Format for

ANALYSIS OF ALTERNATIVES

and

SOCIO-ECONOMIC ANALYSIS

Legal name of applicant(s):	Vertik-al ltd, Custom Wyteline powder ltd, Alucoat ltd, Architectural Powder Coating ltd, Senior architectural systems ltd, Superior Paint & Powder Coating ltd, Protective metal finishing ltd.
Submitted by:	Vertik-al ltd
Date:	Date when the document was completed, normally the date of submission
Substance:	Chromium Trioxide CrO_3, EC number 215-607-8 CAS number 1333-82-0
Use title:	Pre-treatment conversion coating of aluminium for the construction industry by spray and dip process.
Use number:	Use 1

Contents

DECLARATION

We, the Applicants, Vertik-al ltd, Custom Whytline powder ltd, Alucoat ltd, Architectural Powder Coating ltd, Senior architectural systems ltd, Superior Paint & Powder Coating ltd, Protective metal finishing ltd are aware of the fact that further evidence might be requested by REACH UK to support the information provided in this document.

Signed on behalf of the consortium.

Signature: Date

Tristan Pope BSC. Hons Cert ED. 2/12/2024

SUMMARY

The main conclusions of the AoA and SEA:

- The use is for conversion coating prior to powder coating of architectural parts in aluminium.
- There has been active work to find an alternative for our processes and extensive trials.
- The alternatives tested are widely available based on Titanium and/or Zirconium hexafluoride.
- The consortium is requesting authorisation because it has had quality issues with the alternatives, including product failures. Some of the consortium members have older plant that is not suitable for alternatives without investment, and the situation in Europe means that work will flow from the UK in the EU for chromium trioxide pre-treatment. A period of time is required to evaluate the alternatives in more detail and resolve the technical issues.
- Two major architectural specifications demand Chromium trioxide and they will not change their specifications while Chromium trioxide is still available in the EU
- There are two scenarios for the alternatives which is either adapting the current processes or buying replacement pre-treatment plant. The high costs associated with process replacement means that some consortium members will be unable to do this in the short term and may cease trading.
- The alternatives identified are generally accepted by the industry. The consortium requires time to adapt their process to be able to use them without the risks associated with failure of the parts. A substitution plan is detailed in the application.
- If the authorisation is not granted the consortium will proceed with the alternatives but at high risk of more failures that could cause financial difficulties, loss of work to Europe or cease trading.
- The societal cost of discontinuing the use would be the potential failure of consortium members, loss of work to the EU and reduced life expectancy of powder coated aluminium in the field.
- The residual risks for human health are minimal as the process has very low exposures and environmental discharges are only to wastewater and controlled within the consented limits.
- The societal costs outweigh the risks given the high costs of the alternatives and exposures are negligible.

1. AIMS AND SCOPE

The consortium is seeking to obtain an authorisation for 12 years for continued use of Chromium Trioxide pre-treatments. The basis for this request is based on the following arguments.

Argument 1. The alternatives are giving lower quality results or inconsistent results so are less reliable than chromate. Consortium members have experienced wet adhesion failures and some adhesion failures resulting in product recall

Argument 2. The alternatives are not working well on older plant requiring large investments or adaptation, some consortium members have plant requiring adaptation or replacement. Some members of the consortium will not be able to finance the required changes.

Argument 3. The consortium comprises members with more complex requirements than other companies that have changed to Chromium trioxide free. These are variety of aluminium grades, variety of powders (C1, C2, metallics)

Argument 4. The industry had fed a narrative that the alternatives were equivalent and straight forward to use. Only when making the switch did some consortium members discover that this narrative was too simplistic and misleading. Also the original authorisation led by the CTAC consortium was not supported in the UK after Brexit so that extension of that authorisation was not possible in March 2023

Argument 5. Where reduced performance was experienced the suppliers were not able to identify root causes, the suppliers are not fully competent of advising how to use the alternatives, especially on older or adapted plant. Some consortium members were forced back to chromate after changing to de-risk the process and nervous about changing back without root cause.

Argument 6. The alternatives are not accepted by the architectural industry as equivalent to Chromium Trioxide.

Wintech and FMDC the two main specifiers are not changing the requirement for chromate while it remains available in the EU

Consortium members have several projects to these specifications per year and will lose this business to the EU

2. ANALYSIS OF ALTERNATIVES

2.1. SVHC use applied for

2.1.1. Description of the function(s) of the Annex XIV substance and performance requirements of associated product

The Chromium trioxide is used as a conversion layer coating for aluminium to provide a suitable base for powder coating of architectural parts. The parts require good adhesion of the paint coating and corrosion resistance in all environments. The parts must provide a warranty period of 25 years, and many architectural contracts are also looking for expected life times of 40 years. The performance of Chromium Trioxide is recognised by the industry to meet these warranty requirements.

Two of the main specifiers for the industry

Wintech Wintech - Dedicated Façade Engineering Consultants (wintech-group.com) and FMDC Home | FMDC

both specify Chromium Trioxide and it appears they will continue to do so while it is still available in Europe.

The chromium trioxide conversion works under a wide tolerance and conditions, with no deterioration of performance over time.

The coating also has some self-healing properties so continues to provide protection even if the paint becomes scratched or damaged.

The Chromium trioxide conversion does not leave Chromium trioxide on the part so that the requirement for authorisation does not extend beyond the process.

2.1.2. Market analysis of products manufactured with the Annex XIV substance

Consortium members produce painted products for the architectural industry, comprising of extrusions and fabricated products in aluminium.

We are small to medium sized businesses and our customers do not have their own painting facilities. Large scale investments for the consortium members require amortisation over long timescales and investment funds are limited.

Research is not possible within the consortium businesses and they are reliant on suppliers for the alternative technologies and technical expertise in making them work.

The consortium operates to BS EN 12206

Companies within the consortium are also certified to Qualicoat and or GSB standards

Customer specifications currently state the pre-treatment requirements, some specifications do not allow for the use of alternative pre-treatments. Because the situation in Europe is allowing the continued use of Chromium trioxide following the abandonment of the authorisations for Chromium Trioxide until restriction is bought in to replace them. Two of the main specifiers Wintech and FMDC have determined that they do not yet have to revise their specifications and will result in work moving from the UK into Europe.

Projects that were started in Chromium Trioxide may not be able to be switched to alternatives without going back to sign off and delay building.

This will not only affect the companies painting the parts but also the fabricators of the parts.

The alternative chemistries have become widespread in the UK mainly driven by OEMs that have put in their own plants for painting, these plants are predominantly new plants although some older plants have changed

The companies comprising the consortium were delaying the change to alternatives towards the deadline date of September 21st, 2024, in the first instance because the industry is more accepting of Chromium Trioxide pre-treatment for its proven performance, and secondly because these are smaller companies with complex product variation. OEMs can specify to one grade of aluminium and limit their paint offering.

The consensus view within the finishing sector of Alfed, comprising of industry actors was that an authorisation would have limited chance of success and excessive cost. So was not pursued earlier.

This consortium has been formed from companies that have found difficulties in making the change due to technical difficulties with making the alternatives work, or commercial difficulty in funding the change.

The experience of one consortium member that has recorded adhesion failure requiring product recall identifies a high risk as if parts were to fail on the building the costs would be very challenging.

2.1.3. Annual volume of the SVHC used

- 10-100 tonnes per year of formulated products containing Chromium Trioxide.

2.2. Efforts made to identify alternatives

The consortium companies are a mixture of different businesses with different experiences of the transition to alternatives. A case study on each company and their unique challenge is detailed below.

CASE STUDY VERTIK-AL

Planning phase Started July 2020

Benchmark of alternative technologies and suppliers from Qualicoat and GSB approved lists.

Available technologies limited by GSB approvals.

Alternative technologies based on Titanium and/or Zirconium hexafluoride or tri-valent chromium

Companies Approached during planning phase.

Alufinish (Germany) conducted site survey and made recommendations, strong presence in EU market. Low confidence in the technical support network as reliant on an Agent with no current users in the UK.

