ANALYSIS OF ALTERNATIVES
and
SOCIO-ECONOMIC ANALYSIS

Legal name of applicant:	Bard & Brazier Ltd
Submitted by:	Bard & Brazier Ltd
Date:	31st October 2025
Substance:	Chromium trioxide EC : 215-607-8 CAS : 1333-82-0
Use title:	Use of chromium trioxide for the chromium electroplating of sanitaryware and associated accessory components for the purpose of creating a coating to provide very specific performance characteristics and to match existing components and those supplied from other sources
Use number:	3 - Functional chrome plating with decorative character

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DECLARATION

We, the Applicant (Bard & Brazier), are aware of the fact that further evidence might be requested by HSE / DEFRA to support the information provided in this document.

Also, we request that the information blanked out in the "public version" of the Analysis of Alternatives and Socio-economic Analysis is not disclosed. We hereby declare that, to the best of our knowledge as of today (31st October 2025), the information is not publicly available, and, in accordance with the due measures of protection that we have implemented, a member of the public should not be able to obtain access to this information without our consent or that of the third party whose commercial interests are at stake.

Signature:

Andy Whitmore
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Date. 31st October 2025
Place. Wolverhampton

1. SUMMARY

This Analysis of Alternatives and Socio-Economic Analysis relates to the application for authorisation for the continued use of chromium trioxide in electroplating of sanitaryware and associated accessory components for the purpose of creating a coating to provide very specific performance characteristics and to match existing components and those supplied from other sources.

Bard & Brazier is a small business and manufactures, under its own brand name, a wide range and bespoke, handmade towel warmers and together with its sister company Lefroy Brooks, offer a range of high specification sanitaryware and associated accessory components for luxury bathrooms. Both companies are located on the same site, on the south side of Wolverhampton in well-appointed workshops.

Bard & Brazier is the primary manufacturer and employ a team of highly skilled craftsmen and its metal finishing unit benefits from long serving and experience employees. The chromium plating process is carried out in a single dedicated unit on the site.

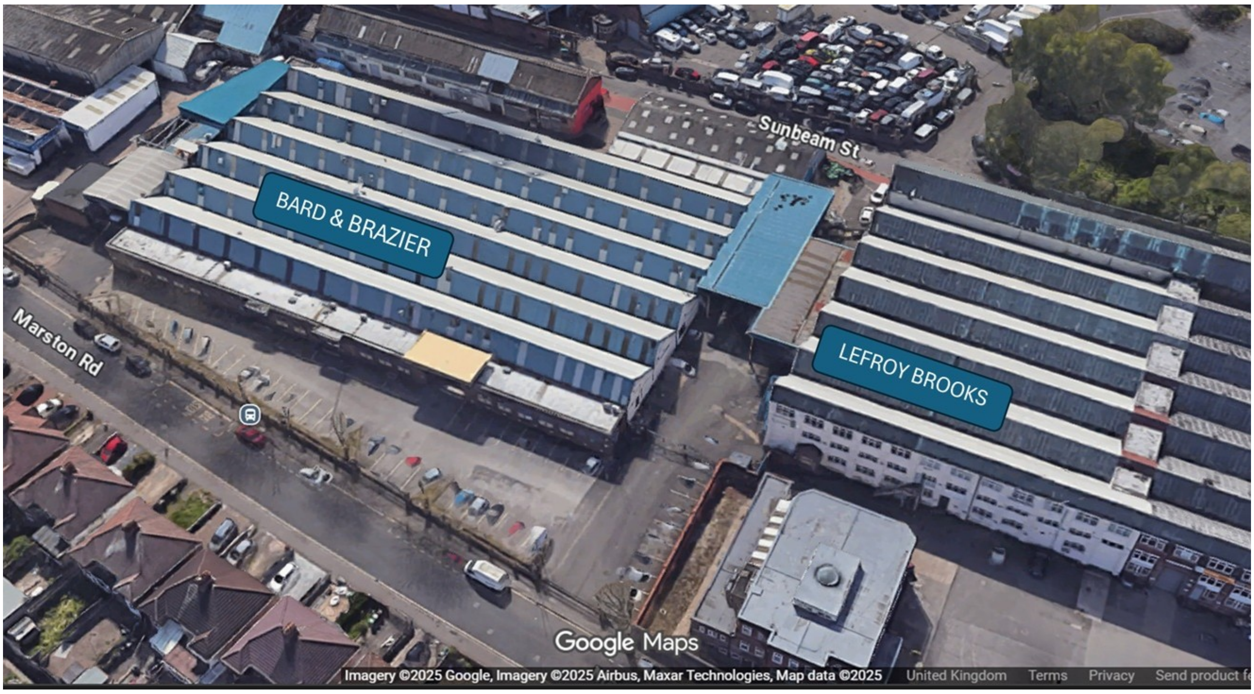
Bard & Brazier and Lefroy Brooks are both members of the Davroc Group, a well-established organisation serving both retail showroom customers across the UK and high-profile contract clients in the hotel and leisure sectors.

The Davroc group has headquarters in Hertfordshire and comprises of 3 distribution warehouses across the UK together with 2 manufacturing companies (Bard & Brazier and Lefroy Brooks) and a supporting furniture factory in Chichester. The group employs 210 people in total across the UK.

In addition to the Bard & Brazier and Lefroy Brooks brands, the group distributes a number of other well-known and trusted brands including Alca, Aqualisa, Bette, Carron Bathrooms, Laufen, Roca, Grohe, VitrA.

The chrome plating facilities were on the current site for many years before the arrival of the applicant's manufacturing unit and Lefroy Brooks in 2008. To have manufacturing, metal finishing and assembly on the same site was a commercially and operationally sound decision. In a non-use scenario, without chrome plating facilities on site, the whole strategic objective would be destroyed.

The Wolverhampton Site



Lefroy Brooks is the applicant's largest customer for onsite manufactured components and metal finishing services. The applicant offers a wide range of finishes, including options in nickel, copper, brass, bronze and gold, together with both hexavalent and trivalent chrome.

Typical components, plated in hexavalent chromium, include bath and basin taps, including mixer taps, shower mixers and diverters, shower heads and roses, rails and risers, and accessories such as towel rails, robe hooks, toilet roll holders, tumbler holders, shaving mirrors and corner baskets.

The complexity of bespoke bathroom designs can involve components being sourced from a wide range of international suppliers, with uncompromising standards for finish uniformity. Components imported from China are often stripped and reprocessed by the applicant, in order for them to meet the exacting standards of customers and end users.

The applicant has reviewed previous applications for authorisation from similar trades and consulted with its chemistry supplier regarding alternatives to chromium trioxide-based plating. Customers have also been consulted, and all are of the opinion that any current alternative would not meet all of their requirements.

The function of the chromium trioxide is to provide a thin metallic chromium electroplated coating, which is essentially inert, usually termed decorative chromium plating. All components are manufactured from high quality brass and coated with a layer of nickel and chromium, to adhere to the requirements of BS EN ISO 1456:2009 as a minimum.

The chromium electroplated coating provides specific characteristics that include corrosion resistance, chemical resistance, hardness and resistance to wear and abrasion, UV resistance, heat resistance, colour and shine stability, surface consistency and smoothness.

In addition, the coating is fully recyclable.

The customer defines its requirements and ultimately the process and finish specifications. This means that the use of chromium trioxide is led by the consumer and any alternative must mirror the customers' expectations, which primarily is to meet the specification and match the other chrome plated components in their bathroom.

The applicant relies totally on the propriety chemistry suppliers, other larger manufacturers in the sector and trade associations to conduct research and development as the costs are so prohibitive.

There are currently three technologies that could be considered as potential alternatives to the use being applied for. Trivalent chromium electroplating (Chloride and Sulphate based) and Physical Vapour Deposition (PVD. The majority of propriety chemistry suppliers, appear to be considering that the only alternative which has a serious chance in time, of replicating the appearance and characteristics of Cr(VI) bright chrome, and gaining acceptance by the functional decorative plating sector, is the sulphate based trivalent chromium technology.

With respect to the specific performance requirements of the required coating, none of the potential alternatives were considered to be viable alternatives at the present time nor in the foreseeable future. A review period of 12 years is therefore requested.

With the passage of time, further research and development will be undertaken to improve the performance of trivalent chromium technology and newly developed coatings may become available.

If authorisation is granted, the applicant will continue to use chromium trioxide for its high quality chrome plating in line with best practice principles, together with continuing to ensure that the control of exposure to chromium trioxide is maintained as low as practicable. With a modest capital investment, the applicant proposes to increase capacity on its plating line by repurposing under-utilised tanks for the pretreatment of zinc die-cast and aluminium substrates.

If the authorisation is not granted, the applicant, in conjunction with its sister company, expect that without their exceptionally high quality hexavalent chrome-plating facility, the site in Wolverhampton would be closed down. This would result in lost turnover and profits and necessitate approximately 80 redundancies across both businesses.

For the applicant, over the 12 years (requested review period), the societal costs resulting from non-use is £550,000 per year, of which £264,000 per year is resulting from unemployment and lost wages.

Over the same period, the residual risks to human health of continued use are extremely low, where the excess lung cancer risk is estimated at 0.004 and the monetised excess risk is estimated over the full 12 years (review period) at £13,500.

Additionally, for Lefroy Brooks, the potential supply chain impact, resulting from unemployment over the 12 years is £183,398 per year.

The societal costs of not granting this authorisation far outweigh the residual risks from the continued use of chromium trioxide for the use applied for.

The Chemical Safety Report demonstrates that risks to workers are well managed and controlled, and there is negligible risk to the environment or ‘man via environment’.

With the continued use of airborne mist monitoring, personal air monitoring and biological monitoring, all routes of exposure can be regularly assessed and the principles of “as low as reasonably practicable” will be maintained.

2. AIMS AND SCOPE

This application for authorisation covers the use of chromium trioxide to produce a final thin layer of electroplated metallic chromium on top of a layer of electroplated nickel on sanitaryware and associated accessory components generally made of brass.

The applicant is a small business and manufacturers, under its own brand name, a wide range and bespoke, handmade towel warmers and together with its sister company Lefroy Brooks, offer a range of high specification sanitaryware and associated accessory components for luxury bathrooms.

Both companies are members of the UK based Davroc Group, so providing direct employment, generating tax revenues, and preserving specialist engineering skills for the UK.

Customers are worldwide but imports of sanitaryware, generally accounts for over 64% of the UK market. It is vital that the UK retains the necessary skills and production processes to be able to reverse the drift towards imports and assist in the reduction of the sector's climate impact.

The applicant, Bard & Brazier are the primary manufacturers and employ a team of highly skilled craftsmen and its metal finishing unit benefits from long serving and experience employees. The chromium plating process is carried out in a single dedicated unit on the site and is the final stage of what can be a complex process of component manufacture.

Market research reveals that bright chrome remains the dominant finish in the UK sanitaryware sector, especially taps, shower heads, mixers, towel rails and bathroom accessories, accounting for an estimated 60–70% of all brassware sold in the UK. (2025).
It is favoured for:

- durability and corrosion resistance
- ease of cleaning and maintenance
- aesthetic neutrality across both residential and commercial applications
- compatibility with modern and traditional styles

This application for authorisation covers the use of chromium trioxide to produce an electroplated coating of metallic chromium on top of nickel and the overall finish must adhere to the requirements of BS EN ISO 1456:2009 as a minimum.

BS EN ISO 1456:2009 specifies coating designations appropriate for the service conditions (SC) to which the coated product will be exposed. Each service condition requirement will determine the deposit thickness of the nickel layers. The thickness of the chromium layer remains the same across all service conditions (Typically 0.3 - 5.0 µm)

Table 2.1 BS EN ISO 1456:2009 Extract (5.3 Service-condition number)

SC No	SC Description	Severity of the Conditions
1	Mild	Service indoors in warm dry atmospheres, e.g. offices
2	Moderate	Service indoors where condensation may occur, e.g. bathroom, kitchens
3	Severe	Service outdoors where occasional or frequent wetting by rain or dew may occur, e.g. outdoor furniture, bicycles, hospital goods.
4	Very severe	Service outdoors in very severe conditions, e.g. components of automobiles, boat fittings.
5	Exceptionally severe	Service outdoors in exceptionally severe conditions, where long-time protection (such as longer than about 10 years) of the substrate is required, e.g. vehicle components: bumpers, wheels.

Bathroom fixtures and fittings will have to meet the requirements of SC2 as a minimum.

The chromium electroplated coating provides specific characteristics that include corrosion resistance, chemical resistance, hardness and resistance to wear and abrasion, UV resistance, heat resistance, colour and shine stability, surface consistency and smoothness.

The aim of this Analysis of Alternatives is to demonstrate that no suitable alternative to the use of chromium trioxide is currently available for the use being applied for.

The aim of the Socio-Economic Analysis is to demonstrate that the benefits of the continued use of chromium trioxide, for the use applied for, far outweigh any potential risks to human health and/or the environment.

The scope covers the applicant (Bard & Brazier) who is carrying out the chromium trioxide plating process and its customers and details the societal implications of a refusal to grant an authorisation for the continued use of chromium trioxide for this specific use.

The applicant is a proud UK business and provides employment for the local community, which includes many local businesses who also make parts, which complement the product range and the parts are subsequently polished and plated by the applicant.

3. ANALYSIS OF ALTERNATIVES

3.1 SVHC use applied for

Use of chromium trioxide for the chromium electroplating of sanitaryware and associated accessory components for the purpose of creating a coating to provide very specific performance characteristics and to match existing components and those supplied from other sources.

