ANALYSIS OF ALTERNATIVES (AoA)

and

SOCIO-ECONOMIC ANALYSIS (SEA)

including

SUBSTITUTION PLAN (SP)

Public version

Legal name of applicant:	Tata Steel UK Limited
Type of application:	Review report
Submitted by:	Tata Steel UK Limited
Date:	12 June 2026
Prepared by:	Tata Steel UK Limited Sagentia Regulatory (Technology Sciences Group Consulting Ltd)
Substance:	Sodium dichromate (EC no. 234-190-3, CAS nos 10588-01-9, 7789-12-0)
Use title:	The use of sodium dichromate for the passivation of electrolytic tinplate (ETP)
Use number:	1

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Declaration

We, the Applicant (Tata Steel UK Ltd), are aware of the fact that further evidence might be requested by the Health & Safety Executive (HSE) to support the information provided in this document.

Also, we request that the information redacted from the “public version” of this combined Analysis of Alternatives, Socio-Economic Analysis and Substitution Plan is not disclosed. We hereby declare that, to the best of our knowledge as of today (12 June 2026), 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.

James Davies
Works Manager – Director
Packaging – Trostre
Llanelli, Carmarthenshire
12 June 2026

On behalf of Tata Steel UK Ltd

List of abbreviations

AfA	Application for Authorisation
AFUS	Applied-for use scenario
AoA	Analysis of Alternatives
APEAL	Association of European Producers of steel for packaging (now called Steel for Packaging Europe)
BPA	Bisphenol A
BS	British Standard (published by the British Standards Institution, BSI)
BS EN	British Standard, European Norm, i.e. a British Standard that implements a European Standard
BS EN ISO	British Standard which implements an identical European and International Standard
C&L	Classification & labelling
CAGR	Compound annual growth rate
CAS	Chemical Abstracts Service
CFPA	Chrome-free passivation alternative
CLP	Regulation (EC) No 1272/2008 on classification, labelling and packaging of substances and mixtures (as amended) (References in this report to CLP should be taken as referring to GB CLP, as assimilated EU law following the UK's exit from the EU and the end of the Implementation Period on 31 December 2020, unless otherwise specified.)
CMR	Carcinogenic, mutagenic or toxic to reproduction
COGS	Cost of goods sold
Cr(O)	Metallic chromium
Cr(III)	Trivalent chromium
Cr(VI)	Hexavalent chromium
CSR	Chemical Safety Report
CTAC	Chromium Trioxide REACH Authorisation Consortium
D&I	Drawn and ironed (also referred to as DWI)
Defra	Department for Environment, Food & Rural Affairs
DRD	Drawn and Redrawn
DWI	Drawn and wall ironed (also referred to as D&I)
EAF	Electric Arc Furnace
EBITDA	Earnings before Interest, Taxes, Depreciation and Amortization
EC	European Commission
ECCS	Electrolytic chromium coated steel (also known as tin-free steel or TFS)
ECHA	European Chemicals Agency
ECS	Environmental contributing scenario
EEA	European Economic Area, i.e. the EU plus Norway, Iceland and Liechtenstein
ELR	Excess Lifetime Risk
EN	European Norm, i.e. European Standard (published by the European Committee for Standardisation, CEN)
EN ISO	European Standard which implements an identical International Standard

EPR	The Environmental Permitting (England and Wales) Regulations 2016
ERC	Environmental Release Category
ES	Exposure scenario
ETP	Electrolytic tin-plated steel (also known as tinplate)
EU	European Union
FCM	Food contact materials
FTE	Full-time equivalent
FY	Financial Year
GB	Great Britain
HSE	Health & Safety Executive
IARC	International Agency for Research on Cancer
ISO	International Standard (published by the International Organisation for Standardisation, ISO)
IUPAC	International Union of Pure and Applied Chemistry
LTS	Low tin steel
NPV	Net present value
NUS	Non-use scenario
OC	Operational Conditions
PC	Chemical product category
PEC	Predicted environmental concentration
PPE	Personal protective equipment
PROC	Process category
R&D	Research and development
RAC	Committee for Risk Assessment (ECHA)
RAR	Risk assessment report
RCR	Risk characterisation ratio
REACH	Regulation (EC) No 1907/2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (as amended) (References in this report to REACH should be taken as referring to UK REACH, as assimilated EU law following the UK's exit from the EU and the end of the Implementation Period on 31 December 2020, unless otherwise specified.)
RMM	Risk Management Measure(s)
RPE	Respiratory protective equipment
SAGA	Suitable alternative generally available
SEA	Socio-economic analysis
SEAC	Committee for Socio-Economic Analysis (ECHA)
SEG	Similar exposure group
SfPE	Steel for Packaging Europe (formerly APEAL)
SR&D	Scientific research and development
SP	Substitution Plan
SU	Sector of use

SVHC	Substance of very high concern
TFS	Tin free steel (i.e. ECCS)
TSN	Tata Steel Netherlands
TSUK	Tata Steel UK Ltd (the applicant)
TWA	Time-weighted average
VCM	Value of cancer morbidity
VSL	Value of a statistical life
WCS	Worker Contributing Scenario
WEL	Workplace exposure limit
WTP	Willingness to pay
WWTP	Wastewater treatment plant

1. Summary

Tata Steel UK Ltd ('the applicant') is the largest steel company in the United Kingdom (UK), with operations and distribution sites across the UK. It provides a vital foundation for many of the UK's key strategic supply chains, particularly in the automotive, construction, engineering and packaging sectors. It is a supplier of high-quality steel products and an innovation partner to many household names.

The applicant's site in Llanelli, Carmarthenshire (the Trostre Works) is the sole producer of electrolytic tin-plated steel (ETP, also known as tinplate) and electrolytic chromium coated steel (ECCS, also known as tin-free steel) for packaging in the UK. The site, which celebrated its 70th year in 2022, manufactures up to 400,000 tonnes of tin, chromium and polymer coated steels every year for food and drinks cans, bakeware and other packaging applications. It is widely regarded as a leading supplier of high-quality packaging steels, supplying over fifty countries worldwide.

Figure 1*: The Trostre Works in Llanelli, Carmarthenshire*

The applicant is part of Tata Steel Europe, one of the largest steel producers in Europe which manufactures and supplies high-quality strip steel products to demanding markets such as construction, automotive, packaging and engineering. Tata Steel Europe is in turn part of the Tata Steel Group which is one of the world's most geographically diversified steel producer with fully integrated operations – from mining to the manufacturing and marketing of finished products. The Tata Steel Group is itself part of the Tata Group, a global business conglomerate operating across diverse industries such as agrochemicals, automotive, chemicals, construction, finance, consumer products, and hospitality.

The applicant uses sodium dichromate at the Trostre Works for the passivation of ETP. Passivation is a critical surface treatment applied after tin plating to stabilise the freshly deposited tin and reduce its chemical reactivity. Fresh tin oxidises readily when exposed to air and, without control, this oxidation continues during storage and transport, leading to excessive tin oxide growth, surface discolouration and impaired performance. Passivation addresses this by forming a very thin conversion layer on the tin surface, consisting of metallic chromium and chromium (III) oxide, which significantly slows further oxidation and provides a stable, reproducible surface.

A brief overview of different applications of ETP products is given in the table below.

Application	Examples of final products
Food packaging	Vegetable and soup cans; pet food cans; fish cans; ready meal cans
Beverage packaging	Beer and soft drinks cans
Aerosol cans	Personal care and household products in aerosol cans; food products (e.g. whipped cream)
General line	Cans for paint, oil or syrups; decorative tins (promotional packaging); tins for confectionery and for dry products (milk powder/ coffee); and unlacquered applications of tinplate for general line
Closures and can ends	Closures for glass bottles and glass jars
Non-packaging	Toys and gas canisters, including specialities and automotive parts

***Table 1**: Overview of the packaging applications for the applicant's products*

***Figure 2**: An example of how the applicant's ETP products (left) are used by its customers to make food packaging (centre) for well-known food brands (right)*

Sodium dichromate is listed in Annex XIV of REACH (entry no. 18) and is subject to authorisation because of intrinsic properties relating to carcinogenicity, mutagenicity and reproductive toxicity. The applicant already has an authorisation under REACH for the use of sodium dichromate for the passivation of ETP (authorisation number UKREACH/22/01/1), with a review period ending on 31 December 2027.

The applicant needs to continue to produce ETP using sodium dichromate beyond the end of 2027. This report sets out information regarding the absence of suitable alternatives, the applicant's substitution efforts and plan, and socio-economic benefits to support an extension to the authorisation.

1.1 Analysis of alternatives (AoA)

Sodium dichromate plays a critical role in the manufacture of the applicant's ETP products. Through its use in passivation, sodium dichromate enables the formation of a thin, stable chromium metal and chromium (III) oxide layer on the tin surface, which is essential to control tin oxide growth, ensure surface stability during storage and transport, and provide a reliable interface for subsequent organic coatings. These functions underpin the corrosion resistance, lacquer adhesion, formability and long-term performance required for demanding packaging applications, particularly food and beverage packaging. For the majority of end uses served by the applicant, passivation using sodium dichromate is therefore an integral process step that directly determines product safety, quality and customer acceptance.

The AoA seeks to determine whether there are any suitable alternative substances or technologies to the use of sodium dichromate for the passivation of ETP. In particular, the AoA considers:

a) the technical feasibility of alternatives to sodium dichromate.
b) the economic feasibility of alternatives to sodium dichromate.
c) whether transferring to alternatives would result in reduced overall risks to human health and the environment.
d) whether the alternatives are available to the applicant, i.e. whether they would be of sufficient quality and accessible in sufficient quantities.

In preparing this AoA, the applicant has considered a wide range of potential substances, surface treatments and process changes that could, in principle, replace sodium dichromate for the passivation of ETP. These include alternative chromium chemistries, inorganic and organic conversion coatings, silane-based systems and zirconium and titanium-based treatments. Each option has been assessed against the applicant's key functional requirements, including corrosion resistance prior to use, compatibility with downstream forming and welding processes, adhesion and durability of organic coatings, suitability for food contact, visual appearance, scalability and process robustness.

This assessment demonstrates that most alternatives fail at an early stage due to fundamental technical limitations or incompatibility with the highly demanding requirements of tinplate packaging applications. In many cases, alternatives provide insufficient control of tin oxide growth, inadequate lacquer adhesion after deformation or sterilisation, poor resistance to sulphur-containing foods, unacceptable changes in surface appearance or lack the robustness required for high speed, continuous industrial production. Other options would also require wholesale changes to manufacturing processes or downstream customer operations, making them neither technically nor economically feasible in practice.

Against this background, the Chromium Free Passivation Alternative (CFPA) has emerged as the most advanced and credible potential alternative. CFPA has been developed collaboratively by European packaging steel producers over many years and aims to replicate the key surface-stabilising functions of chromate passivation without the use of hexavalent chromium (Cr(VI)). It has been the subject of extensive laboratory testing, industrial trials and downstream evaluation. No other alternative identified in this AoA approaches CFPA in terms of technical maturity, relevance to tinplate processing or alignment with existing supply chains.

However, despite this progress, CFPA cannot yet be considered a technically feasible replacement for sodium dichromate across the full range of the applicant's products and applications. Experience to date has shown that CFPA does not consistently deliver all key functionalities under industrial and downstream conditions, particularly in more demanding food packaging applications. In addition, recent regulatory restrictions on bisphenol A (BPA) have fundamentally altered the coatings landscape, meaning that much of the historic qualification of CFPA has been carried out using lacquer systems that are now being phased out. The performance of CFPA in combination with emerging BPA-free lacquers remains uncertain and requires substantial further development, optimisation and customer-led pack testing. For these reasons, CFPA does not currently meet the criteria for a suitable alternative generally available, and continued use of sodium dichromate remains necessary while the applicant pursues substitution through a structured and realistic development pathway.

1.2 Socio-economic analysis (SEA)

For the applicant, ETP is a strategically critical product within its packaging steel portfolio and underpins a substantial proportion of production at the Trostre Works. The applicant has invested over many decades in the specialist infrastructure, process control and operational expertise required to manufacture high-quality ETP, including advanced annealing, tempering and coating processes. These capabilities not only support domestic manufacturing, particularly in the food and beverage sector, but also position the applicant as a competitive player in the European packaging steel market. The applicant's customers, including can makers and food producers in the UK and beyond, rely on a consistent and high-quality supply of passivated tinplate to meet stringent food safety requirements, regulatory obligations and consumer expectations. The mechanical performance and surface characteristics of ETP are critical to efficient can making and reliable long-term packaging performance.

At a national level, the continued production of ETP at Trostre supports the UK economy through skilled employment, industrial output, integrated supply chains and food security. The Trostre Works is the sole producer of tinplate for packaging in the UK, and its output plays a vital role in supplying domestic food, beverage and aerosol packaging markets. The strategic importance of packaging steel was clearly demonstrated during the COVID-19 pandemic, when production of food grade packaging materials was recognised by the UK Government as an essential activity, allowing operations to continue throughout periods of lockdown.

The SEA evaluates potential impacts to the health of workers and the public in the vicinity of the Trostre Works that may be exposed to Cr(VI) because of ongoing Cr(VI)-based passivation. It also evaluates the economic and social benefits relating to these activities. The assessment focuses on impacts within the UK and the impacts are described quantitively or qualitatively, depending on the complexity of the issue and the availability of data. Impacts beyond the UK are also discussed for context where relevant.

The applicant has considered what it would do if an extension to the authorisation is not granted, i.e. the non-use scenario (NUS). As set out in the AoA, no alternative is currently available that would allow continued manufacture of passivated ETP meeting the applicant's key functional requirements. In the absence of sodium dichromate, the applicant would therefore be unable to continue ETP production at Trostre.

ETP is one of the two principal products manufactured at Trostre and represents a substantial proportion of site output, revenues and customer demand. The applicant has assessed whether it would be possible to continue operating the site on the basis of ECCS and other products alone and has concluded that this would not be realistic due to the resulting loss of revenue, the inability to absorb fixed operating costs and the high degree of operational and economic integration across the site.

As a result, the cessation of ETP production would be expected to lead to the closure of the Trostre Works as a whole. This would have major implications for the applicant's revenues, profitability and operations and would extend well beyond the immediate loss of tinplate production. In particular, closure of Trostre would have significant knock-on effects for the applicant's wider UK steelmaking operations, including the new electric arc furnace (EAF) based steelmaking facility at Port Talbot. That facility, which is central to the applicant's green steel transition, is expected to supply substantial volumes of hot rolled coil (HRC) to Trostre for further processing into high value packaging steels. Loss of Trostre as a downstream outlet would undermine the production assumptions and financial viability of the EAF project, which is a strategic priority for the applicant and is supported by a £500 million Grant Funding Agreement with the UK Government.

Beyond the applicant's own operations, the impacts of a refused extension to the authorisation would propagate throughout the supply chain. The Trostre Works is the sole domestic producer of ETP in the UK, and its customers, including can makers and food producers, rely heavily on a secure and consistent supply of ETP for critical packaging applications. In the absence of domestic supply, customers would be forced to source tinplate from overseas. This would weaken domestic manufacturing resilience, expose the UK food and packaging sectors to increased supply chain disruption, raise costs and create additional risks relating to logistics, quality consistency and security of supply for critical food packaging applications.

In other words, the consequences of a refused authorisation would extend far beyond the applicant's use of sodium dichromate at Trostre. They would affect the applicant's customers, destabilise critical domestic supply chains for food and consumer goods packaging, and materially undermine the economic and strategic rationale for the applicant's £1.25 billion investment in low carbon steelmaking at Port Talbot.

On the other hand, the risks of continued use of sodium dichromate are assessed as follows:

- health impacts on directly exposed workers at the applicant's site, conservatively monetised at £7,681 to £12,866 over the requested review period; and
- health impacts by inhalation and oral route on the local population including indirectly exposed workers, conservatively monetised at £754,308 to £1,485,758 over the requested review period.

The requested review period of 10 years from the end of the existing review period on 31 December 2027 is used for the purpose of the assessment. This represents the minimum length of time within which the applicant anticipates being able to replace sodium dichromate with a suitable alternative and retain customer confidence as regulatory pressure to substitute sodium dichromate subsides in the EU. The SEA also considers the period between the estimated date of a refused decision, assumed for the purpose of this assessment to be 1 January 2028, i.e. the end of the current review period, and 31 December 2037, in terms of the assessment of certain economic impacts. 2026 is used as the base year for calculations.

The aggregated societal benefits of the continued use sodium dichromate for the manufacture of ETP are expected to be at least [redacted] (public range: £135 million to £291 million) over the period, whereas the aggregated monetised health impacts of the use applied for are expected to be between £0.76 million to £1.50 million (lower and upper bounds over the review period requested by the applicant). Therefore, over the 10 years, the benefits outweigh the risks by a factor of over [redacted] (public range: > 100). This is a very conservative estimate – in this AfA, the risks of using sodium dichromate have been deliberately overstated, whereas the benefits have been deliberately understated.

1.3 Substitution plan (SP)

The applicant's initial AfA was intended as a bridging measure, reflecting the identification of a promising potential alternative in the form of CFPA while recognising that further development and refinement were required before it could be fully implemented. That application was prepared collectively by members of APEAL (now Steel for Packaging Europe) and submitted by each legal entity. Since its submission in November 2019, however, progress towards substitution has been affected by several significant developments. These include:

- the restructuring of Tata Steel's European operations in October 2021, which resulted in the applicant losing direct access to the IJmuiden Technology Centre that had been leading CFPA development within the wider organisation.

- the regulatory restriction of bisphenol A in food contact materials following the European Food Safety Authority's 2023 conclusions, which has fundamentally altered the coatings landscape, reducing the relevance of further optimisation of CFPA with legacy BPA-containing lacquers and introducing uncertainty as new BPA-free systems are still under development and qualification.

- the European Commission's request for ECHA to prepare a restriction proposal for Cr(VI) substances under EU REACH, published in May 2025, which would allow continued use of sodium dichromate for defined uses under strict conditions once in force, thereby reducing the regulatory pressure to substitute within the EU and influencing the pace and prioritisation of substitution activities across the sector.

The applicant recognises and fully supports the objectives of REACH in promoting the progressive substitution of substances of very high concern with safer alternatives, where this is technically and economically feasible. In line with this objective, the applicant has been actively engaged for many years in the development, evaluation and qualification of alternatives to sodium dichromate for the passivation of ETP. These efforts have been undertaken both independently and in collaboration with other European packaging steel producers, customers and coating suppliers.

This report therefore includes a detailed substitution plan which sets out the actions already taken by the applicant, the activities currently underway and the further steps required to achieve substitution of sodium dichromate with a technically viable alternative. The substitution plan is not presented as a theoretical or aspirational exercise, but as a practical, experience-based roadmap that reflects the technical complexity of tinplate passivation, the stringent requirements of food packaging applications and the interdependence of actors across the supply chain.

Successful substitution of sodium dichromate is influenced by a set of inter-related technical, regulatory and market factors that collectively determine both the feasibility and timing of transition. Progress depends on the following, each of which carries inherent uncertainty:

- *The availability of suitable BPA-free lacquers developed by customers and their suppliers*. BPA-free lacquer development is highly variable across suppliers and applications, requiring multiple formulations and staggered qualification pathways, meaning that success for one customer or product cannot be readily extrapolated to others.

- *The optimisation of the applicant's CFPA process to ensure compatibility with those lacquers*. In parallel, CFPA process optimisation must address outstanding issues relating to coating uniformity, surface behaviour and downstream compatibility, within the practical constraints of limited industrial operating experience and restricted access to a single high-utilisation production line at Trostre.

- *The successful completion of extensive customer-specific pack testing and qualification*. Customer qualification further adds complexity, as each application and filling requires long-duration testing, often involving multiple iterations, with risks arising from CFPA-related defects, acceptance thresholds and potential diversion of customers to non-UK suppliers to mitigate commercial risk.

- *Regulatory developments in the EU*. Evolving regulatory developments in the EU, including the proposed restriction of Cr(VI) substances under EU REACH, may alter substitution drivers and influence investment priorities across the sector.

The applicant's substitution plan is structured around a phased development pathway, beginning with the development of BPA-free coatings and associated development of CFPA and extending through pilot-scale production, customer testing, approvals and eventual industrial transition. Each phase is associated with specific milestones, dependencies and uncertainties, recognising that progress is influenced not only by the applicant's own activities but also by developments within downstream customer operations, coating technologies and regulatory frameworks.

Importantly, the substitution plan acknowledges that substitution cannot be achieved through a single, uniform transition across all products and customers. Instead, it is expected to proceed incrementally, with different applications and customer segments progressing at different rates depending on technical readiness, pack-testing requirements and commercial considerations. The plan therefore allows for overlap between phases and for iteration where issues are identified, while maintaining a clear direction of travel towards eventual cessation of sodium dichromate use.

The substitution plan plays a central role in supporting the requested review period by demonstrating that the applicant is pursuing substitution actively, systematically and in good faith, but that additional time is required to resolve outstanding technical challenges and to complete customer-led qualification activities without jeopardising supply continuity, product safety or downstream manufacturing operations. The plan is intended to provide transparency regarding both the complexity of substitution efforts across the various actors involved and the realistic timeframe within which it can be achieved. As a result, **a review period of 10 years (from the end of the existing review period on 31 December 2027) is requested**.

Against this background, and to assure the market of its continued ability to supply high-quality products while progress towards substitution continues, the applicant has developed this review report application to extend its authorisation beyond 2027.

2. Aims and scope

The applicant recognises and agrees with the objectives of REACH in seeking to substitute substances of very high concern (SVHC) with safer alternatives. This combined AoA, SEA and SP report supports the AfA, which aims to demonstrate the following:

- The applicant has a robust package of risk management measures (RMMs) in place to minimise exposure to sodium dichromate, as described in the Chemical Safety Report (CSR).
- The applicant has been conducting appropriate R&D efforts, and continues to do so, to identify suitable alternatives to the use of sodium dichromate for the passivation of ETP. However, there will be no suitable alternatives available to the applicant by the end of the current review period (31 December 2027).
- An AoA has been conducted for the purpose of this application to examine the technical and economic feasibility of potential alternatives, their availability and the level of risk reduction they present. The AoA has found that none of the identified potential alternatives are currently suitable to replace the current Cr(VI)-based technology without significant loss of technical and/or economic performance.
- A SEA has been conducted for the purposes of this application to describe and analyse the most significant relevant impacts (positive and negative effects) of granting an authorisation compared to refusing to grant the authorisation. The SEA has found that the benefits of continued use of sodium dichromate by the applicant significantly outweigh the risks of continued use for human health and the environment.
- Granting the authorisation would allow the applicant to continue to use sodium dichromate while continuing its search for a more sustainable alternative and avoiding the socio-economic impacts associated with the NUS. This would avoid the loss of a substantial value of profits and the redundancy of many hundreds of workers, amongst other very significant impacts. The applicant foresees that the substitution of sodium dichromate will not be feasible for at least the duration of the requested review period.
- The applicant has revised (and is implementing) its substitution plan which sets out, based on the current state of technology, the actions and timetable foreseen to substitute sodium dichromate with a suitable alternative. The SP describes the complexities associated with substitution and provides detail about why the review period requested is necessary.

The scope of this assessment is the evaluation of potential health impacts from exposure to sodium dichromate arising from the passivation of ETP at the applicant's Trostre Works site, as well as the socio-economic impacts resulting from the NUS. A detailed description of technical requirements and processes can be found in the CSR for this application.

2.1 Regulatory background for sodium dichromate

The substance subject to this AfA is sodium dichromate (EC no. 234-190-3), an inorganic, soluble salt of hexavalent chromium (Cr(VI)). Sodium dichromate was included in the candidate list of substances of very high concern (SVHC) on 28 October 2008 (ECHA Decision ED/67/2008) and was included in Annex XIV of EU REACH on 17 April 2013 (as entry no. 18) by virtue of Commission Regulation (EU) 348/2013. This was because of intrinsic properties relating to carcinogenicity, mutagenicity and reproductive toxicity. It was given a latest application date of 21 March 2016 and a sunset date of 21 September 2017.

EU REACH was retained in UK law from 1 January 2021, including entry no. 18 of Annex XIV. Transitional arrangements under UK REACH are directly relevant for the applicant, as explained below.

Substance name	Intrinsic properties *	Latest application date	Sunset date
Sodium dichromate EC no. 234-190-3 CAS no. 10588-01-9 and 7789-12-0	Carcinogenic (cat. 1B) Mutagenic (cat. 1B) Toxic to reproduction (cat. 1B)	21 March 2016	21 September 2017
* Intrinsic properties are those referred to in Article 57 of REACH that result in the substance being included in Annex XIV.			

***Table 2**: About sodium dichromate and its entry in Annex XIV of REACH*

The applicant already has an authorisation under REACH for the use of sodium dichromate for the passivation of ETP. The application was made under EU REACH on 3 December 2019 and final opinions were issued on 28 December 2020 by ECHA's Risk Assessment Committee (RAC) and Committee for Socio-Economic Analysis (SEAC). However, the authorisation itself had not been granted by the European Commission by the end of the Implementation Period on 31 December 2020, following the UK's exit from the EU.

Under UK REACH transitional rules, Tata Steel resubmitted its application for authorisation as an 'in-flight' application to the Secretary of State (SoS) for the Department for Environment, Food and Rural Affairs (Defra). The authorisation was granted by the SoS on 24 January 2022 (authorisation number UKREACH/22/01/1) with a review period ending on 31 December 2027.

This authorisation was granted together with an authorisation for chromium trioxide for the same use. Both sodium dichromate and chromium trioxide had featured in the original AfA because the applicant had submitted the application jointly with another Tata Steel company, Tata Steel IJmuiden BV, based in the Netherlands (referred to in this report as Tata Steel Netherlands or TSN). While TSN may use chromium trioxide as well as sodium dichromate for the passivation of ETP, the applicant does not, and so this review report application covers sodium dichromate only.

2.2 The applicant

2.2.1 About the applicant and its role in the UK and European steel markets

The applicant, Tata Steel UK Ltd, is a major steel manufacturer based in the UK and forms part of the wider Tata Steel Group, which is headquartered in India. The applicant operates extensively across the UK, with a significant presence in South Wales. The company is the largest steelmaker in the UK, supplying high-quality steel products such as hot-rolled, cold-rolled and coated steels to demanding markets such as construction, infrastructure, automotive, packaging and engineering.

The applicant's Port Talbot steelworks is one of the largest in Europe and serves as a central hub for the company's integrated steelmaking operations. Port Talbot is the applicant's primary steelmaking site and the molten steel produced there is cast and rolled into coils or slabs. Many of these products are transported to the applicant's other sites across the UK for further processing and value-added services, such as cold rolling, galvanising and coating. The applicant also operates facilities in Sweden, France, Germany and Norway, with sales offices across the world.

As part of its commitment to reducing environmental impacts, the applicant announced in September 2024 an investment of £1.25 billion – of which £500 million is supported by the UK Government – to transition to EAF steelmaking at its Port Talbot site. This investment is expected to enhance the UK's steel security and represents a significant step toward decarbonising the nation's steel industry. The transition is projected to reduce direct carbon emissions by 50 million tonnes over the next decade, equivalent to 1.5% of the UK's total direct CO_2 emissions alone, while maintaining an annual production capacity of three million tonnes of steel and preserving over 5,000 jobs.

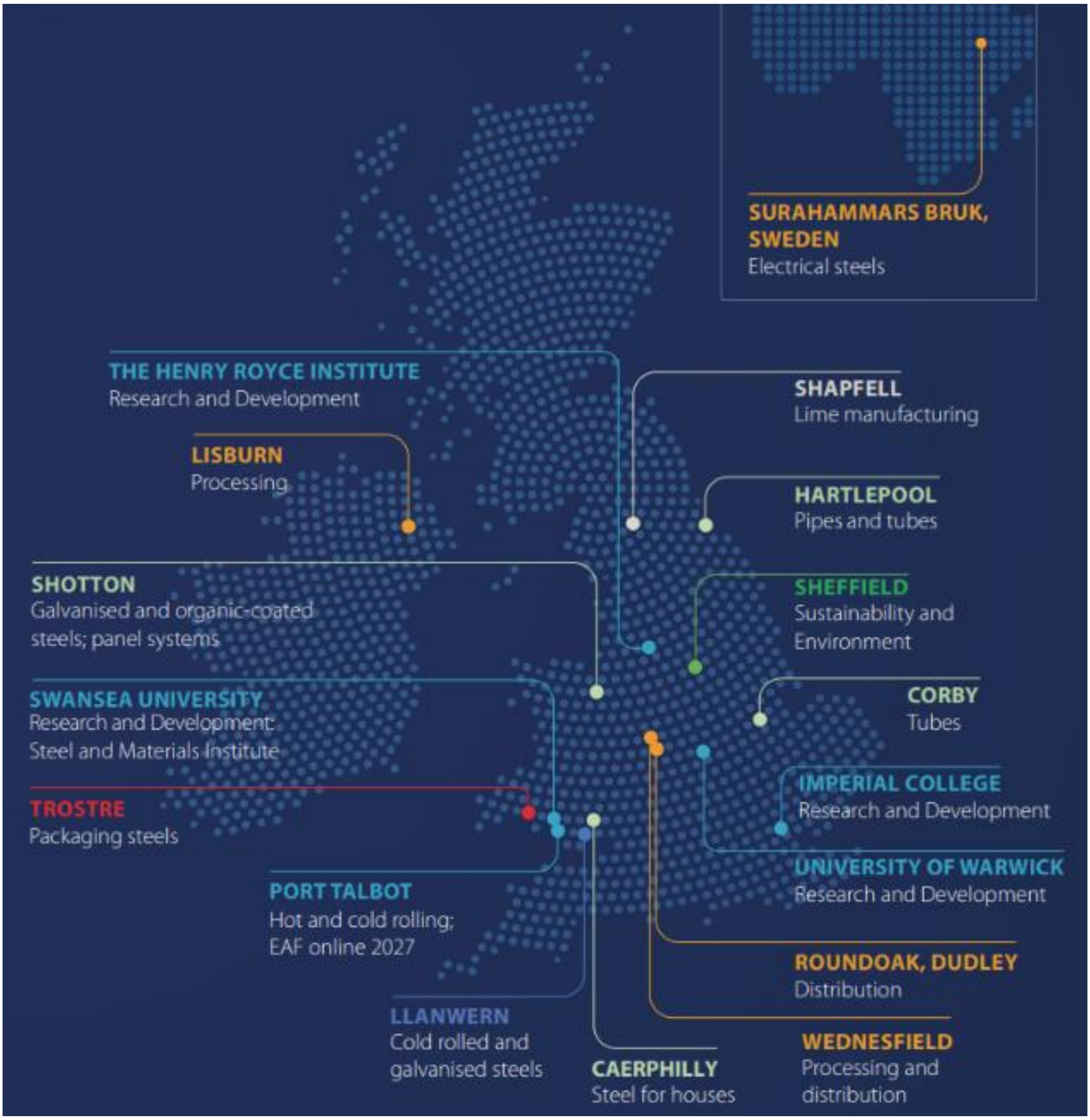


***Figure 3**: The applicant's UK sites*

These UK sites are highly integrated, i.e. they are interdependent and work together as part of a coordinated production and supply chain. This integration allows the applicant to efficiently manage the flow of materials, optimise production processes and deliver a wide range of steel products to customers. Each site has its own specialisation and strategic role in the company's steel production and processing network. The following provides an overview of the applicant's major locations and their functions:

- Port Talbot (Wales). This is the largest steelworks in the UK and one of the largest in the world. It is an integrated steelmaking facility that includes furnaces, a basic oxygen steelmaking plant and hot strip mills. Port Talbot is the heart of primary steel production in the UK and is currently undergoing a major transformation to become a hub for green steelmaking, with plans to transition to EAF technology.

- Shotton Works (Deeside, Wales). Shotton is a leading site for coated steel products. It is best known for producing Colorcoat pre-finished steel, which is widely used in the construction sector for roofing and cladding.

- Llanwern (Newport, Wales). Llanwern is a key downstream processing site. It includes a hot strip mill and facilities for cold rolling and galvanizing. The site plays a crucial role in producing high-quality flat steel products for automotive and construction applications.

- Trostre (Llanelli, Wales). This site, the focus of this AfA, specialises in the production of packaging steels, primarily ETP and ECCS. These products are used for food and beverage cans, aerosols and other packaging solutions, serving both domestic and international markets.

- Corby (England). Corby is a major hub for tubular products. It manufactures steel tubes used in construction, infrastructure and industrial applications. The site includes tube mills and finishing lines.

- Hartlepool (England). The Hartlepool site focuses on the production of large-diameter steel pipes, particularly for the energy sector, including oil and gas pipelines. It has been a key supplier for offshore and onshore pipeline projects.

- Wednesfield (Wolverhampton, England). This site is home to the Steelpark facility, one of the largest steel service centres in the UK. It provides processing and distribution services, including slitting, decoiling, and cutting to length, catering to a wide range of industries.

The interdependence between these sites means that impacts at any one site ripple across the network. For instance, the recent closure of the blast furnaces at Port Talbot meant that sites such as Llanwern, Shotton and Trostre lost their main domestic source of steel. To maintain operations, the applicant is temporarily relying on imported steel, which has introduced logistical challenges and increased costs. Similarly, were Trostre forced to close (e.g. in the event of a refused authorisation), this would mean that a significant amount of the hot rolled coil (HRC) that will be produced at the new EAF based steelmaking facility from early 2028 could no longer be supplied for further processing into packaging steels, which would fundamentally affect the production assumptions on which the EAF facility is based. This is discussed further in section 5.3 below.

The applicant's products are essential to a range of industries, including automotive, construction, engineering and packaging. Its customer base includes major companies such as BMW, Kraft Heinz, Jaguar Land Rover and JCB. The shift to EAF technology is anticipated to open new opportunities for these sectors through the supply of low CO_2 steel.

Since acquiring the UK business in 2007, the applicant has invested £4.5 billion into its UK operations, underscoring its long-term commitment to both the industry and the communities in which it operates. The additional £1.25 billion investment in the EAF project further reinforces this commitment and marks a pivotal moment in the UK's industrial strategy. It will dramatically reduce CO_2 emissions and ensure the continuation of domestic steelmaking, promoting self-sufficiency in the UK supply chain and supporting thousands of jobs and associated industries for generations to come.

2.2.2 About the Trostre Works

The Trostre Works is a prominent manufacturing site for packaging steels with a rich history. The plant was initially built by the Steel Company of Wales in 1947. The site was chosen due to its proximity to railway access and the availability of skilled labour in the region with a strong heritage in tinplate manufacture. Production at Trostre began in 1950 and, by 1956, the plant had reached its planned output of 400,000 tonnes per year. Following nationalisation of the steel industry in 1967, the site became part of the British Steel Corporation. In 1999 ownership transferred to the Corus Packaging Plus business following the merger of British Steel with Koninlijke Hoogovens. In 2007, Tata Steel completed the acquisition of Corus Group plc and has operated the facility to the present day.

Figure 4*: The Trostre Works in Llanelli, Carmarthenshire*

At the Trostre Works, the applicant produces tin (ETP), chromium (ECCS) and polymer (Protact) coated steels, primarily for the packaging industry. The plant manufactures up to 400,000 tonnes of steel products annually, which are used by its customers to produce food and beverage cans, aerosols, paint tins and luxury packaging. The facility is equipped with advanced technology and operates under stringent health, safety and environmental standards, being subject to both the Control of Major Accident Hazards Regulations 2015 (COMAH) and the Environmental Permitting (England and Wales) Regulations 2016 (EPR). Tata Steel has continuously invested in the site, focusing on innovation, sustainability and efficiency to maintain its competitive edge in the market.

The importance and significance of the Trostre Works extends beyond its production capabilities. The facility is a major employer in the region, contributing to the local economy and providing hundreds of skilled jobs. The Trostre site also maintains close links with the local community through various bursary awards and educational awareness programmes run in local schools and colleges. Its commitment to sustainability and innovation has positioned it as a leader in packaging steels production. The plant's ability to adapt and evolve over the years has ensured its longevity and continued success, making it a vital part of Tata Steel's operations and the broader steel industry today.

2.2.3 About the applicant's use of sodium dichromate at the Trostre Works

The applicant uses sodium dichromate at the Trostre Works in the passivation of electrolytic tinplate (ETP). Passivation is a surface treatment applied after tin plating to stabilise the freshly deposited tin surface and make it less chemically reactive. Fresh tin readily oxidises when exposed to air and, if left uncontrolled, this oxidation continues during storage and transport, leading to the formation of a progressively thick, undesirable tin oxide layer. Passivation controls this process by creating a very thin conversion layer on the tin surface, rendering it chemically passive and significantly slowing further oxidation. The use of a sodium dichromate-based passivation treatment results in the formation of a thin layer of metallic chromium (Cr(0)) and chromium (III) oxide (Cr(III)).

At Trostre, passivation is performed in a highly automated way with a minimum of exposure and emissions. The resulting coating is free of sodium dichromate. The resulting products are then used by the applicant's customers to produce food packaging (cans for food and drink) and various other types of metal packaging. Further information about the passivation process can be found in section 3.1.1 below.

This passivation layer performs several essential functions. It prevents excessive tin oxide growth and surface discolouration during storage, provides a stable and reproducible surface that ensures reliable adhesion of subsequent organic coatings and supports consistent performance during welding, forming and can-making operations. Without effective passivation, tinplate would oxidise unpredictably between manufacture and use, leading to poor lacquer adhesion, increased corrosion risk after filling and sealing, loss of product quality and customer acceptance, and detrimental impacts to material stored in the packaging, particularly food. For the majority of food applications, passivation is therefore an integral and necessary step in the manufacture of ETP rather than an optional enhancement.

2.2.4 About the applicant's products

At Trostre, the applicant produces four product types, described in further detail below:

- **ETP**: electrolytic tin-plated steel, also known as 'tinplate', a process which uses sodium dichromate and which is the subject of this AfA.
- **ECCS**: electrolytic chromium coated steel, also known as 'tin-free steel', a process which uses chromium trioxide and which is covered by a separate authorisation.
- **Protact**: a type of ECCS that has been laminated with a three-layer polymer coating on each side.
- **Blackplate**: although this usually serves as the base material for producing ECCS and ETP, it may be sold as a product in its own right.

The Trostre Works is the only site in the UK where packaging steel is manufactured. Trostre's customers include major global and regional brands in the food and beverage sector, as well as manufacturers of aerosols, paint cans, bottle caps, closures and high quality bakeware. These customers use the applicant's coated steel products to produce items such as food tins, beverage cans and other sealed containers that require both durability and corrosion resistance. Trostre's products are also used in non-food sectors, including personal care, household products and industrial packaging, where the steel's formability and protective coatings are essential for product integrity and shelf life. In addition, some of the ECCS produced at Trostre is further processed to become Protact or supplied to Tata Steel's sites at Duffel (Belgium) and Ijmuiden (the Netherlands) where organic coatings are also applied on their laminating lines.

Figure 5*: An example of the applicant's finished products*

The applicant manufactures up to 400,000 tonnes of products annually. ETP and ECCS make up the vast majority of Trostre's output. The table below shows product sales and percentage splits for those products over the last five years.

[redacted]

Table 3*: Turnover and percentage split for ETP, ECCS and Protact at Trostre*

Although this AfA only covers the use of sodium dichromate for the passivation of ETP, a short comparison of the different types of products manufactured by the applicant at Trostre is needed to help explain the choice customers make between different kinds of packaging materials (which is highly relevant to the AoA). The choice is not straightforward, and selection depends on a number of factors which are considered further in the sections below.

2.2.4.1 ETP (tinplate)

There are two types of electrolytic tinplate (ETP): passivated and non-passivated. In the case of passivated ETP, a layer of tin is first deposited onto both sides of the blackplate, followed by the application of a thin chromium oxide layer (as illustrated in Figure 6 below). The role of Cr(VI) in this process is to stabilise the surface and ensure both reliable performance and food safety. This stabilisation process is known as passivation, which refers to making the material chemically 'passive' or less reactive.

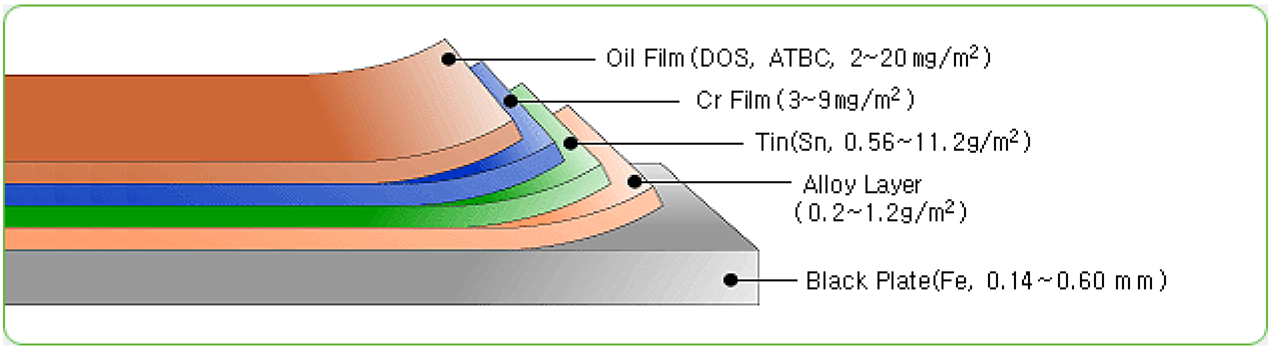


***Figure 6**: Structure (layers) of ETP*

Passivation prevents the formation of tin oxide on the surface, which would otherwise occur when tin is exposed to air. This is achieved through the electrolytic deposition of a thin chromium layer over the tin. When exposed to air, chromium naturally forms a stable layer of chromium oxide (Cr_2O_3) which, unlike iron oxide (rust), acts as a barrier, preventing oxygen from reaching the underlying metal. In addition to corrosion protection, this process also enhances the surface's adhesion properties, making it suitable for further processing and coating.

Non-passivated ETP can be suitable for some packaging applications where the enhanced corrosion resistance and surface stability provided by passivation are not necessary. Cost considerations also play a role, as non-passivated ETP can be more economical to produce and is sufficient for dry or non-food applications where exposure to moisture or corrosive substances is minimal. Additionally, certain industrial packaging, closures or components that do not require long-term corrosion protection may not benefit from passivation. Ultimately, the choice to use non-passivated ETP often reflects customer specifications and compatibility with downstream processing or materials.

2.2.4.2 ECCS (tin-free steels)

ECCS, also called tin-free steel, is an electrolytic chromium plated steel consisting of a layer of chromium metal (Cr(0)) and a layer of chromium (III) oxide (Cr_2O_3) deposited electrolytically. In the plating baths, chromium trioxide (Cr(VI)) in the electrolyte is reduced to Cr(III) and Cr(0) on the cold rolled steel base (blackplate steel). While Figure 7 below shows one layer only, the Cr(0) and Cr(III) coating gives a lustrous metallic finish on both sides of the steel plate. A layer of oil film is also applied.

