SIDS INITIAL ASSESSMENT PROFILE

CAS No.	10361-37-2
Chemical Name	Barium chloride
Structural Formula	Ba^{2+} $2Cl^-$

SUMMARY CONCLUSIONS OF THE SIAR

Physical and chemical properties

Barium chloride is a white hygroscopic orthorhombic crystal with a melting point of 962 °C, a boiling point of 1560 °C and a vapour pressure of essentially zero. The calculated octanol-water partition coefficient (log K_{ow}) is not applicable and the water solubility is 375 g/L at 25 °C.

Human Health

Radiolabelled barium chloride ($^{131}BaCl_2$) was administered via intubation in rats. When ^{131}Ba concentrations in the eyes, heart, liver, kidney, and muscle was determined 24 hours after dosing, the ^{131}Ba concentration in those tissues, appeared 2-8 times higher than the ^{131}Ba concentration in blood. This demonstrates that $^{131}BaCl_2$ is not only absorbed, but concentrated above the blood levels at least in some tissue compartments. The absorption, distribution and excretion of $^{133}BaCl_2$, administered orally or intra-peritoneal, were studied in weanling male rats. ^{133}Ba was rapidly absorbed from the gastrointestinal tract with the peak concentration in the blood and soft tissues occurring 30 min after administration. Total uptake of ^{133}Ba increased with increasing dosage. Absorbed ^{133}Ba was mainly distributed in the combined gastrointestinal tract and contents. The barium chloride was excreted in both urine and feces, but with majority of the excretion occurring via the fecal route. Barium chloride is rapidly taken up by the soft tissues, more slowly taken up by the skeleton, and excreted primarily in the feces.

Male and female rats were gavaged with barium chloride in deionized water over a dosage range of 60 to 960 mg/kg (10 animals per sex per dose). The acute oral LD_{50} values were 408 mg/kg bw for male and 419 mg/kg bw for female rat. Hemorrhagic areas in the stomach and inflammation of the intestines were seen at necropsy. The dermal LD_{50} values were >2,000 mg/kg bw for male and female rat [OECD TG 402]. The LD_{50} studies suggest a moderate acute oral toxicity and a low acute dermal toxicity. No studies were available on acute inhalation toxicity.

There were no reliable skin/eye irritation studies nor skin sensitization studies available.

Barium chloride was administered via the drinking water to rats, equivalent to 0, 1.7, 8.1 or 38.1 mg/kg bw/day for males and 0, 2.1, 9.7 or 45.7 mg/kg bw/day for females for 4, 8 and 13 weeks, respectively. Any changes noted were not considered to be toxicologically or biologically relevant as they were within normal variation or did not occur in a dose related manner. The NOAEL of the repeated-dose oral toxicity study was considered to be 250 ppm (38.1-45.7 mg/kg bw/day).

Barium chloride dihydrate was given to rats and mice in drinking water for 13 weeks at concentrations of 0, 125, 500, 1,000, 2,000 or 4,000 ppm. The NOAEL was 2,000 ppm (corresponding to the average daily dose of 110 and 115 mg Ba/kg bw/day to male and female rats, respectively, and 205 and 200 mg Ba/kg bw/day to male and female mice, respectively) based on mortality, renal toxicity, decreases of mean body weight gains and of water consumption.

In *in vitro* bacterial reverse mutation tests, barium chloride and barium chloride dihydrate were negative both with and without metabolic activation in multiple strains of *Salmonella typhimurium*. In an *in vitro* chromosomal aberration test, barium chloride dihydrate did not exhibit clastogenic effects with and without S9 mix. In contrast, barium chloride dihydrate, at concentrations of 250 ug/mL and above, induced gene mutation at the TK+/- locus of L5178Y mouse lymphoma cells in the presence of S9; without S9, no increase in the number of mutant colonies was observed. In cytogenetic tests with cultured Chinese hamster ovary cells,

barium chloride dihydrate did not induce sister chromatid exchanges or chromosomal aberrations, with or without S9. No cell cycle delay was observed at any of the concentrations tested. Based on the results, barium chloride is considered to be non genotoxic *in vitro*. No *in vivo* genotoxicity studies were available.