3.1.1 Description of the function(s) of the Annex XIV substance and performance requirements of associated products

Hexavalent Chromium (Chromium trioxide Cr(VI)) is used to produce an electroplated metallic chromium coating. The base material of components is high quality brass.

For the specific use being applied for, the chrome plating process is performed on a manually operated in-line rack plating line containing a total of 33 process stations and chrome plating is the final stage of a predetermined sequence of operations as detailed below:

Preparation : Machining and manufacturing sub-components

Assembly : Brazing, soldering etc.

Polishing : Manual polishing to provide a smooth surface and prepares for the mirror-like finish

Pre-treatment processes : Cleaning and pickling the surface of the component

Electroplating processes : Plating in nickel and chrome

Post-treatment processes : Immersion in neutralising solution, removing any traces of chromium trioxide residue

Components are rinsed by immersion in clean water between processes to prevent contamination from previous stages.

Components are inspected for defects at the polishing stage and after the chrome plating process prior to packing and despatch.

The final coated component does not contain any hexavalent chromium and is essentially inert and the only potential exposure to chromium trioxide occurs when operating the plating line.

The chromium plated components, for the use being applied for, requires the following performance requirements:

- **Corrosion resistance**
  Surface must be resistant to corrosion from the high-humidity environments where frequent condensation exists. This can reduce product service life and consumer satisfaction. Table 2.1 above provides the conditions which components could be subjected while in service.
- **Chemical resistance**

Surface must be resistant to chemicals to which a component is likely to be exposed to throughout its service life. This can affect the integrity of the coating and visual quality. Bathroom cleaning chemicals, disinfectants and bleach are examples. This is particularly relevant in hotel bathrooms, where fittings undergo frequent cleaning.

- **Hardness and resistance to wear and abrasion**
  Surface must resist damage in normal use, which can reduce service life and visual quality. Breakthrough, due to scratching and chipping can bring on corrosion down to the underlying nickel layer. Nickel could contaminate drinking water and poses a health risk. Water Supply (Water Quality) Regulations 2016 applies. Resistance to the regular use of abrasive bathroom cloths and cleaners is also important.
- **UV resistance**
  Surface must be highly stable under UV exposure and does not degrade, fade, or yellow. The mirror-like finish must remain intact under typical UV conditions.
- **Heat resistance**
  Surface must provide robust heat resistance. Surfaces must be resistant to temperature change and heat, bearing in mind the demanding conditions products are exposed to in bathroom environments.
- **Colour and shine stability**
  Surface must be resistant to discolouration and loss of shine while in service. Colour and shine should be consistent across different components and different batches, wherever sourced, together with matching any originally installed fixtures and fittings.
- **Surface consistency and smoothness**
  Surface must be consistent and smooth to a mirror finish, without blemishes or other faults. Failure to achieve this leads to rejection and consumer dissatisfaction.

The plated surface must comply with technical specifications and international standards. An example is BS EN ISO 1456:2009 which specifies requirement conditions for appearance, impact resistance, coating performance and salt spray resistance.

Salt spray testing is used to evaluate the corrosion resistance of coatings. The test involves exposing coated samples to a controlled corrosive environment, typically a salt fog, to simulate long-term exposure to harsh conditions. This helps in assessing how well the coatings can protect the underlying material from corrosion.

3.1.2 Market analysis of products manufactured with the Annex XIV substance

Using data published by AMA Research, Barbour ABI, Market Research Future, Mintel Market Intelligence, Mordor Intelligence and elsewhere, the global bathroom fittings market is projected to grow from approximately $23.32 billion in 2025 to $35.2 billion by 2034. The UK bathroom fittings market is estimated to be worth between £1.2 billion and £1.5 billion, with some forecasts suggesting it could reach £1.7 billion.

The top 5 mainstream brands [redacted] likely account for 60–70% of UK brassware (metal fittings and fixtures, usually made of brass or chrome-plated brass) and these are overwhelmingly imported, primarily from China, Germany, and Italy.

UK manufacturing is focusing on niche or luxury segments. Precise market share figures for UK sanitaryware brands like Davroc, Bard & Brazier, and Lefroy Brooks are not publicly disclosed, but they are considered niche or premium players within the broader £1.2–£1.5 billion UK bathroom fittings market.

The UK **high-end and ultra-premium brassware** market (including bespoke, Edwardian, and Deco-style taps and showers) is estimated to be worth £120–£150 million in 2025, representing roughly 10–12% of the total UK bathroom brassware and taps market. This segment is driven by heritage renovations, boutique hospitality, and luxury residential demand. The overall UK bathroom market is forecast to grow by +4% by 2028.

Bard & Brazier positions itself in the ***High-End Bespoke Brassware*** segment emphasizing *bespoke craftsmanship, bold design features (e.g. Baronial ball joints), and a palette of metallic finishes that evoke Deco sensibilities*. Their positioning leans toward *luxury innovation within a heritage framework.* This segment has an estimated value of £80–£100 million.

Lefroy Brooks positions itself in the ***Ultra-Premium Edwardian/Deco Styles*** segment explicitly marketing its *Edwardian marble consoles and other fittings as part of a curated historical range spanning 1900–1950, reinforcing its identity as a heritage brand rooted in early 20th-century design.* This segment has an estimated value of £40–£50 million.

Typical components that require decorative chromium plating for the use being applied for are:

Bath, basin and bidet taps
Mixer taps
Shower mixers and diverters
Toilet flush plates and levers
Shower heads and roses
Shower arms
Shower curtain rods and rings
Rails and risers
Towel rails and rings
Grab rails and support bars
Heated towel rails and warmers
Towel and robe hooks
Toilet roll holders
Tumbler holder
Soap dishes and dispensers
Toothbrush holders
Mirror frames and mounts
Corner baskets
Shower caddies and shelves

Market research reveals that bright chrome remains the dominant finish in the UK sanitaryware sector, especially taps, shower heads, mixers, towel rails and bathroom accessories, accounting for an estimated 60–70% of all brassware sold in 2025.
It is favoured for:

- durability and corrosion resistance
- ease of cleaning and maintenance
- aesthetic neutrality across both residential and commercial applications
- compatibility with modern and traditional styles

As already indicated, the applicant has to operate to the very highest quality standards in this extremely demanding **high-end and ultra-premium brassware** market and in the aftermarket and replacement market, component parts should have the same appearance and match all other chromium plated parts in the luxury and exclusive bathroom regardless of when or where they are sourced.

Product Portfolio


LEFROY BROOKS
1900
CLASSIC
1900 1910 1920 1930 1935 1940 1950
DAVROC
BARD & BRAZIER

3.1.3 Annual volume of the SVHC used

The applicant is a small enterprise for the purpose of REACH authorisation applications and only uses a total weight of 50-75 kg per annum.

3.2 Efforts made to identify alternatives

3.2.1 Research and development

As detailed in Section 2 of the CSR, the chrome plating line was originally installed on this site in 1997 and operated, alongside several other plating lines, by a separate metal finishing company. Throughout this period and in response to increasing regulatory pressure to phase out hexavalent chromium, managements have been researching and trialling alternatives to hexavalent chromium.

Our experience and findings over this period have clearly demonstrated that trivalent chrome is likely to be the only technically, economically and practical alternative to hexavalent chrome and. in time, being capable of matching all the key functionalities and very specific characteristics that include corrosion resistance, chemical resistance, hardness and resistance to wear and abrasion, UV resistance, heat resistance, colour and shine stability, surface consistency and smoothness.

Throughout this period all alternatives have been found to have issues with corrosion and chemical resistance, wear and abrasion or aesthetics (colour matching). This will be discussed later in this application.

Chromium electroplating using trivalent chromium was first marketed in the 1970s. There has been considerable research and development since then, by the major chemistry suppliers and research continues in an attempt to obtain a true 'drop in' alternative to chromium electroplating using hexavalent chromium.

In response to increasing regulatory pressure to phase out hexavalent chromium, several years ago the applicant proactively invested in trivalent chromium technology. This trivalent process is operated in parallel with the hexavalent chromium process, referred to in this authorisation application. The dual-path approach reflected a commitment to transition but has recognised that trivalent chromium does not meet all of the very specific performance requirements of their customers in the high-end and ultra-premium brassware market.

The applicant utilises hexavalent chromium in its electroplating operations, with process chemicals and technologies supplied by specialist chemistry providers.

Specialist chemistry providers, currently involved in the research for a true alternative to hexavalent chromium include [redacted]

[redacted] is the applicant's current preferred partner and supplier of chemicals and plating technology.

The applicant has the expertise in producing its products for the applications and sectors to which it supplies and will determine the key functionalities and set performance standards for the products they manufacture. The chemistry suppliers are the service provider and hold the specialist knowledge regarding electroplating technologies and any changes or improvements are driven by their efforts.

The applicant acknowledges that substantial resources are being invested in R&D activities aimed at identifying potential alternatives to chromium trioxide within the plating sector. However, it is not reasonable to expect the applicant to lead such efforts, as they lack the specialised expertise, infrastructure, and personnel required to initiate and manage these complex research programmes.

This means the development of new or improved technologies must be undertaken in cooperation with the applicant who does have that expertise. The applicant is highly supportive of the drive towards a true alternative to chromium trioxide and are actively engaging with specialist suppliers and technology providers.

In a continued use scenario, the applicant, together with its preferred supplier (and/or another), will continue trialling alternatives to hexavalent chromium as they become available. The trivalent chrome technology currently in use is [redacted] , which is supported and monitored by [redacted] and is a chloride-based trivalent chromium plating process. Poor hardness and resistance to wear and abrasion, together with a lack of colour and shine stability makes it unsuitable for the extremely demanding **high-end and ultra-premium brassware** market and unacceptable to our major customer Lefroy Brooks.

The latest addition to the [redacted] which is a sulphate-based trivalent chromium plating process and is promoted to 'closely resemble' hexavalent chrome. This has already been trialled in the supplier's laboratory, using examples of our products. The plated samples were examined by our major customer Lefroy Brooks, and they again found that the samples did not meet their expectations and exacting quality standards.

3.2.2 Consultations with customers and suppliers of alternatives

As is demonstrated above, the applicant has consulted its customers on a regular basis and has trialled a variety of alternatives over the last 10 years. Our experience and findings over this period have clearly demonstrated that trivalent chrome is likely to be the only technically, economically and practical alternative to hexavalent chrome and. in time, being capable of matching all the key functionalities of hexavalent chrome.

3.2.3 Data searches

Several sources of information have been evaluated during the compilation of this analysis of alternatives. In addition, the applicant has reviewed data presented as part of other similar applications for authorisation that have already been made under EU REACH.

The AoA for these applications are made available on the ECHA website and these documents were reviewed to ensure that all potential alternative processes to hexavalent chrome electroplating have been considered.

The various sources of information used are:

Literature
BAuA (Federal Institute for Occupational Safety and Health, Germany)
Survey on technical and economic feasibility of the available alternatives for chromium trioxide on the market in hard/functional and decorative chrome plating (2020)
https://www.baua.de/EN/Service/Publications/Report/Gd101.pdf

Websites
BAuA-SUBSPORTplus (Substitution Support Portal)
Federal Institute for Occupational Safety and Health
https://www.subsportplus.eu/EN/Cases/Case-studies-for-selected-substances

European Chemicals Agency (ECHA), public information on alternatives
https://echa.europa.eu/de/alternatives-to-harmful-substances-subject-to-authorisation
Database: shortlisted_alternatives_en.xlsx

Previous applications for authorisation (Examples)

CTAC (EU REACH application ID 0032-03)
Grohe (EU REACH application ID 0034-01)

Using the ECHA database *shortlisted_alternatives_en.xlsx* – 31 of the AfAs were identified as having the Use Name : "*Functional chrome plating with decorative character*" and included "*for sanitary applications*" and *"electroplating of metal substrates"*.
The latest entry on the database was dated May 2024.

3.2.4 Identification of alternatives

Using this data, alternative substances and/or technologies for the use being applied for have been identified.

The selection of alternatives was based on information available on the ECHA database which spans a period of 9 years.

The headline alternatives are detailed below, together with a short initial assessment.

- **Trivalent Chromium Cr(III) based electroplating**

Similar plating process to that used in hexavalent chromium plating. A trivalent chromium plating solution contains dissolved trivalent chromium salts and additives, that act as complexing agents, and boric acid which acts as a buffering agent to control the pH.

There are two different systems available, based on chromium sulphate or chromium chloride. The applicant has already installed the chloride based system and found that the produced finish does not meet some its customers high specification requirements. Sulphate-based trivalent chromium systems are widely regarded as having strong long-term potential to replicate key characteristics of hexavalent chromium, but this system still currently faces technical and aesthetic limitations that require further R&D.

Out of the 22 ECHA AfAs referencing *Trivalent Chromium Cr(III) based electroplating* as a potential alternative, 11 considered the process to be the most promising alternative.
Headline decision : Shortlisted

- **CVD - Chemical vapour deposition**

Chemical Vapor Deposition (CVD) works by introducing reactive gases into a heated chamber, where they chemically react or decompose on a substrate surface to form a solid, high-purity coating. CVD coatings are neither technically nor economically feasible as an alternative to metallic hexavalent chrome coatings. This makes CVD a very limited alternative for only some kinds of substrates and applications. It cannot replicate the bright chrome aesthetic demanded in sanitaryware, not suitable for parts with internal threads or narrow cavities. High setup cost and slower throughput limits its viability.

