U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
CENTER FOR DISEASE CONTROL
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH
CINCINNATI, OHIO 45226

HEALTH HAZARD EVALUATION DETERMINATION
REPORT HE 78-99-562

GRUMMAN FLXIBLE
LOUDONVILLE, OHIO

February 1979

I. TOXICITY DETERMINATION

The National Institute for Occupational Safety and Health (NIOSH) conducted an environmental evaluation on August 2, 1978, for employees working in the Blueprint Reproduction Department of Plant #3. Employee exposures to airborne concentrations of ammonia were evaluated. It has been determined that during the period of this evaluation, occupational exposures to airborne concentrations of ammonia did not constitute a health hazard. This determination is based on environmental measurements of airborne ammonia, confidential employee interviews, observations of work practices and engineering controls, and a review of the relevant literature. Recommendations have been included to help improve the health and safety conditions in the employees' work area.

DISTRIBUTION AND AVAILABILITY OF DETERMINATION REPORT

Copies of this Determination Report are currently available upon request from NIOSH, Division of Technical Services, Information Resources and Dissemination Section, 4676 Columbia Parkway, Cincinnati, Ohio 45226. After 90 days the report will be available through the National Technical Information Service (NTIS), Springfield, Virginia. Information regarding its availability through NTIS can be obtained from NIOSH, Publications Office at the Cincinnati address.

Copies of this report have been sent to:

1. Plant Safety Engineer, Grumman Flxible, Loudonville, Ohio.
2. Safety Committee Representative, United Steelworkers of America - Local 4781, Loudonville, Ohio.
3. Director, Safety and Health Department, United Steelworkers of America, Pittsburgh, Pennsylvania.
4. U.S. Department of Labor - Region V
5. NIOSH - Region V

For the purpose of informing the 7 potentially exposed employees, the employer shall promptly "post" for a period of 30 calendar days the Determination Report in a prominent place(s) near where the affected employees work.

III. INTRODUCTION

Section 20(a)(6) of the Occupational Safety and Health Act of 1970, 29 U.S.C. 669(a)(6), authorizes the Secretary of Health, Education, and Welfare, following a written request by any employer or authorized representative of employees, to determine whether any substance normally found in the place of employment has potentially toxic effects in such concentrations as used or found.

The National Institute for Occupational Safety and Health received such a request from the Safety Committee Representative, United Steelworkers of America Local 4781. As the authorized employee representative for Grumman Flxible, Loudonville, Ohio, the Safety Committee Representative submitted the request on behalf of several employees who work in the Blueprint Reproduction Department of Plant #3, and for 1 employee who works in the paint warehouse. The requestor indicated that the employees may be exposed to a hazardous concentration of ammonia gas and/or a strong aqua ammonia solution (an aqueous solution containing more than 10 percent ammonia). It was also noted that the aqua ammonia solution is stored in unlabeled plastic containers.

An interim SHEFS-I Report, dated August 31, 1978, was distributed to representatives of both management and labor. Discussed in the Report were the observations and preliminary findings of the NIOSH investigators during the environmental survey of August 2, 1978; recommendations to help improve the health and safety conditions in the employees work environment were also included.

IV. HEALTH HAZARD EVALUATION

A. Process Description

The facility operated by Grumman Flxible, Loudonville, Ohio, manufactures subassemblies for two bus models which are produced by the Company. The plant has been in operation for about 50 years and employs approximately 535 persons. Of the total work force, approximately 200 are administrative, 300 are production workers, and 35 are maintenance personnel; however, only 7 employees are directly affected by the alleged hazard.

At the present time, the company manufactures 5 subassemblies per day for each of two bus models. However, the company has made plans to phase out one bus model by the end of August 1978. When completed, the subassemblies are shipped to another plant in Ohio for final assembly.

