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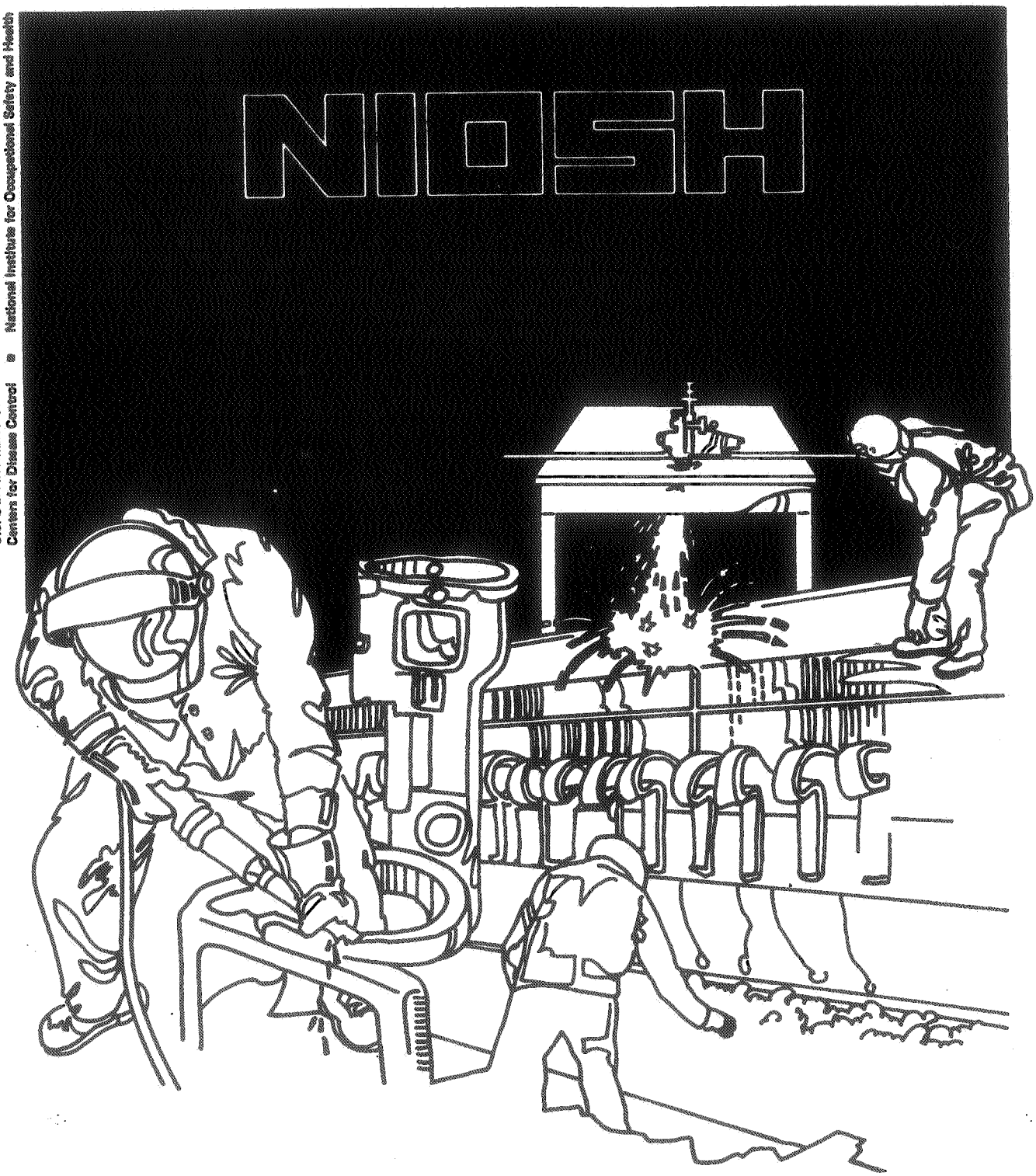

Health Hazard Evaluation Report

HETA 83-276-1499
CHARLIE'S TAXIDERMY AND GIFTS
FLEETWOOD, PENNSYLVANIA

PREFACE

The Hazard Evaluations and Technical Assistance Branch of NIOSH conducts field investigations of possible health hazards in the workplace. These investigations are conducted under the authority of Section 20(a)(6) of the Occupational Safety and Health Act of 1970, 29 U.S.C. 669(a)(6) which authorizes the Secretary of Health and Human Services, following a written request from 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 Hazard Evaluations and Technical Assistance Branch also provides, upon request, medical, nursing, and industrial nygiene technical and consultative assistance (TA) to Federal, state, and local agencies; labor; industry and other groups or individuals to control occupational health hazards and to prevent related trauma and disease.

