SUBSTITUTION PLAN

Non-confidential

Legal name of applicant(s):	Maschinenfabrik Kaspar Walter GmbH & Co. KG
Submitted by:	Maschinenfabrik Kaspar Walter GmbH & Co. KG
Date:	February 5th, 2021
Substance:	Chromium trioxide EC No.: 215-607-8 CAS No.: 1333-82-0
Use title:	Use 1: Formulation of chromium trioxide-based electrolyte for electroplating process Use 2: Chromium trioxide based functional chrome plating of cylinders used in the rotogravure printing and embossing industry
Use number:	1 and 2

CONTENTS

FIGURES

LIST OF ABBREVIATIONS

ACIMGA	Italian: Associazione Costruttori Italiani Macchine Per L'industria Grafica, Cartotecnica, Cartaria, Di Trasformazione E Affini (Association of Italian Manufacturers of Machinery for the Graphic, Paper, Papermaking, Printing and Related Machines Industries)
AfA	Application for Authorization
AoA	Analysis of Alternatives
Cr(VI)	Hexavalent Chromium
CTAC	Chromium Trioxide Authorisation Consortium
DU	Downstream users
ECHA	European Chemicals Agency
EEA	European Economic Area
ERA	European Rotogravure Association
GAA	Graphic Arts Association
R&D	Research and Development
SAGA	Suitable Alternative Generally Available
SEA	Socio-Economic Analysis

DECLARATION

The Applicant, Maschinenfabrik Kaspar Walter GmbH & Co. KG is aware of the fact that evidence might be requested by ECHA to support information provided in this document.

Also, we request that the information blanked out in the "public version" of this substitution plan is not disclosed. We hereby declare that, to the best of our knowledge as of today (February 5th, 2021) 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.

Christoph Gschossmann

CEO Maschinenfabrik Kaspar Walter GmbH & Co. KG

Date, Place: February 5th, 2021, Krailling

1. Introduction

This document presents the substitution plan for the use of chromium trioxide in the functional chrome plating of cylinders used in the rotogravure printing and embossing industry (Use 2), submitted by Maschinenfabrik Kaspar Walter GmbH & Co. KG (from here on referred to as K. Walter) as part of the application for authorization (AfA) for the continued use of chromium trioxide. A substitution plan for Use 1 (formulation of chromium-trioxide-based electrolytes for electroplating processes) was purposefully not submitted. A justification is provided in section 2.

K. Walter is a German company with more than 110 years of corporate history dedicated to the design of electroplating units for gravure form manufacture and the development of technologies for the process of system integration tailored to customer requirements.

K. Walter uses chromium trioxide in the formulation of electrolytes used for the electroplating of gravure cylinders, used in rotogravure printing and embossing applications. As an importer of chromium trioxide, K. Walter applies for the continued use of this substance to cover its entire supply chain.

Rotogravure printing is a printing technique based on the transfer of fluid ink from engravings on a gravure cylinder to the surface of a substrate, or the material to be printed. An impression roller is used to apply pressure and cause ink to be transferred from the engravings on the printing cylinder's surface to the substrate due to the ink's surface tension. Rotogravure is used primarily for long printing runs in applications such as packaging, magazines, catalogues, inserts, wallpapers and floorings, among many others, achieving fine and clear images and high printing consistency.

Embossing is a process by which a relief is created on a substrate, usually paper, by means of a gravure cylinder. It is usually carried out on an industrial scale in roll-to-roll processes. This technique is used for giving a 3D-texture to the embossed surface for both decorative and functional purposes. An example of a decorative application is the embossing of a texture into a protective foil in which the embossing follows the printed image below. In this way, a printed wood look can be given the haptics corresponding to the pattern, for example, thus increasing the value of the embossed surface. For technical applications, an example is the embossing of a specific surface pattern that provides anti-slip properties to the surface.

In all rotogravure printing and embossing processes (publication rotogravure, packaging rotogravure and decorative rotogravure printing) the gravure cylinders must be covered with a functional hard chromium layer. It is important that the surface of the cylinders is homogeneous, scratchproof, highly wear resistant, and hard (> 900 HV), as interaction with hard ink particles, with the doctor blade and the substrate causes damage to the cylinder's surface. Figure 1 below shows an overview of the cylinder preparation process.

