UNION CARBIDE CORPORATION
Chemicals & Plastics Company, Inc.
Health Safety & Environmental Affairs

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Location P-2

TO: R. E. Plevan
Danbury

DATE: November 21, 1990

COPY TO: B. Ballantyne
M. R. Huffman
T. R. Tyler

SUBJECT: Vinyl Chloride

In response to your recent request, I have quickly surveyed the available information on the acute toxicity of the vinyl chloride. In particular, you requested guidance regarding the appropriate Emergency Response Guideline (ERG) for vinyl chloride monomer. The ERG is the maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to one hour without experiencing or developing irreversible or other serious health effects or symptoms that could impair their abilities to take protective action.

Pertinent information regarding the acute inhalation toxicity of vinyl chloride has been summarized below.

There are numerous studies describing the acute effects of vinyl chloride exposure in animals; these studies indicate that mortality is not elicited in animals with 1-hour exposures until concentrations in excess of 100,000 ppm are achieved. Prolonged and repeated exposure to lesser concentrations (1000-10,000 ppm) are well tolerated.

Vinyl chloride monomer was once utilized as an anesthetic; concentrations of 10 to 20 percent (100,000 to 200,000 ppm) were used. Difficulties encountered because of flammability, induction of cardiac arrhythmias, and high volumes required to produce surgical anesthesia discouraged its use.

Several reference texts indicate that signs of central nervous system effects occur at concentrations in excess of 1000 ppm, however the actual concentration and duration of exposure are not indicated. More definitive studies on the acute effects of vinyl chloride in humans indicate that acute exposures to concentrations in excess of 8,000 ppm produce varying degrees of early intoxication in some subjects, experienced as dizziness,

lightheadedness, and nausea. In studies conducted by Dow, some subjects exposure to 6,600 ppm for 30 minutes experienced dizziness, drowsiness, loss of equilibrium, and persistent nausea. Exposure to lower concentrations (780 - 4,100 ppm) for 1 hour resulted in no definite response, except slight nausea, headache, and sleepiness in two individuals exposed to 1,400 ppm.

Recommendations

In view of the potential for early intoxication noted in some individuals at concentrations of 8,000 and 6,600 ppm, an ERG of 5,000 ppm is recommended. This represents the maximum concentration that would afford protection against central nervous system effects for the majority of exposed personnel.

Very truly yours,

Carol J. Maslansky, Ph.D., D.A.B.T.

11/13/90
11/21/90

EMERGENCY EXPOSURE PLANNING GUIDELINE DOCUMENTATION

CHEMICAL: VINYL CHLORIDE DATE: 11/10/86

SYNONYMS: Chloroethene, VCM

WORKPLACE EXPOSURE GUIDELINES:

TLV: 5 ppm, A1a
PEL: 1 ppm

IHG: --
IDLH: --
NRC: --

PHYSICAL STATE: colorless gas
ODOR: sweet, ethereal
MOLECULAR WEIGHT: 62.5
VAPOR DENSITY: 2.2
FLAMMABILITY: 3.6-33%
EXPLOSIVITY: 4-22%
FLASH POINT: -78°C

ACUTE TOXICITY INFORMATION:

SPECIES	CONC.(ppm)	DURATION	RESULTS	REF.
g. pigs	200,000-400,000	short	deaths	8
	100,000	sev. hr.	lung, liver & kidney effects	
mice	80,000-120,000	10 min	minimum anesthetic range	1,7
	250,000-300,000	10 min	lethal	
dogs, rabbits	180,000	1 min	anesthesia, rapid recovery	1
dogs	100,000	--	anesthesia, decrease in BP, cardiac irregularities	1
mice, rats, g. pigs	100,000	1 min	slight irritation in mice & rats	1
	100,000	15 min	tremor, incoordination	
	100,000	30 min	deep narcosis, slight lung pathology, no deaths	
	200,000	1 min	immediate irritation in mice & rats	
	200,000	2 min	incoordination in mice & rats	
	200,000	10 min	unconsciousness	
	200,000	15 min	deep narcosis, 1/15 died	
	300,000	1 min	immediate irritation, incoordination	
	300,000	5 min	unconsciousness	
	300,000	30 min	death of all rats & mice	
mice	113,000	2 hr	LC50, narcosis, death from respiratory failure;	3,9
rats	150,000	2 hr	lung, liver & kidney injury	
g. pigs	230,000	2 hr		
rabbits	113,000	2 hr		

