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. 78-65-514

CARLETON STEWART MUSIC COMPANY
MASON CITY, IOWA

AUGUST 1978

I. TOXICITY DETERMINATION

Based on the environmental and medical data, it has been determined that a hazard to the health of employees exposed to various chemicals and microorganisms did not exist at the Carleton Stewart Music Company in Mason City, Iowa, during the period of the Health Hazard Evaluation conducted by NIOSH on April 10-13, 1978.

Environmental sampling for various chemical agents used in the repair of musical instruments and for microorganisms did not identify any concentrations of airborne toxic substance(s) or concentrations of microorganisms that could be considered a health hazard or even capable of producing the alleged symptoms. A potential health hazard may exist to the instrument repairman if operations were significantly increased in the instrument repair shop; i.e., increased dipping and degreasing operations resulting in additional exposure of the instrument repairman to methylene chloride, trichloroethylene, xylene, toluene, and benzene. Although the levels of the aforementioned organic compounds outside the instrument repair shop were well below the environmental criteria for these compounds, they are indicative of some exposure to the other employees.

Detailed information concerning the results of this survey are contained in the body of this report. Recommendations are included in this report which are designed to reduce employees' (particularly the instrument repairman's) exposure to a minimum.

II. 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:

a) Carleton Stewart Music Company
b) State of Iowa, Bureau of Labor, Des Moines, Iowa
c) U.S. Department of Labor - Region VII
d) NIOSH - Region VII

For the purpose of informing the approximately 8 "affected employees", the employer shall promptly "post" for a period of thirty calendar days, this Determination Report in a prominent place(s) near where exposed 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 received such a request from the owner of the Carleton Stewart Music Company regarding worker exposures to trichloroethylene and other chemicals used for instrument repair, and the possibility that some of the employees' symptomatology might be attributed to occupational exposure to these chemicals. Both employees and management personnel reported developing "lumps" under their arms. It was stated that one employee had a "blood disease" with associated swollen "lumps" under the arms.

IV. HEALTH HAZARD EVALUATION

A. Process Description

There are 10 full-time employees and 5 part-time employees who are potentially exposed with most of these employees working on the first floor of a two-story facility in the downtown shopping center. Of these employees, 8 were considered as exposed employees as they spent all their time in the facility as manager, salespersons, accountants, clerical staff, and one instrument repairman. The instrument repairman is the only employee working directly with the chemicals involved in this evaluation. Exposure of the other employees is limited to the natural diffusion of organic vapors from the instrument repair shop to surrounding areas.

The first floor consists of an office and display and sales areas for band instruments, stereos, sheet music, music books, records and similar items associated with a retail music shop of approximately 3000 square feet of floor area. The second floor involves approximately 4500 square feet of area consisting of a large display area for pianos and organs, a warehouse with small area for electronic repair of organs and pianos, a

storage warehouse, a business office, and a separate room (about 40 feet by 24 feet) used for the overhaul and repair of instruments.

One employee is assigned to the overhaul and repair of musical instruments, and his is the only source of potential chemical exposure. Approximately 70 percent of his time is spent in the general repair (e.g., dismantling, replacing parts, assembling, etc.) of instruments which does not involve any exposure to chemicals. Approximately 25 percent of the instrument repairman's time is spent in buffing operations, 15 minutes per week in silver soldering, 1 hour per week in degreasing operations, 1.5 hours per week in acid dipping to remove lacquer, and 2-3 hours per week in lacquering instruments. Buffing operations involve potential exposure to animal tallow, iron oxide, silica and mineral oil. Degreasing operations involve potential exposure to methylene chloride and trichloroethylene. Dipping operations involve potential exposure primarily to formic acid, acetic acid, and methylene chloride, although one dipping solution (not used very much) did contain chromic acid and sulfuric acid, and another solution (not used for over a year) contained sodium cyanide. Lacquer operations involve potential exposure to several different acetates and alcohols as well as toluene and xylene with benzene as a possible contaminant. Lacquering operations are conducted in a small paint room that has a separate fan which vents vapors to the outside. Buffing operations are also conducted in a separate room that has provisions for a local recirculating filtered ventilation system. There is a main central heating and air conditioning system in the organ and piano display area with a supplemental system in the lunch room by the business office on the second floor.