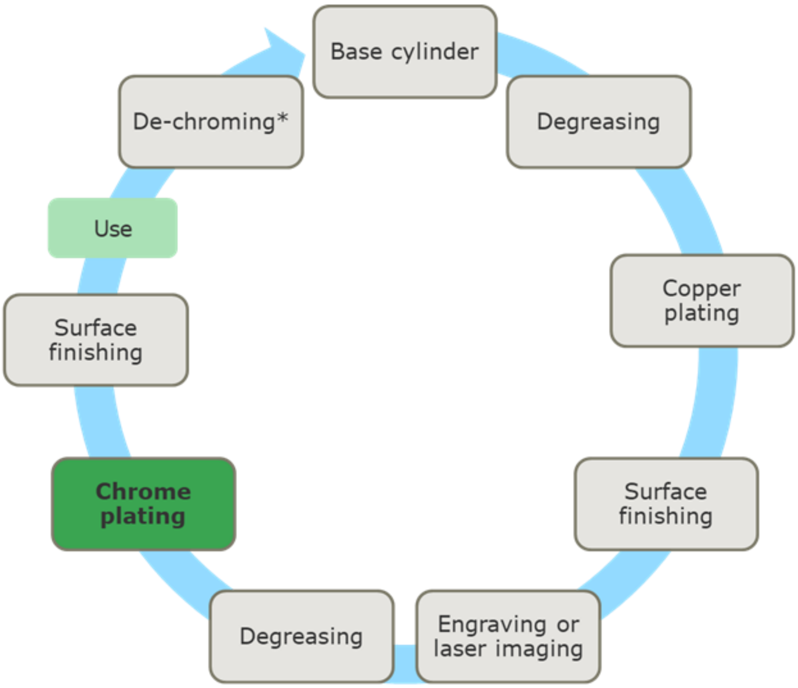

Figure 1: Flow diagram of cylinder preparation process. *De-chroming can refer to either refurbishing or refinishing.

For a detailed description of the overall process for the chrome-plating of gravure cylinders please refer to section 3.6 in the Analysis of Alternatives (AoA) and Socio-Economic Analysis (SEA) document.

Identification of potential alternatives

K. Walter has developed a triple parallel strategy for substituting chromium trioxide in the manufacture of rotogravure and embossing cylinders. This strategy is called HelioGreen. It features the development and implementation of the alternative manufacturing techniques Helio® Pearl and HelioChrome® NEO, coupled with the submission of this AfA for the extended use of chromium trioxide until 2032 (a project that K. Walter has named ChromeXtend). HelioChrome® NEO focuses on the development of Cr(III)-based electroplating as an alternative to the current process and has been ongoing since 2013. Helio® Pearl was started in 2014 and targets the development of polymer-based coatings. Combined, these developments could potentially substitute current applications of K. Walter's customers. For a detailed description of these technologies see section 4.2 of the AoA/SEA document submitted along with this Substitution Plan.

2. Justification for not submitting a substitution plan for Use 1

K. Walter imports chromium trioxide into the EEA and hires a third party to formulate chromium trioxide into liquid electrolytes (mixtures). These electrolytes are then supplied to downstream users to carry out the functional chrome plating of gravure cylinders at their own sites.

As stated in the chapter 3.3. of the guidance document **How to develop use descriptions in applications for authorisation** (European Chemicals Agency, 2017) *"When formulating an Annex XIV substance into a mixture, the presence of that substance may or may not provide an explicit function and, accordingly, may or may not require a discrete 'use-applied-for'. The* *same applies to other activities preceding the end use of a substance. "(…) "In the case of formulation (…) Where a mixture is prepared by a 'formulating company' but the mixture is only 'used' at another site by a downstream user to which the mixture is supplied (…) an AoA for the formulation use is not necessary because there is no function per se provided by the Annex XIV substance. (…) The same principles apply to 'uses' such as repackaging."*

Chromium trioxide has no function per se during the formulation process. Therefore, the application for authorisation for the formulation use submitted by K. Walter does not contain a standard AoA, even though it includes robust SEA and CSR documents as required by the authorisation process.