ACUTE TOXICITY INFORMATION: VCM, Cont'd

SPECIES	CONC.(ppm)	DURATION	RESULTS	REF.
dogs	200,000	short	marked salivation, respiratory arrest, narcosis	10
rats	50,000	2 hr	moderate intoxication	11
	70,000	2 hr	loss of righting reflex	
	100,000	2 hr	loss of corneal reflex	
	150,000	2 hr	respiratory failure	
animals	7,500	8 hr	slight symptoms	12
humans (estimated)	70,000-100,000	short	narcotic	10
	120,000	--	dangerous	
humans	25,000	3 min	dizziness, disorientation, burning sensation in feet, lingering headache	13
humans	>1000	?	drowsiness, blurred vision, staggering gait, tingling & numbness in extremities	10,7
humans (6) (test)	8,000-12,000	5 min	dizziness & lightheadedness in some subjects	11
	16,000	5 min	various degrees of intoxication	
	20,000	5 min	dizziness, lightheadedness, some nausea, sensory dullness; symptoms disappear after exposure ends	
humans (estimated)	>6000	prolonged	least exposure causing minimal intoxication	11
humans (2) (test)	780	1 hr	no definite response	14
	1100	3 hr	no definite response	
	1400	1 hr	slight nausea, headache, sleepiness, no odor	
	1970	1 hr	no response	
	4100	1 hr	no response, slight odor	
	6600	30 min	dizziness, tingling of lips, sleepiness, thickness of tongue, loss of equilibrium, persistent nausea, unpleasant odor	
humans	6000	30 min	dizziness, drowsiness	2
humans (estimated)	100,000	30-60 min	dangerous to life	8
	5,000	sev. hr.	max. allowable conc. without severe acute effects	

OTHER: Carcinogenicity studies were positive; teratogenicity were negative. Has shown mutagenic response in bacteria and yeast but was negative in a dominant lethal study in mice. Has been associated with chromosomal abnormalities in human lymphocytes; frequency was normal following reduction of exposure (R-5,6). Using methodology proposed by the National Research Council's Committee on Toxicology and based on a version of the multistage model for calculating carcinogenicity risk (R-4), 1700 ppm would be appropriate for protection against a potential carcinogenic hazard resulting from a one-hour emergency exposure to vinyl chloride.

HUMAN EXPERIENCE:

ODOR THRESHOLD: varies greatly (300-4000 ppm)
(R-14): unpleasant at 6600 ppm, slight at 4100 ppm.

IRRITANCY: (R-1): 100,000 for 1 min = slight irritation in mice, rats. No irritation noted in humans. No warning properties because of relative lack of odor and irritancy.

VCM, Cont'd

Emergency Exposure Planning Guideline*

1-hour EEPG: 1000 ppm

Rationale

An EEPG of 1000 ppm is believed to be appropriate for protection against both transient central nervous system effects and irreversible health effects.

REFERENCES:

1. Mastromatteo, AIHA J. 21:394, 1960.

2. Casarett and Doull's Toxicology, 2nd Ed., 1980.

3. IARC 19:390, 1979.

4. Crump and Howe, Risk Analysis 4:163-176, 1984; as used by the National Research Council's Committee on Toxicology for estimating upper limits on carcinogenicity risk from short-term exposures to carcinogens.

5. Purchase, Mutation Res. 57:325-334, 1978.

6. Anderson, Mutation Res. 79:151-162, 1980.

7. von Oettingen, W. F., The Halogenated Hydrocarbons of Industrial & Toxicological Importance, 1964.

8. Patty, Yant & Waite, Pub. Hlth. Rep. 45, 1930; cited in References 1 and 7.

9. Prodan, L., et al. Annals N.Y. Acad. Sci., 246:154-158, 1975.

10. Schaumann, O., 1938 in von Oettingen, W. F., Pub. Hlth. Serv. Pub. #414, 1955, and in Ref. 1.

11. Lester, D., et al. AIHAJ, 24:265-275, 1963.

12. Henderson & Haggard, Noxious Gases, 1943.

13. Dublin & Vane, U.S. Labor Bull. 582, 1935; as cited in Ref. 7.

14. Adams, Dow, 1951.

15. Torkelson, T. R., et al., AIHAJ, 22:354-361, 1961.

*The EEPG definition and intended uses are described in "The Dow Program to Develop Emergency Exposure Planning Guideline Concentrations (EEPGs)", Health and Environmental Sciences, July 31, 1986.