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 NO. 76-15-308

DEPARTMENT OF ANESTHESIA
NORTHWESTERN UNIVERSITY MEDICAL SCHOOL
CHICAGO, ILLINOIS

JULY 1976

I. TOXICITY DETERMINATION

Exposures of employees to chemical agents are not believed to be toxic under the conditions observed by the NIOSH Hazard Evaluation personnel during the survey of March 4, 1976. Employees in the Department of Anesthesia, have experienced episodes of eighth cranial nerve disease as well as measured residual effects. No evidence exists to suggest that these health problems are due to chemical exposures. Recommendations are made to re-evaluate the existing ventilation.

This determination is based upon measurements of workplace concentrations of airborne chemicals, inspection of the work area and materials used, medical evaluation using questionnaires and physical examinations, and review of the current knowledge of ototoxic agents.

II. DISTRIBUTION AND AVAILABILITY OF DETERMINATION REPORT

Copies of this Determination Report are available upon request from NIOSH, Division of Technical Services, Information Resources and Dissemination Section, 4676 Columbia Parkway, Cincinnati, Ohio 45226. Copies have been sent to:

a) Campus Manager, Northwestern University Medical School, Chicago, Illinois
b) Authorized Representative of Employees
c) U.S. Department of Labor, Region V
d) NIOSH, Region V

For the purpose of informing the approximately nine "affected employees", the employer shall promptly "post" for a period of 30 calendar days the Determination Report in a prominent place(s) where 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 an 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 (NIOSH) received such a request from an authorized representative of employees regarding worker exposures to "unknown-organic solvents" at the Department of Anesthesia, Northwestern University Medical School, Chicago, Illinois.

IV. HAZARD EVALUATION

A. Description of Process - Conditions of Use

The Department of Anesthesia is located on the 14th floor of an older wing of the medical complex. Other wings of this complex have been added at various times. A dental clinic is located on floors 11-13, and an animal care area is located on the 15th floor. The nine employees of the Department of Anesthesia are located on both sides of the corridor which divides this area. The four clerical workers are located in the Department office at the west end of the corridor, the Assistant Chairman and Chairman of the Department of Anesthesia have offices located across the corridor from the Department office, and a research technician works in five labs along the corridor. These facilities have a total area of about 2,500 square feet. The research facilities/equipment include a gas chromatograph, a cold room, an atomic absorption spectrophotometer, and several scintillation counters. Most activities conducted in the immediate location of the Department relate to teaching and administrative duties. Research activities are performed primarily by the technician and currently involve an *in vitro* enzyme project and tissue culture.

B. Evaluation Design and Methods

The request for a Health Hazard Evaluation submitted by the Chairman of the Department of Anesthesia cited the history of middle and inner ear disturbances and asked that the work areas be evaluated for hazardous agents. This facility was visited on March 4, 1976 by NIOSH personnel for the purpose of conducting a medical/environmental evaluation of this work area. The employees in this area were examined by medical history and physical examination. Employee exposure to hazardous agents was investigated by collecting information on materials used, questioning concerning the occurence of odors, survey of the physical facilities, and air sampling. Subsequent to this visit a literature search of ototoxic agents was performed.

1. Air Sampling

Air sampling was conducted on March 4 to help identify any air contaminants. General air sampling was conducted in the central corridor using activated charcoal and silica gel as collecting media. Low flow pumps were used to draw air through the tubes containing the media. The activated charcoal samples were desorbed in carbon disulfide with analyses for non-polar organic compounds by gas chromatography/flame ionization detection. The silica gel samples were desorbed in methanol or water with analyses for amines and polar compounds by gas chromatography/flame ionization detection and if necessary gas chromatography/mass spectroscopy.

2. Medical

Eight of the nine workers were evaluated using questionnaires and physical examinations. The physical exam consisted of evaluation of the eyes, ears, nose, throat and the taking of the blood pressure. Certain workers had undergone extensive evaluations by private physicians and consultants from the Northwestern University Medical School, including the performing of electronystagmograms, as well as other tests. Copies of these were obtained.