The investigation of alternatives to chromium trioxide in the functional chrome plating of gravure cylinders, as well as the foreseen substitution plan for this application, is elaborated as part of Use 2 of this AfA.

Given that:

- chromium trioxide has no specific function per se in the formulation of electrolytes (mixtures) supplied to downstream users;
- it has already been acknowledged in documents published by ECHA that no AoA is needed for e.g. formulation uses where the Annex XIV substance has no function per se and that the same applies to other activities preceding the end use of a substance.
- the assessment of potential alternatives to chromium trioxide in the functional chrome plating of gravure cylinders is a part of Use 2 of this AfA;

K. Walter sees no technical possibility nor reason to submit a substitution plan as part of its application for authorisation of Use 1 (formulation).

3. Use 2: Factors affecting substitution

K. Walter's view is that there is no market-ready alternative for this use that is commercially available. Through its close relations with European-level rotogravure industry associations such as ERA, as well as local associations like ACIMGA in Italy or GAA in the US, and the collaboration with local distribution partners, K. Walter is well informed about other technologies offered to DUs. K. Walter's opinion is that no suitable alternative generally available (SAGA) currently exists for this use.

The alternatives currently being developed by K. Walter constitute the most promising alternatives but are not yet mature enough to substitute Cr(VI). The status of their development and the remaining challenges are discussed in section 4.4 of the AoA/SEA document. Other alternatives considered by K. Walter but rejected as feasible alternatives are presented and discussed in section 4.3 of the accompanying AoA/SEA.

Many of the technical requirements needed to substitute Cr(VI) in the electroplating of gravure cylinders have already been successfully established for Helio® Pearl and HelioChrome® NEO. However, further testing is needed at DU sites to ensure the reliability of these technologies. These tests are expected to start in 2021. Because both alternatives use a different technology than the current Cr(VI)-based method, downstream users will need to implement new plating lines (in the case of substitution HelioChrome® NEO) or new manufacturing lines (when substituting with Helio® Pearl) while replacing the Cr(VI)-based process. Given the large investment costs associated with this transition, it will occur slowly.

K. Walter foresees that at least 12 years will be needed for a complete transition to a Cr(VI)-free alternative. This time includes the technical development of the short-listed alternatives and the time needed by K. Walter to manufacture and distribute the new units, as well as the time needed for DUs to evaluate and switch to the new process(es). The technical development of Cr(III)-based electroplating and polymer coatings is already ongoing and runs simultaneously.

4. List of actions and timetable with milestones for use 2

K. Walter foresees that at least 12 years will be needed for a complete transition to a Cr(VI)-free alternative. This time includes the technical development of the short-listed alternatives and, most importantly, the time needed for DUs to evaluate and switch to the new alternative processes (transition period). The technical development of Cr(III)-based electroplating and polymer coatings is already ongoing and runs in parallel. Importantly, DUs will decide which of these two alternatives better fits their specific application, mainly considering economic and technical aspects (see results from DU survey in section 4.2.2 of the AoA/SEA).

The steps needed for completing the transition to Cr(VI)-free alternatives are discussed below.

Technical development (2 years)

This step comprises the development of stable process parameters to ensure the quality and reproducibility of the new technology. In the case of Cr(III)-based functional plating, this phase includes the design of new anodes and equipment. Development work in recent years has shown that the process control of Cr(III)-based electroplating is much more difficult than that of Cr (VI)-based functional plating. For this reason, a new type of chrome electroplating unit was developed including new software for process control. For polymer-based coatings, this phase includes the following tasks: chemical formulation of the polymer coating (evaluation of toxicity of the coating, formulation optimization according to developments on laser technology, temperature and time stability testing); construction of first coating machines; optimization of laser engraving on polymer for controllable ink transfer; abrasion/wear testing; and assessing stability of polymer coating in printing machines.

For both alternatives, technical development must be completed before continuing to the next step in the implementation process, the external R&D phase.

External R&D phase (5 years)

New gravure cylinders (either Cr(III)-plated or with polymer coatings) must be tested under real operating conditions at several beta-testing sites, where parameters such as wear can be finally evaluated. Beta tests are tests carried out at customer locations under real operating conditions and without any intervention from K. Walter. First beta tests for both alternatives are scheduled to start in 2021.