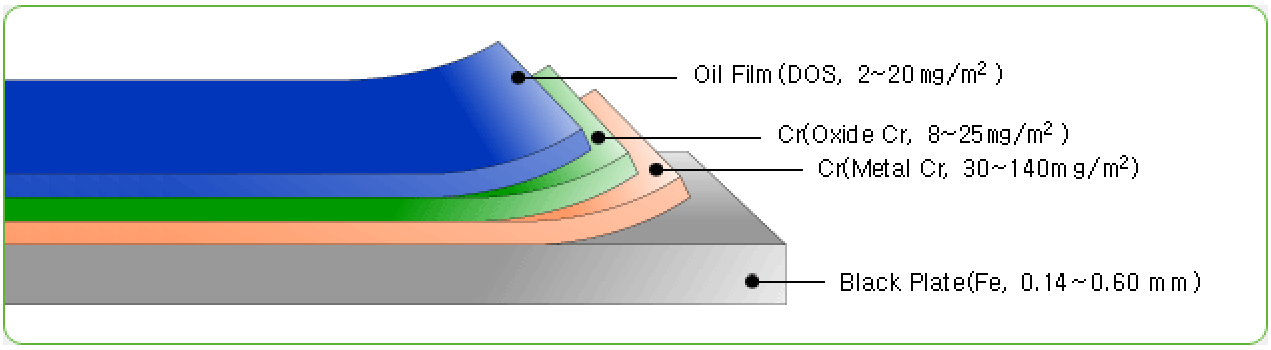


***Figure 7**: Structure (layers) of ECCS*

The primary purpose of the chromium coating is to protect the blackplate from corrosion, particularly during storage before packaging is manufactured. While the chromium layer in the ECCS offers some degree of corrosion resistance, it is not sufficient on its own to withstand chemical exposure from food products. Therefore, an additional organic coating must be applied to the side of the steel strip that is in contact with the food. This coating can vary widely in composition and may include lacquers, polymer laminates, paints and other materials. Protact (discussed below) is one such example. Another important reason for applying an organic coating is to improve the workability of the steel during further processing by the applicant's customers. Since the chromium layer is very hard and brittle, it would otherwise cause excessive wear on the tools used in manufacturing. The steel surface system must support excellent adhesion to organic coatings as well as product integrity.

The chromium layer plays a crucial role in maintaining key performance characteristics of the steel, such as strong adhesion of the lacquer and resistance to corrosion. These properties are essential for protecting the material during storage and transportation, ensuring the safe preservation of food and beverages, and supporting other important functions of the packaging

2.2.4.3 Protact

Protact consists of a steel substrate coated on both sides with a three-layer polymer system, specifically engineered for use in food, aerosol, beer and beverage, and general line product applications. Each side of the ECCS substrate is coated with three distinct layers – an adhesion layer, a main functional layer, and a surface layer. Depending on the application, the coating will comprise polyethylene terephthalate (PET) or polypropylene (PP) and is available with a total coating thickness ranging from 12 to 40 µm. Each layer in the Protact polymer coating system will be independently optimised to meet customers' can performance requirements and ensure efficient processing during can making.

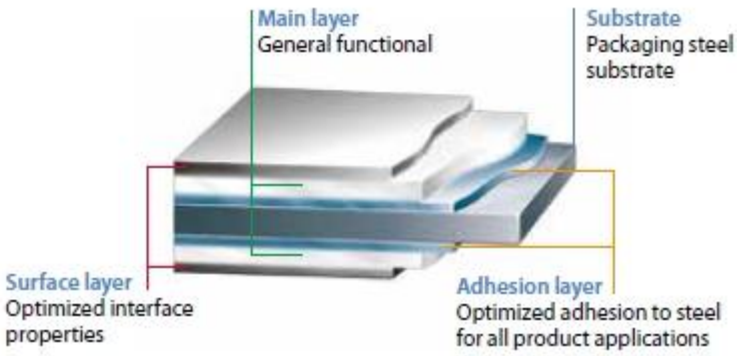


***Figure 8**: Structure (layers) of Protact*

The applicant's Protact laminated steels address the growing demand for sustainable, reliable and safe packaging materials. Fully recyclable and food-safe, Protact is designed for efficient can-making and has been successfully used across a wide range of high-performance applications and formats, including drawn and redrawn (DRD) cans and drawn and wall ironed (DWI) aerosols.

Protact is also well-suited for aerosol can manufacturing, offering several advantages over traditional lacquered ends used in components such as tops and bottoms. One key benefit is the prevention of orange rust rings, which can form in humid environments like bathrooms. Traditional, more brittle lacquers are prone to corrosion when exposed to liquids such as shaving foam. In contrast, Protact's more flexible coating eliminates end corrosion by providing enhanced resistance.

A long-standing application of Protact is in the general line sector, which includes products like paint cans. In this context, Protact is used to manufacture components such as lids and rings. Its flexible coating allows for significant deformation during forming processes, while still delivering strong performance, particularly with water-based paint systems.

2.2.4.4 Blackplate

Blackplate is a thin, cold-rolled, low-carbon steel sheet used as the base material for ETP and ECCS. It is made by cold rolling hot-rolled coil (HRC) to achieve the desired thinness and then annealing it to restore ductility. The resulting material has a smooth, clean surface that makes it ideal for further processing. Blackplate typically ranges in thickness from about 0.14-0.49 mm, depending on the intended application.

Though not usually used directly in packaging, blackplate is essential as a substrate for coated products. When coated with a thin layer of tin, it becomes ETP (tinplate), and when electroplated with chromium, it becomes ECCS (tin-free steel). Its strength and formability influence the quality of the final coated steel. Blackplate can also be used uncoated in applications where corrosion resistance is not critical or where protective coatings are added later. Common uses include dry food containers, battery jackets, caps, stationery, decorative tins and some automotive parts. To prevent rust, it is often lacquered, painted or laminated.

2.2.5 About the use of steel for packaging applications

Packaging is one of the most ubiquitous yet under-appreciated elements of modern life. It surrounds nearly every product we encounter, from the food we eat to the tools we use, yet it rarely commands our attention. For most users, whether industrial, professional or consumer, packaging is something to be discarded, often without a second thought. However, behind every package lies a complex interplay of design, engineering, material science and regulatory compliance, all working together to ensure that products arrive safely, intact and fit for purpose.

The role of packaging extends far beyond mere containment. It is a critical component in preserving product quality, ensuring hygiene and safety, and enabling efficient transport and storage. In sectors such as food, pharmaceuticals and chemicals, packaging must meet stringent standards to prevent contamination, degradation or accidental exposure. For steel-based packaging materials like ETP, the requirements are especially exacting, combining strength, formability, corrosion resistance and compatibility with food contact regulations.

Packaging is also increasingly at the forefront of sustainability efforts, with the demand for recyclable, reusable and resource-efficient packaging growing. Steel packaging is an important part of the solution – it is infinitely recyclable without loss of quality, and its magnetic properties make it easy to separate from waste streams. Yet even sustainable packaging must be carefully engineered to balance environmental goals with performance, cost and regulatory compliance.

Packaging manufacturers and customers have a wide array of material options available for use, with each suited to different types of products and applications. Factors that influence the selection of different packaging types include:

- *Product protection and compatibility*: The primary function of packaging is to protect the product from physical damage, contamination, moisture, light, oxygen and other environmental factors.
- *Shelf life and barrier properties*: Different materials offer varying levels of barrier protection against gases, moisture and light.
- *Sustainability*: The carbon footprint of production, ease of recycling and consumer perception of sustainability all play a role in material selection.
- *Cost and availability*: The cost of raw materials, processing and transportation significantly influences packaging choices.
- *Regulatory compliance*: Packaging materials must comply with food contact regulations, chemical safety standards and environmental regulations in the markets where the products will be sold.
- *End user convenience and functionality*: Packaging must be easy to open, reseal, store and dispose.
- *Branding and aesthetics*: Packaging is a key marketing tool. Materials are chosen not only for function but also for how they look and feel. For example, glass and metal often convey premium quality, while paper and cardboard can suggest eco-friendliness or artisanal appeal.
- *Machineability and filling requirements*: The packaging must be compatible with the producer's filling and sealing equipment.

The following sections consider why producers and suppliers will select metal packaging, particularly ETP, from all the various options available and therefore why the continued availability and performance of such packaging remains vital.

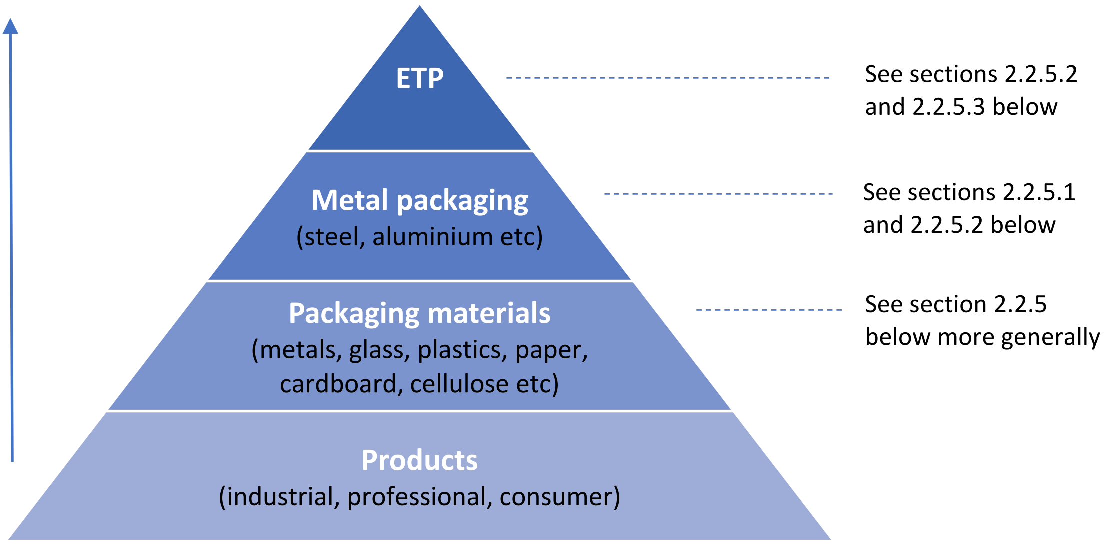


Figure 9: *Pyramid chart illustrating the selection of ETP as a packaging material*

For food and drink packaging, the most commonly used materials include metals such as steel and aluminium, plastics, glass, cardboard and cellulose, amongst others.

- **Metals**, particularly **steel** and **aluminium**, are used extensively for beverages, soups, vegetables and pet food. Steel is often used for food cans due to its strength and excellent barrier properties, while aluminium is often used for drink cans and foil due to its lighter weight; this is further discussed below.

- **Plastics** are among the most prevalent packaging options due to their versatility, lightweight nature and cost-effectiveness. They can be moulded into various shapes and offer good barrier properties when used in multilayer formats. Common types include PET (polyethylene terephthalate), HDPE (high-density polyethylene), LDPE (low-density polyethylene), and PP (polypropylene). These are widely used for bottles, trays, films and flexible pouches. However, manufacturers and consumers are beginning to move away from plastic packaging due to increasing concerns about its environmental impacts.

- **Glass** is another traditional packaging material, valued for its inertness, transparency and premium feel. It is commonly used for drinks, sauces and preserved foods. While heavier and more fragile than other materials, glass is fully recyclable and does not interact with the contents.

- **Paper and cardboard** are widely used for dry goods, frozen foods and secondary packaging. They are biodegradable, recyclable and easy to print on, making them ideal for branding. However, they generally require coatings or laminates to provide moisture and grease resistance.

- **Biodegradable and compostable materials**, such as cellulose-based films, PLA (polylactic acid) and other bio-based plastics, are gaining popularity as sustainable alternatives. These are especially relevant in markets with strong environmental regulations or consumer demand for eco-friendly packaging.

Material	Relative cost	Recycla bility	Barrier properties	Weight	Typical uses
Plastics	Low	Variable	Good	Light	Bottles, containers, trays, films, blister packs, packaging during shipping
Glass	Medium	High	Excellent	Heavy	Beverages, sauces, preserved foods, lab chemicals, cosmetics
Steel	Medium	High	Excellent	Medium	Cans for food & drink, aerosols, pet food, paint and industrial cans
Aluminium	Medium	High	Good	Light	Drink cans, foil
Cardboard	Low	High	Poor	Light	Dry goods, frozen foods, secondary packaging
Biodegradable materials	Variable	High	Variable	Variable	Various eco-friendly packaging

Table 4: *Comparison of the key properties of common packaging materials*

The selection of food and drink packaging materials is influenced by a complex interplay of factors, each tailored to the specific needs of the product, the manufacturer and the end consumer. One of the primary considerations is the nature of the contents. For food and drinks packaging, factors such as acidity, moisture content, shelf life requirements and sensitivity to light or oxygen are key. For instance, highly acidic foods may corrode certain metals, making glass or plastic more suitable. Similarly, products that require a long shelf life often benefit from materials with superior barrier properties, such as metal cans.

Cost and availability of materials also play a significant role. Plastics, for example, are often chosen for their low cost, lightweight nature and versatility in forming various shapes. Cardboard and cellulose-based materials are favoured for dry goods due to their biodegradability and ease of printing, which is advantageous for branding. Glass, while heavier and more fragile, is inert and recyclable, making it useful for premium products or those sensitive to contamination. Ceramics are less common but may be used for specialty or traditional items where aesthetics and reusability are valued.

Steel packaging, particularly in the form of ETP (tinplate) or ECCS (tin-free steel), offers numerous advantages that make it preferable in certain contexts. For instance, steel packaging used for food and drink applications offer the following benefits:

- It provides an excellent barrier against light, oxygen and contaminants, crucial for preserving the quality and safety of food over extended periods. Food and drink packed in steel cans has equivalent vitamin content to freshly prepared, without needing preserving agents.

- It is stronger than cartons or plastic, and less fragile than glass, protecting products in transit and preventing leakage or spillage, while also reducing the need for secondary packaging.

- It extends the product's shelf-life, allowing longer sell-by and use-by dates and reducing waste.

- As an ambient packaging medium, steel packaging does not require cooling in the supply chain, simplifying logistics and storage, and saving energy and costs. At the same time, steel's relatively high thermal conductivity means canned drinks chill much more rapidly and easily than those in glass or plastic bottles.

- Steel packaging without resealable closures are among the most tamper-evident of all packaging materials.

- From an ecological perspective, steel may be regarded as a closed-loop material: post-consumer waste can be collected, recycled and reused to make new cans or other products, indefinitely and without loss of quality, aligning with growing environmental concerns and regulations. Each tonne of scrap steel recycled saves 1.67 tonnes of CO_2, 1.4 tonnes of iron ore and 0.8 tonnes of coal.[1] In addition, the magnetic properties of steel also simplify the recycling process, as it can be easily separated from waste streams.

In terms of **metal** packaging, food and drink manufacturers also have aluminium as an alternative to steel. The choice between steel and aluminium is influenced by a combination of material properties, manufacturing requirements, product characteristics and commercial considerations. Both metals offer excellent barrier properties and recyclability but differ significantly in terms of mechanical behaviour, cost and suitability for specific applications.

- **Steel** is typically chosen for applications that require strength, rigidity and durability. Steel is particularly well-suited to packaging formats like food cans, paint tins and aerosols where structural integrity is important. Steel's higher strength allows for thinner walls without compromising performance, which is especially valuable in pressurised containers. It also offers excellent resistance to deformation during stacking and transport. Additionally, steel's magnetic properties simplify sorting during recycling and its surface is highly receptive to coatings and lacquers, making it ideal for food contact and branding.

- **Aluminium**, on the other hand, is lighter while still offering good levels of corrosion resistance. It is commonly used in beverage cans, foil packaging and certain types of aerosols. Its lower density makes it ideal for applications where weight reduction has a higher priority, e.g. for consumer convenience. Aluminium also has a naturally protective oxide layer, which enhances its resistance to corrosion without the need for additional coatings in some cases. Its excellent formability allows for high-speed production of thin-walled containers and it is particularly well-suited to applications requiring easy opening or resealing.

  However, aluminium is generally more expensive than steel and its mechanical strength is lower, which can limit its use in larger or more demanding packaging formats. Steel, while heavier, is more robust and can be tailored through tempering and coating to meet a wide range of performance needs. For example, tinplate (ETP) and tin-free steel (ECCS) offer different surface and corrosion characteristics that can be matched to the acidity of the food or the required shelf life.

As a result, manufacturers choose steel over other materials when strength, durability, coating flexibility, product integrity, long shelf life and sustainability are paramount. For example, canned vegetables, soups and carbonated beverages often use steel packaging because it ensures product safety and longevity while supporting circular economy goals. Ultimately, the decision hinges on balancing performance, cost, environmental impact, and consumer expectations.

Steel is used extensively in packaging across a broad range of applications, including containers and closures for food and beverages (both for humans and pets) as well as for aerosols, personal care items, household and automotive products, industrial goods and paints. It is also commonly employed in giftware and promotional packaging. Additionally, steel plays a key role in hermetically sealing glass jars and bottles.

Such is its importance, during the COVID-19 pandemic the applicant's continued production of packaging steel for food applications was recognised as an essential activity in the UK. This recognition allowed the Trostre Works to keep producing, even during periods of strict lockdown and widespread industrial shutdowns. With increased consumer demand for packaged goods during the pandemic, driven by stockpiling and reduced access to fresh food, maintaining a steady supply of food-safe packaging materials

[1] See e.g. https://circulareconomy.europa.eu/platform/sites/default/files/euric_metal_recycling_factsheet.pdf

became vital. The continuation of production ensured that disruptions to the food supply chain were minimised and that essential goods could continue to reach consumers safely and reliably.

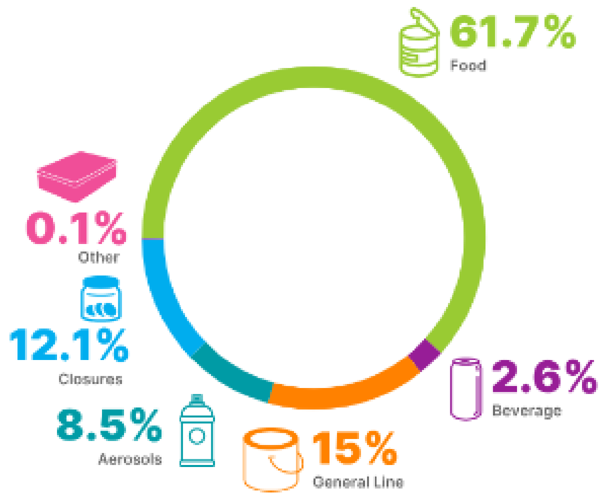


***Figure 10**: Uses of steel packaging (source: Steel for Packaging Europe)*

2.2.5.1 Packaging applications relevant to the applicant's products

The applicant's order book covers the following packaging applications:

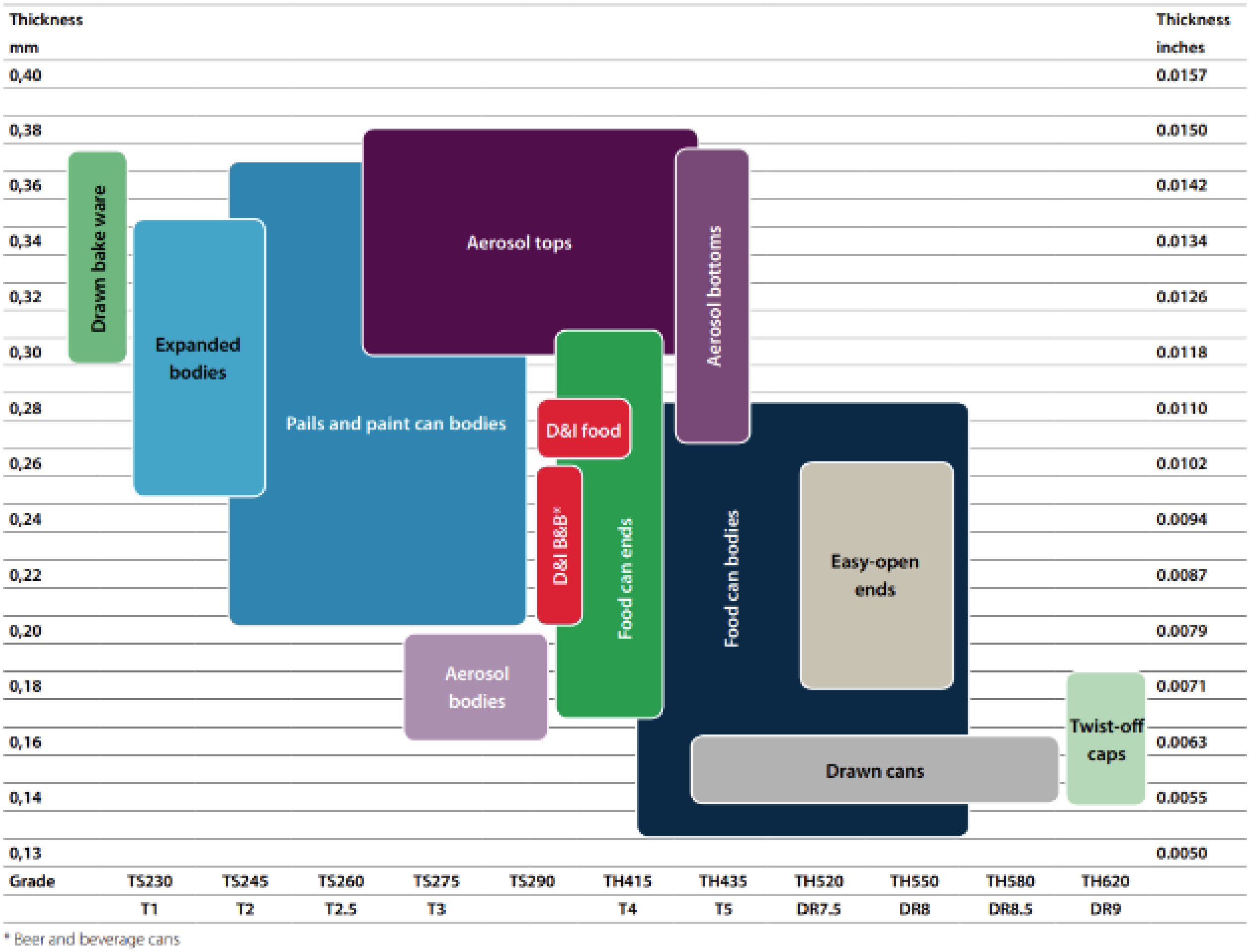


***Figure 11**: The applicant's general specification window for packaging applications*

In steel packaging, the interplay between thickness and grade is crucial in determining the material's suitability for specific applications. The **thickness** of the steel affects its strength, formability and weight. Thinner steels are generally used where lightweighting is important, such as in beverage cans or aerosol containers, while thicker steels are preferred for applications requiring greater structural integrity, such as large food cans or industrial containers.

The **temper grade** of steel (often denoted by classifications like T1 or T2 etc and double-reduced grades such as DR7.5 or DR8 etc) refers to the steel's temper and mechanical properties, particularly its hardness and tensile strength. Lower temper grades like T1 and T2 are softer and more formable, making them ideal for deep-drawn applications such as two-piece food cans or complex closures. These grades allow the steel to be shaped without cracking or losing integrity. In contrast, higher temper grades like T3 or T4 are harder and stronger, suitable for flatter applications or where less deformation is required, such as in ends and lids. Double-reduced (DR) grades undergo an additional cold reduction process after annealing, which enhances their strength while maintaining a thinner gauge. This makes them particularly valuable in applications where both strength and material efficiency are critical, such as in beverage can bodies. DR grades also allow manufacturers to use less material without compromising performance, contributing to cost savings and sustainability goals.

Ultimately, the choice of thickness and grade is a balancing act between mechanical performance, formability, cost and the specific demands of the packaging application. For example, a steel grade used for a pressurised aerosol can must withstand internal pressure without deforming, while a food can might prioritise ease of sealing and corrosion resistance. The applicant's customers will select the appropriate combination based on these functional requirements, as well as regulatory standards and consumer expectations.

The applicant's customers will use their products to make metal packaging, of which there are three main types: two-piece cans, three-piece cans, and closures.

- **Two-piece cans** consist of a separate top, while the bottom and side walls are formed from a single piece of steel, as illustrated in Figure 12. The can body is created by deforming a metal disc using a high-pressure press, a process known as *drawing*. This forms the disc into a beaker-like shape. The can then undergoes a second forming stage called *redrawing*, which shapes it into its final form.

  These cans are commonly referred to as DRD (Drawn and Redrawn) or DWI (Drawn and Wall-Ironed, also known as D&I cans). The key difference between DRD and DWI lies in the forming process: DWI includes an additional *wall-ironing* step that stretches the metal further, resulting in taller cans. DRD cans typically start with thinner metal than DWI cans. Common examples include shallow fish cans (DRD) and beverage or beer cans (DWI). Both ETP and ECCS can be used for manufacturing these cans.

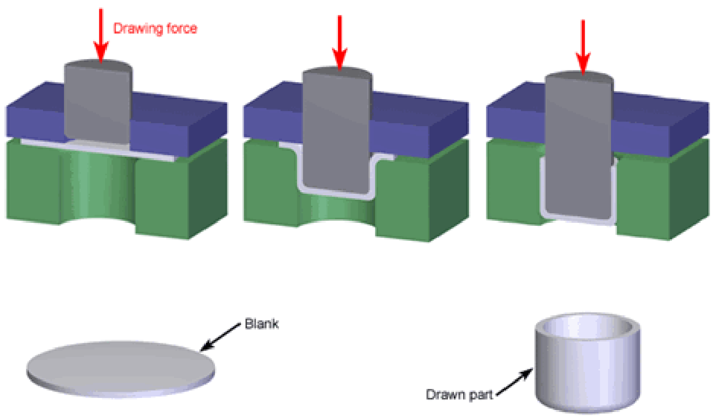


***Figure 12**: Deep drawing sequence (source: CustomPartNet)*

- **Three-piece cans** are the original form of metal cans and consist of three components: a cylindrical body, a top and a bottom. The body is formed by rolling a steel sheet into a cylinder and welding the seam. The bottom lid is then attached, and after the can is filled, the top lid is sealed on. These lids often feature circular ridges, known as expansion rings, to accommodate changes in food volume during thermal processing. The cylindrical body may also include beads to facilitate compression at the end of the can's life. Typical applications include cans for vegetables and fruits. Due to the welding process involved, only ETP steel is suitable for this type of can.

- **Closures**, also known as *ends*, *tops*, or *caps*, are used to seal containers. They can be reusable, such as jar lids or whiskey bottle caps, or single-use, like the crowns on beer bottles. Both ETP and ECCS are suitable materials for closures, depending on the specific application.

In two-piece or three-piece cans, the top lid and cylinder will be seamed together as shown in Figure 13. Extensive deformation of the steel plate is required for this process, which mechanically closes the packaging, protecting the contents from external influences like air and light. The lid itself can be of various types, such as easy opening or aluminium seal).

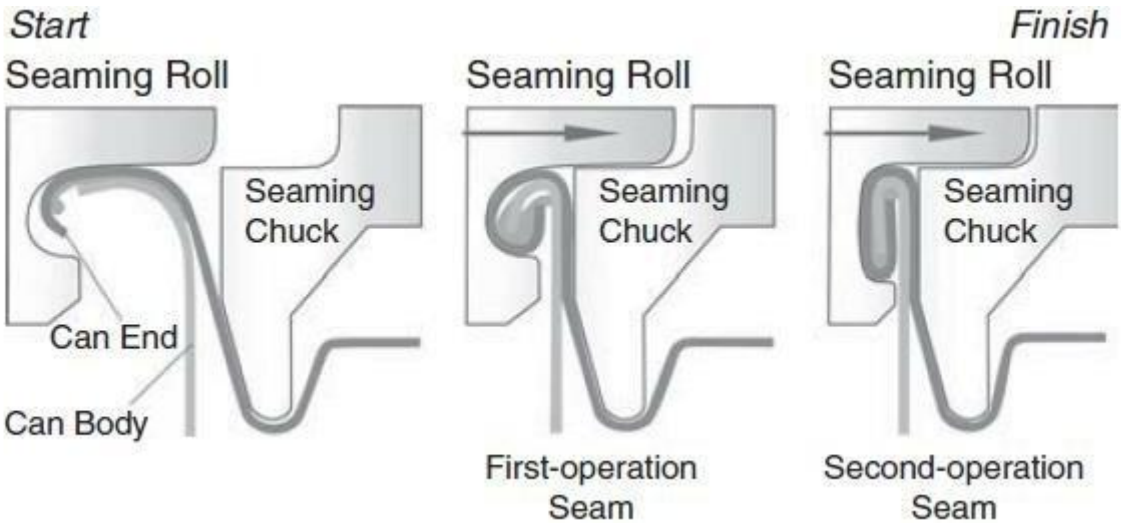


Figure 13*: A schematic of the double seam process (source: Niemiec et al.)*

If a packaging steel manufacturer like the applicant changes the specifications of its packaging steel products it can have significant implications for downstream users (customers) who convert the steel into packaging products like cans, aerosols, and containers. One of the most immediate impacts is on tooling and forming operations. Packaging manufacturers use highly specialised machinery and tooling that are finely tuned to specific material properties, including thickness, temper (hardness), surface finish and coating type. A change in any of these parameters (including changes to coatings should sodium dichromate no longer be available for use) could affect how the steel behaves during forming. For example, harder steel may crack or resist deep drawing, while thinner steel might wrinkle or fail to hold its shape. This could necessitate retooling or recalibration of equipment, which involves time, cost, and potential production downtime.

Changes in steel specification can also lead to quality and consistency issues. If the new material behaves differently under stress or during sealing, it may result in defects such as split seams, paneling (buckling) or poor lacquer adhesion. These defects not only compromise the integrity of the packaging but can also lead to product recalls or customer complaints, especially in sectors like food and pharmaceuticals where safety and shelf life are critical. Coating compatibility is another concern. Packaging steels are often coated with organic lacquers, laminates or inks for corrosion resistance and branding. A change in surface roughness or coating weight can affect how well these finishes adhere, potentially leading to flaking or corrosion over time.

From a supply chain and regulatory standpoint, any change in material specification may also require requalification or certification of the packaging, particularly for regulated markets. This can delay product launches or disrupt ongoing production schedules.

Figure 14*: Examples of downstream uses of the applicant's ETP products*

2.2.5.2 Factors influencing the choice of products for steel packaging applications

Just as there are choices between different types of packaging materials generally, so too are their choices between different types of packaging steels. The market for packaging steel is complex; for certain applications, different types of steel are possible while for other applications, one or the other type of packaging steel has to be used. For example, ECCS is not suitable for soldering or welding as it has a high electrical resistance, making it inferior to ETP. As a result, it is not used for the body of 3-piece cans.

In addition, the choice of organic coating can play a role in the type of steel packaging selected. This coating can be applied either before or after the metal is formed into its final shape. Where the coating is applied prior to forming, as with ECCS, it must exhibit exceptionally strong adhesion to the metal surface to withstand the subsequent mechanical forming processes. The type of organic coating itself is also influenced by the nature of the base material. For example, coatings that require high curing temperatures are unsuitable for use with ETP, due to tin's relatively low melting point, which is why the applicant's Protact product uses ECCS as its base material.

The table below provides a comparison of the properties and characteristics of ETP and ECCS which are factors in the choices made by the applicant's customers as to which type of packaging steel to purchase.

Property / characteristic	ETP (tinplate)	ECCS (tin-free steel)
Chemical composition	Low carbon steel coated with a thin layer of tin.	Low carbon steel coated with a thin layer of chromium and chromium oxide.
Surface properties	Bright, smooth, and reflective surface.	Matte, non-reflective surface. Lower brightness than ETP.
Corrosion Resistance	Excellent corrosion resistance when passivated and depending on coating weight.	Excellent corrosion resistance but does need an organic coating (lacquer, laminate) to achieve this.
Adhesion	Relatively lower adhesion to lacquers and coatings compared to ECCS. Less suitable for the application of printing inks, enamels and varnishes than ECCS due to its tin layer which has a lower melting point.	ECCS generally offers superior coating adhesion compared to ETP. ECCS is favoured in situations where lacquer adhesion is critical, particularly for can lids and ends where the coating needs to withstand the stresses of can-making.
Formability and strength	Excellent formability and strength, suitable for deep drawing. However, the tin layer on the surface can generate tin dust during manufacturing due to friction between components.	Good formability and strength, although this is dependent on an organic coating for deep drawing applications. The ECCS steel surface is very hard and causes high consumption of downstream users' processing tools in the absence of an organic coating.
Weldability	Good weldability/solderability: this makes ETP more suitable for certain types of cans, e.g. 3 piece cans.	One of the most significant differences between ECCS and ETP is that ECCS is not suitable for welding or soldering.
Food contact characteristics	Even when uncoated, ETP is particularly well-suited for packaging light-coloured, acidic foods. This is because tin oxidises more readily than the food itself, forming a protective layer that helps prevent discolouration and flavour changes caused by oxidation. In the case of carbonated beverages, metal packaging is predominantly made from non-passivated ETP.	ECCS is usually used for foods rich in protein or containing organic sulphur, e.g. meat, fish, peas, sweet corn. ETP is avoided because the tin in ETP steel can result in tin oxide stains.

Property / characteristic	ETP (tinplate)	ECCS (tin-free steel)
Organic coating	Some passivated ETP applications, such as baby food containers, do not require an organic coating. Even if the ETP requires an organic coating, one layer is sufficient, whereas ECCS usually requires a minimum of two.	ECCS always requires at least one layer of organic coating in the final packaging.
Availability	There is a greater number of ETP producers, resulting in a more abundant supply compared to ECCS.	There are fewer ECCS producers than ETP producers worldwide.
Cost	While ECCS may be less expensive, it always requires at least one, often two, layers of organic coating, whereas ETP may require only one layer or, in some cases, none at all. When factoring in the cost of coatings, ETP-based solutions can sometimes be more economical overall.	Chromium coating was primarily developed as an economic alternative to tin coating. This is due to the lower market price of chromium compared to tin, and the smaller quantity of chromium required per square metre of ECCS relative to the amount of tin used in ETP.
Sustainability	Fully recyclable. However, tin has a higher environmental extraction cost and sources are slowly running out, which may change into greater demand for ECCS steel in the future.	Fully recyclable, although organic coating layers may need separation. Chromium is less abundant but used in smaller quantities to make ECCS compared to tin for ETP.

***Table 5**: Comparison of the properties / characteristics of ETP and ECCS*

2.2.5.3 Applications for which ETP products are used

ETP is commonly chosen for packaging because of its good weldability. This supports the production of welded three-piece can bodies and is appropriate for Drawn and Wall-Ironed (DWI) food and beverage cans, where the metal is shaped before lacquering. In contrast, ECCS must be coated or printed before it is formed, which restricts its use in some manufacturing processes.

ETP also provides stronger corrosion resistance than ECCS. This improved protection makes it suitable for a wider range of food and drink products, including those with pH values below 4, where the lower corrosion resistance of ECCS can make it unsuitable.

ETP is fully recyclable, supporting sustainability objectives and aligning with circular economy principles within the food and beverage packaging sector. Compared to alternative materials such as aluminium or plastic, ETP delivers a favourable balance of performance and cost-effectiveness, especially in high-volume manufacturing environments.

The following tables illustrate typical packaging applications for the applicant's ETP products.

Packaging application	Drawn and Wall Ironed (D&I or DWI)
Tata Steel grade	TH330 (T3) or TH360 (T3.5)
Image	**Reason**
	ETP for DWI applications have specific properties including low earing performance (‘earing’ refers to the tendency for uneven, wave-like edges to form around the rim of a drawn cup during forming, caused by differences in how the rolled steel deforms in different directions). The applicant offers alloyed extra low carbon, continuous annealed products to ensure excellent formability and highly efficient processing. Through a continuous improvement approach, the applicant focuses on developing stronger, more ductile and formable steel grades to further increase the efficiency of can making. These steel grades combine the formability requirements of can making with the strength required of the final pack in beer and beverage and food applications.

Packaging application	Three-piece can bodies
Tata Steel grade	TS245 (T2) or TS260 (T2.5) or TS275 (T3) Typically TS245 or TS260 due to formability for welding and shaping
Image	**Reason**
	Three-piece cans represent the traditional design of metal containers, comprising three main components: a cylindrical body, a top and a bottom. The lids typically incorporate circular ridges, known as expansion rings, which allow for variations in food volume during thermal processing. The body may also feature beads to enable controlled compression at the end of the can’s lifecycle. Common applications include packaging for vegetables and fruits. ETP offers excellent weldability and therefore as welding is required in the manufacture of three piece cans then ETP is used.

Packaging application	Twist-off caps
Tata Steel grade	TH620 (DR9) High strength, excellent formability, and controlled anisotropy
Image	**Reason**
	ETP offers excellent corrosion resistance, making it well suited for closures exposed to acidic or moisture-rich contents such as sauces, jams and beverages, helping to maintain seal integrity and prevent contamination. It also exhibits excellent ductility, allowing formation into the complex geometries required for twist-off caps, including stamping, curling and threading. This supports the production of closures with tight dimensional tolerances and reliable sealing performance. The steel substrate provides the mechanical strength needed to withstand opening and closing torque while maintaining a secure seal under varying pressure conditions, including those found in carbonated beverages and vacuum-packed containers. To further enhance barrier performance, ETP can be internally coated with food-safe lacquers or sealants, particularly for aggressive or reactive products.

Packaging application	Food can ends
Tata Steel grade	TS290 (T4) or TH415 (T4) Relatively high toughness
Image	**Reason**
	The heat sterilisation process preserves food naturally in a safe, strong and convenient pack without having to rely on additives and preservatives. A steel can is the only packaging that captures nutrients in heat-processed food without the need for preservatives. Packaging steel offers a 100% barrier against water, light and air and are unmatched for safety and reliability. Food cans ends made of ETP can be used without lacquer in many food applications due to its sacrificial corrosion protection mechanism, which helps preserve food safely.

Packaging application	Easy-open ends (EOEs)
Tata Steel grade	TH520 (T7.5) or TH550 (T8) Excellent rigidity and strength
Image	**Reason**
	ETP EOEs are widely used in food packaging, including canned vegetables, fruits, meats, seafood and dairy products, with demand driven by consumer preference for convenience and sustainable packaging. ETP offers excellent formability and mechanical strength, which are essential for precise scoring to enable easy opening via a pull tab. Scoring depth must be carefully controlled, as insufficient depth can hinder opening while excessive depth may compromise lid integrity and cause leakage or failure. The rigidity and toughness of ETP help maintain this balance, delivering a reliable opening experience comparable to ECCS. In addition, ETP's strength ensures durability during handling and use, while its smooth surface supports high-quality decorative printing and branding.

Packaging application	Aerosols
Tata Steel grade	TH435 (T5) Excellent buckling resistance
Image	**Reason**
	ETP offers a robust and versatile solution for aerosol packaging, particularly in applications where product compatibility and formability are critical. ETP's ductility allows for efficient shaping into complex aerosol can designs without compromising structural integrity. The tin coating provides a protective barrier against mild corrosive contents, making it suitable for certain personal care aerosols and food-grade aerosols, e.g. whipped cream. ETP also supports quality printing and coating applications for branded packaging. These attributes make ETP a reliable choice for specific aerosol applications, especially where internal coatings can be used to enhance corrosion protection.

Packaging application	Pails and paint can bodies
Tata Steel grade	TS245 (T2) or TS260 (T2.5) or TS275 (T3) or TS290
Image	**Reason**
	ETP provides a barrier against rust, which is critical for storing paints, chemicals and other liquids that could degrade the container. It is easy to form into cylindrical shapes and can be seamed without cracking, making it ideal for cans and pails. It offers good mechanical strength while remaining relatively lightweight, which is important for handling and transport. Tin is non-reactive with many substances, reducing contamination risk and preserving product quality. Temper grade selection is dependent on can size and shape (larger pails need higher strength – TS290), forming process (deep drawing needs softer temper - TS245) and end-use conditions (stacking, transport, internal pressure - TS275).

2.3 Relevant supply chains

The supply chain for ETP is a multi-step process with each stage involving specialised processes and stakeholders that transform the raw material into finished products suitable for packaging applications, particularly in the food and drinks industry.

The journey starts with hot rolled coil (HRC), a form of steel produced by heating steel above its recrystallisation temperature and then rolling it into a coil. Up until recently, HRC was manufactured at the applicant's Port Talbot site and supplied directly to Trostre. However, with the closure of the blast furnaces in 2024, the applicant is currently sourcing HRC from elsewhere, including Tata Steel sites in the EU as well as other suppliers in the EU and the rest of the world.

Supply of HRC from Port Talbot is planned to resume from late 2027 or early 2028 when EAF-based steelmaking operations commence. [redacted]

At Trostre, HRC is converted to blackplate, a thin, cold-rolled low-carbon steel sheet which serves as the base material for ETP. The HRC is passed through a series of cold rolling mills, reducing its thickness and adjusting its surface finish. After cold rolling, the steel is brittle, so it is annealed to recover its mechanical properties. Once the blackplate is ready, it is passed through several consecutive plating tanks to apply tin to the steel by electrochemical precipitation. Following the application of tin, Cr(VI) passivation takes place in the chemical treatment section. During the passage of the tin-plated steel through the passivation baths, Cr(VI) is reduced in a cathodic driven process and deposited on the steel as a mixed layer of metallic chromium (Cr(0)) and chromium (III) oxide (Cr_2O_3) on both sides of the steel. After passivation, the steel is rinsed and further treated in the oiling unit before it is wound up again in the exit section or cut into sheets.

The applicant's ETP products are then delivered to can-makers or packaging manufacturers, who further process the material by cutting, forming and welding it into various packaging components such as can bodies, can ends, can lids and closures. These manufacturers may also apply organic coatings (lacquers or

[2] See, e.g. the applicant's 'Electrifying Packaging Steel' initiative at https://www.tatasteeluk.com/packaging/news/tata-steel-uk-launches-electrifying-packaging-steel

laminates) and print, ink and label the packaging, e.g. for branding purposes. The finished packaging components are then sent to filling companies, which are often food or beverage producers. These companies fill the cans or containers with their products, seal them, and prepare them for distribution. From there, the packaged goods move through the logistics and retail chain, eventually reaching consumers.

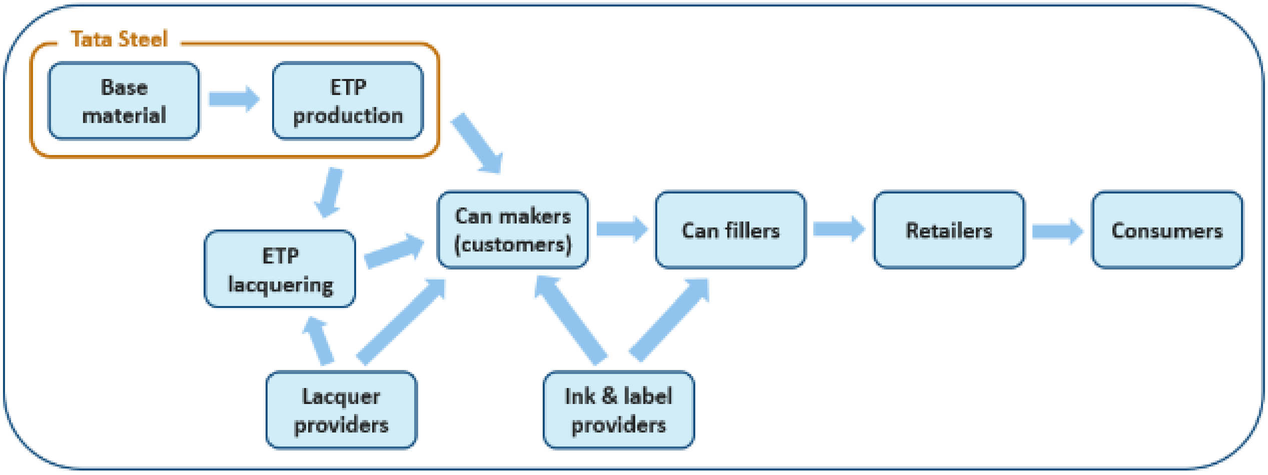


***Figure 15**: Depiction of the ETP supply chain*

The ETP supply chain is highly interdependent, meaning that disruptions or changes in one part of the chain can significantly impact the others. This interdependence stems from the specialised nature of each step and the tight integration required to maintain quality, efficiency and regulatory compliance. For example, if there is a shortage or delay in HRC or blackplate production, it directly affects the availability of material for coating, which in turn delays the supply of ETP to packaging manufacturers. Since ETP is produced to specific customer requirements (in terms of thickness, coating weight and surface finish), any upstream disruption can cause a ripple effect, leading to production halts or rescheduling downstream. Packaging manufacturers relying on just-in-time delivery may then face material shortages, delaying their ability to produce cans or other containers.