B. Evaluation Progress and Methods

1. Progress

An initial walk-through survey was conducted on April 11, 1978, to identify potential exposures to the various chemicals used in the repair of instruments. A medical-environmental survey was subsequently conducted on April 12-13, 1978. Operations (e.g., buffing, degreasing, etc.) were conducted in the instrument repair shop to simulate maximum exposure conditions for a day, although such operations are conducted off and on throughout the week and the results may be more representative of weekly exposures. For instance, operations conducted on April 12, 1978, involved approximately 6 hours of buffing operations and 2 hours of degreasing and acid dipping operations. Operations conducted on April 13, 1978, involved 6 hours of intermittent lacquering operations and 2 hours of degreasing and acid dipping operations. An interim internal SHEFS-I Report dated April 27, 1978, was sent to appropriate representatives of the company.

2. Environmental Evaluation Methods

Breathing zone and general area samples were obtained to characterize the exposure of the instrument repairman, the only employee working directly

with the chemicals. General area samples were obtained in other areas (e.g., offices, display areas, etc.) to characterize the potential exposure of other employees who do not work directly with the chemicals. The following is a summary of the sampling/analytical methods used during this survey:

a. Charcoal tube samples were obtained using Sipin pumps at a sampling rate of 0.2 liters per minute (lpm). These samples were analyzed for several organic compounds with a detection limit of 0.01 mg per sample.

b. Pre-weighed FWSB filter samples in three-piece cassettes for total dust and two-piece cassettes preceeded by a 10 millimeter (mm) cyclone for respirable dust were obtained at 1.7 lpm. These samples were analyzed for total weight and "free silica" (defined as quartz and/or cristobalite) with a detection limit of 0.03 milligrams per sample.

c. An AA filter sample in a three-piece cassette was obtained using an MSA pump at a sampling rate of 1.5 lpm. A PVC filter sample in a three-piece cassette was obtained using an MSA pump at a sampling rate of 1.5 lpm. The AA filter sample was analyzed for sulfuric acid with a detection limit of 0.020 mg per sample. The PVC filter sample was analyzed for chromium (Cr) with a minimum detection limit of 0.004 mg per sample. These samples were obtained by the container of sulfuric acid and chromic acid to ascertain if these acids became airborne during the very limited use of the acid solution. No sulfuric acid or chromic acid was detected, and therefore, are not considered as a hazard at the time of the survey and are not discussed further in this report.

d. Impinger samples containing 15 millimeters of 0.1 N sodium hydroxide solution were obtained using an MSA pump at a flow rate of 1.0 lpm. These samples were analyzed for formic acid.

e. Samples for microorganisms (bacteria and fungus) were also collected on: blood agar culture plates or petri dishes by exposing the plates to the environment for approximately one half hour to one hour; sterilized AA filters in an open-face two-piece cassette using an MSA pump at a flow rate of 1.0 lpm for 30 minutes and placing the filter in a growth median; throat swabs for smearing various surfaces; and bulk samples which may contain microorganisms.

All of the samples were analyzed for the various chemicals in accordance with appropriate procedures contained in the NIOSH Manual of Analytical Methods, HEW Publication No. (NIOSH) 77-157, Cincinnati, Ohio, 1977. Bacteria and fungus were analyzed using standard biological procedures by an outside laboratory specializing in such procedures.

