MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY

INTEROFFICE COMMUNICATION

TO: File for Sulfamic Acid (CAS # 5329-14-6)

FROM: Keisha Williams, Air Quality Division (AQD)

DATE: March 22, 2016

SUBJECT: Screening Level for Sulfamic Acid

The initial threshold screening level (ITSL) for sulfamic acid (CAS # 5329-14-6) is 5 µg/m^3 on an annual averaging time. This ITSL was previously established by AQD on July 27, 1999 at 4 µg/m^3 based on the same key study as presented below. The difference between values is presumed to be due to rounding.

The following references or databases were searched to identify data to determine the screening level: United States Environmental Protection Agency's (EPA's) Integrated Risk Information System (IRIS), the Registry of Toxic Effects of Chemical Substances (RTECS), the American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLV), National Institute of Occupational Safety and Health (NIOSH) Pocket Guide to Hazardous Chemicals, MDEQ Library, International Agency for Research on Cancer (IARC) Monographs, Chemical Abstract Service (CAS) Online, National Library of Medicine (NLM), Health Effects Assessment Summary Tables (HEAST), National Toxicology Program (NTP) Status Report, EPA Aggregated Computational Toxicology Resource (ACToR) Database, EPA TSCATS database, EPA Superfund Provisional Peer Reviewed Toxicity Values, EPA Acute Exposure Guideline Levels for Airborne Chemicals, EPA High Production Volume Database, United States Department of Labor Occupational Safety and Health Administration Permissible Exposure Limits, Spacecraft Maximum Allowable Concentrations, California Office of Environmental Health Hazard Assessments Reference Exposure Levels, Chemical Safety Program Protective Action Criteria, Texas Commission on Environmental Quality Effects Screening Levels, and European Chemicals Agency Registered Substances Dossiers.

No inhalation toxicity studies were found, and very few oral toxicity studies were found. In human studies, sulfamic acid has been shown to be a dermal irritant (Ambrose, 1943; Tracor-Jitco, 1973). Five volunteers had a 4% solution of either sulfamic acid or ammonium sulfamate applied to the anterior surface of each arm. "A slight degree of irritation was experienced by all subjects" where sulfamic acid had been applied, but there was no noted irritation on the arm where ammonium sulfamate had been applied (Ambrose, 1943). Similarly, rats subjected to subcutaneous injections of a 4% sulfamic acid solution showed necrosis at the site of injection.

A summary of a feed study in cows was presented in a U.S. Food and Drug Administration evaluation where 1% sulfamic acid (estimated to be 150 mg/kg per day) in silage produced

diarrhea, but 0.5% (≈75 mg/kg per day) sulfamic acid in silage had no noted adverse effects (US FDA, 1976). Another summary was identified where an oral study in dogs fed 100 mg/kg per day sulfamic acid for 6 days resulted in no adverse effects (Tracor-Jitco, 1973).

Also in the Ambrose (1943) study, was a 15 week oral study in white, female rats. One-month old rats weighing approximately 30 grams were given 0, 1% or 2% sulfamic acid in a “basic diet” feed. Over the course of the study, the 1% and 2% sulfamic acid doses were approximated to be 1 and 2 grams per kilogram body weight, respectively. Food consumption, growth rate as measured with body weight, and gross histological measurements were evaluated. There was no significant difference in food consumption or gross histology between any of the groups. There was a significant decrease in growth rate with the 2% group as compared to control, but not with the 1% group.

The mechanism of toxicity is hypothesized to be due to its acidity, especially considering the salt form as seen with ammonium sulfamate is significantly less toxic. Since acid-related toxicity causes irritation and portal of entry effects, extrapolation from the repeated-dose oral to inhalation route of exposure may not be appropriate. Considering this, the feed studies will not be used to develop an ITSL at this time.

The ITSL previously established in 1999 seems to be based on the study by Ambrose (1943) where 2 out of 8 white, male rats died after oral ingestion of 1.6 grams/kilograms body weight. The 1.6 gram/kg, which is 1600 mg/kg, dose was used as a surrogate LD50. According to AQD Rule 232 (1) (h),

$$ITSL = \frac{1}{500} x \frac{1}{40} x \frac{1}{100} x \frac{LD50\left(\frac{mg}{kg}\right) x\, W_A}{0.167\ x\ I_A}$$

$$ITSL = \frac{1}{500} x \frac{1}{40} x \frac{1}{100} x \frac{1{,}600\left(\frac{mg}{kg}\right) x\ 0.47}{0.167\ x\ 0.431} x \frac{1000\ \mu g}{mg} = 5.22\ \frac{\mu g}{m^3} \approx \mathbf{5}\ \boldsymbol{\frac{\mu g}{m^3}}, \boldsymbol{annual\ averaging\ time}$$

where W_A=0.470 kg and I_A = 0.431 m^3/day (US EPA, 1988).

After an updated literature search, no new toxicity studies were identified. Use of the lethal, oral dose study to derive the ITSL is a conservative measure in light of the limited toxicity data, because this method of ITSL derivation does not pose concerns for the route of administration, which is the concern with the repeated-dose oral studies. However, this ITSL should be re-evaluated when more toxicity studies become available.

References

Act 451 of 1994, Natural Resources and Environmental Protection Act and Air Pollution Control Rules, Michigan Department of Environmental Quality.

Ambrose, A.M. 1943. Studies on the Physiological Effects of Sulfamic Acid and Ammonium Sulfamate. Journal of Industrial Hygiene and Toxicology, 25 (1): 26-28.

Tracor-Jitco, Inc. 1973. Scientific Literature Reviews on Generally Recognized as Safe (GRAS) Food Ingredients-Sulfamic Acid. National Technical Information Service.

US EPA. 1988. Recommendations for and Documentation of Biological Values for Use in Risk Assessment. U.S. Environmental Protection Agency, Washington, DC, EPA/600/6-87/008 (NTIS PB88179874).

US FDA. 1976. Evaluation of the Health Aspects of Sulfamic Acid as it May Migrate to Foods from Packaging Materials. U.S. Food and Drug Administration, Washington, D.C. Life Sciences Research Office, Federation of American Societies for Experimental Biology.

KW:lh