On the downstream side, changes in consumer demand or product specifications from food and beverage companies can also influence upstream supply. Each stakeholder has specific process requirements and this can significantly limit the speed at which new materials can be introduced.

The supply chain is also sensitive to logistics and geopolitical factors. Trade restrictions, transportation bottlenecks or energy price fluctuations can all impact the cost and timing of materials moving through the chain.

In overall terms, the ETP supply chain is a tightly-linked system where each node relies on the timely and precise performance of the others. This makes coordination, communication and contingency planning critical for maintaining stability of production and supply, and meeting market demands.

2.4 Temporal and geographical boundaries

2.4.1 Temporal boundaries

Any calculations and considerations provided in this SEA are based on an anticipated review period of 10 years (from the end of the existing review period on 31 December 2027), which is the minimum possible length of time within which the applicant could adequately implement a suitable replacement for sodium dichromate for the passivation of ETP. This review period is requested due to factors described in detail in other sections of this report, in particular, section 4 (substitution plan) and 5.7 (information to support the review period).

The SEA also considers the period between the estimated date of a refused decision, assumed for the purpose of this assessment to be 1 January 2028, i.e. the end of the current review period, and 31 December 2037, i.e. the end of the requested review period, in terms of the assessment of certain economic impacts. 2026 is used as the base year for calculations, i.e. the year of submission of the review report application.

2.4.2 Geographical boundaries

The applicant's use of sodium dichromate for the passivation of ETP takes place at the Trostre Works located in Llanelli, Wales. The applicant also has other manufacturing sites although does not use sodium dichromate at these sites. The UK is the geographical scope for the assessment of socio-economic impacts of not using sodium dichromate as well as the potential health impacts of the continued use. These impacts are described in section 5 of this report. Unless otherwise stated, any statistics, references and calculations used within the SEA are based on impacts associated with the UK.

2.5 Trends and impacts

2.5.1 Market analysis

2.5.1.1 Worldwide

The packaging steel market can be considered a subset of the flat steel products market. In the steel industry, 'flat products' refers to steel in sheet, plate, strip or coil form, as opposed to 'long products' like bars and rails. These flat products are commonly used in industries like automotive, aviation, construction and consumer goods. Examples of flat steel products include hot and cold rolled coil, packaging steels such as ETP and ECCS, and other products such as electrical steel and galvanised steel.

The steel value chain for flat products, such as hot-rolled coil, cold-rolled steel and coated metal products, is a complex process involving multiple stages of production, from raw material sourcing to final processing. In the steelmaking industry, higher added value comes from processing flat steel products through various additional manufacturing techniques, or through product development and related services, ultimately leading to higher profitability. The more processing steps there are, the greater the value that is created. The fewer, the less financially viable and more vulnerable the model is. Products such as slab and HRC are lower-value, commodity products whereas coated products such as hot-dip galvanised steel or ETP, are higher-value, premium products.

For example, the figure below illustrates the value added along the value chain for flat products, beginning with key raw materials used in steelmaking. It presents recent global price trends for various stages of the production process, including iron ore, pig iron, slab, hot-rolled and cold-rolled steel coil, hot-dip galvanized sheet (HDG) and organic coated sheet (OCS). [redacted]

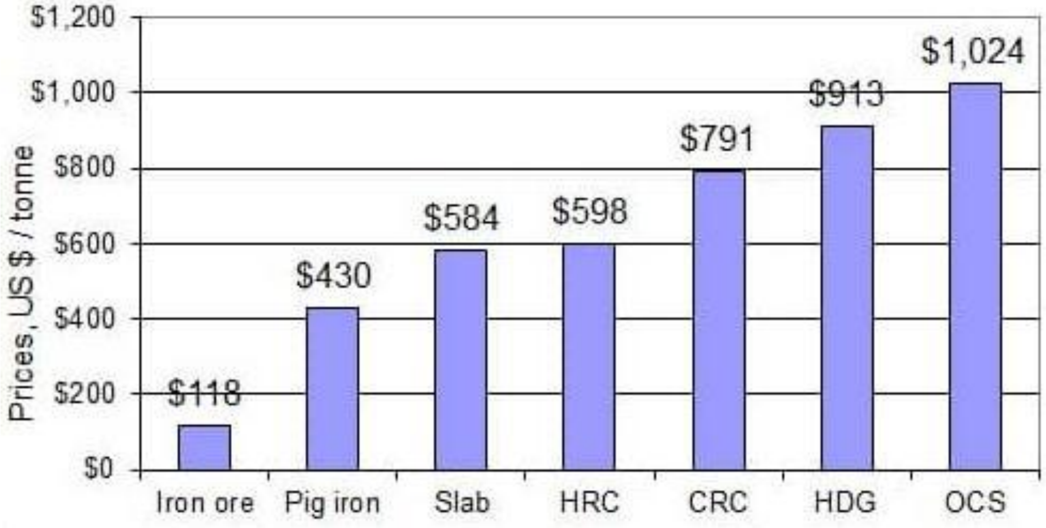


***Figure 16**: Value chain: flat steel products (as of H1 2024) (Source: Steelonthenet.com)*

Packaging steel plays a vital role in the global economy by supporting various industries, contributing to food security and facilitating the circular economy. Its durability, recyclability and ability to protect products make it a valuable component in numerous value chains, from food and beverages to chemicals and pharmaceuticals. Packaging steel primarily includes two types of steel: ETP (tinplate) and ECCS (tin-free steel). ETP is often preferred over ECCS in applications where excellent corrosion resistance, food safety and visual appeal are critical. The tin layer in ETP provides a more inert surface, making it particularly suitable for direct food contact, especially with acidic or moist contents. Tin also has a bright, reflective finish that is aesthetically desirable for consumer packaging, such as cans for beverages, fruits and vegetables. Additionally, ETP is more malleable, which can be advantageous in forming complex shapes without compromising the protective layer.

The packaging steel sector is sensitive to fluctuations in raw material prices, especially steel and tin, and is also influenced by regulatory changes, including those under REACH which affects the use of substances like sodium dichromate. Additionally, shifts in consumer preferences toward sustainable and recyclable packaging materials can significantly impact demand.

The global packaging steel market has showed continuous momentum, reaching an estimated value of 28.5 billion dollars in 2024. Within the broader category, the ETP market represents a key piece of the packaging steels market, alone, the ETP market is valued at approximately $1.8 billion as of 2023 and projected to grow to $3.1 billion by 2032. This increase reflects a compound annual growth rate (CAGR) of 6.5%, which is supported by increasing demand for durable, fully recyclable materials across food, beverage, household, and industrial sectors.

The leading producers of packaging steels are concentrated in regions with strong steel manufacturing capabilities, such as East Asia, North America and Europe. Countries such as China, Japan and South Korea are dominating the production and consumption, while countries such as Germany, Luxembourg and the UK are prominent due to their advanced industrial infrastructure and high domestic demand. In addition to the applicant, other major companies in this space include Nippon Steel Corporation, JFE Steel and ArcelorMittal.

The global shift toward recyclable, food-safe and environmentally responsible packaging materials continues to support ETP's competitive position, reflecting its 100% recyclability and strong alignment with both regulatory sustainability objectives and evolving consumer expectations. At the same time, rapid urbanisation, rising consumption of packaged food and beverages and the continued growth of e-commerce are collectively driving increased demand for robust, durable metal packaging solutions.

Nonetheless, the sector faces a number of significant challenges. Ongoing volatility in raw material prices continues to affect production costs and profit margins, while increasingly stringent environmental and chemical safety regulations are driving technological change and investment in alternative coating solutions. In response, the wider packaging steel market is already adapting through innovations in lightweighting, advanced coatings and improved corrosion-resistant technologies. Despite these pressures, the overall outlook for ETP remains positive.

2.5.1.2 The UK and Europe

The total European packaging steel production was estimated at 4.6 million tonnes per year in 2020, with an annual turnover of EUR 3 trillion and direct and indirect employment of over 15,000 people.[3] This represents around one-third of the estimated packaging steel production worldwide. About 25 billion food cans are produced and filled in Europe each year.

In the UK, steel is used to package more than 1,500 types of food and drink products as well as paint, health and beauty products and household products. 99.4% of UK households buy canned food each year.[4] The applicant is the most prominent player in the UK packaging steel market and the only domestic producer of ETP and ECCS. Other influential players include ArcelorMittal and JFE Steel, which supply the UK market through imports.

More generally, the UK steel sector directly employs approximately 33,700 individuals, with an additional 42,000 jobs supported across the broader supply chain.[5] Average wages in the industry are 26% higher than the national median and 35% higher than the regional median in Wales, Yorkshire, and Humberside, regions where the majority of steel sector employment is concentrated. In 2023, the UK steel industry contributed £1.8 billion directly to the national economy, with a further £2.4 billion generated through its supply chains. The sector also added £3.4 billion to the UK's balance of trade.[6]

Despite these contributions, recent years continue to be particularly challenging for the industry. In 2023, UK steel production and demand fell to historic lows, reaching just 5.6 million tonnes (Mt) and 7.6 Mt respectively. These levels were even lower than those recorded during the peak of the COVID-19 pandemic in 2020. At the same time, import penetration in the UK steel market continued to rise. Net imports reached 4.6 Mt in 2023, accounting for 60% of domestic demand, up from 55% the previous year. Although total import volumes declined by 5% in absolute terms, imports from countries such as India, Vietnam and France increased. These countries benefit from significantly lower electricity costs, enhancing their competitive advantage in the UK market.

The challenges faced by the UK steel sector, not least the applicant, including the following:

- **Rising energy costs**, given that steel production is highly energy-intensive. UK producers are at a disadvantage compared to regions with lower energy costs, such as the United States, Asia and certain European countries. The recent surge in electricity and gas prices has put immense pressure on profit margins, making it difficult for UK steelmakers to compete globally.

- **Environmental regulations,** which require steel manufacturers to significantly cut their carbon footprint. While these measures are crucial for sustainability, they impose substantial costs on an industry that traditionally relies on carbon-intensive processes. Transitioning to greener technologies, such as the applicant's EAF-based steelmaking at Port Talbot, requires significant investment and innovation.

[3] Słowik et al., 2020.

[4] Steel for Packaging Europe (formerly known as APEAL). See https://www.steelforpackagingeurope.eu/

[5] House of Commons Library, 2025.

[6] UK Steel. See https://www.uksteel.org/steel-news-2024/key-stats-2024

- **Competition from non-UK (and often non-EU) steel producers**, particularly those in China and other Asian countries. These manufacturers benefit from lower production costs and less stringent environmental regulations, allowing them to produce steel more cheaply. The influx of low-cost steel continues to put downward pressure on prices, making it difficult for UK producers to maintain profitability, especially for lower-value, commodity products. Additionally, changing regulation of Cr(VI) substances in the EU will allow the ongoing use of Cr(VI) in the manufacture of steel packaging (both ECCS and ETP).

- **Domestic demand** for steel within the UK has been on the decline, reflecting broader economic challenges in downstream sectors such as construction and automotive. This decline in demand exacerbates the difficulties faced by the steel industry, as reduced consumption leads to lower production volumes and increased competition for limited market opportunities.

As a result, competitors will be readily able to take the applicant's market for packaging steel products if the applicant were to stop offering ETP, e.g. as a result of a refused authorisation. In particular, because finished products ('articles' under REACH) are free from Cr(VI), ETP manufactured outside the UK and EU, where sodium dichromate is not regulated in a similar way to REACH authorisation, can be produced without authorisation being required and imported into the UK. For example, a significant new facility for manufacturing packaging steel is currently under construction in Turkey where the Habaş Group, a major Turkish steel producer, is building a new downstream cold rolling and packaging complex in Aliağa, near Izmir, designed to meet growing demand in the metal packaging sector. The facility is designed with a total annual capacity of 900 Kt, of which 250 Kt will be dedicated to ETP production, understood to involve the use of Cr(VI) substances for passivation.

2.5.1.3 The applicant's markets

The applicant is the only producer of ETP in the UK and its ETP line at Trostre currently operates at or near full capacity each year. The applicant is also the largest supplier of ETP (as well as other metal packaging products) in the UK. In 2025, the applicant's UK market share for ETP was [redacted] (public range: >70%), compared to [redacted] (public range: <30%) imports from the EU and from the rest of the world. In 2025, for all steel packaging products, i.e. ETP, ECCS and Protact combined, the applicant's market share by volume was [redacted] (public range: >70%) in the UK.

The applicant's main markets for ETP are depicted in Figure 17 below and are predominantly for the food and drinks sector.

[redacted]

***Figure 17**: The applicant's main markets for ETP (2025 data)*

The table below shows product sales quantities (in kilotonnes) from the Trostre Works attributed to the 2025/26 financial year.

[redacted]

***Table 6**: Quantity of products invoiced by the Trostre Works in 2024*

The applicant's customers include the following:

- [redacted]
- [redacted]
- [redacted]
- [redacted]

- [redacted]

2.5.2 Financial performance

Over the past decade, the applicant's financial performance has reflected the broader challenges and transformations within the wider steel industry, including fluctuating demand, high energy costs and increasing environmental regulations. The business has experienced periods of both profitability and significant losses, with a notable focus in recent years on restructuring and transitioning toward more sustainable steelmaking practices.

From 2014 to around 2017, Tata Steel Europe (which included UK operations at the time) faced considerable financial strain, largely due to global overcapacity in steel production, low prices and high operational costs in the UK. This led to the sale of several assets, including the long products division to Greybull Capital LLP in 2016. Between 2018 and 2020, Tata Steel Europe made some progress in stabilising its operations, but profitability remained elusive. The COVID-19 pandemic in 2020 further disrupted operations and demand, leading to additional financial pressures. Despite this, Tata Steel Europe reported a modest recovery in late 2020 and 2021, supported by a rebound in steel prices and demand.

In October 2021, Tata Steel formally split its European operations into two distinct entities: Tata Steel Netherlands (TSN) and Tata Steel UK (TSUK). This marked the end of Tata Steel Europe as a unified business, a structure that had existed since the Tata Group acquired the Anglo-Dutch steelmaker Corus in 2007. The split was a strategic move to allow each branch to operate independently under the direct oversight of the Indian parent company, Tata Steel Ltd. The restructuring, which occurred after the original AfA was submitted in 2019, aimed to allow each entity to pursue tailored strategies that aligned with their respective national regulatory environments, market conditions and sustainability goals.

The result of the split has been a clearer strategic direction for both branches. Although the separation was largely administrative, it has had substantial operational and strategic implications, allowing each entity to respond more effectively to local challenges and opportunities, as described further below. The separation has also had significant implications for the purposes of this AfA, as it resulted in the applicant losing direct access to TSN's R&D data on the further development of potential alternatives to sodium dichromate since 2021. This is considered in more detail in section 3 (AoA) and section 4 (substitution plan) below.

In the most recent years, particularly from 2022 to 2024, the applicant has been undergoing a major transformation. The UK government and the applicant announced a £1.25 billion investment package in 2023 to support the transition from blast furnace-based steelmaking to EAF technology at the Port Talbot site. This move is aimed at reducing carbon emissions and improving long-term financial sustainability. In 2023, while revenue remained substantial, profitability was under pressure due to high energy costs and inflationary pressures. Nonetheless, the strategic shift toward greener steel production is expected to improve cost efficiency and market competitiveness in the long term.

Packaging itself currently represents around [redacted] (public range: > 15%) of the company's sales (by revenue). Packaging steel is a strategically important part of the applicant's portfolio. The business has historically emphasised its commitment to this sector due to its alignment with sustainability goals and the circular economy, given steel's high recyclability. The Trostre plant is one of the few facilities in Europe capable of producing both ETP and ECCS, making it a key asset in Tata Steel's European operations.

The table below provides information on turnover and sales price (per tonne of product) for ETP, ECCS and Protact produced at Trostre for the financial years 2020/21 to 2024/25.

[redacted]

Table 7*: Turnover and sales price, 2021-2025 financial years*

The applicant does not expect sales volumes of ETP to change significantly in the near future. The ETP line in Trostre is currently working near to capacity and therefore the sales plan is to maintain current sales volumes.

2.5.3 Competitor information

The steel industry has historically been highly cyclical. It is significantly affected by general economic conditions, consumption trends as well as by worldwide production capacity and fluctuations in international steel trade and tariffs. This is due to the cyclical nature of the automotive, construction, machinery and equipment, packaging and transportation industries that are the principal consumers of steel.

As a result, the environment in which the applicant operates is subject to intense competition. The main challenges that the applicant faces include volatility, shifting demand centres, complex supply chains, productivity and cost efficiency. The applicant's market is also affected by general economic conditions and end-use markets, including the automotive, appliance, construction and energy industries. If these industries experience a downturn, the steel market usually follows their trend.

Packaging is a key market for the applicant and its customers are heavily reliant on its products and services. It is also strategically important for the applicant to ensure diversity of its markets (such as construction, automotive, packaging and engineering) to protect it against fluctuations in those markets. For instance, when the construction or automotive sectors are down, the packaging sector will typically be up. The applicant's ETP process is unique and sales of packaging products are important to the resilience and flexibility of their business model.

The applicant is the only manufacturer of ETP in the UK and holds the majority of UK market share (see section 2.5.1.3 above). The applicant's main competitors in the packaging steel space are therefore non-UK manufacturers whose products are shipped to the UK. They include:

- [redacted]
- [redacted]
- [redacted]
- [redacted]
- [redacted]

In relation to EU-based competitors, sodium dichromate is also subject to authorisation under EU REACH, although EU-producers of ETP using Cr(VI) processes already have authorisations or are covered by an upstream authorisation, as shown in the table below.

AfA ID	Applicant name	Quantity (tonnes per year)	Application type	Review period requested	Review period expiry
0032-06	Chemservice et al (CTACSub, use 6)	1,000 *	Upstream	4 years	21 September 2024
0043-03	Brenntag Chemicals Distribution (Ireland) Ltd; Henkel AG & Co. KGaA; AD International BV	1,300	Upstream	4 years	14 April 2024
0063-03	Gentrochema BV	1,300	Upstream	4 years	14 April 2024
0134-01	ThyssenKrupp Rasselstein GmbH	95 *	Downstream	7 years	Originally 21 October 2027, now extended to 1 July 2030
0211-02	Tata Steel IJmuiden BV	29.3	Downstream	7 years	Originally 31 December 2027, now extended to 1 July 2030
0221-02	U. S. Steel Košice, s.r.o.	5-15	Downstream	7 years	Originally 31 December 2027, now extended to 1 July 2030
0274-02	ArcelorMittal France; ARCELORMITTAL ESPAÑA S.A.	< 250	Downstream	7 years	Originally 31 December 2027, now extended to 1 July 2030
0301-02	LIBERTY GALATI SA	10-40 *	Downstream	7 years	Originally 31 December 2027, now extended to 1 July 2030
0304-01	Acciaierie d'Italia S.p.A.	5-15	Downstream	7 years	Originally 31 December 2027, now extended to 1 July 2030
Notes: * Application relates to the use of chromium trioxide for the passivation of ETP rather than sodium dichromate					

***Table 8**: Applications for authorisation under EU REACH relevant to the use of sodium dichromate for the passivation of ETP*

There are five members of Steel for Packaging Europe (formerly known as APEAL) that manufacture ETP within the EU. These companies, ArcelorMittal, Tata Steel, US Steel, Acciaierie d'Italia, and Thyssenkrupp Rasselstein, likely represent the vast majority of production of ETP in Europe. As can be seen in the table above, all are covered by authorisations.

The review periods of the authorisations granted to the applicant's EU-based competitors expire on 1 July 2030 (as recently extended by Commission Implementing Decision C(2026)50). However, by this stage it is anticipated that their use of sodium dichromate can continue without further authorisation (by way of review report submission) due to the proposed restriction of Cr(VI) substances under EU REACH. This will see sodium dichromate, as well as other related substances, move from Annex XIV (authorisation) to Annex XVII (restriction) of EU REACH. The current restriction proposal would allow for the continued use of sodium dichromate for the passivation of ETP provided that specified worker and environmental exposure limits are not exceeded.

For the applicant's non-EU competitors, sodium dichromate is not regulated in the way it is under REACH (nor is it currently subject to restriction proposals) meaning they do not face similar regulatory challenges.

Finished products that have been passivated using sodium dichromate (such as ETP) no longer contain any Cr(VI) and do not present a risk to human health or the environment. There are no barriers under chemicals regulations to the export of Cr(VI)-passivated products from non-UK countries to the UK, given that REACH authorisation requirements do not apply to imported articles.

Taking all the above into account, this means that there is, and will continue to be, a large source of Cr(VI)-passivated ETP manufactured outside the UK which is readily available for import into the UK. Consequently, if the applicant attempts to move away from ETP that has been passivated using sodium dichromate to ETP passivated using inferior alternatives, it will be hampered by the continued availability of Cr(VI)-passivated ETP from abroad. If the applicant were no longer able to offer Cr(VI)-passivated ETP, its customers would all have the option of switching to Cr(VI)-passivated ETP that is readily available from numerous suppliers in the EU and the rest of the world. This would have significant operational and cost implications for them but in reality, would be their only option, given that there are no suitable alternatives to sodium dichromate at the present time.

2.5.4 Regulatory context

In addition to the above, the applicant must also ensure its products meet regulatory requirements and applicable standards relevant to each of the markets that it supplies. While this includes non-UK markets such as the EU and North America, the following information focuses on UK requirements to illustrate just this part of the regulatory backdrop against which the applicant operates.

2.5.4.1 Food packaging legislation

Following the UK's exit from the EU, the UK retained much of the EU's regulatory framework for food contact materials (FCM), which includes ETP. The primary legislation governing FCM in the UK is the Materials and Articles in Contact with Food Regulations 2012, which implements provisions from assimilated EU Directives and provides for the enforcement of assimilated EU Regulations. These include Regulation (EC) No 1935/2004 which sets out general safety requirements for materials intended to come into contact with food, and Regulation (EU) No 2023/2006 on good manufacturing practice for materials and articles intended to come into contact with food.

FCM regulations apply to all materials and articles intended to come into contact with food, including packaging, containers, processing equipment and coatings, and aim to ensure that such materials do not transfer harmful substances to food and drink or compromise their quality. The overarching principle is that materials must be manufactured in accordance with good manufacturing practice (GMP) and must be safe under their intended conditions of use. For the purposes of this AfA, this means the applicant must consider very carefully any changes to the current composition and manufacturing processes for its products, as these must be assessed for their potential impact on food safety and quality.

Duties under the legislation apply to all actors in the supply chain, including manufacturers, importers, processors and distributors. These dutyholders must ensure that their materials comply with applicable compositional and migration limits, maintain documentation demonstrating compliance (known as a Declaration of Compliance, or DoC) and cooperate with enforcement authorities such as the Food Standards Agency (FSA) or local authorities. Businesses must also ensure traceability of materials throughout the supply chain and be prepared to take corrective action if non-compliance is identified.

In addition, food packaging labelling is also highly regulated, governed by a combination of retained EU law and domestic regulations, primarily Regulation (EU) No. 1169/2011 on the provision of food information to consumers (the FIC Regulation). While the labelling requirements themselves do not regulate the type of packaging material, they do have practical implications for material selection. Steel containers, such as food cans, aerosols and closures, must be compatible with label printing or adhesive labels that can withstand the rigours of production, transport and storage. This means the surface finish of the steel must be suitable for ink adhesion or label application.

2.5.4.2 Packaging waste

Following the UK's exit from the EU, the UK has introduced a new framework for packaging and packaging waste under the Producer Responsibility Obligations (Packaging and Packaging Waste) Regulations 2024, which replaces earlier EU-derived rules. These regulations are part of the UK's Extended Producer Responsibility (EPR) scheme, which shifts more of the financial and operational burden of managing packaging waste onto producers. Under this framework, businesses that place packaging on the UK market, including manufacturers, packers/fillers, importers and brand owners, must register with the appropriate environmental agency, report detailed data on the packaging they handle, and meet recycling and recyclability assessment obligations.

For a company like the applicant, which manufactures materials such as ETP and ECCS that are used by downstream customers to make packaging, the obligations under the packaging waste regulations are more nuanced. The applicant itself does not place finished packaging on the market, so it is not directly classified as a packaging producer under the EPR scheme. However, the applicant's customers will have duties and so the applicant may be required to provide data and compliance information to its customers, particularly under the new requirements for recyclability assessments and traceability. Changes to raw materials prior to their conversion into packaging (such as the applicant's products) will therefore impact obligations under the legislation and must be carefully considered.

2.5.4.3 Pack testing

Pack testing in the food and drink packaging sector refers to a series of technical evaluations carried out to ensure that packaging performs as intended throughout its lifecycle, from filling and sealing, through transport and storage, to final use by the consumer. Pack testing is not explicitly required under UK food safety legislation but it plays a critical role in demonstrating compliance with broader legal obligations related to food safety, packaging suitability and consumer protection. Pack testing is essential because it helps manufacturers verify that packaging meets regulatory requirements, protects the product effectively and performs consistently across production batches. It also supports brand reputation by ensuring that consumers receive products in good condition, with no leaks, spoilage or contamination. In the food and drinks industry, where shelf life and safety are tightly regulated, inadequate packaging performance can lead to costly recalls, legal liabilities and damage to consumer trust.

The evaluation of new packaging materials is carried out in several stages. Initially, screening tests are conducted to assess performance. These are typically **accelerated tests**, designed to simulate the effects of long-term storage within a shorter timeframe. To achieve this, test conditions are intensified, such as by increasing the temperature or using food simulants, to compensate for the reduced duration. However, a limitation of accelerated testing is that the intensified conditions can influence the failure mechanisms, potentially leading to results that do not fully reflect real-world performance. Despite this, accelerated tests are particularly valuable in the early stages of material development, where the primary goal is to compare different materials and identify those with the best relative performance.

If a material performs well in these initial tests, it proceeds to the next phase: **real-time or real-conditions testing**, also known as direct determination. This phase is essential because it has been shown that performance under normal storage conditions cannot be reliably predicted from accelerated testing alone. For both product integrity and food safety, real-time testing is critical. Real-time testing involves filling cans with a variety of representative contents, storing them at ambient and elevated temperatures, and inspecting them at regular intervals, typically every six months, over a period of two to four years. The exact duration depends on the customer's requirements and the expected shelf life of the food products. However, there is a growing trend toward longer testing periods and it is common for testing periods to now last for four years.

These tests are usually conducted by can-makers, sometimes in collaboration with their customers. The applicant does not carry out pack testing themselves because they do not know what the end use will be for the products they produce.

When there is a change to packaging materials, such as the introduction of a new substrate or coating, pack testing becomes even more critical. Any modification can affect the packaging's mechanical, chemical or barrier properties. Therefore, a full validation process is typically required, including compatibility testing with the product, migration testing for food contact compliance and performance testing under expected storage and transport conditions. Regulatory bodies and quality assurance teams often require documented evidence that the new material performs at least as well as the previous one, ensuring continuity of safety and functionality.

2.5.4.4 Standards and certifications

A range of standards and certifications apply to packaging steel producers like the applicant, to ensure that their products are safe, compliant and suitable for use in food packaging. These standards cover not only food safety and hygiene but also religious, environmental and quality management considerations.

One of the most significant certifications is the **BRCGS Global Standard for Packaging Materials**. The applicant's Trostre site is certified to Grade AA+, which represents the highest level achievable in an unannounced audit. This standard, recognised by the Global Food Safety Initiative (GFSI), ensures that packaging materials are manufactured in hygienic environments and meet rigorous safety and quality criteria. It is particularly important for materials intended for direct or indirect food contact and is often a prerequisite for supplying major food brands and retailers.

In addition to BRCGS, the Trostre site has obtained **EHDA Halal** and **KLBD Kosher** certifications, which confirm that its products meet the dietary and ethical requirements of Muslim and Jewish consumers respectively. These certifications are increasingly important in global markets where religious compliance influences purchasing decisions and regulatory access.

ETP itself is manufactured according to specific requirements outlined in various standards, such as BS EN 10202:2022 (*Cold reduced tinmill products: electrolytic tinplate and electrolytic chromium/chromium oxide coated steel*) and BS EN 10333:2024 (*Steel for packaging. Flat steel products intended for use in contact with foodstuffs, products and beverages for human and animal consumption. Tin coated steel (tinplate)*). These standards specifically allow for the use of Cr(VI) in passivation and, while they recognise that chrome-free passivation alternatives may be used, the products are not interchangeable. This means if the use of Cr(VI) is no longer permitted, the applicant would need to ensure that the requirements of the standards can continue to be met and update all relevant certifications and Declarations of Conformity (DoCs).

The above certifications and standards exist to ensure that products brought into contact with food are safe, traceable and manufactured under controlled conditions. They provide assurance to regulators, customers and end users that the materials will not compromise food safety or quality. They also support market access, brand reputation and legal compliance.

If a manufacturer like the applicant makes changes to its products, such as introducing a new coating or modifying a surface treatment, it will trigger the need for revalidation of existing certifications. This could involve updated migration testing, risk assessments and audits to confirm continued compliance with the requirements of certification standards. Failure to reassess and revalidate could result in the suspension or withdrawal of certifications, potentially affecting customer relationships and market access.

3. Analysis of alternatives (AoA)

The aim of this AoA is to assess the feasibility of potential alternatives to the use of sodium dichromate for the passivation of ETP. The objective is to identify the most likely NUS for the applicant in the event that its use of sodium dichromate must cease, to provide input for the SEA and SP.

Article 60(5) of REACH provides that when assessing the availability of suitable alternative substances or techniques, all relevant aspects must be taken into account, including:

a) whether the transfer to the alternative would result in reduced overall risks to human health and the environment (as compared to the Annex XIV substance) taking into account risk management measures; and

b) the technical and economic feasibility in the UK of alternatives for the applicant for replacement of the Annex XIV substance.

The alternative must also be available for the applicant, i.e. it can be accessed in sufficient quantity and quality for substitution.

In this section, the applied-for use scenario is described, including the key functionalities currently provided by sodium dichromate which any potential alternatives must be capable of delivering. The applicant's efforts to identify potential alternatives are then described and a longlist of potential alternatives drawn up. Those shortlisted are assessed in terms of their technical feasibility, economic feasibility, potential for risk reduction and availability. A potential alternative process or technology must fulfil all key functionalities; any general attempt to offer products to the market using an inferior alternative without additional development would likely result in a critical loss of market share and sales, as customers would most likely switch to more reliable, proven and readily-available products made using Cr(VI)-based processes imported from outside of the UK.

The assessment focuses on technical feasibility in the first instance and, if the alternative is found to have critical technical weaknesses which means some of the key functionalities are not fulfilled, economic feasibility and other considerations do not then need to be assessed in as much detail. This is in line with the approach suggested in the ECHA guidance on authorisation[7] and aims to ensure a proportionate approach is taken to the AoA.

3.1 Applied-for use scenario (AfUS)

3.1.1 Process description

The applicant uses sodium dichromate at the Trostre Works for the passivation of ETP. The oxide film normally present on tin-plated steel strip, although protective to some degree, will readily grow during storage. As well as discoloration of the surface, at a certain thickness the tin oxide film will result in impairment of the adhesion of a subsequent lacquer layer and cause difficulties with welding. Conversely, too little tin oxide can have negative consequences for de-tinning the steel. This means it is critically important to control the tin oxide layer to prevent further oxidation. Sodium dichromate is therefore used to apply a thin layer of chromium metal (Cr(0)) and chromium oxide (Cr(III)) onto both sides of the tin-plated coil by passivation.

[7] ECHA, 2021(a), p45 and p81.

The tinplate is immersed in an electrolyte [redacted] with an electric current applied. The stable protective layer, so formed, consists of tin oxides, Cr(III) oxides and hydroxides and also metallic chromium. The produced oxide layer is free of Cr(VI).

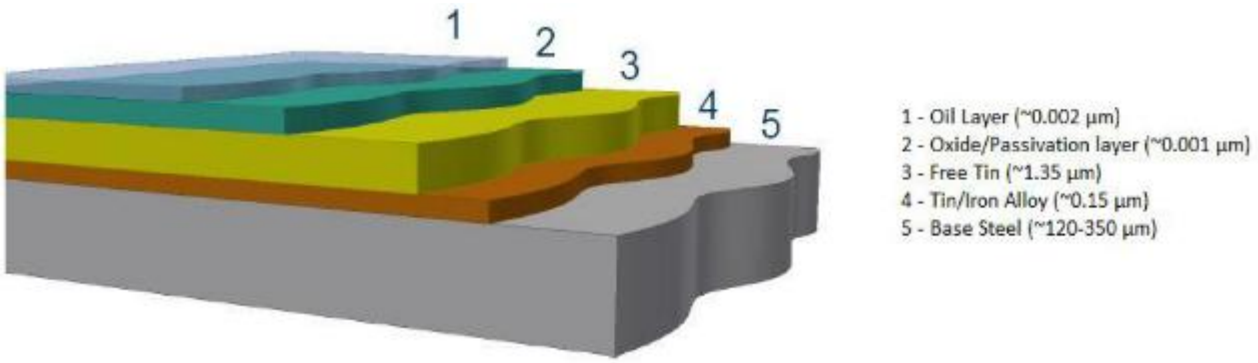


***Figure 18**: Schematic structure (not to scale) of tinplate showing the main functional layers*

The production of ETP is an automated, continuous process. At the entry end of the line, the tail end of one coil is welded to the nose of the subsequent coil and at the exit end the strip is sheared, to again separate the coils. Production involves the following process steps, which are illustrated in Figure 19 below:

- **Entry section**: The black plate steel coil is unwound and cut to appropriate width via a side trimmer before it passes through to the different treatment tanks. The trailing end of the preceding coil is trimmed square and welded to the prepared end of the new coil. This ensures that the process is continuous. Meanwhile the plating section of the line is fed continuously from the strip stored in the looping tower. The looping tower makes it possible to maintain a constant and high speed through the plating tanks. The looping tower consists of upper and lower sets of rolls over which the strip passes. The lower set of rolls is mounted on a frame, which can be moved up or down depending on whether strip is being drawn from or accumulated in the equipment.

- **Cleaning section**: The coiled black plate as received from the entry section is usually slightly contaminated with oils and dirt. Successful tin deposition requires the steel surface be free of these contaminants, so it is important that the cleaning operation is as thorough as possible. The strip is therefore passed through five tanks – [redacted] cleaner 1 and 2 electrolytic tanks, followed by two rinsing tanks. Cleaning consists of treating the strip with [redacted] and then cleaning in two electrolytic tanks containing [redacted]. The chemical cleaning action of the [redacted] is electrolytically aided due to the short time available for cleaning. [redacted] All baths are connected to individual circulation tanks situated in the basement of the production area.

- **Pickling section**: In addition to oils and other organic matter, the incoming steel strip will carry oxides and other acid-soluble contaminants, which must be removed by pickling. Pickling is also an electrolytic process. The purpose of the acid is to remove the oxides and lightly etch the strip surface, to present as clean a steel surface as possible to the plating solution. [redacted] is used for pickling at ambient temperature.

- **Tin plating section**: The plating section consists of a number of vertical tanks arranged in tandem so that any point on the strip passes into each tank consecutively and the tin coating thickness is increased in successive pass-throughs.

[redacted]

***Figure 19**: Tandem arrangement of plating tanks*

The plating tanks are constructed of rubber lined steel and contain a rubber covered driven sink roll. In addition to the sink roll, two chromium-plated copper conductor rolls are associated with each tank. Current is transferred from the roll to the strip. The anodes are cast from electro-refined tin, which is greater than 99.85% pure and mounted in the tank. The number of anodes in use and the spacing between anodes are adjusted so that the total anode bank covers the strip width.

[redacted] All additions are made remotely from the operator's pulpit via automatic pumps and valves. Samples of solution are analysed to provide the operator with the information required to keep the solution within specification. [redacted]

- **Drag-out section**: A drag-out section minimises the loss of plating electrolyte carried over from the plating section, in order to minimise the incidence of indents and arcing and to recover carried over plating electrolyte (which is returned to the plating section). It also maintains a controlled level of dilute electrolyte on the strip surface. A separate 'flux chemical' is applied to the strip via sprays to ensure the surface of the tin is reflowed to give the desired surface finish.

- **Differential marking**: This process involves marking the surface of the strip with lines of various spacing, which are normally applied on the heavy coating surface. This is used for products with differential coating weights, to enable the customer to identify the one surface from another. Other, non-standard marks may be specified, such as interrupted marker lines or single centre line markers or edge markers.

- **Flow melting (flow brightening)**: The tin coating, as deposited on the strip, has a dull matt appearance. To give it a bright lustrous surface similar to that of hot dip tinplate, [redacted]

- **Passivation**: The tinplate surface is then stabilised either chemically or electrochemically in the passivation section (also called the chemical treatment section). This section consists of passivation tanks and rinsing tanks. [redacted] During the passage of the steel through the passivation tanks, Cr(VI) is reduced in a cathodic driven process and deposited on the steel as a mixed layer of metallic chromium (Cr(0)) and chromium (III) oxide (Cr_2O_3) on both sides of the steel. After the passivation, the steel is rinsed in the successive rinsing tank.

A number of treatments have been developed; the choice of treatment depends on the degree of oxide stability that is desired and the end use of the tin-plate steel. In view of the satisfactory results obtained commercially with [redacted] chemical treatments over many years of use, this is the normal treatment for most tinplate applications. This treatment forms a suitable surface at any line speed and is satisfactory for use with most tinplate lacquer systems. Some applications, such as caps and closures and those involving milk products, use lacquer systems which require a lower level of passivation, known as [redacted] chemical treatment, whilst applications which involve the packaging of products containing sulphides may require a higher level, called [redacted] chemical treatment.

- [redacted]

- [redacted]

- [redacted]

- **No passivation**: Certain DWI applications require a surface with no chrome deposition. This is achieved by re-routing the strip so that it completely bypasses the chemical treatment section.

[redacted]

- **Oiling**: After the tinplate has been treated, rinsed and dried, a thin film of lubricant is applied to the tinplate surface. The function of this film of lubricant is to minimise subsequent damage by abrasion, to facilitate sorting, handling, mechanical feeding and fabricating operations and to aid in lacquering and printing operations.

- **Final inspection:** Final inspection of the finished strip is by visual examination in two vertical mirrors and an online Parsytec automatic inspection system. This is to look for surface defects generated through process. Continuous monitoring of tin coating weight, strip thickness, gauge, pinhole levels, coil weight and length are also undertaken.

3.1.2 Key functionalities and performance standards

Sodium dichromate ($Na_2Cr_2O_7$) is an inorganic compound commonly used as an oxidizing agent in various industrial processes, including metal surface treatment. It is used in the passivation of ETP to create a thin protective chromium oxide layer, improving corrosion resistance for packaging.

Potential alternatives are assessed for their suitability in the final application but also for their compatibility with the entire packaging unit (e.g. a can, which will include closures) and the broader metal packaging manufacturing process. For example, ETP must be compatible with the lacquer systems applied to ensure essential qualities such as corrosion resistance, shelf life and visual appearance.

[redacted]

ETP products are manufactured according to specific requirements outlined in various standards, such as BS EN 10202:2022 (*Cold reduced tinmill products: electrolytic tinplate and electrolytic chromium/chromium oxide coated steel*) and BS EN 10333:2024 (*Steel for packaging. Flat steel products intended for use in contact with foodstuffs, products and beverages for human and animal consumption. Tin coated steel (tinplate))*. Customer processes are finely tuned to these specifications, meaning any changes to the ETP manufacturing process must be carefully evaluated for their impact on both the customer's production processes and the final product's properties.

A significant portion of ETP used in packaging is dedicated to food packaging. Even non-packaging uses are often intended for food contact, such as bakeware. This means the technical approval standards for food contact remain a dominant factor in determining the feasibility of any alternative, i.e. any potential substitute must meet food-contact requirements as well as other key functional requirements. In addition, different types of food create varying conditions within the packaging, requiring the material to withstand a range of chemical and physical stresses. The demanding conditions of canned food production and the need for long shelf life further increase the performance requirements of the steel. Therefore, any potential alternative must be tested in collaboration with food packaging manufacturers and fillers.

The combination of the steel base material and a multi-layer organic coating provide several critical properties, including mechanical strength and stiffness, cold formability, strong lacquer adhesion and aesthetic appeal. Key functional requirements also include corrosion resistance during storage and transport, and chemical resistance to food products to ensure safe preservation of food and beverages.

Different stages in the lifecycle of the steel impose different requirements. A distinction must be made between the steel strip before packaging manufacture and the final, filled packaging. Steel strip may be stored for up to a year before use and must resist corrosion during this period. Once formed into cans, the material must provide sufficient chemical resistance to the contents. The passivated coating alone is not enough; an organic coating (lacquer) will be applied to form a structured barrier that prevents adverse interactions between the packaging and its contents. Such interactions may include oxidation (due to oxygen in the food or headspace) or the diffusion of chemical compounds through the organic layer.

The following overarching requirements have been identified for evaluating suitable alternatives to sodium dichromate for passivating ETP:

1. **Corrosion resistance** of the steel plate prior to use
2. **Adhesion**, i.e. a suitable surface for organic coating application
3. **Chemical resistance** to the contents of the packaging
4. **Compatibility** with downstream processes, including heat resistance and formability
5. **Suitability for food contact** (in compliance with food contact regulations)
6. **Visual properties**, including aesthetics, brightness and overall appearance
7. **Scalability and stability** of the production process for high-volume manufacturing
8. **Sustainability**, in particular, the ability to recycle

These functional requirements are explained in detail below and have been used as the basis for screening potential alternatives. Most of these functionalities are highly interconnected with each other and are due to the characteristics of sodium dichromate-based passivation. Therefore, it is essential that a potential alternative sufficiently fulfils every minimum requirement.

3.1.2.1 Corrosion resistance

Corrosion resistance, i.e. the ability of a material to withstand gradual degradation due to oxidation in its environment, is a critical requirement. In this context, it refers to the resistance of tin-plated steel to ambient air exposure during transport and storage, prior to the packaging manufacturing process.

The thin layer of metallic chromium and chromium oxide (Cr_2O_3) on the surface of tin-plated steel acts as a physical barrier against oxygen and moisture. This barrier prevents the diffusion of oxygen and inhibits further oxidation of the tin-plated steel, thereby protecting it until it undergoes further processing.

Corrosion resistance is verified through controlled storage testing. The following tests are conducted:

- Accelerated corrosion test: Samples are placed in a humidity chamber at 40°C and 90% relative humidity for one week. Visual inspections are carried out daily.
- Long-term evaluation: Regular inspections of stored material over time.

In practice, steel coils are typically stored at customer sites for around three months before being used in packaging production and filling. However, this period can be extended, e.g. if harvest yields are lower than expected when the steel was originally ordered. In general, packaging materials are used within one year of production.

3.1.2.2 Adhesion

The second key function of the Cr(0) and Cr(III) layer is to provide an optimal surface for strong adhesion of organic coatings (lacquers). These coatings primarily offer chemical resistance, protecting against degradation caused by chemical reactions with the environment, and enhance the downstream processability of ETP material. A metallic chromium and chromium oxide layer on the surface of the tinplate ensures better adhesion of these coatings and prevents peeling. In addition, the lacquer provides further protection from the contents and must be free from taint and issues of processability at high temperatures as most food cans are in can food sterilised.

Beyond chemical resistance, the organic coating also addresses a challenge posed by the chromium layer itself: its hardness. The Cr(0) and Cr(III) surface is very hard and can cause wear on can-making machinery at customer sites. Applying an organic coating significantly improves the processability of ETP in manufacturing equipment. Even in applications where chemical resistance is less critical, organic coatings are still applied to enhance processability. In some cases, the surface properties of the organic coating provide additional functional benefits, such as anti-stick properties. In these applications, excellent adhesion to the base material remains essential. Additionally, the organic coating contributes to the decorative appearance of the can or metal packaging.

The organic coating can only perform its protective and functional roles if it remains firmly adhered to the steel surface. Adhesion strength depends on both the properties of the ETP substrate and the organic coating. The bond must be strong enough to withstand mechanical deformation during can and closure manufacturing, as well as the conditions encountered during use, such as sterilization or baking.