3. Medical Evaluation Methods

The eight people who participated in this study did so because of their proximity to the degreasing operations and/or long-term employment. They comprised all of the people (save two individuals who declined participation and had no complaints) who were available in the music store at the time this survey took place. The participants included the current instrument repairman and a previous employee who was employed as an instrument repairman. Each person was questioned regarding any pertinent past medical and occupational history, or as regards specific symptoms known to be associated with degreasing compounds. In addition to the history, a physical examination was performed on each person. Detail was paid to mucous membranes, the epidermis, and the axillary, cervical, and inguinal lymph node groups. Throat cultures for bacteria and fungus were taken from all the participants in this study, as well as blood pressure readings.

C. Evaluation Criteria

1. Environmental Criteria

The three primary sources of environmental evaluation criteria considered in this report are: (a) NIOSH Criteria Documents with recommended standards for occupational exposure; (b) American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLV's) with supporting documentation; and (c) Federal Occupational Health Standards as promulgated by the Occupational Safety and Health Administration, U.S. Department of Labor (29 CFR 1910.1000). For the substances evaluated during this study, the primary environmental criteria considered most appropriate are:

TABLE OF ENVIRONMENTAL CRITERIA

SUBSTANCE	STANDARD OR GUIDE mg/M^3*
"Free Silica" (as quartz and/or cristobalite) - respirable	0.05 (a)**
Total dust (nuisance)	10.0 (b)
Respirable dust (nuisance)	5.0 (b)
Total dust (containing "free silica")	$\frac{30}{\%\ \text{quartz} + 3}$ (b)
Acetic acid	25.0 (b)
Formic acid	9.0 (b)
Trichloroethylene	537.0 (a,b)***

Methylene chloride	261.0 (a)
Toluene	375.0 (a,b) (750.0 - 10 minutes)
Benzene	3.2 (a)****
Xylene	434.0 (a,b)
n-Butyl alcohol	150.0 (b)
Isobutyl alcohol	150.0 (b)
n-Butyl acetate	710.0 (b)
Isobutyl acetate	700.0 (b)
Cellosolve acetate	540.0 (b)
Ethyl acetate	1400.0 (b)

*Approximate milligrams (mg) of substance per cubic meter (M^3) of air sampled.

**Reference letters in parentheses refer to the source(s) from the above discussion from which the standard or guide was obtained.

***In case of a mixture of air contaminants[2] which produce similar biological effects, particularly with organic solvents, the overall effects are considered as additive. An employer shall compute the equivalent exposure as follows:

$$*Em = \frac{C_1}{L_1} + \frac{C_2}{L_2} \cdots \frac{C_n}{L_n}$$

Where:

Em is the equivalent exposure for the mixture.
C is the concentration of a particular contaminant.
L is the exposure limit or environmental criteria for that contaminant.

*The value of Em shall not exceed the value of 1.

****The current ACGIH-TLV for benzene is 30 mg/M^3 with a reference that benzene is a chemical substance associated with industrial processes which are suspect of inducing cancer in man. However, recent data from clinical as well as from epidemiological data are conclusive at this time that benzene is leukemogenic because it produces progressive, malignant disease of the blood-forming organs. Based on this more recent data, NIOSH recommended to OSHA that a standard for benzene be 3.2 mg/M^3. OSHA has recently published a standard for benzene of 3.2 mg/M^3.

Occupational health exposure limits for individual substances are generally established at levels intended to protect workers occupationally exposed during an 8 or 10 hour work day, 40 hour work week, over a normal working lifetime.

2. Medical Criteria - Review of Literature[1,2,3,4,5,6]

a. Toxic Substances

Nuisance dusts and dusts containing "free silica" - Nuisance dusts are those dusts which are considered biologically inert such as graphite, limestone, rouge, and kaolin. The dust may cause irritation or dryness of the eyes and throat, stuffy nose and cough. These are non-specific symptoms of irritation which may be caused by any dust exposure. The polishing materials used by the instrument repairman may contain minor amounts of "free silica" as cristobalite and/or quartz, which is biologically active in causing a pulmonary fibrosis known as silicosis. This normally takes several years to develop at lower levels of exposure. Silicosis is a very debilitating and progressive disease. Silica exposure causes no specific symptoms at the time of the exposure. The cardinal symptom of silicosis which may occur 20 years after the initial exposure is shortness of breath. Cough, usually non-productive, may be present.