HETA 83-276-1499
AUGUST 1984
CHARLIE'S TAXIDERMY AND GIFTS
FLEETWOOD, PENNSYLVANIA

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I. SUMMARY

In May 1983, the National Institute for Occupational Safety and Health (NIOSH) received a request to evaluate potential health hazards at Charlie's Taxidermy and Gifts, Fleetwood, Pennsylvania. With the assistance of the Pennsylvania Taxidermy Association, the study was expanded to five shops, which were surveyed in October 1983. At each shop, specimen preparation procedures and work practices were observed; air samples were obtained to indicate dust and vapor exposures; and bulk samples of process materials were collected for specific analyses.

With one exception, air samples for methyl ethyl ketone, stryene, xylenes, toluene, 1,1,1-trichloroethane, acetone, trichloroethylene, methylene chloride, methanol and formaldehyde vapors showed air concentrations below evaluation criteria. While using a hand held hair dryer on two solvent soaked pheasant skins, one taxidermist was exposed to 210 ppm of toluene as compared to the evaluation criteria of 150 ppm for a 10 minute exposure. Airborne dust samples for bone, paper mache, polyurethane, and a proprietary preservative showed 8-hour average exposures ranging from 0.2 to 1.5 mg/m^3 as compared to the evaluation criteria of 10.0 mg/m^3. An 8-hour average borax dust exposure was 0.6 mg/m compared to the evaluation criteria of 5.0 mg/m^3.

Bulk sample analyses showed the presence of asbestos in two paper maches, arsenic in a dry preservative, and formaldehyde in a liquid preservative.

Improper work practices such as getting hands wet with solvents, eating and drinking in work areas, dry sweeping, and improper storage of solvents were noted.

Considering the frequency and duration of exposures, it is concluded that the taxidermists were not being overexposed to those substances whose air concentrations were measured during the study. Several carcinogens (e.g. asbestos, arsenic, formaldehyde, trichloroethylene) were determined to be present in certain process materials and several improper work practices were noted. Recommendations for substitution, ventilation, good work practices, and personal protective equipment, are included in this report.

Keywords: SIC 7699 (Repair Shops and Related Services, NEC), acetone, asbestos, arsenic, formaldehyde, methylene chloride, styrene, toluene, 1,1,1-trichloroethane, solvents, taxidermy.

II. INTRODUCTION

On May 16, 1983, NIOSH received a request for technical assistance from the Vice-President of the Pennsylvania Taxidermy Association. Because taxidermists use a variety of solvents and chemical agents, the requestor was interested in an evaluation of potential health hazards in his shop (Charlie's Taxidermy and Gifts) and dissemination of the survey findings to other members of the taxidermy profession. During the initial stages of the study, it was determined that: 1) there were no reports in the literature of environmental conditions in taxidermy shops (except for one NIOSH health hazard evaluation); 2) nearly all of the taxidermy operations are small one-man shops; 3) Pennsylvania alone has about 430 licensed shops; and 4) toxic materials are used in the these shops. Therefore, with the assistance of the Pennsylvania Taxidermy Association, it was arranged to survey an additional four shops to make a total of five. These five shops were surveyed during the week of October 23, 1983. The survey findings were presented to Pennsylvania Taxidermy Association members at their annual spring meeting in Danville, Pennsylvania, on March 17, 1984. Additionally, this report will be distributed to all licensed taxidermy shops in Pennsylvania and to all members of the Pennsylvania Taxidermy Association.

III. BACKGROUND

The typical Pennsylvania taxidermy shop is a small family owned business. Generally the owner, perhaps with some family assistance, is the sole employee although one of the five shops surveyed had one full-time hired hand. Each of the five shops had a prime work area which varied from 400 to 700 square feet and each had an attached trophy display/sales area which varied from 200 to 600 square feet. Two of the shops were located in the principal's residence, two on the same property as the principal's residence, and one in a small building near the town business center.

Specimens processed in the shops include fish, birds, small and large mammals, reptiles, and African trophies. The taxidermist would normally work on a couple of trophies per day and would process several hundred trophies per year. Time spent on each trophy would vary from hours to days depending upon the specimen type and treatment processes. Most of the shops considered the number of specimens processed to be somewhat proprietary.

The processes and materials employed were many and varied from shop to shop. Consequently, it is not feasible to detail each process observed. However, several of the processes observed are described as this illustrates the general sorts of procedures and materials used in taxidermy.

