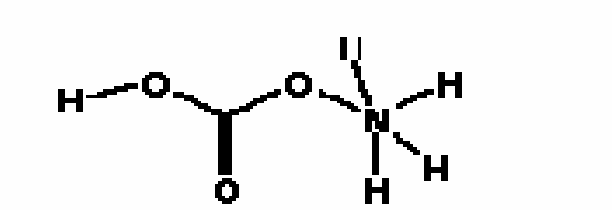
SIDS INITIAL ASSESSMENT PROFILE

CAS No.	1066-33-7
Chemical Name	Ammonium bicarbonate
Structural Formula	NH_4HCO_3 

SUMMARY CONCLUSIONS OF THE SIAR

Human Health

Ammonium bicarbonate rapidly dissociates in biological fluids to yield ammonium ion (NH_4^+) and bicarbonate ion (HCO_3^-). Ammonia and ammonium ions are integral components of normal metabolic processes and play an essential role in the physiology of man and other species, the toxicological profile of the substance is assumed to be due to the free ammonia rather than to the ionized form.

It is noted that ammonium bicarbonate, as a human food ingredient is generally recognized as safe (GRAS) by the US FDA. Most of the data related to acute toxicity endpoints come from secondary data sources. Original studies could not be found. These data indicate that the acute oral LD_{50} in rats is LD_{50} is ca. 1576 mg/kg bw. The dermal toxicity reported is LD_{50}>5000 mg/kg bw. Acute inhalation toxicity results are not available but could refer to ammonia produced by ammonium bicarbonate decomposition which increases with the temperature. The calculated value is LC_{50} (inhalation, 1h, mice) ≥ 13.8 mg NH_4HCO_3/L air. Data from secondary data sources also indicate that ammonium bicarbonate is moderately irritating for the skin and eye.

No information could be found on skin sensitization. However, NH_4^+ or HCO_3^- are not known to be sensitizers, and a further study with ammonium chloride gave negative results.

A repeated (6d) dose study in the rat lead to an oral NOAEL of 2.37 g/kg and the NOEL found in sheep was 2.7 g/kg. Rats exposed continuously for 90 days at 127 mg/m^3 ammonia had no signs of toxicity.

As only negative results were obtained in *in vitro* mutagenicity tests, ammonium bicarbonate should not be considered as genotoxic.

There is no convincing substantiation of NH_4HCO_3 having carcinogenic effects and it is thus considered not carcinogenic. The long history of safe use in humans likewise supports this conclusion.

There are no indications that ammonium bicarbonate has effects on reproduction.

Environment

Ammonium bicarbonate is a volatile crystalline powder of 1.586 g/cm^3 density, which starts to decompose at 30-35°C, below its melting point, achieved by 60°C into CO_2, H_2O and NH_3. Vapour pressure is 78.5 hPa at 25°C. The substance is not flammable and explosive.

The water solubility is 174-178g/L at 20°C. As ammonium bicarbonate is an inorganic compound which rapidly

dissociates in water, some physico-chemical endpoints (Henry's law constant, partition coefficient) and biodegradation are not easily applicable. Fate and behavior of ammonium bicarbonate are closely related to nitrogen and carbon cycles in air and water.

Ammonium bicarbonate rapidly dissociates in the environment to yield ammonium ion (NH_4^+), bicarbonate ion (HCO_3^-) and *un-ionized* ammonia (NH_3).

- Among these compounds, *un-ionized* ammonia is the most toxic.
- Ammonia toxicity would depend on the pH and temperature of the media, and on the amount of ammonia already present in the media. Increasing pH, and temperature to a lesser degree, solution results in more *un-ionized* ammonia (percentage of total ammonia present as NH_3 in aqueous solutions at 20°C is 0.039% at pH 6 and 3.82% at pH 8).
- Relevant toxicity results obtained by testing with ammonium bicarbonate or more generally derived from tests relating to NH_3, expressed in mg N /L at pH 8, gave the following lowest toxicity values for the substance (expressed as mg NH_4HCO_3/L): an acute LC50 of 41 mg/L for fish (*Onchorynchus mykiss*) or 87.4 mg/L for *Daphnia magna* and a long term EC20 of 7.6mg/L (*Onchorynchus mykiss*) or <8.2 mg/L (*Hyallela azteca*), while ammonium chloride has a 21d NOEC of 14.6 mg/L with *Daphnia magna*, and a 28d to 44d NOEC of 8.0 to 23.9 mg/L with fish.

No substance relevant data is available for algae, but the reported value is in agreement with other ammonium salts like ammonium chloride (12125-02-9) or sulfate (7783-20-2) and bicarbonates. For ammonium chloride an EC50 value of 1300 mg/L is available for algae (*Chlorella vulgaris*).

According to USEPA (1985), plant species are more tolerant (NOEC 5g/L aspersion of cucumber) than invertebrates or fish. Therefore the results for the two other trophic levels (fish and invertebrates) are more relevant.

Ammonia in the environment is part of the nitrogen cycle and has indirect and long-term effects to the ecosystems, e.g., eutrophication, groundwater pollution, water and soil acidification and can dramatically lower dissolved oxygen in the water resulting in adverse impacts on aquatic organisms. The acidifying effects on soil and water take place when ammonia ions are transformed into nitrate by micro-organisms, a so-called nitrification. In soil, if the nitrate is not absorbed by plants, and instead reaches the surface or groundwater, the acidifying effects increase. In the aquatic environment, ammonia may undergo nitrification, which yields hydrogen and consumes four atoms of oxygen for every atom of nitrogen converted so that, in certain systems, acidification and oxygen depletion may result. These indirect effects of ammonia can result in long-term negative impacts on aquatic organisms.

Exposure

Ammonium bicarbonate is widely used in various sectors as food additive (alone or as component of bicarbonate special), in industrial uses (in cooling baths, in fire extinguishers, in the manufacture of porous plastics and ceramics, dyes, and pigments, in catalyst system for the stiffening of tobacco), in therapeutic and agricultural uses. The present hazard assessment covers ammonium bicarbonate as industrial chemical. Ammonium bicarbonate is a naturally occurring substance. The production and use of ammonium bicarbonate may result in inhalation, dermal and/or oral exposure.

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

Human Health: The chemical is currently of low priority for further work because of its low hazard profile. However, as the substance degrades in the environment to nitrite, it is recommended that the releases of ammonium bicarbonate are taken into account when assessing the exposure of nitrite and nitrate in drinking water.

Environment: This chemical is currently of low priority for further work. The chemical possesses properties indicating a hazard for the environment (fish and Daphnia). These hazards do not warrant further work as they are related to acute toxicity which may become evident only at high exposure level. However, ammonia has indirect and long-term effects to the ecosystems, e.g. eutrophication, groundwater pollution and soil acidification due to the nitrification of ammonia**.**