Kluthe (Germany) conducted site survey and made recommendations, Product did not have both approvals. UK technical support limited personal, and experience (current supplier of chromate) Lab trials conducted.

Almetron (UK) conducted site survey and made recommendations, Only have Qualicoat approval but ambition for GSB, questions whether it meets criteria for BSEN 12206. Good UK based technical service network. Lab trials conducted.

Henkel (Germany) Conducted site survey and made recommendations, Experienced technical personnel but overstretched, advanced technical control systems IOT

Chemetall (Germany) conducted site survey and made recommendations. Market leader in UK, all vertical lines in UK using chemetall.

August 2020, shortlisted to Henkel, Chemetall and Almetron

Supplier selection Chemetall based on their market lead position, the technical structure in the UK, Other customers with Vertical line processes in the UK.

Companies Approached following failure of first attempt.

Nubu (Germany) contacted following discussion with GSB about the issues experienced, conducted site survey made recommendations that went beyond previous suppliers. Selected for the Horizontal line Chrome free introduction based on this detailed analysis. Strong presence in EU and were the first company in EU to be promoting chromium free pre-treatments so have a long record. Completed DUIN to enable import and planning to commence production trials at earliest opportunity.

Trials conducted with Kluthe, PMD and Almetron on Trivalent chromium products, in laboratory performed worse than Titanium/Zirconium products thought to be due to absence of adhesion promoters, no benefit in continuance of this line of investigation was determined.

Phase 2. Preparation stage Vertical line August 2020- January 2023

Comprising of.

Increase supply of Demineralised water

Plant modification pipe work

Plant control systems

Laboratory equipment

Works completed August 2023.

Phase 2 preparation Horizontal line August 2020- January 2023

Quotations for new plant. £0.5 - £2 million

Refurbishment of old plant.

Evaluation of the lowest quote suggested it would be of more interest to modify the existing plant with additional tanks.

Investment budgeted at £125000 with additional investments required on control equipment.

Phase 3. Implementation vertical line

Ran chrome free in production from 4th September 2023 till 6th November 2023. Converted back to Chromate following product recall due to adhesion failure.

Root cause analysis of failure and expertise bought from Europe prior to second attempt. Root cause was not fully determined.

Ran chrome free in production from 4th March 2024 till 29th July 2024 Period failure of wet adhesion that fails predictably over 24 hours requiring tank replenishment. Adhesion failure at customer was experienced but contained.

Phase 4. Implementation horizontal line

Trials ran with Chemetall 4th March 2024

Invited Nabu to visit following failure of Chemetall on the Vertical line, planned changeover will miss deadline date.

Vertik-al have been investing heavily since 2020 on preparing the plant for chromate free production. Budgeting in excess of £0.25 million in the various works to date with more to spend.

We have been hitting the milestones to meet the date of the current authorisation ending but have experienced some significant technical issues that have hindered the implementation in a satisfactory manner. Especially failures on the vertical line hindering progress on the horizontal line due to limited resources.

During our change to Chromate free we have experienced regular failures in wet adhesion and 5 failures of adhesion requiring product recall one of which was a significant financial challenge for ourselves and the customer.

The supplier of the chrome free chemistry is unable to determine the root cause and resolve the issues although a lot of research has gone into the root cause analysis by both Vertik-al and the supplier, We have not found a solution that works and are operating in a risk environment.

One of the claims required the use of our product liability insurance which has now become too expensive to renew so that this safety net is no longer available. This insurance has never been required in the previous years operating with Chromium Trioxide but was required within three months of using alternative.

We see a rapid deterioration in performance of the chemistry over 24 hours and are managing our production by remaking the bath when we see the first sign of failure. This is not an ideal way to operate and risks further failures in the field.

The table below shows our production data and wet adhesion failure recording, we were running at 7% failure of wet adhesion which went to zero when returning to chromate.

Overview 31/05/2024																
Chrome Free Transition Vert line 06/05/2024 to date													chromate	chromate	Chromate	
Date (week commencing)	wk. 06/05	wk. 13/05	wk. 20/05	wk. 27/05	wk. 03/06	wk. 10/06	wk. 17/06	wk. 24/06	wk. 01/07	wk. 08/07	wk 15/7	wk 22/7	wk 29/7	wk 5/8	wk 12/8	
Week	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	To date
V line Days processed	3,691	8,472	6,711	5,529	6,941	8,717	6,470	9,192	7,568	10,208	8,538	8,777	10,331	8,705	5,424	115,274
V line Nights processed	2,958	6,826	7,907	5,137	6,765	7,895	8,704	6,954	7,840	10,742	7,018	5,722	10,615	9,728	7,613	112,424
Total V-line processed	6,649	15,298	14,618	10,666	13,706	16,612	15,174	16,146	15,408	20,950	15,556	14,499	20,946	18,433	13,037	227,698
Samples Tested	64	64	64	48	48	64	74	64	64	74	64	64	64	64	60	944
Wet adhesion test fail	2	6	3	6	2	4	0	4	11	4	6	4	-		-	52
Wet test fail sample %	3.13%	9.38%	4.69%	12.50%	4.17%	6.25%	0.00%	6.25%	17.19%	5.41%	9.38%	6.25%	0.00%	0.00%	0.00%	5.51%
Dry adhesion test fail	-	-	-	-	-	-	-	-	-	-	-					-
Dry test fail sample %	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
E19 - Bath Changes	1	2	1	2	1	2	2	5	5	2	2	3	-	-	-	28
Approx bath cost £6.08/litre	£ 60.80	£121.60	£ 60.80	£121.60	£ 60.80	£121.60	£121.60	£304.00	£304.00	£121.60	£121.60	£182.40	£ -		£ -	£1,520.00

Our business has some challenges that are different to other operators in the same industry, we are a jobbing shop so have a wider variety of aluminium grades passing through our doors than the typical OEMs that have similar vertical plant, we find some links to our problem caused by processing different grades of aluminium. We also have the largest range of different powders and find that performance of chrome free is particularly compromised with class 2 metallics, although we have seen wet adhesion failure on all paint types and substrate grades. We also process different lengths of parts that impact how we can optimise the spraying. We have anecdotal evidence that some users of alternative pre-treatments are avoiding class 2 and class 2 metallics by offering limited colour range.

We require a stop gap to fully investigate the root cause and make the corrections to the plant to resolve the issues.

We are also in advanced discussions with other suppliers and require more time to develop these opportunities.

We are currently persevering with Chrome free although we see it as a significant risk to our business, For that reason have approached the UKREACH authority to start the process of authorisation to give us time to resolve the technical issues.

END

Case study Superior Paint and Powder coating (SPPC)

SPPC operate an immersion process since 2002

Ran Trials of Chromium Trioxide free using Qualicoat approved product Decorrdal AL230A

Initial trials gave satisfactory results, so the trial was extended.

Once the volumes of work increased the pre-treatment started to fail for wet adhesion (placed in boiling water 2hrs, cooled 1 hour and cross hatch adhesion test) This is similar to the experience at Vertik-al where there is a deterioration in adhesion performance over time.

Following failures SPPC made the decision to go back to Chromium Trioxide until the 21st September 2024 to remove risk.

SPPC made the decision on the 21st September to run with the Decorrdal AL230A in order to comply with the authorisation end date. They are acting in good faith.

SPPC are now operating with Alternative but still experiencing failures in wet adhesion, this represents a high-risk situation, it requires close monitoring and tank changes to mitigate the risk. They are very nervous given the regular failures.

SPPC joined the consortium to extend the timescales to allow time for progressing root cause of the adhesion failures.

The timescale for this analysis is 6 to 12 months to provide adequate time on the production plant. If this is not successful, then SPPC will need to build a new plant. SPPC is a small business and does not have the resources for immediate investment. This will need to be spread over 10 years as the costs are higher than SPPC would be able to secure as a loan over 5 years.

SPPC are also a fabricator in their own right and have competition that is in Europe, SPPC believe they will lose work to European companies that are able to continue with Chromium Trioxide as the industry recognises Chromium Trioxide as a more robust pre-treatment.