Out of the 3 ECHA AfAs referencing *CVD - Chemical vapour deposition* as a potential alternative, 0 considered the process to be the most promising alternative.
Headline decision : Not Shortlisted

- **DLC - Diamond like carbon**

Diamond-like carbon (DLC) coatings work by depositing an ultra-thin layer of amorphous carbon onto a substrate using vacuum-based processes like PVD. This layer mimics the hardness and low friction of diamond while remaining chemically inert and biocompatible. It is not technically nor economically feasible as an alternative, furthermore it does not yield a chrome -like colour and fails to meet a fundamental requirement. No further evaluation is justified.

Out of the 3 ECHA AfAs referencing *DLC - Diamond like carbon* as a potential alternative, 0 considered the process to be the most promising alternative.
Headline decision : Not Shortlisted

- **Electroless nickel plating**

Electroless nickel plating is an autocatalytic chemical process that deposits a uniform layer of nickel-phosphorus or nickel-boron alloy onto a substrate without using electricity. Electroless nickel as an alternative is not technically nor economically feasible. The bright silvery-bluish appearance of hexavalent chrome cannot be reached with an electroless nickel layer, as this layer shows a slightly yellow appearance. Electroless nickel coatings provide a functional, but not a decorative finish.

Out of the 4 ECHA AfAs referencing *Electroless nickel plating* as a potential alternative, 0 considered the process to be the most promising alternative.
Headline decision : Not Shortlisted

- **PVD - Physical Vapour Deposition**

PVD – Physical Vapour Deposition, refers to a vacuum coating process in which a film of coating material is deposited atom by atom on the substrate material by the process of condensation from the vapour phase to the solid phase. The two most common PVD Coating processes are Sputtering and Thermal Evaporation.

With respect to PVD based processes, the technical feasibility is not comparable to coatings obtained from chromium trioxide based electroplating. In addition, transition to PVD based processes would lead to very high investment costs and the coating time is usually significantly higher resulting in increased costs per part and thus a reduced competitiveness.

Technical limitations include surface roughness and aesthetics. The process is incompatible with complex geometries and small internal cavities.

Out of the 14 ECHA AfAs referencing *PVD - Physical Vapour Deposition* as a potential alternative, 0 considered the process to be the most promising alternative.
Headline decision : Shortlisted

- **Lacquer + PVD + Lacquer systems**

The Lacquer + PVD + Lacquer system is a multilayer decorative coating process that combines organic and inorganic layers to achieve a tailored surface finish. It involves three sequential steps: base lacquer application, physical vapor deposition (PVD), and a final clear lacquer topcoat. The base layer provides the initial colour tone or adhesion enhancement and needs to be cured. A PVD Coating is then applied using a vacuum chamber. Chromium is vaporized and deposited onto the lacquered surface. This inorganic layer adds metallic sheen, hardness, and wear resistance. The final layer of clear lacquer is applied to enhance gloss, protect against corrosion, and seals the surface. Final curing ensures durability and aesthetic stability.
Apparently, this process is in use for some interior automotive applications and was developed as an alternative for Cr(VI) plating on plastic articles. The process lines involve high capital and operational cost. Organic-inorganic interfaces may delaminate under stress or poor surface preparation. R&D is still ongoing, but the process is unlikely to ever be a suitable process for the applicant's requirements.
Out of the 8 ECHA AfAs referencing *Lacquer + PVD systems* as a potential alternative, 0 considered the process to be the most promising alternative.
Headline decision : Not Shortlisted

- **Powder coating**

Powder coating on brass involves applying a metallic-effect powder, typically silver or chrome-look formulations, via electrostatic spraying, followed by thermal curing to form a continuous, decorative finish. While true mirror-like chrome reflectivity is not fully achievable, advanced powder systems can approximate a bright metallic appearance. Powder coatings are not a technically feasible alternative to metallic chrome coatings applied by electroplating.

Out of the 3 ECHA AfAs referencing *Powder coating* as a potential alternative, 0 considered the process to be the most promising alternative.
Headline decision : Not Shortlisted

- **Stainless steel**

Stainless steel as an alternative substrate is neither comparable nor competitive in our market sector. Inability to achieve chromium-like colour and insufficient surface hardness and wear resistance. Unsuitable surface finish. Inadequate corrosion resistance.

Out of the 5 ECHA AfAs referencing *Stainless steel* as a potential alternative, 0 considered the process to be the most promising alternative.
Headline decision : Not Shortlisted

- **Wet lacquering/ colour painting**

Wet lacquers are not technically feasible as an alternative to metallic chrome coatings, as the requirement for a high aesthetic appearance is not fulfilled. Wet lacquer coatings may be an alternative for applications requiring fewer demanding characteristics. R&D is ongoing in the automotive sector to improve the technical functionality of wet lacquering for applications with a non-bright chrome requirement.

Out of the 3 ECHA AfAs referencing *Wet lacquering/ colour painting* as a potential alternative, 0 considered the process to be the most promising alternative.
Headline decision : Not Shortlisted

Summary
In conclusion, *Trivalent Chromium Cr(III) based electroplating* and *PVD - Physical Vapour Deposition* have been shortlisted as plausible alternatives.

Amongst others, these shortlisted alternatives were considered in the *Survey on technical and economic feasibility of the available alternatives for chromium trioxide on the market in hard/functional and decorative chrome plating (2020*). Published by BAuA (Federal Institute for Occupational Safety and Health, Germany)

They concluded: *As surfaces deposited from chromium trioxide electrolytes serve multiple purposes in the product, it is challenging to find a one-to-one replacement or single alternative technology which can fulfil all requirements in different areas of application at once. This can pose a relevant economic problem for small or medium sized electroplating subcontractors, who cannot afford to provide several different alternative processes, but would have to in order to serve their diverse clients' needs. In the scope of this survey – without claiming completeness – several applications were identified where currently none of the discussed alternatives are technically feasible.*

The AfA submitted by CTAC (EU REACH application ID 0032-03) to ECHA in 2015, stated "*as of today, no complete chromium trioxide free process, providing all the required properties to the surfaces of all articles in the scope of this application, is industrially available*".

This consortium included several of the largest suppliers in Europe of electroplating and surface engineering wet chemistry, clearly confirming the absence of a 'drop in' replacement for chromium trioxide.

3.2.5 Shortlist of alternatives

The most relevant coating technology with potential, in the future, to replace the current use of hexavalent chrome is shown in Table 3.1.

Table 3.1 Shortlisted alternatives

Name	CAS or EC Number	Description of alternative
Trivalent Chromium Cr(III) based electroplating -Chloride	N/A	Chromium electroplating using a trivalent chromium- chloride based processing solution

Trivalent Chromium Cr(III) based electroplating - Sulphate	N/A	Chromium electroplating using a trivalent chromium- sulphate based processing solution
PVD - Physical Vapour Deposition	N/A	Physical Vapour Deposition to produce a metallic chromium coating

3.3 Assessment of shortlisted alternatives

3.3.1. Alternative 1: Trivalent Chromium Cr(III) electroplating - Chloride

3.3.1.1 General description of Alternative 1

Trivalent chromium Cr(III) and hexavalent chromium Cr(VI) based electroplating processes are similar in principle, where the hexavalent chromium is replaced by a mixture of substances which ultimately produces trivalent plating technology, using similar plant and equipment.

Chromium electroplating with the trivalent chromium chemistry still enables the deposition of the thin metallic chromium onto components.

The component to be coated is immersed in the trivalent chromium plating solution, which contains dissolved trivalent chromium salts and additives, that act as complexing agents, and boric acid which acts as a buffering agent to control the pH.

The actual composition of the chromium trioxide plating solution depends on the performance requirement of the coating. The most commonly used types of chemistry is either sulphate based or chloride based chromium trioxide.

There are several major differences in the technology to be considered, such as:

- the complex chemical composition of the plating solution and its control
- the strict operating parameters necessary
- the need for additional ancillary equipment such as ion exchangers.

It must be noted that the transition to trivalent chrome plating involves significant capital investment.

Alternative 1 focusses on the chloride based variant of trivalent plating technology.

3.3.1.2 Availability of Alternative 1

Chloride based trivalent chromium electroplating technology is available worldwide and is being used in a variety of indoor decorative applications. In fact, the applicant has already installed this technology, however, the issue arises where trivalent chromium does not meet all the performance requirements for the particular use being applied for, as is the case for this applicant.

3.3.1.3 Safety considerations related to using Alternative 1

This trivalent chromium process involves the use of many more substances than just the one substance required by hexavalent chrome. The following are typically required in chloride based trivalent chromium electroplating solutions:

- Chromium trichloride hexahydrate ($CrCl_3 \cdot 6H_2O$) EC: 629-714-6 CAS: 10060-12-5
- Boric Acid (H_3BO_3) EC: 233-139-2 CAS: 10043-35-3
- Ammonium Chloride (NH_4Cl) EC: 235-186-4 CAS: 12125-02
- Complexing Agents to stabilize Cr(III) ions and control deposition
- Stabilizers to suppress the formation of Cr(VI)

Chromium Trichloride Hexahydrate shown above has several hazards according to CLP:

Corrosive to metals (H290): It may corrode metals
Acute toxicity, Oral (H302): Harmful if swallowed
Skin sensitization (H317): May cause an allergic skin reaction
Short-term (acute) aquatic hazard (H401): Toxic to aquatic life
Long-term (chronic) aquatic hazard (H411): Toxic to aquatic life with long-lasting effects

Boric Acid shown above has a severe hazard according to CLP:

Reproductive toxicity (H360FD): May damage fertility or the unborn child

Ammonium Chloride has several hazards according to CLP:

Acute toxicity, Oral (H302): Harmful if swallowed
Serious eye irritation (H319): Causes serious eye irritation

It is the applicants view that the hazards listed above are no greater than those already being controlled on the current hexavalent chrome process on the plating line.

Nevertheless, the trivalent chrome process increases the use of boric acid, a **Substance of Very High Concern** (SVHC), on the plating line, The concentration of boric acid in a chloride based trivalent plating solution is 60 g/l, whereas boric acid is not required by hexavalent chromium plating solutions.

Boric acid is included on the UK REACH/ECHA Candidate List of SVHCs. It was added in 2010 due to its classification as toxic for reproduction under Article 57(c) of the REACH Regulation.

In general, the trivalent electroplating processes are less toxic than chromium trioxide plating due to the oxidation state of the chromium and do not pose serious air emission issues.

3.3.1.4 Technical feasibility of Alternative 1

As previously stated, our core customer, specifically requests the traditional hexavalent chrome for their components because it matches the very specific performance characteristics. Performance characteristics relate to corrosion resistance, chemical resistance and resistance to wear and abrasion. Other specific requirements relate to UV resistance, heat resistance, colour and shine stability, surface consistency and smoothness.

The principal decisive factor for any technically feasible alternative is its ability to fully replicate the very specific and essential characteristics without compromise.

Regarding the alternative process, it should be able to plate on a variety of base materials such as steel, castings, zinc die-castings and brass. Our current pretreatment process is optimised exclusively for brass substrates; however, we are actively exploring the repurposing of under-utilised tanks to support additional pretreatment facilities.

Our research and experience, confirms that the trivalent chrome process differs from the hexavalent chrome process in a number of important ways. Additional plant and equipment was required, along with the need for significantly tighter process control procedures. Trivalent chrome solutions are very sensitive to impurities; therefore an ion exchange unit was required to remove contaminants on a continual basis. The current ion exchange unit operates 24 hours per day. Components being processed need to be totally free of contamination from previous processing stages and therefore extra rising stages were required before the trivalent chromium plating tank.

Trivalent chromium chemistry is much more sensitive to temperature change and to changes in the pH of the plating solution. Even small deviations in the process conditions can strongly influence the deposition success, the layer quality, performance, and the final appearance.

As mentioned previously, the principal decisive factor for any technically feasible alternative is its ability to fully replicate the very specific and essential characteristics without compromise. This is examined in detail below:

Corrosion resistance

The corrosion resistance of electroplated chromium using trivalent chromium chemistry is dependent on many differing parameters. These include the type of process chemistry being used, the electroplated under-layers and any potential post-treatments used to enhance the corrosion resistance. A range of previous applicants for authorisation have demonstrated and concluded that the corrosion resistance of trivalent chromium electroplating does not currently meet the requirements of customers in this very demanding high-end and ultra-premium market sector.

BS EN ISO 1456:2009 provides a structured framework for selecting corrosion tests based on service-condition numbers, ensuring that electroplated coatings are evaluated under conditions representative of their intended use. Neutral salt spray (NSS) testing durations increase with environmental severity.

Chemical resistance

A range of previous applicants for authorisation have demonstrated and concluded that the chemical resistance of electroplated chromium using trivalent chromium chemistry is lower than when using hexavalent chromium trioxide. It is concluded that the chemical resistance of trivalent chromium electroplating does not currently meet the requirements of customers in this very demanding high-end and ultra-premium market sector.

Hardness and resistance to wear and abrasion

Although these terms are often seen as interchangeable, wear is the loss of material from the surface of a material and abrasion is one of the actions which can cause wear. The chromium plating produced from trivalent chemistry tends to have a lower hardness and therefore lower wear resistance. It is reported that research and development continues with regards to modifying the process parameters in order to improve this condition.

