20 December 2011

Background document for cobalt(II) dinitrate

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) dinitrate
EC Number:	233-402-1
CAS Number:	10141-05-6

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

2. Background information

2.1. Intrinsic properties

Cobalt(II) dinitrate 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 1B[1], 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 in the range **100 – 1,000 t/y**.

[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 dinitrate can be prepared by dissolution of the simple oxide or carbonate in nitric acid, but more often it is produced by direct oxidation of the metal with nitric acid (Kirk-Othmer 2010 in Netherlands, 2010). Workers in a factory in the Russian Federation producing cobalt acetate, chloride, nitrate and sulphates were reported to be exposed to cobalt in dust at concentrations of 0.05–50 mg/m^3 (IARC 2006, in the Netherlands, 2010; not mentioned, but assumed that concentration refers to Co^{2+}). At a different study, measured cobalt concentrations at workplaces with exposure to cobalt salts in a refinery were 68 – 89 µg/m^3 (range 1 – 7700 µg/m^3) (Lison 1994 in the Netherlands, 2010). According to the CoRC, these data are very unlikely to represent current cobalt dinitrate 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) dintrate are located in Belgium, France, Germany, and the UK (the Netherlands, 2010).

2.2.2.2. Uses and releases from uses

Uses

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

- ***Manufacture of other chemicals*** *(e.g. cobalt(II) carbonate or carboxylates);*

This includes also use in ***other wet chemical processes***. Furthermore, cobalt(II) dinitrate is mentioned to be used in the ***production of pigments*** (RCOM, 2011), as well as in the manufacture of ***active substances for the production of batteries*** (it seems that production of batteries requires prior manufacture of another cobalt compound from cobalt(II) dinitrate). This latter use concerns for example Li-ion and alkaline rechargeable (such as NiCd) batteries, which are used e.g. in the automotive market (HEV Vehicle and Electric Vehicle) and storage applications (for intermittent renewable energy generation; photovoltaic and wind) (industrial / portable batteries; RCOM, 2010; The Netherlands, 2010). According to the Cobalt Development Institute, Cobalt(II) dintrate is also used in the manufacture of ***catalysts*** (hydrotreating; oxidation catalyst; hydrodesulphurisation; Fischer Tropsch (GTL); RCOM, 2010; personal communication with EUROMETAUX, 2011).

- ***Surface treatment processes****:*

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

- *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*
- *Electroless plating* (RCOM, 2011)

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

- *Formulation and industrial use* ***as water treatment chemical / oxygen scavenger / corrosion inhibitor****;*

The formulated mixtures may be added e.g. to process water for protection of the pipes from corrosion by oxygen, or as micro-nutrient solution.

- ***In analytical applications****, for example in nuclear plants (RCOM, 2011).*

This includes for instance the use in small amounts as reagent in monitoring laboratories in nuclear plants. The purpose is checking the condition of fuel cladding, in order to determine the amount of caesium present in the water and in contact with the fuel assemblies. A further use in nuclear plants is as calibration standard for coupled plasma atomic emission spectroscopy (ICP/AES) (RCOM, 2011).

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 kohl 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 (RCOM, 2011).

Volumes per sector or use

According to information collected by the Cobalt REACH Consortium (RCOM, 2011), the EU marketed volume comprises:

- Production of other chemicals during catalyst manufacture. ~35%
- Manufacture of chemicals. ~30 %
- Manufacture of pigments. ~20%
- Use in surface treatment. ~10%
- Manufacture of batteries. ~5%
- Use as an oxygen scavenger/corrosion prevention in industrial water systems. << 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) dinitrate may cause cancer by inhalation, with a low specific concentration limit of 0.01% for this hazard (it is noted that cobalt(II) dinitrate 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 /m^3), and in a refinery (relating to cobalt salts use - 68 – 89 µg/m^3; range 1 – 7700 µg/m^3) (the Netherlands, 2010; 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

Industry organisations stated that cobalt compounds are widely used by small and medium size enterprises (SMEs) in many surface treatment processes and that these applications, including in decorative plating, are becoming increasingly important (RCOM, 2010; RCOM, 2011). For example, as regards passivation of zinc or zinc alloy plating with Co(II) compounds, more than 3 billion pieces p.a. alone in Germany are treated for the automotive industry. Therefore, extrapolating on the European scale, there is uncertainty as to whether surface treatment in such dimensions could take place at a low/medium number of sites (not taken into account formulator sites and other uses in the scope of authorisation). The amounts of the Co(II) substances (including cobalt dinitrate) used for surface treatment seem to be as well relatively high, given the claimed specialty of the surface treatment uses and the relatively small amounts of cobalt needed per treated object.

CoRC confirmed that, in contrast to the initial survey, it now seems that there are many more facilities than expected (potentially thousands) involved in surface treatment with cobalt salt (mainly passivation treatment). CoRC further commented that use for passivation treatment is declining due to the availability of cobalt free alternatives and therefore the total number of sites is expected to decrease in the next years (Communication of CoRC to MSC, 2011).

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[2]

As for cobalt(II) dinitrate 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) dintrate 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 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) dinitrate 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 dinitrate in at least some of its uses by another cobalt salt or that cobalt dinitrate 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).

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

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

3.1. Prioritisation

Verbal-argumentative approach

Manufacture of other substances, including catalysts, active substances batteries and pigments, appear to be uses of the substance as intermediate. Uses of cobalt(II) dinitrate in surface treatment processes, and as water treatment chemical / oxygen scavenger / corrosion inhibitor appear to be in the scope of authorisation.

Therefore, on the basis of the tonnage allocation per use (personal communication with EUROMETAUX, 2011b) a relatively high volume appears to be used in the scope of authorisation.

Sites using the substance in the scope of authorisation are according to the Cobalt REACH Consortium unknown, but expected to be below 100 (RCOM, 2011). This figure though might according to latest information (Communication of CoRC to MSC, 2011) be much higher.

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 a moderate priority.

Scoring approach

Score			Total Score
Inherent properties (IP)	Volume (V)	Uses - wide dispersiveness (WDU)	(= IP + V + WDU)
Score: 0 -1 [3] (carcinogen 1B; toxic for reproduction 1B)	5 (Relatively high volume in the scope of authorisation)	Overall score: 2 * 3 = 6 Site-#: 2 (Used at a presumably medium number of sites) Release: 3 (for some uses risk of significant and potentially uncontrolled exposure)	11 - 12

Conclusion, taking regulatory effectiveness considerations into account

On the basis of the prioritisation criteria, cobalt(II) dinitrate gets moderate priority for inclusion in Annex XIV.

[3] 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.

As there are other cobalt(II) compounds on the Candidate List that could replace the substance in at least some of its uses[4], these other cobalt(II) compounds should be grouped with the substance and included in Annex XIV as well.

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

4. References

Communication of CoRC to MSC, 2011: "Summary information: Cobalt Salts and Inter-changeability", Room document ECHA/MSC-21/2011/1040 provided by the Cobalt REACH Consortium via EUROMETAUX for the Member State Committee meeting 21 (7-9 December 2011).

The Netherlands (2010): Annex XV dossier for the proposal for identification of Cobalt(II) dinitrate 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/10162/41857e48-d306-4a6c-a903-d33606befbf8

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) dinitrate as SVHC (08.03.-22.04.2010).

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

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

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

[4] As Co(II) dinitrate may be used to replace the other cobalt(II) substances in some of their uses.