END

Case study Senior architectural systems

Senior are a job powder coater with a large variety of aluminium grades from different sources and powder classes, this is the typical product mix of the consortium.

Senior have made the largest investment for the change from Chromium Trioxide in the consortium upwards of £500 K, acting in good faith from advice from their chosen supplier to try to achieve the deadline date.

They had a plant built by Transmetal that was an identical plant to the vertical line at Vertik-al, that is experiencing problems with wet adhesion over short periods of time. This type of plant is based on spray system.

They were advised that it would be difficult to operate a vertical line with spray system for alternatives and were advised by their chosen supplier (Chemetall) to convert the plant to cascade. Cascade being a delivery system that is like a waterfall.

On completion of the conversion by Transmetal, Senior are then advised that they do not have enough demineralised water to operate the alternative and are having to make additional investments at this late stage.

They are disappointed with the late advice by their supplier that recommended the conversion to cascade that the water issue was not already identified, they are also disappointed that the supplier will not sign off on the modifications to the plant that were recommended by them as guaranteed to work.

Senior are using Chromium Trioxide while they make the further investment in water volumes.

When complete they will commence, work with alternative pre-treatment but they now acknowledge that where they thought they would be able to change albeit later than envisaged that the actual position will be on a trial basis with no guarantee of success. Their confidence in the supplier has diminished.

Senior's engagement with the consortium is primarily as they now identify a risk bought about by the reluctance of the alternative supplier to give confidence that the changes recommended to them will work. This makes them uneasy about the alternative chemistry if the supplier themselves cannot give certainty that it is suitable as a chromium trioxide replacement in their case.

END

Case study

Product metal finishing (PMF)

PMF are a small business established in 2022 to supply powder coating to its sister company Finish Architectural.

The plant at PMF is not suitable for a drop in alternative for Chromium Trioxide. It has too few tanks.

Chromium Trioxide is a robust chemistry that operates over a wide tolerance and can be used in simple set ups, it can tolerate poor rinsing and still achieve the standards required for successful adhesion of the powder paint and corrosion resistance. It is relatively cheap to build a plant for Chromium Trioxide.

The alternative chemistries rely on extremely clean rinse tanks, PMF do not have a discharge from the site using tankers to remove waste rinse. PMF cannot operate with continuous flow without making changes to the water sewage system and obtaining a consent to discharge. They could not achieve the standard required for the alternative technology, they also have no deionised water production which is a key requirement for the alternative.

It was not commercially viable for PMF to make the investment required for the Alternative being a small business.

The non-use scenario for PMF would be to cease trading as they would struggle to raise the capital to invest in new plant in the short to medium term.

Failure of PMF would also impact heavily on Finish Architectural in terms of coating costs, flexibility and lead times. Finish Architectural operate a business model of fast turn over and just in time that allows them to remain competitive in the market. This would be heavily impacted if PMF ceased its operation.

The authorisation would enable PMF to consider longer term investment to establish a possible route to the alternative chemistry.

END

Case Study: Alucoat Ltd.

Alucoat started trading in 2008, based at Granada Trading Estate, Oldbury, West Midlands. The Company is solely engaged in the powder coating of aluminium pressed metal for architectural applications. Classified as a micro business with just 14 employees, Alucoat operates in a tier below the major approved applicator coaters. Whilst not an approved applicator or a member of Qualicoat the majority of our processes, particularly with regard to pretreatment are very similar.

Since the outset Alucoat has used a Chromate conversion process to pretreat the aluminium pressings prior to powder coating. We use 12000litre immersion tanks in a 5-stage process. None of the tanks are heated or agitated in any way. In all our years of trading we have found this process to be extremely reliable, robust and resilient. The process allows for wide margins to operate within, solution concentrations, Ph values and immersion timings do not have to be particularly precise. Our chemical suppliers carry out checks on a weekly basis for solution strengths and Ph values, which means in practical terms we have no need for an onsite lab or a permanently employed Quality Technician.

Initially we installed effluent tanks to process wastewater from the pretreatment rinse tanks but for the last 6 years we use a licensed waste contractor (Veolia) to pump out and dispose of our waste rinse water, which again reduces the need for onsite management of our pretreatment process.

We have been aware for some years of the movement away from Chromium Trioxide in the powder coating industry and have spent a considerable amount of time looking at alternatives. In 2023 we tried a Qualicoat Approved non-chrome product from Pretreat Ltd. Over a 6-week period, tanks were dumped, cleaned and the new chrome free product (Walterisation 7460) was added. It became apparent that in order for the new product to be effective it would require heating elements to be added, in addition it seems water hardness impacted adversely on the rinses and it was suggested that water filtration or a de-mineralised final rinse be added to the setup. As a small business with very short time constraints, we had no option but to revert back to the Chromium Trioxide.

Alucoat Ltd., if faced with non-use has 2 choices.

They invest heavily in new plant and equipment suitable for non-chrome pretreatment. This would include new stainless immersion tanks, some requiring heating elements, a final demineralised water plant and a full-time quality technician to supervise and maintain pretreatment quality. Upfront cost would be more than £100k with additional ongoing costs in excess of £50k/year. These cost on their own are quite prohibitive but when added to our lack of confidence in new chrome free technologies would require quite a leap of faith.

Option 2 would be to rebrand the Company as a trade coater and to look for new markets, this is something we have no experience of. Both options are daunting and there is a real chance that the Directors of Alucoat Ltd may in the end decide to close the business.

END

Case study

Custom Wytelyne powder coating (Custom)

Custom are small business operating as a jobbing powder coater in Aluminium, Steel and Galvanised parts.

The company came under new ownership in May 2024 and the previous owner had not made the investment into the alternative technologies or other investments in the plant over recent years. The new ownership and management are making the changes required to improve the plant for the future.

The aluminium pre-treatment operates using Chromium Trioxide. The plant has seven stages and deionised water. They have the basic infrastructure to develop the alternative technology with the help of suppliers and expertise.

Custom have engaged with expertise to evaluate what would be required in terms of plant changes and investment, Custom have identified that they require additional tanks and would have to cease trading for 3 months to make the changes. The alternative would have to work from day 1 so they require a detailed plan to make the required changes.

The plant in general requires investment to bring it up to standard and remain competitive so Custom are evaluating how best to use their limited resources. This means that capital expenditure needs to be strategic and long term. The investment required for the aluminium line offers no payback and as suppliers are reluctant to guarantee successful transition requires a leap of faith.

Their most likely non-use scenario would be to invest although they may decide to cease the aluminium work in the short or medium term while they determine the requirements for alternative chemistry.

Custom would use the authorisation to evaluate fully the alternatives, identify a supplier that can advise them fully and determine a robust plan.

Custom will benefit from the shared experiences of the Consortium to assist in the knowledge required for a successful transition.

END

Architectural powder coating (APC)

APC are a small business with 27 employees operating a jobbing powder coating facility for architectural aluminium. Operating under the current directors since 2019.

They have improved their current plant to a standard where they are able to obtain Qualicoat certification. They offer guarantees of up to 30 years and punch above their weight for quality.

Currently APC operates Chromium Trioxide and have the basic infrastructure required to enable investigations into the alternative technology.

They have made enquiries and had recommendations from suppliers.

APC do not have any spare plant or capacity to facilitate the ability to conduct trials on the alternatives and see it as a high risk to their business to make a leap of faith.

They require the confidence from a supplier that can guarantee success from day 1. They see the change to the alternative on their plant as a high risk. They seek guarantees from suppliers that they have confidence in the transition to alternatives.

APC will benefit from the shared experience of the consortium especially with Vertik-al and Superior that operate similar immersion size plant.

The experience of Vertik-al with the UK suppliers has shown that the recommendations do not go into enough detail and additional recommendations were made when engaging outside of the normal network of UK suppliers.

APC non-use would be a change to alternative with a high risk of failure. The failures at Vertik-al and Superior for wet adhesion support this apprehension.