Lacquers are usually selected by customers, resulting in a broader range of materials and a wider testing scope. Historically, many organic lacquers used for metal packaging, particularly epoxy-based systems, contained bisphenol A (BPA) and were well established in terms of performance and testing requirements. The more recent introduction of BPA-free lacquers has added complexity to testing, as these systems are often evaluated alongside other changes, making interpretation of results more challenging. Regardless of the type of organic coating, excellent adhesion is critical.

Adhesion is evaluated through several methods:

- Simulation tests using substances that mimic real-use conditions.
- Pack tests to assess long-term coating adhesion.
- Can production test runs to evaluate adhesion under mechanical stress during manufacturing.

For lacquer coatings, adhesion is tested using a cross-hatch test (ISO 2409:2020 – Paints and varnishes: cross-cut test). A polyamide adhesive tape is pressed onto the coated surface and removed after two minutes. The degree of delamination is assessed using the Gitterschnitt scale, ranging from 0 (no delamination) to 5 (complete delamination). Adhesion is also tested after sterilization using different media (e.g. 121°C for 60 minutes with lactic acid and/or cysteine) to simulate real-world conditions.

***Figure 21**: Lacquer adhesion test showing insufficient adhesion (left) and good adhesion (right) (source: Marmann et al., 2011)*

3.1.2.3 Chemical resistance

Chemical resistance refers to a material’s ability to withstand gradual degradation caused by chemical reactions with its environment. In this context, the entire layered system, comprising both the metallic and organic coatings, must be evaluated as a whole. The ‘environment’ refers to the contents of the packaging, which can trigger various chemical reactions, such as oxidation from the headspace or food, acid-base reactions or diffusion of substances through the organic layer.

Some canned products are highly corrosive due to their acidic or alkaline nature, strong polarity, oxidizing properties or high salt concentrations. These contents can aggressively attack the plated steel, for example, protein-rich meat and fish and, to a lesser extent, vegetables such as peas, beans and corn, containing naturally occurring sulphur compounds. These can react with an uncoated tinplate surface, producing a purple-black stain of tin sulphide that forms when sulphide corrosion products develop on the tin. The resulting oxidation products may negatively affect the organoleptic (taste, smell, appearance) properties of the food.

The Cr(VI) passivation layer, together with the organic coating, protects the steel by forming a physical barrier and modifying the surface reactivity. This layered system delays the onset of chemical reactions and slows their progression once initiated.

Chemical resistance is assessed through exposure tests followed by visual inspection for signs of damage, such as pitting. Testing typically includes:

- Controlled storage conditions with subsequent visual inspection.
- Heat treatment of cans (typically above 100°C) to simulate sterilization.
- Long-term pack tests, ranging from 2 weeks to up to 4 years, to evaluate performance over the expected shelf life of the product.
- Sterilization resistance tests using real or simulated media (e.g. salt, acetic acid, reducing agents, sulphur compounds, cysteine, lactic acid) at 130°C for 1 hour.

After testing, cans are inspected and rated based on the presence and severity of defects, with scores assigned to quantify chemical resistance performance.

3.1.2.4 Compatibility with downstream processes

Since a significant proportion of ETP packaging material is used in food packaging, the sterilization process, conducted after can formation, is a critical boundary condition. One of the key advantages of metal packaging is its ability to undergo simultaneous sterilization of both the packaging and its contents. To support this functionality, the packaging must be able to withstand the conditions of sterilization without compromising its integrity.

This requirement is particularly stringent for Drawn and Wall Ironed (D&I or DWI) cans, which undergo substantial mechanical deformation during production. The final material, including the organic coating, must maintain its performance and adhesion throughout these deformation processes. In other applications, such as bakeware, the organic coating must also demonstrate strong adhesion and stability at elevated temperatures.

Heat resistance of the coated material is verified by exposing it to relevant elevated temperatures in combination with mechanical deformation. The material must withstand both the high temperatures encountered during processing and those experienced throughout its lifecycle.

- Sterilization temperature target: 100°C to 130°C
- Performance criteria: No delamination or degradation of the coating, even after deformation

This ensures that the coated steel remains functional and safe for use in food packaging and other high-temperature applications.

3.1.2.5 Suitability for food contact

Food contact materials are regulated in the UK and internationally. While EU food contact legislation is broadly similar to that of the UK, the applicant's markets also include non-EU countries such as the US. One of the most frequently requested certifications by can-makers is compliance with the US Food and Drug Administration (FDA) regulations, due to the international nature of the food packaging industry. Clients often require FDA food contact compliance in addition to meeting UK and EU regulations because this ensures global market access and regulatory alignment.

Compliance is verified through composition checks, migration testing and adherence to approval procedures. Migration testing is typically conducted using migration cells, which ensure controlled and reproducible test conditions. The procedure involves:

1. Placing a sheet of the packaging material on a base plate.
2. Positioning a cylindrical ring over the sheet.
3. Adding a second sheet of packaging material on top of the ring.
4. Assembling the cell and filling the internal volume with a suitable liquid food simulant via access ports.

***Figure 22**: Use of migrations cells (open on left, closed on right)*

After exposure to specified time and temperature conditions, the simulant is removed and analysed for potential chemical migration from the packaging material. This test helps determine whether the material complies with regulatory limits for food contact safety.

3.1.2.6 Visual properties

The visual appearance of ETP, such as surface structure, colour and brightness, can significantly influence the final look of lacquered products. Even when coated, the base material can affect the visual outcome, especially when transparent coatings are used. Variations in appearance will influence the purchasing behaviour of the applicant's customers when considering alternative materials, as differences in the final product's look can be perceived as quality issues.

Although most ETP is predominantly coated, many coatings are transparent, allowing the underlying surface to remain visible. As a result, any change in the base material's visual characteristics can still be seen after coating. Customers have reported that such changes, particularly in gloss or colour, can have significant operational consequences. For example:

- Automated visual inspection systems may misidentify changes as defects, leading to increased rejection rates or requiring time-consuming recalibration.
- Perceived defects, such as dullness or discoloration, may be mistaken for microbiological contamination, potentially damaging brand reputation.
- Consumer perception can also be affected, as visual appeal plays a key role in purchasing decisions.

Visual appearance is assessed through light reflection measurements to quantify gloss and brightness, and a visual inspection to detect any noticeable changes in surface appearance.

These evaluations help ensure that any alternative materials meet the high aesthetic standards expected by both manufacturers and end consumers.

3.1.2.7 Scalability and stability of the process

The production process for any alternative to sodium dichromate-based passivation must be compatible with stable, high-volume manufacturing. Packaging steel production is a high-throughput, highly automated, continuous process. Current production lines operate at speeds of up to [redacted] per minute. If an alternative material or process reduces throughput compared to the existing system, additional production lines may be required to maintain output levels, significantly impacting cost and efficiency.

In addition to throughput, process stability is essential. The quality of the passivation must remain consistent over time, which depends on the stability and the application of the layer.

Suitability for high-volume production is verified through:

- Trial production runs on both pilot-scale and full-scale production lines
- Monitoring of line speed compatibility, coating quality consistency, and electrolyte stability

These trials ensure that any proposed alternative can meet the demands of industrial-scale manufacturing without compromising quality or efficiency.

3.1.2.8 Sustainability

Cr(VI)-based passivation plays a critical role in providing corrosion resistance, adhesion properties and chemical resistance, all of which are essential for the performance and longevity of ETP used in food and beverage packaging. However, the assessment of alternatives must go beyond technical performance to address broader societal and environmental concerns, including sustainability.

Recyclability is a fundamental aspect of sustainability in the steel packaging sector. Steel is one of the most recycled materials globally and ETP is designed to be fully recyclable within existing steel recycling streams. Cr(VI)-based passivation, which applies a thin layer of Cr(0) and Cr(III) to the tin-plated coil, does not hinder this recyclability. Therefore, any alternative must be assessed not only for its ability to replicate the technical functions of Cr(VI)-based passivation but also for its compatibility with established recycling processes. If an alternative introduces contaminants or requires separation processes that complicate recycling, it could undermine the circular economy benefits that ETP currently offers.

Scrap steel is composed of products that have reached their end of life such as vehicles, machineries or ships, are no longer in use or demolished structures, old or broken domestic appliances such as refrigerators or washing machines, packaging as well as yield losses in the steelmaking processes. Used steel packaging can be put directly into furnaces and melted down to produce new steel an endless number of times with no loss of quality. The large volumes of steel produced in Europe every year (around 160 million tonnes) are already made with large amounts of scrap steel. No artificial incentive is needed to recycle.

This means permanent materials such as steel can be recycled over and over again without losing their key intrinsic properties, thus maintaining circular material loops. Such materials are, and will remain, at the heart of any proven and well-functioning circular economy. In addition, steel’s magnetic properties mean that steel is easy to recover from any waste stream by using magnets.

In June 2024, Steel for Packaging Europe, formerly known as APEAL, confirmed a new record recycling rate for steel packaging, following the harmonised method for calculating packaging recycling rates within the EU. Independently verified figures published by Steel for Packaging Europe confirmed that 80.5% of steel packaging placed on the market was ‘really recycled’ in 2022 (see Figure 23). It follows the announcement in December 2023 that steel packaging had met its EU recycling rate target for 2025, four years ahead of schedule.

This announcement also represents a 2% increase on the 2021 recycling rate and confirms steel packaging remains the most widely recycled sales packaging material in Europe, which is testament to its unique properties and the collaborative efforts of stakeholders across the value chain towards reaching a 100% closed material loop.

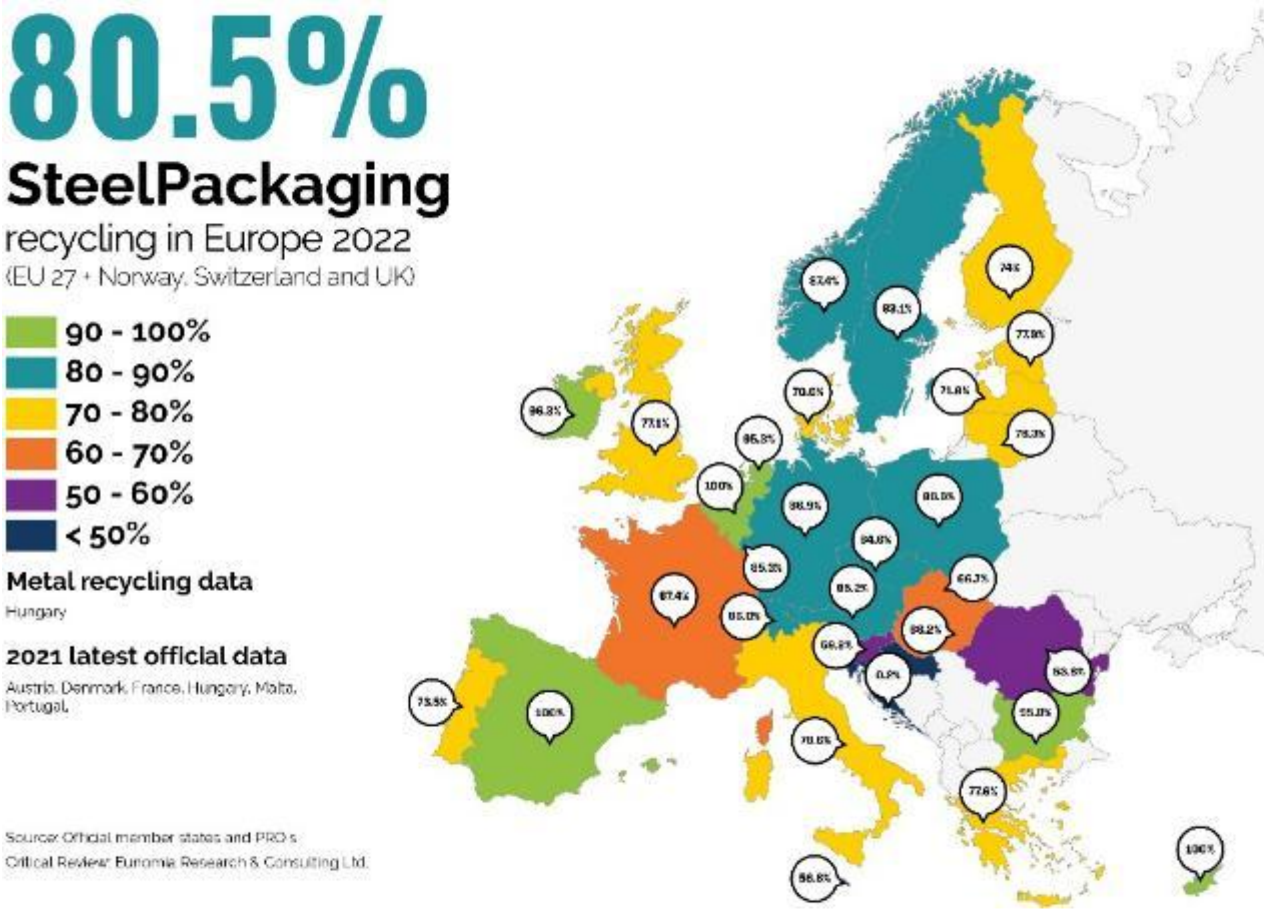


***Figure 23**: Steel packaging recycling rates across Europe (source: Steel for Packaging Europe)*

Global resources are limited, yet society's demands are increasing. Managing resources efficiently is therefore a top priority for the steel sector. Metal, as a highly recycled permanent material, saves raw materials, lowers energy consumption and reduces CO_2 emissions (see Figure 23).

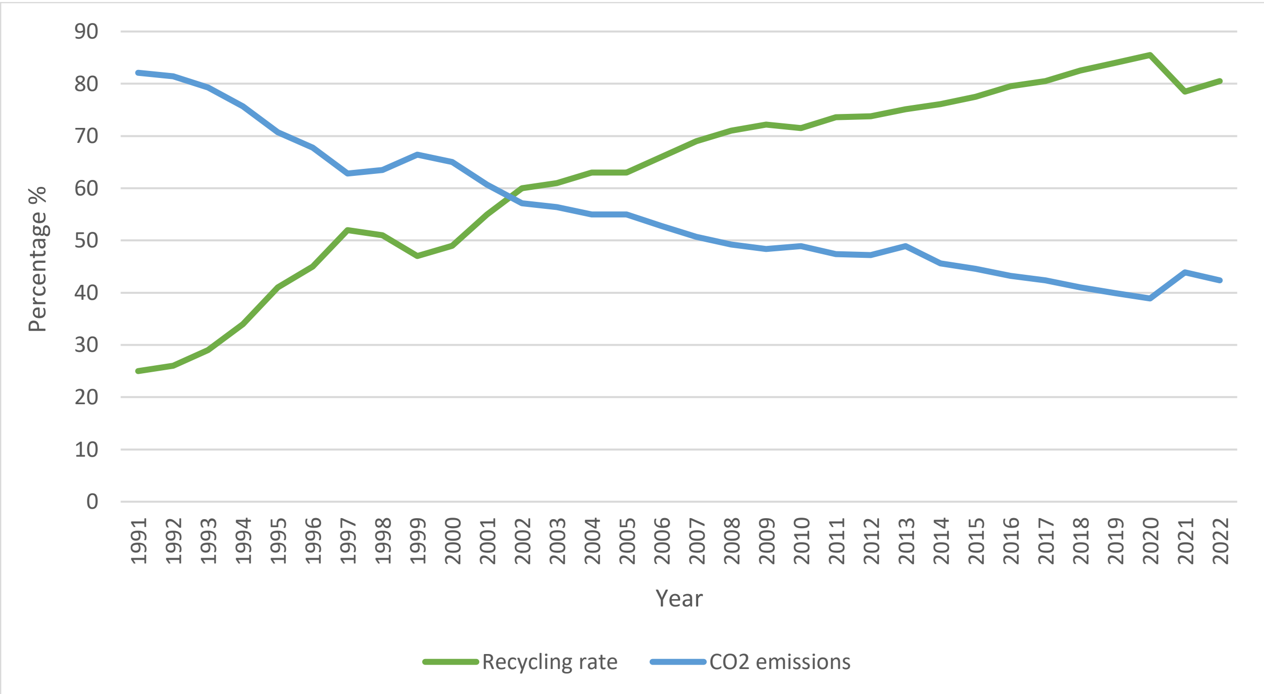


***Figure 24**: Relationship between CO_2 emissions and recycling rate (source: Steel for Packaging Europe)*

To assess whether an alternative is sufficiently sustainable, a life cycle assessment (LCA) approach can be employed. This includes evaluating the environmental impacts of the alternative across its entire life cycle, from raw material extraction and production to use and end-of-life disposal or recycling. Key indicators would include greenhouse gas emissions, energy and water use, toxicity and the potential for resource recovery. Additionally, the alternative should be assessed against chemical regulations (including REACH), occupational health and safety legislation, food contact materials regulations and environmental protection legislation. Stakeholder engagement is also crucial. This includes consulting with recyclers, downstream users and regulatory bodies to ensure that the alternative does not introduce unintended consequences in the supply chain.

3.1.3 Annual quantities

The tonnage information has been calculated on the basis of the quantity of sodium dichromate used in production each year. This is shown in Table 9 below. The values presented in the first row represent the quantity of product used (sodium dichromate in aqueous solution). The second row then represents the corresponding quantity of sodium dichromate used (i.e. excluding the water fraction). The third row then reflects the hexavalent chromium (Cr(VI)) content.

[redacted]

***Table 9**: Tonnage (tonnes/year) of sodium dichromate used at the Trostre Works for the ETL process*

The values in the table above are based on calendar years. However, in recent years, the highest quantity consumed was across a financial year rather than a calendar year – [redacted] of product in the financial year 2018/2019. This equates to [redacted] of sodium dichromate (i.e. less water) as the product used to date is an aqueous solution of sodium dichromate at 60% concentration.

However, as previously discussed, the applicant's supplier will soon change and the product purchased from them will be at a 70% concentration. [redacted] of product at this higher concentration equates to [redacted] (public range: 10-20 tonnes) of sodium dichromate, or [redacted] Cr(VI), which is used as the assessed annual tonnage for the purposes of this application. This higher quantity also accounts for any potential future increase to the consumption of sodium dichromate, e.g. in response to increased customer demand or in the event of an increase in surface area passivated due to greater width of finished products.

3.2 Identification of alternatives

Electrolytic tin-plated steel has been used for food packaging for many decades due to its combination of corrosion resistance, formability, strength and suitability for food contact. While tin itself provides a degree of corrosion protection through the formation of a surface oxide, freshly plated tin is chemically active and prone to uncontrolled oxidation during storage and subsequent processing. Over time, as production volumes increased and supply chains lengthened, it became clear that additional surface stabilisation was required to ensure consistent performance.

Chromate passivation of electrolytic tinplate was introduced in the mid-20th century to control the chemistry of the tin surface immediately after plating. It became standard industrial practice from the 1950s onwards, as electrolytic tinning was scaled up for high volume packaging applications. By the 1960s, chromate-passivated tinplate was already well established and widely studied in the corrosion and packaging literature. By forming a very thin, stable conversion layer, chromate passivation suppresses uncontrolled oxide growth, improves corrosion resistance and, critically, provides a reproducible surface for the adhesion of organic lacquers and coatings. These functions are essential for the performance of tinplate in demanding food and beverage applications and cannot be delivered reliably by tin alone.

The Trostre Works, built in 1947 and fully operational by 1952, has exclusively produced electrolytically tinned steel. As with other electrolytic tinning lines of that era, post-tinning passivation using chemical chromate treatments has always featured as part of the production process. While the fundamental principles of chromate passivation have remained unchanged, operating parameters and equipment design have been progressively refined over successive generations of production lines. In particular, the commissioning and subsequent modernisation of ETL5 from the early 1990s onwards has delivered significant improvements in productivity, process control, tin efficiency and environmental performance, while retaining Cr(VI)-based passivation as a critical and irreplaceable surface treatment:

- **1993:** ETL5 commissioned, [redacted]
- **1995:** Modifications to the plating section [redacted]
- **2013:** Transition from [redacted]
- **2016:** Replacement of the [redacted]
- **2017:** Conversion of the [redacted]
- **2017:** Upgrades to the [redacted]
- **2018:** Installation of a chrome-free passivation alternative (CFPA) on ETL5 (see section 3.3 below for further information).
- **2018:** Change of the [redacted]

The continued use of Cr(VI)-based passivation at Trostre reflects not a lack of innovation, but the absence to date of any suitable alternative surface treatment that can consistently deliver equivalent performance across the full range of ETP applications.

Concerns regarding the environmental and occupational health hazards associated with Cr(VI) have led to sustained efforts, both at Trostre and across the wider packaging steel industry, to identify and qualify alternatives to Cr(VI)-based passivation. These investigations began as early as 2006 and have intensified as regulatory requirements have tightened. The following sections describe the alternative passivation systems that have been evaluated to date, the limitations identified and the reasons why none currently provide a technically and economically viable substitute for Cr(VI)-based passivation for ETP at Trostre.

3.2.1 Efforts made to identify alternatives

The applicant has been searching for an alternative to the use of Cr(VI) for the passivation of ETP for nearly 20 years. These efforts have been undertaken collaboratively with other European packaging steel producers, [redacted], reflecting the shared technical challenges associated with tinplate for food and general line packaging.

A major early milestone in this work was the launch of a coordinated European research programme approved in 2006 and initiated in 2007 under the title *Innovative Packaging Steel with Enhanced Adhesion to Organic Coatings Based on Nanostructured Interphases (IPSA)*. The IPSA project was supported through the Research Fund for Coal and Steel and was explicitly intended to identify and evaluate chromium-free surface treatments capable of delivering performance comparable to conventional chromate-passivated tinplate, in anticipation of increasing regulatory and societal pressure to eliminate hexavalent chromium from industrial processes. At the time the project commenced, the primary driver was the anticipated regulatory action under EU REACH and, to some extent, legislative developments in the United States.

The project ran for approximately six years, its duration reflecting the scale and depth of the work undertaken. The final report was published in 2013 by the Publications Office of the EU under the Research Fund for Coal and Steel. The IPSA programme was structured as a staged and systematic investigation in three phases, progressing from laboratory screening to increasingly application-relevant evaluation:

- Phase I was to screen parameters (tin oxidation, wettability, sulphur staining, flexibility) with a gold epoxy phenolic lacquer. The procedure for the evaluation of alternative passivation technologies was also agreed.
- Phase II was divided by geographic region, with three regional sector choices for testing that were driven by can-makers. The number of tested lacquers was also increased, with the possibility of small-scale pack tests (evaluation, through laboratory and real-time testing, on food-contact packaging and related materials to ensure there is no migration from the packaging material to the food which is contained within) on alternatives that were deemed the most promising.
- Phase III envisaged the identification of a globally acceptable alternative, followed by full pack tests conducted by can-makers to confirm long-term performance, food contact safety and consumer protection.

Suitable alternatives were initially assessed against several essential criteria. The process needed to be economically effective, using cost-effective chemicals, generating minimal wastewater and requiring little new equipment or maintenance. It also had to deliver reliable quality, with simple control of coating thickness and distribution and a stable operating window, while fitting into a commercial tinplating line with minimal changes.

Compliance with occupational health and safety and environmental protection legislation was mandatory, as was compliance with food safety regulations, with no migration of hazardous substances into packaged food. The chosen option had to provide excellent lacquer wettability and adhesion on both flat and deformed parts. It also needed to prevent sulphur staining, resist tin oxidation during transport and storage and maintain appearance and avoid changes in gloss, colour or dust formation during its lifetime. Finally, it had to ensure trouble-free processing further along the supply chain, including high speed weldability.

A large number of potential chromium-free systems were screened at laboratory or pilot scale, including:

- silane and polysiloxane systems,
- organic resins and natural products,
- zirconium, titanium and mixed oxide systems,
- electrochemically applied and spray-applied treatments.

Most candidates failed early against one or more critical criteria, such as poor lacquer adhesion after deformation, inadequate control of tin oxide growth, sulphur staining, instability during storage or incompatibility with high-speed welding or forming.

Following the initial laboratory and pilot-scale screening, a small number of candidate chromium-free surface treatments were identified as meeting baseline technical screening criteria under controlled conditions and were therefore selected for further evaluation:

- [redacted]
- [redacted]
- [redacted]

These systems were not considered proven substitutes for chromate passivation at this stage but were among those taken forward for more detailed testing under increasingly application-relevant conditions.

Test	Reference sample	[redacted]	[redacted]	[redacted]	[redacted]
Surface Tension mN/m (Softal range)	30				
Contact Angle (º)	84				
Sulphur Staining	1				
Sulphur Staining (def*)	2				
Adhesion (flat/dry)	0				
Adhesion (def/dry)	0.5				
Adhesion (flat/ster**)	0				
Adhesion (def*/ster**)	0				
Rapid deformation (mm)	14				
Scratch Resistance (g)	700				
Welding Range [9]	600			N/a	N/a

Notes:
* deformed
** sterilised in broth plasma

Table 10*: Early test results from alternatives against an ETP reference sample.*

Early comparative testing indicated that the candidate systems generally exhibited higher surface tension than the chromate-passivated reference material, which is associated with improved lacquer wettability. However, performance in sulphur-staining tests was consistently inferior to the reference, indicating reduced protection against sulphide attack. Lacquer adhesion results were mixed and, while broadly comparable to the reference material in simple adhesion tests, performance deteriorated following deformation and sterilisation in broth plasma. This highlighted limitations in the robustness of the alternative surface treatments under conditions representative of commercial food packaging manufacture and use.

Among the systems evaluated, [redacted] initially appeared to offer the most favourable overall balance of properties, with performance that was broadly comparable to chromate-passivated ETP in several screening tests. It was therefore taken forward for further trials. However, subsequent evaluation demonstrated that [redacted] could not consistently meet the full range of functional and process requirements necessary for ETP used in food and general line packaging, and its development as a chromate replacement for ETP was discontinued for several reasons:

- [redacted]
- [redacted]
- [redacted]
- [redacted]

Taken together, these findings demonstrated that, despite initial promise, [redacted] and the other screened systems could not deliver performance equivalent to chromate passivation across the full range of functional, processing and supply-chain requirements for electrolytic tinplate. This outcome reinforced the conclusion that further development work was required and provided an important foundation for subsequent industry-wide efforts to identify and qualify alternative passivation technologies.

Even before IPSA, EU-funded research had already identified the substitution of chromate passivation as a major industrial challenge. For example, the ECSC project *"Environmentally friendly-coated tinplate for food cans"* ran from 1999 to 2002, explicitly targeting chromium-free passivation systems and recognising the difficulty of achieving equivalent performance across the full tinplate and can-making chain. IPSA built directly on this earlier recognition but adopted a more structured and industry-wide approach.

Following the conclusion of IPSA in 2013, work did not stop. Instead, the focus shifted from broad exploratory screening to incremental, application-driven development, much of it coordinated through industry bodies rather than formal EU research projects. In particular, the applicant, together with other European tinplate producers acting through APEAL (now Steel for Packaging Europe), continued joint development of chromium-free passivation technologies for ETP. This work ultimately led to the development of the Chromium-Free Passivation Alternative (CFPA), based on titanium- and zirconium-containing oxide systems, which is now included in European and international tinplate standards and is undergoing qualification across the supply chain for certain applications. The development of CFPA is considered in further detail in section 3.3.2 below and represents a direct continuation of the learning from IPSA, informed by the limitations identified in silane, organic and early oxide systems.

3.2.2 Longlist of alternatives

The longlist of alternatives presented below represents the outcome of the efforts described above and also includes details of further alternatives that have been tested since the early investigations. Presented below is a complete list of alternatives which have been considered. These alternatives have been screened as appropriate for technical limitations, economic considerations, regulatory / safety concerns and availability in order to achieve a realistic shortlist of alternatives. The screening was based on the key functionalities (see section 3.1.2 above) essential for adequate performance that are in scope of this AfA. Based on this screening, the alternatives are categorised either as shortlisted alternatives that will be assessed in further detail in this report or as rejected alternatives which are not considered further as potential alternatives at the present time.

Alternative considered	Commentary / justification	Shortlist?
Chromium free passivation alternative (CFPA)	CFPA is widely regarded as the most advanced and credible potential alternative to conventional Cr(VI) passivation for ETP. It has been developed collaboratively by European packaging steel producers to provide equivalent control of tin oxide growth, corrosion resistance and lacquer adhesion without the use of hexavalent chromium. Early development and evaluation work included industrial-scale trials at Tata Steel in 2011–2012, during which CFPA was applied using spray-based systems on a commercial tinning line. These trials provided valuable operational experience with CFPA application, including spray configuration, process control and integration into existing line layouts, and led to a number of design and operational improvements that informed subsequent scale-up activities. Since that time, CFPA has undergone further technical development, standardisation and, in certain cases, downstream qualification across the European tinplate supply chain. In 2021, the European standard EN 10202 was revised to formally include specifications for chromium-free passivation alternatives for electrolytic tinplate, reflecting its potential to become a recognised and accepted alternative.	Yes
Trivalent chromium (Cr(III))-based surface treatment	Cr(III)-based passivation systems have been investigated for many years as a potential alternative to conventional Cr(VI) passivation. In principle, Cr(III) chemistries can form chromium oxide-containing surface layers on tinplate without the use of Cr(VI). However, in practice, Cr(III)-based processes have consistently failed to deliver a thin, uniform and reproducible passivation layer with performance equivalent to that achievable using conventional Cr(VI) systems. The passivation layers formed using Cr(III) electrolytes tend to be insufficiently homogeneous and provide less effective control of tin oxide growth, resulting in variable corrosion resistance and reduced robustness during storage and downstream processing. Attempts to improve passivation performance by modifying electrochemical conditions can lead to the formation of excessively dense or locally hard chromium-rich layers, which are detrimental to subsequent forming operations. In particular, the increased hardness and brittleness associated with such layers adversely affect the mechanical deformation behaviour of tinplate during can-making processes, including drawing, flanging and seaming. This leads to an increased risk of coating fracture, loss of lacquer adhesion and the creation of local corrosion sites after forming and sterilisation. As a result, Cr(III)-based passivation systems have not demonstrated reliable performance across the full range of forming, coating and food-contact requirements applicable to electrolytic tinplate. For these reasons, despite long-standing investigation, Cr(III) passivation does not represent a technically viable substitute for chromate passivation for ETP and has not been shortlisted for further development.	No
Ti(III)/Ti(IV) sulphate	Titanium-based passivation systems, including Ti(III) and Ti(IV) sulphates, have been evaluated as potential chromium-free alternatives. However, testing has demonstrated inferior technical performance for plain canning applications, particularly in terms of corrosion resistance and lacquer adhesion after processing. In addition, significant challenges were encountered with bath stability and control during manufacture, leading to variability in surface treatment quality and reduced process robustness. These limitations prevented consistent industrial application and ruled out titanium-based sulphate systems as a viable alternative for ETP.	No

Alternative considered	Commentary / justification	Shortlist?
K/Ti oxalate	Potassium–titanium oxalate-based passivation systems have been evaluated as chromium-free alternatives. However, testing showed that the protective layer formed on the tinplate surface was insufficiently developed, being thinner and less continuous than required to provide reliable control of tin oxide growth and corrosion behaviour. As a result, the surface treatment did not provide a stable or robust interphase for organic coatings. Poor lacquer adhesion was consistently observed, with detachment occurring in all tested conditions, particularly after deformation and thermal processing. The weakness of the passivation layer and the lack of cohesive bonding at the tinplate–passivation interface rendered this system unsuitable for food and general line packaging applications. On this basis, K/Ti oxalate passivation was not shortlisted for further consideration.	No
Zr sulphates	Zirconium sulphate-based passivation systems have been evaluated as chromium-free alternatives for ETP. However, similar to K/Ti oxalates, testing showed that the protective layer formed on the tinplate surface was insufficiently developed, being thinner and less continuous than required to provide effective control of tin oxide growth and long-term corrosion performance. The resulting surface treatment did not form a robust or stable interphase suitable for subsequent organic coating application. Poor lacquer adhesion was consistently observed, with detachment occurring in all tested conditions, particularly following deformation and thermal processing representative of can-making and sterilisation. The lack of a sufficiently cohesive and continuous passivation layer rendered zirconium sulphate-based systems unsuitable for food and general line packaging applications, and they were therefore not shortlisted for further consideration.	No
Zirconium-based (Zirconium oxides / Zr-Ti / organic Zirconates)	Zirconium-based passivation systems, including zirconium oxides, mixed Zr–Ti systems and organic zirconates, have been evaluated as potential Cr(VI)-free alternatives. However, significant manufacturing issues were identified, notably progressive tin build-up within the passivation solution during operation. This led to instability of bath chemistry, reduced control of passivation layer formation and increasing variability in surface treatment quality over time. The accumulation of dissolved tin species adversely affected process robustness and required frequent bath intervention or replacement, making stable long-term operation on high-speed electrolytic tinning lines impractical. As a result, zirconium-based systems were not considered suitable for industrial application to electrolytic tinplate and have therefore not been shortlisted.	No
Silane/Siloxane (organometallics) [redacted]	Silane- and siloxane-based organometallic systems, such as [redacted], have been evaluated as potential Cr(VI)-free alternatives. These systems form an immobile, cross-linked polysiloxane film that is covalently bonded to the tinplate surface. The fully cross-linked nature of the film prevents migration into food media, making such systems intrinsically suitable from a food-contact perspective, particularly for non-lacquered applications. In a number of performance areas, including initial lacquer adhesion, resistance to rapid deformation, scratch resistance and weldability, silane-based systems showed performance broadly comparable to Cr(VI)-passivated ETP under controlled conditions. However, testing consistently demonstrated poor resistance to sulphur staining, which is a critical requirement for food packaging applications. This deficiency was attributed to non-uniform film formation and incomplete surface coverage, resulting in localised areas of inadequate protection. The inability to achieve a sufficiently homogeneous and continuous	No

Alternative considered	Commentary / justification	Shortlist?
	polysiloxane layer under industrial tinning-line conditions led to variability in corrosion protection and unacceptable susceptibility to sulphide attack. As a result, despite favourable performance in some respects, silane-based passivation systems such as [redacted] cannot be considered suitable substitutes for chromate passivation for electrolytic tinplate and are therefore not shortlisted for further consideration.	
Acidic anodising	Acidic anodising was considered as a potential surface treatment approach; however, the process inherently promotes accelerated growth of a relatively thick and poorly structured tin oxide layer on the tinplate surface. As demonstrated in the literature, excessive or unstructured tin oxide growth is detrimental to lacquer adhesion, as failure tends to occur within the oxide layer rather than at the lacquer interface, particularly after deformation and thermal processing representative of can-making and sterilisation. Given the high likelihood of producing an oxide morphology incompatible with reliable lacquer adhesion and downstream forming performance, acidic anodising was not considered capable of delivering the controlled, thin and reproducible surface required for electrolytic tinplate. On this basis, the approach has not been taken forward for further experimental evaluation.	No
Aluminium oxide deposition by pH shift	Aluminium oxide deposition by pH shift was considered as a potential Cr(VI)-free surface treatment. However, the alumina layers formed by this approach were found to provide insufficient chemical resistance under conditions relevant to food and general line packaging, particularly in the presence of acidic or sulphur-containing media. The deposited oxide layer lacked the stability and protective performance required to control corrosion and prevent degradation during storage and thermal processing. In addition, the alumina films produced by pH-induced deposition did not form a sufficiently robust or compatible interphase with the tin substrate, leading to poor durability of subsequent organic coatings. Given the combination of inadequate chemical resistance and limited robustness under application-relevant conditions, aluminium oxide deposition by pH shift was not considered a viable alternative to chromate passivation and was not shortlisted.	No
Aluminium-based coatings [redacted]	Aluminium-based conversion coatings and aluminide systems, including trivalent-chromium conversion coatings developed for aluminium substrates [redacted] aluminium-ceramic coatings [redacted] and aluminide slurry coatings [redacted] were considered due to their excellent corrosion resistance and established industrial use in aerospace, automotive and high-temperature applications. However, these systems are specifically engineered for aluminium or aluminised substrates and are not designed to interact with the tin surface chemistry of electrolytic tinplate. In addition to substrate incompatibility, these coatings are typically optimised for non-food applications and service environments that differ fundamentally from those encountered in food and general line packaging. As a result, uncertainties remain regarding food-contact compliance, migration behaviour and long-term performance under packaging-relevant conditions, including forming, sterilisation and prolonged contact with food media. On this basis, aluminium-based coating systems were not considered technically suitable for ETP passivation and were not shortlisted for further consideration.	No
Iridite NCP (Al, F, O-based non-chrome passivation)	Iridite NCP (Non-Chrome Passivate) is a zirconium-based chemical conversion coating developed to provide corrosion protection, good paint adhesion and electrical conductivity on aluminium and its alloys. It is widely used as an environmentally compliant alternative to chromate conversion coatings in aerospace, automotive, electronics and general industrial applications, where	No

Alternative considered	Commentary / justification	Shortlist?
	it can be applied as a final finish or as a pre-treatment for organic coatings. However, Iridite NCP is specifically formulated to react with aluminium substrates and relies on aluminium surface chemistry to form its protective conversion layer. It is not designed to interact with the tin surface of ETP, and its performance characteristics are therefore not transferable to ETP applications. In addition, Iridite NCP has not been developed or qualified for food-contact use, and uncertainties remain regarding its behaviour under packaging-relevant conditions such as forming, sterilisation and prolonged contact with food media. On this basis, Iridite NCP was not considered a technically suitable alternative for tinplate passivation and was not taken forward for further consideration.	
Mineral tie-coat (cathodic mineralisation)	Mineral tie-coat systems based on cathodic mineralisation are designed to form inorganic mineral layers through electrochemically driven precipitation processes and are primarily optimised for zinc-based or galvanised substrates, where sacrificial behaviour and zinc surface chemistry play a key role in coating formation and performance. The mechanism by which cathodic mineralisation coatings develop and adhere is not compatible with the surface chemistry of ETP. Application to tin-plated substrates would therefore require fundamental modification of both process chemistry and operating conditions, with no assurance that the resulting layer would provide the required control of tin oxide growth, lacquer adhesion or sulphur resistance. On this basis, mineral tie-coat systems were not considered technically viable for tinplate passivation and were not taken forward for further consideration.	No
Molybdate conversion coatings	Molybdate-based conversion coatings have been investigated as potential Cr(VI)-free alternatives due to their lower toxicity relative to chromates and their ability to act as corrosion inhibitors on a range of metal substrates. While molybdate systems can provide some degree of passivation under controlled conditions, testing and published studies indicate that the protective layers formed on tinplate are relatively weak and prone to degradation in aggressive or packaging-relevant environments, particularly in the presence of sulphur-containing species and during prolonged exposure to moisture or heat. In practice, the molybdate-derived films do not provide the level of chemical resistance or stability required to ensure consistent control of tin oxide growth and reliable lacquer adhesion throughout forming, sterilisation and storage. As a result, molybdate conversion coatings were not considered capable of delivering performance equivalent to chromate passivation for ETP and were therefore not shortlisted.	No
Plasma electrolytic oxidation	Plasma electrolytic oxidation (PEO), also known as micro-arc oxidation, is designed to generate thick, ceramic-like oxide layers through high-energy plasma discharges and is primarily applied to so-called valve metals such as aluminium, magnesium and titanium, where the controlled growth of dense oxide coatings provides enhanced wear and corrosion resistance. When applied to tin-plated substrates, the high-energy nature of the PEO process presents a significant risk of excessive and poorly structured tin oxide formation. As established for tinplate, the growth of thick or disordered tin oxide layers is detrimental to lacquer adhesion and downstream forming performance. Given the inherent tendency of PEO to produce relatively thick oxide coatings, and the lack of a viable process window to control oxide growth to the thin, uniform levels required for tinplate packaging applications, plasma electrolytic oxidation was not considered a technically suitable alternative and was not shortlisted.	No

Alternative considered	Commentary / justification	Shortlist?
Vapor deposition-based technologies: (PVD, sputtering e.g. TiN, ZrN)	Physical vapour deposition (PVD) and sputtering-based technologies, including the deposition of hard nitride films such as TiN or ZrN, were considered due to their ability to produce dense, chemically stable and well-adhered thin films. However, these techniques require high-vacuum environments, precise substrate handling and relatively long deposition times, and are therefore typically applied in batch or low-throughput processes for high-value components rather than continuous strip processing. The requirement to operate under vacuum, combined with inherently limited deposition rates and line-of-sight constraints, makes PVD and sputtering incompatible with the high line speeds, continuous operation and large surface areas involved in electrolytic tinplate manufacture. On this basis, vapour-deposition-based technologies were not considered technically or commercially viable alternatives for tinplate passivation and were not taken forward for further consideration.	No
Zn-Sn based coatings	Zinc/tin-based coating systems were considered due to the corrosion-protective properties of zinc in other metallurgical applications. However, zinc is not approved for direct food-contact use in packaging applications, as zinc can migrate into food media, particularly under acidic or saline conditions, leading to potential exceedance of dietary exposure limits. As a result, zinc-containing layers are not permitted for use on food-contact surfaces of tinplate under applicable food-contact legislation and safety assessments. In addition to regulatory non-compliance, the presence of zinc at the surface of tinplate would introduce sacrificial corrosion behaviour and dissolution mechanisms that are incompatible with the controlled oxide growth and surface stability required for ETP packaging. Given the combined regulatory, toxicological and technical limitations, Zn/Sn-based coatings were not considered a viable alternative to Cr(VI) passivation and were not shortlisted.	No
Pine-derived resin systems, [redacted]	Pine-derived resin systems such as colophony (rosin) are currently used as an adhesive and as a fluxing agent for welding. The primary resin acids, notably abietic acid, contain carboxylic acid (–COOH) functional groups that can interact with hydroxylated tin oxide surfaces, forming hydrogen-bonded and ionic Sn-OOC linkages. This could potentially provide an initial basis for adhesion to the tinplate surface and for limiting tin oxidation under mild conditions. However, during testing the adhesion provided by the colophony-based layer was found to be unstable under packaging-relevant conditions, particularly following sterilisation. The formulation required the addition of zinc to suppress tin oxidation, but this resulted in a significant reduction in adhesion performance, with coating failure observed after thermal processing. In addition, zinc introduction raises food-contact concerns (see above) and adversely affects surface behaviour. Further limitations were identified in terms of poor weldability and insufficient resistance to sulphur staining. Taken together, the lack of adhesion durability after sterilisation, incompatibility with welding, sulphur staining susceptibility and food-contact concerns led to pine-derived resin systems being ruled out as viable alternatives for tinplate passivation.	No
Oleic acid-based surface treatments	Oleic acid was evaluated as a potential organic surface treatment due to its ability to adsorb onto metallic surfaces and form hydrophobic layers that can temporarily inhibit oxidation. Initial tests indicated some short-term suppression of tin oxidation through surface coverage, consistent with the behaviour of fatty acids forming adsorbed boundary layers on metal oxides. However, oleic acid is inherently susceptible to oxidative degradation,	No

Alternative considered	Commentary / justification	Shortlist?
	particularly under exposure to oxygen, heat and moisture. During testing under packaging-relevant conditions, including thermal processing and storage, the oleic acid-derived layer was found to oxidise and degrade, resulting in loss of surface protection and instability of the treated tinplate. The breakdown of the organic layer led to poor durability, with no reliable control of tin oxide growth or sustained surface performance. Given the intrinsic oxidative instability of oleic acid and the inability to maintain protection through sterilisation and storage, oleic-acid-based treatments were not considered suitable alternatives for tinplate passivation and were not taken forward.	
Tungstate-based conversion coatings	Tungstate-based conversion coatings were evaluated due to their chemical similarity to chromates and their documented corrosion-inhibiting behaviour on a range of metallic substrates. Tungstates are known to form conversion layers that can reduce corrosion rates under certain conditions and have therefore been investigated as lower-toxicity alternatives to chromate systems in non-packaging applications. However, testing on tinplate demonstrated that tungstate-derived surface layers did not provide sufficient resistance to oxidation under packaging-relevant conditions, particularly during thermal processing and prolonged exposure to moisture and oxygen. The protective films formed were relatively unstable and failed to maintain effective control of tin oxide growth, leading to surface degradation and loss of performance. Given the inability of tungstate-based systems to deliver durable oxidation resistance compatible with forming, sterilisation and storage requirements, this alternative was not considered suitable for tinplate passivation and was not taken forward for further consideration.	No
Electrolytic Chromium Coated Steel (ECCS)	As discussed in section 2.2.5.2, ECCS and ETP are well-established but fundamentally different packaging steels, each selected according to distinct application requirements. For a limited subset of applications, ECCS could theoretically be considered as an alternative to ETP, for example for certain deep-drawn and DRD cans for human food, pet food and technical fillings such as paints, as well as for food can ends, crown caps and vacuum closures for glass jars. However, ECCS has several inherent limitations that preclude its use across the majority of ETP applications. ECCS must always be used lacquered or laminated and it is not weldable. As a result, it cannot be used for welded three-piece can bodies, nor for DWI beverage and food cans, which are formed prior to lacquering and which account for the vast majority of ETP usage. Weldability is a critical technical requirement within the can-making process and falls under the criterion of suitability and compatibility with existing manufacturing operations. In addition, ECCS is restricted to fillings with pH values above approximately pH 4; for acidic products below this threshold, only ETP provides acceptable performance. Taken together, these limitations mean that large-scale replacement of ETP by ECCS is not technically feasible. Furthermore, the current industrial manufacture of ECCS itself relies on the use of Cr(VI) as a processing agent. Consequently, substitution of ETP with ECCS, even where technically possible, would not lead to any meaningful reduction in the risks associated with hexavalent chromium use. On this basis, ECCS cannot be regarded as a realistic or effective alternative to ETP within the scope of this assessment.	No
Non-passivation (i.e. unpassivated ETP)	In limited and well-defined circumstances, ETP can be supplied without passivation, and this approach is indeed used at Trostre for specific customer and product combinations where storage time is short, subsequent processing is tightly controlled and surface stability requirements are minimal. In such	No

Alternative considered	Commentary / justification	Shortlist?
	cases, the passivation stage is deliberately bypassed. However, non-passivation is not generally regarded as a true alternative to passivation for tinplate packaging applications. Under normal storage and processing conditions, ETP requires a passivation layer to control the growth of tin oxide on the surface. In the absence of passivation, tin oxidises readily during storage, leading to progressive thickening of the oxide layer. Excessive tin oxide formation is well established to result in poor lacquer adhesion, staining and discolouration, reduced corrosion resistance and a consequent reduction in shelf life. These effects are exacerbated by thermal processing, forming and prolonged storage, which are typical for food and general-line packaging applications. Passivation is therefore a critical surface treatment that prevents or significantly slows oxidation of the tin surface and ensures stable, reproducible performance through downstream manufacturing and service life. Unpassivated tinplate does not provide the level of surface stability, adhesion performance or durability required for the majority of food and general-line packaging applications. As a result, while non-passivation may be acceptable in some controlled cases, it does not meet the functional performance requirements for most ETP uses and cannot be considered a viable general alternative to passivation within the scope of this assessment.	

