Committee for Risk Assessment

RAC

Opinion

proposing harmonised classification and labelling
at EU level of

Barium chromate

EC Number: 233-660-5
CAS Number: 10294-40-3

CLH-O-0000007322-81-01/F

Adopted

8 June 2023

8 June 2023

CLH-O-0000007322-81-01/F

OPINION OF THE COMMITTEE FOR RISK ASSESSMENT ON A DOSSIER PROPOSING HARMONISED CLASSIFICATION AND LABELLING AT EU LEVEL

In accordance with Article 37 (4) of Regulation (EC) No 1272/2008, the Classification, Labelling and Packaging (CLP) Regulation, the Committee for Risk Assessment (RAC) has adopted an opinion on the proposal for harmonised classification and labelling (CLH) of:

Chemical name: **Barium chromate**

EC Number: **233-660-5**

CAS Number: **10294-40-3**

The proposal was submitted by **The Netherlands** and received by RAC on **8 June 2022.**

In this opinion, all classification and labelling elements are given in accordance with the CLP Regulation.

PROCESS FOR ADOPTION OF THE OPINION

The Netherlands has submitted a CLH dossier containing a proposal together with the justification and background information documented in a CLH report. The CLH report was made publicly available in accordance with the requirements of the CLP Regulation at ***http://echa.europa.eu/harmonised-classification-and-labelling-consultation/*** on **4 July 2022**. Concerned parties and Member State Competent Authorities (MSCA) were invited to submit comments and contributions by **2 September 2022**.

ADOPTION OF THE OPINION OF RAC

Rapporteur, appointed by RAC: **Ifthekhar Ali Mohammed**

The opinion takes into account the comments provided by MSCAs and concerned parties in accordance with Article 37(4) of the CLP Regulation and the comments received are compiled in Annex 2.

The RAC opinion on the proposed harmonised classification and labelling was adopted on **8 June 2023** by **consensus**.

Classification and labelling in accordance with the CLP Regulation (Regulation (EC) 1272/2008)

	Index No	Chemical name	EC No	CAS No	Classification		Labelling			Specific Conc. Limits, M-factors and ATE	Notes
					Hazard Class and Category Code(s)	Hazard statement Code(s)	Pictogram, Signal Word Code(s)	Hazard statement Code(s)	Suppl. Hazard statement Code(s)		
Current Annex VI entry	No current Annex VI entry										
Dossier submitters proposal	TBD	barium chromate	233-660-5	10294-40-3	Carc. 1B	H350	GHS08 Dgr	H350			
RAC opinion	TBD	barium chromate	233-660-5	10294-40-3	Carc. 1B	H350	GHS08 Dgr	H350			
Resulting Annex VI entry if agreed by COM	TBD	barium chromate	233-660-5	10294-40-3	Carc. 1B	H350	GHS08 Dgr	H350			

GROUNDS FOR ADOPTION OF THE OPINION

RAC general comment

Barium chromate ($BaCrO_4$) is a hexavalent chromium (Cr(VI)) compound with very low water solubility (0.003 g/L at 20 °C). It is used in pyrotechnics, in high-temperature batteries, in safety matches, as a corrosion inhibitor in metal-joining compounds, as a pigment in paints, in ceramics, in fuses, in metal primers, and in ignition control devices (IARC, 1990).

The dossier submitter (DS) reported two toxicokinetic studies on barium chromate from publications in Japanese with very limited summaries in English. Miyai (1980) exposed rats and mice to barium chromate dust via inhalation for 6 h/d, 5-6 d/w for 15 months at concentrations corresponding to 0.25 and 2.5 mg/m^3. No results for mice were provided by the DS as these were not reported in the English summary. In rats, even 30 days after the 15-month exposure, increased chromium concentrations were found in lung, stomach, testis, spleen, brain, salivary gland and duodenum. Highest concentrations were measured in lung, followed by in kidney (only during the exposure). The study author calculated a biological 'half-time' in the lung (according to the DS it is unclear if it's the residence time in the lung) of about 195 days for barium chromate (22 days for sodium chromate, a highly water soluble (845 g/L at 25 °C) Cr(VI) compound that was tested in parallel).

