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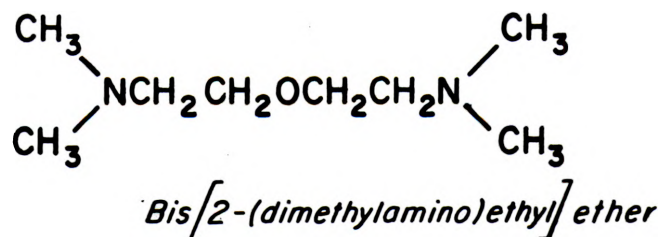
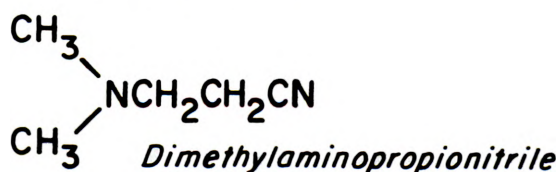
NIOSH / OSHA

Current Intelligence Bulletin 26

May 22, 1978

[®]
NIAX Catalyst ESN

a mixture of



U. S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
Public Health Service
Center for Disease Control
National Institute for Occupational Safety and Health

U.S. DEPARTMENT OF LABOR
Occupational Safety and Health Administration

This Current Intelligence Bulletin is a joint effort of the National Institute for Occupational Safety and Health (NIOSH) and the Occupational Safety and Health Administration (OSHA) and is part of the NIOSH Current Intelligence System. The purpose of the Current Intelligence System is to promptly review, evaluate, and supplement new information received by NIOSH on occupational hazards that are either unrecognized or are greater than generally known.

As warranted by this evaluation, the information is capsulized and disseminated to NIOSH staff, other government agencies, and the occupational health community, including labor, industry, academia, and public interest groups. With respect to currently known hazard information this system also serves to advise appropriate members of the above groups of recently acquired specific knowledge which may have an impact on their programs or perception of the hazard. Above all, the Current Intelligence System is designed to protect the health of American workers and to allow them to work in the safest possible environment.

IDENTIFIERS AND SYNONYMS FOR DIMETHYLAMINOPROPIONITRILE

Chemical Abstracts Service Registry Number 1738-25-6
NIOSH RTECS Number UG15750
Chemical Formula $C_5H_{10}N_2$

3-(Dimethylamino)propanenitrile
3-(Dimethylamino)propionitrile
 β -(Dimethylamino)propionitrile
N,N-Dimethylamino-3-propionitrile
3-(N,N-Dimethylamino)propionitrile
 β -N-Dimethylaminopropionitrile

IDENTIFIERS AND SYNONYMS FOR BIS(2-(DIMETHYLAMINO)ETHYL) ETHER

Chemical Abstracts Service Registry Number 3033-62-3
NIOSH RTECS Number KR94600
Chemical Formula $C_8H_{20}N_2O$

A99
A99 amine
Bis 2-(dimethylamino)ethyl ether
Kalpur PC
NIA X A99
2,2'-Oxybis(N,N-dimethylethanamine)
2,2'-Oxybis(N,N-dimethylethylamine)

DHEW (NIOSH) Publication No. 78-157

JOINT NIOSH/OSHA

CURRENT INTELLIGENCE BULLETIN: NIAX®CATALYST ESN

A Mixture of Dimethylaminopropionitrile and Bis(2-(dimethylamino)ethyl) ether

May 18, 1978

The National Institute for Occupational Safety and Health (NIOSH) and the Occupational Safety and Health Administration (OSHA) jointly recommend that NIAX® Catalyst ESN and its components, dimethylaminopropionitrile and bis(2-(dimethylamino)ethyl) ether, as well as formulations containing either component, be handled in the workplace as exceedingly hazardous materials. Investigations of outbreaks of urinary dysfunction among workers at a number of facilities that manufacture flexible polyurethane foam strongly suggest an association between NIAX® Catalyst ESN and the urological disorders. There is no current Federal standard for occupational exposure to NIAX® Catalyst ESN or either of its components. However, on April 7, 1978, OSHA issued a Health Hazard Alert and indicated "it is imperative that worker exposure to ESN and its components be completely avoided."

Background

NIAX® Catalyst ESN, a proprietary product of Union Carbide Corporation, is composed of dimethylaminopropionitrile (95%) and bis(2-(dimethylamino)ethyl) ether (5%). Similar mixtures were also marketed as NIAX® Catalysts 125 and 126. These catalysts were used in the manufacture of flexible polyurethane foams and may comprise from 0.5% to 2% of the wet urethane liquid prior to foaming. Union Carbide has voluntarily discontinued the sale of these three catalysts as well as dimethylaminopropionitrile.

Dimethylaminopropionitrile is also used as a component of acrylamide based gels (for soil grouting and other purposes), and as an intermediate in the synthesis of dimethylaminopropylamine and some pharmaceuticals. Manufacturers of dimethylaminopropionitrile include Abbott Laboratories, American Cyanamid Company, Jefferson Chemical Company, and Union Carbide Corporation.