The finish must be resistant to wear and abrasion to prevent breakthrough to the underlying nickel layer, which, if exposed, may corrode and release nickel ions. The chromium topcoat is thin (typically 0.2–0.5 µm) and primarily serves as a sacrificial, wear-resistant barrier. If worn through, the underlying nickel layer is exposed, which can corrode and leach metals.

This is particularly critical for components in contact with drinking water, where nickel release is regulated under the Water Supply (Water Quality) Regulations 2016. Regular use of abrasive cloths or scouring agents can erode the thin chromium layer, especially on sanitary fittings, increasing the risk of nickel exposure. Prolonged exposure can cause dermatitis and, at higher levels, systemic toxicity

It is concluded that the hardness and resistance to wear and abrasion of trivalent chromium electroplating does not currently meet the requirements of the applicant's customers who operate in a very demanding high-end and ultra-premium market sector.

Colour and shine stability

The colour and appearance of trivalent chromium deposits vary depending on the composition of the process solution and the specific additives employed. These formulations are designed and promoted to replicate the bright, mirror-like finish traditionally associated with hexavalent chromium plating.

The differences in hue and reflectivity persist due to the inherent chemistry of the trivalent system. Trivalent chrome deposits from chloride based systems are typically darker and less reflective with a yellowish/brownish colour and not comparable to the silvery-bluish colour of a hexavalent based chrome coating.

Additives used to boost plating speed often contributes to the darker tone. Our chemistry supply partner suggests that adjusting certain operating parameters could provide a more whitish appearance to the finished deposit. [redacted] But working outside recommended operating parameters does not go without risk. Plating issues such as poor adhesion, plating defects and general process instability often ensues.

The visual appearance of components that are plated using this trivalent chromium chemistry does not currently meet the requirements and expectations of the applicant's customers who operate in a very demanding high-end and ultra-premium market sector.

Surface consistency and smoothness

The surface consistency of the deposit produced by trivalent chromium electroplating varies according to the make-up of the process solution and any impurities present. The surface quality can be so variable that it does not currently meet the requirements and expectations of the applicant's customers in the very demanding high-end and ultra-premium market sector.

UV Resistance

UV resistance of the chromium electroplating from this trivalent chromium chemistry is deemed to be acceptable for this particular use.

Heat Resistance

The heat resistance of the chromium electroplating from trivalent chromium chemistry is deemed to be acceptable for this particular use.

On the basis of this review, the conclusion is that a chloride based trivalent chromium electroplating system is not a technically feasible alternative to the traditional hexavalent chrome system at this time.

This is confirmed by the rejection of this finish by the applicant's major customer, who operates in a very demanding high-end and ultra-premium market sector.

3.3.1.5 Economic feasibility of Alternative 1

The applicant has operated its chloride-based trivalent chromium plating process for several years. The initial capital investment and commissioning costs were substantial, and ongoing operational expenditure remains significantly higher than those associated with its proven and established hexavalent chromium process.

Plant, Equipment and Infrastructure

The process line had to be re-engineered to account for the ion exchange process and the extra rinsing requirements to avoid impurities. It was not possible to run both chrome plating systems in tandem during transition. Temporary outsourcing plating arrangements had to be made, with a considerable amount of disruption. Lead times for deliveries to its customers went from weeks to months.

An ion exchange unit had to be purchased (capital investment & increased energy consumption) to ensure that any impurities in the trivalent chromium process were removed.

Start up

New graphite anodes with hangers made of titanium were purchased for the new trivalent chromium process. The hexavalent chrome process uses lead anodes. Fresh solution make-up chemicals were purchased. In a replacement situation there would be disposal costs involved in the removal of the existing hexavalent chromium solution from the site, but this process remains operational.

Running costs

Regular solution maintenance is essential since the trivalent chromium process chemistry requires more substances and additives. Compared to the hexavalent process, the operating costs are significantly higher.

On the basis of this review, the applicant has found that the chloride based trivalent chromium electroplating technology has not been an economically feasible alternative to the traditional hexavalent chrome system.

3.3.1.6 Suitability of Alternative 1 for the applicant and in general

With respect to the very specific performance requirements of the coatings for the use being applied for, the use of the chloride based trivalent chromium electroplating technology has not been a viable alternative and is not likely to be so in the foreseeable future.

3.3.2. Alternative 2: Trivalent Chromium Cr(III) electroplating - Sulphate

3.3.2.1 General description of Alternative 2

Trivalent chromium Cr(III) and hexavalent chromium Cr(VI) based electroplating processes are similar in principle, where the hexavalent chromium is replaced by a mixture of substances which ultimately produces trivalent plating technology, using similar plant and equipment.

Chromium electroplating with the trivalent chromium chemistry still enables the deposition of the thin metallic chromium onto components.

The component to be coated is immersed in the trivalent chromium plating solution, which contains dissolved trivalent chromium salts and additives, that act as complexing agents, and boric acid which acts as a buffering agent to control the pH.

The actual composition of the chromium trioxide plating solution depends on the performance requirement of the coating. The most commonly used types of chemistry is either sulphate based or chloride based chromium trioxide.

There are several major differences in the technology to be considered, such as:

- the complex chemical composition of the plating solution and its control
- the strict operating parameters necessary
- the need for additional ancillary equipment such as ion exchangers.

It must be noted that the transition to trivalent chrome plating involves significant capital investment.

Alternative 2 focusses on the sulphate based variant of trivalent plating technology.

3.3.2.2 Availability of Alternative 2

Sulphate based trivalent chromium electroplating technology is available worldwide and is being used in a variety of indoor decorative applications. However, the issue arises where trivalent chromium does not meet all the performance requirements for the particular use being applied for.

3.3.2.3 Safety considerations related to using Alternative 2

The trivalent chromium process involves the use of many more substances than just the one substance required by hexavalent chrome. The following are typically required in sulphate based trivalent chromium electroplating solutions:

- Chromium(III) Sulphate ($Cr_2(SO_4)_3$) EC: 233-253-2 CAS: 10101-53-8
- Boric Acid (H_3BO_3) EC: 233-139-2 CAS: 10043-35-3
- Ammonium Sulphate ($(NH_4)_2SO_4$) EC: 231-984-1CAS: 7783-20-2
- Complexing Agents to stabilize Cr(III) ions and control deposition
- Stabilizers to **s**uppress the formation of Cr(VI)

Chromium(III) Sulphate shown above has several hazards according to CLP:

Acute toxicity, Oral (H302): Harmful if swallowed
Acute toxicity, Dermal (H312): Harmful in contact with skin
Acute toxicity, Inhalation (H332): Harmful if inhaled
Skin corrosion (H314): Causes severe skin burns and eye damage
Serious eye damage (H318): Causes serious eye damage

Boric Acid shown above has a severe hazard according to CLP:

Reproductive toxicity (H360FD): May damage fertility or the unborn child

Ammonium Sulphate according to CLP:

Not classified as hazardous

It is the applicants view that the hazards listed above are no greater than those already being controlled on the current hexavalent chrome process on the plating line.

Nevertheless, the trivalent chrome process increases the use of boric acid, a Substance of Very High Concern (SVHC), on the plating line. The concentration of boric acid in a sulphate based trivalent plating solution is 70 g/l, whereas boric acid is not required by hexavalent chromium plating solutions. (60 g/l for a chloride based trivalent solution)

Boric acid is included on the UK REACH/ECHA Candidate List of SVHCs. It was added in June 2010 due to its classification as toxic for reproduction under Article 57(c) of the REACH Regulation.

In general, the trivalent electroplating processes are less toxic than chromium trioxide plating due to the oxidation state of the chromium and do not pose serious air emission issues.

3.3.2.4 Technical feasibility of Alternative 2

As previously stated, our major customer, specifically requests the traditional hexavalent chrome for their components because it matches the very specific performance characteristics. Performance characteristics relate to corrosion resistance, chemical resistance and resistance to wear and abrasion. Other specific requirements relate to UV resistance, heat resistance, colour and shine stability, surface consistency and smoothness.

The principal decisive factor for any technically feasible alternative is its ability to fully replicate the very specific and essential characteristics without compromise.

Regarding the alternative process, it should be able to plate on a variety of base materials such as steel, castings, zinc die-castings and brass. Our current pretreatment process is optimised exclusively for brass substrates; however, we are actively exploring the repurposing of under-utilised tanks to support additional pretreatment facilities.

Our research and experience, confirms that the trivalent chrome process differs from the hexavalent chrome process in a number of important ways.

Additional plant and equipment will be necessary for the sulphate-based trivalent chrome system, alongside even more rigorous process control measures than those required for chloride-based operation. These again relate to the strict control of metal contamination. For example, copper contamination must be restricted to <2mg/l whereas for the chloride based system this figure rises to <10mg/l. The current ion exchange unit which operates 24 hours per day may not alone be capable of achieving these new tolerances and it may be necessary to incorporate additional filtration mechanisms.

For trivalent chrome systems, copper contamination can cause plating defects at concentrations as low as 3–4 mg/l. Hexavalent chrome plating systems can tolerate significantly higher levels..

Copper contamination is critical and must be avoided. Anode rails will have to be protected by PVC coating , titanium wrap or similar.

The solution complexity and strict additive replenishment regimes inherent to sulphate based systems make automatic dosing systems essential for consistent process control. At least 3 pumps and associated equipment will be required.

Trivalent chromium chemistry is much more sensitive to change in temperature and pH. Even small deviations in the process conditions can strongly influence the deposition success, the layer quality, performance, and the final appearance.

As mentioned previously, the principal decisive factor for any technically feasible alternative is its ability to fully replicate the very specific and essential characteristics without compromise. This is examined in detail below:

Corrosion resistance

The corrosion resistance of electroplated chromium using trivalent chromium chemistry is dependent on many differing parameters. These include the type of process chemistry being used, the electroplated under-layers and any potential post-treatments used to enhance the corrosion resistance. A range of previous applicants for authorisation have demonstrated and concluded that the corrosion resistance of trivalent chromium electroplating does not currently meet the requirements of customers in this very demanding high-end and ultra-premium market sector.

BS EN ISO 1456:2009 provides a structured framework for selecting corrosion tests based on service-condition numbers, ensuring that electroplated coatings are evaluated under conditions representative of their intended use. Neutral salt spray (NSS) testing durations increase with environmental severity.

Chemical resistance

A range of previous applicants for authorisation have demonstrated and concluded that the chemical resistance of electroplated chromium using trivalent chromium chemistry is lower than when using hexavalent chromium trioxide. It is concluded that the chemical resistance of trivalent chromium electroplating does not currently meet the requirements of customers in this very demanding high-end and ultra-premium market sector.

Hardness and resistance to wear and abrasion

Although these terms are often seen as interchangeable, wear is the loss of material from the surface of a material and abrasion is one of the actions which can cause wear. The chromium plating produced from trivalent chemistry tends to have a lower hardness and therefore lower wear resistance. It is reported that research and development continues with regards to modifying process parameters in order to improve this condition.

The finish must be resistant to wear and abrasion to prevent breakthrough to the underlying nickel layer, which, if exposed, may corrode and release nickel ions. The chromium topcoat is very thin (typically 0.03–0.08 µm) which is far less than the chloride based deposit of 0.2–0.5 µm and primarily serves as a sacrificial, wear-resistant barrier. If worn through, the underlying nickel layer is exposed, which can corrode and leach metals.

This is particularly critical for components in contact with drinking water, where nickel release is regulated under the Water Supply (Water Quality) Regulations 2016. Regular use of abrasive cloths or scouring agents can erode the thin chromium layer, especially on sanitary fittings, increasing the risk of nickel exposure. Prolonged exposure can cause dermatitis and, at higher levels, systemic toxicity

It is concluded that the hardness and resistance to wear and abrasion of trivalent chromium electroplating does not currently meet the requirements of the applicant's customers who operate in a very demanding high-end and ultra-premium market sector.

Colour and shine stability

The colour and appearance of trivalent chromium deposits vary depending on the composition of the process solution and the specific additives employed. These formulations are designed and promoted to replicate the bright, mirror-like finish traditionally associated with hexavalent chromium plating

The differences in hue and reflectivity persist due to the inherent chemistry of the trivalent system. Trivalent chrome deposits from sulphate based systems are typically brighter but still less reflective and not comparable to the bright silvery-bluish colour of a hexavalent based chrome coating.

The brighter appearance is provided by the significantly reduced plating rate (typically 0.03–0.05µm per minute) and the reduced deposit thickness which reduces optical distortion and enhances reflectivity.

The visual appearance of components that are plated using this trivalent chromium chemistry does not currently meet the requirements and expectations of the applicant's customers who operate in a very demanding high-end and ultra-premium market sector.

Surface consistency and smoothness

The surface consistency of the deposit produced by trivalent chromium electroplating varies according to the make-up of the process solution and any impurities present. The surface quality can be so variable that it does not currently meet the requirements and expectations of the applicant's customers in the very demanding high-end and ultra-premium market sector.

UV Resistance

UV resistance of the chromium electroplating from this trivalent chromium chemistry is deemed to be acceptable for this particular use.

Heat Resistance

The heat resistance of the chromium electroplating from trivalent chromium chemistry is deemed to be acceptable for this particular use.

On the basis of this review, the conclusion is that a sulphate based trivalent chromium electroplating system is not a technically feasible alternative to the traditional hexavalent chrome system at this time.

This is confirmed by the rejection of this finish by the applicant's major customer, who operates in a very demanding high-end and ultra-premium market sector. Samples have been produced by our chemistry supply partner using this technology in their laboratory.