APC would use the authorisation to further investigate the alternatives and build confidence in a chosen supply partner.

2.2.1. Research and development

The research and development efforts have been to analyse the approved lists for GSB and Qualicoat and engaging with the suppliers with products on these lists. Inclusion on these lists requires the alternatives to have undergone some testing of suitability for the aluminium coating industry.

The list of approved suppliers with products on both Qualicoat and GSB listings is limited by the GSB listing.

In a discussion with an auditor for GSB they say they have struggled to add additional products to their list since they changed the criteria for inclusion requiring more testing on class 2 powder coatings, This demonstrates that there are some differences between performance of class 1 and class 2 powders on alternative pre-treatments.

This can be explained by the different properties of the two powder classes. Class 2 powders are less elastic than Class 1 powders that build residual stresses in the composite. Where tensile stress exceeds the bond strength then adhesion failure occurs. The alternatives provide bond strength over a narrow range compared to chromate.

Failure = Tensile stress > Bond strength

The alternatives listed on the Qualicoat and GSB listing obtained their endorsement on class 1 powder coatings and have not had to retest to the new requirements.

There are also differences in aluminium grades the two main grades being AS6060 and AS6063. The alternative chemistry uses nucleation sites for bonding that are more prevalent in some grades that others. Vertik-al analysis of wet adhesion failure found that it is more prevalent in AS6060. Also the grades are produced in several companies that vary the use of recycled content that could also affect the bond strength.

The consortium members argue that because they are job coating companies they have greater variety of powder and aluminium grades that makes it more difficult to optimise the parameters for adhesion. They have no control over the aluminium being used.

2.2.2. Consultations with customers and suppliers of alternatives

Collectively the consortium has discussed alternatives with Almetron, Alufinish, Chemetall, Henkel, Kluthe, Nabu, and Pretreatment technologies All of these conducted plant surveys of varying sophistication and put forward recommendations to changes of our plant to accommodate the alternative technologies.

We discussed with an independent inspector for our industry Clive Plant associates, They also advised numerous occasions of early failure of alternatives in the field. They also indicated that parts that were perforated are particularly susceptible to early failure in the field.

Many specifications require either chromate or pre-anodising for external coating and alternatives allowed only through consultation with the architect. The architectural industry recognises the superiority of chromium trioxide over the alternatives in terms of consistency of performance. The two main specifiers are not changing their specification while the EU can continue with Chromium Trioxide

We have had limited discussions with customers as the assumption was that we would be converting to chromium trioxide free chemistry and customers have been aware of the change for many years.

Consortium members have visited competitor plants to discuss their experience of Chrome free.

The consortium has been formed by companies that have been experiencing technical issues with the alternatives or lack the means to make the changes without guarantees of success. Almetron has facilitated the meeting of the consortium having recognised that some of it customers needed more time to comply. Almetron themselves are seeking extension to support their customers.

The finishing sector have historically been of the opinion not to seek authorisation, and this led to some complacency in the industry that the alternatives were working without inherent problems. This false assumption has resulted in late enquiry for authorisation in those companies such as ourselves that have hit technical stumbling blocks.

Named companies for contact detail

Chemetall Chemetall Group - United Kingdom

Almetron Almetron

Kluthe UK | Europe | Global | Kluthe

Nabu Startseite - NABU-Oberflächentechnik GmbH | Behandlung von Metall in Stulln (nabu-stulln.de)

Alufinish Home - Alufinish

Henkel Home (henkel.co.uk)

Pre-treatment technologies Pre-Treatment Chemicals For Metal Finishing | PreTreat Ltd

Clive Plant associates Clive Plant & Associates

2.2.3. Data searches

Analysis of GSB and Qualicoat approved pre-treatments, benchmark conducted

					process stages										
supplier	product	chemical system	GSB	QC	1	2	3	4	5	6	7	8	9	10	comments
current chromium process		chromate	y	y	etch cleaner	etch cleaner	rinse	rinse	desmut	rinse	chromat e	rinse	demin rinse		
Almetron	Tetramet 1000 plus			y	etch cleaner	etch cleaner			desmut		tetramet				gives a coloured finish
Almetron	CF20	ZrTi		y	etch cleaner	etch cleaner	rinse	rinse	desmut/ etch	rinse	CF20, 15-25C, 20-30s	demin rinse			
Alufinish	Alfipas 745/746, envirox s	Ti	y	y	etch cleaner	etch cleaner	rinse	demin rinse	desmut/ etch	demin rinse	alfipas	demin rinse			use agents for UK
Alufinish	Alfipas 748, envirox SG	Ti	y	y	etch cleaner	etch cleaner	rinse	demin rinse	desmut/ etch	demin rinse	alfipas				use agents for UK, received proposal
BCI	E CLPS2100		y	y	etch cleaner	etch cleaner	rinse	rinse	desmut/ etch	rinse	E CLPS21 00				use agents for UK
chemetall	Guardobond X4707	ZrTi	y	y	etch cleaner	etch cleaner	rinse	demin rinse	desmut/ etch	demin rinse	GB X4707, 20-40C, 20-60s	demin rinse or dry in place			control using pH, chemical adjustment, resin additive
chemetall	oxsilan AL0510	silane	y	y	etch cleaner	etch cleaner	rinse	demin rinse	desmut/ etch	demin rinse	oxsilan AL0510				
Henkel	Bonderite MNT 400	Ti	y	y	etch cleaner	etch cleaner	rinse	rinse	desmut	demin rinse	bonderi te MNT40	rinse or dry in place			
Henkel	bonderite MNT 2040R2		y	y	etch cleaner	etch cleaner	rinse	rinse	e MNT204 0R2 desmut/ conversi	rinse	demin rinse	demin rinse			held discussions
Kluthe	Deccordal AL 240A	Zr		y	etch cleaner	etch cleaner	rinse	rinse	desmut/ etch	rinse	AL 240A	demin rinse			expertise in germany
Kluthe	Deccordal AL 230A	ZrTi	y		etch cleaner	etch cleaner	rinse	rinse	desmut/ etch	rinse	AL 230A	demin rinse	decorrd al 270		expertise in germany, received proposal
McDermid	Iridite CF		y	y	etch cleaner	etch cleaner	rinse	rinse	desmut/ etch	rinse	Iridite CF	demin rinse			
Nubu	Nabutan 310	ZrTi			etch cleaner	etch cleaner	rinse	rinse	desmut/ etch	rinse	nabuta n 310	demin rinse			received recommendation, Received proposal and plant audit

2.2.4. Identification of alternatives

There are two main groups of alternatives, alternative conversion coatings or anodising,

The alternative conversion coatings are based on Zirconium or Titanium Hexafluoride or a mixture of these two, sometimes Trivalent chromium is added to provide bare metal corrosion protection.

Most suppliers of pre-treatment chemicals can provide these alternatives and there is good choice on the GSB and Qualicoat listing of pre-treatment chemicals that have undergone a testing regime for corrosion protection.

These alternative conversion coatings have widespread use within the industry.

Anodising is also a possible alternative leaving the surface open to provide adhesion for the powder paint.

2.2.5. Shortlist of alternatives

Table 1: Shortlisted alternatives.

Number	Alternative name	CAS or EC Number (where applicable)	Description of alternative
1	Pre-treatments based of Zirconium and/or Titanium hexafluoride		Conversion coatings
2	Anodising		Anodised layer on the aluminium
3.	Pre-treatments based of Zirconium and/or Titanium hexafluoride, with addition of Chromium III compounds		Conversion coating with trivalent chromium, these are favourable to the aerospace and similar industries where bare metal corrosion protection is important.

2.3. Assessment of shortlisted alternatives

2.3.1. Alternative 1: Chromate free conversion

2.3.1.1. General description of Alternative 1

Pre-treatments based on Zirconium hexafluoride and/or Titanium hexafluoride with organic resin adhesion promoters

2.3.1.2. Availability of Alternative 1

There are no problems of availability of alternative 1.

