Australian Government
Department of Health
Australian Industrial Chemicals Introduction Scheme

Cesium salts

Evaluation statement

14 September 2021

Table of contents

Contents

AICIS Evaluation Statement

Subject of the evaluation

Cesium salts

Chemicals in this evaluation

Name	CAS registry number
Acetic acid, cesium salt	3396-11-0
Carbonic acid, dicesium salt	534-17-8
Carbonic acid, monocesium salt	15519-28-5
Cesium bromide (CsBr)	7787-69-1
Cesium chloride (CsCl)	7647-17-8
Cesium fluoride (CsF)	13400-13-0
Cesium hydroxide (Cs(OH))	21351-79-1
Cesium hydroxide, monohydrate	35103-79-8
Cesium iodide (CsI)	7789-17-5
Ethanedioic acid, dicesium salt	1068-63-9
Nitric acid, cesium salt	7789-18-6
Nitrous acid, cesium salt	13454-83-6
Sulfuric acid, dicesium salt	10294-54-9

Reason for the Evaluation

The Evaluation Selection Analysis indicated a potential risk to human health.

Parameters of evaluation

A human health risk assessment for all identified industrial uses of the chemicals. Chemicals in this evaluation are all cesium salts listed on the Australian Inventory of Industrial Chemicals (the Inventory). Cesium salts have been reported to be toxic to reproduction. Based on a review of the available information, the cesium ion causes reproductive toxicity and acute oral toxicity. These are expected to be the main cesium-related drivers of any risk management recommendations for this group of chemicals. Hence, this evaluation will focus specifically on these toxicity categories for cesium salts.

Effects related to the anions in these salts are not specifically addressed.

Please note that cesium-related information may be found under the alternative spelling, i.e. caesium.

Summary of evaluation

Summary of introduction, use and end use

No information is available on the use of these chemicals in Australia. However, one or more of these chemicals in this group are reported to have the following commercial and/or site-limited uses internationally, as identified through European Union Registration, Evaluation, Authorisation and Restriction of Chemicals (EU REACH) dossiers; Galleria Chemica and the Substances and Preparations in the Nordic countries (SPIN) database:

- adsorbent and non-metal-surface treatment products
- in manufacturing cesium compounds and other chemicals
- in manufacturing electrical, electronic and optical equipment
- in explosives
- as a process regulators or catalysts.

Human health

Summary of health hazards

This evaluation specifically focuses on the acute oral and reproductive toxicity of cesium salts. Based on the weight of evidence from available experimental data, chemicals in this group are considered to be harmful by ingestion and to cause specific adverse effects on fertility following oral exposure.

Cesium compounds have reproductive toxicity via effects on the male reproductive system. In several oral repeated dose studies, statistically significant adverse effects on sperm motility and morphology were reported. A lowest adverse effect level (LOAEL) of 38 mg/kg bw/day was determined. In a one generation reproductive/developmental toxicity screening study, with both males and females being treated, statistically significant adverse effects in offspring (higher percentage of dead offspring at postnatal days 0-4, lower mean number of live-born offspring, lower mean litter weight and lower mean litter weight gain) were seen. These occurred at 200 mg/kg bw/day. In a gestational developmental study, where only dams were treated, no effects on offspring were seen at up to 150 mg/kg bw/day.

Further details on the acute oral and reproductive toxicity of cesium salts are provided in the Supporting information (see below).

Cesium salts are highly soluble in water and completely dissociate in water, to form the cesium cation and respective anion to form the cesium cation and respective anion. Various salts of the relevant anions have been assessed by AICIS (formerly NICNAS) under the Inventory Multi-tiered Assessment and Prioritisation (IMAP) framework and are available on the AICIS website.

Some of the cesium salts in this evaluation have anions which have known toxicological properties. Given the chemicals' uses in this group it will not lead to public exposure. Correct classification is sufficient to ensure appropriate risk management for the anions.