3.3.2.5 Economic feasibility of Alternative 2

The applicant has operated its chloride-based trivalent chromium plating process for several years. The initial capital investment and commissioning costs were substantial. Additional investment will be necessary, and the ongoing operational expenditure of a sulphate based trivalent chrome system will remain significantly higher than those associated with its proven and established hexavalent chromium process.

Plant, Equipment and Infrastructure

For the chloride based system, the process line had to be re-engineered to account for the ion exchange process and the extra rinsing stations. It is expected that the line will have to be modified further to accommodate additional filtration for the significantly less contamination tolerant sulphate based system. During the installation of the chloride based system it was not possible to run both chrome plating systems in tandem during transition. Temporary outsourcing plating arrangements had to be made, with a considerable amount of disruption. Lead times for deliveries to its customers went from weeks to months.

Start up

New inert Mixed Metal Oxide anodes will have to be purchased for the new sulphate based trivalent chromium process. The hexavalent chrome process uses lead anodes. Fresh solution make-up chemicals will have to be purchased. There would be disposal costs involved in the removal of both the hexavalent chromium solution and the chloride based solution.

Running costs

Regular solution maintenance is essential since the trivalent chromium process chemistry requires significantly more substances and additives. Compared to the hexavalent process, the operating costs are significantly higher.

Setting up a chloride-based trivalent chrome plating system is generally less costly and operationally simpler than a sulphate-based system, due to lower equipment demands, faster plating rates, and reduced additive sensitivity. Sulphate systems require more precise controls, expensive anodes, and additional infrastructure. Although not accurately costed, an unquantified estimate of plant modifications and setup coats would be in excess of £20,000.

On the basis of this review, the applicant has found that a sulphate based trivalent chromium electroplating technology would not be an economically feasible alternative to the traditional hexavalent chrome system.

3.3.2.6 Suitability of Alternative 2 for the applicant and in general

With respect to the very specific performance requirements of the coatings for the use being applied for, the use of a sulphate based trivalent chromium electroplating technology is not considered as a suitable alternative for this particular use and is not likely to be so in the foreseeable future.

3.3.3. Alternative 3: PVD - Physical Vapour Deposition

3.3.3.1 General description of Alternative 3

PVD – Physical Vapour Deposition, refers to a vacuum coating process in which a film of coating material is deposited atom by atom on the substrate material by the process of condensation from the vapour phase to the solid phase. The two most common PVD Coating processes are Sputtering and Thermal Evaporation.

Sputtering involves the bombardment of the coating material known as the target with a high energy electrical charge causing it to "sputter" off atoms or molecules that are deposited on a substrate.

Thermal Evaporation involves elevating a coating material to the boiling point in a high vacuum environment causing a vapor stream to rise in the vacuum chamber and then condense on the substrate.

BAuA(2020) indicates that titanium nitride (TiN), titanium-aluminium nitride (TiAlN), zirconium nitride (ZrN), chromium nitride (CrN), chromium carbide (CrC), silicon carbide (SiC), titanium carbide (TiC), and tungsten carbide (WC) are examples of PVD coating materials.

3.3.3.2 Availability of Alternative 3

PVD coatings are widely available and are used on machining & cutting Tools, in metal forming & stamping, on plastic moulding & injection tools, in die casting, on medical & food-grade equipment and on specific decorative & consumer products

3.3.3.3 Safety considerations related to using Alternative 3

In terms of substance / chemical use, PVD type coatings show a reduction in risk as they currently do not use any substances that are classified as Substances of Very High Concern.

3.3.3.4 Technical feasibility of Alternative 3

As previously stated, our major customer, specifically requests the traditional hexavalent chrome for their components because it matches the very specific performance characteristics. Performance characteristics relate to corrosion resistance, chemical resistance and resistance to wear and abrasion. Other specific requirements relate to UV resistance, heat resistance, colour and shine stability, surface consistency and smoothness.

The principal decisive factor for any technically feasible alternative is its ability to fully replicate the very specific and essential characteristics without compromise.

BAuA(2020) and other sources suggest that PVD coatings have the following technical limitations when being considered for this particular use:

Corrosion resistance

PVD coatings can suffer from poor corrosion resistance and research is still ongoing. Combination PVD processes, incorporating lacquer coating stages are now offering increased corrosion resistance. Currently the PVD coatings do not meet the corrosion resistance requirements for this use.

Chemical resistance

PVD coatings are promoted as having good resistance to mild acids (but depends on coating type) and is generally resistant to alkalis (especially CrN). This needs to be independently verified for sanitaryware applications and the particular use in this AfA.

Hardness and resistance to wear and abrasion

PVD Coatings can produce very high hardness coatings, but this can lead to internal stresses being developed during processing. Hardness is comparable if not superior to hexavalent chromium but because the coating is extremely thin, the long-term wear can be limited.

Colour and shine stability

It is suggested that a PVD process is capable of matching and even surpassing the mirror finish and bluish tint of hexavalent chrome plating. The survey by BAuA(2020) proposes otherwise.

Surface consistency and smoothness

The surface consistency of PVD finishes is deemed to be acceptable for this particular use.

UV Resistance

PVD coatings generally offer good UV resistance, especially when paired with UV-curable topcoats. However, standalone PVD layers may require additional protection for the particular use in this AfA

Heat Resistance

The heat resistance of PVD finishes is deemed to be acceptable for this particular use.

Other Considerations

Vacuum/Geometry: The requirement of a vacuum chamber limits the size and the type of parts that can be coated. It should also be remembered that PVD coatings are line of sight processes and are not suitable for complex geometries and large parts, such as radiators and towel warmers.

Operating parameters: The process conditions for PVD require sub-atmospheric pressures and temperatures between 150 and 600°C. Process temperature, especially towards the upper limit can restrict the substrate materials that can be coated.

Cleanliness: PVD coatings require an atomically clean surface because they are highly sensitive to contaminants (e.g. water, oils and paints) on the surface to be coated. In fact, inadequate or non-uniform ion bombardment leads to weak and porous coatings and is the most common cause of failure in PVD coating. Therefore, an extremely efficient cleaning and drying method is required for this process.

Training: A significant re-training programme would be required for the current employees to firstly understand the PVD process, know how to use it safely and how to maintain it in a safe working manner. The current electroplating process does not use any vacuum or vapourising technologies.

When considering the technical feasibility of alternative 3, it is not considered to meet all the technical requirements for this use.

3.3.3.5 Economic feasibility of Alternative 3

Despite the technical shortcomings of the PVD coating processes, the following overview has been compiled using BAuA(2020) and other sources.

If a change from electroplated chromium using chromium trioxide to a PVD Coating was envisaged, the installation of a completely new production line would be required, since PVD coatings cannot be produced on existing electroplating lines, it is a complete change of technology.

The throughput of a typical PVD coating process (including cleaning & loading) would be considerably lower than that for electroplating by a factor of almost 50%. The typical operating costs can often be 30-40% higher.

The initial start-up costs of a single PVD process would be about £250,000, and it is uncertain that the new process would be capable of processing the typical components for the particular use in this AfA. Indicative estimates point to a potential fourfold increase in the finishing cost of a part.

The capital investment required, together with the reduced throughput and increased unit cost would be unsustainable and be prohibitive for the applicant.

When considering the economic feasibility of alternative 3, it is not considered to be a valid alternative at present.

3.3.3.6 Suitability of Alternative 3 for the applicant and in general

BAuA(2020) concludes that:

PVD, with its diverse coating materials, can be applied as a substitute for hard chrome coating where restrictions regarding geometry, material properties or corrosion resistance do not apply. The process is carried out economically for machine parts, cutting gear or forming tools, which require high wear resistance but no or only low corrosion resistance.

However, application for sanitary products as well as high-end manual tools is seen as neither economically nor technically feasible.

The ECHA database *shortlisted_alternatives_en.xlsx,* offers a range of conclusions on the suitability of PVD for the typical components for the particular use in this AfA:

Generally, PVD technologies are commercially available. However, they are still not commonly applied in the sanitary sector and not yet fully available for industrial production.

Technical requirements regarding corrosion resistance, wear/abrasion resistance and the chemical resistance of the sanitary sector are not met.

Economically infeasible due to the applicants no experience on the PVD technology.

Additionally, there are still several uncertainties e.g. regarding the availability of the PVD systems and regarding the processing of different geometries covering a broad spectrum of products.

The applicant has concluded that, with respect to the very specific performance requirements of the coatings for the use being applied for and the excess cost involved, the use of PVD would not be a viable alternative and is not likely to be so in the foreseeable future.

3.4 Conclusion on shortlisted alternatives

Whilst all the three potential alternative coatings have successfully replaced hexavalent chromium trioxide in variety of decorative chromium environments, for the specific products with the very specific technical and performance requirements, none of them are currently considered to be viable alternatives for this particular use.

4. SOCIO-ECONOMIC ANALYSIS

4.1 Continued use scenario

4.1.1 Summary of substitution activities

The applicant has researched the potential alternatives to chromium trioxide and has practical experience of the components produced from the trivalent chromium plating technology. They continue to work with their preferred chemistry supplier who offer sample components, plated under laboratory conditions, when new developments become available.

On assessment, none of the alternatives satisfy all the performance characteristics and any of the visual characteristics that is required by our customers and end users.

The most significant performance characteristics being corrosion resistance, chemical resistance, hardness and resistance to wear and abrasion, no alternative is able to satisfy these criteria.

To the end user, the most important visual characteristics are colour and shine stability, surface consistency and smoothness. The component parts should have the same appearance and match all other chromium plated parts in their luxury and exclusive bathroom regardless of when or where they are sourced. None of the potential alternatives can satisfy these requirements.

4.1.2 Conclusion on suitability of available alternatives in general

Since currently available alternatives are unacceptable for our extremely demanding **high-end and ultra-premium brassware** market and our major customer Lefroy Brooks, the conclusion is that the applicant has no available or potential alternative, likely to be introduced for the foreseeable future. Furthermore, hexavalent chromium has been authorised to be used by competitors in the high-end sanitary ware sector. Therefore, it is not possible to produce a substitution plan.

4.1.3 R&D plan

The applicant is a small enterprise, as defined in the EU recommendation 2003/361, and does not have the resources and access to funds to perform individual R&D activities.

The applicant relies entirely on the R&D carried out by the major process chemistry suppliers.

We have a good working relationship with our chemistry supplier, and they are eager to improve the visual and performance characteristics that are available from the trivalent chromium plating technology they supply to us.

The costs involved in R&D are prohibitive to small businesses and platers will simply review samples produced in the laboratories of these major suppliers as and when new plating systems become available.

We are in a privileged position in having feedback from our customers and end users regarding the performance of our chloride based trivalent chrome plated components which are satisfactory for economy-grade components and only suitable for non-critical applications.

Any decisions to proceed with an alternative would be made in partnership with customers who would be the ultimate judge of quality.

The complexity of bespoke bathroom designs can involve components being sourced from a wide range of international suppliers, with uncompromising standards for finish uniformity. Components imported from China, by the applicant's major customer, are often stripped and reprocessed in hexavalent chrome, by the applicant, for them to meet the customer's exacting standards.

Trade associations are also a valuable source of information and have access to research and development activities on a global scale.

4.2 Risks associated with continued use

4.2.1 Impacts on humans

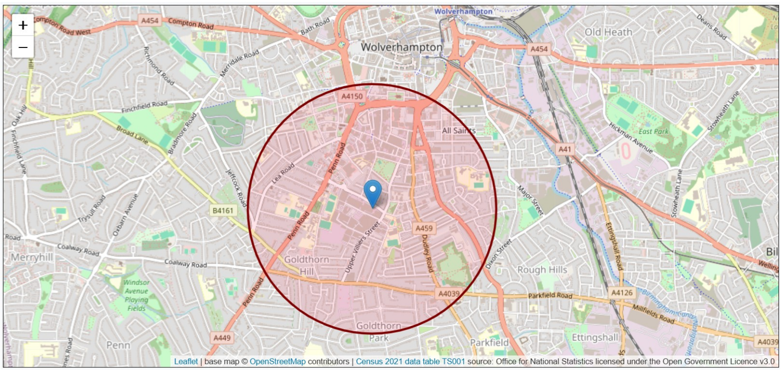
Since the results of the plating workers biological monitoring programme for 2025 are below the background level of hexavalent chromium (Cr(VI)) for the general population (which is typically around 1.9 µmol/mol creatinine) and that there are negligible discharges of chromium trioxide to the environment, it can be concluded there is no excess lifetime risk to individuals (workers or general population) or to the environment.

Nevertheless, as chromium trioxide is classified as a non-threshold carcinogen, the dose response relationship for exposure to chromium trioxide developed by the Risk Assessment Committee of the European Chemicals Agency should be employed to calculate the excess risk.

An assessment of the impact of hexavalent chromium (Cr(VI)) on the local community has been made.

Using the Environment Agency's H1 impact assessment tool the process contribution (PC) has been estimated as below:

Long term PC (ug/m^3) = 0.000002252 (0.90% of Environmental Assessment Level)
Using https://www.datadaptive.com/ an estimate of the population within one kilometre = 16,547



Excess lifetime risk (ELR) is defined as the additional risk of dying from lung cancer due to exposure of toxic substances incurred over the lifetime of an individual.
With reference to RAC-27-2013-06 Rev.1, for the general population, based on an exposure for 70 years (24h/day, every day), the following risk estimates are used:

An excess lifetime lung cancer mortality risk = 2.9 x 10^{-2} per µg Cr(VI)/ m^3.