For Cr(III)-based electroplating, a first pilot system will be integrated into the automatic line at K. Walter's existing development site at a packaging printer in Ronsberg Germany (Huhtamaki Flexible Packaging). A second one will be integrated into the automatic line at a second packaging printer that has not yet been finally determined. Subsequently, both pilot systems will have to prove in regular operation that they have the same quality and process stability as the previous Cr(VI) systems without the intervention of K. Walter's process engineers. In discussions with K. Walter's development partner, the qualification criteria were defined which are necessary to be able to consider the alternative as a full replacement for the Cr(VI)-based technology: it must be possible to run for three months without any major, unplanned changes to the plating unit or process that cannot be performed by the partner's own production staff. If the processes show that there are still major instabilities, K. Walter will consider redesigning the process and restart beta-testing at Huhtamaki Flexible Packaging in Ronsberg. As soon as the beta tests are positive, the electroplating unit design can also be released for sale and assembly by K. Walter.

For polymer coatings, potential development partners are companies that have their own printing plants. This is because beta tests must primarily evaluate the coated cylinders in terms of their suitability for printing. Unlike Cr(III)-based electroplating, however, the first test setup for polymer-based coatings will be located at K. Walter's site (first full-scale beta facility), as no electroplating lines need to be installed. Cylinders would then be sent directly to potential customers for testing. However, the closest development partner and first installation site for preparing engraved cylinders with polymer coatings outside the company would again be Huhtamaki Flexible Packaging in Ronsberg, Germany, favoured by its proximity to K. Walter. The second beta plant in this case will not be built before the end of 2022. Further development and implementation timelines will otherwise be very similar to those of Cr(III)-based electroplating. The focus will initially be on packaging printing because of its lower surface stress and the technology will then be optimized for other application areas in succession.

Cr(III)- and polymer-coated cylinders must be tested with different substrates, inks and doctor blades to demonstrate that the printing quality is not compromised. This timetable is currently only for cylinders of type A and C (see section 1.2 of the AoA/SEA document), which correspond to the packaging and publishing industries, respectively. Decorative rotogravure is more demanding in terms of cylinder wear. Here, particles such as TiO_2 are often added to the ink and more abrasive substrates are used, wearing down the cylinders more quickly. Polymer coatings might not be able to fulfil performance parameters for Type B (decorative) applications, since wear might be too high. This application will take 1-2 more years compared to packaging, for a total of 4 to 5 years. Overall, the external R&D phase will take 5 years to be fully completed.

Transition period (at least 8 years):

The transition period is expected to start approximately two years before the end of the External R&D phase. Within this period, K. Walter will continuously substitute the Cr(VI)-based technology at DUs with either Cr(III)-based electroplating or polymer coatings. A progressive decrease in the volume of Cr(VI) used by DUs will take place, while use of an alternative will increase accordingly. As mentioned above, the development of both alternatives is carried out in parallel. In general, DUs will substitute their Cr(VI)-based units with the alternative that better suited for their specific application (see results from the DU survey in section 4.2.2 of the AoA/SEA submitted as part of this AfA). It needs to be highlighted that for both alternative processes DUs will need to purchase new equipment because the electroplating units currently produced and sold by K. Walter can only be used with the Cr(VI)-based electrolyte. Substituting the electrolyte only is therefore not possible. This means that the electroplating units will first need to be manufactured and distributed by K. Walter.

The length of the transition period is determined by how fast these Cr(VI)-based electroplating units can be substituted by an alternative process. This, in turn, is determined by how fast

K. Walter can manufacture the new machines and how fast it can build the know-how required for their service. However, it is very difficult to estimate an average production rate of new machines because this rate is expected to increase gradually throughout the transition period. During the first 2 to 3 years, for example, technicians will have to be trained in the installation and service of the new machines, so fewer of them will be manufactured. Another limiting factor might be the low availability of qualified personnel on the labour market which could prevent the simultaneous installation and servicing of new plating units at several sites. As knowledge and experience increase, however, the number of machines produced every year will likely increase.

K. Walter estimates that the minimum average production rate will be of 20 machines per year, which is aligned with the current production rate of Cr(VI)-based electroplating machines at full capacity. At a minimum average production and installation rate of 20 electroplating machines per year and considering that at least 214[1] Cr(VI)-based units in the EEA need to be substituted, more than ten years would be needed for 100% substitution. These calculations do not include any new contracts, which would increase the number of units that need to be substituted and therefore the length of the transition period.