2.3.1.3. Safety considerations related to using Alternative 1

[Hazard statements: For chromium trioxide

H290 - May be corrosive to metals.

H302 - Harmful if swallowed.

H314 - Causes severe skin burns and eye damage.

H317 - May cause an allergic skin reaction.

H331 - Toxic if inhaled.

H334 - May cause allergy or asthma symptoms or breathing difficulties if inhaled.

H335 - May cause respiratory irritation.

H340 - May cause genetic defects.

H350 - May cause cancer.

H361f - Suspected of damaging fertility.

H373 - May cause damage to organs through prolonged or repeated exposure.

H411 - Toxic to aquatic life with

Hazard Statement: For typical alternative

H319 Causes serious eye irritation.

H315 Causes skin irritation.

H311 Toxic in contact with skin.

H302 Harmful if swallowed.

H290 May be corrosive to metals.

In principle the inherent hazard of the alternative while is less hazardous than the Chromium Trioxide containing mixture for long term health effects. The alternative chemicals contain HF which is hazardous. Can be absorbed quickly and requires specialist

first aid, they are labelled with the serious health hazard label. So pose an immediate health risk equivalent to or exceeding Chromium Trioxide.

The way that the products are used within our factories means that there is little to no exposure to either chemical during use, so that this difference is largely insignificant.

Measurements of airborne exposures from the chromium trioxide at the worst measurement during the previous 4 years was an average of 0.0014mg/m^3 or 1.4ug/m^3

Exposure to chromium trioxide within our processes is most likely during maintenance activity by touch or generation of dust, this can be mitigated by hygiene measures, good work practice and PPE. Companies can also operate a permit to work system.

Exposure measurement of the alternative has not been undertaken but as it is used in the same way a similar order of magnitude is expected.

Technical feasibility of Alternative 1

The alternative technology is in widespread use although many operators have retained Chromium trioxide until the last minute.

The consortium has a mixture of vertical, spray and immersion plant

For vertical processes new plant use a cascade system to apply the chemistry (waterfall) and this runs down the length of the bar. Older plants using spray are finding technical issues when scaling up with wet adhesion that the suppliers do not fully understand to resolve them.

Other plants within the consortium are spray or immersion process which are critical for rinsing.

The alternative chemistry has a narrow window of operation so that adhesion drops off at higher coating weights. There is always some potential for adhesion issues especially on older plant that are less automated.

The main observed failures are internally when testing for wet adhesion (2 hour boiling water, followed by cross hatch adhesion test) This is then non-conformant to BS EN 12206, Qualicoat and GSB specifications. One consortium member recorded a 7% failure rate using Alternative 1 and 0% failure rate when reverting to Chromium Trioxide

The mechanism of failure is not known though it is predictable. Wet adhesion failure begins at the bottom of the bar and migrates upwards to 1-2 meters over subsequent sampling. This indicates that the lifetime of the parts will be diminished and potentially fail early.

Wet adhesion failure is a risk indicator for adhesion failure resulting in product recall.

Vertik-al report 5 adhesion failures requiring product recall with alternative 1 over 15 weeks of production, whilst no part made it onto a building and the parts could be reprocessed costs are incurred and reputation is damaged. Using Chromium Trioxide since 1994 no failure had ever been reported for adhesion resulting in a product recall.

One of these recalls was substantial enough to use product liability insurance the cost of which has now increased removing this safety net for the future.

2.3.1.4. Economic feasibility of Alternative 1

Consortium members have individually invested heavily in adaptations for alternative 1.

The investments have not resulted in stable processes and further adaptation, or complete plant replacement is a predictable outcome.

An immersion line with automation is circa £2 million, £500,000 for a manual operation

A Vertical line with cascade is circa £3 million

(costs based on budget quotes)

There is no financial payback for this investment as the costs to operate the alternative are equivalent to the cost to run Chromium Trioxide.

The cost of Chromium trioxide compared to the alternative is more expensive, but the alternative uses large amounts of deionised that is expensive to produce for the purpose of this analysis it can be regarded as cost neutral.

Some consortium members had to employ additional staff to operate alternative 1 as it requires a lot more testing than Chromium Trioxide to control to a narrow operating window. Giving the additional control does not lead to a process that is as reliable or robust as Chromium Trioxide. This is a cost burden compared to Chromium Trioxide.

Chromium Trioxide has continuation in Europe while the EU has suspended the authorisation status of chromium trioxide. The EU is moving towards restriction and this does not automatically mean that our industry will be included. Many large projects especially those using the Wintech or FMDC specification are not changing their requirement from chromium trioxide whilst it is still available in Europe will move work out of the UK into Europe.

On 18th September 2024, 3 days before the authorisation end date consortium members were still receiving specifications requiring Chromium Trioxide.

This work will be sent to Europe and UK companies will lose the coating of these parts but also the fabrication of the parts is also likely to shift. This will affect the consortium members, the UK coaters and wider industry mostly small and medium businesses.

2.3.1.5. Suitability of Alternative 1 for the applicant and in general

Alternative 1 represents the most likely alternative for our processes and is widely used in the industry.

Given that it does work in many cases the challenges experienced by the consortium are mostly regarding the plant that the alternative is being processed on, the variability in aluminium substrates and the variety of paints.

It is probable that these challenges can be overcome in the shorter term with adaptation of the process and in the longer term with plant replacement. This however results in a financial burden that exceeds the improvement in safety given that the safety record is already high and exposures were mostly below the detection level.

2.3.2. Alternative 2: Anodising

2.3.2.1. General description of Alternative 2

pre-treatments based on anodising, growth of an oxide layer using sulphuric acid and electrolysis.

2.3.2.2. Availability of Alternative 2

There are no problems of availability of alternative 2.

2.3.2.3. Safety considerations related to using Alternative 2

Hazard statements: For chromium trioxide

H290 - May be corrosive to metals.

H302 - Harmful if swallowed.

H314 - Causes severe skin burns and eye damage.

H317 - May cause an allergic skin reaction.

H331 - Toxic if inhaled.

H334 - May cause allergy or asthma symptoms or breathing difficulties if inhaled.

H335 - May cause respiratory irritation.

H340 - May cause genetic defects.

H350 - May cause cancer.

H361f - Suspected of damaging fertility.

H373 - May cause damage to organs through prolonged or repeated exposure.

H411 - Toxic to aquatic life with

Hazard Statement: For Anodising (Sulphuric acid)

H290 – May be corrosive to metals

H314 - Causes severe skin burns and eye damage

H335 - May cause respiratory irritation

It is also listed as a known carcinogen by IARC

Measurements of air borne exposures from the Chromium trioxide at the worst measurement during the previous 4 years was 0.05mg/m3 with a TWA of 0.1mg/m3

Exposure to chromium trioxide within our processes is most likely during maintenance activity by touch, this can be mitigated by hygiene measures, good work practice and PPE. We also operate a permit to work systems.

Exposures to acid fume are possible with anodising the TWA of 0.1mg/m3 puts it in a similar risk category to chromium trioxide. It is also a known carcinogen so has a similar risk profile to Chromium trioxide.

Our industry operates Chromium trioxide as a cold process with no fume or aerosol and this keeps emissions low, Anodising uses electrolysis and generates heat requiring cooling and gaseous Hydrogen and Sulphuric fume is possible.

The risk profile of anodising requires more engineering control than Chromium Trioxide.

Technical feasibility of Alternative 2

It would require investment of a new plant approximately £2 million,

Anodising also requires parts to be jigged to allow the electrical contact, this would not be possible for all consortium members having a large mix of parts to process and varying complexity of parts and volumes.

Some consortium members have considered adding anodising as an option to replace Chromium Trioxide as this would allow us to meet the Wintech and FMDC specifications for external powder coating. This is considered as an add on rather than as the main replacement. The safety aspects are similar to Chromium Trioxide and the cost to install, and run are high.

Anodising would only exist as an alternative to the immersion lines

If consortium members were to consider Anodising, it would be as an additional process and Alternative 1 would still be required. It would however mitigate the argument regarding specifications as those specifications normally state Chromate or Pre-anodising.