FISH

---After skinning, borax is applied to the inside of the skin.

---Measurements are taken of the carcass, and a urethane body form is carved from a block of urethane. Some taxidermists pour their own urethane forms or use body forms of excelsior, etc.

---The form is inserted in the skin and the skin sewed.

---Paper mache is used for fill (cavities-e.g., mouth, eyes, gills).

---The body cavities are finished with polyester resins.

---The epoxy fill is smoothed with methylene chloride.

---A fibrous glass reinforced polyester resin is used to support the fins and tail.

---The fish is allowed to dry for four to six months.

---The fish is wiped with solvent (e.g., lacquer thinner, white gas), shellaced, painted with lacquer, and coated with a clear varnish.

---The finished fish is fastened to a display board.

BIRDS

---Birds are skinned, excess fat removed from the skin, and the skin washed with soap and water.

---Skins are soaked for a couple of hours in a solvent, patted dry with paper towels and newspaper, and dried with a hair dryer.

---Inside of skins are dusted with borax.

---Skins are mounted over polyurethane body forms which are poured in the shop. Some body forms are purchased, or made of wood wool, excelsior, or a similiar material.

---Mouths may be packed with paper mache.

---Wires are pushed with through legs and feet for mounting.

---Lacquers are used (by air brush) to touch up beak, skin around eyes, and feet.

DEER

---Deer and other mammals are handled in a similiar fashion.

---The hide is removed from the animal (including skull), scrapped, salted for a couple of weeks, and shipped to a tannery. The hides of thin skinned animals (e.g. squirrels) are not tanned but simply treated with borax or some other preservative.

---The horns and eyes are set in a polyurethane mannequin. The mannequins are either purchased or made in the taxidermy shops.

---The tanned hide is soaked in water and fitted to the mannequin. The hide may be glued, nailed, or stapled to the mannequin.

---Clay, polyester resins, or paper mache may be used to fill eyes, ears, and nose.

---Lacquers may be used to touch up the nose, lips, eye lids, etc.

---Fur or hair may be combed with a hair dressing.

---Epoxy glues may be used to attach plastic tongues, etc.

HAND TANNING

---The hide is removed from the animal and scrapped, salted, and dried.

---The hide is soaked in a solution containing alum and an acid such as sulfuric acid.

---The preceding step may be repeated as necessary.

---The hides are rinsed and hand rubbed with tanning creams, etc.

FREEZE DRYING

---The body, eyes, and excess fat are removed from the skin of a bird or small animal.

---The skin is rinsed in cold water and soaked in Solution #1 (29% Edolen U) for 20 minutes and rinsed.

---The skin is soaked in Solution #2 (29% acetic acid) for 10 minutes and rinsed.

---The skin is soaked in Solution #3 (97.5% methanol, 2.5% dimethylthiocarbamyl) for 5 minutes and rinsed.

---The skin is blot dried with paper, tumbled with sawdust, and cleaned with compressed air.

---The skin is "posed up" over a body form, frozen, and placed in a vacuum-freeze drier for 2-3 months (or until weight loss stops).

SKULLS

---The skulls are boiled in water to remove flesh, brains, etc.

---Soaked in chlorox/detergents to bleach/clean.

---Soaked in 1,1,1-trichloroethane to remove fats.

---Air dried.

MISCELLANEOUS

---Hides shipped in from Africa may be repackaged for shipment to tannery.

---Older trophies may be cleaned using Pinesol, phenol, perchloroethylene, 1,1,1-trichloroethane, etc. Sometimes this is done at the business/residence of the customer. Some taxidermists try to do this work out of doors.

---A band saw and a belt sander may be used to shape the skull cap for antler/horn displays.

The principal inhalation exposures to the taxidermists are dusts and vapors. Dust exposures may occur from such process steps as: 1) dusting the skins of an animal with borax or other preservative; 2) sanding a urethane body form; 3) mixing paper mache; 4) blowing sawdust from feathers or fur of animal; 5) combing hair/fur with hair dressing; or 6) shaping skull caps for displays. Vapor exposures may occur from such steps as: 1) Using epoxy or other resin systems; 2) smoothing polymerized epoxy resin with methylene chloride; 3) Use of paints, shellacs, varnishes, thinners, lacquers, etc., by hand or airbrush; 4) soaking skins in solvents and drying the skins; 5) soaking skins in tanning or other preparation solutions; 6) removing skulls from 1,1,1-trichloroethane or other soaking solutions and 7) using perchloroethylene, 1,1,1-trichloroethlane, or other cleaners/solvents for cleaning of older trophies.