Health hazard classification

This group of chemicals (cesium salts) satisfy the criteria for classification according to the Globally Harmonized System of Classification and Labelling of Chemicals (GHS) (UNECE, 2017), as relevant for work health and safety as follows. This does not consider classification of physical hazards and environmental hazards.

Health hazards	Hazard category	Hazard statement
Reproductive and developmental toxicity	Category 2	H361f: Suspected of damaging fertility
Acute toxicity (oral)	Category 4	H302: Harmful if swallowed

Note, the evaluation has only considered hazard classification based on the cesium ion, as applicable to all of the chemicals in this group, in detail.

Classification for the effects of the anions may be drawn from classification of other completely dissociating salts of these anions, in particular potassium salts.

Although potassium nitrite and potassium fluoride are classified as Acute Toxicity – Category 3 (SWA), after adjusting for molecular weight, the acute toxicity classification recommended for cesium salts is considered more appropriate for CAS No.13400-13-0 and 13454-83-6.

However, classifications for:

- soluble salts of oxalic acid (see supporting information) should also be applied to cesium oxalate (CAS No.1068-63-9)
- corrosivity for potassium hydroxide (Skin corrosion – Category 1A—H314: Causes severe skin burns and eye damage (SWA)) should also be applied to CAS No. 21351-79-1 and CAS No. 35103-79-8
- eye damage for dipotassium carbonate (Eye damage – Category 1—H318: Causes serious eye damage (SWA)) should be applied to CAS No. 534-17-8.

Summary of health risk

Public

While cesium oxalate (CAS No.1068-63-9) has Australian and international existing regulatory controls relevant to consumer use (refer to **Supporting information** section), no reported consumer uses of these chemicals in this group were identified. Based on the available use information, it is unlikely that the public will be exposed to the chemicals. Therefore, there are no identified risks to the public that require management.

Workers

During product formulation and packaging, dermal, ocular and inhalation exposure might occur, particularly where manual or open processes are used. These could include transfer and blending activities, quality control analysis, and cleaning and maintaining equipment. Worker exposure to the chemical at lower concentrations could also occur while using formulated products containing the chemical. The level and route of exposure will vary depending on the method of application and work practices employed. Good hygiene practices to minimise oral exposure are expected to be in place.

Given the critical health effect of reproductive toxicity, these chemicals could pose a risk to workers. The existing regulatory controls relevant to workers are limited to cesium hydroxide and cesium oxalate (refer to **Supporting information** section). Control measures applying to all of the chemicals in this group, to minimise dermal and inhalation exposure, are needed to manage the risk to workers (refer to **Recommendation** section).

Conclusions

The conclusions of this evaluation are based on the information described in the statement. Obligations to report additional information about hazards under section 100 of the Industrial Chemicals Act 2019 apply.

The Executive Director is satisfied that the identified human health risks can be managed within existing risk management frameworks. This is provided that all requirements are met under environmental, workplace health and safety and poisons legislation as adopted by the relevant state or territory. The proposed means of managing the risks identified during this evaluation are set out in the Recommendations section.

Recommendations

Workers

Recommendation to Safe Work Australia

It is recommended that Safe Work Australia (SWA) update the HCIS to include classifications relevant to work health and safety.

Advice to industry

The information in this report, including recommended hazard classifications, should be used by a person conducting a business or undertaking at a workplace (such as an employer) to determine the appropriate controls.

Recommended control measures that could be implemented to manage the risk arising from exposure to these chemicals include, but are not limited to:

- using closed systems or isolating operations
- minimising manual processes and work tasks through automating processes
- adopting work procedures that minimise splashes and spills
- cleaning equipment and work areas regularly
- using protective equipment that is designed, constructed, and operated to ensure that the worker does not come into contact with the chemicals
- to ensure control measures in place are working effectively and continue to do so.

These control measures should be supplemented with conducting health monitoring for any worker who is at significant risk of exposure to the chemicals, if valid techniques are available to monitor the effect on the worker's health.

Measures required to eliminate, or manage risk arising from storing, handling and using hazardous chemicals depend on the physical form and the manner in which the chemicals are used.