Bis(2-(dimethylamino)ethyl) ether is manufactured in the United States exclusively by Union Carbide and used extensively in their line of catalysts for flexible polyurethane foams. Bis(2-(dimethylamino)ethyl) ether may

comprise from 0.02% to 0.1% of the wet urethane liquid prior to foaming. NIOSH and OSHA are unaware of any other application of bis(2-(dimethyl-amino)ethyl)ether.

Human Toxicity

Preliminary results of NIOSH Health Hazard Evaluations suggest NIAX® Catalyst ESN is neurotoxic, producing urinary bladder dysfunction as the prevailing clinical feature.

Of the ten industrial facilities reported to have used commercial quantities of NIAX® Catalyst ESN, five are known to have had excessive numbers of their workers seek medical attention for urological and/or neurological problems. Common urinary tract symptoms after exposure include difficulty beginning urination, inadequate bladder emptying, strain on urination, increased duration of voiding time, and post void fullness. Other symptoms include frequent urination, pain and burning on urination, as well as impotence. Neurological manifestations include dysesthesias in the form of pins and needles sensation in the hands and feet. Muscular weakness, lassitude, nausea, and vomiting were also reported. Exposure may occur by inhalation, skin absorption, and ingestion.

NIOSH epidemiological and medical studies are presently underway in two of the industrial facilities involved. Clinical manifestations in exposed workers coincide with the introduction or increased use of the catalyst in manufacturing processes. After exposure is discontinued, improvement occurs in some individuals over a variable period of time. NIOSH is investigating whether symptoms persist after exposure to the catalyst is eliminated.

Approximately a third of the hundred workers exposed at one plant and half of the two hundred exposed workers at the other plant studied reported urinary problems. Detailed clinical and laboratory studies of eight workers severely affected with urinary problems revealed that five of the eight did not have a bladder reflex and were therefore unaware of the need to void as their bladders became full. Though not conclusive, the evidence suggests that the absent bladder reflex may be the cause of urinary retention and abnormal change in bladder habits. Long term urinary retention can lead to urinary tract infection and kidney damage, and thus can pose a threat to life. In addition to bladder dysfunction, some of the workers were found to have decreased nerve conduction times of the lower legs.

Sufficient evidence does exist to suggest that occupational exposure to NIAX® Catalyst ESN is associated with the urinary and neurologic abnormalities. The extent of toxicity of the catalyst to other systems and organs including kidney, liver, eye and skin are unknown. Definitive information regarding safe levels of exposure to NIAX® Catalyst ESN or its components is not available at this time.

Animal Studies

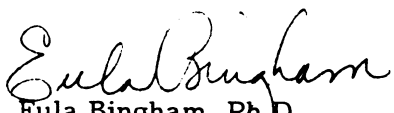
Dr. Alan Pestronk (The Johns Hopkins University) is currently investigating the effect of NIAX® Catalyst ESN, as well as its components, on the nervous system of laboratory rats. Results of this study are not yet available. Several propionitriles have been previously reported to be neurotoxins, however, specific data regarding the neurotoxicity of dimethylaminopropionitrile could not be located. Union Carbide is also sponsoring toxicity studies of NIAX® Catalyst ESN, dimethylaminopropionitrile and bis(2-(dimethylamino)ethyl)ether; these studies have been in progress for approximately two weeks but have not proceeded far enough to be adequately evaluated.

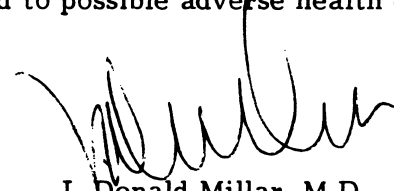
Conclusions

Although there does appear to be an association between NIAX® Catalyst ESN and the outbreaks of urinary dysfunction, it is not now known whether either component of the mixture could cause the disorder itself. Additional research in this area is clearly appropriate. Union Carbide has suggested that the nitrile component (dimethylaminopropionitrile) may be the causative agent. They stated that bis(2-(dimethylamino)ethyl) ether has been used in urethane catalyst systems for fifteen years and proper use of the material has not been known to cause any adverse health effects. (Acute overexposure may result in symptoms characteristic of amine toxicity).

Recommendation

The National Institute for Occupational Safety and Health (NIOSH) and the Occupational Safety and Health Administration (OSHA) jointly recommend that occupational exposure to NIAX® Catalyst ESN its components, dimethylaminopropionitrile and bis(2-(dimethylamino)ethyl) ether, as well as formulations containing either component, be minimized. Exposures should be limited to as few employees as possible, while minimizing workplace exposure levels with engineering and work practice controls. Exposed employees should be carefully monitored for potential disorders of the nervous and genitourinary system. Although substitution is a possible control measure, alternatives to NIAX® Catalyst ESN or its components should be fully evaluated with regard to possible adverse health effects.


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SUGGESTED GUIDELINES FOR MINIMIZING EMPLOYEE EXPOSURE TO

NIAX® CATALYST ESN and its Components,

Dimethylaminopropionitrile and Bis(2-(dimethylamino)ethyl) ether

NIOSH and OSHA recommend that it would be prudent to handle NIAX® Catalyst ESN and its components in the workplace as exceedingly hazardous materials. Workplace exposure levels and employee exposure should be minimized. The area in which NIAX® Catalyst ESN, or either of its components, is used should be restricted to only those employees essential to the process or operation.