The blueprint reproduction area is located on the 3rd floor of plant 3. Although there are 6 employees in this area, only 2 employees are needed to operate the Bruning-Revolute 870® blueprint reproduction machine. The "control operator" stands directly in front of the machine and is responsible for aligning the original document on the copy paper and then directing them into the machine. Normally, 7 copies are made of each original document and on an average day, 300-400 copies are produced. A single copy can be runoff in approximately 10 seconds. After developing, the blueprints are directed down a chute in the rear of the machine and onto a folding table. The "folder" then folds and stacks each set of blueprints. A single 15-20 gallon plastic carboy of strong aqua ammonia (29% ammonium hydroxide solution) is located adjacent to the machine. The ammonia solution is automatically delivered to the machine through plastic tubing via a specially designed pump. When empty, the carboy is changed by the control operator or anyone of the office staff. Three additional carboys are stored in the hallway adjacent to the blueprint reproduction department and are opposite the employees' lunch and break area.

When these are empty, the "warehouseman" will bring up 3 full carboys from the paint warehouse. Empty carboys are returned to the paint warehouse and refilled from a 55 gallon drum. Two steel drums of strong aqua ammonia are kept in storage and are vertically stacked, one on top of the other. When refilling the plastic carboys, the warehousemen lowers the drum to ground level with a chain hoist. The drum is then turned on its side and lifted in the horizontal position and placed atop two additional drums. The carboys are then filled from this position. Approximately 30 minutes is required to fill all 3 carboys; however, the warehouseman is able to leave the area for approximately 15 minutes while the carboys are being filled.

B. Evaluation Design

In response to this request, an environmental survey was conducted on August 2, 1978, in the blueprint reproduction area. An opening conference was conducted and attended by representatives of both management and labor. Following the opening conference, a walk-through survey was performed in the blueprint reproduction and paint warehouse areas and several employees were privately interviewed. At the request of the union representatives, the NIOSH investigators also performed a walk-through survey in the spray painting and chassis undercoating areas. Environmental sampling was conducted later the same day in the blueprint reproduction area. At the conclusion of the survey, a closing conference was conducted to discuss preliminary findings and recommendations with representatives of management and labor.

*Mention of a commercial product does not constitute endorsement by the National Institute for Occupational Safety & Health.

C. Evaluation Methods

Employee exposure to airborne concentrations of ammonia were measured via personal and area air samples which were collected on August 2, 1978, during the 7:00 am - 3:30 pm shift in the vicinity of the Bruning-Revolute 870® blueprint reproduction machine.

Employee exposure to ammonia was evaluated by drawing air though a midget impinger containing 10 milliliters of 0.1 N sulfuric acid absorbing solution. Vacuum sampling pumps were utilized to draw air through the midget impingers at a flow rate of 1 liter per minute for both personal and area air samples. Personal air samples were collected in the breathing zone of the exposed employees, while area air samples were collected in locations adjacent to the Bruning-Revolute 870® machine in an effort to characterize the general work environment. These air samples were transmitted to a NIOSH contract laboratory in Salt Lake City and were analyzed by a NIOSH spectrophotometric method.

For screening purposes, direct reading Drager® detector tubes were utilized to evaluate atmospheric levels of ammonia in the vicinity of the blueprint reproduction machine.

D. Evaluation Criteria

The concept that there are concentrations of air contaminants to which most employees may be exposed on a day-to-day basis, without discomfort or adverse health effects, is fundamental to the practice of industrial hygiene. Airborne exposure limits for many chemical substances encountered occupationally have been recommended or promulgated by several organizations. These limits are normally expressed as a time-weighted average (TWA) exposure for a normal 8 to 10-hour workday, or a 40-hour workweek, and are presumed to be valid through out a normal working lifetime. However it should be noted, that due to a wide variation in individual susceptibility, a small percentage of employees may experience discomfort from exposure to some substances at concentrations at or below the recommended level; a smaller percentage may be affected more seriously by aggravation of a pre-existing condition or by development of an occupational illness.