Personal protective equipment should not solely be relied upon to control risk and should only be used when all other reasonably practicable control measures do not eliminate or sufficiently minimise risk.

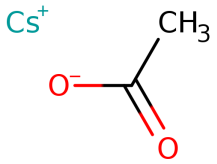
Model codes of practice, available from the Safe Work Australia website, provide information on how to manage the risks of hazardous chemicals in the workplace, prepare an SDS and label containers of hazardous chemicals. Your Work Health and Safety regulator should be contacted for information on Work Health and Safety laws and relevant Codes of Practice in your jurisdiction.

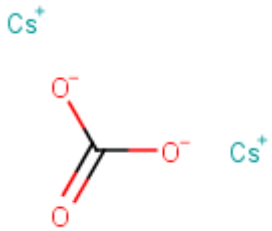
Supporting information

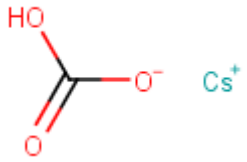
Grouping rationale

The chemicals in this group are all soluble cesium salts of well characterised anions. Given the high dissociation of cesium salts in aqueous solution, the toxicity properties of the anions may be drawn from other sources.

Chemical identity

Chemical name	Acetic acid, cesium salt
CAS number	3396-11-0
Synonyms	cesium acetate
Structural formula	
Molecular formula	C2H4O2.Cs
Molecular weight (g/mol)	191.95
SMILES	[Cs+].CC(=O)[O-]
Chemical description	White to light-brown powder, with a mild vinegar odour.

Chemical name	Carbonic acid, dicesium salt
CAS number	534-17-8
Synonyms	cesium carbonate; carbonic acid, cesium salt (1:2)
Structural formula	
Molecular formula	CH2O3.2Cs
Molecular weight (g/mol)	325.83
SMILES	[Cs+].[Cs+].[O-]C(=O)[O-]
Chemical description	Odourless, white crystalline powder.

Chemical name	Carbonic acid, monocesium salt
CAS number	15519-28-5
Synonyms	cesium bicarbonate
Structural formula	
Molecular formula	CH2O3.Cs
Molecular weight (g/mol)	193.93
SMILES	[Cs+].OC(=O)[O-]
Chemical description	Odourless, colourless to white crystalline powder.

Chemical name	Cesium bromide (CsBr)
CAS number	7787-69-1
Synonyms	-
Structural formula	Cs^+ Br^-
Molecular formula	BrCs
Molecular weight (g/mol)	212.81
SMILES	[Br-].[Cs+]
Chemical description	White or transparent solid

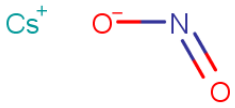
Chemical name	Cesium chloride (CsCl)
CAS number	7647-17-8
Synonyms	cesium chloride
Structural formula	Cs^+ Cl^-
Molecular formula	ClCs
Molecular weight (g/mol)	168.36
SMILES	[Cl-].[Cs+]
Chemical description	Odourless, white crystalline solid.

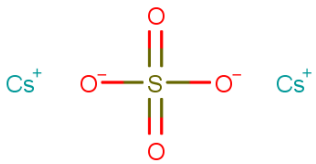
Chemical name	Cesium fluoride (CsF)
CAS number	13400-13-0
Synonyms	cesium fluoride
Structural formula	
Molecular formula	CsF
Molecular weight (g/mol)	151.91
SMILES	[F-].[Cs+]
Chemical description	Odourless, white crystalline powder.

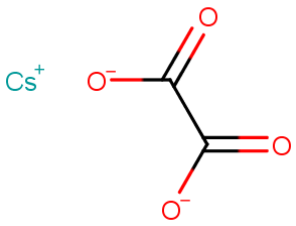
Chemical name	Cesium hydroxide (Cs(OH))
CAS number	21351-79-1
Synonyms	cesium hydroxide
Structural formula	
Molecular formula	CsHO
Molecular weight (g/mol)	149.92
SMILES	[OH-].[Cs+]
Chemical description	Colourless, odourless solid.