EXPOSURE MONITORING

Initial and routine employee exposure surveys should be made by competent industrial hygiene and engineering personnel. These surveys are necessary to determine the extent of employee exposure and to ensure that controls are effective. The sampling and analytical method recommended by the Union Carbide Corporation for the bis-ether component of NIAX® Catalyst ESN is currently being used and evaluated by NIOSH as a procedure for the analysis of dimethylaminopropionitrile as well as bis(2-(dimethylamino)ethyl) ether.

The NIOSH Occupational Exposure Sampling Strategy Manual, NIOSH Publication #77-173, may be helpful in developing efficient programs to monitor employee exposures to NIAX® Catalyst ESN and its components. The manual discusses determination of the need for exposure measurements, selection of appropriate employees for exposure evaluation, and selection of sampling times.

Employee exposure measurements should consist of 8-hour TWA (time-weighted average) exposure estimates calculated from personal or breathing zone samples (air that would most nearly represent that inhaled by the employees). Area and source measurements may be useful to determine problem areas, processes, and operations.

MINIMIZING EMPLOYEE EXPOSURE

There are four basic methods of limiting employee exposure to NIAX® Catalyst ESN and its components. None of these is a simple industrial hygiene or management decision and careful planning and thought should be used prior to implementation of any of these.

- o Product Substitution

One method is the substitution of an alternative material with a lower potential health risk. However, extreme care must be used when selecting possible substitutes. Alternatives to NIAx® Catalyst ESN and its components should be fully evaluated with regard to possible human effects. Unless the toxic effects of the alternative have been thoroughly evaluated, a seemingly safe replacement may be found to induce serious health effects, possibly only after years of use.

- o Contaminant Controls

The most effective control of NIAx® Catalyst ESN and its components is by local exhaust ventilation and/or enclosure of the operation at the source of contamination.

If feasible, the process or operation should be enclosed with a slight vacuum so that any leakage will result in the flow of air into the enclosure.

The next most effective means of control is a well designed local exhaust ventilation system that physically encloses the process as much as possible, with sufficient capture velocity to keep the contaminant from entering the work atmosphere.

To ensure that ventilation equipment is working effectively, air velocity, static pressure, or air volume should be checked every three months. System effectiveness should be checked soon after any change in production, process, or control which might result in significant increases in airborne exposures to NIAx® Catalyst ESN or its components.

In cases where the contaminant release is not excessive and is not in the workers' breathing area, good general dilution ventilation may assist in keeping the contaminant levels from reaching hazardous levels.

Care should be exercised in controlling exposure resulting from residual material in off-gassing from the uncured or curing products.

- o Employee Isolation

A third alternative is the isolation of employees. It frequently involves the use of automated equipment operated by personnel observing from a closed control booth or room. The control room is maintained at a greater air pressure than that surrounding the process equipment so that air flow is out of, rather than into, the room. This type of control will not protect those employees who must do process checks, adjustments, maintenance, and related operations.

o Personal Protective Equipment

The least desirable way to control employee exposures is with the use of personal protective equipment, which may include respirators, gloves, goggles, etc. This equipment should not be used as the only means to prevent or minimize exposure during routine operations.

Exposure to NIAX® Catalyst ESN or its components should not be controlled with the use of respirators except:

- During the time period necessary to install or implement engineering or work practice controls; or
- In work situations in which engineering and work practice controls are technically not feasible; or
- For maintenance; or
- For operations which require entry into tanks or closed vessels; or
- In emergencies.

Neither NIOSH or OSHA has definitive information concerning the warning properties of NIAX® Catalyst ESN or its components or the service lives of typical industrial respirator for these substances. Therefore, as an interim recommendation, NIOSH and OSHA feel that only the following type respirators may be used for personal respiratory protection against NIAX® Catalyst ESN or its components as allowed under the previous guidelines.

A type C supplied-air respirator with a full facepiece operated in pressure-demand or other positive pressure mode or with a full facepiece, hood, or helmet operated in continuous-flow mode.

Self-contained breathing apparatus with a full facepiece operated in pressure-demand or other positive pressure mode.

A combination respirator which includes a type C supplied-air respirator with a full facepiece operated in pressure-demand mode or other positive pressure or continuous-flow mode and an auxiliary self-contained breathing apparatus operated in pressure-demand or positive pressure mode.

Only respirators approved by the National Institute for Occupational Safety and Health (NIOSH) should be used. Refer to NIOSH Certified Equipment,

December 15, 1975, NIOSH publication #76-145 and Cumulative Supplement June 1977, NIOSH Certified Equipment, NIOSH publication #77-195. The use of faceseal coverlets or socks with any respirator voids NIOSH approvals.

Refer to A Guide to Industrial Respiratory Protection, NIOSH publication #76-189 for guidelines on appropriate respiratory protection programs.

Proper maintenance procedures and good housekeeping in the work area are very important aspects of a good control program. In addition, it is vital that employees be educated as to the nature and control of the hazard, and proper personal hygiene.