Acetic acid and formic acid - The primary physiological characteristic of these acids is their irritating action on the mucous membranes, eyes and respiratory passages. Fahy and Elkins[1] reported that workers exposed to formic and acetic acids in a textile plant complained of nausea. Levels at the plant were 2 to 3 times the recommended criteria.

Trichloroethylene - Trichloroethylene is toxic by inhalation, by prolonged and repeated contact with skin or mucous membranes, or by oral intake. Prolonged or repeated exposures to the product in any form is hazardous. Signs and symptoms of excessive absorption usually appear gradually and only after repeated exposure. In order of appearance they commonly are unusual fatigue, loss of appetite and weight, nausea, vomiting, constipation, abdominal pain, jaundice, drowsiness, going on in severe cases to unconsciousness and death.

Methylene chloride - Methylene chloride vapor is a narcotic and may cause a toxic encephalopathy. This compound's route of entry is by inhalation. Severe but non-fatal poisoning in man is characterized by a latent period of several hours followed by dizziness, nausea, vomiting, double vision, weakness, convulsions, and coma. Kidney and liver damage along with anemia can occur. Exposure to lower concentrations shows delayed signs including weakness, drowsiness, staggering gait, slurred speech and memory lapse. The onset is often insidious, and may be confused with mild viral illness. Because carbon monoxide is produced by the metabolism of methylene chloride, its effects may be additive with other sources of carbon monoxide such as smoking.

Benzene - The most significant toxic effect of benzene is insidious and often irreversible injury to the blood-forming tissues, resulting most commonly from repeated low-level chronic exposures. Route of entry to the body is by inhalation and skin absorption. Excessive human exposure may cause headache, weariness, loss of appetite and lassitude with incipient blood effects including decreased red cell counts and unusual white cell configurations. Leukemia is a possibility.

Toluene, xylene, n-butyl alcohol and isobutyl alcohol - The medical effects of this mixture of solvents is one of pre-narcotic and narcotic symptoms such as dizziness, incoordination, ataxia (staggering gait), euphoria, drowsiness, nausea, loss of appetite, and vomiting. Coma and death may result from intense exposures. Butyl alcohol is an irritant to the eyes, nose, throat and upper airways. It may cause tissue damage to the cornea and to the upper airways (bronchitis). It may also cause depression of the red blood cell count in the peripheral blood.

Butyl acetate, isobutyl acetate, cellosolve acetate, and ethyl acetate - Acetates are mildly narcotic in nature and produce irritation of the eyes and salivation at concentrations above the environmental criteria. The higher acetates appear to cause more irritative effects on the eyes and respiratory passages. Therefore, butyl acetate would be considered more toxic than ethyl acetate. As a general rule, acetates are not significantly irritating to the skin.

Silver soldering - Many silver soldering compounds contain cadmium. When cadmium is heated, dangerous quantities of cadmium oxide are found. Exposure is via inhalation/ingestion. Acute symptoms following inhalation of cadmium include dryness of the throat, headache, and nausea. The chronic effects of cadmium exposure are cummulative and are mainly directed at the kidneys and lungs. Symptoms include weight loss, cough and shortness of breath, gross pulmonary emphysema, and the appearance of a low molecular protein in the urine. Where a man works with metallic silver, small particles may penetrate the exposed skin surface, giving rise to small pigmented lesions by a process equivalent to tattooing.

D. Evaluation Results and Discussions

1. Environmental Results and Discussions

Table IA shows the results of samples obtained for methylene chloride and trichloroethylene during dipping and degreasing operations. The results for the instrument repair operator were approximately 50 percent of the environmental criteria of 261 mg/M^3 for methylene chloride but may approach the criteria since minimum values were obtained on one sample. The maximum exposure was less than 20 percent of the environmental criteria of 537 mg/M^3 for trichloroethylene. General area sample results show exposure in other areas of the facility to be less than 10 percent of the environmental criteria for methylene chloride and trichloroethylene. One area sample was obtained for acetic acid and two area samples were obtained for formic acid in the close vicinity of the dipping operations.