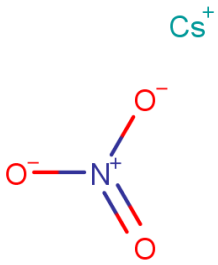
Chemical name	Cesium hydroxide, monohydrate
CAS number	35103-79-8
Synonyms	-
Structural formula	
Molecular formula	CsHO.H2O
Molecular weight (g/mol)	167.93
SMILES	O.[OH-].[Cs+]
Chemical description	N/A

Chemical name	Cesium iodide (CsI)
CAS number	7789-17-5
Synonyms	cesium iodide
Structural formula	
Molecular formula	CsI
Molecular weight (g/mol)	259.81
SMILES	[I-].[Cs+]
Chemical description	Colourless, odourless solid.

Chemical name	Nitrous acid, cesium salt
CAS number	13454-83-6
Synonyms	cesium nitrite
Structural formula	
Molecular formula	Cs.HNO2
Molecular weight (g/mol)	178.91
SMILES	N(=O)[O-].[Cs+]
Chemical description	N/A

Chemical name	Sulfuric acid, dicesium salt
CAS number	10294-54-9
Synonyms	cesium sulfate
Structural formula	
Molecular formula	Cs.1/2H2O4S
Molecular weight (g/mol)	361.88
SMILES	[Cs+].[Cs+].[O-]S(=O)(=O)[O-]
Chemical description	Colourless, odourless solid.

Chemical name	Ethanedioic acid, dicesium salt
CAS number	1068-63-9
Synonyms	cesium oxalate
Structural formula	
Molecular formula	C2H2O4.2Cs
Molecular weight (g/mol)	355.5
SMILES	C(=O)(C(=O)[O-])[O-].[Cs+].[Cs+]
Chemical description	N/A

Chemical name	Nitric acid, cesium salt
CAS number	7789-18-6
Synonyms	cesium nitrate
Structural formula	
Molecular formula	Cs.HNO3
Molecular weight (g/mol)	194.91
SMILES	[Cs+].[O-][N+](=O)[O-]
Chemical description	Odourless, white crystalline solid.

Relevant physical and chemical properties

The cesium salts in this group are all expected to be readily soluble in water, with reported solubilities ranging from 240 mg/L to >1000 mg/L (REACHa; REACHb; REACHc; REACHd; REACHe; REACHf; REACHg; REACHh; REACHi).

Existing Australian regulatory controls

AICIS

There are no AICIS specific regulatory controls applicable to chemicals in this group.

Public

Cesium oxalate (CAS No. 1068-63-9) is the soluble cesium salt of oxalic acid; therefore, it is covered by the listing of oxalic acid in the Poisons Standard—the Standard for the Uniform Scheduling of Medicines and Poisons (SUSMP) in Schedule 6 (SUSMP, 2021).

Schedule 6: 'OXALIC ACID except

a) in dental care preparations, including mouthwashes, containing 3 per cent or less of soluble salts of oxalic acid; or

b) its insoluble salts.'

Schedule 6 chemicals are described as 'Substances with a moderate potential for causing harm, the extent of which can be reduced through the use of distinctive packaging with strong warnings and safety directions on the label'. Schedule 6 chemicals are labelled with 'Poison' (SUSMP, 2021).

No other specific regulatory control are currently applicable to the remainder of the chemicals in this group.

Workers

Cesium oxalate (CAS No. 1068-63-9) is currently covered by the listing of ‘oxalic acid, salts (with the exception of those specified elsewhere in this database)’ in the Hazardous Chemicals Information System (HCIS), and classified as hazardous with the risk phrases for human health (Safe Work Australia), as detailed in the table below.

Health hazards	Hazard category	Hazard statement
Acute toxicity (oral)	Category 4	H302: Harmful if swallowed
Acute toxicity (dermal)	Category 4	H312: Harmful in contact with skin

However, soluble salts of oxalic acid have since been assessed under IMAP, and determined to cause effects including target organ toxicity (kidneys) following repeated exposure (refer to the IMAP assessment for further details; NICNAS IMAP 2014), and recommended classifications have been included in the HCIS (SWA). Due to the high solubility of these cesium salts, these hazard classifications listed below are also considered applicable to cesium oxalate.