***Table 11**: Longlist of potential alternatives*

The above longlist considers alternatives that would still result in the production of metal packaging. In the broader sense, there are various other packaging materials available on the market both for food and non-food applications, e.g. aluminium, glass, plastics, paper and cardboard, cellulose and so on. Based on recent data from 2023-2024,[8] an approximate breakdown of the global packaging materials market by material type (based on revenue share) is depicted in Figure 25 below.

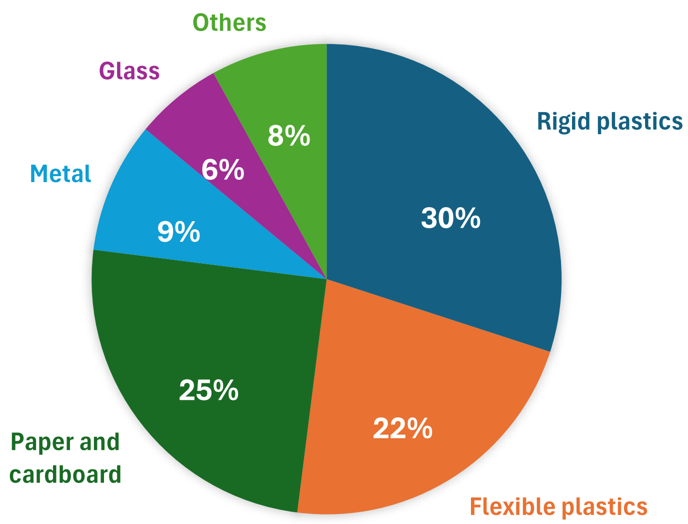


***Figure 25**: Approximate breakdown of the global packaging materials market by material type (based on revenue share) (source: Grand View Research)*

[8] Grand View Research, 2024.

As described in section 2.2.5 above, metal is often chosen as a packaging material for various reasons:

- **Heat resistance**: Alongside glass and aluminium, steel can withstand heat processing, allowing for the simultaneous sterilisation of both the can and its contents. In contrast, packaging materials like paperboard cartons (e.g. TetraPak) require aseptic processing, where the package and the product are sterilised separately.
- **Food preservation**: Food packed in steel, glass or aluminium retains a vitamin content equivalent to freshly prepared food, without the need for added preservatives.
- **Protection**: Steel packaging offers a complete barrier against light, water, and air, making it a secure solution for volatile products. It ensures the integrity of the contents throughout a long shelf life and provides superior resistance to solvents, which is particularly important for applications such as paint packaging.
- **Strength**: In terms of strength, steel is more robust than aluminium, while glass is brittle and prone to breakage. Although heavier than aluminium, plastic or paper/cardboard, steel is lighter than glass, making it more efficient to transport.
- **Sustainability**: Steel outperforms other materials in recyclability. It can be recycled indefinitely without any loss in quality, unlike glass which can only be recycled a limited number of times. In addition, steel scrap is a vital raw material in the production of new steel.
- **Cost**: From a cost perspective, steel packaging is more affordable than aluminium and, when factoring in the higher transport costs associated with glass, it becomes a cost-effective alternative. While plastic packaging is cheaper, it lacks several key attributes that steel offers: strength, long shelf life, compatibility with heat processing, and the ability to preserve vitamins.

Taken in the round, the specific properties of steel packaging create a distinct demand for steel in a market with many available packaging options. Due to its unique set of characteristics, steel packaging is often the only technically viable solution. Alternative materials like glass can only replace steel to a limited extent. If the applicant were to attempt to switch production to a different packaging material entirely and away from steel, their customers would not switch to non-steel alternatives; they would be forced to purchase it elsewhere instead, i.e. from abroad. Moreover, any such move would not be compatible with the applicant's wider business operations and would undermine their highly integrated UK business model. Indeed, the wider Tata Steel business would not support the required capital and infrastructure spend necessary for such a conversion, nor would Tata Steel easily be able to find new customers.

Because of the clear advantages of steel packaging for specific applications, other packaging materials cannot be considered suitable alternatives. From the applicant's perspective, switching to non-steel packaging would require entirely different technologies, which would take significantly longer to implement and would be considerably more expensive compared to developing an alternative steel-based solution.

3.2.3 Shortlisted alternatives

Although a wide range of potential alternatives to the use of Cr(VI) in ETP have been identified and assessed, comparison of these options against application-relevant performance criteria demonstrates that only one alternative can reasonably be taken forward to the shortlist, namely the **Chromium-Free Passivation Alternative (CFPA)**. CFPA is clearly differentiated from all other candidates in terms of technical maturity, industrial adoption and alignment with existing tinplate manufacturing and can-making processes.

CFPA has been developed collaboratively by the European steel industry as a direct functional replacement for chromate passivation and in recent years has received substantially greater investment, testing and validation than any other alternative system. As a result, CFPA demonstrates superior overall passivation performance compared with other Cr(VI)-free options. While CFPA is not yet fully suitable for the applicant's ETP products, meaning further development is required to address specific performance gaps, no other alternative identified in this assessment approaches CFPA in terms of its promise. Other potential alternatives remain at significantly lower manufacturing readiness levels, exhibit fundamental incompatibilities with tinplate processing or packaging requirements, or would require wholesale changes to manufacturing and coating systems.

Shortlisting multiple such options would not meaningfully advance substitution but would instead dilute development effort and increase uncertainty without a realistic prospect of deployment. Therefore, CFPA is the only alternative that can credibly be considered for further development as a substitute for Cr(VI) for the passivation of ETP. The applicant's decision to shortlist CFPA alone therefore reflects a focused and evidence-based substitution strategy, consistent with both current industrial practice and the objective of achieving effective and timely risk reduction.

3.3 Assessment of shortlisted alternatives: CFPA

3.3.1 Introduction

The aim of this AoA is to assess the feasibility of potential alternatives to the use of sodium dichromate for the passivation of ETP. The objective is to identify the most likely NUS for the applicant in the event that its use of sodium dichromate must cease, to provide input for the SEA and SP.

Article 60(5) of REACH provides that when assessing the availability of suitable alternative substances or techniques, all relevant aspects must be taken into account, including:

a) whether the transfer to the alternative would result in reduced overall risks to human health and the environment (as compared to the Annex XIV substance) taking into account risk management measures; and

b) the technical and economic feasibility in the UK of alternatives for the applicant for replacement of the Annex XIV substance.

The alternative must also be available for the applicant, i.e. it can be accessed in sufficient quantity and quality for substitution.

In this section, the shortlisted potential alternative is therefore assessed in terms of its technical feasibility, economic feasibility, potential for risk reduction and availability. A potential alternative process or technology **must fulfil all key functionalities** to ensure products can continue to be manufactured that provide sufficient corrosion resistance prior to use, adhesion and chemical resistance to the contents of the packaging. The alternative must also allow products to be made that are suitable for food contact, are compatible with downstream processes, have the necessary visual properties, are scalable and stable for high-volume production, and are sufficiently sustainable.

Any general attempt to offer products to the market using an inferior alternative without additional development would likely result in a critical loss of market share and sales, as customers would most likely switch to more reliable, proven and readily-available products made using Cr(VI)-based processes imported from outside of the UK.

The assessment focuses on technical feasibility in the first instance and, if the alternative is found to have critical technical weaknesses which means some of the key functionalities are not fulfilled, economic feasibility and other considerations do not then need to be assessed in detail. This is in line with the approach suggested in the ECHA guidance on authorisation and aims to ensure a proportionate approach is taken to the AoA.

3.3.2 Development of CFPA

By around 2010, European tinplate manufacturers had converged on [redacted] as the most promising Cr(VI)-free passivation chemistry. In preparation for semi-industrial application, a series of four line trials were undertaken by the applicant between 2011 and 2012. These trials provided essential practical experience with spray application on an industrial tinning line and led to a number of process refinements. Building on this work, the first semi-industrial production run was completed in May 2012, with downstream pack testing of the resulting material commencing in 2014.

In 2017, in direct response to the inclusion of chromium trioxide and sodium dichromate on Annex XIV of EU REACH, the Chromium-Free Passivation Alternative Research and Development Working Group (CFPA R&D WG) was formally established. The group was created to coordinate a sector-wide response to the regulatory requirement for substitution and to underpin the preparation of analyses of alternatives for EU REACH applications for authorisation. This work was coordinated through APEAL, now SfPE, and involved collaboration across the entire European tinplate value chain.

The primary objectives of the CFPA R&D WG were to develop industrial best practice for the CFPA process, to provide a structured forum for sharing operational experience between manufacturers, and to secure global food contact approvals for CFPA-passivated tinplate (including the EU, USA, Mercosur and China). In parallel, the group acts as the central technical interface with downstream users, including can makers, lacquer suppliers and fillers.

To deliver these objectives efficiently, the working group was structured into six dedicated sub-groups:

- *Core project coordination*: for overall project management and control, comprising one member from each member company and the APEAL Secretariat.
- *Lacquer compatibility*: for the evaluation of lacquer performance with CFPA, the identification of any issues, liaising with lacquer system suppliers and, in conjunction with the Core WG, elucidation of solutions to identified issues.
- *Detinning behaviour*: for the evaluation of tinning performance and identifying solutions to detinning issues involving CFPA material, in conjunction with the Core WG.
- *Regulatory approvals*: to consider filings and approvals for CFPA globally.
- *Product and process optimisation*: responsible for the identification of best practice manufacturing and, in conjunction with the Core WG, elucidation of solutions to identified issues with production processes.
- *Customer and filler engagement*: to provide the interface with can-makers to gather feedback on material performance which feeds into the other WGs and directs potential R&D in relation to issues identified during can-maker testing.

This structure reflected the recognition that successful substitution of Cr(VI) passivation requires coordinated progress across surface chemistry, downstream compatibility and regulatory acceptance, rather than optimisation of passivation chemistry in isolation.

Through this sustained and coordinated programme of work, CFPA emerged as the most viable and mature alternative to Cr(VI) passivation for European tinplate manufacturers. No other alternative system has attracted comparable levels of investment, testing, industrial trialling or supply-chain alignment.

However, research and development activity on CFPA has been significantly affected by EFSA's 2023 conclusion[9] that bisphenol A (BPA) is an endocrine disruptor with potentially harmful effects on immune, reproductive, developmental and metabolic functions, and its subsequent restriction in food contact materials.

[9] EFSA, 2023.

As a large proportion of existing lacquer systems contain BPA, work on CFPA has stalled because coating suppliers are currently prioritising the development and qualification of BPA-free alternatives. Once suitable BPA-free lacquers are available, these systems will in turn require rigorous re-qualification on CFPA-passivated tinplate, meaning that further CFPA development and validation remains necessary before full substitution can be achieved across all ETP applications.

3.3.3 Process description

CFPA consists of a zirconium- and titanium-based fluoride solution applied to the surface of the tin-plated steel strip as a thin conversion layer. Following application and drying, the treatment forms a protective surface comprising zirconium and titanium oxides (ZrO_2/TiO_2), together with phosphate and polymeric components. This layer is intended to stabilise the naturally occurring tin oxide on the surface of the tinplate, thereby limiting further oxidation during storage and downstream processing.

In contrast to conventional Cr(VI)-based passivation, which is applied electrochemically in an electrolytic bath, CFPA is deposited using a non-electrolytic, contact-based application process. The solution can be applied to the moving strip using [redacted] the objective is to achieve a uniform, low-weight coating across the full strip width.

Following application, the treated strip is passed through a drying section, where the aqueous components of the formulation are removed and the protective layer is formed on the tin surface. The quality and consistency of the resulting CFPA layer are therefore dependent on precise control of application parameters, including solution chemistry, coating weight, strip speed and drying conditions.

[redacted]

Figure 26*: Methods of application of CFPA to ETP*

There is currently no universally accepted method for applying the passivation. This lack of standardisation increases the complexity of knowledge sharing and process learning, while also heightening the risk of unforeseen defects that could lead to customer complaints and market issues.

The applicant has already installed CFPA capability at Trostre in 2018, [redacted] (see Figure 27 below). This formed part of the applicant's proactive response to the inclusion of Cr(VI) substances in Annex XIV of REACH and the associated requirements to assess and pursue substitution where feasible. The installation was undertaken in an attempt to demonstrate that CFPA could be implemented at industrial scale on a modern, high-speed tinning line and to support ongoing sector-wide development, testing and qualification activities. While this investment confirmed the technical implementability of CFPA from an engineering perspective, it did not represent a transition to commercial operation, as outstanding technical and downstream acceptance challenges remain, as discussed in the following section.

[redacted]

Figure 27*: The applicant's CFPA installation on the ETL5 line*

3.3.4 Technical feasibility

In collaboration with other European tinplate manufacturers, the applicant has made substantial progress in the development and industrial application of CFPA as a replacement for Cr(VI) for passivation, with [redacted] emerging as the preferred CFPA chemistry. While this work has demonstrated that CFPA can be applied on industrial tinning lines, a number of technical non-conformities have been identified that currently preclude its application for all but a very limited number of products and applications.

Further process adaptations are therefore required to resolve issues as follows, particularly concerning surface consistency and visual appearance:

- **Tin corrosion spots**
  One category of non-conformity relates to the occurrence of localised tin corrosion spots. These present as dark, droplet-shaped marks aligned in the rolling direction and are not immediately visible after production. Subsequent investigation has shown that these defects arise from localised corrosion of the tin layer, where the coating is thinner and exhibits increased surface roughness. The root cause has been identified as acidic [redacted] droplets deposited on the strip surface during passivation, leading to non-uniform surface chemistry and subsequent corrosion development during storage.

[redacted]

Figure 28*: Tin corrosion spots*

- **Water stains**
  A second class of defects comprises water stains, which appear as dark lines along the rolling direction and, again, are not readily visible immediately after production. The morphology and chemical composition of these marks indicate that water droplets fall onto the strip surface, causing localised oxidation of the tin layer. Although these defects are superficial and no measurable change in surface roughness has been detected, they represent an inconsistency in surface appearance. At present, there is no evidence that water staining leads to reduced lacquer adhesion or accelerated corrosion, but their presence remains undesirable from a quality and consistency perspective.

[redacted]

Figure 29*: Water stains*

- **Carbonate stains**
  Carbonate staining has also been reported during production. These defects appear as white surface marks that interfere with effective passivation and are visible immediately. The underlying cause has been traced to excessive pre-treatment solution remaining on the strip prior to passivation. Where carbonate staining occurs, the affected material cannot be downgraded for alternative use and must be scrapped, resulting in a direct yield loss.

[redacted]

***Figure 30**: Carbonate stains*

- **Excess** [redacted]
  A related but distinct issue arises from excess [redacted] deposition. This manifests as fine, white surface marks that are often continuous and may extend across the full width of the strip. These defects are visible during production and can lead to the rejection of entire coils. As with carbonate staining, material affected by excess [redacted] cannot be recovered and must be scrapped.

[redacted]

***Figure 31**: Excess deposition*

In parallel with these manufacturing challenges, downstream qualification data from the can-making sector indicate that approximately 20% of product groups tested to date have not achieved a level of qualification deemed acceptable for conversion to CFPA. Furthermore, even where qualification has been achieved, it cannot be assumed that all approved product groups would be substituted immediately. On a conservative basis, it is estimated that only around 60–70% of current passivated tinplate product groups would be capable of successful market conversion at the current stage of development. This implies a potential loss of 30–40% of passivated tinplate product groups for which CFPA material cannot presently be used.

It is important to note that downstream qualification and pack-testing of CFPA-passivated tinplate carried out to date has predominantly been undertaken using epoxy-based lacquer systems containing bisphenol A (BPA), reflecting the historical industry standard. However, following EFSA's 2023 conclusion that BPA is an endocrine disruptor of concern,[10] and the subsequent regulatory restrictions on its use in food-contact materials,[11] can-makers and lacquer suppliers are now prioritising the development and qualification of BPA-free coating systems.

[10] EFSA, 2023.

[11] Regulation (EU) 2024/3190 bans the intentional use of BPA in food-contact coatings subject to transition periods.

As a consequence, further technical development and qualification work on CFPA has effectively stalled, not due to a resolution of CFPA-related challenges, but because downstream stakeholders have redirected resources towards addressing BPA substitution. When BPA-free lacquer systems are identified and introduced at scale, there can be no assumption that their performance will mirror that of legacy BPA-containing lacquers when applied to CFPA-passivated tinplate. All existing qualification data, including pack testing, would therefore need to be repeated for each relevant product group using the final CFPA and BPA-free lacquer combination.

Accordingly, the qualification success rates reported above must be interpreted in context and cannot be relied upon as an indicator of CFPA suitability under future, BPA-free coating regimes. This further reinforces the applicant's conclusion that CFPA, while the most advanced alternative currently available, is not yet technically feasible as a full replacement for Cr(VI) passivation across the complete range of ETP applications.

Below is a summary of a questionnaire on CFPA pack test results, compiled and presented collectively by manufacturers and suppliers within the metal packaging industry. The underlying data are supplied by individual companies to [redacted] The results referenced here are drawn from the Q1 2025 dataset, which was shared with industry members in May 2025 and represents the most recent information available to the applicant at this time.

Many of the reported results relate to testing carried out using BPA-containing lacquer systems, reflecting the prevailing industry standards. In addition, the data set represents submissions from only three of the thirteen industry member groups and therefore provides a partial snapshot rather than a comprehensive assessment of CFPA performance across the full sector.

[redacted]

[redacted]

***Figure 32**: Summary of a questionnaire on CFPA pack test results*

Those undertaking testing include the applicant's customers, one of whom shared the results of an investigation involving aerosol containers manufactured from CFPA-passivated tinplate and filled with shaving cream and shaving gel. Following three months of storage after opening, the aerosol cans maintained commercially acceptable integrity. However, performance was assessed as marginally inferior when compared with equivalent products manufactured using standard chromium-based passivation.

In a separate trial, three different coating systems were evaluated on CFPA-passivated easy-open ends (EOE) using chicken soup stored at 35 °C. Two of the coatings were judged to be commercially unacceptable within one month due to the onset of under-film corrosion. The third coating, a PVC-free system, exhibited performance comparable to the chromium-passivated control sample at this stage of the trial. Further assessments were scheduled at two- and three-month intervals in order to monitor longer-term performance and confirm whether this initial equivalence can be maintained.

Coating	Comment
1	Under-film corrosion with microblistering, isolated detinning and lacquer lifting
2	Moderate to severe under-film corrosion with microblistering, detinning and lacquer lifting
3	Slightly worse than control with microblisters at countersink radius

***Table 12**: Results of a customer trial on CFPA passivated easy open ends (EOE) using chicken soup stored at 35 °C*

Under-film corrosion	Detinning	Micro-blistering	Lacquer lifting

***Figure 33**: Images from the results of a customer trial, clearly showing the under-film corrosion, detinning, micro blistering and lacquer lifting experienced*

In early 2025, feedback provided by a second customer, [redacted], indicated that CFPA-passivated tinplate continues to exhibit a number of cosmetic surface issues which, in their assessment, could present a risk of rejection by regulatory authorities. Their current focus is on evaluating CFPA performance in the most technically demanding applications. [redacted] further indicated that any potential implementation would require confidence that CFPA delivers consistent and reliable performance across their full product portfolio; in the absence of such assurance, adoption would not be pursued. The issues they currently experience are outlined below:

Deep Drawn Ends	
	*Observation*: Yellowing occurred after 9 months of storage, regardless of whether the end was in contact with the filling. *Location of Defect*: Internal surface. *Packaging Conditions*: Packed in an inert atmosphere. This is considered a rejection criterion for [redacted], as it indicates potential compromise of the passivation layer. *Current Assessment*: The issue is cosmetic only and does not affect food contact compliance at this stage.
Foil Ends	
	*Observation*: Pro-range works well; less premium ranges do not perform as well. Footprint developing after 24 hours. *Location of Defect*: Not explicitly stated but implied to occur on the ends (major ends tested from several suppliers). *Packaging Conditions*: They pass leak tests but are expected to fail transport tests. *Current Assessment*: The technical solution is to migrate to the Pro end. All major ends tested show the same issue across suppliers. Replacement will have a high global impact.

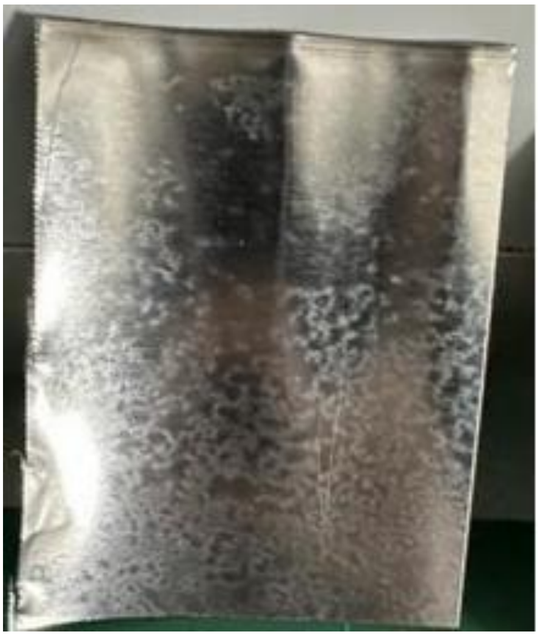
<table>
<tr><th colspan="2">High fat content</th></tr>
<tr><td></td><td>Observation: Mottled appearance observed on high-fat fillings, such as fatty milk powder and coffee powder containing oil.
Defect Location: Present on all internal components in direct contact with the filling.
Packaging Conditions: Defect develops and persists beyond nine months in pack testing.
Current Assessment: The nutrition business has rejected the defect. There is a significant risk that consumers or regulatory authorities may perceive it as mould, potentially leading to consumer complaints or enforced product recalls.</td></tr>
</table>

***Figure 34**: Issues experienced by a customer in relation to CFPA passivated tinplate*

While the above demonstrates that further fine-tuning of the CFPA process remains necessary, this work has largely been paused as downstream customers and coating suppliers have redirected their efforts towards the identification and qualification of BPA-free lacquer and coating systems. The optimisation activities undertaken to date have predominantly focused on CFPA performance in combination with established BPA-containing lacquers. These systems are now being phased out for regulatory reasons, and their performance cannot be assumed to be representative of future BPA-free alternatives.

It therefore remains uncertain whether the existing CFPA process, even once refined for legacy lacquer systems, will be suitable for use with BPA-free lacquers, which are themselves still under development and not yet fully proven across all applications. The introduction of BPA-free coating systems is expected to necessitate further process optimisation and comprehensive re-qualification of CFPA-passivated tinplate, including renewed pack testing and long-term performance assessment.

In the absence of a technically and commercially viable CFPA-based solution compatible with BPA-free lacquers, there is a risk that can-makers may seek alternative supply routes, including the import of Cr(VI)-passivated tinplate from outside the UK (including from EU sources prior to or following the implementation of the EU REACH Cr(VI) restriction). Such outcomes would undermine the objective of progressive risk reduction within the UK tinplate supply chain.

In summary, at their current stage of development, CFPA does not meet the applicant's key functionality requirements:

- **Corrosion resistance prior to use**: Cr(VI)-based passivation produces a dense and electrochemically stable surface layer comprising chromium oxide and metallic chromium, which provides highly effective resistance to corrosion during storage and handling. In contrast, CFPA systems rely on titanium- and zirconium-based compounds, typically applied as fluorides with minor phosphate and polymer components. While these layers can limit tin oxide growth, they do not provide the same level of electrochemical stability as chromium-based systems. As a result, CFPA-passivated tinplate has been shown to be more susceptible to corrosion, particularly in sulphur-containing and acidic environments, where performance is consistently inferior to that of Cr(VI)-passivated material.

- **Adhesion and suitability for organic coatings**: Cr(VI) passivation provides a robust and well-understood surface that promotes consistent adhesion of organic coatings and lacquers. CFPA-passivated surfaces have exhibited issues with reduced adhesion, including localised delamination and blistering following thermal processing or extended storage. These effects are currently attributed to differences in surface chemistry and interfacial stability. Furthermore, as the industry transitions away from BPA-containing lacquers, the applicability of existing CFPA optimisation work remains uncertain. Once BPA-free lacquer systems are introduced, a full programme of adhesion testing and pack validation will be required to determine whether acceptable performance can be achieved.

- **Chemical resistance to packaged contents**: Cr(VI)-passivated tinplate has a long-established track record of resistance to a wide range of food chemistries, including sulphur-rich and acidic products. CFPA systems, while acceptable in some applications, have demonstrated reduced resistance under more aggressive conditions, particularly where sulphur staining or under-film corrosion mechanisms are dominant. This limits their current applicability across the full spectrum of food and general-line packaging.

- **Compatibility with downstream processing**: Cr(VI)-passivated tinplate is fully compatible with downstream forming, welding, coating and thermal processing operations, including high-temperature sterilisation and long-term storage. CFPA-passivated material has shown sensitivity to downstream processing conditions, with performance variability observed following forming and heat treatment. These sensitivities increase the technical risk for can-makers and require tighter process control than is currently necessary for chromium-based systems.

- **Suitability for food contact**: CFPA-passivated tinplate is capable, in principle, of meeting UK, EU and international food contact regulatory requirements for both plain and organically coated packaging, subject to appropriate compliance testing. However, unlike Cr(VI)-based passivation, CFPA does not benefit from decades of regulatory and market experience across all product categories. In addition, ongoing changes to lacquer chemistries driven by BPA restrictions introduce further uncertainty, requiring renewed food contact and migration assessments for CFPA-based systems.

- **Visual properties**: Cr(VI) passivation delivers a uniform, bright and visually stable surface with minimal cosmetic variability. CFPA-passivated tinplate has been associated with a range of visual non-conformities, including film corrosion, detinning, micro-blistering and lacquer lifting. While some of these defects do not immediately affect functional performance, they are commercially significant and can lead to rejection by customers or regulators, particularly in applications with high aesthetic requirements.

- **Scalability and stability of the production process**: Cr(VI)-based passivation is applied via a well-controlled electrolytic process that provides uniform coverage and high process robustness at industrial scale. CFPA, by contrast, is applied via spray or roller transfer without a subsequent rinse stage. This increases sensitivity to process variability and can result in uneven deposition, localised over-application or incomplete coverage, all of which have been linked to scrap generation and yield losses in high-volume manufacturing.

- **Sustainability**: From a recyclability perspective, tinplate passivated using CFPA is expected to be comparable to conventional ETP. Both materials are steel-based and are readily processed through established steel recycling streams. The passivation layers represent only a very small fraction of the overall material mass and do not present a barrier to recycling.

The following chart gives an overview of the technical feasibility of CFPA as an alternative to sodium dichromate in the passivation of tin plated steel.

Corrosion resistance	Organic coating adhesion	Chemical resistance	Compatibility with downstream processing	Suitability for food contact	Visual properties	Scalability and stability	Sustainability

Key:

	Not sufficient – the parameters / assessment criteria do not fulfil the requirements at the alternative's current stage of development.
	The parameters/assessment criteria fulfilment are not yet clear / the process is still not defined / further experimental investigations need to be performed.
	Sufficient - the parameters/assessment criteria do fulfil the requirements.

3.3.5 Economic feasibility

From a formulation perspective, CFPA is broadly comparable to the current Cr(VI)-based passivation system in terms of raw material costs. The quantities of passivation chemicals used per tonne of tinplate are low, and the substitution of sodium dichromate with zirconium- and titanium-based compounds does not, in itself, result in a material increase in variable operating costs. Similarly, energy consumption, staffing requirements and routine operating costs associated with the passivation step are expected to remain broadly equivalent once the process is fully stabilised.

However, the economic feasibility of CFPA cannot be assessed solely on the basis of formulation costs. The transition from Cr(VI)-based passivation to CFPA requires significant capital investment to modify existing tinning lines, together with associated engineering work, commissioning, validation and downtime. These costs are incurred upfront and are independent of whether CFPA is ultimately accepted by downstream users for all applications.

The applicant has already invested in the installation of CFPA capability at Trostre. CFPA was installed on Electrolytic Tinning Line 5 (ETL5) in 2018, at a capital cost of approximately [redacted] (public range: >£5 million), including equipment modification, installation, commissioning and initial process optimisation. While this investment demonstrates that CFPA is technically implementable from an engineering standpoint, the process is not currently operated in commercial production due to the outstanding technical and market acceptance issues described in section 3.3.4 above.

In addition to the initial capital expenditure, further costs have been, and continue to be, incurred as part of the ongoing development, optimisation and learning associated with CFPA implementation. These include, for example:

- design limitations associated with the installed single top and bottom spray system, whereas alternative configurations (such as dual spray systems) can facilitate fault finding and process control
- ongoing optimisation of smoothing roll material, surface roughness and hardness due to reduced roll life and a susceptibility to surface staining arising from tramlines and transferred linear defects

- installation of sound-attenuation booths to manage increased noise levels associated with air blade operation
- adjustments to operating parameters and replacement of affected equipment in response to corrosion issues linked to hydrogen fluoride generation during the CFPA drying process.

These additional investments and operational interventions highlight that the transition to CFPA entails not only significant upfront capital costs, but also continuing technical and economic impacts as the process is refined and evaluated for broader commercial applicability.

Further indirect economic impacts associated with the conversion to CFPA include production losses associated with commissioning trials, reduced line availability during installation and optimisation, increased scrap rates during early operation, and the need for ongoing technical support and R&D input. These costs are difficult to quantify precisely but are material, particularly in a high-volume, low-margin manufacturing environment such as tinplate production.

It is also important to note that these investments are made in advance of, and at risk of, downstream acceptance. Even where a tinning line has been converted to CFPA, the economic benefits of that investment cannot be realised unless can-makers and fillers accept CFPA-passivated tinplate across the relevant product range. As set out in section 3.3.4 above, CFPA is not yet suitable for all applications, particularly in combination with newer BPA-free lacquer systems that are themselves still under development and qualification. As a result, the capital the applicant has invested in CFPA conversion remains, and likely will continue to remain, under-utilised for a prolonged period.

Notwithstanding these challenges, the fact that the applicant and other European tinplate producers have already incurred, and continue to incur, significant capital and R&D expenditure to develop and install CFPA demonstrates that cost alone is not a prohibitive barrier to substitution. Rather, the limiting factors are technical performance, downstream compatibility and regulatory/market acceptance for food contact applications. In economic terms, CFPA can therefore be considered a potentially feasible alternative, but one whose deployment is constrained by uncertainty and risk rather than by excessive operating costs.

3.3.6 Risk reduction

A substantial reduction in risk to human health and the environment would likely be achieved through the replacement of sodium dichromate with CFPA.

CFPA does not contain substances classified as carcinogenic, mutagenic or toxic to reproduction. The formulation comprises zirconium- and titanium-based compounds, including hexafluorotitanic acid and hexafluorozirconic acid, which are classified for acute toxicity and corrosivity. These substances therefore require appropriate handling and risk management measures during use. However, they are not classified as substances of very high concern (SVHCs) and are not associated with long-term systemic toxicity. In addition, the CFPA formulation does not carry classifications for acute or chronic aquatic toxicity under the CLP Regulation.

Substance / constituent name	CAS #	Constituent Classification	Overall Formulation Classification
Hexafluorotitanic acid solution	17439-11-1	Met. Corr. 1; H290 Acute Tox. 3 (Oral); H301 Acute Tox. 3 (Dermal); H311 Acute Tox. 3 (Inhalation); H331 Skin Corr. 1B; H314	Acute Tox. 4 (Oral); H302 Acute Tox. 4 (Dermal); H312 Skin Irrit. 2; H315 Eye Irrit. 2; H319

Phosphoric acid	7664-38-2	Met. Corr. 1; H290 Skin Corr. 1B; H314 Acute Tox. 4 (Oral) H302	
Hexafluorozirconic acid solution	12021-95-3	Met. Corr. 1; H290 Acute Tox. 3 (Oral); H301 Acute Tox. 3 (Dermal); H311 Acute Tox. 3 (Inhalation); H331 Skin Corr. 1B; H314	
Trimanganese bis(orthophosphate)	14154-09-7	Eye Irrit. 2; H319 STOT RE 2; H373 Aquatic Chronic 3; H412	

***Table 13**: Typical constituents and hazard classification of CFPA*

By contrast, sodium dichromate is a Cr(VI) compound classified as carcinogenic, mutagenic and toxic to reproduction, as well as for many other hazards. The intrinsic hazard profile of sodium dichromate is therefore significantly more severe than that of the substances used in CFPA.

Accordingly, substitution of Cr(VI)-based passivation with CFPA would result in a clear reduction in the intrinsic hazard of the passivation process and a corresponding reduction in potential risks to workers, the environment and, indirectly, the general population. While CFPA is not hazard-free and continues to require appropriate controls, the nature and severity of the hazards involved are materially lower than those associated with the continued use of Cr(VI).

3.3.7 Availability

CFPA is commercially available in the quantities and quality required to support tinplate manufacture at the applicant's current production scale. The formulation is supplied by established chemical manufacturers and can be procured on a continuous basis, such that availability of the passivation chemistry itself does not represent a limiting factor.

In addition, the applicant has installed and maintained CFPA capability on a tinning line at its site, demonstrating that the technology can be implemented from an engineering and operational perspective. The presence of this line confirms that CFPA is physically available for use and can be integrated into existing manufacturing infrastructure.

3.4 Conclusions on assessment of shortlisted CFPA alternative

CFPA represents the most advanced and credible alternative to Cr(VI)-based passivation currently available to the applicant. For well over a decade, the entire value chain, including European tinplate manufacturers, can makers and coating suppliers, has been actively engaged in its development, testing and qualification. Significant investment has been made in research, industrial trials and manufacturing capability, and CFPA is demonstrably the most mature Cr(VI)-free passivation system available to the applicant. All other identified alternatives remain at a substantially earlier stage of development and would require significantly greater time and further R&D effort before they could be considered viable for industrial implementation.

Notwithstanding this maturity, CFPA cannot at present be considered technically feasible for all products and applications served by the applicant. The diversity of packaged contents, particularly across food applications, imposes stringent and highly variable performance requirements. Customer testing has identified a range of issues in certain applications, including colour discolouration, under-film corrosion, detinning, micro-blistering and lacquer lifting. Customers have consistently indicated that any Cr(VI)-free alternative must perform reliably across their full product portfolios. Where this condition cannot be met, they have made clear that they would not proceed with implementation, and would instead source ETP from alternative suppliers, including EU producers operating under authorisation or in line with the conditions of any future EU REACH restriction or, where available, non-EU suppliers.

The applicant therefore requires further time to optimise CFPA, particularly in the context of broader changes within the coatings supply chain. Following EFSA's 2023 conclusions on BPA, coating suppliers are prioritising the development and qualification of BPA-free lacquers, many of which are not yet fully proven for long-term food contact use. The majority of CFPA development and testing to date has been undertaken using established BPA-containing lacquer systems, and performance with newer BPA-free alternatives cannot be assumed. Once suitable BPA-free coatings are identified, comprehensive pack testing with CFPA-passivated tinplate will be required, and further process adjustments are expected to ensure acceptable adhesion, corrosion resistance and shelf-life performance.

In conclusion, while CFPA offers a clear pathway towards reduced chemical risk and remains the most promising long-term alternative to Cr(VI) passivation, it is not yet suitable for universal adoption across all applications. Its current limitations arise not from lack of availability or investment, but from unresolved technical performance and downstream acceptance challenges, which are compounded by ongoing changes in lacquer technology. Continued use of Cr(VI)-based passivation is therefore necessary on a transitional basis to maintain supply continuity and allow sufficient time for CFPA and associated coating systems to be fully optimised and qualified.

4. Substitution Plan

4.1 Summary of substitution activities

The applicant's initial AfA aimed to be a bridging authorisation, in that a promising potential alternative (CFPA, [redacted]) had been identified but more time was needed to fine tune the process before it could provide acceptable results and be implemented. At the time, the application was prepared collectively by members of APEAL (now SfPE) and submitted by each legal entity.

However, since the initial AfA was made in November 2019, substitution efforts have not proceeded as originally anticipated, for several reasons:

- In October 2021, Tata Steel formally split its European operations into two separate entities: Tata Steel UK (the applicant) and Tata Steel Netherlands ('TSN'). The split resulted in the end of the operational Tata Steel Europe organisation, with the two new companies operating independently. As a result of this split, the applicant lost access to Tata Steel Packaging's R&D facilities located at TSN (the IJmuiden Technology Centre or IJTC) which was leading on the development of Cr(VI) alternatives. Without its own equivalent R&D facilities for packaging in the UK, the applicant therefore became more reliant upon TSN being able to successfully continue the development of CFPA.

- Further optimisation of CFPA must be considered in the context of the progressive ban on coatings containing BPA in food contact materials. This follows EFSA's 2023 conclusion that Bisphenol A (BPA) is an endocrine disruptor with potentially harmful effects on the immune system and on reproductive, developmental and metabolic functions. Much of the CFPA development and performance optimisation undertaken to date has been carried out using established BPA-containing lacquer systems, which historically have been used on both Cr(VI)-passivated and CFPA-passivated tinplate. Following EFSA's conclusions, coating suppliers are increasingly prioritising the development and qualification of BPA-free alternatives. As a result, additional optimisation of CFPA against legacy lacquer systems is of diminishing value, as performance with BPA-containing coatings cannot be assumed to be representative of performance with future BPA-free systems (which is yet to be demonstrated). This has introduced a degree of uncertainty and has necessarily influenced the timing and prioritisation of further refinement activities.

- Additionally, the European Commission has recently requested that ECHA prepare a restriction proposal for Cr(VI) substances under EU REACH that would transfer their regulation from Annex XIV (authorisation) to Annex XVII (restriction). When the restriction enters into force, the use of sodium dichromate in the EU will be able to continue without authorisation, provided the conditions of restriction are met. Details of the restriction proposal were published in May 2025 and would only permit the continued use of Cr(VI) substances for certain well-defined uses and providing strict worker exposure and environmental emissions limits are met. Passivation using sodium dichromate is one of the defined uses and businesses in the EU that have implemented good control practice should be able to meet the mandated limits. If so, those businesses will be able to continue to use Cr(VI) substances, meaning there will be much less emphasis on substitution.

The applicant remains fully committed to the substitution of sodium dichromate and has already invested significant technical and financial resources in the development and implementation of CFPA. Indeed, CFPA capability has already been installed at Trostre. Further details on the applicant's historic and ongoing efforts, including resources committed to substitution and engagement across the value chain, are provided in sections 3.2.1 and 3.3 above. Current efforts continue to focus on improving CFPA performance and robustness, particularly in relation to its interaction with evolving lacquer technologies.

At present, however, there is no fully qualified alternative to sodium dichromate-based passivation that delivers consistent and reliable performance across all applications served by the applicant. While CFPA can be regarded as somewhat of a drop-in replacement from a process and economic perspective, it does not yet fulfil all key functional requirements for all end uses, particularly for more demanding food contact applications. Further time is therefore required to continue targeted R&D activities, address identified technical limitations, and, where feasible, demonstrate acceptable performance in combination with BPA-free lacquer systems through pack testing. Only once these challenges have been resolved can full qualification, industrial scale-up and transition be achieved.

A granted authorisation will enable the applicant to continue operating while pursuing these substitution activities in a structured and proportionate manner. This will allow ongoing R&D, further industrial trials, downstream qualification and phased implementation of CFPA as performance improvements are realised and market acceptance is secured. The substitution plan set out below describes the planned activities, indicative timescales and associated complexities and uncertainties that underpin this transition.

4.2 Conclusion on suitability of available alternatives in general

Following the judgment of the General Court in the lead chromates pigments case,[12] businesses applying for authorisation for the continued use of a substance where there is a suitable alternative generally available (SAGA) are expected to submit a substitution plan.[13]

The lead chromates pigments case involved the General Court of the European Union annulling a Commission decision granting an authorisation for certain uses of two lead chromate pigments. As regards the assessment of the suitability of alternatives under Article 60(4) of REACH, the Court found that if suitable alternatives are available in general, albeit not technically or economically feasible for the applicant, and if the applicant demonstrates that the socio-economic benefits of continued use outweigh the risk to human health and the environment, an authorisation may be granted if the applicant submits a substitution plan.

Based on the applicant's analysis, the current CFPA technology is not a SAGA. This, and all other alternative technologies and processes considered in the AoA, currently fail because they are not technically feasible. CFPA technology does exist and in one sense could be adopted by any manufacturer – in this sense, it is 'generally available'. However, the applicant is unable to use it for their own purposes due to its clear technical deficiencies compared with the existing Cr(VI)-based process.

Therefore, for the applicant's purposes, their analysis has not identified any SAGA. Nevertheless, the applicant respects and agrees with the objectives of REACH authorisation to substitute very hazardous substances to less hazardous alternatives. For this reason, even though a substitution plan is not legally required under REACH, the applicant has still produced (and is in the process of implementing) a substitution plan. This is described below and submitted as part of this application to signal the applicant's commitment and intention to identify and implement an alternative to sodium dichromate for the passivation of ETP.

