

MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY

INTEROFFICE COMMUNICATION

TO: File for distillates (petroleum), light thermal cracked (CAS #64741-82-8)

FROM: Anne Kim, Air Quality Division, Toxics Unit

SUBJECT: Screening Level Derivation

DATE: June 15, 2007

The initial threshold screening level (ITSL) for distillates (petroleum), light thermal cracked is 93 µg/m³ based on an annual averaging time.

The following references or databases were searched to identify data to determine the screening level: U.S. Environmental Protection Agency (EPA) Integrated Risk Information System, Registry for Toxic Effects of Chemical Substances, American Conference of Governmental and Industrial Hygienists Threshold Limit Values, National Institute for Occupational Safety and Health Pocket Guide to Hazardous Chemicals, Environmental Protection Bureau Library, International Agency for Research on Cancer Monographs, Chemical Abstract Service (CAS) - Online (1967 – 2007), National Library of Medicine, Health Effects Assessment Summary Tables, and National Toxicology Program Status Report. The EPA has not established a reference concentration or reference dose for distillates (petroleum), light thermal cracked.

Background

The TSCA description for distillates (petroleum), light thermal cracked defines it as “[a] complex combination of hydrocarbons from the distillation of the products from a thermal cracking process. It consists predominantly of unsaturated hydrocarbons having carbon numbers predominantly in the range of C10 through C22 and boiling in the range of approximately 160 degrees Celsius to 370 degrees Celsius (320 degrees Fahrenheit to 698 degrees Fahrenheit)” (EPA, 1979).

Animal Toxicity

A developmental study was conducted in Sprague-Dawley rats (Environmental and Health Science Laboratory, 1993). Groups of 12 pregnant female rats were exposed to 2000 mg/kg of water or coker light gas oil (CLGO), CAS #64741-82-8, on gestation day 13. Observations were made throughout the study period for changes in appearance, behavior, and mortality. Body weight measurements were recorded on gestation days 0, 6, 13, 14, and 20. On gestation day 20, all animals were necropsied. Organs were grossly examined, select organs were weighed (liver, thymus, and uterus), the number of corpora lutea per ovary was recorded, and the number and location of implantations (early/late resorptions and live/dead fetuses) were recorded. Litters were gendered, weighed, and externally examined for malformations. Each litter was then equally divided into two groups; one for visceral examination and one for skeletal examination.

Maternal effects: Red vaginal discharge, perineal staining, soft stool, decreased stool to no stool, and animals cold to touch were observed in females exposed to CLGO. Body weight gain was significantly decreased immediately following exposure, but this effect was transient. Even though the decreased net body weight gain observed throughout the study period was not statistically significant, it was considered to be biologically significant. The organ weights of the exposed females did not differ from control values.

Fetal effects: Fetal body weights were unaffected by CLGO exposure. A statistically significant increase in the incidence of hind paw digit malformations was observed in fetuses from an exposed dam. Thus, both maternal and fetal effects resulted from exposure to a single, oral dose of 2000 mg/kg CLGO on gestation day 13.

An acute oral toxicity study reported the effects of exposure to distillates (petroleum), light thermal cracked via gavage in Sprague Dawley rats (IITRI, 1992). A group of five male and five female rats were exposed to a single dose of 10 g/kg, and a group of two male and two female rats were exposed to a single dose of 5 g/kg. A second experiment was conducted where a group of five females were treated with the low dose of 5 g/kg after observing a high number of deaths in the high dose female group. All rats were observed for 14 days following exposure.

In the 10 g/kg dose group, 1 male and 3 female rats died after exposure, and 1 female rat died after exposure to 5 g/kg. The second low-dose experiment resulted in a single death, as well (1 out of 5 female rats). All high dose rats showed discolored facial fur, discolored and wet inguinal fur, decreased motor activity, and ataxia during the first two days following exposure. Several low dose rats exhibited ataxia as well. Observations of tearing and diarrhea were noted in both the high- and low-dose rats. These signs of toxicity disappeared by the 7th day of the study. Hair loss, however, was observed beginning on the 6th day and was evident throughout the remainder of the study.