Health hazards	Hazard category	Hazard statement
Acute toxicity (oral)	Category 4	H302: Harmful if swallowed
Acute toxicity (dermal)	Category 4	H312: Harmful in contact with skin
Skin irritation	Category 2	H315: Causes skin irritation
Eye damage	Category 1	H318: Causes serious eye damage
Respiratory irritation Specific target organ toxicity (single exposure)	Category 3	H335: May cause respiratory irritation
Repeat dose toxicity Specific target organ toxicity (repeated exposure)	Category 2	H373: May cause damage to kidneys through prolonged or repeated exposure

The remainder of the chemicals in this group do not have any existing applicable hazard classifications.

Cesium hydroxide (CAS No. 21351-79-7) has an exposure standard of 2 mg/m^3 Time Weighted Average (TWA) in Australia (Safe Work Australia); this was recommended to protect for irritation to the eyes, respiratory tract and skin in exposed workers (SWA, 2019).

International regulatory status

Exposure standards

There is a consistent exposure standard of 2 mg/m^3 reported internationally for cesium hydroxide (CAS No. 21351-79-7) including in, but not limited to, the following:

- United States (US) National Institute for Occupational Safety and Health (NIOSH) recommended exposure limits (RELs) (NIOSH)
- US American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLV) (Galleria Chemica)
- United Kingdom Health and Safety Executive, Workplace Exposure Limits (WELs) (Galleria Chemica)
- Austrian occupational exposure limits, maximum workplace concentrations (MAK), which also lists a short-time value of 4 mg/m^3(Galleria Chemica)
- other countries such as Beligium, Canada, China, Singapore, Italy, Greece, Spain and Taiwan (Galleria Chemica).

Other

Cesium oxalate (CAS No. 1068-63-9) is covered by the listing of ‘oxalic acid, its esters and alkaline salts’ included in, but not limited to, the following (Galleria Chemica):

- ASEAN Cosmetic Directive Annex III – Part 1 (List of substances which cosmetic products must not contain except subject to restrictions and conditions laid down)

- EU Regulation (EC) No 1223/2009 Annex III (List of substances which cosmetic products must not contain except subject to the restrictions laid down)
- New Zealand Cosmetic Products Group Standard - Schedule 5 - Table 1 (Components cosmetic products must not contain except subject to the restrictions and conditions laid down)
- Philippines Restricted Ingredients For Use In Cosmetics - List of substances which cosmetics products must not contain except subject to the restrictions and conditions specified
- Thailand Cosmetic Act (Food and Drug Administration Thailand, Cosmetic Control Group, The listing of specially controlled substances).

For the above, the chemicals are restricted to use in hair products, for professional use only, at a maximum concentration of 5%.

Health hazard information

Acute toxicity

While the reported LD50 values for the chemicals range from 500 to 2600 mg/kg bw, all studies using cesium salts of low toxicity anions and conducted according to an appropriate Test Guideline (TG) reported LD50 values mainly below 2000 mg/kg bw. The data are sufficient to support classification of this group of chemicals.

The following acute oral toxicity studies were conducted either in accordance with, or similar to, the Organisation for Economic Cooperation and Development (OECD) TG 401:

- Cesium acetate (CAS No. 3396-11-0) – rat oral LD50 of 1,550 mg/kg bw (REACHg)
- Cesium iodide (CAS No. 7789-17-5) – rat oral LD50 of 2,386 mg/kg bw; a deviation to the study guideline of using 9 animals/dose instead of 10, was noted (REACHf).

The following acute oral toxicity studies were conducted either in accordance with, or similar to OECD TG 423:

- Cesium nitrate (CAS No. 7789-18-6) – rat oral LD50 between 300 and 2,000 mg/kg bw (REACHd)
- Cesium sulfate (CAS No. 10294-54-9) – rat oral LD50 between 300 and 2,000 mg/kg bw (REACHb).

