

## Hydrogen Cyanide

### ◆OC 275/3

#### Target Audience:

**Agricultural and Factory Inspectors  
FCG Specialist Inspectors (Occ Hyg)  
Senior/Employment Medical Advisers  
Employment Nursing Advisers**

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|--------------------------------|----------------------------------|
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## SUMMARY

### INTRODUCTION

1 The attached Information Document contains a summary of HSE's opinions on the hazards associated with the production and use of hydrogen cyanide (HCN) and the precautions which should be observed. It may be copied and given to interested persons outside HSE.

2 The Information Document does not deal with fumigation or pest control activities. This is covered by the COSHH ACoP "Control of substances hazardous to health in fumigation operations" and further details may be found in AIM 1986/48 and AIC 1986/86.

## OM 1991/33

### BACKGROUND

3 HCN is produced in bulk quantities at 3 sites in the UK viz:

(1) →

(2)

(3) ←<sup>1</sup>

Current annual production is in the region of 40,000 tonnes. In addition, about 15,000 tonnes are produced as an intermediate in the manufacture of cyanide salts and methyl methacrylate.

4 About 200 persons are thought to be routinely exposed during the manufacture and bulk use of HCN. Several thousand employees in the metal-plating and precious-metal-extraction industries may be exposed to low concentrations of HCN. There is also the possibility of exposure due to accidental generation of HCN, eg in laboratory work or from cyanide wastes, but such incidents are thought to be rare.

5 There are no known UK suppliers of liquefied HCN in small (laboratory size) cylinders. One company supplies calibration gases that contain a known concentration of HCN vapour (usually in the ppm range).

6 More detailed advice on the bulk storage and handling of liquefied HCN is contained in an 1985 Occupational Hygiene Section report (FISM 9/1985/9 - file 275).

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## **ASI headings**

Chemicals - manufacture: hydrogen cyanide: toxic.

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<sup>1</sup> Exemption 15 – Statutory and other restrictions

## HYDROGEN CYANIDE

### INTRODUCTION

1 This document contains internal guidance which has been made available to the public. The information may not be directly applicable in all circumstances and any queries should be directed to the appropriate enforcing authority.

2 It draws attention to the health risks which can result from exposure to hydrogen cyanide (HCN), and gives advice on the precautions which may be needed in relation to its manufacture or storage, and maintenance work on plant containing HCN. As such, it should be read in conjunction with the Control of Substances Hazardous to Health Regulations (COSHH) and the general Approved Code of Practice. It does not deal with fumigation operations nor with the use of HCN in pest control, details about which can be found elsewhere (see Appendix which gives a list of some other relevant documents).

### OCCUPATIONAL EXPOSURE LIMIT

3 A maximum exposure limit (MEL) for HCN of 10 parts per million (ppm)/10mg/m<sup>3</sup> is listed in COSHH Schedule 1 for both a 10-minute and an 8-hour reference period. Therefore, exposure to HCN should be reduced to the lowest reasonably practicable level and, in any case, the MEL should not be exceeded.

### EFFECTS OF EXPOSURE

4 HCN exposure can occur through inhalation of the gas, by ingestion of the liquid or by absorption of liquid through intact or damaged skin. The toxic action is so rapid at high concentrations that smell has no value as a warning. The primary routes are inhalation and absorption through the skin, either being rapid.

5 HCN is a rapidly acting acute poison which can be dangerous to human life at concentrations of 90 ppm (100 mg/m<sup>3</sup>) or more. Human toxicity depends on concentration and duration of exposure. Concentrations of 90-135 ppm are fatal if continued for 30-60 minutes, whilst exposure above 300 ppm may be fatal within a few minutes.

6 Exposure to HCN in concentrations of 20 ppm or more has produced adverse effects in humans in a matter of hours. At lower levels of human exposure the effects are not as dramatic, do not occur as rapidly after exposure and are not as well documented. Headache and vertigo have occurred in workers exposed to 5-18 ppm. There are no documented pathological conditions or major adverse effects from human exposure to airborne HCN at concentrations below a value somewhere between 5 and 18 ppm. However, prolonged exposure at levels approximately 4 to 13 ppm has been reported to give rise to subjective complaints and disturbances amongst cyanide workers including headache, weakness and nausea.

7 An escape of liquefied HCN involves the additional possibility of persons being splashed with the liquid and suffering death or ill health through skin absorption. Absorption of liquid HCN through the skin is likely to prove fatal, with non-fatal consequences being more probable where the concentration of HCN is less than 2 per cent.

8 Gaseous HCN can be hazardous by skin absorption from high concentrations of the gas. This route would only be of prime importance in cases where those exposed are wearing effective respiratory protection as the concentrations involved would otherwise prove fatal by inhalation.

## PREVENTION AND CONTROL OF EXPOSURE

9 Where HCN is manufactured or used in bulk, plant should be designed to achieve total enclosure. Where integrity of the plant is maintained then very low concentrations of HCN are to be expected. Exposure is only likely to arise where maintenance work has to be carried out on plant containing HCN or where there is an escape of HCN.

10 Routine exposures to HCN during manufacture and use are below 1 ppm. Where exposure occurs during routine maintenance work, airborne concentrations of HCN can exceed the MEL of 10 ppm. These levels should be predictable and manufacturers and users will need to plan in advance how to adequately control such exposures.

11 It is important that plant and equipment are properly prepared prior to maintenance work, in order that levels are kept as low as is reasonably practicable. Whenever possible, this should be achieved by the use of engineering and process control measures. When this is not reasonably practicable, adequate protection can be afforded by the use of suitable respiratory protective equipment (RPE), together with appropriate protective clothing, to prevent the possibility of absorption of liquid HCN through the skin.

12 There are also circumstances where HCN could escape from the plant, possibly in large quantities. Potential causes of escape are failure of storage pipes or valves, flanges or joints, overfilling of storage vessels or loss of process control leading to build up of pressure and loss of containment. Although the possibility of such escapes cannot be eliminated totally, a very high standard of containment can be attained through good standards of design, construction, maintenance and the implementation of safe systems of work.

13 Effective emergency procedures should also be implemented to minimise exposure in the event of an escape. For bulk users of liquid or gaseous HCN it is usual for continuously operating monitoring system to provide warning of increased levels.

14 Accidents in which HCN has been released or generated from release of cyanide dust are rare.

APPENDIX  
(para 2)

OTHER RELEVANT DOCUMENTS

1 The following are available free from the Health and Safety Executive:

- (a) ~~Cyanide gassing powders: agricultural safety - AS14~~ **OM 1991/33**
- (b) What you should know about poisoning: a guide for employers - MS(A)9
- (c) Cyanide can kill: pocket card for employees - MS(A)10
- (d) Introducing COSHH
- (e) Introducing assessment
- (f) Hazard and risk explained

2 The following are priced publications ((a) is available from the Health and Safety Executive Sales Point, St Hugh's House, Bootle, (b), (c) and (d) are available from HMSO):

- (a) Hydrogen cyanide in air: MDHS 56/2 Laboratory method using an ion selective electrode ISBN 0 7176 0355 5
- (b) Control of Substances Hazardous to Health Regulations 1988: Approved codes of practice, control of substances hazardous to health and the control of carcinogenic substances ISBN 0 11 855 468 2
- (c) Control of substances hazardous to health in fumigation operations ACoP ISBN 0 11 885 4690
- (d) COSHH assessments (a step-by-step guide to assessment and the skills needed for it) ISBN 0 11 885470 4