There was no evidence of carcinogenic activity when barium chloride dihydrate was given at 0, 500, 1,250 or 2,500 ppm in the drinking water to rats or mice (50 sex/species/dose level) for 2 years. The highest concentrations were equivalent to 60-75 mg barium/kg bw/day in rats and 160-200 mg barium/kg bw/day in mice.

Barium chloride dihydrate was administered to rats and mice (males for 60 days; females for 30 days) via the drinking water prior to mating. No treatment-related decreases in pregnancy rate or gestation length were observed in rats. A small reduction in pup birth weight was shown at 4,000 ppm at 1 day but not at 5 days of age. No alterations in epididymal sperm counts, sperm motility, sperm morphology, testis or epididymal weight or vaginal cytology were observed in rats and mice exposed to 4,000 ppm and 2,000 ppm, respectively. The NOAEL for fertility and developmental toxicity was determined to be 4,000 ppm for rats (equivalent to 201.5 mg/kg bw/day for males and 179.5 mg/kg bw/day for females) and 2,000 ppm for mice (the average dose was 206 mg Ba/kg bw/day for males and 199.8 mg Ba/kg bw/day for females), the highest concentration tested. Note that these doses are expressed as barium, not barium dichloride (or barium dichloride dihydrate). Thus, based on drinking water studies with barium dichloride dihydrate, barium is considered to have low potential for developmental and reproductive toxicity.

Environment

Environmental biodegradation and environmental fate analysis based on log K_{ow} and log K_{oc} is not applicable for inorganic salts such as barium chloride. Photodegradation and biodegradation are not relevant transformation processes for barium chloride but, upon emission to water, it will dissolve and release the divalent cation in solution. Under natural conditions, barium will form compounds in the +2 oxidation state. Soil adsorption of barium was studied in a sandy soil and a sandy loam soil. Sludge solutions appeared to increase the mobility of elements in soil. Barium adsorption in algae increased proportionally with decreasing barium concentration in the medium. The current state of the science does not allow for the unambiguous interpretation of the significance of various measures of bioaccumulation (e.g., BCF, BAF) for metal-containing inorganic substances.

The following acute toxicity test results have been determined for aquatic species:

Fish [*Fundulus heteroclitus*]	96-h LC_{50} > 1,000 mg Ba/L (measured)
Invertebrate [*Daphnia magna*]	48-h LC_{50} = 14.5 mg Ba/L (measured)
Plant [*Lemna minor*]	96-h EC_{50} = 26 mg/L and 61 mg Ba/L (measured)

The following chronic toxicity test results have been determined:

Invertebrate [*Daphnia magna*]	21 days, EC_{50} = 8.9 mg Ba/L (measured)
	EC_{16} = 5.8 mg Ba/L (measured)

Exposure

Barium chloride was commercially imported with an annual import volume of 1,933 tonnes in the Republic of Korea in 2006. The Republic of Korea's annual production of barium chloride was not reported in 2006. Barium chloride is mainly used as an intermediate in production processes. Barium chloride is used for manufacturing of pigments, colouring agents, paints, inks, additives, heat transferring agents, and stabilisers in the sponsor country.

No monitoring data for effluents, surface water, or in occupational settings are available from the production and processing sites in the Republic of Korea. Occupational and consumer exposures are considered to be negligible. The general population is exposed to barium primarily through ingestion of drinking water and consumption of food. Concentrations of barium in raw surface waters and drinking water supplies have been found in concentrations ranging from 7 to 15,000 μg/L. Concentration of barium in seawater is on average 6 ug/L. Ambient barium concentrations in air ranged from 0.0015 to 0.95 $\mu g/m^3$ in the USA.

RECOMMENDATION AND RATIONALE FOR THE RECOMMENDATION AND NATURE OF FURTHER WORK RECOMMENDED

Human Health

This chemical is of low priority for further work. The chemical possesses properties indicating a hazard for human health (moderate acute oral toxicity). Based on exposure data presented by the Sponsor country exposure to human is expected to be low. Countries may desire to investigate any exposure scenarios that were not presented by the Sponsor country.

Environment

Barium chloride is currently of low priority for further work. The chemical possesses properties indicating a hazard for the environment (acute toxicity to aquatic organisms between 1 and 100 mg/L). However, chronic toxicity to aquatic organisms is typically > 1 mg/L.