 SUBSTITUTED

New insulation made of VitroSilK®, without added basic oxides: no reaction partner for chromate formation.

High-temperature calcium-containing insulation tends to form carcinogenic, skin-resorptive and environmentally harmful **chromium(VI)** compounds (chromates). The result can be a large-scale contamination of entire genset rooms and CHP plants that is no longer tolerable in terms of occupational health and safety. With Kavarmat® the workplace becomes safe again for people and the environment.

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MECHANISM

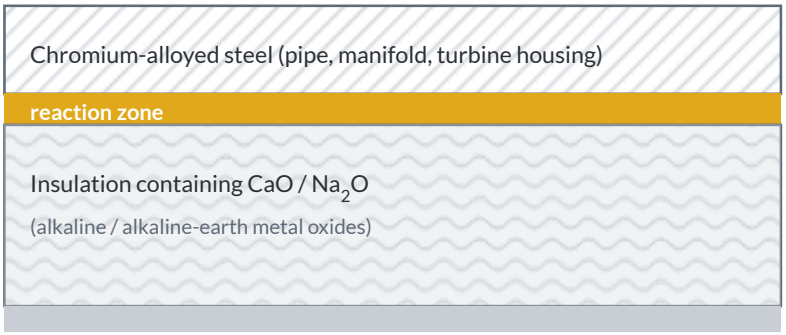
The Known Flaw

Today's high-temperature insulation systems contain alkaline or alkaline-earth metal oxide compounds, especially calcium oxide.

If these come into contact with chromium-containing hot parts, such as pipelines, engines, turbines or elements of exhaust gas aftertreatment, at temperatures above 300 °C, carcinogenic and environmentally toxic **chromium(VI)** compounds (chromates) can be formed.

The purple discoloration of **chromium(VI)** rapid tests confirms the presence of these dangerous, also skin-resorptive chromates, especially in combined heat and power plants and emergency power generators, but also in the engine compartments of ships and in power plants.

IN-SITU FORMATION AT THE HOT INTERFACE



Surface temperature > approx. 300 °C, oxidising atmosphere

Calcium chromate

$$2\,CaO + Cr_2O_3 + 1.5\,O_2 \rightarrow 2\,CaCrO_4$$

Sodium chromate

$$2\,Na_2O + Cr_2O_3 + 1.5\,O_2 \rightarrow 2\,Na_2CrO_4$$







Operators of energy-generating plants are obliged to initiate immediate occupational health and safety measures to prevent further uncontrolled exposure, including the following German Technical Rules for Hazardous Substances (TRGS): 400, 401, 402, 561, 600, 910, as well as the German Hazardous Substances Ordinance (GefStoffV), based on the European Carcinogens and Mutagens Directive 2004/37/EC*. It prescribes a substitution test: the formation of hazardous substances must be minimised or, at best, prevented.

* GB: COSHH · F: Code du travail · NL: Arbobesluit

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PILLAR 1 · DEINSTALLATION

Removing the Wrong

with Kavarmat®





Deinstallation, decontamination and substitution are the cornerstones of occupational health and safety and environmental protection.

Kavarmat® implements occupational health and safety and environmental protection in accordance with the regulations, on the basis of the previously prepared risk assessment (D: Gefährdungsbeurteilung, GBU). Its preparation was already triggered by the information from the engine manufacturers alone (D: TRGS 400).

There are no thresholds for hexavalent chromium compounds.

EVERY EXPOSURE ROUTE IS ASSESSED INDIVIDUALLY

Inhalation	Dermal	Oral	Environment
H350	H317		H410
chromate-containing dusts and fibres in the air	skin contact, skin-resorptive	hand-to-mouth transfer	water-soluble chromates, wastewater, soil
air value “unremarkable”	risk remains	assessed separately	risk remains

Even if the air value is “unremarkable”, the dermal and environmental risk alone suffice to trigger the CMR protection regime.

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PILLAR 2 · DECONTAMINATION

Eliminating Risks

with Kavarmat®

It is not possible to estimate where long-term exposure has been deposited. In engine compartments there is a risk of turbulence due to artificial and natural ventilation. Without complete decontamination, uncontrolled chromate-containing dusts and fibres can not only be dispersed but also carried away.