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[12] EU General Court judgment of 7 March 2019 in Case T-837/16, *Sweden v. Commission*, upheld on appeal in the EU European Court of Justice judgment of 25 February 2021 in Case C-389/19 P, *Commission v. Sweden.*

[13] Despite the UK having since left the EU, the European Union (Withdrawal) Act 2018 provides that relevant cases of the Court of Justice of the European Union (CJEU) formed part of retained EU law in the UK (now referred to as 'assimilated' law). This meant that UK courts and tribunals still had to follow pre-exit CJEU case law, unless the Supreme Court decided to depart from it or retained EU law itself is modified. The Retained EU Law (Revocation and Reform) Act 2023 then stipulated that the Court of Appeal and the Supreme Court were no longer bound by assimilated case law except where domestic case law has already modified or applied it. Even so, lower courts must still follow assimilated case law and more senior courts will no doubt continue to find it persuasive.

4.3 Substitution Plan

4.3.1 Factors affecting substitution

The substitution process is shaped by four inter-related factors: the development of BPA-free lacquers by the applicant's customers and their suppliers; the optimisation of the applicant's own CFPA process for compatibility with those lacquers; the successful completion of customer-specific pack testing and market introduction; and the extent to which the relevant markets remain accessible during the transition period. Each of these factors influences both the overall timescale and the likelihood of successful substitution, and each carries inherent uncertainties which may lead to delays or require iteration of earlier steps

- **Development of new BPA free lacquers**
  Substitution is dependent on the availability of suitable BPA-free lacquers for food contact applications. The introduction of restrictions on BPA in food contact materials has necessitated renewed development and qualification efforts by coating suppliers and can-makers.

  Customers typically require multiple lacquer systems to accommodate different can-making processes, geometries, filling types and processing conditions. In addition, BPA-free lacquer formulations are not uniform across the supply chain and will vary between suppliers and customers. As a result, the successful qualification of CFPA with a particular BPA-free lacquer for one customer or application does not imply immediate suitability for others, nor that qualification activities can proceed in parallel or on a common timeline.

  This variability introduces additional complexity into the substitution process, as CFPA optimisation and qualification must be repeated for different lacquer systems and customer-specific conditions. Progress is therefore expected to be incremental and staggered across applications and customers, rather than achieved through a single, uniform transition. These factors lie largely outside the direct control of the applicant but are critical to the pace and ultimate success of substitution.

- **Development and optimisation of the CFPA process**
  From a process development perspective, substitution requires the identification and resolution of defects observed in products manufactured using CFPA, together with the refinement and stabilisation of process parameters. This includes addressing issues such as coating uniformity, surface reactivity and compatibility with downstream operations.

  Industrial experience with CFPA within the applicant's operations remains limited and must therefore be developed alongside process optimisation. With CFPA currently installed on a single tinning line at Trostre, opportunities for investigative trials, operator training and optimisation activities must be accommodated within a production environment that is already operating at high utilisation. Creating sufficient access to the line for development work, without disrupting commercial supply, represents a practical constraint on the pace of substitution.

- **Pack testing, qualification and market introduction**
  The applicant's customers manufacture a wide range of products, including general line and decorative items, aerosol cans, food and beverage cans and closures. Each product type, and often each individual filling, is associated with specific internal conditions and performance requirements. Consequently, customers must undertake extensive pack-testing programmes tailored to their own product portfolios and regulatory obligations.

  The introduction of BPA-free lacquers further increases complexity, as each new lacquer must be assessed in combination with CFPA-passivated tinplate. Multiple iterations are likely to be required before acceptable combinations are identified. In some cases, certain metal-lacquer combinations may prove unsuitable, necessitating further reformulation of the coating system and restarting parts of the qualification process. These uncertainties represent a significant risk to the substitution timeline.

Additional risks arise from potential CFPA-related defects, which may reflect either process design limitations or more fundamental constraints associated with the chemistry of Cr(VI)-free passivation. There is also uncertainty regarding customer acceptance, as the introduction of CFPA-based material may require operational adjustments within high-speed, high-volume can-making facilities. Finally, market behaviour remains uncertain, particularly where customers may choose to mitigate risk by sourcing ETP from non-UK suppliers rather than participating in a prolonged transition.

- **Restriction of Cr(VI) substances in the EU**
  The applicant is also mindful of potential regulatory developments affecting Cr(VI) substances in the EU. Any movement of Cr(VI) substances from Annex XIV to Annex XVII of EU REACH would alter the regulatory drivers for substitution and may influence R&D prioritisation and investment decisions across the EU market. Given the close alignment between the UK and EU steel packaging markets, investment in substitution must be carefully targeted to ensure that it delivers an appropriate return within a reasonable timeframe.

  Against this background, the applicant will continue to review progress towards substitution in light of evolving regulatory requirements, customer expectations and market conditions. Substitution activities will be prioritised where they offer the greatest likelihood of achieving a technically robust, commercially viable and sustainable long-term alternative to sodium dichromate-based passivation.

4.3.2 List of actions and timetable with milestones

A substitution plan was included in the applicant's initial AfA, which envisaged a transition to CFPA at Trostre by the end of 2027. That plan was based on the technical understanding and market conditions prevailing at the time, including the use of established coating and lacquer systems that were widely deployed across the steel packaging supply chain.

Since submission of the initial AfA, material changes have occurred that affect the assumptions underpinning that plan. In particular, regulatory developments relating to BPA in food contact materials have accelerated the transition towards BPA-free lacquers. As a result, further optimisation and qualification of CFPA against legacy BPA-containing lacquer systems now has limited relevance to future commercial use. While CFPA remains the most advanced and viable alternative to Cr(VI)-based passivation, its further development must now proceed in parallel with the identification, optimisation and qualification of new BPA-free coating systems by customers and their suppliers.

The applicant has therefore prepared a revised substitution plan which reflects the current technical, regulatory and market context. This plan does not represent a restart of substitution efforts, but rather a recalibration of timelines and activities to address new dependencies and uncertainties, particularly at the interface between CFPA-passivated tinplate and evolving lacquer technologies.

The revised substitution plan comprises five inter-linked phases, ranging from further R&D activities through to industrial qualification and market introduction. These phases are described in detail in Table 14 and illustrated in Figure 35, together with indicative timescales, key uncertainties and areas of dependency. Some activities necessarily involve variable durations or customer-specific requirements, and a degree of overlap between phases has therefore been assumed where appropriate. Even allowing for such overlap and for optimistic assumptions in certain areas, the revised plan demonstrates that **a review period of at least ten years (from the end of the existing review period, i.e. 31 December 2027) is required** to enable substitution to be achieved in a technically robust and commercially viable manner. In practice, substitution may take longer should unresolved technical or market uncertainties persist.

Step	Timing	Description	Milestones	Uncertainties & challenges
Step 1 **Development of BPA-free coatings** (Responsibility: Customer)	2026 - 2029 4 years	This step involves the development and initial qualification of BPA-free coatings by the applicant's customers and their coating suppliers. In the steel packaging sector, can-makers typically do not develop coating formulations in-house but rely on specialist coating manufacturers and established collaborative development pathways. This is standard practice across the sector, including for large customers as well as SMEs, and does not represent a barrier to substitution. In practice, BPA-free lacquer development is expected to proceed primarily through engagement with specialist coating suppliers. The majority of innovation in metal packaging coatings is undertaken by a limited number of major manufacturers, many of whom are already developing or supplying BPA-free epoxy alternatives, acrylic systems and polyester-based lacquers. Initial work will therefore focus on identifying and adapting existing or emerging BPA-free formulations rather than developing entirely new systems from first principles. In some cases, customers may also collaborate with academic institutions or applied research organisations with expertise in polymer science and coating formulation to support targeted development or problem-solving activities. During this development phase, the essential performance characteristics of each lacquer will be defined and assessed. These include durability, adhesion, corrosion resistance, aesthetic properties and compliance with food contact legislation. In addition, the coating must be compatible with existing can-making processes, application methods and curing conditions. Market and regulatory reviews will be undertaken to benchmark candidate BPA-free lacquers and confirm compliance with REACH and relevant food contact regulations. For the purposes of the substitution plan, it is assumed that the development and initial qualification of any given BPA-free lacquer will take approximately one year. However, it is also recognised that multiple iterations are likely to be required to identify lacquer systems that satisfy the performance, compatibility and regulatory requirements described above and that can be taken forward for further testing in combination with CFPA-passivated tinplate. This complexity is increased by the fact that multiple lacquer systems are expected to be developed by different suppliers and across different	Engagement established between customers and one or more specialist coating suppliers (and, where relevant, supporting research organisations) for the development of BPA-free lacquer systems suitable for steel packaging applications. Identification of one or more candidate BPA-free lacquer formulations per relevant application category, supported by initial laboratory-scale performance data addressing key requirements such as adhesion, corrosion resistance and food contact compliance. Decision point confirming which candidate lacquer systems are suitable to be taken forward to CFPA-specific optimisation and customer pack-testing in subsequent steps.	Development of BPA-free lacquers may involve collaboration with external organisations, including specialist coating suppliers or academic institutions. Where formal research collaborations are required, negotiation of contractual arrangements may take longer than anticipated, for example due to intellectual property ownership, confidentiality obligations or publication rights. Available information from literature and patent reviews may be incomplete, proprietary or insufficiently detailed to support direct application to the applicant's specific products and markets. As a result, additional experimental work may be required to validate or adapt candidate coating systems. Market and regulatory research to identify suitable BPA-free coatings and assess their compliance with food contact legislation can be time-intensive, particularly where data are emerging or where suppliers are developing formulations in parallel. The formulation of new coating systems is inherently iterative. Multiple cycles of laboratory testing, evaluation and reformulation may be required before acceptable performance is achieved. Early prototypes may underperform or exhibit unforeseen weaknesses, leading to delays or the need to pursue alternative formulations. Performance demonstrated at laboratory scale does not necessarily translate directly to industrial conditions. Differences in application methods, curing conditions and

Step	Timing	Description	Milestones	Uncertainties & challenges
		customers, reflecting the diversity of applications and supply chains. While it is anticipated that a proportion of these activities will proceed in parallel, progress is unlikely to be uniform across customers or suppliers. An indicative timeframe extending to 2029 is therefore assumed for completion of this step. These assumptions reflect a realistic and experience-based planning approach rather than a worst-case scenario. Actual timelines may vary depending on technical outcomes, customer-specific requirements and the performance of individual lacquer systems.		production speeds may require further adaptation and optimisation before candidate lacquers are suitable for downstream testing and qualification.
Step 2 **Prototype development and small-scale production** (Responsibility: Applicant and Customers)	2027 - 2030 4 years	This step involves the production of limited batches of CFPA-passivated tinplate and the application of candidate BPA-free lacquers by the applicant's customers using production-relevant methods. These batches will be used to generate prototype material for early-stage evaluation under conditions intended to be representative of downstream manufacturing and use, but prior to full pilot-scale or industrial production. The objective is to assess how the CFPA passivation layer and the BPA-free lacquer interact outside of controlled laboratory conditions, including their durability, appearance and consistency when applied using customer-relevant coating and curing processes. During this phase, both the CFPA application parameters and the lacquer application conditions may require adjustment to achieve acceptable uniformity and performance across different substrates and trial runs. This step is expected to overlap substantially with Step 1. As candidate BPA-free lacquer systems are identified and refined by customers and their suppliers, they can be taken forward promptly for CFPA interaction testing, allowing early identification of incompatibilities or performance limitations and helping to focus subsequent development efforts.	The outcome of this step will be a validated CFPA prototype that can consistently meet the defined performance criteria and is ready for scale-up.	A key uncertainty at this stage is how candidate BPA-free lacquers will perform when applied to production-representative tinplate substrates and under manufacturing-relevant application and curing conditions. Performance demonstrated at laboratory or pilot scale does not always translate directly to consistent behaviour on full-scale production material. The availability of candidate lacquers in sufficiently consistent small batches may also be limited during early development. Variability in formulation, raw material supply or processing conditions can affect reproducibility and complicate interpretation of test results. In addition, the interaction between CFPA-passivated surfaces and newly developed lacquer systems may be sensitive to relatively small changes in coating formulation or process parameters, requiring further optimisation or reformulation before acceptable performance is achieved. These factors may introduce delays or necessitate additional development cycles.

Step	Timing	Description	Milestones	Uncertainties & challenges
Step 3 **Scale-up and process development** (Responsibility: Applicant)	2030 - 2031 2 years	This step focuses on the transition from laboratory and small-batch trials to pilot-scale and pre-industrial production of CFPA-passivated tinplate. The objective is to demonstrate that CFPA can be applied reliably and consistently at increased production volumes, using production-representative equipment and operating conditions, while maintaining the surface performance achieved during earlier development stages. During this phase, process parameters will be systematically refined to ensure stability, repeatability and operational robustness. This includes optimisation of application conditions, coating weight control, drying and curing parameters, and quality monitoring across extended production runs. Particular attention will be paid to minimising variability across strip width and along coil length, as well as to ensuring that performance is not unduly sensitive to normal process fluctuations. A critical element of this step is confirming that CFPA-passivated tinplate produced at pilot scale remains compatible with BPA-free lacquer systems identified in Step 1 and optimised in Step 2. This involves producing sufficient quantities of representative material to support downstream testing and to verify that interactions between the passivation layer and the lacquer remain stable under manufacturing-relevant conditions. Successful completion of this step will provide confidence that the CFPA process is sufficiently mature to support customer-led pack testing and qualification, and that scale-up does not introduce new defects or performance limitations that would undermine subsequent stages of substitution. Limited pilot-scale CFPA production activities are expected to commence before completion of step 2 where candidate BPA-free lacquer systems demonstrate sufficient stability. Partial overlap between Steps 2 and 3 is therefore anticipated, although full progression is dependent on the outcomes of earlier development work. Based on prior experience with CFPA development and industrial scale-up, this step is expected to take approximately 18–30 months. The duration reflects the need to demonstrate process robustness under production-representative conditions and to accommodate iterative optimisation where scale-related effects are identified.	Successful completion of pilot-scale or pre-industrial CFPA production trials demonstrating stable operation under production-representative conditions over extended runs. Confirmation that CFPA-passivated tinplate produced at this scale meets defined internal quality criteria and maintains compatibility with selected BPA-free lacquer systems. Production of sufficient quantities of representative CFPA-passivated tinplate to enable customer-led pack testing and qualification activities in subsequent steps. Internal decision gate confirming readiness to progress to customer qualification and market introduction trials.	Processes that perform well at laboratory or pilot scale do not always translate smoothly to pre-industrial or industrial operation. Differences in equipment, throughput, thermal profiles and process control can introduce variability affecting coating uniformity, surface chemistry or downstream performance. Identification of such scale-related issues may require further optimisation or a return to earlier development steps. Customer readiness represents an additional uncertainty. Customers will progress at different rates in developing and qualifying BPA-free lacquer systems and may prioritise different end-use applications. As a result, CFPA scale-up activities may need to accommodate multiple lacquer systems and asynchronous customer timelines, complicating trial planning and extending the overall programme. As CFPA is currently installed on a single production line at the Trostre site, switching between CFPA and Cr(VI) passivation will be required, limiting flexibility and constraining access to production windows for scale-up trials. Progress through this step therefore depends on close coordination between the applicant and its customers, including aligned trial programmes, timely data exchange and iterative refinement of both the passivation process and associated lacquer systems.

Step	Timing	Description	Milestones	Uncertainties & challenges
Step 4 **Customer testing and regulatory approvals** (Responsibility: Customers)	2031 – 2034 4 years	The customer testing and approvals stage is a critical phase in the substitution plan, as it involves validating and qualifying products produced with the new coating in real-world downstream manufacturing environments. During this stage, selected customers will trial the new product on their own production lines and, where relevant, overlaying it with organic coatings such as lacquers. These trials will assess how well the new product integrates into existing production processes, including the application and curing of coatings and the product's performance under operations such as forming, seaming and sterilisation. In the food packaging sector, this stage also includes long-term packaging performance tests, commonly referred to as pack tests. These tests simulate the full lifecycle of a packaged product, including storage, transport and shelf life, and can take up to four years to complete depending on the product type and regulatory requirements. The objective is to confirm that the coating maintains its integrity, safety, and protective properties over time, particularly in contact with food. Customer approvals will depend not only on technical performance but also on compliance with food safety regulations and internal quality standards. This phase is essential for building customer confidence and securing commercial adoption, but it is inherently time-consuming and must be carefully managed to avoid delays in market entry. Once CFPA has been successfully validated as a direct replacement for sodium dichromate passivated ETP in both performance and application then the focus shifts to securing the necessary commercial and regulatory approvals to move toward full industrialisation.	Initiation and, where applicable, completion of customer-specific pack testing programmes confirming that the combined CFPA-passivated tinplate and BPA-free lacquer system meets defined performance, safety and shelf-life requirements for the relevant applications. Receipt of formal customer approvals, or conditional approvals, for defined product ranges and applications, confirming suitability of CFPA-based material as a replacement for Cr(VI)-passivated ETP. Internal decision gate confirming that sufficient customer acceptance has been achieved to support progression towards broader commercialisation and industrialisation in the subsequent step.	The customer testing and approvals stage is particularly vulnerable to delays due to its reliance on external parties and long pack testing timelines (up to 4 years) bearing in mind the strict regulatory requirements. In particular, early results may be inconclusive or failures may occur late in the testing cycle. One major uncertainty is the variability in how different customers implement and evaluate the coating within their own production environments, which can lead to inconsistent feedback or the need for tailored adjustments. Customer priorities or production schedules may shift, causing delays in trial execution or feedback. Any issues identified during these trials may require further adjustments to the formulation or application process to ensure seamless adoption. These factors make this stage one of the most unpredictable and time-intensive in the project, requiring proactive coordination and contingency planning to manage effectively.
Step 5 **Transition of production to approved alternative process** (Responsibility: Applicant)	2035 – 2037 3 years	This final step involves the managed transition from Cr(VI)-based passivation to CFPA on the applicant's existing tinning line, following successful customer qualification and approval for defined products and applications. CFPA does not require the installation of a new production line; however, targeted modifications, operational adjustments and updated control procedures may be required to support sustained production using the alternative passivation process. As customer approvals are obtained, supply of CFPA-passivated tinplate will be progressively increased for those applications where substitution	Progressive increase in the proportion of CFPA-passivated tinplate supplied to customers, reflecting completed approvals and contractual transitions for defined products and applications. Demonstrable and sustained reduction in the use of sodium	A key challenge during this step is maintaining consistent product quality as CFPA-passivated tinplate moves from controlled trial production into routine, higher-volume operation. Even minor deviations in process parameters, raw material quality or line conditions can affect surface performance and downstream behaviour. Experience indicates that the

Step	Timing	Description	Milestones	Uncertainties & challenges
		has been demonstrated to be technically and commercially viable. New commercial arrangements will be entered into accordingly. At the same time, existing contractual obligations requiring Cr(VI)-passivated material will need to be fulfilled for customers or applications where suitable alternatives are not yet available. This will necessitate a phased and carefully controlled transition, rather than an immediate and complete switch. During this period, production using CFPA will be ramped up in a controlled manner, with ongoing monitoring to confirm consistent product quality, regulatory compliance and downstream performance. Quality assurance and process control systems will be refined as necessary to ensure that material produced using CFPA continues to meet customer specifications under routine operating conditions. Continued technical support and engagement with customers will be required to address any early-stage issues and to support their own transition to the new material. Given that CFPA and Cr(VI) passivation cannot be operated simultaneously on the same line, careful production planning will be required to manage changeovers and minimise disruption to supply. Where appropriate, strategic stock management may be used to buffer customer supply during the transition period. As customer uptake of CFPA increases and reliance on Cr(VI)-passivated material decreases, use of sodium dichromate will be progressively reduced. Once CFPA-based products are fully embedded across the relevant customer base and remaining uses of Cr(VI) passivation have been eliminated, the applicant will be able to cease use of sodium dichromate. Any remaining equipment or infrastructure associated solely with Cr(VI) passivation will then be decommissioned in accordance with applicable environmental, health and safety requirements. This step is expected to extend over several years and to proceed incrementally, reflecting the phased nature of customer uptake, contractual commitments and operational constraints. A duration of approximately 3 years is considered realistic.	dichromate, evidenced by production records showing declining volumes and reduced frequency of Cr(VI) passivation campaigns. Internal decision gate confirming that all commercially relevant applications have transitioned to CFPA or that any remaining uses of Cr(VI) passivation have been eliminated or rendered unnecessary. Cessation of sodium dichromate use for the passivation of tin-plated steel at the site. Decommissioning or permanent disablement of any equipment or infrastructure dedicated solely to Cr(VI) passivation, carried out in accordance with applicable environmental, health and safety requirements.	CFPA process can be sensitive to contamination and parameter variability, and any quality excursions at this stage could undermine customer confidence or require further optimisation. Customer conversion remains a significant uncertainty. Some customers may require modifications to downstream equipment, extended internal validation or prolonged pack-testing before committing fully to CFPA-based material. Others may be cautious in transitioning away from established Cr(VI)-passivated products, particularly for critical or high-risk applications. Slower-than-anticipated customer uptake could therefore extend the period of dual production. Managing production planning and inventory during the transition is inherently complex. The applicant must balance increasing volumes of CFPA-passivated tinplate with the phased reduction of Cr(VI)-passivated material, while continuing to meet contractual supply obligations. Constraints associated with operating a single production line, together with the need to build and manage strategic stock buffers, increase exposure to demand fluctuations, scheduling conflicts and supply-chain disruption.

***Table 14**: Substitution steps, timelines and uncertainties / challenges*

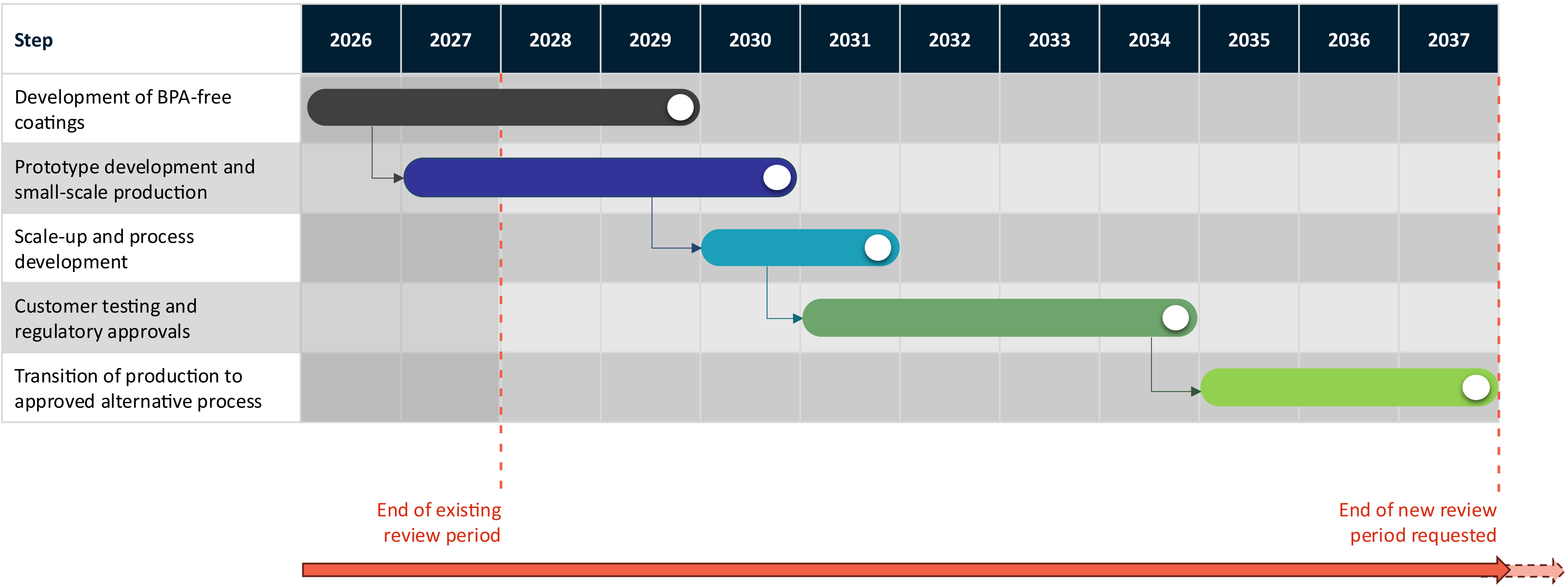

***Figure 35**: Substitution roadmap*

4.4 Monitoring implementation of the substitution plan

A project must pass through several phases before it can be implemented in any of the applicant's production facilities. The applicant defines the following four phases in their Project Manual:

1. Concept
2. Definition
   - Development
   - Planning
3. Implementation
   - Design, Procure, Manufacture (DPM)
   - Construction
   - Commissioning
4. Handover and Closeout

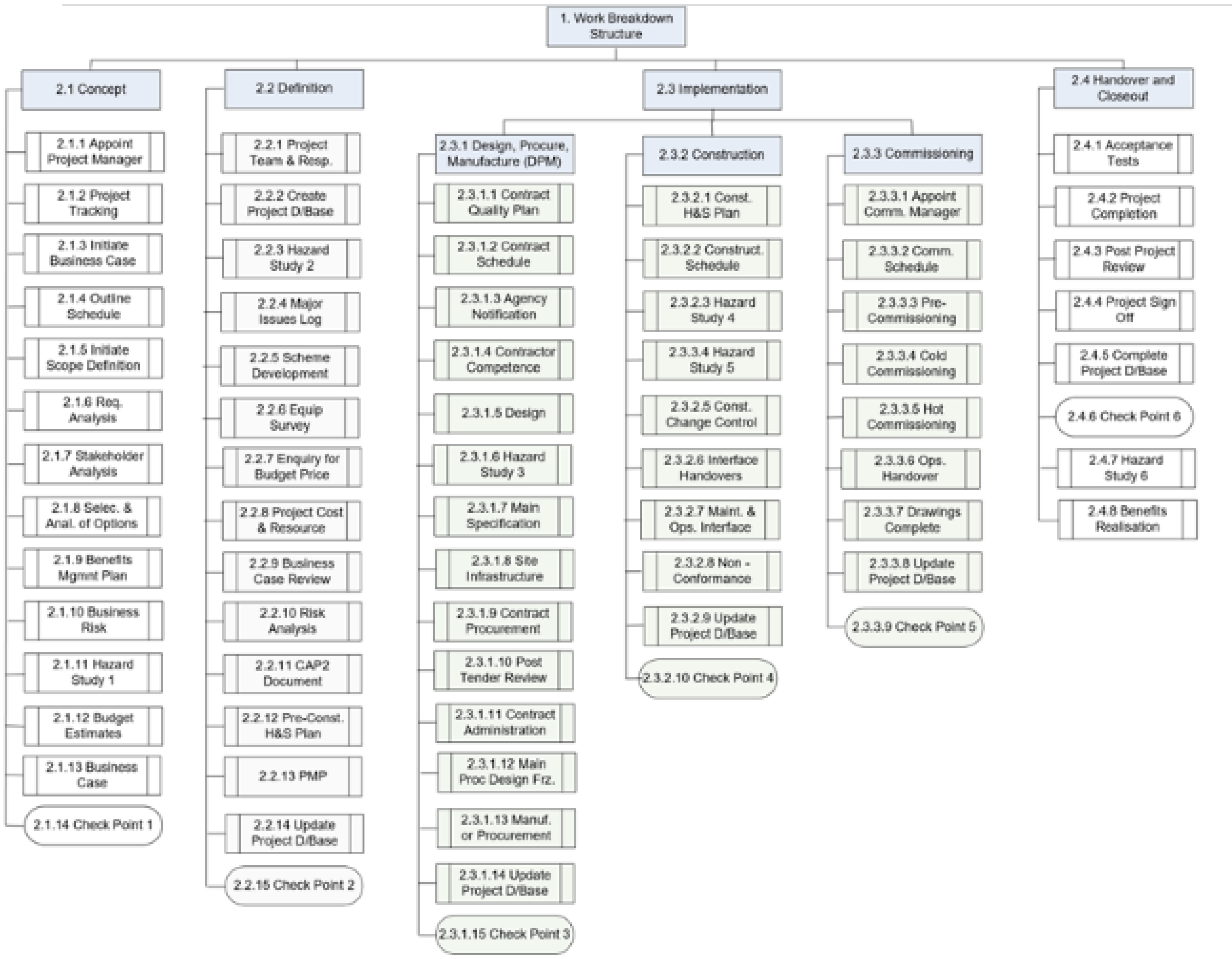

***Figure 36**: Work breakdown structure in Project Manual*

Each phase is made up of a number of activities that need to be carried out on a timely basis and, as can be seen above, phases 2 (Definition) and 3 (Implementation) are further broken down into more manageable sub-phases. The work breakdown structure for this approach is depicted in Figure 36 above. The applicant's approach to projects has been ratified against the structured methodology of the PRINCE2 (PRojects IN Controlled Environments) process model, which has been developed from the experiences of scores of projects, project managers and project teams.

The overall responsibility for project management within the applicant's organisation falls to the Business Management Team (BMT) comprising senior management representatives. The function of the BMT for Project Management is to:

- control and allocate the annual CAPEX spend
- ensure that a competent Project Management structure is in place
- monitor, review & steer capital plan
- categorise each project as major or minor CAPEX, which determines the level of Project Management required

The applicant's BMT will appoint a Project Manager for each capital scheme. The Project Manager's key tasks are to:

- establish and control a competent Project Team
- ensure the project process is followed
- ensure stakeholder communication
- plan checkpoint reviews for major CAPEX projects

The Design Services & Projects Department is responsible for project planning; resource planning and ensuring project reviews are carried out in accordance with agreed schedules, with the key tasks being to:

- control and administrate the applicant's Project Management Manual
- provide resource to develop and manage capital projects
- apply and promote the Project Management processes described in the Project Manual

All project reviews are held in accordance with the applicant's Project Management Project Categorisation System. There are two distinct levels of project review, 'major' and 'minor'. The Cr(VI) substitution project involves a new process/system and, as such, it is categorised as a major project. There are seven major checkpoint reviews required for major projects, all of which should be chaired by a senior manager. These reviews are carefully timed and executed to ensure that each phase of the project has been managed effectively. The checkpoint review includes a traffic light system which highlights where further measures are necessary.

All major projects must be fully controlled using the applicant's project management process. All relevant documentation must be prepared at all stages by the appropriate team member in readiness for the scheduled checkpoint reviews. To assist the effective management of projects, a set of standardised documents has been developed. The main objective of these documents is to summarise information in a format which makes it easy to understand project roles and responsibilities (see Table 15), project status and concerns. Each document is developed at a pre-determined period within each phase of a project and can be used at gate reviews (see Figure 37) as evidence that activities are complete.

Role	Responsibilities
Project Sponsor (Member of BMT) Senior management is responsible for the overall direction and management of the project and has responsibility and authority for the project within the remit (the project mandate). The Project Steering Committee is the project's 'voice' to the outside world and is responsible for any publicity or other dissemination of information about the project.	• **Project ownership and strategic oversight**: Accountable for the business case, overall project success, benefit realisation, legal compliance and post-implementation review. Owns the project vision, objectives and ensures alignment with strategic goals. • **Governance and decision-making**: Chairs the Project Steering Committee, approves or selects the Project Manager, secures funding, sets project KPIs and control boundaries, and authorises changes impacting the business case. Makes go/no-go decisions at phase gates. • **Support and escalation management**: Champions the project at senior levels, empowers the Project Manager, resolves escalated

Role	Responsibilities
	issues and ensures critical risks and issues are addressed through oversight of logs and registers. • **Communication and value assurance**: Promotes the project widely, articulates its importance at kick-off, ensures delivery of essential functionality only and avoids waste. Ensures the finished product meets compliance and safety standards.
Project Manager Has the authority to run the project on a day-to-day basis on behalf of the Managing Director within the constraints laid down by Senior Management or the Project Steering Committee. The Project Manager's prime responsibility is to ensure that the project delivers to the required standard of quality and safety within the specified constraints of time and cost. The Project Manager is also responsible for the project producing a result capable of achieving the benefits defined in the Business Case.	• **Team leadership & resource management**: Ensure the project team is adequately resourced, competently staffed, directed and motivated. Coordinate training and systems support for operations and maintenance. • **Project planning and execution oversight**: Develop and monitor plans, manage risks and contingencies, oversee budget and initiate corrective actions. Responsible for project administration and contract strategy, including contractor selection and negotiations. • **Governance and reporting**: Liaise with the Project Sponsor and Steering Committee to maintain project direction and integrity. Provide regular updates through reports and gate reviews, and agree on safety, technical and quality management strategies. • **Quality, safety and close-out**: Ensure independent reviews of process safety and plant integrity meet standards. Oversee the development and review of the Project Quality Plan and compile the final 'Lessons Learnt' report.
The Engineer The Engineer leads on all engineering issues and is accountable for the quality of engineering, including quality of the deliverables produced by contractors and suppliers. The Engineer has the authority to commit or acquire contractor resources.	• **Engineering leadership and coordination**: Lead and manage all engineering activities, ensuring effective coordination between designers, consultants, contractors and internal disciplines. Oversee design, procurement, installation and commissioning plans for capital equipment and infrastructure. • **Design integrity and safety assurance**: Ensure designs meet engineering standards, are safe to build, operate, and maintain, and incorporate feedback from production and maintenance teams. Manage change control, design freeze and configuration management processes. • **Project execution and documentation**: Plan and organise all project operations. Monitor and control budget, programme and contractual progress. Ensure complete documentation, including manuals, drawings and calculations, and coordinate snagging and handover activities. • **Stakeholder engagement and support**: Liaise with the Project Manager, escalate issues beyond control, support contract negotiations and lead training for operational teams. Ensure all work is carried out safely and in line with project requirements.
Project Engineers The Project Engineer's prime responsibility is to ensure delivery of those processes defined by the Engineer to an appropriate quality, in a timescale and at a cost acceptable to the Engineer and Project Manager. The Project Engineer reports to and takes direction from the Engineer or Project Manager.	• **Technical and commercial support**: Provide initial scheme assessments, recommend plant and equipment, evaluate tenders and support supplier selection and requisitioning. • **Project control and coordination**: Manage change control and configuration management. Monitor and control budget, schedule and contractual progress for specific contracts or disciplines, in coordination with the Engineer. • **Installation and quality assurance**: Ensure contractors deliver to specification and schedule, verify safe working practices and

Role	Responsibilities
	oversee the completion and proper storage of all required documentation, including QA records. • **Handover and post-installation support**: Liaise with the Works Area to resolve snagging issues and support a smooth transition post-handover.
Works Area Manager This role represents the interests of all those who will operate the final process, those of whom the process will achieve an objective or those who will use the process to deliver benefits.	The Works Area Manager is responsible for specifying the needs of those who will use the final product / process, for user liaison with the project team and for monitoring that the solution will meet those needs within the constraints of the Business Case in terms of safety, quality, functionality and ease of use. The Works Area Manager also commits user resource and monitors the process against requirements.

***Table 15**: Project management roles and responsibilities*

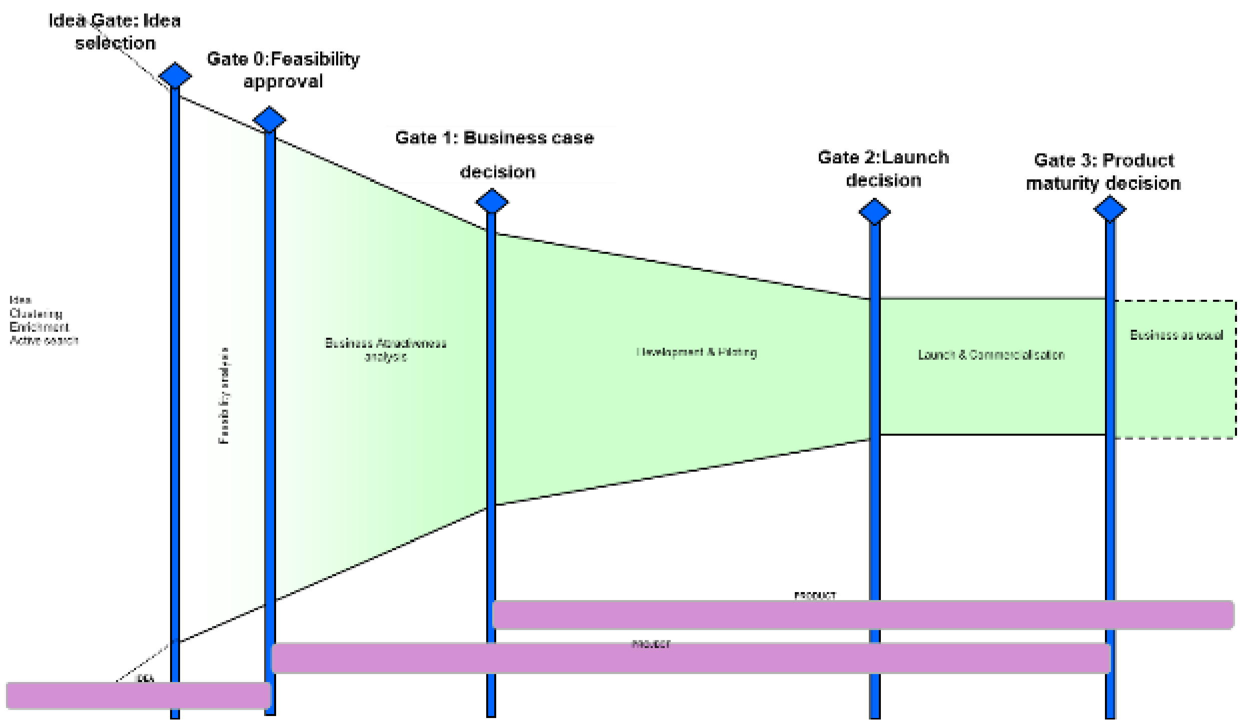

***Figure 37**: Gate reviews during the project management process*

4.5 Conclusions

Investigations into Cr(VI)-free passivation technologies for tin-plated steel have been ongoing for many years and pre-date the introduction of REACH Regulation. They have involved extensive collaboration across the European (and indeed the global) steel packaging value chain. Through these efforts, CFPA has emerged as the most promising potential alternative and represents the most mature and technically advanced option currently available.

However, the introduction of restrictions on BPA in food contact materials means that this historic testing is no longer representative of future commercial conditions. Identification, development and qualification of suitable BPA-free lacquers, and optimisation of CFPA to ensure compatibility with these new systems, are therefore required before substitution can be completed.

As set out in this Substitution Plan, the development pathway comprises multiple inter-dependent phases, including lacquer development, CFPA optimisation, pilot-scale production, customer pack testing and phased industrial transition. Each phase involves technical, regulatory and market uncertainties and requires iterative refinement. In particular, long-duration food pack tests, staggered customer readiness and the need to manage dual production during transition materially influence the overall timescale.

This Substitution Plan demonstrates the applicant's continued commitment to the development, testing, qualification and eventual industrial implementation of CFPA as an alternative to sodium dichromate-based passivation. Achieving this transition will require sustained technical effort, close engagement with customers and coating suppliers, and significant ongoing investment.

Based on the applicant's experience and allowing for overlapping activities where feasible, it is estimated that full implementation of CFPA and cessation of sodium dichromate use could be achieved by the end of 2037. A review period of 10 years from the end of the current review period on 31 December 2027 is therefore requested. This timeframe reflects a realistic and proportionate assessment of the steps required to complete substitution while maintaining supply continuity and product safety. Given the inherent uncertainties and dependencies identified, substitution may take longer in practice; however, the applicant remains committed to progressing substitution as efficiently as technically and commercially feasible.

5. Socio-Economic Analysis (SEA)

Sodium dichromate is covered by entry 18 of Annex XIV and only authorised uses are permitted after the sunset date given in the entry (21 September 2017) unless otherwise exempted. As sodium dichromate is a non-threshold carcinogen, adequate control of risks cannot be demonstrated and therefore applications for authorisation must follow the socio-economic route.

This socio-economic analysis (SEA) has been undertaken as part of work to demonstrate the case for granting the applicant an authorisation to allow for continued use of sodium dichromate for the passivation of ETP during the requested review period of 10 years. The aim of the SEA is to assess and compare human health and socio-economic impacts of the continued use and of the non-use scenarios.

A period of 10 years (the review period requested) is used for the purposes of this assessment. The SEA considers the period between the date that use must cease in the event of a refused decision, assumed for the purpose of this assessment to be 31 December 2027 (the end of the existing review period), and 31 December 2037 (the end of the requested review period) in terms of the assessment of certain economic impacts. 2026 is used as the base year for calculations.

5.1 Continued use scenario

The continued use scenario, or applied-for use scenario (AFUS), has been outlined in section 3.1 of this report (taking into account the information in section 2 which provides the context and scope of the AfA). Further information on the applicant's use of sodium dichromate, as well as a detailed process description, appears in section 9 of the CSR.

During the review period, the applicant will continue efforts to identify and implement a suitable alternative to sodium dichromate. These activities are described in detail in the substitution plan in section 4 above, along with associated timescales, costs, challenges and uncertainties.

5.2 Risks associated with continued use

Sodium dichromate has been identified as a substance of very high concern (SVHC) under Article 57(a), 57(b) and 57(c) of REACH and included on Annex XIV of REACH due to its carcinogenicity, mutagenicity and reproductive toxicity. For this reason, the risk associated with continuous use of sodium dichromate focuses on human health. The risk to the environment is not required to be assessed for the authorisation of sodium dichromate, although releases to, and fate in, the environment are relevant for the assessment of human exposure via the environment.

The most important potential routes of exposure and target organs are inhalation causing lung cancer and oral exposure causing intestinal cancer. The substance is also classified as a category 1B reproductive toxicant. However, the CSR has found that the calculated exposure levels are below the DNELs for reproductive toxicity. Therefore, the risk from that endpoint is considered adequately controlled and as such it will not be examined further in this SEA.

The SEA assesses the health impacts attributable to the ongoing use of sodium dichromate in line with the scope of the applied for authorisation (i.e. considering the applied for use and review period). Such impacts are compared to the situation in the non-use scenario (NUS). Impacts beyond the UK are not strictly within the scope of this assessment, though the implications are considered where relevant for context and completeness.

5.2.1 Impacts on humans

The human health impacts that arise from the remaining risk associated with the exposure of humans to sodium dichromate in the applied for use scenario have been assessed. The potential health impacts relevant for this application for authorisation are lung cancer and gastrointestinal cancer associated with exposure to sodium dichromate via inhalation and ingestion respectively. The excess lifetime risk (ELR) for directly exposed workers and for the general population via the environment for developing lung cancer or small intestine cancer is derived based on the exposure assessment and on the existing reference dose-response function established for carcinogenicity of hexavalent chromium that was published by ECHA's Risk Assessment Committee (RAC).[14]

The risk associated with sodium dichromate relates to the hexavalent chromium ion, and the assessment of risk to human health is therefore based on exposure to the hexavalent chromium ion. The RAC document (RAC/27/2013/06 Rev.1) refers to sodium dichromate, hexavalent chromium and chromium (VI). The molecular weight of sodium dichromate is 262g/mol and the molecular weight of the hexavalent chromium ion is 105g/mol.

The assessment considers both workers that could be directly exposed to sodium dichromate in the course of their activities at the applicant's Trostre Works site and the general population, specifically residents and workers in the neighbourhood of the site that, hypothetically, could be indirectly exposed to releases from the site to the local environment.

The number of potentially exposed workers and members of the general population considered for the assessment are summarised in the table below. The number of different workers that may be in the scope of this assessment should not be confused with the full time equivalent (FTE) of the number of workers that carry out specific tasks (tasks may be shared between equally trained individuals). Workers that are not directly exposed to hexavalent chromium in the course of their activities are considered as part of the local general population for this assessment.