(pre-anodising is anodising without the final seal step)

2.3.2.4. Economic feasibility of Alternative 2

Investment into a plant to process both by Alternative 1 and 2 would be approximately £2 million.

The cost to operate Anodising are high requiring a lot of energy that is also detrimental to climate change.

It would not be possible to replace all of the consortium's production by this method.

2.3.2.5. Suitability of Alternative 2 for the applicant and in general

Alternative 2 has potential to consortium members as an additional process but would not replace Chromium Trioxide.

2.3.3. Alternative 3: Trivalent chromium

2.3.3.1. General description of Alternative 3

pre-treatments based on the same technologies as alternative 1 with the addition of trivalent Chromium compounds

2.3.3.2. Availability of Alternative 3

There are no problems of availability of alternative 3.

2.3.3.3. Safety considerations related to using Alternative 3

Can be considered broadly equivalent to alternative 1

Technical feasibility of Alternative 3

One member investigated 3 of these pre-treatments in the lab in comparison to alternative 1, there was no advantage observed over alternative 1 and the methods of control are the same. In some tests the results were not as good because this type of pre-treatment does not generally contain adhesion promoters.

2.3.3.4. Economic feasibility of Alternative 3

The same as for alternative 1

2.3.3.5. Suitability of Alternative 3 for the applicant and in general

Alternative 3 has been ruled out as it offers no benefit over alternative 1, although for other industries where bear metal corrosion is a requirement it is finding some use.

2.4. Conclusion on shortlisted alternatives

Alternative 1 is the most promising and with some successful work within the consortium, The problems experienced are mainly due to the deterioration of performance.

It is possible by investment to potentially overcome the technical issues experienced. The question then is whether this investment cost outweighs the safety improvements. Given that the safety record on Chromium Trioxide in this industry is high and exposures are very low to zero.

It is envisaged that over the 12-year requested authorisation period the consortium members will most likely switch over to alternative 1 as they overcome the technical challenges.

Some members of the consortium will change quicker than others and the 12 year request is to provide for companies that will require additional investment, some companies might struggle to raise the required finance and seek further extension.

3. SOCIO-ECONOMIC ANALYSIS

3.1. Continued use scenario

3.1.1. Summary of substitution activities

The consortium has invested individually both time and expenditure on utilising alternative 1. As demonstrated in the case studies chosen.

All companies that have attempted to switch to the alternatives have tried multiple suppliers to try to find the technical competence to resolve the issues experienced.

This had led to the companies either reverting back to Chromium Trioxide to eliminate high risk situations or continuing nervously with the alternatives.

The situation has arisen in part because the performance of the alternatives on older plant is not understood by the suppliers, so they are not able to advise the adjustment required.

Some members of the consortium are seeing failures of wet adhesion, one member of the consortium had product recalls.

Some of the consortium members have not had the finances or the plant configuration to attempt changes to alternatives. They continue to operate Chromium trioxide to safe practices.

3.1.2. Conclusion on suitability of available alternatives in general

Alternatives based on alternative 1 are suitable for use and are in general use, however the consortium members have all had difficulties making them work that represents a risk to business continuity. The difficulties experienced are a mixture between the plant age requiring adaptation or possible replacement and the competence of suppliers to resolve the issues. There is also the variability of substrates and powder types. The alternatives have been shown to work in a limited way, but performance drops rapidly and requires constant intervention. The consortium companies require time and investment to resolve the issues.

Some of the plant are not suitable for the alternative technology because they are too small and lack basic infrastructure requirements. For these companies the challenge is more difficult and requires long term strategies.

Failures have occurred and mostly are wet adhesion which breaches the standards BS EN 12206, Qualicoat and GSB. This is a worrying failure as it will not reveal itself in the fabrication stage and end up on buildings. This could jeopardise warranties and build up problems for the future.

There have been failures resulting in product recall and the costs and damage to reputation resulting from these.

3.1.3. Substitution plan

The consortium is requesting 12 years, it is envisaged that some will require this time on the basis that they will need to replace plant, are small companies and will struggle to raise loans on 5 year terms.

Substitution activities will be different for each member of the consortium.

Having come together at this stage the companies will develop collaboration and share experiences that will assist to develop understanding and close the gap in the technical competence of our suppliers.

The first stage of substitution to avoid huge expenditure will be to adapt the plant to resolve the issues, as we will be trying to produce at the same time this will likely take the form of trial runs and evaluation over a timescale of 1-3 years.

The second stage will be replacement of plant if the issues cannot be resolved by adaptation. The timescale of replacement will be 5 years or more as financing will be required.

Some companies will not be able to raise the funds for investment and will face closure in non-use scenarios.

3.1.3.1. Factors affecting substitution

It is thought that the issues experienced by the consortium members are not due only to the suitability of alternative 1 to provide a pre-treatment for aluminium to meet the standards for the industry but the way it works on some plant. There are several investigations that might provide insights into the causes of the problems that our suppliers are trying to understand.

Vertik-al investigated a failure requiring product recall, and there was a causal relationship to Aluminium grade and powder class in the laboratory. This relationship appears less predominant on the plant from analysis of wet adhesion failures, which appear more general. This identifies that the root causes are complex and require time to understand, and the causes of wet adhesion failure may be different to the failure of adhesion resulting in product recall.

Failure is characterized by a gradual worsening of the bath as work is processed and drops off over 24 to 48 hours, the change in equilibrium giving rise to the problem is not detected by the routine testing so is a parameter that is either not measured or not detectable. The suppliers to date have not given insight to the cause mechanism.

One of the main factors affecting substitution is building the technical know-how within the consortium in the absence of technical competence within the supply chain. The UK is dominated by a few chemical companies and the standard of knowledge appears lacking in some areas, The market share is dominated by a single company has led to other companies in the UK having a smaller base to build their expertise, The dominant company has some complacency when things go wrong and stretched resources. Vertik-al for

example have engaged with a company that doesn't operate within the UK, the depth of knowledge when they visited site seemed to be more detailed and they made recommendations that go beyond previous advice, these are being implemented prior to plant trials. The absence of an established supply chain for that company meant raising DUIN notifications through UKREACH. The confidence that an alternative can be substituted with immediate success is low.

There are some companies within the consortium operating a single plant without the ability to conduct trials without a leap of faith, in this case companies have prepared for alternative but without guarantees of success from suppliers. The ability of the consortium to share experiences going forward will assist those companies in this situation.

There are some companies in the consortium that do not have the plant that would enable drop in replacement of alternatives, these companies are likely to consider plant closure as a non-use outcome. Especially being small companies that would struggle to raise capital.

With collaboration that will begin with the forming of this consortium the opportunities to share experiences will greatly improve. When breakthroughs in understanding occur, they can be shared within the consortium.

If the only way to resolve the issues is new plant, then some companies due to space limitations will be forced to cease or partially cease trading while work is carried out.

3.1.3.2. List of actions and timetable with milestones

Short term actions:

For those members that identify the alternative as the preferred outcome.

1. Identification of root cause of the problems experienced to date. 1 year

Vertik-al have spent a year already on root cause analysis of wet adhesion and adhesion failure. There have been no break throughs although some lines of enquiry are ruled out.

This is ongoing and work will continue, in most cases the root causes are still to be determined. Investigations have been conducted on rinsing affects, acid etch, different aluminium grades, dwell times between stages.

Engaging outside of the usual supply chain in the UK is also revealing that the detail required for the alternative technology is lacking in the UK supply chain.

Superior is in a similar situation with unexplained wet adhesion failures.

The shared experience of Vertik-al and Superior indicate a cautious approach to trials and risk avoidance that diminishes opportunities for meaningful trials.

2. Identification of changes to the existing plant. 1-3 years

This largely depends on the outcome of the root cause investigations. A detailed analysis of the plant is underway to determine what changes will enable the plant to operate with the alternative. Investigations into the spraying patterns and parameters, the effect of the etch and acid etch upstream of the alternative process.

It also requires periods of plant shutdown to enable windows to allow trials.