Necropsy of rats that died during the study all showed findings of red intestines or intestines filled with red fluid. Of the rats that survived to the end of the 14-day observation period, none showed any significant findings upon necropsy.

The LD50 was estimated to be greater than 10 g/kg and 5 g/kg for male and female rats, respectively.

Discussion

Establishing a screening level by using an already established screening level from a chemical that has similar chemical and physical properties is a procedure that has been used by AQD for other petroleum distillates. The numbers of carbons and the boiling point ranges for the following chemicals are very similar to those of distillates (petroleum), light thermal cracked: CAS #s 64742-80-9, 64741-44-2, 68334-30-5, and 64741-59-9 (see Table 1, below).

Table 1. Chemicals of similar chemical and physical properties.

Chemical CAS No.	Carbon Chain Length	Boiling Point Range (°C)	Initial Threshold Screening Level
64741-82-8	10-22	160-370	–
64742-80-9	11-25	205-400	2 ug/m ³ – annual
64741-44-2	11-20	205-345	36 ug/m ³ – annual
68334-30-5	9-20	163-357	70 ug/m ³ – annual
64741-59-9	9-25	150-400	93 ug/m ³ – annual

The similar chemicals (listed above) have ITSLs that were based on 4-hour LC50 studies except for one, CAS #64742-46-7; this chemical's ITSL was based on a 4-week inhalation study. The ITSL values shown in Table 1 vary widely because they were established using chemical-specific data for each.

Of all these similar chemicals, distillates (petroleum), light catalytic cracked is considered the most similar (Parker, personal communication). Although all of the chemicals have similar hydrocarbon chain lengths and boiling point ranges, distillates (petroleum), light catalytic cracked is the only one that undergoes a cracking process like distillates (petroleum), light thermal cracked. "Cracking is a process that breaks ("cracks") the heavier, higher boiling petroleum streams produced by atmospheric or vacuum distillation into lighter molecular weight materials.... There are two basic types of cracking processes, those using heat and pressure (thermal cracking) to break molecular bonds, and those using a catalyst (catalytic cracking) to facilitate the cracking process" (HPV, 2004). Distillates (petroleum), light thermal cracked is a stream that results from a thermal cracking process, and distillates (petroleum), light catalytic cracked is a stream that results from a catalytic cracking process. Thus, the distillates (petroleum), light catalytic cracked ITSL value could potentially be adopted for the final ITSL for distillates (petroleum), light thermal cracked.

The developmental study will not be used to derive the ITSL because the fetal effects observed with the single exposure dose of 2000 mg/kg produced frank effects; an ITSL cannot be based on an exposure concentration that results in frank effects. Generally, a chemical-specific study is preferred for developing an ITSL. Inhalation data is also generally preferred over oral data for development of an ITSL. While the LD50 study is chemical-specific, the LC50 is an inhalation study. Comparing the two acute studies, the LC50 study results are determined to be more reliable; the LD50 study used no controls and resulted in LD50 values estimated to be greater than the doses administered. Therefore, the ITSL for distillates (petroleum), light thermal cracked will be derived based on the LC50-based ITSL for distillates (petroleum), light catalytic cracked.

Therefore, the ITSL for distillates (petroleum), light thermal cracked (64741-82-8) is 93 ug/m³ based on an annual averaging time.

Note: The combined air emissions of distillates (petroleum), light thermal cracked (64741-82-8) and distillates (petroleum), light catalytic cracked (64741-59-9) must meet this ITSL of 93 ug/m³ annual.

References

IIT Research Institute (IITRI). 1992. Initial Submission: Acute Oral Toxicity Study of Light Thermal-Cracked Distillate in Rats (Final Report) with Attachments and Cover Letter Dated 022592. IIT Research Institute under Amoco Corp. IITRI Project No. L8100. Study No. 542DR. Test Article No. 165. EPA/OTS; Doc #86-890000439. NTIS/OTS0535708.

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