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Background document for cobalt(II) carbonate

Document developed in the context of ECHA's third Recommendation for the inclusion of substances in Annex XIV

Information comprising confidential comments submitted during public consultation, or relating to content of Registration dossiers which is of such nature that it may potentially harm the commercial interest of companies if it was disclosed, is provided in a confidential annex. This confidential annex is not included in the public version of this background document.

1. Identity of the substance

Chemical name: Cobalt (II) carbonate
EC Number: 208-169-4
CAS Number: 513-79-1

This background document covers also the hydrated forms of Cobalt (II) carbonate.

2. Background information

2.1. Intrinsic properties

Cobalt(II) carbonate was identified as a Substance of Very High Concern (SVHC) according to Articles 57(a) and (c) as it is classified according to Annex VI, part 3, Table 3.1 of Regulation (EC) No 1272/2008 as a carcinogen category 1B[1] , H350i (may cause cancer by inhalation), and as toxic for reproduction category 1B1, H360F (may damage fertility), and was therefore included in the candidate list for authorisation on 15 December 2010, following ECHA's decision ED/95/2010.

2.2. Imports, exports, manufacture and uses

2.2.1. Volume(s), imports/exports

According to registration information the volume manufactured / imported in the EU is in the range of 1,000 – 10,000 t/y.
On the basis of tonnages reported to the Cobalt REACH Consortium (CoRC; RCOM, 2011), the annual tonnage manufactured and/or imported in the EU, corrected for export, is less than a third of the range maxima of 10,000.

[1] Classification in accordance with Regulation (EC) No 1272/2008 Annex VI, part 3, Table 3.1 List of harmonised classification and labelling of hazardous substances as amended and adapted to technical and scientific progress by Commission Regulation (EC) No 790/2009, OJ No L 235, p. 1, 5.9.2009

2.2.2. Manufacture and uses

2.2.2.1. Manufacture and releases from manufacture

Cobalt(II) carbonate is prepared by adding a hot solution of cobalt salts to a hot sodium carbonate or sodium bicarbonate solution. Precipitation from cold solutions gives a light blue unstable product. Dissolution of cobalt metal in ammonium carbonate solution followed by thermal decomposition of the solution gives a relatively dense carbonate (HSDB 2010) (Kirk-Othmer in the Netherlands, 2010).

At a study mentioned in the Annex XV dossier, measured cobalt concentrations at workplaces with exposure to cobalt salts in a refinery were 68 – 89 µg/m3 (range 1 – 7700 µg/m3) (Lison 1994 in the Netherlands, 2010). According to the CoRC, these data are very unlikely to represent current cobalt carbonate exposure levels from industrial processes in the EU, with reference being made also to the Registration exposure scenarios that would demonstrate effective control of exposure (RCOM, 2011).

The Cobalt REACH Consortium reported that manufacture and/or import facilities of the Cobalt REACH Consortia members for cobalt(II) carbonate are located in Belgium, Finland, Germany, Norway, and the UK (the Netherlands, 2010). According to information provided during the public consultation, further manufacture / import sites exist in the Netherlands and in France (RCOM, 2011).

2.2.2.2. Uses and releases from uses

Uses

According to Registration data (additional info from other sources as cited below), cobalt(II) carbonate is used in the EU in:

- **Manufacture of other chemicals;**

This includes also use in **other wet chemical processes**. According to the Cobalt Development Institute (CDI), and other comments received during stakeholder consultation, cobalt(II) carbonate is also used in the manufacture of **catalysts** (hydrotreating; oxidation catalyst; hydrodesulphurisation; Fischer Tropsch (GTL); The Netherlands, 2010; RCOM, 2010; personal communication with EUROMETAUX, 2011).

- **Fertilisers**

Although there were comments during the public consultation stating that this use is unlikely due to the low water solubility of cobalt(II) carbonate (RCOM, 2011), the use was later confirmed by industry (personal communication with EUROMETAUX, 2011).