No formic acid or acetic acid was detected on these samples which indicates minimal exposure of the instrument repair operator or others to these compounds.

Table IB shows all sample results obtained during buffing operations. All sample results were well below the environmental criteria of 10 mg/M^3 for total dust (nuisance) and 5 mg/M^3 for respirable dust (nuisance). No free silica was detected in the respirable dust samples. The average percent "free silica" found in a total airborne dust sample was two percent which results in an environmental criteria of 6 mg/M^3 $(\frac{30}{2 + 3})$ using the ACGIH recommendation for dusts containing silica. The maximum sample result for total dust containing free silica was 3.2 mg/M^3 which is well below the environmental criteria of 6.0 mg/M^3.

Table IIA shows the sample results for methylene chloride, trichloroethylene, xylene, toluene, and benzene which were all below the environmental criteria of 261 mg/M^3, 537 mg/M^3, 440 mg/M^3, 375 mg/M^3 and 3.2 mg/M^3, respectively. Sample M was a short term sample (9 minutes) obtained to ascertain if any short-term environmental levels were exceeded. Sample M showed a concentration of 566 mg/M^3 for toluene which approached the environmental criteria of 750 mg/M^3 for toluene for a 10 minute sampling period.

Table IIB shows the results for n-butyl acetate, isobutyl acetate, cellosolve acetate and ethyl acetate which were all below respective environmental criteria for these compounds.

Table IIC shows the results for n-butyl alcohol and isobutyl alcohol which were all well below the respective environmental criteria for these compounds. One charcoal tube sample was obtained and analyzed for isopropyl alcohol. No isopropyl alcohol was detected in the sample.

In evaluating the data presented in the tables, it is apparent that the most significant exposure is to the instrument repair operator. Exposure of the other employees was minimal or less than ten percent of the environmental criteria of Em = 1 when considering the combined effects of all the organic compounds as additive. Exposure of the instrument repair operator was below (less than ninety percent) the environmental criteria of Em = 1 when considering the combined effects of all the organic compounds as additive. It is noted that the sample results probably represent maximum concentrations as a week's work of buffing, dipping, degreasing and lacquering operations were accomplished in two days rather than spread over an entire week.

At the time of the survey the NIOSH team felt that any symptomatology elicited from the employees was probably not due to exposure to the chemicals used in repair instruments but may be from exposure to bacteria and/or fungus. Therefore, the following samples were obtained and analyzed for bacteria and/or fungus:

a. Ten blood agar culture plates or petri dishes were uncovered and set out for a 30 minute period in the buffing room, instrument repair room, office below repair room, first floor office and display areas.

b. Six thirty-minute air samples (1 lpm) using sterilized AA filters were obtained in the business office on the 2nd floor, buffing room, and 1st floor office. The six filters were then placed in a growth median for bacteria and/or fungus.

c. Six bulk samples were obtained from the duct in the main air conditioning unit, duct in small air conditioning unit, buffing dusts, red-rouge fine polish, tripoli-rough polish, and dust from ventilation system in buffing room.

d. Fourteen smears (7 throat type for bacteria and 7 swabs for fungus) were obtained from surfaces inside the main air conditioning unit, inside the small air conditioning unit, dust collector in buffing room, air conditioning supply ducts on 1st floor offices and display areas, and the shag rug (1st floor, 2nd floor and steps) which was in the display areas.

Several of the samples were positive in identifying specific species of bacteria and/or fungus but the organisms are ubiquitous in the environment and represent normal flora with no overgrowth of any identifiable pathogens. One would expect similar results from samples obtained from most homes or similar business firms. Therefore, it is very unlikely that a microorganism from this facility could be a causative agent in producing the symptomatology of the affected workers.