The following reported LD50 values were based on non-guideline studies:

- Cesium chloride (CAS No. 7647-17-8) – rat oral LD50 of 2600 mg/kg bw and mouse oral LD50 of 2,300 mg/kg bw; study methods not specified (REACHe).

Reproductive and development toxicity

Based on the available information, cesium salts are considered potentially toxic to reproduction, specifically in regards to the male reproductive system. The relevant studies are detailed below.

In a 90-day repeated-dose toxicity study, conducted according to OECD TG 408, cesium chloride (CAS No. 7647-17-8) was administered by oral gavage to Wistar rats (115 male/dose group and 54 female/dose group) at 13, 38, 127 and 253 mg/kg bw/day, with a recovery period of 16 weeks (REACHa; REACHb; REACHc). Reduced food consumption and lower body weight gain were reported in males from the 127 mg/kg bw/day group, and both males and females from the 253 mg/kg bw/day group. Clinical signs of toxicity and mortality were also observed at this highest dose. No effects on food consumption or body weight, or clinical signs of toxicity were observed in animals from the 13 or 38 mg/kg bw/day or females from the 127 mg/kg/day treatment groups.

In regards to specific effects relevant to reproductive toxicity, a no-observed-adverse-effect-level (NOAEL) of 13 mg/kg bw/day was reported in this study, based on statistically significant adverse effects on sperm motility and morphology observed at higher dose levels, as compared to control-group animals. This included abnormal sperm (head and tail separation, morphological irregularities, fraying and flattened head) and significantly reduced number of sperm in the cauda epididymis at ≥38 mg/kg bw/day. Adverse effects on sperm motility included completely immotile sperm observed at ≥127 mg/kg bw/day, while increased beat-cross frequency was the only effect on motility observed at 38 mg/kg bw/day. Following the 16-week recovery period, one male from the 127 m/kg bw/day group was reported to still have reduced numbers of sperm, with all sperm immotile and morphologically abnormal. No adverse effect on sperm count, motility or morphology were reported at 13 mg/kg bw/day throughout the study or recovery period.

In a 90-day repeated-dose toxicity study, conducted according to OECD TG 408, cesium hydroxide monohydrate (CAS No. 35103-79-8) was administered by oral gavage to Wistar rats (10 animals/sex/dose) at 25, 125 and 250 mg/kg bw/day (REACHb; REACHd; REACHe). While reduced body weight gain was reported in males from the 125 mg/kg bw/day group, and both males and females from the 250 mg/kg bw/day group at certain time-points during the study, statistical significance throughout the study period (day 0 to day 89) for these effects, in comparison to control group animals, was only reported in males from the highest dose group.

For specific effects relevant to reproductive toxicity, a NOAEL of 25 mg/kg bw/day was reported in this study, based on statistically significant adverse effects on the male reproductive system observed at higher dose levels, compared to control-group animals. This included damage to sperm cells (head and tail separation, and immotility) and reduced epididymis weights at ≥125 mg/kg bw/day. At the highest dose of 250 mg/kg bw/day, adverse effects on spermatogenesis were reported (reduced number of mature spermatozoa in the ductus epididymis and the seminiferous tubules, and reduced number of spermatids in the seminiferous tubules). No adverse effect on sperm parameters were reported at the lowest dose of 25 mg/kg bw/day.

In one available reproductive/developmental toxicity screening study, conducted according to OECD TG 421, cesium nitrate (CAS No. 7789-18-6) was administered by oral gavage to Wistar rats (12 animals/sex/dose) at 10, 50 and 200 mg/kg bw/day (REACHd). Both males and females were treated with the chemical for two weeks prior to mating. For males, the duration of treatment was 56 days, including during mating and a 33-day post mating period. For females, the duration of treatment was between 40 to 49 days, depending on the date of mating, this included treatment during the mating period, though gestation and up to lactation day 7.

A NOAEL of 50 mg/kg bw/day for reproductive performance in parental animals (P0) was reported, based on adverse effects on sperm motility and morphology, and reduced weights of the testes and epididymides, reported at the next highest dose of 200 mg/kg bw/day.