Vertik-al have currently spent 6 months making the changes recommended by Nabu on the immersion line prior to being able to conduct a line trial on their chemistry. Trials to date at Vertik-al have been in production situations and this proved to be a high risk strategy due to wet adhesion failures. The leap of faith in this case proved foolhardy. Future works will be more cautious and therefore more time consuming and relying on plant shutdown periods or planned during quiet production periods .

Senior have spent months on plant modification to cascade and will not finish until the shutdown for Christmas that will be the first opportunity for trials. They will then be taking a leap of faith and may wish to stop and evaluate the results.

APC require shutdowns to enable trials to proceed to avoid leaps of faith into the unknown.

Parts produced through trials require 40 days of salt spray testing and filiform corrosion testing. The experience of Vertik-al shared with the group identifies that precaution is required on trials, this extends the timescale of work.

Parts would also benefit from extended weathering to determine the effect of wet adhesion failure against parts that do not fail for the affect to warranty and parts subjected to weathering for 1-5 years in accordance with BS EN 12206 would make sense to evaluate the risk.

3. Feasibility of the changes to existing plant against new.

Once changes have been identified these will be evaluated against the purchase of a new plant.

4. Implementation of changes to existing plant.

Long term actions: 5 years- 10 years

- Obtain quotes for new plant designed for the alternatives
- Evaluate the cost of new plant for affordability
- Justify Capex
- Secure investment
- Implementation, 12-24 months, this may require a partial cessation of trade for consortium members

The main constraint to new plant is finance, all the companies in the group are small to medium size. New plant also requires extended shutdown of 3 months to enable the new plant to be built. This decision could lead some companies to cease trade rather than invest given the loss of business whilst construction is proceeding.

5. Some of the consortium recognise that they are not able to finance and invest the sums required for the alternatives and their non-use would be plant closure. Membership of the consortium offers these companies an opportunity to consider long term strategies and benefit from the experiences of the group that might allow them to make the necessary investments later with the benefit of lessons learnt from other group members. Their current substitution plan however would be to maintain the status quo operating safely with Chromium Trioxide.

3.1.3.3. Monitoring of the implementation of the substitution plan

Managed as projects by the methods of each consortium member.

3.1.3.4. Conclusions

Substitution will be implemented on different timelines for each member some may also be partial if they operate more than one plant.

A request for 12 years is to allow the time for the longer-term actions if the options are exhausted for the shorter-term implementation and for the companies that are small to medium sized to raise the finance or stage the implementation.

3.1.4. R&D plan

Suppliers are working on root causes and there are opportunities to collaborate.

3.2. Risks associated with continued use

The way the substance is used is very well contained and measured exposures are well below the TWA limits, there is limited exposure during maintenance activities that can be mitigated with good hygiene measures and PPE. The environmental discharges from the process are by water only through a dedicated effluent plant and well below the consent limits for discharge, or by tanker to approved waste facilities.

The health risks associated with this application are less than those of other industries where authorisation has been granted.

3.2.1. Impacts on humans

The use is very well contained, and very low exposures were measured, Chromium Trioxide does not escape the boundaries of the companies.

3.2.2. Impacts on environmental compartments

The only discharge to the environment is via water and chromium is treated within the process, Consortium members are consistently well below the discharge consent limits imposed for Chromium.

3.2.3. Compilation of human health and environmental impacts

Table 2: Summary of additional statistical <endpoint> cases for human health.

	Excess lifetime <cancer> risk[1]	**Number of exposed people**	**Estimated statistical <cancer> cases ([per year[4]] [over 5 years])[5]**	**Value per statistical <cancer> case**	**Monetised excess risk ([per year[4]] [over 12 years])[5]**

Workers					
Directly exposed workers[2]	4×10^{-5}	115	0.000115	£4,200,000 VSL £453,600 VSM	£5,921
Indirectly exposed workers[3]	0	0	0	0	0
Sub-total	4×10^{-5}	115	0.000115	£4,200,000 VSL £453,600 VSM	£5,921
General population: Not applicable as substance contained within factory boundaries					
Latency (years)	10 years lung, 26 year intestinal				

Notes:

1. Excess risk is estimated over a typical lifetime working exposure (40 years) and via the environment over a typical lifetime exposure (70 years). As excess risks are likely to be different depending on the task, report the overall minimum and maximum excess risk among of all the tasks carried out by the workers.
2. Directly exposed workers perform tasks described in the worker contributing scenarios, typically characterised by an 8-hour Time Weighted Average (TWA) exposure of a representative worker.
3. Indirectly exposed workers (bystanders) do not use the substance.
4. Per average year during the time horizon used in the analysis.
5. Derived from the lifetime risk of 40 or 70 years.

VSM value is taken from the SEAC reference values for 2024 of 540,000 euros. = £453,600

VSL value is taken from the SEAC reference values for 2024 of 5,000,000 euros = £4,200,000

Monetised risk calculation

Inhalation exposure mg/m3	0.0014		
Inhalation exposure ug/m3	1.4		
Excess risk 40 years	0.00004	$0.4*10^{-3}$	RAC
Excess risk per year	0.000001		
Number of exposed workers	115		
Total annual risk	0.000115		
VSL 2024 (value of statistical life)	£4,200,000		5000000 euros
VSM 2024 (value of cancer morbidity)	£453,600		540000 euros
cost of fatal cancer	£483.00	per year	
non fatal portion	0.000023		+20% survival rate
cost of non fatal cancer	£10.43		
Total cost of cancer 1 year	£493.43		

Total cost over period (12 years)	£5,921.19

Table 3: Summary of remaining releases to the environment.

	[Per year] [Over x years]
Total releases/emissions (in kg per period)	35 kg per year total chromium in waste water 1250kg Chromium Trioxide tankered

3.3. Non-use scenario

The consortium members have presented a selection of non-use scenarios, Three companies have presented closure of the business as a possibility, the others have presented investment strategies as the assumed position.

The initial non-use scenario is that consortium members will try to operate Chromium free at high risk of economic failure, The main problem with this approach is that most the companies have already experienced product failures either by wet adhesion showing reduced suitability of the parts to perform to warranty requirements or in some cases adhesion failure requiring product recall.

Or they have had their plant identified as not suitable and requiring adaptation. These adaptation costs that vary, For small businesses these adaptation costs are a financial burden and this is not helped when the suppliers are not guaranteeing a successful transition. investments to date are approaching £1 million across the consortium members and only one has managed to make the change to Alternative to be compliant on the deadline date at high risk and is experiencing wet adhesion failure on a regular basis, seriously jeopardising their business to be compliant.

Anecdotally we are aware of companies with new plant designed for Alternative chemistry that have had issues of wet adhesion and adhesion during the initial commissioning process, It would not be fair to name these companies but it does reinforce the story that the suppliers are not fully competent to advise how to use these chemistries and rely on trial and error on the plant.

Failures leading to product recall are expensive, currently all reported failures have been detected by the customer and dealt with as recall, If failure results in the field on a building the costs escalate and will result in severe loss of reputation and the cost of claims could result in financial failure. Wet adhesion failure indicates a possibly higher risk than immediate failure as potentially inferior parts will get onto the building and will perform worse to environmental conditions than a similar part that is treated by Chromium Trioxide. Wet adhesion failure represents a risk of future problems during warranty, with parts on a building.

Potential investment requirements to replace plant if adaptation doesn't work, is the next main strategy, as the businesses are small to medium size investment in new plant requires to be financed over long terms and there is no payback. Potential future investment in productivity would be jeopardised. For that reason, some of the companies have identified closure as a likely outcome to non-use as it constrains the business going forwards.

Loss of business to European companies for specifications requiring Chromium Trioxide, is another likely outcome. The architects and specifiers are reluctant to change specifications while they consider Chromium trioxide to be superior and while it remains available in Europe. The situation is Europe bought about by the ruling annulling the granting of the CTAC authorisation has resulted in a change in position where Europe will seek a restriction rather than authorisation. This could result in a ban or continued use depending on how that restriction is drafted. Loss of the painting by job coaters has the potential for loss of the fabrication also so could affect the wider economy.

