- U.S. Department of Labor
- Occupational Safety and Health Administration
- Directorate of Technical Support and Emergency Management
- Office of Science and Technology Assessment

Chemical Grain Fumigant

Safety and Health Information Bulletin

SHIB 01-06-2015

This Safety and Health Information Bulletin is **not** a standard or regulation, and it creates no new legal obligations. The Bulletin is advisory in nature, informational in content, and is intended to assist employers in providing a safe and healthful workplace. Pursuant to the *Occupational Safety and Health Act*, employers must comply with hazard-specific safety and health standards and regulations promulgated by OSHA or by a state with an OSHA-approved state plan. In addition, pursuant to Section 5(a)(1), the General Duty Clause of the Act, employers must provide their employees with a workplace free from recognized hazards likely to cause death or serious physical harm. Employers can be cited for violating the General Duty Clause if there is a recognized hazard and they do not take reasonable steps to prevent or abate the hazard. However, failure to implement any recommendations in this Safety and Health Information Bulletin is not, in itself, a violation of the General Duty Clause. Citations can only be based on standards, regulations, and the General Duty Clause.

On January 6, 2015, the OSHA Directorate of Technical Support and Emergency Management (DTSEM) created this Chemical Grain Fumigant Safety and Health Information Bulletin (SHIB) to incorporate amendments into the Grain Fumigant Hazard Information Bulletin (HIB) dated March 14, 1984 as directed by memorandum from *Mr. Edward J. Baier to Regional Administrators on May 11, 1984*. Since the guidance from both of these documents is represented in this SHIB, the HIB and memo were archived. DTSEM removed Ethylene dibromide (EDB) and 1,2-Dibromo-3-chloropropane (DBCP) from the original list of chemical fumigants since they were banned for use as pesticides in the United States by the U.S. Environmental Protection Agency (EPA) in 1984 and 1985 respectively.

March 14, 1984

MEMORANDUM FOR:

REGIONAL ADMINISTRATORS

THROUGH:

- JOHN B. MILES
- Director
- Directorate of Field Operations

FROM:

- EDWARD J. BAIER
- Director
- Directorate of Technical Support

SUBJECT:

- Health **Hazard Information** - Grain Fumigant

The use of chemical grain fumigants for the control of insect infestation of stored grain can result in hazardous exposures to workers involved in the handling of both fumigants and fumigated grain. It has been reported by Region V that recent climatic conditions have contributed to the need for increased fumigation of stored grain due to an upsurge in insect infestations and that economic developments have led to the increased movement of stored grain.

Fumigants commonly used for insect control on stored grain include methyl bromide, phosphine (also known as Phostoxin, "L-fume or aluminum phosphide) and mixtures of carbon tetrachloride and carbon disulfide. None of these has adequate warning properties, yet their toxic effects can include permanent central nervous system damage, heart and vascular disease and lung edema as well as cancer.

The increased use of these fumigants and increases in the handling of fumigated grain, coupled with the insidious nature of these toxicants makes it imperative that employers take special care in the evaluation of their grain handling facilities and transit carriers (e.g., truck trailer, railroad cars and barges) via quantitative test methods common to industrial hygiene practice for the protection of affected employees.

Emphasis should be placed on the careful monitoring of grain shipments and storage facilities that are subject to fumigation and the protection of potentially exposed employees. A table of substances that have been used as fumigants is attached for your information.

Please assure that all area offices will receive this information.

Attachment

Substances That Have Been Used as Fumigants[1]

Fumigant and Chemical Structure	Physical State of Fumigant as it is Applied	Approx Boiling Point (C)
Acrylonitrile (CH_2=CHCN)	Liquid	77.3
Aluminum phosphide (AlP)[2]	Solid	

Substances That Have Been Used as Fumigants[1]

Fumigant and Chemical Structure	Physical State of Fumigant as it is Applied	Approx Boiling Point (C)
Anhydrous ammonia (NH^3)[3]	Liquid (gas)	
Calcium cyanide ($Ca(CN)_2$)[4]	Solid (gas)	
Carbon disulfide (CS_2)	Liquid	46.5
Carbon tetrachloride (CCl_4)	Liquid	76.7
Chloroform ($CHCl_3$)	Liquid	61.62
Chloropicrin (CCl_3NO_2)	Liquid	112
Cyanogen bromide (BrCN)	Liquid	61-62
Cyanogen chloride (ClCN)	Gas	13.8
1,3-Dichloropropene ($CHCl=CHCH_2Cl$)	Liquid	108
Ethylene dichloride (CH_2ClCH_2Cl)	Liquid	83-84
Ethylene oxide (CH_2 - CH_2)	Gas	10.7
Hydrogen cyanide (HCN)	Liquid (gas)	26
Magnesium phosphide (Mg3P2)	Solid	
Methylbromide (CH3Br)	Gas	4.5
Methylene chloride (CH2Cl2)	Liquid	40
Naphthalene ($C_{10}H_8$)	Solid	
Para-dichlorobenzene ($C_6H_4Cl_2$)	Solid	
Phosphine (PH3)	Gas	-87
Propylene dichloride ($CH_2ClCHClCH_2$)	Liquid	95-96
Propylene oxide (CH_2 - CH-CH_3)	Gas	-10
Sulfur dioxide (SO2)	Gas	55
Sulfuryl fluoride (SO2F2)	Gas	-55
1,1,1-trichloroethane (CH_3CCl_3)	Liquid	74

Source: American National Standard for respiratory protection during fumigation, ANSI Z88.3-1983

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[1]Many of these substances are not currently registered for use as fumigants. Contact the U.S. Environmental Protection Agency (EPA) for information on currently registered material.

[2]Aluminum and magnesium phosphide are solid substances that react with moisture to produce phosphine gas. At high concentrations, phosphine is spontaneously combustible.

[3]3Anhydrous ammonia was added to the list on May 11, 1984 after the U.S. Department of Agriculture (USDA) export grain inspectors made an inquiry to OSHA Region X about the health effects of prolonged exposure to anhydrous ammonia. "Anhydrous ammonia is being used as a grain fumigant by some grain shippers from Montana. The USDA inspectors were complaining of the irritant effects of ammonia released form the grain loads during inspection of incoming rail cars. Because of this recent information, we are amending the March 14th list to include anhydrous ammonia as a grain fumigant." (Memorandum from *Mr. Edward J. Baier to Regional Administrators, May 11, 1984, archived*).

[4]Calcium cyanide, a solid, reacts with acids to produce HCN, a gas.