In the second study, Miyai et al. (1980) calculated a biological 'half-time' in mice of 18 days for barium chromate after inhalation exposure (7.5 days for sodium chromate). According to the DS, the reasons for the big difference in the 'half-time' of barium chromate in rats (195 days) and in mice (18 days) remains unclear. Within 17 days after 30 minutes inhalation exposure in mice, the pulmonary absorption rate of barium chromate was "low" (lower than that of sodium or calcium chromate). Within 48 hours after intratracheal administration in mice, about 88 % of the dose remained in the lung while chromium retention in the whole body was about 92 % of the dose. No details on exposure concentrations or quantitative information on absorption rates are reported in the English summary.

Read-across

Several of the Cr(VI) compounds have a harmonised classification for carcinogenicity according to the CLP Regulation. A few non-guideline *in vitro* mutagenicity and *in vivo* carcinogenicity studies with barium chromate are reported in the CLH report but the DS considered the quality of the data to be insufficient for harmonised classification. Therefore, the DS proposed read-across from other Cr(VI) compounds to barium chromate as it is also hexavalent chromium and Cr(VI) is known to be a genotoxic carcinogen (IARC, 2012).

The oxidation state of chromium is of importance as Cr(VI) is unreactive towards DNA under physiological conditions but trivalent chromium (Cr(III)) is shown to be genotoxic both *in vitro* and *in vivo* (IARC, 2012). The DS discussed the following mechanism(s) of action (MoA) for carcinogenicity: "*Cr(VI) anions, which are structurally similar to sulphate and phosphate, enter the target cells via anion transporters. If Cr(VI) anions are extracellularly reduced to Cr(III) prior to transport via the cell membrane, the Cr(III) ions are not absorbed via anion transporters and are therefore of limited toxicity. Once inside the cells Cr(VI) is reduced to Cr(III). DNA damage can occur either by direct binding of Cr(III) to DNA and/or proteins and/or by reactive oxygen species generated during the reduction of Cr(VI) and may subsequently give rise to mutations. […]. The latter MoA is especially discussed in the context of gastrointestinal cancer after Cr(VI) exposure (ATSDR, 2012; Hartwig, 2012; Health Canada, 2016).*"

For barium chromate, the DS proposed to read-across from Cr(VI) compounds with similar water solubility, "*as it is assumed that the water solubility of the substances has a relevant influence on their bioavailability*".

***Table**: Harmonised classification for carcinogenicity and water solubility of some Cr(VI) compounds*

Cr(VI) compound	EC No.	Harmonized classification for carcinogenicity (Annex VI, CLP Regulation)	(Range of) Water solubility (g/L)
Chromium trioxide	215-607-8	Carc. 1A	617-1 668
Sodium chromate	231-889-5	Carc. 1B	873
Potassium chromate	232-140-5	Carc. 1B (inhalation)	394-792
Strontium chromate	232-142-6	Carc. 1B	1.2-30
Zinc chromates including zinc potassium chromate*	-	Carc. 1A	-
Zinc chromate	236-878-9		0.058
Zinc tetrahydroxy chromate (syn: zinc chromate oxide, monohydrate; basic zinc chromate)	- (CAS No. 15930-94-6)		0.01-0.3
Zinc potassium chromate (syn: potassium hydroxy octaoxodizincate dichromate)	234-329-8		0.5-1.5
Barium chromate	233-660-5	-	0.003-0.01
Lead chromate	231-846-0	Carc. 1B	0.58-5.8 × 10^{-4}

* The DS pointed out that a complete list of substances included in the CLP Annex VI group entry "zinc chromates including zinc potassium chromate" is not available. For two of the substances in this group (zinc chromate and zinc potassium chromate) genotoxicity and epidemiological data are available.