3.3.1. Summary of the consequences of non-use

1. Potential closure of some businesses
2. Investments of up to £2million per business if new plant is required to resolve issues
3. Warranty issues for parts processed in Alternative during trial periods are a potential unknown risk factor.
4. Use of Alternative with unresolved issues could be building problems for the future.
5. Loss of work to Europe due to some specifiers not recognising the alternatives as equivalent to Chromium Trioxide. Could extend to the wider supply chain.

3.3.2. Identification of plausible non-use scenarios

Use of chromium free in a high-risk operation, Adhesion failures and financial claims.

3.3.3. Conclusion on the most likely non-use scenario

Use of chrome free with high risk of financial failure, loss of trade from UK to Europe

3.4. Societal costs associated with non-use

Based on the potential for failure experienced and the absence of the root cause the societal costs are the potential failure of the businesses.

This would be a loss of employees, a loss in capacity for the industry.

There would also be financial losses by affected customers.

3.4.1. Economic impacts on applicants

Potential failure of the businesses and loss of trade to Europe.

Investment into new plant.

3.4.2. Economic impacts on the supply chain

Losses to customers through failure and loss of trade to Europe.

3.4.3. Economic impacts on competitors

The consortium is varied and do not all compete directly there is no major advantage to be gained over companies that have already made the conversion to alternative 1.

Some capacity would move out of the UK into Europe where it is still possible to use Chromium Trioxide or further afield.

3.4.4. Wider socio-economic impacts

Loss of UK trade to Europe, this will occur already because Chromium Trioxide can continue in the UE while the authorisations are changed to restrictions.

3.4.5. Compilation of socio-economic impacts

1. Potential failures in the field resulting in claims
2. Loss of work from the UK to Europe where Chromium Trioxide can still be used
3. Potential failure of the business through claims, loss of employees.

Table 4: Societal costs associated with non-use.

The below table contains data for consortium.

Description of major impacts	**Monetised/quantitatively assessed/qualitatively assessed impacts**
1. Monetised impacts	**€ [per year[1]] [Over x years]**
Producer surplus loss due to ceasing the use applied for *OR* Investment and/or additional production costs related to the adoption of an alternative	£12.97 million investment financed over 5 years, estimate interest £0.8 million
Relocation or closure costs	£2.7 million loss of sales 3 months, lost profit of £600K
Loss of residual value of capital[1]	£215K due to depreciation
Social cost of unemployment[16]	*£1.0 million, layoff during cessation of business.*
Spill-over impact on surplus of alternative producers[17]	*£840K*
Please specify {These could include, e.g., additional costs for transportation or quality testing}	*£290K per year testing*
Sum of monetised impacts	*£18.69million over 5 years*
2. Additional quantitatively assessed impacts	**[Per year] [Over x years]**
Please specify {These could include, e.g., the number of non-treated patients or additional tonnes of greenhouse gas emissions}	£16K transport
3. Additional qualitatively assessed impacts	
Please specify {These could include, e.g., consumer surplus loss due to inferior quality, higher price or reduced quantity"	Loss of business to Europe £1.3 million x 3 years minimum. £400k costs already incurred from claims for product recall.

Notes:

1. Per average year during the time horizon used in the analysis.

Analysis based on the scenario that new plant is required to overcome the technical difficulties. Cessation of the production line for 3 months while work in completed, and loss of 2-8% business to European companies that are able to continue using Chromium Trioxide.

3.5. Combined impact assessment

[1] If profit losses have not been already accounted for.

Table 5: Societal costs of non-use and risks of continued use.

Societal costs of non-use		**Risks of continued use**	
Monetised impacts (€ [per year[1]] [over x years])	Up to £18.69 million over 5 years	Monetised excess risks to directly and indirectly exposed workers (€ [per year[2]] [over x years])	Not available
Additional quantitatively assessed impacts ([per year][over x years])	Not available	Monetised excess risks to the general population (€ [per year[2]] [over x years])	Not applicable as contained within process
Qualitatively assessed impacts ([per year][over x years])	£1.3million per year over 3 years, when it is expected that Chromium Trioxide is restricted in Europe £400k costs for claims	Qualitatively assessed risks ([per year][over x years])	175kg per year over 5 years, as total chromium discharge to sewer 6250kg as CrO3 by tanker
Summary of societal costs of non-use	£20.39 million total cost	**Summary of risks of continued use**	6425kg discharge over 5 years

Notes:

1. Annualised to a typical year based on the time horizon used in the analysis.
2. Per average year during the time horizon used in the analysis.

For PBT/vPvB substances, endocrine disruptors, and other substances of similar concern for which endpoints and impacts could not be estimated, describe the societal costs of non-use together with the releases or emissions predicted under the continued use scenario, and derive the corresponding cost-effectiveness ratio in

Table 6: Costs of non-use per unit of release.

	[Per year[4]] [Over x years]
Total costs[1] (€)	£20.39 million over 5 years
Total releases[2] (kg)	6425kg over 5 years
Ratio[3] (€/kg)	£3,173 per kg

Notes:
1. "Total costs" (in case of non-authorisation) = Societal costs of non-use
2. "Total releases" are from Table 3.
3. "Ratio" = Total costs/Total releases.
4. Annualised to a typical year based on the time horizon used in the analysis.

3.6. Sensitivity analysis

The analysis is based on the reasonable worst-case scenario that consortium members will require investment in new plant to resolve the technical issues encountered, this is based on the fact that alternatives are generally working on newly installed plant. This would cause disruption and cessation of production during installation.

The product recalls experienced jeopardies the business in terms of servicing claims which could incur huge costs. These have not been evaluated as an ongoing cost as it is an unknown but in the 6 months of chrome free during trial period claims came to £400k

3.7. Information to support for the review period

We are requesting a review period of 12 years. It will allow time for our suppliers to evaluate the root cause of the technical issues experienced to inform improvements. This will allow us to explore the feasibility of modifying the existing equipment in the first instance to avoid the huge costs of replacement. If this strategy is unsuccessful, it would allow time to raise finance and project manage new installations by the consortium businesses.

4. CONCLUSION

Overall conclusions on the AoA and SEA based on:

- The Alternatives for the architectural industry are well established and can be identified easily form approved listing by qualicoat and GSB. When changing to an approved alternative from the market leading supplier. Technical issues have occurred on our plant resulting in field failures. The root cause of failure is not fully understood so constitutes a huge risk to our business. There are some factors that can be identified why our risk is higher than the general industry. As a job coater we have a much greater complexity of materials for both powder coatings and aluminium grade and quality. Our plant is 30 years old and was designed for Chromium Trioxide.
- The alternatives are available for the use, the suitability on our plant has been proven to be inadequate, resulting in failures of wet adhesion and in the field as adhesion issues.
- The substitution plan has three phases, 1. Identify the root cause of failure, 2. Investigate options to adapt the current equipment. 3. Replace current equipment with new if adaptation does not work.
- The implementation of alternatives would lead to a reduction in risk, however due to very low exposures from the process these reductions do not out weight the socio-economic risks of the company.
- The socio-economic benefits of continued use of the Annex XIV substance are avoidance of high replacement costs of equipment, Also the incurred costs of servicing claims for early failure.
- Residual risks to human health and the environment of continued use are low as the measured exposures are very low and there are no discharges of the Annex XIV substance beyond our boundaries.
- For the above reasons the socio-economic benefits of continued use outweigh the risks to human health and the environment.
- The consortium has taken all reasonable steps to try to meet the deadline, It has converted to alternatives and abandoned the change only when failures occurred. The companies continue to investigate the alternatives.
- The factors that UKREACH in our opinion should take into consideration when assessing the duration of a review period of 12 years, are the circumstances resulting in the consortium requesting the authorisation being failures of the alternatives on our plant, suppliers unable to define the root causes, The consortium remain committed to try to resolve the situation and the companies will endeavour to meet the requirements earlier if possible.