Silver soldering operations were conducted for only a few minutes. Air samples were not obtained during this operation as the short time period would not obtain sufficient air being drawn through sample(s) media to allow for detection of suspected contaminants. It is noted that the instrument repair operator would silver solder for a maximum of only 15 minutes per week.

2. Medical Results and Discussions

A total of 7 current employees (5 females and 2 males) were interviewed, examined, and had their throats cultured for both bacteria and fungus during this evaluation. Another male who was previously employed as an instrument repairman was also interviewed. The age range was 20-52 years with a mean of 37 years. The average employment span was 7.3 years per employee.

Symptomatology eludicated from the respondents yielded relatively few common complaints. These included two employees with transient coryza symptoms (stuffy nose, dry scratchy throat). Three employees complained of swollen axillary lymph nodes. Physical examination findings revealed a single palpable axillary node in one employee. A rash (neurodermatitis) was observed about the neck and anterior chest of two employees. The throat cultures revealed normal flora with no overgrowth of pathogens. Permission was obtained to review these 7 employees' (as well as the previous employee's) private medical records. One employee underwent excissonal lymph node biopsy at the Mayo Clinic where a diagnosis of angioimmunoblastic lymphadenitis was made. Subsequent lymph node biopsy was performed on two other concerned employees. The pathology report stated in both instances that the tissue indicated a chronic lymphadenitis. Medical records indicated that the complete blood counts of participants in this study were within the normal range (excepting the individual with angioimmunoblastic lymphadenitis). Other than the objectionable odor, the current instrument repair operator did not have any complaints or other symptomatology such as dizziness or irritation.

E. Observations and Conclusions

The above environmental and medical data did not identify any airborne toxic substance(s) or concentrations of microorganisms that could be considered a health hazard or even capable of producing the alleged symptoms. The instrument repair operator's exposure, although less than the environmental criteria, to various organic compounds is considered significant. Also, some of the observed work practices (e.g., not wearing gloves, no face shield or chemical goggles, etc.) in the instrument repair room were not good practices for handling toxic chemicals. Although the levels of organic solvents outside the instrument repair shop were well below the environmental criteria, they are indicative of some exposure to the employees.

Recent research has shown that trichloroethylene has been demonstrated to be carcinogenic by lavage in the mouse but not the rat. The studies are considered appropriate for assessing the potential of trichloroethylene for inducing occupational cancer although the doses were considerably higher and via a different route than encountered in the workplace. NIOSH currently recommends that the permissible limit for occupational exposure to trichloroethylene be reduced and controlled as an occupational carcinogen.

V. RECOMMENDATIONS

In view of the above information, the following recommendations are offered as suggestions to provide for a more desirable working environment for all personnel:

A. The dipping, degreasing, and silver soldering operations should be consolidated into closer proximity to allow for ease of operations and lessen the possibility of contaminating the floor or other areas with various chemicals. Also, the containers used in the dipping and degreasing operations should be provided with local ventilation and with tight-fitting lids. The lids should be on the containers at all times when not in use. Consideration should be given to providing local ventilation for the silver soldering operations. The local ventilation should provide for movement of fumes or vapors away from the breathing zone of the instrument repair operator and be vented to the outside ambient air during these operations and not into the general room air.

B. The ventilation system in the buffing room should be modified to provide for better local ventilation at the point of operation and should be used during buffing operations. The lacquer spray room should be modified to provide for additional air flow through the room and may need some modification to assure that electrical outlets and other equipment (e.g., lights, fans, etc.) are intrinsically safe and there is no source of ignition in the spray room.

C. The recommendations contained in Section IX - Recommended Preventive Measures of the Special Occupational Hazard Review with Control Recommendations - Trichloroethylene, DHEW (NIOSH) Publication No. 78-103, January 1978, should be implemented for the degreasing operations.

D. All solutions of sodium cyanide should be disposed of as sodium cyanide is no longer in use for removal of old lacquer. Also, sodium cyanide should not be stored in the same room with acids.