The DS noted that zinc chromate, zinc tetrahydroxy chromate and lead chromate are of a similar low water solubility as barium chromate (see table above). However, the DS did not use lead chromate for read-across as it would be difficult to differentiate the contribution of the lead cation to the overall toxicity of the substance. The DS noted that health effects of zinc salts like zinc chloride or zinc sulphate have been extensively investigated and reviewed by several agencies and these compounds were not identified as producing carcinogenic, mutagenic or reproductive toxic effects indicating no contribution of zinc cation. In response to a comment made during the consultation, the DS also noted that there is no evidence, e.g., from carcinogenicity studies with barium chloride, that the barium cation itself has carcinogenic properties. Therefore, the DS used data from zinc chromate and zinc tetrahydroxy chromate for read-across to barium chromate.

Inhaled Cr(VI) is readily absorbed from the respiratory tract. The degree of absorption depends on the physical and chemical properties (size, solubility), and the extent of reduction to Cr(III). After intratracheal instillation in rats, 53-85 % of Cr(VI) compounds with a particle size < 5 µm are absorbed into the blood-stream, with higher absorption rates in case of more soluble compounds; the rest remains in the lung. The same factors apply to absorption from gastro-

intestinal tract, although absorption by this route is generally much less compared with that in the respiratory tract (IARC, 2012).

Since no robust experimental data on the bioavailability of barium chromate is available, RAC agrees with the DS's approach to read-across data from zinc chromate and zinc tetrahydroxy chromate that have similar water solubility.

HUMAN HEALTH HAZARD EVALUATION

RAC evaluation of germ cell mutagenicity

Summary of the Dossier Submitter's proposal

The DS reported several *in vitro* studies with barium chromate, zinc chromate and zinc tetrahydroxy chromate. However, none of these are performed according to OECD test guidelines or GLP. Due to methodological shortcomings or insufficient reporting, the DS considered most of the studies as not reliable.

Only two studies testing barium chromate and zinc chromate/zinc tetrahydroxy chromate were given a reliability score of 2 by the DS: A test investigating the induction of chromosome aberrations and double strand breaks in a human cell line; and a neoplastic transformation assay in Syrian hamster embryo (SHE) cells. The remaining studies (with reliability 3 or 4) included bacterial reverse mutation assays, sister chromatid exchange assays, analysis of deletion mutations and DNA methylation, an enhanced transformation assay, and an anchorage-independent growth assay with barium chromate, zinc chromate and/or zinc tetrahydroxy chromate.

In WTHBF-6 cells (clonal cell line derived from primary human bronchial fibroblasts), after exposure to 24 hours with metabolic activation at 0.01 to 5 µg barium chromate/cm^2 or 0.1 to 0.5 µg zinc chromate/cm^2, concentration-dependent increase in induction of chromosome aberrations and double strand breaks were observed. In parallel, the intracellular chromium concentrations were measured and also increased concentration-dependently. Potencies of the clastogenic effects were similar for barium chromate and zinc chromate (Wise *et al*., 2010, reliability 2).

Positive results were also reported in a neoplastic transformation assay in SHE cells after 7-8 days exposure to barium chromate (= 1-8 µg Cr/mL) or zinc tetrahydroxy chromate (= 0.05-0.6 µg Cr/mL). Barium chromate showed "a very low potency" of transformation frequency compared to zinc tetrahydroxy chromate (Elias *et al*., 1989, reliability 2). Zinc chromate enhanced the morphological transformation induced by the simian adenovirus SA 7 in SHE primary cells (Casto *et al*., 1979; reliability 3) and induced anchorage-independent growth of Syrian hamster BHK fibroblasts (Hansen and Stern, 1985; reliability 3).