The excess cancer cases is calculated using the formula:
[Excess cancer cases] = [Long term PC µg/m³] * [Unit risk per µg/m³] * [Exposed population]

A summary of the results is shown in table 4.1

Table 4.1 Estimated Excess Cancer Cases for the general population

Parameter	Reference	Value
Unit Risk (per µg/m³) [A]	RAC/27/2013/06	2.9×10^{-2}
Long-Term PC (µg/m³) [B]	0.000002252 from above	2.252×10^{-6}
Individual Lifetime Risk	[A] * [B]	6.5308×10^{-8}
Population Size [C]	From above	16,547
Estimated Excess Cancer Cases	[A] * [B] * [C]	0.001080651

The worst-case assessment of worker health risks within this socio-economic analysis utilises the results of a study endorsed by ECHA identifying the reference dose response relationship for carcinogenicity of hexavalent chromium. This methodology reflects the preferred approach endorsed by RAC and SEAC and has accordingly been applied in the calculation of occupational cancer risks within this socio-economic analysis.

The total excess risk value from the CSR, table 10.2 (section 10.1.1), is used to make the assessment of health impacts.

Table 4.2 Excess lung cancer mortality risk to a worker covered by this application

	Total excess risk (40 years) [A]
Main Plater	0.00704
Cover Plater	0.00024
Supervisor	0.00342

Table 4.3 Excess risk estimates for 40 years exposure for workers

Directly exposed workers	Number of excess fatal cancer cases predicted over 40 years *
3	0.01070 [B]

Note: * B = Sum of A

The overall cumulative number of excess fatal cancer cases over a 40-year period, for the exposed worker population in this application is calculated to be 0.01070.

The individual development of cancer may be fatal or non-fatal but the dose response excess risk unit coefficient considers only fatal cancer. It must therefore follow that the excess risk of contracting cancer is higher than the excess risk of fatal cancer.

Referencing information provided by the Agency for UK REACH, Table 4.4 shows the monetary values for fatal and non-fatal cancer that were used when revising the estimates provided by authorisation applicants.

Table 4.4 Monetary values for fatal and non-fatal cancer

Value per statistical fatal cancer case	£3.9m - £5.5m [C]
Value per statistical non-fatal cancer case	£0.5m [D]

According to Cancer Research UK, the 5-year survival rate for lung cancer in England is approximately 20%, meaning that 80% of cases are fatal within five years of diagnosis.

Table 4.5 Statistics for lung cancer in England

5-year survival rate	20% [E]
Non-fatal – fatal ratio	1:4
Present Value Factor (PDF): Discounting at 3.5%. and a latency period of 10 years	0.7089 [F]

Note: $PDF=1/(1+r)^n$ where r= discount rate (3.5%) and n= latency period (10 years)

This enables the determination of present value (PV) of the total monetised excess risk (fatal and non-fatal cancer) over 12 years (review period).

Table 4.6 provides an analysis of the additional lifetime risk of contracting lung cancer due to exposure to Cr(VI) incurred over the working lifetime of directly exposed workers performing tasks described in the worker contributing scenarios.

Table 4.6 Summary of additional statistical lung cancer cases

	Number of exposed people	Estimated statistical fatal cancer cases (over 12 years) [1]	Value per statistical fatal cancer case	(PV) Monetised excess risk, fatal (over 12 years) [2]	Estimated statistical non-fatal cancer cases (over 12 years) [3]	Value per statistical non-fatal cancer case	(PV) Monetised excess risk, non-fatal (over 12 years) [4]
Directly exposed workers	3	0.003210 [G]	£3.9m-£5.5m [C]	£8.8k-£12.5k	0.000642 [H]	£0.5m [D]	£0.2k
Local population	16,547	0.000185	As above	£0.5k-£0.7k	0.000037	As above	£0.0k

Notes: 1. Excess risk is estimated over a typical lifetime working exposure (40 years). G = B x 12/40 (70 for population)
2. Calculation C * G * F
3. Calculation H = G * E
4. Calculation D * H * F

The present value (PV) of total monetised excess risk (fatal and non-fatal cancer) over 12 years (review period) = £9,600-£13,500. Sum of [2]+Sum of [4]

Since exposure from the environment is extremely low, the implications of a non-use scenario is only likely to affect the applicant and its customers.

4.3 Non-use scenario

If the application is not granted, the applicant would have to immediately cease using the chrome plating line for the purposes of plating its hexavalent chrome finish. This would have an immediate effect on its sister company, Lefroy Brooks, and all the applicant's other customers.

The applicant, in conjunction with its sister company, expect that without their exceptionally high quality hexavalent chrome-plating facility, the site in Wolverhampton would be closed down. This would result in lost turnover and profits and necessitate approximately 80 redundancies across both businesses.

This closure decision will take place with immediate effect; outstanding orders will not be fulfilled, and all associated contracts will be cancelled accordingly.

Non-use Scenario 6 (NS6) outlines this situation and is an inevitable consequence of the loss of the exceptional standard of hexavalent chrome finish, the applicant provides, which is unmatched anywhere in the UK or elsewhere.

4.3.1 Summary of the consequences of non-use

The closure decision will take place with immediate effect; outstanding orders will not be fulfilled, and all associated contracts will be cancelled accordingly.

Lefroy Brooks holds approximately [redacted] worth of stock, at any given time, which potentially may have to be written off or strategically repurposed to realise some revenue.

The quality of the hexavalent chrome finish required by all the applicant's customers is exceptional. Zero defects is mandatory. The quality of the applicant's hexavalent chrome finish has been refined to such a degree that reject rates are extremely low, which was not the case when using outsourced platers.

In the non-use scenario, the applicant will cease trading with the direct loss of 43 jobs and with the subsequent closure of Lefroy Brooks there will be a further 38 job losses.

There will be an economic effect on the applicant's suppliers of the proprietary plating chemistry, together with the loss of purchase value from the applicant. The total effect has not been quantified in this application.

The Wolverhampton site plays a key role in the local economy, providing direct employment and supports a regional supply chain. In partnership with its sister company, the applicant makes it possible for several local businesses and sole traders to produce component parts, that complement the product range. These parts are subsequently polished and plated in-house.

The closure of the Wolverhampton site is anticipated to have a material impact on the local community and will further contribute to the progressive decline of traditional manufacturing skills across the UK.

The applicant has developed a highly specialised skill set that is exceptionally rare. It is unlikely that any other manufacturer (in the UK or elsewhere) possesses the capability to replicate the design and craftsmanship of the towel rails within the Bard & Brazier product range.

4.3.2 Identification of plausible non-use scenarios

The unique relationship between the applicant, Lefroy Brooks and the Davroc group, means that a non-use scenario would have far-reaching consequences. The group's business model is intrinsically linked to the partnership between the applicant and Lefroy Brooks, rendering a non-use scenario commercially very difficult and a restructuring of the group's activities inevitable.

The chrome plating facilities were on this site for many years before the arrival of the applicant's manufacturing unit and Lefroy Brooks in 2008. To have manufacturing, metal finishing and assembly on the same site was a commercially and operationally sound decision.

For the purpose of exploring plausible non-use scenarios, below identifies any possible non-use scenarios for the applicant, many of which will not be seem reasonable or probable:

- Change to a worse performing alternative
- Outsourcing of hexavalent chrome plating (to authorised businesses in the UK)
- Shut-down the entire chrome plating line
- Shut down all plating processes (partial closure)
- Shut-down the business, including all manufacturing
- Close the site entirely, which would include Lefroy Brooks

Non-use Scenario 1 (NS1) : Change to a worse performing alternative

As discussed in Section 4.1.3, the applicant is in a privileged position in having feedback from customers and end users regarding the performance of trivalent chrome plated components, which is offered for economy-grade components suitable for non-critical applications. Lefroy Brooks, the applicant's core customer, has already been consulted and has rejected all possibilities that a trivalent chrome finish would be a suitable alternative for their prestigious up-market hexavalent chrome, which is 40% of the finishes it offers in its range of sanitary ware products and accessories.

Lefroy Brooks is well known for its historically inspired designs that span styles from the late Victorian era through to mid-century modernism and promotes to produce high-end fixtures and fittings that blend traditional craftsmanship with modern precision.

That being said, trivalent chromium electroplating is the only alternative seriously being considered as an alternative and this leaves the applicant with no option but to reject this non-use scenario and consider other options outlined below. The applicant is the leading manufacturer of sanitary ware and accessories for the group and if the applicant's business is to continue in its current form outsourcing will have to be an option.

This scenario of changing to a worse performing alternative is not considered as a plausible option.

The applicant will have to dispose of all hexavalent chrome material, using specialist contractors to handle the hazardous waste. The nickel plating capacity will be reduced which will mean the storage or disposal of excess nickel plating solution. Parts of the effluent treatment will become redundant since there will be no requirement for the reduction of hexavalent chrome. Job losses will be inevitable.

Non-use Scenario 2 (NS2) : Outsourcing of hexavalent chrome plating (to firms in the UK)

As detailed in Section 2 of the CSR, the chrome plating line was originally installed on this site in 1997 and operated, alongside several other plating lines, by a separate metal finishing company. In response to increasing regulatory pressure to phase out hexavalent chromium, the line was subsequently modified to accommodate a trivalent chromium process. This transition necessitated a prolonged period of operational downtime.

This caused significant disruption and the requirements for hexavalent chrome plating had to be temporarily outsourced.

During this period, the applicant had to experience significant additional costs related to:

- Increased lead times
- Transport and related issues
- Rejects & generally poor quality
- Stripping and reprocessing
- Packaging
- Additional stock holding due to minimum batch sizes

The experience of outsourcing was so disruptive that this scenario is not a credible option.

Customer lead times extended from weeks to several months, and plating quality from multiple subcontractors consistently failed to meet acceptable standards, reaffirming that the applicant's hexavalent chrome plating process is unmatched within the UK.

The financial implications of this disruption has not been quantified for this application, however the operational consequences (including extended delivery lead times, inflated unit costs, inefficiencies, reject-driven waste, and environmental impact) were substantial.

That said, whilst retaining manufacturing skills and the trivalent chrome process on the plating line for economy-grade components, the applicant could attempt to revert to outsourcing the hexavalent chrome plating process.

While the applicant does not consider it feasible that it could prevent a recurrence of similar disruption. If avoidance was possible, it could offer a short-term opportunity for the applicant, Lefroy Brooks, and Davroc to retain market share.

Lefroy Brooks, the applicant's biggest customer, has stated that *"they feel strongly in trying to keep a manufacturing base including polishing and plating within the traditional heartland of the industry and hence our passion to be the best there is to offer with locally produced goods."*

"Chrome plating is the very essence of the Tap Industry and we at Lefroy Brooks Diffusion acknowledge that without the facilities here onsite , we would have to alter our whole business model and the job losses that would entail with the changes".

"As a major exporter and creator of local jobs, we have heavily invested in Bard & Brazier, especially with developing, together, the quality of your hexavalent chrome plating which is unmatched in the UK. There has been a continuous improvement with yourselves to levels that cannot be matched elsewhere to our standards."

As has been stated, the benefits of having chrome plating onsite is that there is total control of quality and components only have to travel a few metres between operations. Transporting components to and from an outsource is fraught with danger. Significant cost will already have been invested in manufacturing the product and specialist packaging would be essential to maintain quality and avoid damage.

It is envisaged that, not having continuous production flow and just in time operations, there would be an impact on the workforce resulting in a possible 50% reduction of production staff on the Lefroy site alone.

Although this option is feasible, the experience of outsourcing was so disruptive that this scenario is not a credible option.

In this non-use scenario, the applicant will have to dispose of all hexavalent chrome material, using specialist contractors to handle the hazardous waste. The nickel plating capacity will be reduced which will mean the storage or disposal of excess nickel plating solution. Parts of the effluent treatment will become redundant since there will be no requirement for the reduction of hexavalent chrome. The applicant would have to enforce redundancies, together with Lefroy Brooks and elsewhere.

Non-use Scenario 3 (NS3) : Shut-down the entire chrome plating line

As discussed, the non-use scenario of ***changing to a worse performing alternative (NS1)*** would not be a plausible option for customers and end users, together with the non-use scenario of ***outsourcing of hexavalent chrome plating (NS2)*** not being a credible option, it is highly probable that the viability of the entire chrome plating line will be discussed.

Maintaining the facility, in its current form, only plating economy-grade components, with its significant overheads in terms of manpower and ancillary costs, together with its lack of contribution towards the profitability of the group and particularly Lefroy Brooks, would make this option a plausible scenario.

This would be a difficult strategic decision, bearing in mind *the whole ethos of the group companies is of Family and Local communities, and this is especially prevalent with the diversity of staff, many of whom have been employed on the site for the whole of their working lives.*

The chrome plating facilities were on this site for many years before the arrival of the applicant's manufacturing unit and Lefroy Brooks in 2008. To have manufacturing, metal finishing and assembly on the same site was a commercially and operationally sound decision.

In this scenario. the applicant would retain the manufacturing facilities and use **outsourcing of hexavalent chrome plating (NS2)**, together with the outsourcing of economy-grade components suitable for non-critical applications.

The applicant will have to dispose of all materials, using specialist contractors to handle the hazardous waste, thereby incurring unrecoverable clean-up costs. The plating line and effluent plant would then be dismantled and disposed of for scrap recovery, incurring further specialist contractor cost because of the contaminated equipment. Job losses will be inevitable.

