DOWTHERM Q

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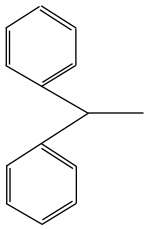
I. IDENTIFICATION

Chemical Name: Mixture of ethylated benzenes
Synonyms: Dowtherm®Q; 1,1- Diphenylethane (50–60%) with (30–50%) Ethylated benzenes
CAS Number: Composite of 612–00–0 and 68987–42–8
DOT/UN Number: Not Available
Molecular Formula: $C_{14}H_{14}$
Structural Formula:



II. CHEMICAL AND PHYSICAL PROPERTIES[1,2]

Physical State: Clear, pale, straw-colored liquid
Odor Description: Aromatic hydrocarbon
Molecular Weight: 190 (average composition)
Conversion Factors: 1 mg/m^3 = 0.13 ppm v/v;
1 ppm v/v = 7.8 mg/m^3
Boiling Point: 267°C (513°F) atmospheric reflux
Melting Point: -40°C (- 40°F) at 760 mm Hg
pH: 6
Vapor Pressure: 0.0149 mm Hg at 25°C (77°F)
Saturated Vapor Concentration: 20 ppm (153 mg/m^3) at 25°C (77°F)
Specific Gravity: 0.97 @ 20°C (68°F)
Solubility in Water: Very low
Flash Point: 121°C (249°F), by SETA
Autoignition Temperature: 412°C (773°F)
Flammability Limits: LFL: 0.55% at 135°C;
UFL: 5.5% at 190°C

III. USES[3]

The end use of this product is as a high temperature heat transfer fluid in closed loop heating or cooling systems, and is only sold for this use. These systems are fairly common in the process industries and are used where steam or direct heating are not practical due to pressure, thermal sensitivity of the material being processed or a chemical sensitivity to water. These systems are designed as closed systems, typically inerted with nitrogen, and not open to the air.

IIV. TOXICOLOGY DATA

A. Acute Toxicity

1. Oral Toxicity

LD_{50} in male rats: >8.0 ml/kg (7760 mg/kg).[4]

2. Eye

The test material was classified as a mild irritant (Class 4 on a 1 to 8 scale) to the rabbit eye. Conjunctival irritation manifested as redness and chemosis moderate in severity was noted at one hour but had healed in all eyes by 72 hours. Slight dulling of the normal luster of the cornea was observed in two treated eyes.[4]

3. Skin Toxicity

a. Irritation

A 4-hr dermal application to rabbit skin resulted in redness and edema in all rabbits which lasted for more than three days but had cleared by seven days. A primary dermal irritation index (PDII) of 4 was obtained indicating that this material is a moderate skin irritant on a scale of 1 to 8.[4]

b. Absorption

The dermal LD_{50} for male rats is >4 ml/kg (388 g/kg). This material is not likely to be absorbed through skin in acutely toxic amounts.[4] In an acute dermal absorption test, two male New Zealand Rabbits received a single, 24 hour dermal application of 2000 mg/kg of undiluted, thermally degraded 1,1-diphenylethane. No signs

of toxicity were observed, erythema and exfoliation were observed on the application sites. The LD_{50} was estimated to be > 2000 mg/kg, therefore, the acute dermal absorption toxicity of the test material was categorized as low.[5]

c. Sensitization

No data available.

4. Inhalation Toxicity

Two 1-hr exposures of four male rats to the vapor of 1,1-diphenyl ethane generated at room temperature, (calculated to contain 1.5–1.6 mg/l based on weight of samples before and after exposure) caused excitability and slight transient eye irritation. All rats appeared healthy and gained weight during the 2-week observation period. No lesions attributable to administration of the test material were observed on gross pathological examination two weeks post-treatment.[6]

B. Subacute Toxicity

A two-week whole-body inhalation study in rats with this specific formulation showed no effects at 86.5 mg/m^3 (11.25 ppm). No exposure-related effects in clinical observations, body weights, gross or histopathology were noted in the repeated inhalation exposure study in which groups of five male Fischer-344 rats were exposed to 0, 19.8, or 86.5 mg/m^3 of mixed isomers of Dowtherm Q for 6 hr/day, 5 days/week for 9 exposures.[2] Since no toxicity occurred at any dose level, the no observable effect level (NOEL) is determined to be 86.5 mg/m^3.

C. Subchronic Toxicity

No data available.

D. Chronic Toxicity/Carcinogenicity

No data available.

E. Reproductive/Developmental Toxicity

No data available.

F. Gentotoxicity/Mutagenicity

The mixed isomers of Dowtherm Q were negative in the UDS test[7] and in the Ames test[8] and showed no clastogenic activity with or without activation when tested *in vitro* in Chinese hamster ovary cells.[9] Also, the 1,1-isomer was negative in the CHO *in vitro* chromosome aberration assay[10] and did not produce evidence of genotoxicity in the unscheduled DNA Synthesis (UDS) assay.[11]

G. Metabolism/Pharmacokinetics

No data available.