C. Evaluation Criteria

No agents known to cause problems of a toxic nature were in use in the Department during this evaluation and all activities were described by the employees as being normal operating conditions.

The lack of obvious toxic agents present in this environment prompted a literature search upon returning. As a result of this search several compounds that have suspected toxicity for the eighth cranial nerve were discovered. Methyl chloride, methylene chloride, chloroform and carbon tetrachloride were implicated by one study to cause changes after chronic exposure in the functional state of the olfactory and vestibular systems.[1] Parathion, malathion and systox were reported to be possibly related to supravestibular and cochlear damage in subacutely poisoned workers exposed to these materials on a chronic basis.[2] Other eighth nerve toxicity was documented to be related to certain drugs (aminoglycosides and lasix) but no history of exposure to any of these agents was ellicited.

D. Evaluation Results

1. Medical

Eight of the nine workers in the anesthesia department were interviewed and examined. The mean age was 35.5 years with a range of 24-54 years. The mean length of employment was 5.8 years with a range of 1.2-10 years. There were five males and three females in the group.

As can be seen by Tables I and II, seven of eight interviewed thought that they had symptoms related to their work place, but no specific inciting odor or time sequence was found. Three of eight reported nausea and vomiting, four of eight experienced vertigo, four of eight reported tinnitus and three of eight reported non-specific chest tightness. A majority of the elicited symptoms (65%) came from those three individuals with documented disease.

Physical examination by the NIOSH medical officer revealed four of eight workers with eye erythema, two of eight had scarred tympanic membranes, four of eight had nasal erythema and three of eight had throat erythema. Blood pressure examination revealed two of eight to have elevated levels, one of these was

being treated with medication at the time of examination. In addition to our evaluation the three persons who had eighth nerve abnormalities had been examined by private physicians with a variety of tests before our visits. All three had abnormalities in the electronystagmogram. No other abnormalities in the other past evaluations, such as blood tests, were found.

2. Environmental

Persons working in this Department were questioned concerning the use of chemicals, microbial research, the nature of their symptoms, and the temporal relationship of symptoms and observed animal and chemical odors. Diagnosis of the ear problems was in December of 1974 (two cases) and December of 1975 (one case). No one could relate the chemical and animal odors to the symptoms. The presence of these odors has never been traced to activities conducted by Department personnel.

The employees in the Anesthesia Department unanimously complained of the poor working facilities. This area was described by employees as embayed and poorly ventilated with various odors present. The reported odors included ether, toluene, phenol, hot rubber, animal excrement, sewer odors and decayed animal flesh. These complaints have been formalized at numerous times with correspondence to University officials. It was reported that this area is uncomfortably hot during the summer period. Hot water/steam pipes run the length of the central corridor and reportedly add to the heat problem in the summer. Supply air vents are located only at the east end of this area in the conference room and hallway..In order to increase air circulation at the west end of the area, unit air con ditioners are constantly run and windows and doors are left open. It was reported that mice, rats, roaches, horseflies, ants and wasps have frequently invaded this area.

A survey of the materials worked with in this area was performed. The research activities conducted here require a few common solvents, (acetone, chloroform, diethyl ether, ethyl alcohol, methyl alcohol, methyl cellusolve, petroleum ether, toluene, and xylene) none of which are recognized or used in quantities likely to cause the symptoms described. The use of pesticides and fumigants in this and adjacent areas was investigated during conversation with the director of the animal facilities and with the contract exterminator. Based on the methods and frequency of use, it appeared unlikely that toxic exposures occurred to persons from the use of these materials.

The ventilation system was evaluated to determine if supply air could be contaminated. Supply air comes from three sources - supply vents at the east end of the corridor (the air intake is located on the roof of the 15th floor), window-unit air conditioners, and open windows at the west end of the corridor (depending on the weather conditions). There are several fume hoods in the laboratories which exhaust onto the 15th floor roof. It appears that there is a potential for contamination of the makeup air due to the closeness of the air intake duct and exhaust stacks for the infectious disease research

facility (15th floor) and fume hoods. It appears that little consideration has been given to locating these intake and exhaust points.