- **Calcination/sintering process in the context of the manufacture/production of inorganic pigments & frits, glass, ceramic ware:**

In ceramics, frits (glazes, enamels) and glass, cobalt salts (cobalt(II) carbonate is used in some, but not necessarily all such applications; see also confidential annex) are used as a colorant or a decolourant in the production process. Decolourising is assumed to be due to the catalytic effect of small amounts of Co(II) on bleaching actually performed by other oxidative substances (see e.g. Zhang et al., 1998, on a different application with similar function of Co2+). Cobalt salts are also possibly used as bleaching agent in sanitary ceramics[2] .

Cobalt salts are used in ceramic pigments and designated as underglaze stains, glaze stains, body stains, overglaze colours, and ceramic colours. The underglaze is applied to the surface of the article prior to glazing. The glaze stain uses cobalt colorants in the glaze. A body stain is mixed throughout the body of the ceramic. Overglaze colours are applied to the surface and fired at low temperatures. Ceramic colours are pigments used in a fusible glass or enamel and are one of the more common sources of the blue coloration in ceramics, china, and enamel ware (the Netherlands, 2010).

Some references of cobalt carbonate used as pigment for decorating porcelain and clays exist (personal communication with EUROMETAUX).

Cobalt has been detected with a concentration of 560 mg/kg in one out of 12 glass and ceramic colours for hobby use (Danish Environmental Agency, 2005: Survey and assessments of chemical substances in glass and porcelain colours. Survey of chemical substances in consumer products No. 59; In RCOM, 2010).

- **Surface treatment processes:**

(Note: not necessarily all the described surface treatment application areas below are relevant for cobalt(II) carbonate)

  - *Passivation / Anti*-corrosion (e.g. conversion layers/coatings on automotive parts, aerospace, military, marine, building, architectural, sanitary fitting, lighting, electrical etc.) (RCOM, 2011)
  - *Electroplating / Electroforming* (e.g. technical / magnetic / decorative plating; application in aerospace, automotive, telecommunication, electronics, storage media, military, household articles, watches, jewellery, metal logos, chains, buckles, medical technology, etc; electroplated as Co metal or alloys with nickel, tungsten, iron, molybdenum, chromium, zinc, precious metals, etc.); The function of the substance is to affect physical properties of surfaces, e.g. smoothness, hardness, brightness, ductility, resistance, porosity, or the production of record and compact discs *(*the Netherlands, 2010; RCOM, 2010; RCOM, 2011).
  - *Colour anodizing*

Those processes involve immersing components in aqueous solutions (Communication of CoRC to MSC, 2011). On the other hand, aAmong the Process categories (PROC) that have been associated with use in surface treatment processes in the registration dossiers is also PROC 7 ("Industrial spraying").

[2] Sanitary ceramics comprise wash-bowls, glass bowls, baths, water massage baths, WC, bidets, seats, mixers, bathroom accessories, heating units, etc.

- **As a catalyst:**

Although this use has been registered as identified use, information provided by the industry suggests that rather other catalysts are manufactured from cobalt(II) carbonate, and that this is in fact a use as intermediate (RCOM, 2010; personal communication with EUROMETAUX, 2011). According to CoRC, the use of cobalt(II) carbonate as such as catalyst is unlikely (RCOM, 2010).

- **As nutrient supplement in biogas production processes (RCOM, 2011)**

- **Animal food supplement ("feed grade materials")**

Information on potential further (to the above listed) uses was not possible to confirm on the basis of the available data. It is noted that cobalt has been detected in cosmetic kohl products (concentrations between 0.11 and 51 mg/kg) and in cosmetic henna products (concentrations between 0.59 and 1.1 mg/kg) (Danish Environmental Agency, 2005: Survey of chemical substances in consumer products No. 65; In RCOM, 2010). Cobalt has been mentioned to be present in khol product as a naturally occurring impurity, in trace amounts, in this mineral. Similarly, henna has been mentioned to be a vegetable product containing natural traces of cobalt.