In a bacterial reverse mutation assay in *Salmonella typhimurium* TA 100, increased mutation frequencies were observed for barium chromate in incubations without metabolic activation and in the presence of nitrilotriacetic acid (NTA). No effects were observed if the test substance was applied in water or in a sodium hydroxide solution or in the presence of metabolic activation which is in line with the assumption that metabolic activation systems reduce Cr(VI) to Cr(III). Under similar test conditions, zinc chromate was slightly more potent than barium chromate (Venier *et al*., 1985; reliability 3). In another bacterial reverse mutation assay, zinc tetrahydroxy chromate was tested in five strains of *Salmonella typhimurium* with and without metabolic activation. It was found to be positive in TA 100; weakly positive in TA 98, TA 1537 and TA 1538;

and negative in TA 1535. Effect in the presence of metabolic activation was decreased (De Flora, 1985; reliability 4).

In the sister chromatid exchange assays in Chinese hamster ovary cells or fibroblasts, barium chromate and zinc tetrahydroxy chromate (at single concentrations), and zinc chromate (at two concentrations) were tested with or without NTA for 24 or 30 hours without metabolic activation. The induction of sister chromatid exchanges was increased at similar potencies for these substances. The effects were more pronounced in the presence of NTA which might be due to the increased acidity of the test substances or due to the complex formation of NTA with the barium and zinc ions and a subsequent increase in availability of chromate ions (Venier et al., 1985, Zelikoff et al., 1988; both of reliability 3).

Induction of deletion mutations but no DNA methylation was reported in Chinese hamster G12 lung cells for barium chromate (Klein et al., 2002; reliability 3).

All the *in vitro* studies mentioned above were positive. However, no *in vivo* mutagenicity/genotoxicity tests are available for barium chromate or the read-across substances. There are no toxicokinetic data showing potential to reach germ cells for the read-across substances. Therefore, the DS proposed no classification for germ cell mutagenicity for barium chromate.

Comments received during consultation

One Member State Competent Authority (MSCA) commented and supported the DS proposal.

Assessment and comparison with the classification criteria

No epidemiological studies are available for barium chromate or the read-across substances zinc chromate and zinc tetrahydroxy chromate. Therefore, Category 1A is not applicable.

There are no *in vivo* heritable germ cell or somatic cell mutagenicity tests in mammals, and no tests showing mutagenic effects in germs cells of humans for barium chromate or the read-across substances zinc chromate and zinc tetrahydroxy chromate. Therefore, Category 1B is not applicable.

Although there are positive *in vitro* mutagenicity assays, in the absence of any *in vivo* somatic cell mutagenicity or genotoxicity tests for barium chromate or the read-across substances zinc chromate and zinc tetrahydroxy chromate, Category 2 is not applicable either.

Overall, RAC agrees with the DS and concludes that **barium chromate warrants no classification for germ cell mutagenicity due to inconclusive data** (lack of *in vivo* tests).

RAC evaluation of carcinogenicity

Summary of the Dossier Submitter's proposal

Animal data

No standard carcinogenicity studies performed according to test guidelines or GLP-compliance are available for barium chromate or the read-across substances zinc chromate and zinc tetrahydroxy chromate. Potential carcinogenicity of barium chromate was investigated in rats with three different applications (intrabronchial, intrapleural and intramuscular), and that of zinc

tetrahydroxy chromate and two different compositions of zinc chromate also in rats by intrabronchial application. A summary of these studies is available in the table below.

***Table**: Summary of carcinogenicity data for barium chromate, zinc chromate and zinc tetrahydroxy chromate (from Table 10 of the CLH report).*