E. Protective clothing (e.g., gloves, aprons, goggles, face shields, etc.) should be provided and used by the instrument repair operator to avoid skin contact for those operations (e.g., dipping, mixing, etc.) where there is a possibility of skin contact due to handling of contaminated instruments or parts and splashes of the chemical on the skin from handling operations.

F. Personal hygiene of employee(s) (e.g., washing hands, changing clothes, etc.), housekeeping and routine cleanup of the work area, contamination control, and use of the protective clothing should be stressed for employee(s) working directly with the chemicals covered by this evaluation. Employee education about the importance of personal hygiene when eating and smoking should be stressed. Employee(s) should be instructed not to eat, drink, or smoke at work stations during operations involving these chemicals due to potential contamination to skin, mouth, gastrointestinal tract of the employees. (Note: This recommendation is limited to any instrument repair operator handling the chemical involved by this evaluation).

VI. REFERENCES

1. Fahy, J.P.; Elkins, H.B.; Unpublished Data (1954).

2. American Conference of Governmental Industrial Hygienists: Documentation of the Threshold Limit Values for Substances in Workroom Air, Third Edition, 1977, plus subsequent additions.

3. Zinsser; Microbiology, 11th Edition, Appleton Century and Craft.

4. New England Journal of Medicine, Vol. 292, January 2, 1975.

5. Mayo Clinic Proceedings, Vol. 51, May 1976.

6. Stanley L. Robbins, M.D., Pathology, W.B. Saunders Publishing Company.

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CARLETON STEWART MUSIC COMPANY
MASON CITY, IOWA
APRIL 12, 1978

TABLE IA

CONCENTRATIONS OF ORGANIC SOLVENTS FOUND DURING DIPPING AND DEGREASING OPERATIONS

Job and/or Area Classification	Sample Number	Time of Sample	Methylene Chloride mg/M^3*	Trichloroethylene mg/M^3*
Instrument Repair Operator	CT-1	8:10--4:57	>138.5**	86.5
Instrument Repair Room - by degreasing tank - General Area	CT-6	8:43--4:56	43.1	86.5
Instrument Repair Room - General Area	CT-4	8:33--4:53	9.1	11.5
Accounting Business Office 2nd floor - General Area	CT-5	8:39--4:19	3.2	9.1
1st floor Office - General Area	CT-7	8:53--4:06	1.8	5.8
Instrument Display Room - General Area	CT-8	8:58--4:06	1.4	4.2
Sheet Music Display Room - General Area	CT-9	2:41--4:06	1.8	13.0
Environmental Criteria			261.0	537.0

*mg/M^3 - approximate milligrams of substance per cubic meter of air.

**A significant amount of methylene chloride was found on the reference portion (B portion) of charcoal tube sample number CT-1. It may be assumed that the value as reported for methylene chloride is suspect and that the saturation limit of the charcoal may have been exceeded. Therefore, the concentration reported for sample CT-1 represents a minimum value.

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TABLE IB

CONCENTRATIONS OF TOTAL DUST (T - SAMPLE NO.), RESPIRABLE DUST (R - SAMPLE NO.), AND TOTAL FREE SILICA (QUARTZ) AND CRISTOBALITE) FOUND DURING BUFFING OPERATIONS

Job and/or Area Classification	Sample Number	Time of Sample	Total and/or Respirable Dust mg/M^3*	Quartz mg/M^3*	Cristobalite mg/M^3*	Free Silica mg/M^3*
Instrument Repair Operator	2876-R	8:10--5:00	0.5	ND	ND	ND
Instrument Repair Operator	2884-T	8:10--5:00	3.2	0.05	ND	0.05
Accounting Business Office 2nd Floor-General Area	2890-R	8:38--4:19	<0.1	ND	ND	ND
Accounting Business Office 2nd Floor-General Area	2877-T	8:38--4:19	<0.1	ND	ND	ND
1st Floor Office-General Area	2888-R	8:52--4:06	<0.1	ND	ND	ND
1st Floor Office-General Area	2872-T	8:52--4:06	<0.1	ND	ND	ND
Instrument Display Room General Area	2870-T	8:57--4:06	<0.1	ND	ND	ND

Environmental Criteria: Total dust (nuisance)-10 mg/M^3; Respirable dust (nuisance)-5 mg/M^3; Total dust containing free silica (quartz and cristobalite)-6 mg/M^3. See text for further explanation of environmental results and criteria.