For this investigation, environmental evaluation criteria were considered from the following sources:

(1) NIOSH Criteria Documents with recommended occupational exposure standards,

(2) American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLVs) with their supporting documentation, and

(3) U.S. Department of Labor - Occupational Safety and Health Administration (OSHA) standards.

The environmental evaluation criteria given prominence in this study is the NIOSH Recommended Criteria for Ammonia.

NIOSH recommends that occupational exposure to ammonia be controlled so that no worker is exposed to ammonia at greater than a ceiling concentration of 50 ppm as determined by a 5-minute sampling period. The standard is designed to protect the health and safety of workers for up to a 10-hour workday, 40-hour workweek over a working lifetime.[2] The present Federal Standard, as promulgated by OSHA, is 50 ppm as an 8-hour TWA exposure.[5] Therefore, the NIOSH recommendation for an environmental limit of 50 ppm as a ceiling constitutes a recommendation for lowering exposure levels in the workplace. The environmental criteria recommended by the ACGIH (1978) is a TLV of 25 ppm as determined by an 8-hour TWA exposure, and a Short Term Exposure Limit (STEL) of 35 ppm. The STEL is a maximum allowable concentration, or ceiling value, which may not be exceeded during a 15-minute excursion period.[6,7]

Environmental sampling during the blueprint reproduction process has identified the presence of ammonia in the work area. The following discussion is provided so that the employees may better understand the potential health hazards associated with excessive occupational exposure to this substance.

Ammonia - at normal room temperature and pressure, ammonia is a colorless, strongly alkaline, and highly soluble gas with an extremely pungent odor. Available odor threshold data indicates a wide variation in individual perception levels. The reported odor thresholds in humans range from 1-50 parts per million parts of contaminated air by volume (ppm). "Ammonia" is by definition, gaseous or liquified anhydrous ammonia and aqueous solutions thereof (aqua ammonia). Solutions of ammonia are classified according to the percentage of ammonia present in solution: "strong aqua ammonia" is defined as aqueous solutions containing more than 10% ammonia by weight, and "weak aqua ammonia" is defined as solutions of 10% or less. It should be noted that gaseous ammonia will be emitted from solutions of aqua ammonia.[2]

Because of its alkaline properties, ammonia exerts mainly a local corrosive action and usually is not absorbed into the blood stream. Weak aqua ammonia exerts a local irritant action to the skin, eyes, and mucous membranes; exposure to strong aqua ammonia results in tissue destruction on contact. Ammonia is a severe eye hazard, and on the basis of all available data, eye injuries constitute the most serious hazard from ammonia in regard to possible permanent disability. Serious occular damage, including corneal ulceration and blindness, may result from concentrated solutions of ammonia remaining in contact with the eye for even a short period of time. Because ammonia penetrates the eye more

rapidly than other alkalis, it is extremely important that an emergency eye bath, or water suitable for flushing ammonia from the eyes, be readily available whenever the possibility of eye contact exists. If ammonia is splashed or sprayed into the eyes, time is the single most important consideration and the first 10 seconds are critical if blindness is to be prevented. Eyes affected by ammonia should be flushed with water for a minimum of 15 minutes, forcibly holding open the eye lids if necessary. Following irrigation of the eyes, medical attention should be obtained without delay.[2,3,4]

The consequences of skin contact with aqua ammonia vary from relatively mild dermatitis to severe corrosive burns with blister formation; depending upon the solution concentration, length of exposure, and individual skin sensitivity. If splahsed on the skin, all contaminated clothing should be removed at once, and the affected area(s) should be washed thoroughly with cold water.[3,4]

E. Evaluation Results and Discussion

Results from personal and area sir samples for ammonia are reported in Table I. The results indicate airborne concentrations of less than 7.0 percent of the environmental criteria and are thus, not considered to constitute a health hazard during the period of this evaluation. During the blueprint reproduction process, time weighted average exposures in the Blueprint Reproduction Department ranged from 0.8 to 3.3 ppm. The average concentration from this range of samples was 2.1 ± 0.9 ppm ($x \pm s$).