Specifically, there was a statistically significant increase in immotile sperm (91.5%) and morphologically abnormal sperm cells (11.2%), as compared to the control group animals (12.6% and 0.1%, respectively).

A NOAEL of 50 mg/kg bw/day for the first generation (F1) offspring was reported, based on statistically significant effects observed in the 200 mg/kg bw/day F1 group (higher percentage of deceased offspring at postnatal days 0–4, lower mean number of live-born offspring, lower mean litter weight and lower mean litter weight gain). Statistically significantly lower mean body weights were also reported in offspring from the 50 mg/kg bw/day group (postnatal days 0–4). It should be noted that while these measures were reported to be statistically significant in comparison to the study control group, they were reported as being within the ranges of historical control data. In regards to clinical observations in the offspring, the number of pups with clinical signs (not suckled, cold) was reported to be significantly higher for offspring from the 200 mg/kg bw/day treatment-group. Due to the effects in offspring, reported at the parental NOAEL, treatment-related adverse effects on the development of the offspring cannot be ruled out; however, there is insufficient evidence to warrant hazard classification specifically for developmental toxicity.

In a prenatal developmental toxicity study (examining the effect on development following maternal exposure only to the chemical), conducted according to OECD TG 414, cesium hydroxide monohydrate (CAS No. 35103-79-8) was administered by oral gavage to Wistar rats (27 sperm-positive females/dose) at 10, 40 and 150 mg/kg bw/day, daily during gestational days (GD) 5─19 (REACHb; REACHc; REACHe; REACHf). While treatment-related effects on maternal body weight and food consumption were reported, no treatment-related embryotoxic, teratogenic or developmental effects in offspring were reported. A NOAEL of 10 mg/kg bw/day for maternal toxicity and a NOAEL of 150 mg/kg bw/day for developmental toxicity, were reported for this study.

References

AICIS. Inventory Multi-tiered Assessment and Prioritisation (IMAP) Framework Human Health assessments. Australian Industrial Chemicals Introduction Scheme (AICIS). Office of Chemical Safety. Australian Government Department of Health. Available at https://www.industrialchemicals.gov.au/

Galleria Chemica. Accessed May 2021 at: https://jr.chemwatch.net/galleria/

NIOSH. National Institute for Occupational Safety (NIOSH) Recommended Exposure Limit (REL): Cesium hydroxide. Centre for Disease Control (CDC). United States Department of Health and Human Services and Health. Accessed May 2021 at https://www.cdc.gov/niosh/npg/npgd0111.html

NICNAS IMAP 2014. National Industrial Chemicals Notification and Assessment Scheme (NICNAS) IMAP Framework. Soluble salts of oxalic acid: Human Health Tier II assessment report. Published 18 September 2014. Available at: https://www.industrialchemicals.gov.au/chemical-information/search-assessments

REACHa. Registration, Evaluation and Authorisation of Chemicals (REACH) Dossier. Cesium carbonate (CAS No.534-17-8). Accessed May 2021 at https://echa.europa.eu/information-on-chemicals/registered-substances

REACHb. REACH dossier. Cesium hydroxide (CAS No. 21351-79-1). Accessed May 2021 at https://echa.europa.eu/information-on-chemicals/registered-substances

REACHc. REACH dossier. Cesium sulfate (CAS No.10294-54-9). Accessed May 2021 at https://echa.europa.eu/information-on-chemicals/registered-substances

REACHd. REACH dossier. Cesium nitrate (CAS No. 7789-18-6). Accessed May 2021 at https://echa.europa.eu/information-on-chemicals/registered-substances

REACHe. REACH dossier. Cesium chloride (CAS No.7647-17-8). Accessed May 2021 at https://echa.europa.eu/information-on-chemicals/registered-substances

REACHf. REACH dossier. Cesium iodide (CAS No. 7789-17-5). Accessed May 2021 at https://echa.europa.eu/information-on-chemicals/registered-substances

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