Study details	Result	Reference
Barium chromate		
intrabronchial pellet implantation, 2 years Porton Wistar rats Vehicle: Cholesterol	Number of animals with local tumours: **Test Group:** 0/101 **Negative control:** 1/100 (1 male with phaeochromocytoma)	Levy and Martin (1986)
intrapleural application, 2 years Rats, no information on the sex of the animals Vehicle: Sheep fat	Number of animals with local tumours: **Test group:** 1/31 (latent period. 14 month) **Negative control:** 0/34	Hueper (1961)
intrapleural application, 1 year Bethesda Black Strain rats Vehicle: Sheep fat	Number of animals with local tumours: **Test group:** 0/35 **Negative control:** 0/35	Hueper and Payne (1959)
intramuscular application, 2 years Rats Vehicle: Sheep fat	Number of animals with local tumours: **Test group:** 0/34 (latent period 14 month) **Negative control:** 0/32	Hueper (1961)
intramuscular application, 1 year Bethesda Black Strain rats Vehicle: Sheep fat	Number of animals with local tumours: **Test group:** 0/35 **Negative control:** 0/35	Hueper and Payne (1959)
Zinc tetrahydroxy chromate		
intrabronchial pellet implantation, 2 years Porton Wistar rats Vehicle: Cholesterol	Number of animals with local tumours: **Test Group:** 1/100 (1 male with squamous cell carcinoma) **Negative control:** 1/100 (1 male with phaeochromocytoma)	Levy and Martin (1986)
Zinc chromate (low water solubility, no further information)		
intrabronchial pellet implantation, 2 years Porton Wistar rats Vehicle: Cholesterol	Number of animals with local tumours: **Test Group:** 5/100 (3 males and 2 females with squamous cell carcinoma) **Negative control:** 1/100 (1 male with phaeochromocytoma)	Levy and Martin (1986)
Zinc chromate (norge composition, no further information)		
intrabronchial pellet implantation, 2 years Porton Wistar rats Vehicle: Cholesterol	Number of animals with local tumours: **Test Group:** 3/100 (2 males and 1 female with squamous cell carcinoma) **Negative control:** 1/100 (1 male with phaeochromocytoma)	Levy and Martin (1986)

According to the DS, none of these studies are reliable (reliability 3) from today's perspective because of the non-physiological routes of exposure, single implantations, single dose group, too low number of animals in some studies, most details often missing such as the sex of animals, purity of the test substance, information on overall appearance, body weight and survival.

Among the studies with barium chromate, a single incidence of local tumour (out of 31 animals) was observed after intrapleural application. With two different compositions of zinc chromate, 3 out of 100 or 5 out of 100 rats and with zinc tetrahydroxy chromate, 1 out of 100 rats had squamous cell carcinoma after intrabronchial application.

In two more studies (also of reliability 3) with the test substance identified only as Zinc Yellow, local tumours were observed in 22 out of 33 and 16 out of 34 rats after intrapleural and intramuscular applications, respectively (Hueper, 1961, see Table 15 of the CLH report). According to IARC (1990), Zinc Yellow can refer to several zinc chromate pigments, such as basic zinc chromate (zinc tetrahydroxy chromate) or zinc potassium chromate.

Human data

Human data on carcinogenicity are available only for zinc chromate, apart from one study (Davies, 1984) reporting that workers were exposed to small amounts of barium chromate. However, barium chromate exposure was low in relation to other chromate pigments exposure and no correlation with effects was possible.

Five cohort studies from occupational settings (production of zinc chromate and lead chromate pigments) in different countries (Norway, UK, France, Germany, The Netherlands and USA) are reported in the CLH report. All the five studies are assigned a reliability score of 3. A summary of these studies is available in Table 16 of the CLH report.

The cohort studies on zinc chromate reported an increased incidence of lung tumours for workers exposed to high concentrations of zinc chromate in the form of chromate pigments whereas no such clear causal relation could be demonstrated for lead chromate (Davies, 1984). Despite of identified limitations of the epidemiological data (especially inadequate quantitative exposure data, mixed exposure to other chromates, insufficient characterisation of study population, insufficient consideration of influencing factors like smoking) a clear correlation between zinc chromate exposure and induction of lung tumours in humans could be demonstrated which resulted in an evaluation by IARC as "*sufficient evidence in humans for the carcinogenicity of chromium [VI] compounds as encountered in … chromate pigment production…".* Based on the studies in experimental animals with zinc chromate described above IARC further concluded that "*There is sufficient evidence in experimental animals for the carcinogenicity of … zinc chromates…".* In addition, zinc chromates are classified as carcinogenic in Category 1A (CLP Annex VI, entry 024-007-00-3).