V. HUMAN USE AND EXPERIENCE

Air monitoring results for the Diphenylethane mixture (1,1- Diphenylethane and 1,2 Diphenylethane) have been reported from Europe and the United States. A summary of 238 personal air monitoring results show a range for exposures between 0.02 and 0.05 ppm. Repeated short-term exposure monitoring during maintenance tasks resulted in employee exposure ranging between 0.02 and 0.03 ppm. Occupational health records in these facilities reported no health effects attributed to Dowtherm Q exposure.

In 1989, an operator walked through a pool of Dowtherm Q contaminating his shoes and socks. There was no evidence of a skin burn and the employee indicated minimal skin discomfort. The employee returned to work and visited the medical department the next day. He was found to have no lasting adverse health effects resulting from this exposure.[12]

In 1992, a contractor was exposed to one or two drops of Dowtherm Q to his right eye. He washed his eyes for three minutes in the plant and proceeded to the medical department for a further 20 minutes of eye washing. Following washing, the right eye was examined and found to be normal. The contractor experienced no pain, discomfort, or photophobia and was found to have no ill effects.[13]

VI. RATIONALE

The available acute data for Dowtherm Q in rats suggests a low order of acute toxicity. The available irritancy data suggests that it produces slight eye and moderate skin irritation. It was negative in all *in vitro* genotoxicity assays.[1-10] No long-term toxicity data are available via the dermal or inhalation routes. The NOEL for repeated inhalation exposure to Dowtherm Q was 86.5 mg/m^3 (11 ppm).[2] Given the high boiling point and low vapor pressure for Dowtherm Q, inhalation exposures are expected to occur only when mists are formed from spraying, agitating, or heating solutions of the material. Based on a review of the available toxicological and industrial hygiene data and the absence of significant or lasting adverse human health effects attributable to Dowtherm Q exposure in industrial use, this material is not believed to present a significant health hazard in the workplace environment. However, a lack of chronic data suggests that some uncertainty be incorporated using the subacute NOEL of 86.5 mg/m^3 as a basis for the exposure limit. An OEL of 7.8 mg/m^3 (1 ppm) is considered to provide an acceptable level of worker protection from all known exposure routes of Dowtherm Q.

VII. RECOMMENDED OEL

8-hr time-weighted average (TWA): 7.8 mg/m^3 (1 ppm)

VIII. REFERENCES

1. **Dow Chemical Company:** "Material Safety Data Sheet for Dowtherm Q." Midland, MI: Dow Chemical Co., 2000.
2. **Dow Chemical Company:** "Two-Week Inhalation Study in Rats with in Mixed Isomers of Diphenylethane by G.J. Bradley, J.M. Redmond, and B.L. Yano." February 5, 1983. [Unpublished Report.] Toxicology Research Laboratory, Health and Environmental Sciences, USA, The Dow Chemical Co., Midland MI 48640.
3. **Dow Chemical Company:** "Uses of Dowtherm Q (Mixed Isomers of Diphenylethane)." 2000. [Letter to WEEL Committee.] Toxicology Research Laboratory, Health and Environmental Sciences, USA, The Dow Chemical Co., Midland MI 48640.
4. **Dow Chemical Company:** "Acute Toxicity Studies: Diphenylethane (Dowtherm Q) by J.R. Jones, M.P. Blackwell, and T.A. Collier." February 11, 1987. [Unpublished Report.] Dow Chemical, Europe, S.A., Bachtobelstrasse 3, CH-8810 Horgen, Switzerland.
5. **Dow Chemical Company:** "1,1-Diphenylethane (Thermally Degraded): Acute Toxicological Properties by J.W. Lacher." February 27, 1990. [Unpublished Report.] Toxicology Research Laboratory, Health and Environmental Sciences, USA, The Dow Chemical Co., Midland MI 48640.
6. **Dow Chemical Company:** "1,1-Diphenylethane: Acute Toxicological Properties by D.D. Lockwood." May 31, 1984. [Unpublished Report.] Toxicology Research Laboratory, Health and Environmental Sciences, USA, The Dow Chemical Co., Midland MI 48640.
7. **Dow Chemical Company:** "Mutagenicity Assays of UDS in Mixed Isomers of Diphenylethane." [Unpublished Report.].
8. **Dow Chemical Company:** "Ames Assay of Mixed Isomers of Diphenylethane." [Unpublished Report.].
9. **Dow Chemical Company:** "Mutagenicity Assays of SCEs in Mixed Isomers of Diphenylethane." [Unpublished Report.].
10. **Dow Chemical Company:** "Mutagenicity Tests of 1,1-Diphenylethane." 1987. [Unpublished Report.] Toxicology Research Laboratory, Health and Environmental Sciences, USA, The Dow Chemical Co., Midland MI 48640.
11. **Dow Chemical Company:**: "Mutagenicity Assays of UDS in 1,1-Diphenylethane by D.B. McGregor and A.G. Brown." January 8, 1987. [Unpublished Report.] Toxicology Research Laboratory, Health and Environmental Sciences, USA, The Dow Chemical Co., Midland MI 48640.
12. **Dow Chemical Company:** [Unpublished Medical Report.].
13. **Dow Chemical Company:** [Unpublished Medical Report.].