Group	Number
Workers at the Trostre Works (total, employees ([redacted]) plus permanent contractors ([redacted]))	[redacted] (Public range: > 600)
Workers with one or more duties associated with the use of sodium dichromate	70 *
Local workers and residents (within a 1km radius of the site) (default)	10,000
Local workers and residents (within a 1km radius of the site) (actual, estimated)	< 3,822 **
Notes: * Consists of 40 ETP production shift team members (36 of whom may also perform certain maintenance duties), 21 dedicated maintenance workers (5 Tata Steel employees and 16 contractors, which includes the 2 cleaners responsible for desludging activities relevant to WCS 7b), 8 wastewater treatment plant operators (Veolia employees) and 1 delivery driver under current delivery arrangements. ** See Table 23 below for further information	

***Table 16**: Numbers of persons potentially exposed*

For the risk assessment of workers associated with ETP production, the exposure route of concern is inhalation of dusts and mists or aerosols. Taking a conservative approach in line with the ECHA RAC paper (RAC/27/2013/06 Rev.1), in this assessment all particles inhaled are assumed to be respirable as a worst-case assumption for the risk assessment. Direct ingestion of sodium dichromate is not expected to occur considering workplace hygiene standards in place at the site. Therefore, the assessment of the health

[14] ECHA, 2013.

impact to workers directly exposed focuses on the risk of lung cancer associated with inhaling Cr(VI) in the course of work activities.

The assessment of health impacts in the general population considers both the risk of lung cancer relating to inhalation of Cr(VI) and the risk of intestinal cancer relating to the ingestion of Cr(VI) that may be released from the facility to the environment. The assessment considers release of Cr(VI) from the site to air and associated potential for exposure. Exposure via water is not considered because, as demonstrated in the CSR, Cr(VI) is not released to water from the site.

The relevant pathways for this assessment are summarised below:

Group	Inhalation	Ingestion
Workers (directly exposed)	✓	-
General population (indirectly exposed)	✓	✓

***Table 17**: Summary of relevant exposure pathways*

The health impact assessment evaluates the risk of developing cancer based on a detailed characterisation of exposure to Cr(VI) and the reference dose-response relationship for the Cr(VI) ion published by RAC (RAC/27/2013/06 Rev.1). The projected health impacts relating to these exposures are then characterised and valued in financial terms based on available guidance and data.

<u>Impacts on workers</u>
Worker exposure in the case of continued use is explained in the CSR. The CSR presents the estimated average exposures, based on measured and/or modelled data that is representative of the various activities (worker contributing scenarios) involving the continued use of sodium dichromate according to the operating conditions and risk management measures described in the exposure scenarios.

Measured data (personal sampling) is used in preference to modelled data where available. Measured data have been collected and analysed according to recognised standards, under representative conditions of personal exposure, and with sufficient data points over a number of years to provide confidence that it best reflects the real-life exposure situation. However, modelled data are also provided for the limited number of worker contributing scenarios (WCS) where measured data are not available.

The estimated exposure for the WCS set out in the CSR is summarised in the table below. The average exposures presented for each activity are time-weighted over either a 12-hour or 8-hour period depending on the shift length of the workers concerned. They account for both duration and frequency of tasks that contribute to exposure in a representative working day. They also take account of respiratory protective equipment consistent with the WCS.

WCS	Activity	Est. exposure [1] µg/m³	Number of workers exposed [2]
WCS1a	Receipt, transport and storage of sodium dichromate (current using delivery driver)	1.65E-03	1
WCS1b	Receipt, transport and storage of sodium dichromate (future using Tata Steel shift worker)	3.50E-05	4
WCS2a	Sampling of the electrolyte solution: taking samples	1.36E-04	4
WCS2b	Sampling of the electrolyte solution: laboratory analysis	5.43E-03	4

WCS	Activity	Est. exposure [1] µg/m³	Number of workers exposed [2]
WCS3	Adding sodium dichromate to the circulation tank	N/A	None (see CSR)
WCS4	Passivation	3.97E-02	4
WCS5	Control room activities	9.56E-02	12
WCS6	Loading and unloading of steel coils	3.75E-02	12
WCS7a	Maintenance activities: all activities except desludging- workers on 12-hour shifts	2.53E-05	36
WCS7a	Maintenance activities: all activities except desludging- workers on 8-hour shifts	2.17E-04	21
WCS7b	Maintenance activities: Desludging basement circulation tank - ART	2.65E-04	2
WCS8a, WCS8b	Waste management including wastewater treatment	3.24E-02	8
Notes: [1] Estimated exposure per worker as either 12-hour or 8-hour TWA depending on the relevant shift length in question and is adjusted for frequency of task and RPE. Based on results of personal sampling with supplemental ART modelling where required (see CSR). [2] Maximum number of workers who may carry out these activities. To avoid double-counting, this totals 40 for WCS1b to WCS6 inclusive, split across the various WCS, to reflect the total number of ETP production shift team members.			

***Table 18**: Estimated worker exposure for the worker contributing scenarios (WCS)*

As discussed above, ECHA's RAC derived a linear reference dose response relationship which describes the additional (excess) risk, up to the age of 89, of workers dying from lung cancer due to exposure to the Cr(VI) ion in the workplace. This states the excess lifetime lung cancer mortality risk for workers for the purpose of an application for authorisation is 4×10^{-3} per µg Cr(VI)/m^3. According to this model, there is no minimum threshold for effects. It assumes exposure occurs over a 40-year working life (8 hours a day, 5 days a week).

This excess lifetime lung cancer mortality risk for workers value is adapted for use in the application for authorisation by factoring for the duration of the review period requested (10 years) as opposed to 40 years. The number of working days per year is also adjusted from 5 days per week over 52 weeks (260 days) to the number of working days, as appropriate, for each activity or WCS. The additional risk of a fatal lung cancer for each activity is calculated as the product of this adjusted unit risk value and the exposure per worker carrying out the activity. The additional risk of a fatal lung cancer across the workforce is the sum of these risks across all workers, considering all relevant activities for each worker.

The RAC dose-response relationship relates to cancer mortality risk. It does not explicitly consider the excess risk of developing and surviving lung cancer due to exposure to sodium dichromate over the duration of the authorisation. This risk is separately determined considering the excess lifetime lung cancer mortality risk and data on cancer survival. Available data indicate the age-standardised relative survival rates (average for men and women) for lung cancer in the UK over 10 years is 9.5%[15]. This would mean that the UK fatality rate for lung cancer is 90.5% over 10 years and an additional 0.105 (=9.5/90.5) non-fatal cancer cases typically occur for every fatal cancer case in the UK.

[15] ONS, 2019.

Total worker excess cancer risk	Lifetime	Per year
Additional fatal lung cancer risk	2.05E-03	2.05E-04
Additional non-fatal lung cancer risk	2.15E-04	2.15E-05
Total	2.26E-03	2.26E-04

***Table 19**: Total worker excess cancer risk for review period (10 years)*

The valuation of these potential additional fatal and non-fatal cancer cases has been calculated based on values of a statistical life (VSL) and for morbidity due to cancer (VCM) published by ECHA[16] and adjusted from 2012 to the base year (2026) with reference to gross domestic product (GDP) deflator indexes[17] and the current exchange rate[18] for Euro and UK £.

Value	Lower bound EUR 2012	Lower bound [1] EUR 2026	Lower bound [2] UK £ 2026	Upper bound EUR 2012	Upper bound [1] EUR 2026	Upper bound [2] UK £ 2026
Value of statistical life (VSL)	3,500,000	5,144,058	4,451,962	5,000,000	7,348,655	6,359,946
Value of cancer morbidity (VCM)	410,000	602,590	521,516	410,000	602,590	521,516
[1] The 2012 values adjusted by 1.47 (rounded) based on the UK GDP deflator of 2026 compared to 2012.						
[2] Exchange rate EUR : GBP = 0.865						

***Table 20**: Valuation of potential additional fatal and non-fatal cancer cases*

Lung cancer has a latency period of around 10 years. To account for this, the values (VCL and VCM) are discounted (at a rate of 4% in accordance with ECHA guidance) over a 10-year period.[19] Based on these adjusted values:

- the value of (avoiding) a fatal cancer is £3.36 million (lower bound) to £4.65 million (upper bound)
- the value of (avoiding) a non-fatal cancer is £0.35 million

Applying a lower discount rate of 2% to account for an increased value on health and safety in accordance with improved living standards in the UK since 2012:

- the value of (avoiding) a fatal cancer is £4.08 million (lower bound) to £5.65 million (upper bound)
- the value of (avoiding) a non-fatal cancer is £0.43 million.

The health impact cost of continued use (or benefit of a discontinued use) is calculated as the product of the total excess lifetime risk, based on exposure across all workers and activities over the duration of the requested review period, and the adjusted value of one additional lung cancer case, considering both fatality and survival outcomes and rates. Thus, the starting point for the valuation for lung cancer is lung cancer fatality. This is adjusted to include the associated cost of non-fatal lung cancer based on UK survival rates.

The monetised health impacts for workers potentially exposed to sodium dichromate are summarised in the table below.

[16] ECHA, 2016 (a).
[17] HM Treasury, 2024.
[18] Exchange rate EUR:GBP 0.865 as of 24 Mar 2026 (xe.com)
[19] ECHA, 2016 (a), at p41.

	Lower bound * UK £	Upper bound ** UK £
Lung cancer [fatal and non-fatal] during the review period (10 years)	7,681	12,866
Lung cancer [fatal and non-fatal] during the review period (per year)	768	1,287
Notes: * 4% discount rate ** 2% discount rate		

***Table 21**: Summary of monetised health impacts for potentially exposed workers*

Impacts on the general population

Releases of Cr(VI) to the environment from the Trostre Works site are minimised. Wastewater treatment results in the complete reduction of Cr(VI) to Cr(III) prior to release. No Cr(VI) has been detected in wastewater discharged to the estuary (see CSR for further details).

Air above the passivation tanks is extracted and discharged via wet scrubber through a stack. Measurements of total chromium in the air discharged from the stack have been used to predict environmental concentrations (e.g. concentrations in air 100m from the site and in the food chain) and are presented in the CSR.

Environmental parameter	Predicted concentration
Predicted concentration in air 100m from the stack	6.51E-03 µg Cr(VI)/m^3
Predicted concentration in surface water	0.00 µg Cr(VI)/l
Predicted uptake humans via the environment (oral)	9.81E-01 µg Cr(VI)/kg bw/d

***Table 22**: Summary of predicted environmental concentrations relating to releases from the site*

The risk assessment considers exposure of people living and working locally, in the vicinity of the Trostre Works. The site is situated within the county of Carmarthenshire, 1.5 km to the east of the town of Llanelli. There are several small villages within a 5km radius. The village of Llwynhendy is situated within 1 km of the site boundary. The Trostre Business Park and Trostre Retail Park are situated within 0.5 km to the west of the site boundary and the Pemberton Retail Park and 15,000 capacity Rugby Stadium (Parc Y Scarlets) are situated within 0.5 km to the north of the site boundary. The Wildlife and Wetlands Centre, Wales, is located to the south of the site, approximately 0.5 km from the site boundary.

The default number of local people in the vicinity of any site that may be exposed on a local scale is 10,000 (based on ECHA guidance).[20] However, this number significantly overestimates the actual number of people within 1km of the stack where emissions can occur. Figures 38 and 39 below show that the main residential areas surrounding the Trostre site are over 1km from the stacks, with a limited presence of domestic areas within that zone. Commercial parks, an industrial park, a rugby stadium and the rest of the Trostre Works site itself comprise the main areas within 1km of the stacks.

A more realistic (whilst still conservative) estimate of the total number of people (local population and visitors) within 1 km of the stacks is 3,822, as detailed in the table below.

[20] ECHA, 2016 (b).

Population centre	Population / visitors (estimated maximum number)	Number taken forward for assessment	Notes
Llwynhendy (electoral ward, 2021 census data)	4,389 (permanent)	1,463	Approximately one-third of domestic premises in the Llwynhendy electoral ward are within 1km of the stacks. 4,389 x 1/3 = 1,463 No further reduction is made for duration of time people will actually be present in their houses to ensure a conservative approach is taken to the assessment.
Trostre Retail Park & Trostre Industrial Estate	3,000 (transient)	1,000	Assumes retail park and industrial estate operate all year round, 12hrs/day. Reduction of a further third is made for off-peak times. 3,000 x (12/24) x (2/3) = 1,000
Pemberton Retail Park	2,500 (transient)	833	Assumes retail park operates all year round, 12hrs/day. Reduction of a further third is made for off-peak times. 2,500 x (12/24) x (2/3) = 833
Parc Y Scarlets Rugby Stadium (match day)	14,870 capacity, though average match day crowd <7,000 (transient)	80	Assume 25 matches per year, each event of up to 4hrs duration (between doors open/close). 7,000 x (25/365 days) x (4/24 hrs) = 80
Wetlands and Wildlife Centre	Up to 50,000 visitors per year (transient)	46	Open all year round for between 9.30am-5pm. 50,000/365 x (8/24 hrs) = 46
Workers at the Trostre Works itself	Approximately [redacted] employees and [redacted] permanent contractors	400	Of the [redacted] total, the number of workers (employees and permanent contractors) on-site at any one time will not exceed 400. (NB. No further deduction is made for the 70 workers already accounted for in the total number of workers covered by each WCS.)
TOTAL		**3,822**	

***Table 23**: Information on local population around the site*

An aerial view and map with the site boundary and areas within a 1 km radius of the stack serving the ETP line are provided in Figures 38 and 39 below.

The local population is assumed to be exposed to the local predicted concentration of total chromium (as a proxy for Cr(VI)) in air, i.e. the concentration 100m from the point source, calculated as a yearly average in accordance with ECHA guidance.[21] This is a worst-case assumption, not least because the concentration of Cr(VI) in air will be less than the concentration of total chromium.

Changes in the regional concentration of Cr(VI) in air from releases at the site are not considered in this assessment. Several published reports including the EU risk assessment report (RAR)[22] identify Cr(VI) will normally be reduced to trivalent form under environmental conditions and conclude the risk relating to exposure on regional scale is negligible.

[21] ECHA, 2016 (b).

[22] European Chemicals Bureau, 2005.

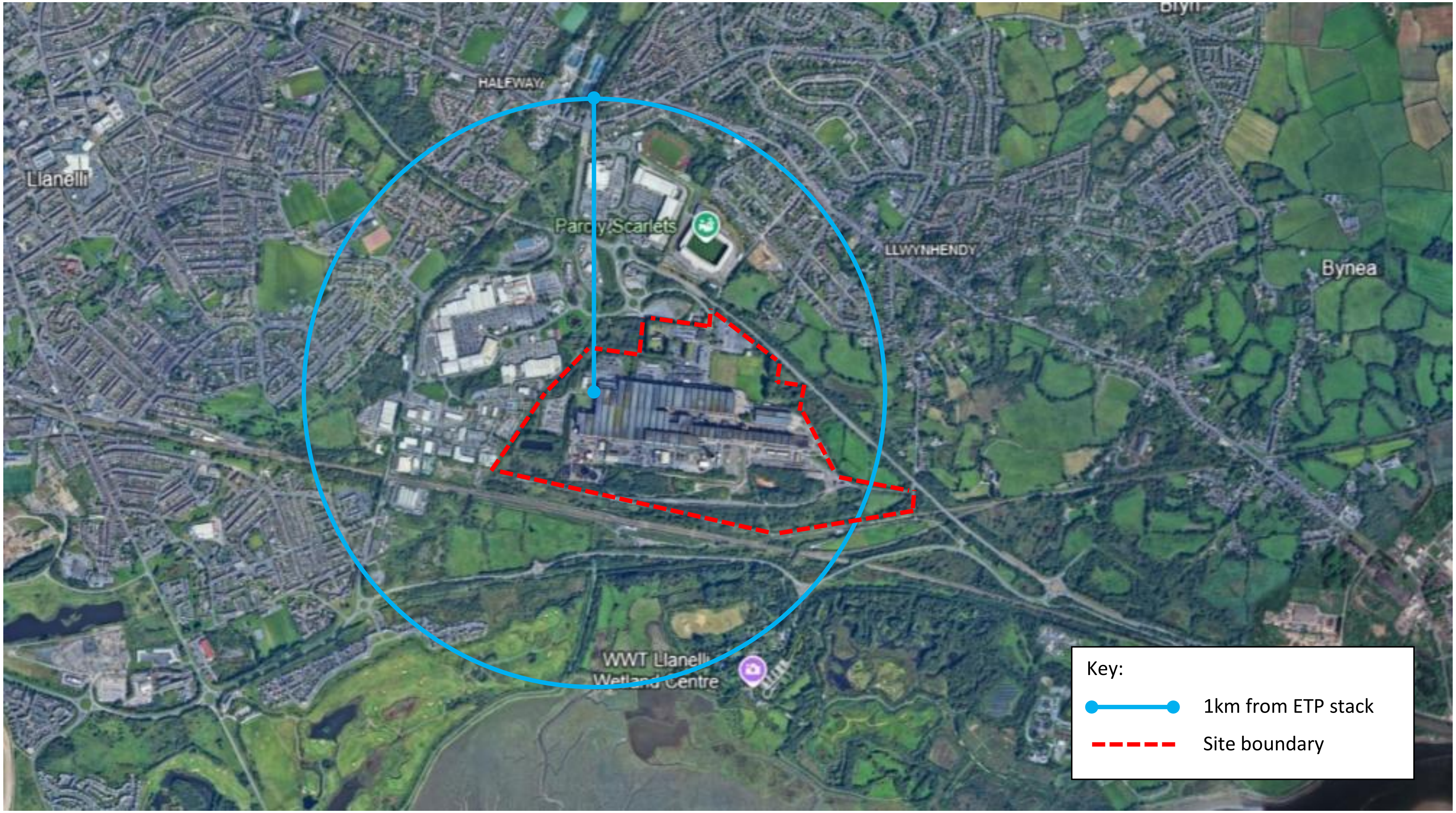

Figure 38*: Overhead view of the Trostre Works showing the site boundary and area within a 1 km radius of the exhaust stack from the ETP line*

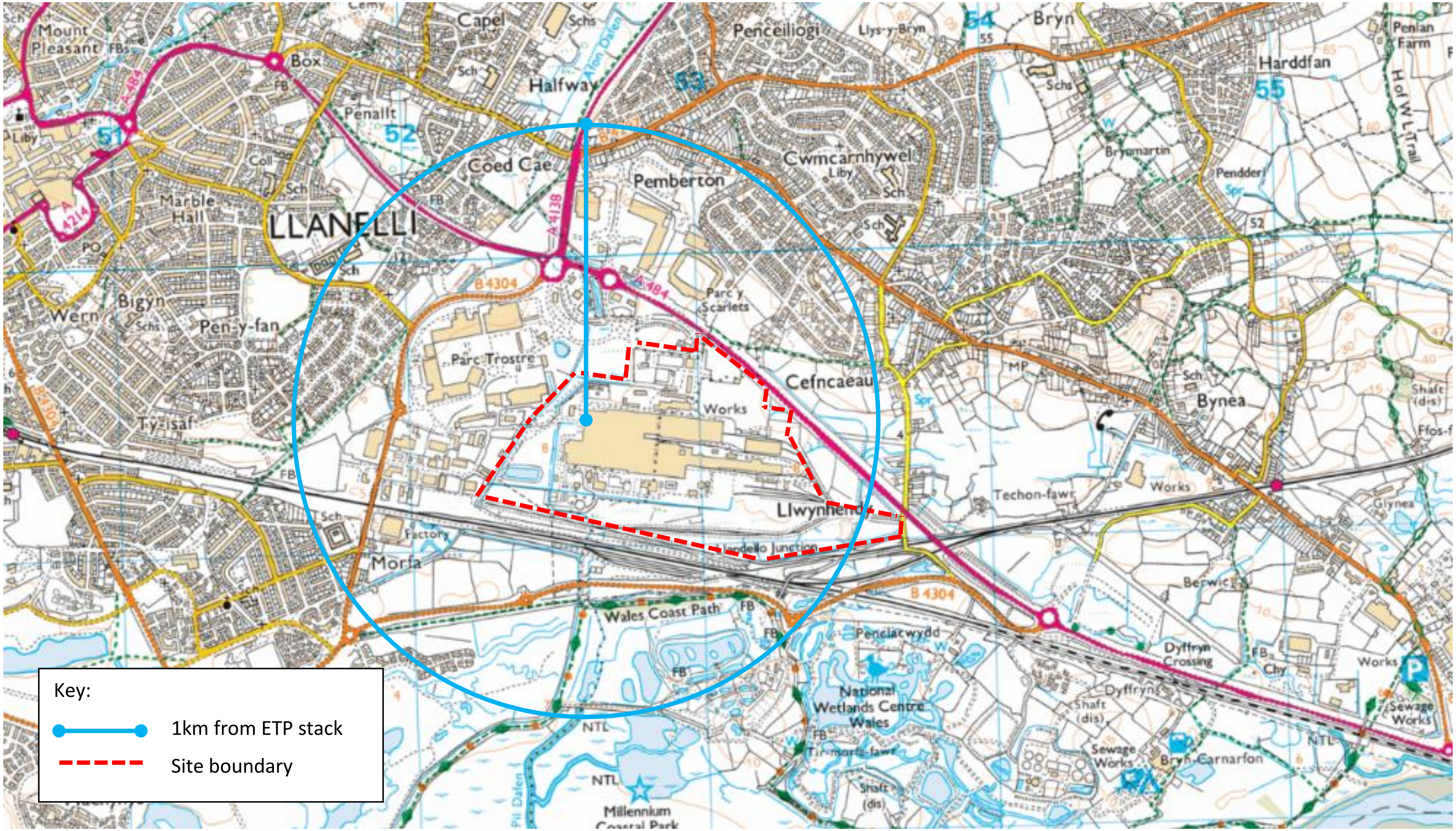

__Figure 39__: OS map (1: 25,000 scale) showing the Trostre Works site boundary and area within a 1 km radius of the exhaust stack from the ETP line

As discussed, RAC-derived linear reference dose response relationships describe the additional (excess) risk of the general population of fatal lung cancer and of developing intestinal cancer due to exposure to Cr(VI). According to the RAC document, the excess lifetime lung cancer mortality risk for the general population is 2.9×10^{-2} per µg Cr(VI)/m^3 and the excess lifetime intestine cancer risk for the general population is 8×10^{-4} per µg Cr(VI)/kg.bw/day. These values are used in the risk assessment. The dose-response relationships for the general population assumes exposure occurs over a 70-year period (24 hours a day, 7 days a week) and assumes there is no minimum threshold for these health effects.

These excess lifetime risk values are adapted for use in the application for authorisation by factoring for the duration of the review period requested (10 years) as opposed to 70 years. The assessment considers everyone in the general population to be a resident as a worst case, although in reality the majority of those within 1km of the site will be workers at the Trostre Works (employees and permanent contractors), workers at other nearby businesses, and transient populations, e.g. visitors to nearby retail sites. As the dose-response relationship relates to mortality for lung cancer and incidence for intestinal cancer, the detailed methods for the cost calculations for lung cancer and intestinal cancer differ accordingly.

The approach to calculating fatal and non-fatal lung cancer cases and associated costs is consistent with the approach described for workers.

The age-standardised five-year survival rates for small intestinal cancer in the UK (average of men and women) is 53%, meaning the UK fatality rate for intestinal cancer is 47% over 5 years[23] and an additional 1.13 (=53/47) non-fatal cancer cases typically occur for every fatal cancer case in the UK. The latency period is 26 years.[24]

The additional risk of developing intestinal cancer is the product of the adjusted unit risk value and the average exposure across the population.

The health impact cost of continued use (or benefit of a non-authorisation) for intestinal cancer is calculated as the product of the total excess lifetime risk, based on exposure across the local population over the duration of the requested review period, and the adjusted value of one additional intestinal cancer case, considering both fatality and survival outcomes and rates. The valuation of avoided intestinal cancer is thus the sum of the VCM and the fatality rate multiplied by VSL.

The monetised health impacts for the general population in the vicinity of the Trostre Works site are summarised in Tables 24 and 25 below. Table 24 sets out the monetised health impacts over the requested review period (10 years) and Table 25 sets out the monetised health impacts per year of the review period. The impacts for both the default (10,000) and realistic (3,822) local populations are presented, although the realistic figures are used for the assessment.

	Lower bound (UK £)	Upper bound (UK £)
Potentially indirectly exposed local workers and residents (within a 1km radius of the site) (default) [1]		
Lung cancer [fatal & non-fatal]	916,565	1,535,333
Intestinal cancer [fatal & non-fatal]	1,057,030	2,352,051
Total for 10 years	1,973,595	3,887,384
Potentially indirectly exposed local workers and residents (within a 1km radius of the site) (realistic) [2]		
Lung cancer [fatal & non-fatal]	350,311	586,804
Intestinal cancer [fatal & non-fatal]	403,997	898,954

[23] Cancer Research UK, available at https://www.cancerresearchuk.org/health-professional/cancer-statistics/statistics-by-cancer-type/small-intestine-cancer
[24] Nadler, D.L. and Zurbenko, I.G., 2014.

Total for 10 years	754,308	1,485,758
Notes: 1 = Based on a local population of 10,000 people. 2 = Based on a local population of 3,822 people, see Table 23.		

***Table 24**: Summary of monetised health impacts for general population over the requested review period*

	Lower bound (UK £)	Upper bound (UK £)
Potentially indirectly exposed local workers and residents (within a 1km radius of the site) (default) [1]		
Lung cancer [fatal & non-fatal]	91,657	153,533
Intestinal cancer [fatal & non-fatal]	105,703	235,205
Total per year	197,359	388,738
Potentially indirectly exposed local workers and residents (within a 1km radius of the site) (realistic) [2]		
Lung cancer [fatal & non-fatal]	35,031	58,680
Intestinal cancer [fatal & non-fatal]	40,400	89,895
Total per year	75,431	148,576
Notes: 1 = Based on a local population of 10,000 people. 2 = Based on a local population of 3,822 people, see Table 23.		

***Table 25**: Summary of monetised health impacts for general population per year (considering a requested review period of 10 years)*

5.2.2 Impacts on the environment

The environmental impacts are not included in the impact assessment of the continued use, since in Annex XIV of REACH sodium dichromate is not listed for risks to the environment but for human impacts only, as a carcinogen (cat. 1B), mutagen (cat. 1B), and reproductive toxicant (cat. 1B), in accordance with Article 57(a), 57(b) and 57(c) of REACH.

5.2.3 Compilation of human health and environmental impacts

This section calculates the risk to human health relating to continued use at the Trostre Works. The table below summarises the findings of the assessment of the impact to human health of continued use of sodium dichromate for the passivation of ETP for a further 10 years, to the end of 2037.

	Excess lifetime cancer risk [1]	No. of exposed people	Est. statistical cancer cases [4]	Value per statistical cancer case (2026) GB £	Monetised excess risk [4] GB £
Workers					
Directly exposed workers [2]	1.40E-07 to 1.15E-03	70 [5]	2.26E-04 per year 2.26E-03 total	3.36 million to 5.65 million	768 to 1,287 per year 7,681 to 12,866 total
Indirectly exposed workers [3]	See below	See below	See below	See below	See below

	Excess lifetime cancer risk [1]	No. of exposed people	Est. statistical cancer cases [4]	Value per statistical cancer case (2026) GB £	Monetised excess risk [4] GB £
General population					
Local	2.70E-05 lung 1.12E-04 intestinal	3,822 (realistic)	1.03E-01 lung 4.28E-01 intestinal	3.36 to 5.65 million (lung) 0.94 to 2.10 million (intestinal)	75,431 to 148,576 per year 754,308 to 1,485,758 total
Regional	0	0	0	0	0
Totals					**76,199 – 149,862 per year** **761,989 – 1,498,625 total**

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) and is adjusted for the requested review period (10 years). As excess risks differ depending on the task, the overall minimum and maximum excess risk among of all the tasks carried out by the workers is reported.
2. Directly exposed workers perform tasks described in the worker contributing scenarios, typically characterised by a 12-hour Time Weighted Average (TWA) exposure of a representative worker.
3. Indirectly exposed workers (bystanders) do not use the substance. They have been assessed as part of the general population.
4. Per average year or over requested review period, derived from the lifetime risk of 40 or 70 years.
5. Total number of workers carrying out one or more tasks involving sodium dichromate.

***Table 26**: Summary of additional statistical cancer cases for human health*

	Per year	Over 10 years
Total releases/emissions (in kg per period)	Water: 0 kg/year Air: 5.01 kg/year Soil: 0 kg/year	Water: 0 kg Air: 50.1 kg Soil: 0 kg

***Table 27**: Summary of remaining releases to the environment*

The range of values presented predominantly reflects uncertainty in the VSL and the discount rate applied during the assessment.

The impact assessment over-estimates exposure considering, for example, the assessment assumes the general population is exposed to calculated total chromium (as a proxy for Cr(VI)) concentrations 100m from the stacks. In reality, concentrations will diminish with distance so the average concentration will be far lower.

In addition, the ECHA dose response relationship assumes no threshold for effects. However, the ETeSS study[25] on which it was based states that "*…the lower the exposure (certainly below 1µg/m^3), the more likely it is that the linear [dose-response] relationship overestimates the cancer risk*". The study further states that "*the risk estimates for … exposures lower than 1 µg Cr(VI)/m^3 might well greatly overestimate the real cancer risks. It is also considered that at progressively lower Cr(VI) air concentrations (from about 0.1 µg/m^3 downwards), cancer risks may be negligible*". The calculated air concentration 100m from the point source is 6.51E-03 µg/m^3, i.e. over 15 times lower than the concentration at which cancer risks may be negligible.

[25] ETeSS, 2013.

5.3 Non-use scenario (NUS)

The non-use scenario (NUS) is defined as what the applicant will do, and what will happen more generally, if an authorisation is refused and they must cease using sodium dichromate for the passivation of ETP. The following section constitutes the derivation of the most-likely NUS for the applicant if their application for authorisation is refused, given that there is no possibility of immediate substitution to an alternative. The assessment is based on technical and economic considerations which give rise to the choice of the most likely scenario.

5.3.1 Identification of plausible non-use scenarios

The applicant has identified and evaluated the following nine different NUS considering the likely impacts and associated responses of each, to determine the most realistic NUS in the event of a refused authorisation:

A. Product rationalisation
B. Site closure
C. Prolonged production downtime
D. Outsource passivation to a third party based outside the UK
E. Outsourcing passivation to a third party based in the UK
F. Relocation of ETP coating line
G. Stockpiling
H. Use a supplier with an upstream authorisation that covers the use

These NUS are explored further below.

Scenario A: Product rationalisation
This scenario considers ceasing the passivation of ETP at the Trostre Works but attempting to continue manufacturing non-passivated ETP (DWI products) as well as ECCS and Protact products, i.e. attempting to switch all production to products that do not require the use of sodium dichromate.

This scenario was not considered realistic by the applicant. The scenario involves the loss of all non-DWI products, which must be passivated and for which there is currently no viable alternative to sodium dichromate. This represents approximately [redacted] (public range: 50-150 Kt/year) of product, from approximately [redacted] (public range: 150-250 Kt/year) of all ETP products, a production volume required to keep continuity on the site's Continuous Annealing and Processing Line (CAPL). It also assumes that all DWI products do not require passivation, although currently one of the site's major customers requires passivated DWI products [redacted] It is possible this customer may accept a switch to non-passivated DWI products, but this is not guaranteed.

Therefore the site would lose between [redacted] (public range: 50-150 Kt/year) of ETP production. The applicant has considered whether it would be possible to compensate by increasing production of non-passivated (DWI) products although noted that there is effectively a production limit of around [redacted]. This is due to the site's total annealing capacity through both its CAPL and batch annealing lines, and also the need to continue manufacturing ECCS products on the ECCS4 production line.

Even if DWI production was run at the maximum [redacted], which is not guaranteed, this still represents a loss of approximately [redacted] (public range: 50-150 Kt/year) of ETP products, when compared to current annual output of approximately [redacted] (public range: 150-250 Kt). Even if some ETP production continued, together with existing quantities of ECCS and Protact products, the revenues and profits associated with products not reliant on the use of sodium dichromate are not able to absorb the fixed costs of operating the site. Those fixed costs are based on production levels of around [redacted] (public range: up to 400,000 Kt/year) spread across all operations. The site would therefore become unprofitable.

In addition, by not being able to continue to offer a full range of products, the applicant would not remain competitive on international markets. The site's customers expect and demand a full range of packaging steel products and were the applicant no longer able to meet this demand, customers would begin to look elsewhere. It is worth noting that the site is currently running at full capacity and the applicant expects this to continue.

It would not be possible to increase the capacity of the annealing lines (both CAPL and the batch annealing lines) without very substantial site investment. This may well not be available, especially if the market for increased volume of products is unproven, also taking into account competition from within Tata Steel itself across its different plants that serve different global markets. It would also take many years to design, install and commission new plant. During this time, the fixed costs associated with operating the site would not be absorbed and running at reduced production levels would cause significant production problems due to the level and complexity of plant integration.

It is also worth noting that production of ECCS and Protact products also relies on a REACH authorisation (for chromium trioxide) for which a review report has also been submitted to ensure continuity of production past the current review period expiry date (31 December 2027). Any reasons for refusing an authorisation for the use of sodium dichromate for ETP would likely apply to the use of chromium trioxide for ECCS.

Scenario B: Site closure

This scenario is the logical outcome of Scenario A above, which demonstrates that ceasing production of passivated ETP products renders the site unprofitable. In such circumstances, the applicant would have no choice but to cease production and close the site, with the subsequent impacts on revenue, profits, jobs and the supply chain that this entails.

As well as the impacts at Trostre itself, this scenario would also have significant implications for the applicant's customers. The applicant is the primary producer of packaging steel in the UK and the Trostre Works is well-positioned to the size and demands of the UK market. Closure of the Trostre Works would have significant implications for its customers who are heavily reliant on its products. The applicant does not have a clear picture of how its customers may respond in the event of a closure of Trostre but it is credible that it would lead to closures of (or significant restructuring within) those businesses, with packaging manufacturing operations being moved abroad.

The applicant's operations are highly integrated, meaning that the loss of the Trostre Works would have implications for the competitiveness, profitability and feasibility for operations across the wider company. Most significant would be the implications for the new EAF-based steel making facility at Port Talbot, a £1.25 billion project expected to be operational by early 2028 that will enable the applicant to supply the market with low-CO_2 steel. Once up and running, that facility will supply the Trostre Works with hot rolled coil (HRC) for future ETP and ECCS production, [redacted]. Closure of Trostre would therefore result in a loss of up to [redacted] (public range: up to 500 Kt/year) of HRC supplied from Port Talbot, from its initial projected production output of [redacted] (public range: up to 3.2 Mt/year).

The loss of up to [redacted] of HRC (public range: up to 500 Kt/year), around [redacted] of all HRC to be produced initially, would fundamentally affect the production assumptions on which the EAF facility is based. The projected [redacted] (public range: up to 3.2 Mt/year) of HRC is based on supply to other of the applicant's sites, including Trostre, Hartlepool, Shotton, Corby and Newport. The applicant would not be able to compensate for the loss of up to [redacted] (public range: up to 500 Kt/year) of HRC to Trostre by increasing volumes supplied to these other sites, as they would already be at capacity. The applicant would therefore either have to find a market for the 'excess' HRC to be produced at Port Talbot, or alternatively decrease production volumes from those currently planned.

Both of these eventualities undermine the basis upon which the EAF facility is moving ahead. Business plans were based on a production volume of [redacted] (public range: up to 3.2 Mt/year) of HRC, so it is not financially viable to simply reduce the amount of HRC to be manufactured at Port Talbot by up to [redacted] (public range: up to 500 Kt/year). Neither would it be financially viable to attempt to sell the 'excess' quantity of HRC that would become available from any closure of Trostre. HRC is a lower-value, commodity product, so selling HRC represents a significant loss in value for the applicant. In the steelmaking industry, higher added value comes from differentiation, i.e. processing finished steel products through various manufacturing techniques (including ETP and ECCS/Protact), or through product development and related services, ultimately leading to higher profitability. The more processing steps there are, the greater the value that is created. The fewer, the less financially viable and more vulnerable the model is.

Manufacturing ETP and ECCS/Protact at Trostre typically contributes at least [redacted] (public range: > £500) per tonne of added value to HRC. In addition to impacts associated with a closure of Trostre itself, ceasing production of ETP, ECCS and Protact at Trostre would result in an overcapacity of HRC at Port Talbot of up to [redacted] (public range: up to 500 Kt/year). The applicant would be forced to place this excess HRC on the market, representing a loss of up to [redacted] (public range: up to £250 million per year), in added value, if not more, This figure does not take into account any further reduction in the price of HRC due to there being excess available on the market.

The applicant's EAF project, one of the largest industrial transition projects in the UK, is crucial for the company's future success, enabling greener, more efficient, and resilient steel production, while also enhancing supply security and competitiveness. For instance, the new assets will reduce the UK's entire industrial carbon emissions by 8% (and Port Talbot's by 90%) while setting a benchmark in circularity by utilising UK scrap, reducing reliance on imported raw materials and creating more stable, locally-rooted supply chains. Closure of Trostre would undermine and destabilise the EAF business model, which is based in part on a £500 million Grant Funding Agreement (GFA) with the UK Government. The GFA recognises the importance of the green steel transition, the need to decarbonise the UK's steel sector whilst safeguarding the UK's steel sovereignty and national resilience, as well as secure steel making in Port Talbot and preserve over 5,000 jobs.

Packaging is a key market for the applicant upon whose products and services its customers are heavily reliant. It is also strategically important for the applicant to ensure diversity of its markets (such as construction, automotive, packaging and engineering) to protect it against fluctuations in those markets. For instance, when the construction or automotive sectors are down, the packaging sector will usually be up. Sales of packaging products are vital to the resilience and flexibility of the applicant's business model. Retaining or closing the Trostre Works was considered as part of the EAF business plan because manufacturing packaging steel from EAF-based HRC introduces operational challenges (given that EAF steel production primarily uses scrap steel as the primary feedstock). The decision was to retain the site, as a major recipient of the HRC to be produced at the new EAF facility.

Scenario C: Prolonged production downtime

This scenario explores a temporary cessation of production of passivated ETP at the site on the assumption that a suitable alternative (e.g. CFPA) can be further developed and implemented.

This scenario was not considered realistic. A cessation of passivated ETP, even if temporary, means the site becomes unprofitable, as explored in Scenario A above. In this case, 'temporary' means multiple years – the most promising suitable alternative (CFPA) is not likely to be available until the mid-2030s at the earliest. The applicant would not be able to sustain running the Trostre Works at a loss for this length of time. In addition, by not being able to continue to offer a full range of products, the applicant would not remain competitive on international markets. The applicant's customers would look elsewhere for their supply of packaging steel, and the applicant would likely lose market share, exacerbating the loss of revenue and profit.

Scenario D: Outsource passivation to a third party based outside the UK

This scenario involves the applicant outsourcing passivation to a third party based outside the UK where sodium dichromate is not regulated as it is under REACH. In theory, the pre- and post-passivation steps could continue at Trostre, although in reality it is likely the entire coating line operation would need to be outsourced. This is because the tin-coated surface of the steel strip would oxidize in transit without passivation, leading to discolouration of the product which is not acceptable to customers.

While this scenario considers outsourcing to a non-UK provider, sodium dichromate is currently subject to authorisation in the EU and so the provider would currently need to be located outside the EU too. However, the European Commission has currently proposed to move the regulation of Cr(VI) substances from authorisation to restriction, following which EU businesses could continue to passivate ETP using sodium dichromate if they meet the conditions of restriction. These currently involve meeting use conditions, and worker and environmental exposure limits.

In any case, this scenario is considered unrealistic for the following reasons:

- Given the high level of plant integration, it would be technically very challenging to simply remove passivation (or even a coating line) from the overall ETP production process and would lead to upstream stoppages.
- The existing very high production volumes (of around [redacted]) (public range: 50-150 Kt/year) of passivated ETP means it is unlikely there would be any service provider immediately available and capable of meeting the applicant's needs. Existing non-UK packaging steel producers are likely to have order books that are already sufficiently full to mean they would not be able to increase production volumes to the extent necessary (they, like the applicant, are likely to be integrated steelmakers).
- It would take many years for any third party to build a new plant, or build a new line at an existing plant, to deliver the required production volumes. As a result, it would likely be necessary to identify and qualify a number of third party providers to be able to deliver the quantities required.
- From a practical perspective, the transport costs and logistics associated with the use of even one third party, let alone several, would be prohibitive. It is likely that damage rates and waste would increase significantly.
- In addition, any third party would likely be a competitor of the applicant and so it would not be commercially desirable to place the work with them.
- From a quality and safety perspective, the applicant's customers expect a high level of integration. The products made at Trostre are used, to a large extent, for food packaging, which is highly regulated to ensure it is safe for food contact and does not pose health risks. Outsourcing introduces quality and compliance risks that are likely to be perceived as a retrograde step by the applicant's customers. These risks would be increased if several third parties were used, as it would be very difficult, if not impossible, to trace individual packaging items back to source if issues were identified (or to manage effective product recalls). Maintaining the site's AA+ rating against the BRCGS Global Standard for Packaging Materials is particularly important in this context (this demonstrates the site is providing products that are quality assured, legally compliant and authentic).
- The increase to the cost of goods sold (COGS) due to transport, logistics, third party charges, quality issues and the potential impact of tariffs would result in a higher product cost which would make the applicant uncompetitive and would therefore significantly affect market share.

Scenario E: Outsource passivation to a third party based in the UK

This scenario is similar to Scenario D above but involves the use of a third party based in the UK (or the EU) who already holds an authorisation for the use of sodium dichromate to passivate ETP.

However, this scenario is considered unrealistic for the following reasons:

- The applicant is not aware of any UK-based business that holds a relevant authorisation, or is currently in the process of applying for an authorisation, covering the applicant's use. Certain other authorisations (or applications for authorisation) cover passivation using sodium dichromate but are for different uses that would not cover the applicant's use, e.g. uses for the aerospace and defence sectors only.
- Even if a UK-based business had its own authorisation that could cover the applicant's use, outsourcing still brings with it all the issues discussed in Scenario D above, i.e. very significant delay, quality, safety, commercial and practical obstacles.

Scenario F: Relocation of ETP coating line

This scenario considers relocating the ETP coating line to a Tata Steel facility outside the UK where the use of sodium dichromate is not regulated as it is under REACH.

Given that Tata Steel's operations span multiple regions worldwide, this scenario was considered but ultimately considered unrealistic for the following reasons:

- Politically such a move would be difficult, especially in the context of the forthcoming EAF project, including the £500 million GFA agreed with the UK Government.
- The scenario would require a new facility, or a new production line within an existing facility. This would take many years to implement, during which time there would be no revenue or profit generated from passivated ETP products. As noted in Scenario A above, this would render the site unprofitable.
- During this period of downtime, existing customers would be forced to source passivated ETP products from elsewhere. When production resumes, a significant loss of market share can be expected which would be difficult to recover.
- Even on resumption of production, passivation outside the UK would bring with it transport and logistics issues that would be prohibitive, given the quantities of raw materials and finished products concerned and their weight.
- Any such move would require significant capital expenditure which is not guaranteed, especially in light of the increased transport and logistics costs.
- More generally, it makes little commercial sense in the steelmaking industry to manufacture in one territory for supply into another. Steel companies invest in a particular territory to sell into that market, not another. The applicant's ETP output primarily serves the UK market. Offshoring production for the UK market would add significantly to the cost of its products. If the applicant were to relocate, it would be offshoring production for offshore markets, not the UK market.

Scenario G: Stockpiling

This scenario involves attempting to build up sufficient backstock of products that have been passivated using sodium dichromate while an alternative is developed.

This scenario was quickly ruled out as unrealistic as it would not be possible – the Trostre Works ETP line is already at capacity with no headroom for the enormous increase in production that this scenario would necessitate, nor space to store all the resulting products.

Scenario H: Use a supplier with an upstream authorisation that covers the use

This scenario involves moving from a downstream user authorisation held by the applicant to an upstream authorisation, e.g. an authorisation held by a supplier of sodium dichromate.