Even small amounts can affect flora and fauna in the long term. Calcium chromate is water-soluble and must not get into the wastewater under any circumstances. Liquids produced by decontamination must also be collected and disposed of as hazardous waste.

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PILLAR 3 · CONTROLLED WASTE MANAGEMENT

Disposing of the Wrong

with Kavarmat®

Chromates are highly toxic, carcinogenic and hazardous to water; even small releases of dust or fibres can damage the respiratory tract, the skin and the environment.

The dismantled and contaminated insulation elements are therefore considered hazardous waste. They must be packed dust-tight, collected separately and treated or landfilled in appropriately approved facilities in order to protect people and water from chromate release.

Dismantling low-dust, PPE ▶ **Packing** dust-tight ▶ **Separate collection** hazardous waste ▶ **Treatment / landfill** approved facilities







kavarmat.com
chromateexperts.com
cleansulation.tech

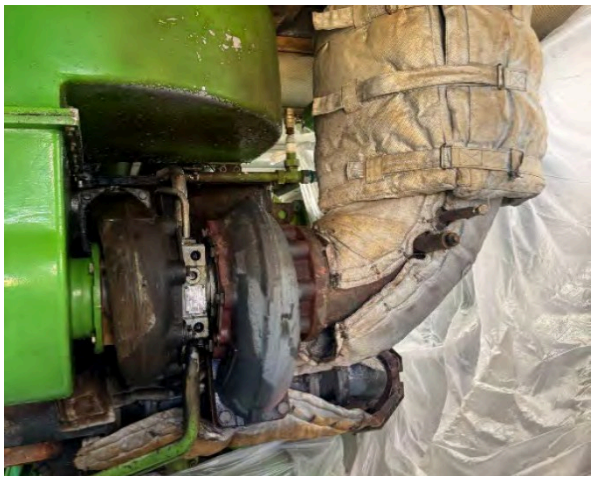
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PILLAR 4 · SUBSTITUTION

Replacing the Wrong Thing

with Kavarmat®



Directive 98/24/EC, the core of the European STOP principle, obliges employers to examine every hazardous agent for a technically and economically feasible substitution by less hazardous alternatives and to implement it.

Directive 2004/37/EC tightens this for carcinogenic, mutagenic and reprotoxic substances (CMR), which may only be used if substitution is demonstrably impossible; otherwise, closed systems or the lowest possible exposure level are prescribed.

SUBSTITUTION REMOVES THE REACTION PARTNER

Cr-alloyed steel > 300 °C	Cr-alloyed steel > 300 °C
conventional insulation with CaO / Na_2O	VitroSilK®: amorphous silicate continuous filament, no added basic oxides
→ $CaCrO_4$ / Na_2CrO_4 formed	→ no reaction partner for chromate formation

Both directives apply not only to deliberately used substances but also to hazardous or CMR substances that are only created or released in the process, and here too they require prevention to take precedence over subordinate protective measures.



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PILLAR 5 · SERVICE AND MONITORING

Keeping the Right Thing

with Kavarmat®

With the conversion (substitution) of calcium-containing insulation to VitroSilK® Protekto, engine and plant operators can quickly return to reassuring normal operation.



The chromate risks are eliminated, so that many additional protective and cleaning measures can be noticeably reduced. We actively accompany the remaining monitoring until each system is proven to be safe again.





We withdraw only when all values are consistently below the limits.

And we still remain reliable.

A 3-year product warranty included.

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We are a carrier of the network **The Chromate Experts** and will be happy to advise you on all questions relating to chromate formation by insulation containing alkaline and/or alkaline-earth metal oxides (calcium oxide).

We support you in preparing the risk assessment and arrange deinstallation and decontamination teams.

THE CHROMATE EXPERTS

Don't give **Chromium(VI)** a chance! · Detecting | Mastering | Preventing

The Chromate Experts

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Cr6 ACADEMY

Cr⁶ Academy

Training and qualification on chromium(VI) from high-temperature insulation for operators, service personnel and insulation companies.

Web: www.cr6.academy

Cr6 INFO

Cr⁶ INFO

Information portal on the in-situ formation of chromium(VI) at hot parts.

Web: www.cr6.info

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