K. Walter expects that the first customers to transition to a Cr(VI)-free alternative are those with more than one chromium plating unit, for whom the additional unit might serve as a "fall-back" technology. Given the large investment required to substitute various plating lines, a transition to a completely Cr(VI)-free process is likely to proceed slowly. First customers of a potential alternative are also expected to be located closer to the city of Munich, where the applicant is based, because the first installations might need frequent visits from technicians. It should also be considered that the capacity to install the new technology as an additional line is often aggravated by regulations, space requirements or automation setup.

In a best-case estimated substitution scenario and under the premises of increasing the production capacity of the alternative equipment, K. Walter assumes that at least eight years are needed for substituting the largest portion of current Cr(VI)-based units by an alternative.

Companies who adopt a new process will not directly substitute 100% of their process but will use a Cr(III)-based unit or a polymer coating process in parallel to their current Cr(VI)-based process to minimise risks and gain experience with the new technology. A change is especially demanding for service houses which do not print and printers which do not have their own cylinder manufacturing line. If the new technology is not 100% reliable, downtimes of several days to weeks are to be expected for printers. This is quite important, since more than 50% of the produced gravure cylinders come from plating service providers.

An overview of the R&D plan discussed above is shown in Figure 2.

[1] Calculated based on results from DU survey and K. Walter's internal knowledge.