There is also a potential for skin problems or absorption through the skin as taxidermists may expose their hands to solvents, tanning creams, resin systems, paint thinners, etc.

It is important to note that most of the process steps are of a short term nature. That is, they last for only a part of a work day and then not every work day. For example, it may require 40 minutes to touch up a display with an airbrush, 62 minutes to dry 2 pheasant skins with a hand hair dryer, 29 minutes to remove skulls from soaking buckets, 14 minutes to dust two pheasant skins with borax, etc.

IV. EVALUATION METHODS

The five taxidermy shops were surveyed during October 25-27, 1983, with a NIOSH industrial hygienist spending a day at each shop. The evaluation at each shop included:

1. The various specimen preparation procedures were discussed with the taxidermists.

2. Air sampling was conducted to afford estimates of exposures to dusts and solvent vapors.

3. Bulk samples of select process materials were collected (to be analyzed for such constituents as asbestos, arsenic, etc.).

4. Work practices (e.g. handling of solvents and chemicals; use of such protective equipment as gloves, aprons, and respirators; storage of materials; smoking, eating, and drinking in the work areas; etc.) were observed.

5. The general layouts and ventilation of the shops were noted.

The air sampling and analytical methods for the different contaminants are shown in Table 1. Included for each substance evaluated are the collection device, the pump flow rate, the analysis method, the analytical detection limit, and where available, the NIOSH reference for the detailed sampling and analytical method. Personal air samples are those for which the worker wears the air sampler with the collection device clipped to his/her shirt lapel or collar so as to obtain air samples representative of what he/she is breathing. Breathing zone samples are taken in the breathing zone of the worker but the worker does not wear either the air sampling pump or the collection device. The fixed location or area samples are usually obtained by placing the sampling apparatus either in general work areas or in locations thought to have air quality similar to that to which the workers are exposed.

V. ENVIRONMENTAL EVALUATION CRITERIA

As a guide to the evaluation of the hazards posed by workplace exposures, NIOSH field staff employ environmental evaluation criteria for assessment of a number of chemical and physical agents. These criteria suggest levels of exposure to which most workers may be exposed up to 10 hours per day, 40 hours per week for a working lifetime without experiencing adverse health effects. It is important to note that not all workers will be protected from adverse health effects if their exposures are maintained below these levels. A small percentage may experience adverse health effects because of individual susceptibility, a pre-existing medical condition, and/or a hypersensitivity (allergy).

In addition, some hazardous substances may act in combination with other workplace exposures, the general environment, or with medications or personal habits of the worker to produce health effects even if the occupational exposures are controlled at the level set by the

evaluation criterion. These combined effects are often not considered in the evaluation criteria. Also, some substances are absorbed by direct contact with the skin and mucous membranes, and thus potentially increase the overall exposure. Finally, evaluation criteria may change over the years as new information on the toxic effects of an agent become available.

The primary sources of environmental evaluation criteria for the workplace are: 1) NIOSH Criteria Documents and recommendations, 2) the American Conference of Governmental Industrial Hygienists' (ACGIH) Threshold Limit Values (TLV's), and 3) the U.S. Department of Labor (OSHA) occupational health standards. Often, the NIOSH recommendations and ACGIH TLV's are lower than the corresponding OSHA standards. Both NIOSH recommendations and ACGIH TLV's usually are based on more recent information than are the OSHA standards. The OSHA standards also may be required to take into account the feasibility of controlling exposures in various industries where the agents are used; the NIOSH-recommended standards, by contrast, are based primarily on concerns relating to the prevention of occupational disease. In evaluating the exposure levels and the recommendations for reducing these levels found in this report, it should be noted that industry is legally required to meet only those levels specified by an OSHA standard.

A time-weighted average (TWA) exposure refers to the average airborne concentration of a substance during a normal 8- to 10-hour workday. Some substances have recommended short-term exposure limits (e.g. 15-minute) or ceiling values which are intended to supplement the TWA where there are recognized toxic effects from high short-term exposures.

A calculation for mixtures is appropriate when two or more hazardous substances, which may result in similar health effects, are present in the same environment. The calculation is performed according to the method published by the American Conference of Governmental Industrial Hygienists. If the sum of the following fractions,

$$\frac{C_1}{T_1} + \frac{C_2}{T_2} + \frac{C_3}{T_3} \text{ -----}$$

exceeds unity, then the recommended environmental limit for the mixture is considered as being exceeded. C_1 is the observed air level and T_1 is the corresponding environmental limit for substance 1, etc. Calculations of the solvent vapor mixture fractions and resultant combined exposures were performed for each personal solvent sample of this study.