Volumes per sector or use

According to information collected by the Cobalt REACH Consortium (RCOM, 2011), the substance is used in the EU as following:

- Manufacture of other chemicals. Approximately 70%
- Production of other chemicals during catalyst manufacture. 25%
- Use in animal feed grade materials and fertilizers. Up to 6%
- Manufacture of inorganic pigments. <1%
- Surface treatment. <<1%

Releases from uses

The main route of occupational exposure of cobalt compounds is via the respiratory tract by inhalation of dusts, fumes and mists containing cobalt (IARC 1991 in RCOM, 2010). According to its classification, Cobalt(II) carbonate may cause cancer by inhalation, with a low specific concentration limit of 0.01% for this hazard (it is noted that cobalt(II) carbonate is also classified as toxic for reproduction).

Some measured concentrations have been reported in the literature for the dust in facilities producing cobalt salts (0.05–50 mg cobalt /m3), and in a refinery (relating to cobalt salts use - 68 – 89 µg/m3; range 1 – 7700 µg/m3) (the Netherlands, 2010; RCOM, 2010).

The Cobalt REACH Consortium and other industry organisations highlighted during the public consultations that further exposure data is available to the Consortium Consultants, which was considered in the detailed Exposure Scenarios prepared for the cobalt salt Registration Dossiers (RCOM, 2010; RCOM, 2011). According to the German Competent Authority, on the basis of toxicological and

exposure data in the open literature the occupational cancer risk is expected to be high (RCOM, 2010). Industry has provided some further exposure-related information during the public consultation 2011, mainly on the uses in surface treatment (RCOM, 2011).

2.2.2.3. Geographical distribution and conclusions in terms of (organisation and communication in) supply chains

Data/estimations provided by CoRC during public consultation (RCOM, 2011) sum up below 100 sites for uses in the scope of authorisation, although for some of those uses no information on sites has been provided by industry.

Therefore, based on the available information, it appears that, in particular for uses in the scope of authorisation, the supply chains contain a relatively small number of EU manufacturers and importers, and a higher number of downstream users.

2.3. Availability of information on alternatives[3]

As for cobalt(II) carbonate and other cobalt salts a number of common uses have been registered, it can be reasonably assumed that such salts could in general replace cobalt(II) carbonate in some of its applications and vice versa.

According to the Cobalt REACH Consortium, the vast majority of the applications do actually not allow for mutual substitution between the cobalt salts for technical and/or economical reasons; Even where it is chemically feasible to substitute the cobalt salts, it would not be practical on an industrial scale without involving excessive cost (personal communication with EUROMETAUX, 2011).

During the most recent public consultation (RCOM, 2011), industry provided some further arguments, mainly for the use in surface treatment, concluding that interchangeability between the cobalt salts included in ECHA's recommendation is not expected to occur at large-scale, and that case-by-case evaluation is deemed necessary.

It is acknowledged that cobalt(II) carbonate may in some of its uses hardly be replaceable by another cobalt(II) salt. However, considering scientific knowledge in chemistry and the principal chemical processes taking place it appears very improbable that it would technically not be possible to replace cobalt carbonate in at least some of its uses by another cobalt salt or that cobalt carboante could not be used to replace other cobalt salts.

During consultation, also comments were provided with reference to existing suitable alternatives / alternatives under development for some uses (such as cobalt-free passivation for zinc or zinc-alloy plating, RCOM, 2011). In several comments, industry argued that no suitable alternatives have been identified (comments mainly referring to the use in surface treatment processes). (More) hazardous substances/technologies have also been referred to in some of the received comments, such as cadmium plating for zinc-cobalt plating, while Co(II) has replaced Cr(VI) in electroplating (RCOM, 2011).

[3] Please note that information on availability of alternatives was not used for the prioritisation.