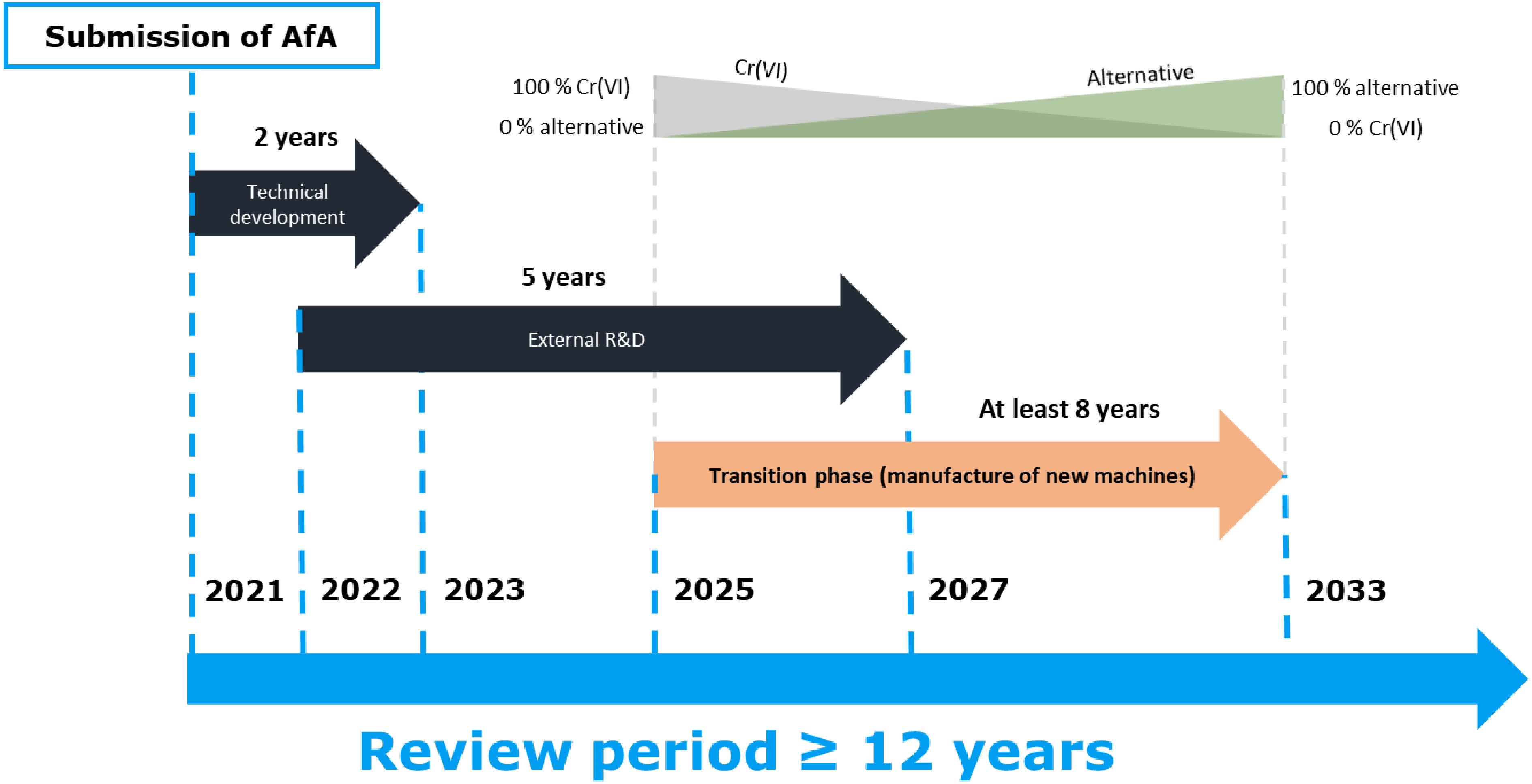

Figure 2: Overview of R&D plan for substitution of Cr(VI)

5. Monitoring of the implementation of the substitution plan for use 2

The development of the most promising alternatives, Cr(III)-based electroplating and polymer coatings, is managed through separate project leaders. For both projects, internal timetables as well as milestones with due dates are defined to monitor development/substitution progress. Each project is split into three different teams: mechanical engineering, electrical engineering and software and process engineering. Updates of the team leaders are reported to the project leaders as well as the CEO in an internal weekly meeting. The manager responsible for the preparation of the AfA is a further member of this meeting.

Tests are continuously ongoing and are part of the development process. Tests for Cr(III)-based electroplating are carried out weekly together with the industry partner Huhtamaki Flexible Packaging on production printing presses. These tests are only abrasion tests and aim to establish a reliable process; no test printing jobs are yet carried out because these are expensive and time consuming. Polymer coated cylinders are evaluated on the printing press of the Hochschule der Medien, Stuttgart. Reports of the printing quality and surface wear are generated from the operators of the printing machines and sent to the project leaders of K. Walter.

Possible technologies not provided by K. Walter are discussed and monitored through the participation in biannual meetings of the industry associations (ACIMGA, ERA, GAA). Furthermore, national distribution partners, which are not part of Heliograph Holding, provide further insight in national markets and technologies offered to DUs.

6. Conclusion

K. Walter and its partners have conducted extensive R&D on several alternatives over the last years. None of these alternatives were found to be suitable, meaning that currently no alternative (technology) is commercially available that ensures the essential combination of the technical key requirements for this use.

Cr(III)-based electroplating and polymer coatings are considered the most promising alternatives for substituting Cr(VI) in the functional plating of gravure cylinders. K. Walter has made significant progress in the development of these alternatives, but these are not yet ready to be implemented at full scale. K. Walter will further develop these alternatives according to the substitution plan described in this document. More time is needed to finalize the technical development and to test these new technologies under real operating conditions. This last step is important to evaluate parameters such as wear and to adjust the operation of the new machines for optimal performance. As discussed in section 4, most of the review period requested is needed for the transition phase, in which new machines will be manufactured and distributed to DUs to replace the existing Cr(VI)-based electroplating units. The implementation of alternatives will require a close work of DUs with K. Walter to solve any unforeseen difficulties and to gain experience with the new technology. Due to the limited capacities to manufacture new machines and the large number of Cr(VI)-based electroplating units that must be substituted (more than 200 in the EEA), a transition period of at least eight years will be necessary to accomplish this transition.

Overall, a review period of at least 12 years is needed for a complete substitution of Cr(VI) in the functional chrome plating of gravure cylinders. K. Walter wants to emphasize that the R&D success of these alternatives is not guaranteed, and that technology failure and/or customer refusal can occur any time during development, resulting in completely different and prolonged R&D timelines.

7. References

European Chemicals Agency. (2017). *How to Develop Use Descriptions in Applications for Authorisation.* Retrieved from https://echa.europa.eu/documents/10162/13566/uses_description_in_auth_context_en.pdf