The results of the detector tube screening survey of August 2, also indicated low environmental levels of ammonia. The lower limit of detection for the Drager® type 5/a ammonia detector tube is 5.0 ppm. The highest detector tube reading was obtained in the vicinity of the blueprint reproduction machine and indicated a level of 10 ppm.

Workers who were privately interviewed in the blueprint reproduction and paint warehouse areas, reported no probelms or adverse health effects from exppsure to ammonia.

F. Conclusion and Recommendations

Thorough analysis of the data obtained from environmental sampling and worker interviews indicated that a health hazard to the employees in the Blueprint Reproduction Department of Grumman Flexible, did not exist during the period of this evaluation. However, the following recommendations are made to help improve the health and safety conditions in the employees work environment:

A. Blueprint Reproduction Department

1. Presently three plastic carboys of strong aqua ammonia are stored in the hallway adjacent to the Blueprint Reproduction Department and are opposite the employees' lunch and break area. The carboys should be removed from this location and storage should be provided in a cool, dry, well ventilated area free from oxidizers and sources of ignition. The storage area should be located outside the main plant or in an area especially provided for ammonia storage.

2. A solution of strong aqua ammonia is extremely irritating and corrosive to the eyes, skin and mucous membranes. Therefore, while changing the carboy adjacent to the blueprint reproduction machine, employees should be provided with and required to wear rubber gloves and chemical safety goggles.

3. At present, the aqua ammonia carboys are improperly labeled. They should be labeled in accordance with the criteria specified in the "NIOSH Recommended Standard for Occupational Exposure to Ammonia", a copy of which was supplied to representatives of management and labor at the opening conference.

B. Paint Warehouse

1. Two, fifty-five gallon steel drums of strong aqua ammonia are stacked one on top of the other in this area. These drums are located directly opposite several plastic drums of Detrex 402® (chromic acid) which was labeled: "Corrosive Acids and Strong Oxidant". This storage arrangement constitutes a potentially hazardous situation because an explosive mixture may be formed if the two chemicals were to come in contact with each other. As previously stated, strong aqua ammonia should be stored in areas free of oxidizers. Therefore, the aqua ammonia drums should immediately be relocated to an approved storage area.

2. The present method of refilling the plastic carboys from the bulk storage drum is hazardous and should be revised. To minimize the possibility of a chemical spill, the drums should be refilled via a safety siphon or non-pressurizing type pump fabricated of materials suitable for immersion in strong aqua ammonia.

3. Several plastic and steel fifty-five gallon drums are stored over one tier high. These drums should be separated by pallets or dunnage where necessary to provide stability and prevent excessive stress on container walls.

4. The employees should be provided and required to wear the following personal protective equipment while refilling the carboys with aqua ammonia: rubber gloves, rubber apron, chemical safety goggles, face shield, and other equipment as necessary. Additionally, emergency flood showers and eyewash facilities should also be available.

C. Undercoating Operation

1. The air filters used in the local exhaust ventilation system whould be replaced more often, daily if necessary. Most were completely clogged with chassis undercoating materials which reduces the systems efficiency.

2. Additional canvas curtains should be installed to more fully enclose the undercoating operation, and thereby, increase the efficiency of the exhaust ventilation system.

3. An open five gallon bucket which reportedly contains lacquer thinner (possibly SC Solvent #1) is used by the employees to clean the spray gun nozzle and their hands and arms. This work practice is unacceptable and should be discontinued immediately as it constitutes a potential health and fire hazard.