2.4. Existing specific Community legislation relevant for possible exemption

There seems to be no specific Community legislation in force that would allow to consider exemption of (categories of) uses from the authorisation requirement on the basis of Article 58(2) of the REACH Regulation (see RCOM, 2011).

2.5. Any other relevant information (e.g. for priority setting)

Not available.

3. Conclusions and justification

3.1. Prioritisation

Verbal-argumentative approach

Manufacture of other substances, including catalysts, appear to be uses of the substance as intermediate. Furthermore, use as animal food supplement is considered to be outside the scope of authorisation. No concrete details that would allow a conclusion on their nature are available on some uses in the calcination process in the context of the manufacture / production of inorganic pigments & frits, glass and ceramic ware. Uses of cobalt(II) carbonate in surface treatment processes, in fertilisers, and in biogas production appear to be in the scope of authorisation.

Therefore, on the basis of the tonnage allocation per use a low volume appears to be used in the scope of authorisation.

Data/estimations provided by CoRC during public consultation (RCOM, 2011) sum up below 100 sites for uses in the scope of authorisation, although for some of those uses no information on sites has been provided by industry.

Main route of occupational exposure is via the respiratory tract by inhalation of dusts, fumes and mists containing the substance. Worker exposure in industrial applications may be controlled in most instances, but there are uses, e.g. in surface treatment, which include process steps with significant potential for exposure to dusts, fumes and aerosols containing the substance.

Therefore, based on the criteria, the substance has low priority.

Scoring approach

Score			Total Score (= IP + V + WDU)
Inherent properties (IP)	Volume (V)	Uses - wide dispersiveness (WDU)	
Score: 0 -1 [4] (carcinogen 1B; toxic for reproduction 1B)	1 (Low volume in the scope of authorisation)	Overall score: 2 * 3 = 6 Site-#: 2 (Used at a probably medium number of sites) Release: 3 (for some uses risk of significant and potentially uncontrolled exposure)	7 - 8

Conclusion, taking regulatory effectiveness considerations into account

On the basis of the prioritisation criteria, cobalt(II) carbonate has low priority for inclusion in Annex XIV.

Cobalt(II) carbonate should however be grouped with the other cobalt(II) substances that are on the Candidate List in order to prevent evasion of a possible authorisation requirement by replacement of those cobalt(II) salts that are subject to authorisation with other equally hazardous cobalt(II) substances not included in Annex XIV.

Therefore, it is proposed to recommend cobalt(II) carbonate for inclusion in Annex XIV.

[4] Some information has been provided by the Cobalt Development Institute regarding a potential concentration threshold of cobalt (II) salts for eliciting cancer effects. For the sole purpose of this prioritisation step a score in the range 0 (carcinogenic with threshold) - 1 (carcinogenic without threshold) is assigned. This scoring does not pre-empt any conclusion by the Risk Assessment Committee when preparing its opinions on the future applications.

4. References

The Netherlands (2010): Annex XV dossier for the proposal for identification of Cobalt(II) carbonate as a CMR CAT 1 or 2, PBT, vPvB or a substance of an equivalent level of concern. Submitted by the Netherlands.

http://echa.europa.eu/documents/10162/8c1a7771-b5b8-4059-8e3c-98d44cb7663b

Personal communication with EUROMETAUX (2011): Comments provided by the Cobalt REACH Consortium on clarification of information regarding the prioritisation of the cobalt salts

RCOM (2010): "Responses to comments" document compiled from the commenting period on the identification of Cobalt(II) carbonate as SVHC (08.03.-22.04.2010).

http://echa.europa.eu/web/guest/identification-of-svhc

RCOM (2011): Annex IV to Responses to comments document (RCOM) on ECHA's draft 3rd recommendation for the group of recommended cobalt(II) substances – comments on cobalt(II) carbonate.

http://echa.europa.eu/documents/10162/17232/rcom_cobalt_compounds_en.pdf