Although this scenario may be a plausible option, there are further implications to be considered. Having discussed the closing of the chrome plating line, the cessation of all plating processes then becomes a plausible scenario as outlined below.

Non-use Scenario 4 (NS4) : Shut down all plating processes (partial closure)

The applicant has additional plating facilities, which are located within the plating shop such as variations on nickel, brass, bronze and gold finishes, together with trivalent chrome. This AfA is focussing on the hexavalent chrome process.

Catalogues describe these finishes as Aged Brass, Antique Gold, Brushed Brass, Brushed Nickel, Geneva, Nickel, Polished Brass, Satin Nickel and Taunton.

All these finishes are produced by a team of 10 additional employees and rely on the contribution to the business made by the chrome plating line.

The non-use scenario of **shutting down the entire chrome plating line (NS3)** brings into question the viability of continuing any metal finishing processes on the site.

Again, this non-use scenario would be a difficult strategic decision, since the hexavalent chrome process makes such an important contribution to the profitability of the applicant and Lefroy Brooks, particularly since hexavalent chrome makes up 20% of the finishes on offer.

In this scenario. the applicant would retain the manufacturing facilities and use **NS2/NS3 outsourcing of all chrome plating**, together with the outsourcing of all other finishes to small jobbing shop platers in the West Midlands of which there are many.

In addition to the dismantling of the chrome line in NS3, the applicant will have to dispose of further plating materials, using specialist contractors to handle the hazardous waste, thereby incurring even further unrecoverable clean-up costs. Although this closure would be relatively straight forward, there would still be a requirement for further specialist contractors to remove contaminated equipment. 14 job losses will be inevitable.

It is concluded that this scenario is a plausible option.

Again, the benefits and advantages of having the metal finishing processes on the same site as manufacturing are significant and have been discussed above. This scenario of shutting down metal finishing facilities then brings into question the viability of manufacturing on this site.

Non-use Scenario 5 (NS5) : Shut-down the business (including all manufacturing)

As discussed in NS3, the chrome plating facilities were on this site for many years before the arrival of the applicant's manufacturing unit and Lefroy Brooks in 2008. To have manufacturing, metal finishing and assembly on the same site was a commercially and operationally sound decision. Without any metal finishing facilities, as in NS4 **Shut down all plating processes (partial closure),** the whole strategic objective has been destroyed. The advantages of having manufacturing and finishing close to its major customer are no longer available. The relocation of the manufacturing unit becomes a distinct possibility.

The Davroc Group "*have been in the bathroom distribution and manufacturing industry since 1980, during this time we have remained a family run business with strong family values. We focus on specifically sourced materials; handmade craftsmanship and our practical designs guarantee that we can provide the best the industry has to offer".*

Bard & Brazier "*has a mission of keeping our crafts, on these shores, alive".*

Lefroy Brooks, "*today we endeavour to uphold the enduring standards of these bygone eras. Each of our products is meticulously crafted, from casting and forging to polishing and inspection, while maintaining modern precision. These timeless products continue to complement and enhance the finest modern interiors".*

The unique towel rail designs, being manufactured by Bard & Brazier, are of such a specialist and complex nature that there will be no business, possibly in the world, with the skills and craftsmanship capable of manufacturing them. The impact of a non-authorisation decision on UK manufacturing and its declining traditional skills should not be overlooked.

Again, this non-use scenario would be a difficult strategic decision, without the hexavalent chrome finish in their portfolio, this will have significant ramifications.

In this scenario 43 job losses will be inevitable.

Non-use Scenario 6 (NS6) : Close the site entirely, which would include Lefroy Brooks

As discussed in NS3, the chrome plating facilities were on this site for many years before the arrival of the applicant's manufacturing unit and Lefroy Brooks in 2008. To have manufacturing, metal finishing and assembly on the same site was a commercially and operationally sound decision.

Lefroy Brooks came to Wolverhampton to be in close proximity to plating and have the opportunity to develop, with its supplier, the exceptional standard of hexavalent chrome finish that would be needed to support its presence in the extremely demanding **high-end and ultra-premium brassware** market. The process needed to be unmatched in the UK and elsewhere.

Without any metal finishing facilities, as in NS4 and manufacturing in NS5 **,** the whole strategic objective has been destroyed.

The advantages of having manufacturing and finishing close to its major customer are no longer available. Closure of the site entirely, which would include Lefroy Brooks, becomes a distinct possibility. In this scenario a total of 80 job losses will be inevitable.

Other scenarios, probably implied by many of the above, are not discussed in detail:

- Outsource manufacturing and chrome plating (possibly outside UK and EU)
- Relocate the Wolverhampton site operations to outside of the UK

The applicant expects that moving the businesses to outside the UK would have a significant negative impact on their brands and would affect their sales and revenue.

There are issues surrounding shipping which includes, time, cost and quality implications. Although there may be no restriction on the use of hexavalent chrome in certain parts of the world, the time impact with outsourcing and relocating is likely to be significant, although possible, could not be achieved immediately.

The costs and the time needed to relocate outside of the UK is not quantified here, but the group does have interests in North America and China so these scenarios may become plausible options in the future.

4.3.3 Conclusion on the most likely non-use scenario

The most likely non-use scenario is **Close the site entirely, which would include Lefroy Brooks (NS6).**

Locating manufacturing and finishing close to its principal customer has proven to be a commercially and operationally sound decision. Lefroy Brooks is heavily dependent on the applicant for manufacturing and plating services, particularly as hexavalent chrome plating underpins approximately 40% of its business and is essential to complement its full product range, particularly with bright chrome accounting for 60–70% of all brassware sold in the UK (2025).

In the analysis of plausible non-use scenarios, all other alternatives have been rejected. Substitution with a lower-performing alternative is not considered viable, and outsourcing of hexavalent chrome plating has been dismissed, as no subcontract electroplaters in the UK are capable of consistently achieving the required standard of finish. Furthermore, by past experiences, outsourcing would introduce unacceptable disruption and extended lead times.

4.4 Societal costs associated with non-use

In the continued use scenario, it is expected that there will be some additional costs resulting from any conditions that may be applied to the authorisation approval but not significant enough to affect future trading. There would be no effect on business activity and employment would continue at the current levels.

There would be no increased health effects to either the workers or the general population and there would be no financial burden on the health or social services.

The applicant currently operates with surplus capacity on the plating line, with existing arrangements primarily dedicated to the processing of brass sanitaryware and accessory components. Under a continued use scenario, a modest capital investment is proposed to repurpose under-utilised tanks for the pretreatment of zinc die-cast and aluminium substrates. This strategic adaptation would enable entry into the high-specification subcontract plating market, broadening the applicant’s service offering and enhancing commercial resilience.

The overall UK bathroom market is forecast to grow by approximately 4% by 2028, which would provide market opportunities for the applicant under a continued use scenario.

Across the UK, the bathroom and sanitaryware manufacturing sector, including ceramics, brassware, showers, and fittings, supports an estimated 20,000–25,000 jobs. The luxury brassware segment accounts for a relatively small but highly specialised share of this, with only a few thousand jobs concentrated in workshops, plating shops, foundries, and finishing facilities. Wolverhampton and the West Midlands continue to host a recognised cluster of premium brassware and chrome-plating firms.

The most likely non-use scenario is the closure of the Wolverhampton site, resulting in approximately 80 redundancies, again contributing to the progressive decline of traditional manufacturing skills across the UK and the West Midlands in particular.

It is assumed that those made redundant would experience a period of temporary unemployment. This assumption reflects the fact that the workforce is generally highly skilled and therefore likely to secure re-employment within a relatively short timeframe.

To address the societal impact of unemployment, the applicant considers the SEAC's approach in SEAC/32/2016/04 (Dubourg, 2016) which concludes that, for the UK, the social cost of one job lost is about 2.09 times the annual pre-displacement wages (excluding taxes paid by the employer) of this job.

Table 4.7 Expected job losses and annual salaries

	No. of workers	Total gross wage paid per annum 2025
Totals	43	£964,000

Using the above total gross wage paid per annum and applying the SEAC(2016) approach for unemployment in the UK, the following figures can be deduced.

Table 4.8 Unemployment cost component estimates

Component	**NPV**	**Distribution of cost**
Lost output	£1,222,557	Nominal years 1-2
Leisure time	-£541,709	Nominal years 1-2
Search costs	£33,862	Nominal years 1-2
Recruitment and training costs	£227,705	Nominal year 3 only
Scarring costs	£1,067,664	Nominal years 2-8
Total cost of job losses	**£2,010,079**	

Nore: Net present value (NPV), discounting as per methodology

This value of total unemployment cost is over an 8 year period, since the distribution of cost using the SEAC(2016) approach is for nominal years 1-8 overall.

4.4.1 Economic impacts on applicants

Welfare Implications

As result of redundancy, there will be costs incurred on payments to workers, subject to statutory regulations.

Site Closure Plan

As a result of a non-use scenario, a site closure programme would involve, redundancy of employees, decommissioning and disposal of saleable assets (plant and equipment, inventory and ultimately the site itself), disposal of waste and site clean-up.

Plant and equipment that would probably attract a resale value are polishing equipment and lathes, CNC turning machines, effluent associated equipment, boilers etc.

Inventory, both finished and work in progress would be written down for repurposing or scrap.

Other cost considerations include specialist site contractors, asbestos consultants, bore hole sampling, and site clearance costs

As an example, the decommissioning of the plating line would involve the disposal of the process chemistry and equipment as shown below:

Table 4.9 Disposal of Plating Line

Commodity	**Est. Volume Litres / Kg**	**Disposal Method ***	**Comments**
Swills & Rinses	11200	Tanker	Dump to effluent storage then tanker
Cleaners & Acids	7000	Tanker	Dump to effluent storage then tanker
Plating Solutions	12000	Contractor	1000L IBCs
Stores	500 est	Inventory for re-sale ?	If these did not attract a buyer, then waste contractor
Solid Waste	2500 est	Contractor	Sludge etc in 205L drums
Effluent Tanks	15000 est	Tanker	
Miscellaneous Solutions	2500 est	Contractor	205L drums / IBCs

Note: * Authorised & Registered Contractors

Plating Equipment for scrap:
Steel Tanks 33 x 700 Kg : Est. scrap value £3,500
Pipe Work, Plastic Liners Etc

Ancillaries for scrap:
Ventilation Ducting, Jigs, Transporters, Switch Gear, Rectifiers, Bus Bars, Cables

Direct business loss due to closure

Following the SEAC's approach in guidance SEAC/52/2021/03 on producer surplus, the default value of 4-years of profit losses has been used to estimate direct business loss due to closure.

This value has been selected because there is no suitable alternative generally available (Non-SAGA) for the use of functional chrome plating with decorative character being applied for.

As discussed in SEAC(2021), a production asset can be considered to have scrap value if it cannot be sold in its current form and instead can only be sold for parts. Furthermore, a production asset has resale (or salvage) value if it can be sold to a new user in its existing form.

As shown above, in the site closure plan, it is likely that certain on-site equipment will be offered for resale and would eventually attract buyers. Book value compared to salvage value resulting in a stranded asset valuation has not been quantified but is likely to be approximately in excess of £0.5 million. These losses have not been included any of the following calculations.

Following the applicant's worst case scenario approach, the disposal cost of process chemicals, shown in table 4.9 is estimated at £25,000 and has not been included in any of the following calculations.

Most of the plating equipment is unlikely to attract buyers and would be considered as scrap. This residual asset value has been conservatively estimated at £30,000 and is deducted from the eventual estimate of profit losses.

4.4.2 Economic impacts on the supply chain

If the application is not granted, the applicant would have to immediately cease using the chrome plating line for the purposes of plating its hexavalent chrome finish. This would have an immediate effect on its sister company, Lefroy Brooks, and all the applicant's other customers.

Following consultations with Lefroy Brooks and the Davroc Group, the applicant anticipates that, in the absence of the exceptionally high-quality hexavalent chrome-plating facility, operations at the Wolverhampton site will cease, resulting in total site closure. This will take place with immediate effect; outstanding orders will not be fulfilled, and all associated contracts will be cancelled accordingly.

When assessing socio-economic impacts, customers affected by the loss of a product or service (e.g. OEMs relying on plated components) are also considered part of the downstream supply chain, even if they don't handle the substance directly. SEAC expects applicants to identify and quantify impacts on these customers and provide evidence of dependency.

This economic impact assessment is based on information provided by the applicant's core customer, Lefroy Brooks, together with supporting evidence from the group.