The possibility of odors coming from the drains was investigated. While one particular floor drain was thought to be a source of odors, it has been sealed off for some time. Sink drains in this area have traps which should prevent odors originating from other users of the sewage system.

Air sampling was conducted on March 4 to help identify any air contaminants Analysis of the charcoal tube samples by CS_2 desorption and gas chromatography/flame ionization detection did not show any peaks attributable to non-polary organic compounds. The silica gel air samples were analyzed by desorbing with water (two samples) or methanol (two samples) with gas chromatography/flame ionization detection. The results of silica gel analysis indicated that measurable levels of amines and polar compounds did not exist. No chemical odors were detected in this area during the periods of air sampling.

E. Conclusions

Based on this evaluation of work practices and materials used, in addition to air sampling, no toxic hazard was identified at the Department of Anesthesia at Northwestern University Medical School. However, the existence of documented episodes of eighth cranial nerve disease as well as measured residual effects (e.g., vertigo, tinnitis) can not be denied or explained. In attempting to explain this small cluster of eighth nerve disorders, three major possibilities exist. The first is that the three cases were unrelated and occurred only in coincidental fashion. The second is that they are related to a non-measureable entity perhaps a viral or other agent. The third being a chemical that was unable to be detected on the date of our visit. While no evidence exists to suggest that toxic exposures to chemicals has occurred, the observed odors are probably due to contaminated and generally indequate supply air. Since the etiologies of the disease in question are only speculative, it makes the evaluation of all of the data involved very difficult. While not investigated in depth, there appeared to be inadequate knowledge of the various chemical and biological materials which are worked with in the overall area.

V. RECOMMENDATIONS

Because of the problems described and the physical characteristics of the area in question, as well as the physical and psychological well-being of those employed in this area, it is recommended that the Department of Anesthesia be relocated. However, if this is not feasible the ventiliation system should be re-evaluated and improved to provide for worker comfort and minimize the potential for exposure to any hazardous airborne agents which may be present as a result of activities at this facility. Criteria for comfort ventilation[3] and control of hazardous agents are available.[4-9]

The positioning of the air exhaust and intake points should be evaluated and changed if indicated.[10]

It is further recommended that a comprehensive program be developed for the registry and control of potentially hazardous operations conducted at the School of Medicine. While control of a given hazardous operation with exhaust ventilation is often required, haphazard location of exhaust stacks could endanger other persons unless a coordinated plan exists to deal with hazardous agents.

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TABLE I

PERCENT POSITIVE SYMPTOMS REPORTED BY
DEPARTMENT OF ANESTHESIA EMPLOYEES
NORTHWESTERN UNIVERSITY MEDICAL SCHOOL
CHICAGO, ILLINOIS

MARCH 4, 1976

1.	Symptoms related to work	(7 of 8)	88%
2.	Ear pain	(3 of 8)	38%
3.	Hearing loss	(2 of 8)	25%
4.	Nausea and vomiting	(3 of 8)	38%
5.	Vertigo	(4 of 8)	50%
6.	Tinnitus	(3 of 8)	38%
7.	Chest tightness	(3 of 8)	38%
	Smokers	(3 of 8)	38%

TABLE II

PERCENT POSITIVE PHYSICAL FINDINGS
AMONG DEPARTMENT OF ANESTHESIA EMPLOYEES
NORTHWESTERN UNIVERSITY MEDICAL SCHOOL
CHICAGO, ILLINOIS

MARCH 4, 1976

Eyes	50%	(4 of 8)	Conjunctival erythema
Ears	25%	(2 of 8)	Abnormal Tympanic membranes
Nose	50%	(4 of 8)	Nasal erythema
Throat	38%	(3 of 8)	Pharangeal erythema
Blood Pressure	35%	(2 of 8)	Abnormally high