This scenario was also quickly ruled out as the applicant is not aware of any existing authorisation for sodium dichromate under UK REACH that covers their use. Similarly, the applicant is not aware of any new or review report applications currently in process that cover their use. Even if there were, it is reasonable to speculate that an upstream authorisation application would be refused for similar reasons as any refusal to grant the applicant its review report authorisation application.

5.3.2 Conclusion on the most likely non-use scenario

Scenario B (site closure) was selected on the basis that it is the only credible option. All other scenarios can be ruled out as unrealistic. Should an authorisation not be granted, the applicant would immediately be forced to cease the passivation of ETP using sodium dichromate, rendering the site unprofitable and which would in turn lead to permanent site closure. The impact of a refused authorisation would travel far beyond the Trostre Works, with significant impacts on customers reliant on the applicant's packaging steel products. It would also undermine and destabilise the £1.25 billion EAF business model and the move to green steelmaking.

5.4 Societal costs associated with non-use

This section assesses the socio-economic impacts associated with non-use, in light of the selected NUS, to enable those to be compared to the applied for use scenario. This difference between the applied for use scenario and the most likely NUS can be seen as equivalent to the benefits of granting an authorisation.

Based on the assessment of non-use scenarios, it has been shown that NUS Scenario B is the most likely scenario to be implemented in case an authorisation is refused, which provides the basis of the assessment. Economic impacts are considered from the point at which a refused decision takes effect, assumed for the purpose of this assessment to be 31 December 2027, i.e. end of the current review period, and are discounted to the base year 2026 (date of application for authorisation). EBITDA (Earnings before Interest, Taxes, Depreciation, and Amortisation) is used as a financial indicator for profits, where relevant. A 4% discount rate is used, in line with ECHA guidance.

5.4.1 Economic impacts on the applicant

Economic impacts of a refused authorisation have been evaluated where possible with reference to ECHA's guidance on assessing changes in producer surplus.[26] It aims to assess the net effect of a refused versus granted authorisation considering that losses or gains at the applicant may be partially or wholly offset by corresponding losses or gains by, for example, competitors. The aim is thus to disregard impacts that may be offset elsewhere in society from the assessment.

In the NUS, i.e. if the authorisation is not granted, the Trostre Works would close permanently, losing the future forecast profitability of the plant. Forecast profits are detailed in the table below, over the requested 10 year review period, and represent foregone profits (in terms of loss of EBITDA) from the date of a refused authorisation (1 January 2028, i.e. immediately following the end of the current review period).

[26] ECHA, 2021 (b).

FY	26/27	27/28	28/29	29/30	30/31	31/32
Forecast EBITDA (£, m)	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Public range (£, m)	30 - 60	30 - 60	20 - 50	20 - 50	20 - 50	20 - 50
FY	**32/33**	**33/34**	**34/35**	**35/36**	**36/37**	**37/38**
Forecast EBITDA (£, m)	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Public range (£, m)	20 - 50	20 - 50	20 - 50	20 - 50	20 - 50	20 - 50

Table 28*: Forecast EBITDA over the requested review period*

ECHA's guidance recommends a period of 4 years of profit losses should be used for assessing producer surplus losses when suitable alternatives are not generally available (no-SAGA). The AoA demonstrates that there is no suitable alternative generally available to the applicant and so the use of the no-SAGA approach is appropriate. However, the guidance also sets out criteria which may justify extending this default period based on case-specific factors, as follows, and which the applicant believes apply in their circumstances:

- **Competition**: Producing ETP requires substantial capital investment in specialised equipment, such as electrolytic coating lines, rolling mills and annealing furnaces. These facilities are not only expensive but also take considerable time to install and commission, and must be operated by highly skilled personnel. New entrants would also need to achieve regulatory compliance not only with the authorisation requirements under REACH but likely also legislation on major accident hazards (COMAH) and environmental permitting (EPR).

  The ETP production process is also tightly integrated with both upstream steel supply and downstream packaging customers. Establishing reliable supply chains and building customer relationships takes time and trust, especially in a business-to-business market where packaging manufacturers rely on consistent quality and supply. Switching suppliers is not trivial due to qualification processes and food safety standards.

  While ETP can also be imported from outside the UK, this route presents its own barriers. Importing involves longer lead times, higher transport costs and potential customs and border delays, particularly in the post-EU Exit context. These logistical challenges limit the flexibility of UK-based packaging manufacturers who often rely on just-in-time delivery.

- **Market share**: Given that the applicant holds approximately [redacted] (public range: >70%) of the UK market for ETP and is the only domestic manufacturer, the market is not contestable in the short to medium term, and losses from closure of Trostre in the NUS would not be offset by gains to rival firms within the UK. If Trostre were forced to close, the UK market would lose its only domestic producer, and the entire volume the applicant currently supplies would need to be replaced by imports. Given the logistical challenges, potential supply chain disruptions and the time required for foreign producers to scale up capacity or reallocate supply, it is unlikely that this transition could happen smoothly or quickly. Moreover, imported ETP may not be a perfect substitute in terms of lead times, flexibility or customer relationships, particularly for food packaging applications where quality and reliability are paramount.

- **Specialisation**: Although ETP production methods are generally known within the industry and not heavily protected by patents, there are confidential aspects of the applicant's specific process that contribute to their competitive advantage. These aspects represent intangible assets that are difficult for competitors to replicate quickly or reliably.

  Just as important are the applicant's long-standing and close relationships with its customers. In the steel packaging sector, especially for food applications, customers place a high value on consistency, reliability and trust. These relationships are built over years through technical collaboration, product qualification and service responsiveness. If Trostre were to close, the applicant's customers would not simply switch to another supplier overnight. They would face disruption, requalification processes and uncertainty about whether alternative suppliers could meet their specific requirements.

- **Location**: The applicant's main competitors in the ETP market are located outside the UK, primarily in continental Europe. Any gains they might make in the NUS, such as increased sales or market share, are not counted in the socio-economic analysis. This means that the losses to the UK economy in the event Trostre is forced to close would not be offset by gains elsewhere. The entire domestic supply of ETP would be lost and the UK would become fully dependent on imports. These imports would only marginally contribute to UK employment and tax revenue, and would introduce additional risks such as supply chain disruption and loss of strategic capability in steel packaging.[27]

In such circumstances, the applicant considers a longer time period for producer surplus loss is appropriate and therefore will consider 5 years of profit losses in this assessment. These profit losses would commence on 1 January 2028, which is when the effects of a refused authorisation would commence, i.e. immediately following the end of the existing review period.

With reference to Table 28 above, forecast profits for 5 years from financial year 2028/29 total [redacted]. Applying a standard social discount rate of 4%, this results in a forecast profit loss of [redacted] (public range £75 million to £200 million).

ECHA guidance also notes that any residual values from the sale or scrappage of tangible or intangible assets should be deducted from the calculated profit losses. The Trostre Works is a highly specialised facility producing up to 400,000 tonnes per year of tin, chromium and polymer-coated steels for packaging. The plant has numerous certifications and has undergone significant upgrades in its history, including energy efficiency improvements and waste recovery systems. However, in the event of sale or scrappage, it is expected that the plant and its inventory would only generate a relatively low sale value, as the plant was designed for the specific needs of the applicant. The plant's specialisation and integration mean that many assets may not be easily repurposed by others. It may be possible to sell some equipment which will have a certain market value, particularly standard items like motors, pumps or drives. However, the resale value of such equipment is difficult to predict reliably as it depends on age, condition and market demand.

Conversely, if the authorisation is not granted to the applicant, there will be high decommissioning costs associated with ceasing production at Trostre. For a facility like Trostre, these costs could include:

- Dismantling and removal of production equipment
- Demolition of buildings and infrastructure
- Utility disconnection and site clean-up
- Environmental remediation
- Waste disposal and recycling
- Regulatory consents, including planning consents and permit surrender
- Contractual/commercial obligations, e.g. costs associated with termination clauses
- Monitoring and compliance reporting

The applicant has not attempted to monetise either the residual values from sale/scrappage of assets or the decommissioning costs as these are difficult to reliably characterise. However, the residual value of assets is expected to be low, whereas the decommissioning costs are expected to be high, meaning that the net effect could be negative. If so, this would add to, rather than detract from, the economic impacts faced by the applicant in the NUS.

[27] House of Commons Library, 2025.

This effect could be reduced if it was subsequently possible to sell the Trostre site, especially for residential construction. It is possible that Trostre's location may be seen as attractive for redevelopment, particularly given its proximity to major roads, existing infrastructure and commercial amenities. However, large industrial sites like Trostre face substantial barriers to redevelopment. Regeneration of former industrial areas in the UK is often constrained by land contamination from historical industrial activity, complex remediation requirements, weak local economies and labour markets, and planning and infrastructure limitations.[28] The applicant is also the major employer in the region and a key economic anchor for Llanelli. Without the applicant's presence, the attractiveness of local development diminishes. In addition, selling the site for residential development may not be practicable because this typically requires the highest standard of remediation and selling the site for commercial and/or industrial development may not be feasible because the site is already surrounded by a number of commercial and industrial parks.

Due to the high uncertainties, no further adjustments are made to the calculated profit losses described above.

5.4.2 Economic impacts on the supply chain

5.4.2.1 Impacts on the applicant's suppliers

The applicant purchases materials such as chemicals, fuels, bulk gases, machinery spares, consumables, utilities such as heating and electricity, and services such as logistics, maintenance, external security and other services from several suppliers. Most of these materials and services that are needed to manufacture the applicant's products are purchased within the UK from a multitude of (often local) companies.

The table below describes the applicant's average annual spend on materials and services using information from the previous five financial years.

Spend category (£, m)	FY 20/21	FY 21/22	FY 22/23	FY 23/24	FY 24/25	Average
Sodium dichromate cost	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Operating supplies	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Carriage and shipping charges	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Electricity	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Bulk gases	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Water	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Fuel oil	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Hire of plant & equipment (without personnel)	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Hire of plant and equipment (with personnel)	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Hire of personnel	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Totals	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Public ranges	**30 - 50**	**40 - 60**	**70 - 90**	**70 - 90**	**50 - 70**	**50 - 70**

Table 29: *Spending by the applicant on materials and services*

[28] House of Lords Library, 2024.

In addition, the table below describes the current annual values of service contracts between the applicant and various service providers.

Area	Contractor	Activity	Annual contract cost (£, m)	Headcount
Maintenance	[redacted]	Mechanical	[redacted]	[redacted]
		Electrical	[redacted]	[redacted]
		Civils	[redacted]	[redacted]
		Anode cast house	[redacted]	[redacted]
		Lubrication & Volk driver	[redacted]	[redacted]
	[redacted]	Scaffolding	[redacted]	[redacted]
Hires and leasing	Veolia	Effluent plant costs, contract waste charges, steam costs, capital costs	[redacted]	[redacted]
	[redacted]	Scrap management, FLT hire	[redacted]	[redacted]
	[redacted]	Stores	[redacted]	[redacted]
		Cleaning	[redacted]	[redacted]
		Packing	[redacted]	[redacted]
	[redacted]	Site security	[redacted]	[redacted]
Totals			[redacted] **(Public range: 5 – 15)**	[redacted] **Public range: > 150)**

Table 30*: Contract values between the applicant and its service providers*

In the NUS, i.e. the closure of the Trostre site, such spending would cease and therefore the applicant's suppliers of materials and services would no longer realise those revenues. The most significant socio-economic impacts from a non-granted authorisation will be suffered by those small and medium size UK companies that currently supply large amounts of raw materials or services exclusively or mainly to the applicant. For these suppliers, at a minimum, some downsizing or, in the worst cases, closure can be expected. Some other (often larger) UK suppliers, even if they do not rely just on the applicant's purchases, might potentially face reduced sales, profit losses and negative social impacts in terms of job losses. Conversely, for companies for which the applicant's business represents a minimal part of their revenues would only be temporally impacted until they find other customers.

As a consequence, there will be significant impacts on many of the applicant's suppliers leading to additional profit and job losses in the supply chain. The applicant has no information about the profits generated by its suppliers as a result of its spending on the materials and services outlined in the tables above, nor can it reliably predict how its suppliers might react to the loss of revenue in terms of downsizing or job losses.

In the absence of detailed financial data from each supplier, the applicant has instead applied a conservative average profit margin of 5% to its total annual spend on goods and services to estimate the producer surplus loss across its suppliers. A 5% profit margin is used as this is a suitably conservative assumption, which helps avoid overstating the impacts while still capturing meaningful economic loss.

The applicant's average annual spend on materials and services is [redacted] (public range £50 million to £70 million) and the current annual service contract costs are [redacted] (public range £5 million to £15 million). Applying a 5% margin would suggest a [redacted] (public range £2.75 million to £4.25

million) annual producer surplus loss across its suppliers. Over a 5-year no-SAGA period, and applying a standard social discount rate of 4%, this would amount to [redacted] (public range £10 million to £16 million).

The estimated loss does not account for costs to the applicant associated with contract termination nor additional impacts on suppliers such as job losses, business closures or secondary economic effects, which are likely to be significant for high-dependence suppliers.

5.4.2.2 Impacts on the applicant's customers

The closure of the Trostre Works would have significant and far-reaching consequences for the applicant's customers who rely on the site's production of ETP, ECCS and Protact steel packaging products. As the only domestic manufacturer of these products in the UK, and with a [redacted] (public range: >70%) market share in 2025, Trostre plays a critical role in ensuring the availability of high-quality steel packaging materials for a wide range of applications, particularly in the food and beverage sector.

Many of the applicant's customers are highly dependent on the site's ability to supply consistent, reliable and compliant products. These customers have developed long-standing relationships with the applicant, built on trust, technical collaboration and supply chain integration. The sudden loss of this domestic supply would disrupt their operations, leading to delays, increased costs and the need to requalify alternative materials or suppliers. This is especially problematic in sectors like food packaging, where regulatory compliance, hygiene standards and product quality are paramount.

For UK-based customers, the loss of domestic supply would likely result in increased reliance on imports, which introduces logistical challenges, longer lead times and reduced flexibility. These changes could lead to production bottlenecks, missed delivery schedules and reputational damage. For some customers, particularly those with limited access to alternative suppliers or specialised requirements, the impact could be severe, potentially requiring changes to product design, packaging formats or even market strategy. International customers may also be affected, especially those who value the quality and consistency of Trostre's products and have built their supply chains around its output. While they may have access to other suppliers, the transition would not be seamless and could involve significant costs and operational risks.

In summary, the closure of Trostre would not only affect the site itself and its employees, but also ripple outward to its customer base, many of whom would face disruption, increased costs and strategic uncertainty. These impacts are not considered in the quantitative impact calculations as the scale and term of the effect are difficult to reliably characterise. Nevertheless, the impacts are real and material, and therefore should be considered as part of the broader socio-economic consequences of a non-use scenario.

5.4.3 Economic impacts on competitors

In case of a refused authorisation, the applicant would be forced to cease manufacturing at Trostre. As the demand for steel packaging would continue, it is expected that existing and new competitors with an established manufacturing base outside the UK would take over the position in the market left by the applicant. The economic impact on competitors is therefore likely to be positive, approximately equal to the value of the lost sales suffered by the applicant.

This means that production activities using sodium dichromate would transfer from one party to another. Considering the current location of competitors, the status of individual competitors with regard to the absence of regulatory requirements outside the EU or existing approvals to carry on using sodium dichromate for passivation inside the EU (both in terms of existing authorisations and the ability to meet the conditions of the forthcoming EU REACH Cr(VI) restriction), and the absence of regulatory restrictions relating to the import of Cr(VI)-passivated ETP into the UK, it is expected that all activities would transfer from the UK to suppliers outside the UK. There would be an associated transfer of economic activity, including profit, and (importantly) risk to human health associated with these activities from the UK to the countries in which the new suppliers are based.

This represents a clear transfer of costs from the UK to the EU and beyond. The economic value associated with domestic production, including revenues, employment, investment and supply chain activity, would be lost to the UK and gained by non-UK producers. While the lost revenues and profits to the applicant and its supply chain have been accounted for elsewhere in this SEA, this transfer of costs highlights the broader societal impact of the authorisation decision. It reflects a redistribution of economic activity across borders, rather than a net loss or gain to society as a whole, and underscores the strategic implications of losing domestic capacity in critical packaging materials.

5.4.4 Wider socio-economic impacts

5.4.4.1 Impacts to workers

The closure of Trostre foreseen in the NUS would mean the permanent loss of [redacted] workers currently employed by the applicant at the site. This figure does not include the applicant's employees who work at other locations but whose jobs are reliant, in whole or part, on Trostre operations, nor approximately [redacted] permanent contractors at the site.

ECHA[29] and Dubourg[30] set out an approach to valuing the social costs from job losses considering:

- the value of lost output/wages during the period of unemployment
- the cost of acquiring a new job
- recruitment and training costs
- scarring costs relating to compulsory redundancy
- the value of leisure time during the period of unemployment

The ECHA approach and associated data from the Dubourg report values the social costs at 1.88 times the annual gross wage including employer taxes and 2.09 times the gross annual salary excluding employer taxes of each worker in the UK. This is lower than the value of 2.7 recommended by ECHA and can therefore be considered conservative.

The unemployment figure associated with a refused authorisation is [redacted]. This value has been used in the assessment of social costs. The most recent Trostre salary data (from the 2024/2025 financial year) is used to calculate the social impacts of unemployment in the NUS. Although jobs would be lost from the date of a refused authorisation, assumed to be 1 January 2028 for these purposes, the salary data have not been adjusted for inflation from the 2026 base year.

	Cost per worker £ [1]	Net number of workers not employed in NUS	Total cost £ [2]
Social cost of unemployment	[redacted]	[redacted]	[redacted]
Public range	80,000 – 120,000	-	50,000,000 to 75,000,000
Notes: 1 = Average annual salary of [redacted], multiplied by the Dubourg figure of 1.88 to give the cost per worker. 2 = Cost per worker multiplied by the number of workers.			

***Table 31**: Social impacts of lost employment opportunity in the NUS.*

[29] ECHA, 2016 (c).
[30] Dubourg, 2016.

The social cost of unemployment is therefore valued at [redacted] (public range £50,000,000 to £75,000,000) in the base year.

5.4.4.2 Other impacts

The closure of the Trostre Works would have very significant social consequences for Llanelli and the wider South Wales region. As the largest employer in Llanelli and a cornerstone of the local economy, Trostre is not only a source of income for hundreds of families but also a symbol of the town's industrial heritage and identity. Its loss would represent more than just job displacement – it would erode the social fabric of a community historically built around steelmaking. The ripple effects would extend to local businesses, schools and public services, all of which are sustained in part by the economic activity generated by Trostre and its workforce.

***Figure 40**: Image from the Tin Works exhibition at the National Museum of Wales (Swansea Waterfront) featuring a display of 146 employee and contractor portraits on tinplate, a project by artist Hilary Powell, as part of the site's 70th-anniversary celebrations in 2022.*

There would also be significant impacts on the applicant's integrated operations and workforce. The applicant operates a highly integrated network of production sites, with Trostre playing a critical role in the downstream processing of HRC into high-value ETP, ECCS and Protact products. The closure of Trostre would disrupt this integration, undermining the operational and financial viability of other sites such as Port Talbot, Shotton, Hartlepool, Corby and Newport. The applicant's sites are interdependent, and the loss of one node in the network, particularly one as strategically important as Trostre, would destabilise the entire system. This could lead to further job losses, reduced investment and diminished competitiveness across the applicant's operations, compounding the social impact well beyond Llanelli.

Prior to the closure of its blast furnaces, Port Talbot supplied Trostre with HRC produced domestically. During the transition period while the new EAF is being constructed, Trostre has had to source HRC from various non-UK suppliers. When the Port Talbot EAF becomes operational, domestic supply is anticipated to resume [redacted]. The EAF facility is designed to produce approximately [redacted] (public range: up to 3.2 Mt/year). Trostre has the potential to consume up to [redacted] (public range: up to 500 Kt/year) of that output through its manufacture of ETP, ECCS and Protact. If Trostre were to close, Port Talbot would therefore face an overcapacity of up to [redacted] (public range: up to 500 Kt/year) of HRC relative to the existing downstream configuration. The applicant would be forced either to reduce production or sell the excess as a lower-value commodity, resulting in foregone added value. The resulting loss could be up to [redacted] per year (public range: up to £250 million per year) at typical differentials, and may be higher once second-order effects such as further reductions in HRC price due to excess market availability are taken into account.

[redacted]

[redacted] the scale and duration of these impacts cannot be quantified with confidence. For this reason, they are not included in the numerical impact calculations presented in this assessment.

However, this [redacted] does not diminish the magnitude of the socio-economic impacts arising from a closure of Trostre. [redacted] Trostre's closure would remove a significant revenue and margin contribution from the UK business. Many functional fixed costs would have to be funded from a reduced revenue base, effectively increasing overhead rates for remaining assets. That dynamic would erode the economics of the wider portfolio and undermine the financial model underpinning the applicant's £1.25 billion EAF investment at Port Talbot, one of the most significant industrial decarbonisation initiatives underway in the UK and supported by a £500 million Grant Funding Agreement with the UK Government.

In addition to these direct commercial effects, closure of Trostre would have wider repercussions. It would result in the permanent loss of skilled employment and specialist know-how embedded at Trostre, put at risk over 5,000 permanent jobs reliant on the success of the Port Talbot transition, disrupt established supply relationships with food packaging manufacturers, and reduce UK self-sufficiency in packaging steels. It would weaken the strategic rationale for domestic production of critical materials aligned to the UK's decarbonisation and circular economy goals, and it would undermine investor confidence in long-duration transition investments such as the Port Talbot EAF project. Taken together, these impacts are substantial and long-lasting.

5.4.5 Compilation of socio-economic impacts

The socio-economic impacts that are expected from a refused authorisation for sodium dichromate, taking effect from the start of 2028 (compared to the situation of continuing the use of the substance) are summarised in Table 32 below. This presents the findings considering a 5-year (no-SAGA) horizon for economic impacts for the applicant to the end of 2032.

Description of major impacts	Monetised / quantitatively assessed / qualitatively assessed impacts	
1. Monetised impacts	**£ [per year]** [1]	**£ [Over 5-year no-SAGA period]**
Economic impacts on the applicant	[redacted] Public range: £15 million to £40 million	[redacted] Public range: £75 million to £200 million
Economic impacts on the supply chain	[redacted] Public range: £2 million to £3.2 million	[redacted] Public range: £10 million to £16 million
Economic impacts on competitors	Not quantified	
Social cost of unemployment	[redacted] Public range: £10 million to £15 million	[redacted] Public range: £50 million to £75 million
Sum of monetised impacts	[redacted] Public range: £27 million to £58.2 million	[redacted] Public range: £135 million to £291 million
2. Additional quantitatively assessed impacts		
N/A	Not considered in this assessment	
3. Additional qualitatively assessed impacts		
Wider socio-economic impacts	Very significant, but not possible to quantify reliably (See sections 5.4.2.2 and 5.4.4.2 for details)	
Notes: 1. Per average year during the time horizon used in the analysis		

***Table 32**: Socio-economic costs associated with non-use.*

5.5 Combined impact assessment

The different impacts that are expected from non-authorisation of the use applied for can be compared to the remaining risks associated with the continued use of sodium dichromate. The findings are summarised in the table below, as relevant.

Societal costs of non-use		Risks of continued use	
Monetised impacts (£)	[redacted] per year Public range: 27,000,000 to 58,200,000 per year [redacted] over 5 years Public range: 135,000,000 to 291,000,000 over 5 years	Monetised excess risks to directly and indirectly exposed workers (£)	768 to 1,287 per year 7,681 to 12,866 over requested review period
Additional quantitatively assessed impacts	-	Monetised excess risks to the general population (£)	75,431 to 148,576 per year 754,308 to 1,485,758 over requested review period
Qualitatively assessed impacts	See section 5.4	Qualitatively assessed risks	-

Societal costs of non-use		Risks of continued use	
Summary of societal costs of non-use (£)	**[redacted] per year** **Public range: 27,000,000 to 58,200,000 per year** **[redacted] over 5 years** **Public range: 135,000,000 to 291,000,000 over 5 years**	**Summary of risks of continued use (£)**	**76,199 – 149,862 per year** **761,989 – 1,498,625 over requested review period**

***Table 33**: Societal costs of non-use and risks of continued use*

The aggregated societal benefits of the continued use sodium dichromate for the manufacture of ETP are expected to be at least [redacted] (public range: £135 million to £291 million) over the period, whereas the aggregated monetised health impacts of the use applied for are expected to be between £0.76 million to £1.50 million (lower and upper bounds over the review period requested by the applicant). Therefore, over the 10 years, the benefits outweigh the risks by a factor of over [redacted] (public range: > 100). This is a very conservative estimate taking into account the lower values for the negative impacts and the higher bound for the human health impacts.

5.6 Sensitivity analysis

The ECHA guidance on SEA[31] proposes an approach to conduct an uncertainty analysis. This approach provides three levels of assessment of uncertainties: qualitative, deterministic and probabilistic. The ECHA Guidance further indicates that the level of detail and dedicated resources to the assessment of uncertainties should be proportionate to the scope of the SEA.

As the socio-economic impacts for the uses applied for outweigh the (worst-case) health impacts of the continued use by a very large factor, performing a systematic (but qualitative) analysis of uncertainties is sufficient. This analysis of the key parameters that might potentially challenge the quantitative results of the SEA and of the human health assessment helps to determine the key uncertainties, their level of magnitude (low, medium, high) as well as their direction (under- or over-estimation).

Where there is variability in the quality of the available input data, given the associated uncertainties, the applicant has sought to apply a conservative approach by overestimating human health impacts of the continued use scenario and by underestimating the socio-economic impacts of the non-use scenario.

	Details	Level of uncertainty (L/M/H)	Direction of the uncertainties (Underestimation and overestimation)
Human health impacts	Reference-dose response relationship for carcinogenicity of Cr(VI)	Medium	The reference dose response relationship for carcinogenicity of hexavalent chromium, including the assumption of linearity at low dose, is likely to overestimate human health risk.
	Exposure levels – workers	Low	Personal sampling results have been increased to reflect the potential exposure over a 12 hour shift. This is likely to overstate the actual exposure because activities liable to result in Cr(VI) exposure only occur for a relatively short period of time across a shift and are already likely accounted for in the measured data, i.e. increasing the filter

[31] ECHA, 2011.

	Details	Level of uncertainty (L/M/H)	Direction of the uncertainties (Underestimation and overestimation)
			concentration is not likely to be a true reflection of potential additional exposure over the unmonitored remainder of the shift.
	Exposure levels – general population	High	The assumption of 100m distance for the entire number of people in the vicinity of the plant likely represents an overestimation of the impact.
	Exposure levels – general population	High	Stack emissions measurements used in the assessment are for total Cr, not Cr(VI), which will overstate the presence of Cr(VI) in emissions to atmosphere from the site.
	Number of people exposed at local level	Medium	Potential for underestimation of the number of people exposed (general population) by not using default value of 10,000. Instead, 3,822 people assumed to be present within 1km radius of emission point.
	VSL and VCM values	Low	Uncertainty in and relevance of the values of a statistical life (VSL) and morbidity due to cancer (VCM) published by ECHA.
Socio-economic impacts	Quantities used	Low	Annual tonnage quoted likely to exceed actual quantities used.
	Forecast revenue and profit data for the applicant	Low	Actual revenue and profit realised may not be the same as forecast revenue and profit data. Nevertheless, revenue and profit forecasts are considered reliable and small variations are unlikely to significantly affect the overall assessment.
	Foregone profits	Medium	The baseline for the assessment considers foregone profits over a 5-year period, compared with health costs over the requested review period of 10 years (from 2028). The estimated foregone profits to 2037 are therefore provided for context and comparison. In both cases, economic costs are far greater than health costs, where both are estimated conservatively, meaning health costs are over-estimated and economic costs are under-estimated.
Substitution plan	Substitution plan timelines	Medium	Uncertainties described in section 4.3.2. Timelines have attempted to establish a suitable balance between 'best-case' and 'worst-case' scenarios.

Table 34*: Uncertainties regarding human health impacts and socio-economic impacts*

5.7 Information to support the review period

A review period of 10 years is requested for the use of sodium dichromate for the passivation of ETP. The evidence presented in this combined AoA-SP-SEA report supports such a review period as it demonstrates that:

- There are currently no suitable alternatives generally available (SAGA) to the use of sodium dichromate for the passivation of ETP that meet the applicant's key functionalities. The applicant, together with others in the steel packaging sector, has been actively seeking alternatives to Cr(VI)-based passivation for many years and has invested significant technical and financial resources in these efforts through collaborative European and global initiatives. These efforts have identified CFPA as the most advanced and credible potential alternative. However, it does not yet deliver consistent and reliable performance, particularly taking into account the diversity of customer requirements, the wide range of packaged contents and the ongoing transition to BPA-free lacquer systems. As a result, CFPA cannot presently be regarded as a suitable alternative generally available.

- Further development, optimisation and customer-specific qualification of CFPA, in combination with newly developed BPA-free lacquers, are required before substitution can be completed. These activities are inherently complex, involve multiple actors across the supply chain and are subject to significant technical and market uncertainties. While CFPA provides a realistic pathway towards substitution, its remaining deficiencies cannot be resolved within a short timeframe. A longer review period is therefore required to allow this process to progress in a technically robust and commercially viable manner.

- The majority of the applicant's products are used by the food and drink sector, which is highly regulated. The applicant must consider very carefully any changes to the current composition and manufacturing processes for its products, as these must be assessed for their potential impact on food safety and quality.

- The applicant's competitors will also supply Cr(VI)-passivated ETP products which are available for import from the EU (under existing authorisations and, in the future, in compliance with the conditions of the forthcoming Cr(VI) EU REACH restriction) or the rest of the world (where the use of sodium dichromate is not subject to comparable regulatory controls). This means that the use of sodium dichromate for the passivation of ETP will continue in the EU and the rest of the world throughout the entirety of the review period requested by the applicant, and beyond.

- Health risks for workers from the use of sodium dichromate are kept at a minimum as the production processes at the applicant's site are highly automated, a range of engineering controls are employed and directly exposed workers wear appropriate PPE (see CSR).

- The applicant's wastewater treatment and air abatement systems are able to minimise the amount of Cr(VI) reaching the environment that might represent a potential exposure risk for the general population.

- Finished products do not contain any Cr(VI) and are not harmful to end users nor to the environment.

- In this AfA, the risks of using sodium dichromate have been deliberately overstated, whereas the benefits have been deliberately understated. Using this approach, the monetised impacts to human health from continued use of sodium dichromate are estimated to be between £0.76 million to £1.50 million (lower and upper bounds over the review period requested by the applicant). On the other hand, the aggregated societal benefits of continued use of sodium dichromate are expected to be at least [redacted] (public range: £135 million to £291 million) over a 5-year no-SAGA period. Even allowing for uncertainty in both risk and benefit estimates, the benefits substantially outweigh the monetised risks by more than two orders of magnitude. This balance is not expected to change materially within the next decade, given the nature of the remaining technical and market constraints on substitution. The application therefore meets the criteria for a "long" review period in accordance with RAC and SEAC guidance.

6. Conclusions

The applicant is the largest steel producer in the UK, operating a network of manufacturing and distribution sites that play a critical role in a range of strategic supply chains, including packaging, automotive, construction and engineering. The applicant is recognised both as a supplier of high-quality steel products and as a long-term industrial partner to major domestic and international customers, contributing materially to the resilience and competitiveness of UK manufacturing.

The applicant's site in Llanelli, Carmarthenshire (the Trostre Works) is the sole producer of ETP for packaging in the UK and represents a strategically important asset within the applicant's operations. The site manufactures up to 400,000 tonnes per year of tin, chromium and polymer-coated steels used in food and beverage cans, aerosols, closures, bakeware and other consumer and industrial packaging applications. Trostre has been producing packaging steels for over seventy years and is widely regarded as a leading global supplier, exporting to more than fifty countries and supporting critical domestic food and consumer goods supply chains.

Sodium dichromate is used at the Trostre Works for the passivation of ETP. Through this process, a thin layer of metallic chromium and chromium (III) oxide is formed on the tin surface in a highly automated, controlled operation with minimal exposure and emissions. The resulting passivation layer is free of sodium dichromate and provides essential functionality, including control of tin oxide growth during storage and transport, reliable adhesion of organic coatings, compatibility with downstream forming and welding operations and long-term corrosion resistance. These properties are fundamental to the safe and effective use of tinplate in demanding packaging applications, particularly food contact uses where product integrity and consumer safety are paramount.

Sodium dichromate is listed in Annex XIV of REACH and is subject to authorisation. The applicant already holds an authorisation for its use in tinplate passivation, with a review period ending on 31 December 2027. However, the applicant needs to continue to produce ETP using sodium dichromate beyond 2027 as it has not yet been possible to substitute to any suitable alternative. This report has presented information regarding the absence of suitable alternatives, the applicant's substitution efforts and plan, and socio-economic benefits to support an extension to the authorisation.

A wide range of potential alternatives has been systematically assessed in the AoA, drawing on the applicant's own development work, collaborative industry initiatives, published literature and experience from other authorisation applications. While CFPA has emerged as the most advanced and credible potential alternative, it does not yet meet all key functional requirements for universal application, particularly when considered in combination with emerging BPA-free lacquer systems. Other alternatives assessed were found to have fundamental technical limitations or incompatibilities with tinplate processing, food contact requirements or downstream manufacturing operations. There is therefore currently no suitable alternative generally available to sodium dichromate for the passivation of ETP.

ETP is a strategically important product for the applicant and forms a substantial part of output at the Trostre Works. The applicant has invested heavily in the specialist infrastructure, process capability and technical expertise required to manufacture high-quality tinplate and its customers, including UK-based can-makers and food producers, rely on a stable and consistent domestic supply. The importance of packaging steel production was highlighted during the COVID-19 pandemic, when food packaging was designated an essential activity by the UK Government, allowing continued operation during periods of lockdown. If authorisation is not granted, and ETP production ceases, customers would be forced to source material from outside the UK. This would expose the UK food sector to supply chain vulnerabilities, increased costs and potential quality risks, while weakening domestic manufacturing capability.

The applicant has assessed the consequences of a refused authorisation and concluded that, in the absence of a technically feasible alternative, production of passivated tinplate would have to cease. Given the high level of integration at Trostre Works, this would also result in the cessation of non-passivated tinplate and ECCS production and therefore result in full site closure. The impacts would extend well beyond the site itself, affecting the applicant's wider UK operations, including the viability of the £1.25 billion electric arc furnace-based steelmaking facility at Port Talbot. Loss of Trostre would remove a critical downstream outlet for high-value steel products, undermining the assumptions and financial sustainability of the EAF project, which is supported by a £500 million Grant Funding Agreement with the UK Government and which is central to the applicant's green steel transition.

Site closure would also impact heavily on customers and downstream supply chains. If authorisation is not granted, and ETP production ceases, customers would be forced to source material from outside the UK. This would expose the UK food sector to supply chain vulnerabilities, increased costs and quality risks, while weakening domestic manufacturing capability.

Given the aims of the SEA, the analysis purposefully sought to characterise certain impacts but also, where appropriate, to undervalue socio-economic impacts, and overvalue health impacts. This approach supports confidence in the findings of the assessment.

Even on this basis, the monetised health impacts associated with continued use of sodium dichromate are estimated to be between approximately £0.76 million and £1.50 million over the requested review period (lower and upper bounds over the review period requested by the applicant). On the other hand, the aggregated socio-economic benefits of continued use are estimated to be at least [redacted] (public range: £135 million to £291 million) over a 5-year 'no-SAGA' period. The benefits therefore outweigh the risks by a factor of over [redacted] (public range: > 100), a balance that is not expected to change materially in the coming decade.

Despite the absence of a technically feasible alternative at present, the applicant remains fully committed to substitution. Significant resources have already been invested in the development and installation of CFPA capability and further work will continue in collaboration with customers and coating suppliers. However, substitution represents a complex, multi-phase and multi-actor process involving further optimisation with BPA-free lacquer systems, customer-specific pack testing, qualification and phased industrial transition. Based on the applicant's experience and the evidence presented in this report, full substitution cannot be achieved within the current review period. The applicant therefore requests a further 10 years from the end of the existing review period, reflecting a realistic, proportionate and evidence-based timeframe to pursue substitution while maintaining supply continuity, product safety and the resilience of critical UK manufacturing supply chains.

References

Court of Justice of the European Union (CJEU), 2019. *Judgment of the General Court (Fifth Chamber) of 7 March 2019 in Case T-837/16, Kingdom of Sweden v. European Commission.* Available from https://eur-lex.europa.eu/collection/eu-law/eu-case-law.html

Court of Justice of the European Union (CJEU), 2021. *Judgment of the Court (First Chamber) of 25 February 2021 in Case C-389/19 P, European Commission v. Kingdom of Sweden.* Available from https://eur-lex.europa.eu/collection/eu-law/eu-case-law.html

Dubourg, R., 2016. *Valuing the social costs of job losses in applications for authorisation*. Chester: The Economics Interface Ltd. Available from https://echa.europa.eu/documents/10162/17086/unemployment_report_en.pdf

ETeSS (Expert Team providing scientific support for ECHA), 2013. *Services to support the assessment of remaining cancer risks related to the use of chromium- and arsenic-containing substances in Applications for Authorisation*. Helsinki: ECHA. Available at https://echa.europa.eu/documents/10162/17233/carcinogenicity_dose_response_cr_vi_report_en.pdf/7158ab67-0801-4307-bf5b-30c75c15518e?t=1395235087502

European Chemicals Agency (ECHA), 2011. *Guidance on the preparation of socio-economic analysis as part of an application for authorisation*. Helsinki: ECHA. Available from https://echa.europa.eu/documents/10162/2324906/sea_authorisation_en.pdf

European Chemicals Agency (ECHA), 2013. *Risk Assessment Committee (RAC) Application for authorisation: establishing a reference dose response relationship for carcinogenicity of hexavalent chromium (RAC/27/2013/06 Rev.1)*. Helsinki: ECHA. Available from https://echa.europa.eu/documents/10162/13579/rac_carcinogenicity_dose_response_crvi_en.pdf/facc881f-cf3e-40ac-8339-c9d9c1832c32

European Chemicals Agency (ECHA), 2016 (a). *Valuing selected health impacts of chemicals: Summary of the Results and a Critical Review of the ECHA study.* Helsinki: ECHA. Available from https://echa.europa.eu/documents/10162/13630/echa_review_wtp_en.pdf/dfc3f035-7aa8-4c7b-90ad-4f7d01b6e0bc

European Chemicals Agency (ECHA), 2016 (b). *Guidance on information requirements and Chemical Safety Assessment. Chapter R.16: Environmental exposure assessment*. (Version 3.0, February 2016). Helsinki: ECHA. Available from https://www.echa.europa.eu/documents/10162/13632/information_requirements_r16_en.pdf

European Chemicals Agency (ECHA), 2016 (c). *SEAC's approach for valuing job losses in restriction proposals and applications for authorisation: SEAC/32/2016/04*. Helsinki: ECHA. Available from https://echa.europa.eu/documents/10162/17086/seac_unemployment_evaluation_en.pdf

European Chemicals Agency (ECHA), 2021 (a). *Guidance on the preparation of an application for authorisation*. Helsinki: ECHA. Available from https://echa.europa.eu/documents/10162/17235/authorisation_application_en.pdf

European Chemicals Agency (ECHA), 2021 (b). *SEAC's approach to assessing changes in producer surplus (agreed at SEAC-52 on 15 September 2021)*. Helsinki: ECHA. Available from https://echa.europa.eu/documents/10162/0/afa_seac_surplus-loss_seac-52_en.pdf

European Chemicals Agency (ECHA), 2024. *SEAC's Recommendation on Review Period: SEAC/62/2024/01 (15 March 2024, agreed at SEAC-62)*, available at https://echa.europa.eu/documents/10162/17091/seac_rac_review_period_authorisation_en.pdf/c9010a99-0baf-4975-ba41-48c85ae64861

European Chemicals Bureau, 2005. *European Union Risk Assessment Report: chromium trioxide, sodium chromate, sodium dichromate, ammonium dichromate and potassium dichromate*. Brussels: European Commission. Available from https://echa.europa.eu/documents/10162/3be377f2-cb05-455f-b620-af3cbe2d570b

European Food Safety Authority (EFSA), 2023. *Re-evaluation of the risks to public health related to the presence of bisphenol A (BPA) in foodstuffs*. Panel on Food Contact Materials, Enzymes and Processing Aids (CEP) (2023). EFSA Journal, 21(4), e06857. Available at https://doi.org/10.2903/j.efsa.2023.6857

Gharbi, O., Thomas, S., Smith, C. and Birbilis, N., 2018. *Chromate replacement: what does the future hold?*. npj Materials Degradation, 2(1), pp.1-8. Available from https://www.nature.com/articles/s41529-018-0034-5.pdf

Grand View Research, 2024. *Packaging Materials Market Size, Share & Trends Analysis Report By Material (Rigid Plastics, Flexible Plastics), By Packaging Format (Primary, Secondary), By Product, By Application, By Region, And Segment Forecasts, 2024 – 2030*. Available at https://www.grandviewresearch.com/industry-analysis/packaging-materials-market-report

Guertin, J., Jacobs, J.A. and Avakian, C.P., 2004. *Chromium (VI) handbook*. CRC press. Available from https://www.taylorfrancis.com/books/mono/10.1201/9780203487969/chromium-vi-handbook-james-jacobs-jacques-guertin-cynthia-avakian

HM Treasury, 2024. National statistics: *GDP deflators at market prices, and money GDP December 2024 (Quarterly National Accounts)*. London: HM Treasury. Available from https://www.gov.uk/government/statistics/gdp-deflators-at-market-prices-and-money-gdp-december-2024-quarterly-national-accounts

House of Commons Library, 2025. *UK Steel Industry: Statistics and policy*. London: House of Commons Library. Available at: https://researchbriefings.files.parliament.uk/documents/CBP-7317/CBP-7317.pdf

House of Lords Library, 2024. Regeneration of former industrial areas in the UK. Available at https://lordslibrary.parliament.uk/regeneration-of-former-industrial-areas-in-the-uk/

Marmann, A., Penning, J.-P., Spagnol, V. and Tschoecke, S., 2013. *Innovative packaging steel with enhanced adhesion to organic coatings based on nanostructured interphases (IPSA).* Directorate-General for Research and Innovation, Publications Office, 2013. Available from https://data.europa.eu/doi/10.2777/7870

Nadler, D.L. and Zurbenko, I.G., 2014. *Estimating cancer latency times using a Weibull model*. Advances in Epidemiology, 2014. Available from https://www.hindawi.com/journals/aep/2014/746769/

Niemiec, K., Fitrzyk, A. and Grabowik, C., 2021. *Methods of manufacture and innovations in steel aerosol cans production*. International Journal of Modern Manufacturing Technologies (IJMMT), 13. https://www.researchgate.net/publication/357327731_Methods_of_manufacture_and_innovations_in_steel_aerosol_cans'_production

ONS (Office for National Statistics), 2019. *Cancer survival in England: adult, stage at diagnosis and childhood – patients followed up to 2018*. [Accessed 14-06-2022) Newport: ONS. Available from https://www.ons.gov.uk/peoplepopulationandcommunity/healthandsocialcare/conditionsanddiseases/bulletins/cancersurvivalinengland/stageatdiagnosisandchildhoodpatientsfollowedupto2018

Słowik, M., Cępa, P., Czapla, K. and Żabiński, P., 2021. *Steel packaging production process and a review of new trends*. Archives of Metallurgy and Materials, 66(1). Available at: https://www.researchgate.net/publication/377592677_Steel_Packaging_Production_Process_and_a_Review_of_New_Trends

Zhang, B., Shi, P. and Jiang, M., 2016. *Advances towards a clean hydrometallurgical process for chromite*. Minerals, 6(1), p.7. Available at https://www.mdpi.com/2075-163X/6/1/7/htm