Contributions: [redacted]

Lefroy Brooks Diffusion Ltd:

Table 4.10 Lefroy Brooks Accounts - YTD Sep 2025 (Extract)

Sales	[redacted]	UK 69% Export 31%
Cost of Sales	[redacted]	
Gross Profit	[redacted]	**45.6%**
Overheads	[redacted]	
Net Profit	[redacted]	

Figure 4.11 Lefroy Brooks - Sales Distribution by Finish

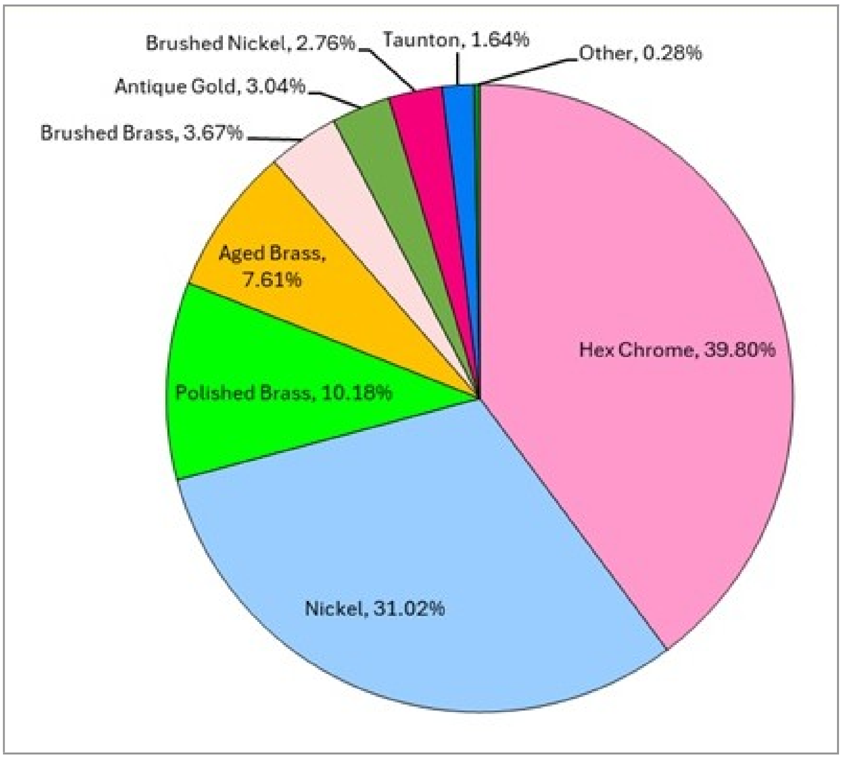


Table 4.12 Sales Distribution by Finish & Value

Finish	Sales Value *	Proportion of Sales
Hexavalent Chrome	[redacted]	39.80%
Nickel	[redacted]	31.02%
Polished Brass	[redacted]	10.18%
Aged Brass	[redacted]	7.61%
Brushed Brass	[redacted]	3.67%
Antique Gold	[redacted]	3.04%
Brushed Nickel	[redacted]	2.76%
Taunton	[redacted]	1.64%
Other	[redacted]	0.28%

Note: * Indicative based on proportion of sales

All of the finishes listed above are produced by the applicant in its plating shop, underscoring Lefroy Brooks' dependency on the functional chrome plating with decorative character that is the subject of this application.

Again, following consultations with Lefroy Brooks and the Davroc Group, the applicant anticipates that, in the absence of the exceptionally high-quality hexavalent chrome-plating facility, Lefroy Brooks would not be able to operate and would close with immediate effect in the event of a refused authorisation. All operations at the Wolverhampton site will cease, resulting in total site closure. Lefroy Brooks employs 38 persons involved in planning, picking, assembling, packing, warehousing, administration and the customer service team.

Redundancies and plant disposal would result.

As discussed in SEAC/32/2016/04 (Dubourg, 2016), *Employment impacts may also affect downstream customers and upstream suppliers. The difficulty here is likely to be in providing an accurate and convincing estimate of the size and nature of these impacts. However, where customers and suppliers are effectively dependent on the production of a firm or sector for their continued business, such knock on employment effects might be justified to be included in the analysis.*

As is the case in this application, to estimate the social cost of job loss for a customer that is economically dependent on the applicant's continued use of a substance under UK REACH, it is reasonable to apply SEAC/32/2016/04 (Dubourg, 2016).

A Causal Link Is Clear: The applicant has demonstrated that Lefroy Brook's job losses are a direct consequence of the applicant being refused authorisation.

***Geographic and Economic Context Aligns*:** Lefroy Brooks is UK-based, and the job loss occurs in a similar labour market context as assumed in the Dubourg (2016) analysis.

No Double Counting: The same job loss is not already counted under the applicant's own workforce or elsewhere in the supply chain.

To address the societal impact of unemployment, the applicant considers the SEAC's approach in SEAC/32/2016/04 (Dubourg, 2016) which concludes that, for the UK, the social cost of one job lost is about 2.09 times the annual pre-displacement wages (excluding taxes paid by the employer) of this job.

Table 4.13 Expected job losses and annual salaries (Lefroy Brooks)

	No. of workers	Total gross wage paid per annum 2025
Totals	38	£1,053,000

Using the above total gross wage paid per annum and applying the SEAC(2016) approach for unemployment in the UK, the total value of unemployment is deduced as £2,200,770.
This is over an 8 year period, since the distribution of cost using the SEAC(2016) approach is for nominal years 1-8 overall.

Nore: Net present value (NPV), discounting as per methodology

In addition to operational impacts, a non-use decision would lead to foregone profit, the write-off of fixed assets, and the devaluation of stockholding, which is presently valued at approximately [redacted] These factors have not been taken into account within this application.

4.4.3 Economic impacts on competitors

The closure of Bard & Brazier and Lefroy Brooks would likely result in short-term demand redistribution across the limited competing brassware manufacturers, with potential gains in pricing power and brand positioning for surviving firms. However, these benefits may be offset by supply chain strain, contract disruption, and reputational spillover, particularly if closures are linked to regulatory refusal under UK REACH.

There may well be strategic repositioning opportunities for other brassware producers, particularly those able to absorb the reallocated demand or even those wishing to expand into the ultra-premium and luxury heritage styling vacated by the applicant and Lefroy Brooks.

The approach to valuing producer surplus losses is based on SEAC(2021) and already accounts for gains to competitors in the non-use scenario.

4.4.4 Wider socio-economic impacts

Socio-economic impacts described in the previous sections, include the societal impact of unemployment resulting from a refused authorisation (Section 4.4) and (Section 4.4.2).

Wider implications would affect local suppliers, logistics networks, and service providers, with knock-on effects across regional economies. The local area will suffer from reduced spending, employment contraction, and erosion of the tax base. Niche craftsmanship and specialist skills (such as hand-finishing and polishing) risk being lost, undermining long-term sector capability.

Downstream firms, including showrooms and contractors, may face delays, re-specification costs, and reputational exposure. Reduced product diversity and availability could impact consumer choice, particularly in bespoke and heritage markets. A decline in competitor numbers may also lead to reduced innovation, diminished resilience, and upward pressure on prices.

4.4.5 Compilation of socio-economic impacts

Table 4.14 Societal Costs Associated with Non-Use

Description of major impacts	**Monetised/quantitatively assessed/qualitatively assessed impacts**	**Monetised/quantitatively assessed/qualitatively assessed impacts**
1. Monetised impacts		**£ [per year] [Over 12 years]**
Direct business loss due to closure	£3,462,448 * over 4 year period	£288,537
Potential supply chain impact	£2,200,770 **** over 8 year period	£183,398
Social cost of unemployment	£2,010,079 ** over 8 year period	£167,507
Cost of lost wages	£1,156,800 *** over 1.2 years	£96,400
Sum of monetised impacts		£735,841
2. Additional quantitatively assessed impacts		**[Per year] [Over x years]**
	Not applicable	
3. Additional qualitatively assessed impacts		
	Not applicable	

Note: * Discounted by 4% to 2022 - Reduced by residual asset value SEAC(2021)
** Net present value (NPV) SEAC(2016)
*** Table 4.7 figure x Mean duration (years) of unemployment UK (1.2 years) SEAC(2016)
**** Social cost of unemployment at Lefroy Brooks Net present value (NPV) SEAC(2016)

4.5 Combined impact assessment

Table 4.15 Societal costs of non-use and risks of continued use

Societal costs of non-use		Risks of continued use	
Economic impacts Direct business loss due to closure Social impacts Social cost of unemployment + Cost of lost wages	£288,537 per year over 12 years + £263,907 per year over 12 years	Monetised excess risks to directly and indirectly exposed workers	£9,102-£12743 over 12 years Equates to £1,062 (upper bound value) per year over 12 years
Potential supply chain impact	£183,397 per year over 12 years		
		Monetised excess risks to the general population	£525-£734 over 12 years Equates to £61 (upper bound value) per year over 12 years
Qualitatively assessed impacts	Not applicable	Qualitatively assessed risks	No direct emissions to the environment

To summarise:

As shown in table 4.15 the monetised excess human health risk (fatal and non-fatal cancer) as a result of exposure to Cr(VI) in this application is estimated as £1,123 (upper bound value) per year over 12 years (review period).

As shown in table 4.15 the total costs of the non-use scenario are estimated at £735,841 per year over 12 years (review period).

Conclusion:

The costs of non-use clearly outweigh the monetised excess health risk as a result of workers exposure to Cr(VI).

Costs of non-use per unit of release.

Not applicable.

4.6 Sensitivity analysis

With reference to the ECHA (2011) Guidance on the preparation of a socio-economic analysis, a simple qualitative assessment of uncertainties should be sufficient because there would need to be extremely significant changes to the calculations for the overall conclusion to change.

Exposure calculations made in the CSR rely entirely on using the Advanced REACH Tool 1.5 (ART) exposure model. Input values are as accurate as possible and include both near-field and far-field parameters as necessary.

The most important worker contributing scenario, WCS 3 - Working on the Plating Line, which was likely to reveal the most significant exposure value, was modelled over a full working shift. The model included two activity stages, to ensure the most precise result.

- Activity 1 : Working outside Chrome Zone
- Activity 2 : Working inside Chrome Zone

The task based personal exposure measurements recently performed reveals a maximum value for this scenario, of <0.015 µg/m³ Cr(VI) Exposure (8hr TWA) compared with an ART modelled value 1.7 µg/m³ Cr(VI) Exposure (8hr TWA).

Although more measurements are required for a true statistical analysis, for the purpose of the CSR, the modelled result is sufficiently representative and is in keeping with the worst case approach taken throughout this application.

The health risks of continued use need to increase significantly and a major reduction in economic and social impacts, would be the only way that the conclusion could affected.

4.7 Information to support for the review period

The applicant considers a review period of 12 years to be appropriate, on the basis that the only viable alternative that might be acceptable to the applicant's customers is unlikely to be commercially available for the foreseeable future and that the risk management measures, and operational controls employed are robust and the human impact risks are extremely low.

Research into alternatives to hexavalent chromium electroplating has been conducted for decades, by the plating industry, without discovering any process that provides a surface finish that matches the unique performance and decorative benefits of hexavalent chrome. Major innovations and developments will be necessary to overcome the performance weaknesses of trivalent chrome. The plating industry and particularly the suppliers of proprietary plating chemistry, will continue to address these weaknesses, but no significant success is expected within the foreseeable future.

Bright chrome, remains the dominant finish in the UK sanitaryware sector, especially taps, shower heads, mixers, towel rails and bathroom accessories, accounting for an estimated 60–70% of all brassware sold in the UK (2025). Components plated using hexavalent chrome have superior performance, prolonged lifespan and visual quality. The only viable alternative, at the moment, "*doesn't come close to matching hexavalent chrome*".

Even if a breakthrough innovation were achieved and a viable alternative to hexavalent chromium, matching its specific performance characteristics, were identified within the requested review period, it would still require several years to mature into a marketable product, to industrialise the associated production processes, and for end-users to implement the necessary process changes for industrial-scale adoption.

In conclusion, with the research and development efforts that have been made in the past and the future ongoing efforts that will required by the industry, it does not provide confidence that it will lead to any major development of a suitable alternative, that could be available within the next decade. While the continuing human impact risks remain low and the socio-economic benefits continue to be high, there is clear evidence that this balance is not likely to change in the next 12 years and justifies the requested review period as appropriate.

5. CONCLUSION

Bard & Brazier is a small business and manufactures, under its own brand name, a wide range and bespoke, handmade towel warmers and together with its sister company Lefroy Brooks, offer a range of high specification sanitaryware and associated accessory components for the **high-end and ultra-premium brassware** market.

Both companies are located on the same site, on the south side of Wolverhampton.

Bard & Brazier is the primary manufacturer and employ a team of highly skilled craftsmen and its metal finishing unit benefits from long serving and experience employees.

Typical components, plated in hexavalent chromium, include bath and basin taps, including mixer taps, shower mixers and diverters, shower heads and roses, rails and risers, and accessories such as towel rails, robe hooks, toilet roll holders, tumbler holders, shaving mirrors and corner baskets.

To meet customer expectations, the chrome finish must achieve an ultra-premium quality standard, demonstrate long-lasting durability, and match the appearance of existing components and those supplied from other sources.

Lefroy Brooks came to Wolverhampton to be in close proximity to plating facilities and, in collaboration with Bard & Brazier, have developed an exceptional standard of hexavalent chrome finish. This finish is essential to maintaining its position in the highly demanding high-end and ultra-premium brassware market. The process needed to be unsurpassed in the UK and elsewhere, and the company maintains that no suitable alternative to hexavalent chromium plating currently exists.

Bard & Brazier has actively assessed potential alternatives but given the highly specific technical and performance demands of these products, no option is presently considered a feasible replacement for hexavalent chromium and the use being applied for.

The Chemical Safety Report has justified that risks to workers are well controlled, and there is an extremely low risk to 'man via environment'.

The costs of a non-use scenario are shown to outweigh the risks of continued use by a significant factor.

If authorisation is not granted, and following consultations with Lefroy Brooks and the Davroc Group, the applicant anticipates that, without access to the exceptionally high-quality hexavalent chrome-plating facility, operations at the Wolverhampton site will cease. This would result in full site closure, with significant redundancies, the disposal of plant and equipment and the sale of premises.

6. REFERENCES

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