As there is no clear evidence for carcinogenic effects of barium chromate in humans, classification in Category 1A was not proposed by the DS. However, there is data indicating that barium chromate is able to reach cells of local target organs and exert effects via common significant metabolite. The effects are comparable to other chromates, including the poorly water-soluble zinc chromates, that are classified as Carc. 1A or 1B. Therefore, the DS proposed classification in Category 1B for carcinogenicity for barium chromate.

As there are no data via oral and dermal routes of exposure, and since the harmonised classification of zinc chromates is not restricted to inhalation exposure, the DS proposed not to specify the route of exposure. Similarly, zinc chromates do not have a harmonised specific concentration limit (SCL) and the DS proposed no SCL for barium chromate.

Comments received during consultation

Two MSCAs commented. One of the MSCAs supported classification as at least Carc. 1B based on read-across to the zinc chromates, which are classified as Carc. 1A. The MSCA considered that Carc. 1A could be applicable should barium have properties closer to zinc. The DS responded that there is no evidence, e.g., from carcinogenicity studies with barium chloride, that barium is

carcinogenic. The DS noted that although zinc chromates are classified as Carc. 1A, the underlying epidemiological evidence has some weaknesses. Considering the limitations of the overall database, the DS proposed Carc. 1B for barium chromate.

The other MSCA supported the proposed classification as Carc. 1B. However, the MSCA recommended not to restrict read-across to poorly soluble Cr(VI) compounds and that apart from solubility, the particle size and cellular uptake in particulate form (e.g., endocytosis, phagocytosis) should be considered. The DS considered that the quantitative difference in bioavailability between barium chromate and soluble chromates, such as sodium dichromate, is so large that a qualitative comparison with these substances can be challenged. The DS noted that investigations of cellular uptake by phagocytosis are available for other chromates (sodium dichromate, metallic chromium or lead chromate) but not for barium chromate. The DS cited the Scientific Committee on Occupational Exposure Limits (SCOEL) recommendation on Occupational Exposure Limits (OELs) for lead chromate (SCOEL/SUM-117, March 2004), which states that although phagocytic particle uptake occurs, particle-cell contact, and extracellular dissolution were decisive factors for its clastogenic activity. Overall, the DS considered that read-across to chromates with similar physico-chemical properties is more adequate.

Assessment and comparison with the classification criteria

In agreement with the DS, RAC notes that barium chromate triggers effects which are involved in the induction of lung tumours by chromates (reviewed by for e.g., Hartwig and MAK Commission, 2012; Proctor *et al*., 2014; Urbano *et al*., 2012). The DS summarised the sequence of the induction of Cr(VI) related lung tumours from these reviews as follows:

1) *Particulate chromium deposits and accumulates in the bifurcations of the lung. If this results in an exceedance of clearance mechanisms cellular absorption of chromium VI results.*
2) *Intracellular reduction of chromium VI induces oxidative stress and the formation of chromium III which can interact with the DNA and proteins.*
3) *The resulting protein and DNA damage may lead to tissue irritation, inflammation, and cytotoxicity.*
4) *These effects together with increased cell proliferation can result in changes to DNA sequences and finally lead to tumorigenesis.*

RAC also notes that the limited experimental data available for barium chromate does not cover all key events for the induction of lung tumours. From the data in the CLH report, it is noted that:

- *Barium chromate is absorbed into the cells despite its limited solubility.*
- *Barium chromate induces mutagenic effects comparable to the effects observed with other (carcinogenic) chromates […]. Barium chromate induces neoplastic transformations in vitro, however with lower potency than other chromates.*
- *Beaver et al. (2009a; 2009b) reported the induction of lung inflammation, injury and proliferation after exposure of mice to the sparsely soluble [Zinc tetrahydroxy chromate]. Already single exposure induced a neutrophilic inflammatory airway response characterised inter alia by an increased number of neutrophils and a decrease of macrophages in lung airways as analysed in broncho alveolar fluid. In a similar manner Cohen et al. (1998) observed an increase in the number of neutrophils and a decrease in the number of alveolar macrophages in the bronchoalveolar lavage of rats treated for 2 or 4 weeks with barium chromate, indicating that both substances induce similar effects.*
- *Levy and Martin (1986) reported an increased number of lungs with chronic inflammation and with bronchial inflammation [to] similar [extent] for barium chromate, zinc chromate and zinc tetrahydroxy chromate.*

These data indicate that barium chromate can induce effects associated with the induction of lung tumours typically observed for chromium (VI).

The animal studies with barium chromate, zinc chromate and zinc tetrahydroxy chromate employed non-physiological routes of exposure. However, the lung tumour data (including that from human studies) is relevant for inhalation exposure.

RAC also notes that no information is available on the induction of tumours after oral application for barium chromate, zinc chromate or zinc tetrahydroxy chromate.

Comparison with the criteria

Category 1A is assigned to substances that are known to have carcinogenic potential for humans. It is largely based on human studies that establish a causal relationship between human exposure to a substance and the development of cancer.

Category 1B is assigned to substances that are presumed to have carcinogenic potential for humans. It is largely based on animal experiments for which there is sufficient evidence to demonstrate animal carcinogenicity.

Category 2 is assigned to substances that are suspected to have carcinogenic potential for humans. It is based on evidence from human and/or animal studies which is not sufficiently convincing to place the substance in Category 1A or 1B.

According to Section 3.6.2.2.7 of Annex I to the CLP Regulation:

> *A substance that has not been tested for carcinogenicity may in certain instances be classified in Category 1A, Category 1B or Category 2 based on tumour data from a structural analogue together with substantial support from consideration of other important factors such as formation of common significant metabolites […].*

The read-across substances zinc chromate and zinc tetrahydroxy chromate are classified in Category 1A. However, other poorly water soluble Cr(VI) compounds such as lead chromate and strontium chromate are classified in Category 1B. For barium chromate, no human data are available that shows its carcinogenic potential. There are also no standard carcinogenicity animal studies that shows its carcinogenic potential. However, it is well established that Cr(VI) is the toxophore that is integral to the underlying mechanism of carcinogenicity for different Cr(VI) compounds. In line with the DS, RAC considers that the experimental data available for barium chromate indicates that it can induce effects associated with the induction of lung tumours typically observed for Cr(VI) and that Category 1B is justified. Category 2 is not considered appropriate as RAC considers the data to be clear, and since Category 1B is in line with the classification of other poorly water soluble Cr(VI) compounds. Since no studies via oral and dermal routes of exposure are available, RAC agrees with the DS to not specify the route of exposure.

Overall, RAC agrees with the DS and concludes that **barium chromate warrants classification as Carc. 1B; H350 (May cause cancer)**.

RAC evaluation of reproductive toxicity

Summary of the Dossier Submitter's proposal

The DS proposed no classification as no studies investigating reproductive toxicity (fertility, developmental toxicity and lactational effects) are available for barium chromate or the read-across substances zinc chromate and zinc tetrahydroxy chromate.

Comments received during consultation

No comments received.

Assessment and comparison with the classification criteria

As no studies are available for evaluation, **RAC agrees with the DS that no classification is warranted due to lack of data for reproductive toxicity** (including adverse effects on sexual function and fertility, adverse effects on development, and effects on or via lactation) for barium chromate.

ANNEXES:

Annex 1 The Background Document (BD) gives the detailed scientific grounds for the opinion. The BD is based on the CLH report prepared by the Dossier Submitter; the evaluation performed by RAC is contained in 'RAC boxes'.

Annex 2 Comments received on the CLH report, response to comments provided by the Dossier Submitter and RAC (excluding confidential information).