

**SIDS INITIAL ASSESSMENT PROFILE**

|                           |                                      |
|---------------------------|--------------------------------------|
| <b>CAS No.</b>            | 64-17-5                              |
| <b>Chemical Name</b>      | Ethanol                              |
| <b>Structural Formula</b> | CH <sub>3</sub> -CH <sub>2</sub> -OH |

**SUMMARY CONCLUSIONS OF THE SIAR****Human Health**

The assessment of the substance is focused on its use as industrial chemical. Ethanol consumption in alcoholic beverages is out of the scope of this report.

Ethanol is readily absorbed by the oral and inhalation routes and subsequently, metabolized and excreted in humans. At exposures relevant to occupational and consumer exposure during manufacture and use of ethanol containing products, the alcohol dehydrogenase metabolic route in the liver dominates and does not become saturated. This mechanism follows first order kinetics. The first step of the metabolic path is the rate-determining step; concentrations of the intermediate metabolite acetaldehyde are very low. Ethanol is not accumulated in the body. Dermal uptake of ethanol is very low.

Ethanol has a low order of acute toxicity by all routes of exposure. Lowest robust reported values are an inhalation LC<sub>50</sub> of >60,000ppm (114,000 mg/m<sup>3</sup>), 1 hour, mouse), and an oral LD<sub>50</sub> of 8300mg/kg.bw (mouse). Ethanol is a moderate eye irritant but is neither a skin irritant nor a sensitizer.

For repeat dose effects, the lowest reported NOAEL is approximately 2400 mg/kg bw/day from a dietary study with rats. At higher doses, male rats showed minor changes to organ weights and haematology/biochemistry; female rats showed minor biochemistry changes and increased length of oestrus cycle along with liver nodules; adverse liver effects were observed at concentrations of 3600mg/kg.bw/day and above

The balance of evidence is that ethanol is not genotoxic. Negative results from a number of bacterial mutation assays appear to be reliable. Of the mammalian cell mutation assays a weak mutagenic effect in mouse lymphoma cells occurred only at very high ethanol concentrations. *In vivo* tests for chromosome aberrations in both rats and Chinese hamsters have given negative results. There is very little evidence to suggest that ethanol is genotoxic in somatic cells and it may have a very limited capacity to induce genetic changes *in vivo* but under very specific circumstances and at very high doses achievable in humans only by deliberate oral ingestion.

Evidence of the carcinogenicity of ethanol is confined to epidemiological studies assessing the impact of alcoholic beverage consumption. These do not indicate any such hazard exists from potential exposure to ethanol in the work place or from the use of ethanol in consumer products.

No fertility or developmental effects were seen at inhalation exposures up to 16000 ppm (30,400 mg/m<sup>3</sup>). The lowest reported NOAEL for fertility by the oral route was 2000 mg/kg bw in rats, equivalent to a blood alcohol concentration of 1320 mg/l, although this was based on a significant increase in the number of small pups rather than a direct effect on fertility; such direct effects are not seen until much higher doses. Many studies exist examining the developmental end point for ethanol. However, most use very high doses and few are individually robust enough to allow a NOAEL to be established. However, the collective weight of evidence is that the NOAEL for developmental effects in animals

This document may only be reproduced integrally. The conclusions and recommendations (and their rationale) in this document are intended to be mutually supportive, and should be understood and interpreted together.

is high, typically  $\geq 6400$  mg/kg bw, compared to maternally toxic effects at 3600 mg/kg bw. The potential for reproductive and developmental toxicity exists in humans from deliberate over-consumption of ethanol. Blood ethanol concentrations resulting from ethanol exposure by any other route are unlikely to produce reproductive or developmental effects.

### Environment

The available physicochemical data are adequate to describe the properties of ethanol. The melting point for ethanol is  $-114^{\circ}\text{C}$ , the boiling point is  $78.3^{\circ}\text{C}$  and the  $\log K_{ow}$  is  $-0.31$ . Ethanol has a measured vapour pressure of 57.3 hPa at  $20^{\circ}\text{C}$ . Ethanol has a specific gravity (density) of 0.7864 and a flashpoint of  $14^{\circ}\text{C}$ . It is fully water miscible at ambient temperatures. Henry's Law constant is 0.000252.

Ethanol is stable to hydrolysis but is readily biodegradable (74% after 5 days) and is not likely to bioaccumulate (calculated  $\log BCF=0.5$ ). Ethanol is not persistent in the environment. Fugacity-based modelling shows that ethanol released into the environment will become distributed mainly into air and water. Relative distributions between compartments based on an emission pattern of 1000:100:10 were 57 % in air, 34 % in water, and 9 % in soil. These predictions are supported by the limited data available on prevailing concentrations, which shows that ethanol has been detected in outdoor air and in river water. The total tropospheric half life of ethanol is estimated to be 10-36 hours, with degradation due to hydroxyl,  $\text{NO}_x$  and  $\text{SO}_x$  radical-mediated photooxidation. As a volatile organic compound in the atmosphere, ethanol is a potential contributor to tropospheric ozone formation under certain conditions, however its photochemical ozone creation potential is considered to be moderate to low (40-45 relative to ethylene as 100).

The aquatic toxicity data in fish, invertebrates, and algae indicate a low order of acute toxicity with  $\text{LC}_{50}/\text{EC}_{50}$  values greater than 1000 mg/l. The most sensitive species were algae *Chlorella vulgaris* with a 96hr  $\text{EC}_{50}$  of 1000 mg/l and the invertebrate *Artemia Salina* with a 24hr  $\text{LC}_{50}$  of 1833 mg/l. Valid chronic toxicity data are available for two trophic levels. The lowest reported NOEC for invertebrates is 9.6 mg/l (10 day reproduction) whilst for plants it is 280mg/l (7 day study).

### Exposure

Worldwide ethanol production was 25,000 kt in 2001. European production is 1,700 kt. Ethanol is manufactured either by fermentation of biomass or by the hydration of ethylene in a continuous, closed process; release from production facilities is low.

Ethanol use falls into four main categories: use as a solvent, in manufacture of chemicals, as a fuel additive and for potable drink manufacture. Solvent use is mainly in paint and ink manufacture and in pharmaceutical production. Ethanol is widely used in consumer products, mainly cosmetics, but also detergents, winter deicing and cleaning products, including detergents.

There is limited published data on exposure of workers to ethanol but what is available indicates that the vast majority of exposures are well below current occupational exposure limits (OELs). However, some scenarios were identified in one of the sponsor countries with the potential for high inhalation exposure (eg pharmaceutical manufacture). Personal protective equipment should be used in these situations to reduce actual exposure. There is no data on consumer exposure from the use of products containing ethanol, but it is likely that the dominant source of consumer exposure to ethanol is through natural sources in foodstuffs and the consumption of alcoholic beverages.

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

**Human Health:** The chemical is currently of low priority for further work. The assessment of the substance is focused on its use as industrial chemical. Ethanol possesses properties that indicate a hazard for human health but these are manifest only at doses associated with consumption of alcoholic beverages. In the context of an industrial chemical, these hazards do not warrant further work as they are not likely to result from the manufacture and use of ethanol and ethanol containing products.

**Environment:** The chemical is currently of low priority for further work due to its low hazard profile.