*mg/M^3 - approximate milligrams of substance per cubic meter of air.

NOTE: The positive result for quartz may be viewed with some caution as the level is at the lower limits of detection.

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MASON CITY, IOWA
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TABLE IIA

CONCENTRATIONS OF ORGANIC COMPOUNDS FOUND DURING LACQUER SPRAYING OPERATIONS AND SOME DIPPING-DEGREASING OPERATIONS

Job and/or Area Classification	Sample Number	Time of Sample	Methylene Chloride mg/M^3*	Trichloroethylene mg/M^3*	Xylene mg/M^3*	Toluene mg/M^3*	Benzene mg/M^3*
Instrument Repair Operator	B	9:07--4:50	>79.4 **	10.6	3.8	35.0	<0.1
Instrument Repair Operator	M	1:00--1:09	<31.0	16.0	49.1	565.7	<0.1
Accounting Business Office 2nd Floor General Area	F	9:15--4:45	3.4	2.4	<0.1	0.1	<0.1
1st Floor Office - General Area	I	9:25--4:35	ND	1.0	ND	<0.1	<0.1
Environmental Criteria			261.0	537.0	440.0	375.0	3.2
						750.0-10 min.	

*mg/M^3 - approximate milligrams of substance per cubic meter of air.

**A significant amount of methylene chloride was found on the reference portion (B portion) of charcoal tube sample number B. It may be assumed that the value as reported for methylene chloride is suspect and that the saturation limit of the charcoal may have been exceeded. Therefore, the concentration reported for sample B represents a minimum value.

CARLETON STEWART MUSIC COMPANY
MASON CITY, IOWA
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TABLE IIB

CONCENTRATIONS OF ORGANIC COMPOUNDS FOUND DURING LACQUER SPRAYING OPERATIONS AND SOME DIPPING-DEGREASING OPERATIONS

Job and/or Area Classification	Sample Number	Time of Sample	n-butyl acetate mg/M^3*	isobutyl acetate mg/M^3*	cellosolve acetate mg/M^3*	ethyl acetate mg/M^3*
Instrument Repair Operator	A	9:07--4:50	14.3	12.1	5.8	4.2
Instrument Repair Operator	L	10:22-10:27	92.0	80.0	36.0	34.0
Instrument Display Room General Area	K	9:35--4:35	ND	ND	ND	0.2
Accounting Business Office-2nd Floor General Area	E	9:15--4:45	ND	ND	ND	ND
1st Floor Office General Area	H	9:25--4:35	ND	ND	ND	ND
Environmental Criteria			710.0	700.0	540.0	1400.0

*mg/M^3 - approximate milligrams of substance per cubic meter of air.

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TABLE IIC

CONCENTRATIONS OF ORGANIC COMPOUNDS FOUND DURING LACQUER SPRAYING OPERATIONS AND SOME DIPPING-DEGREASING OPERATIONS

Job and/or Area Classification	Sample Number	Time of Sample	n-butyl alcohol mg/M^3*	isobutyl alcohol mg/M^3*
Instrument Repair Operator	C	9:07--4:50	7.0	5.3
Accounting Business Office 2nd Floor-General Area	G	9:15--4:45	ND	ND
1st Floor Office - General Area	J	9:25--4:35	ND	ND
Environmental Criteria			150.0	150.0

*mg/M^3 - approximate milligrams of substance per cubic meter of air.