4. While performing chassis undercoating, the employees should be provided and required to use the following personal protective equipment: Chemical safety goggles, Buna-N® or other impervious gloves, long sleeve coveralls or similar protective garments, and safety boots or shoes. Although respirators should not be used as a regular means of protection against solvent vapors, the use of a NIOSH approved half-mask or full facepiece respirator equipped with organic vapor cartridge (s) and particulate pre-filter(s), is also recommended for additional protection.

D. Paint Spray Booth

1. In order to assure efficient overspray removal from the employees' breathing zone, spray gun pressure should be maintained at the recommended level of 40 PSIG.

E. Respirator Program

1. Every respirator manufacturer designs his facepieces to fit as broad a segment of the working population as possible; however, no respirator marketed will fit everyone. Therefore, several brands of respirators (i.e. -half-mask or full-facepiece) should be made available where necessary. All employees who are required to wear a respirator should be given a qualitative fit test to determine if the facepiece-to-face seal is adequate. The "irritant smoke test" and the "isoamyl acetate vapor (banana oil) test" are two commonly administered tests which can be used to select the proper respirator. Before entering any potentially toxic atmosphere, the respirator wearer should also perform a positive and negative pressure test.

REFERENCES

1. P & CAM 205 - Ammonia in Air, NIOSH Manual of Analytical Methods, Second Edition - Volume 1, U.S. Department of Health, Education, and Welfare, PHS, CDC, NIOSH, April 1977. DHEW (NIOSH) Publication No. 77-157-A.

2. Criteria for a Recommended Standard . . . Occupational Exposure to Ammonia, U.S. Department of Health, Education, and Welfare, PHS, CDC, NIOSH, July 1974. DHEW (NIOSH) Publication No. 74-136.

3. Occupational Diseases . . A Guide to Their Recognition, Revised Edition, U.S. Department of Health, Education, and Welfare, PHS, CDC, NIOSH, June 1977. DHEW (NIOSH) Publication No. 77-181.

4. Aqua Ammonia . . Chemical Safety Data Sheet SD-13, Manufacturing Chemists' Association Inc., Washington, D.C., 1947.

5. U.S. Department of Labor, Occupational Safety and Health Administration, 29 CFR 1910.1000, January 1, 1978.

6. American Conference of Governmental Industrial Hygienists: Documentation of the Threshold Limit Values for Substances in the Workroom Air, Third Edition, Cincinnati, Ohio, 1971.

7. Threshold Limit Values for Chemical Substances and Physical Agents in the Workroom Environment with Intended Changes for 1978, American Conference of Governmental Industrial Hygienists, Cincinnati, Ohio, 1978.

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Results of Personal and Area Air Sampling for Exposure to Ammonia

Grumman Flexible
Blueprint Reproduction Department
326 N. Water Street
Loudonville, Ohio

August 2, 1978

Time Weighted Average Exposure in PPM [1]

Sample	Description/Location	Time	Volume (Liters)	Ammonia
A1	Area - Feed-in table, left side	1313 - 1328	15.0	0.8
A2	Area - Feed-in table, right side	1313 - 1328	15.0	0.9
A3	Area - Folding table, near ammonia carboy	1313 - 1328	15.0	1.4
A4	Area - Feed-in table, left side	1341 - 1429	48.0	2.6
A5	Area - Feed-in table, right side	1341 - 1429	48.0	2.2
A6	Area - Folding table, near ammonia carboy	1341 - 1429	48.0	3.3
A7	Personal - Feed-in operator	1341 - 1429	48.0	3.3
A8	Personal - Folder	1341 - 1429	48.0	2.2
A9	Area - Top/Center of machine	1341 - 1429	48.0	2.0
A10	Blank impinger sample	------	-----	ND [2]
	Environmental Criteria			50.0 [3] (Ceiling)

1. PPM - Parts of vapor per million parts of contaminated air by volume at 25°C and 760 mm Hg.

2. ND - None detected, less than the lower limit of detection for this spectrophotometric method of 6.0 micrograms per sample.

3. A "ceiling" concentration should not be exceeded.