



Ontario

Occupational Health Protection Branch  
Community Health Standards Division  
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416/965-4066

Ministry of  
Health

September 26, 1974

Mr. David Brooks  
General Manager  
Manufacturing  
B. F. Goodrich Canada Ltd.  
409 Weber St. W.  
Kitchener, Ontario

Dear Mr. Brooks:

Enclosed is a draft copy of a proposed Occupational Health Data Sheet on Vinyl Chloride. This draft has been prepared by a team of four of our branch staff and is intended to be concise and to reflect how an exposure should be assessed. We have attempted to use the best information available in writing this data sheet.

We would appreciate it if you or your representative would review this document and forward any comments you may wish to make within 10 days. We will consider the comments for the preparation of the final data sheet. This data sheet will be subject to review at regular intervals.

Your co-operation will be most appreciated.

Yours truly,

V. L. Tidey, M. D.  
Acting Director  
Occupational Health Protection Branch

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## VINYL CHLORIDE MONOMER

### Description

Vinyl chloride monomer (VCM) is made by oxychlorination of ethylene or by hydrochlorination of acetylene. It can be polymerised to form polyvinyl chloride or copolymerised with other monomers to form materials such as Saran. It has been used in the United States of America, but not in Canada, as a propellant in pressurized spray containers.

It is a colourless flammable gas at normal conditions of temperature and pressure, but is usually transported and stored as a liquid under pressure (40 p.s.i.g.). It has a pleasant ethereal odour and is practically insoluble in water, but soluble in alcohol, ether and carbon tetrachloride.

|                     |                                                                            |
|---------------------|----------------------------------------------------------------------------|
| Chemical Formula    | $\text{CH}_2 = \text{CHCl}$                                                |
| Molecular Weight    | 62.5                                                                       |
| Boiling Point       | $-13.37^\circ\text{C} (8.9^\circ\text{F})$                                 |
| Density             | 2.55 gm/litre (at $-50^\circ\text{F}$ )                                    |
| Flash Point         | $-78^\circ\text{C} (-108^\circ\text{F})$                                   |
| Auto-ignition Temp. | $472^\circ\text{C} (882^\circ\text{F})$                                    |
| Explosive Limits    | 2.5 - 69.9% by weight in air<br>1.2 - 53% by volume < 4-22% by vol. in air |

### Occupational Exposure

Exposure to vinyl chloride may occur in the manufacture of the monomer and also in the polymerisation process. Loading and unloading of tank cars and trucks also represents an exposure risk. The polymerisation process is the main source of exposure especially when cleaning the polymerisation kettle. The polymer usually contains free VCM which is partially given off in the drying process, packaging operation and storage. Residual monomer may be given off during mixing, compounding and extrusion of polyvinyl chloride. Polyvinyl chloride decomposes on heating to form hydrochloric acid, carbon monoxide, phosgene and possibly other gases.

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No VCM is produced when the polymer is decomposed. PVC products do not constitute any known health hazards.

#### Supply

VCM is supplied in tank cars or trucks in liquid form.

#### Health Aspects

Acute exposure at 1000 ppm or over has been reported to produce dizziness and confusion and may lead to unconsciousness with possible respiratory arrest.

Chronic exposure has been reported in a few cases to cause scleroderma-like skin changes, Raynaud's syndromes, vascular changes, acro-osteolysis, thrombocytopenia, splenomegaly, esophageal varices, liver fibrosis, and pulmonary ventilation disturbances. VCM has been recently reported to be carcinogenic, with angiosarcoma of the liver occurring among a small number of polymerisation workers. Acro-osteolysis has been reported as occurring in some manual cleaners of polymerisers.

#### Threshold Limit Value

The American Conference of Governmental Industrial Hygienists recommendation for 1973 is 200 parts per million or  $510 \text{ mg/m}^3$ . This is reported, subject to change, pending investigation underway.

For the present, the Occupational Health Protection Branch, Ontario Ministry of Health, is using a time-weighted average of 10 ppm during an eight-hour day and a ceiling level of 25 ppm which is not to be exceeded for any period of time.

#### Precautions to be observed

##### Engineering

1. Operations are to be carried out in closed systems wherever possible.
2. Those operations that cannot be contained are to be fully enclosed and provided with local exhaust.

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3. PVC polymer storage areas are to be adequately ventilated.
4. Adequate mechanical general exhaust is to be provided in all process areas.
5. Entry into vessels (e.g. polymerisation kettles) is to be done with adequate safeguards including wearing of air supplied respirators and full protective clothing. All other precautions for entering confined spaces are to be followed.
6. Monitoring of work areas is to be provided where potential high exposures may occur. Depending on the severity of the potential exposure, monitoring may be intermittent or continuous.
7. A carefully controlled maintenance program is to be carried out to reduce the possibility of leaks and spills to a minimum.
8. In clean-up of spills or leaks, full protective clothing including an air supplied respirator is to be worn.
9. During maintenance or repair work or any operation where a worker is liable to have a high exposure, he is to wear full protective clothing including an air supplied respirator.
10. Emergency procedures are to be developed, including evacuation of personnel, for areas where it is possible to have a serious leak of VCM.
11. No food, drinks and tobacco are to be permitted in the exposure area.
12. No eating, drinking, chewing and smoking are to be permitted in the exposure area.
13. Safety showers and eye wash fountains are to be provided in VCM manufacturing, storage, loading and unloading and polymerisation areas.
14. For persons who handle PVC powder containing detectable levels of VCM or who are required to wear protective clothing, the following precautions may be required:

- (a) A double locker system is to be provided such that -
  - (i) each worker has a locker for street clothes in a "clean" locker room and a locker for work clothes in a "dirty" locker room.
  - (ii) a shower room is located between the two rooms so that each worker may take a shower before putting on street clothes.
- (b) Each worker is to be required to wash before eating, drinking, smoking or using toilet facilities and to shower at the end of his work shift.
- (c) Laundry facilities are to be provided and each worker's clothes are to be laundered at least weekly.. As an alternative disposable work clothing could be used.

Medical

i) First Aid in acute exposure

- unconsciousness - remove from exposure and give respiratory resuscitation if necessary.
- skin splash - remove clothes and wash skin thoroughly.
- eye splash - wash thoroughly for twenty minutes minimum and consult a physician.

ii) Pre-placement Examination

A good medical history is to be taken to include past history of hepatitis, past exposure to potential hepatotoxic agents including alcohol, drugs and chemicals, and any associated treatment.

A clinical examination is to be carried out with specific attention paid to detecting enlargement of liver or spleen. Liver function tests are to be done to include serum alkaline phosphatase, SGOT, SGPT and bilirubin. Routine PA chest X-ray (14" x 17") and spirometric ventilation testing are to be done.

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Applicants with liver disease are to be excluded from exposure.

(iii) Periodic Examination

This examination is to be done semi-annually for those exposed to VCM for a period over 10 years. Annual examination is to be done for all other exposed employees.

If a liver function test is abnormal, a repeat is to be done in two weeks. If the second test also is abnormal, the worker is to be removed from exposure. If the second test is normal, a retest is to be done in three months.

On removal from exposure, other disorders are to be excluded, e.g. by performing a liver scan and testing for hepatitis B-antigen. After excluding other disorders, the worker should not be returned to potential VCM exposure until the liver function tests return to normal.

Repeat liver function tests are to be done in three months after returning to work and if then abnormal, no further exposure is to be permitted.

Employees leaving exposure are to be followed medically for a period of 20 years from the time of last exposure and their medical records kept indefinitely.

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### Bibliography

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