The environmental criteria used for this study are presented in Table 2. Listed in Table 2, for each substance, are the recommended environmental limit (evaluation criteria) the source of the recommended limit, the principal or primary health effects underlying each recommended limit, and the current OSHA legal standard.

VI. RESULTS AND DISCUSSION

Because of the small one man shops and the usual routine of the taxidermists working on one specimen at a time, it was not possible to collect as many air samples for dusts and vapors as would have been preferred. But, offsetting this deficiency, it was judged that considering the materials used and the duration and frequency of exposures, the taxidermists were likely not overexposing themselves to dusts and vapors provided that they did not use carcinogens or other especially hazardous materials. The following air sample results support this judgement.

A. Exposures to Dusts

The results of the air sampling to determine dust exposures are given in Table 3.

1. It was thought that arsenic may have been used on imported African hides. Air sampling showed non-detectable levels of arsenic for both the taxidermist doing the recrating and for his assistant taking notes.

2. While dusting the insides of two pheasant skins with borax, a taxidermist was exposed to a mean dust level of 21.0 mg/m^3 for 14 minutes. This computes to an 8-hour average of 0.6 mg/m^3 as compared to the evaluation criteria of 5.0 mg/m^3.

3. While sawing and sanding deer skulls, a taxidermist was exposed to 11.3 mg/m^3 for a period of 53 minutes. This computes to an 8-hour average of 1.2 mg/m^3 as compared to the evaluation criteria of 10.0 mg/m^3.

4. While mixing paper mache, a taxidermist was exposed to a mean dust level of 42.5 mg/m^3 for 17 minutes. This computes to an 8-hour average of 1.5 mg/m^3 as compared to the evaluation criteria of 10.0 mg/m^3.

5. Combining the previous three dust exposures (since one taxidermist did the three procedures in one day) shows the mean exposure for the day to be 3.3 mg/m^3 as compared to the evaluation criteria of 10 mg/m^3 for nuisance dusts or 5.0 mg/m^3 for borax.

6. While using a hand held "Dremel" to grind and shape two polyurethane fish forms, the taxidermist was exposed to a mean dust level of 3.3 mg/m^3 for 33 minutes. This computes to an 8-hour average of 0.2 mg/m^3 as compared to the evaluation criteria of 10 mg/m^3 for polyurethane dust.

7. While treating a snow goose with a commercially available (and proprietary) dry preservative, the taxidermist was exposed to a dust level of 1.0 mg/m^3 for a period of 145 minutes. This computes to an 8-hour average of 0.3 mg/m^3, a value well below

the appropriate environmental criteria. This dry preservative contained 5 ppm (by weight) of arsenic, but the resultant arsenic exposure would be less than 0.3% of the evaluation criteria of 0.002 mg/m^3 for a 15-minute air sample.

These air sample results for dust exposures indicate that the taxidermists were not being overexposed to airborne dusts at the time of the survey. However, for materials/chemicals more toxic than those used during the survey or for greater exposure times, the exposures to the taxidermists might be a health threat.

B. Exposures to Solvent Vapors

The results of the air sampling to determine solvent exposures are given in Table 4.

1. While using an air brush to touch up a bear skin display with acrylic lacquer (40 minute exposure), the principal solvent exposures to the taxidermist were 9.4 ppm of xylene (6% of the short-term evaluation criteria), 2.9 ppm of toluene (2%), 35 ppm of acetone (4%) and 12 ppm of methylene chloride (2%). The combined exposure for these four solvents was 14% of the evaluation criteria.

2. While using an air brush to touch up a deer head and a duck display with acrylic lacquer (40 minute exposure), the principal solvent exposures to the taxidermist were 26 ppm of toluene (17% of the short-term evaluation criteria), 6.1 ppm of acetone (1%), and 3.1 ppm of methylene chloride (1%). The combined exposure for these three solvents was 19% of the evaluation criteria.

3. While using a hand held hair dryer (for 62 minutes) on two pheasant skins which had been soaked in solvent, the principal solvent exposures to the taxidermist were 210 ppm of toluene (140% of evaluation criteria) 45 ppm of acetone (5%), and 23 ppm of methylene chloride (5%). The combined expousre for these three solvents was 150% of the evaluation criteria.

4. While using a small brush and methylene chloride to smooth polyester resin fill in two fish, the prinicpal solvent exposures to the taxidermist were 26 ppm of methylene chloride (5% of evaluation criteria) and 9 ppm of styrene (9%). The combined exposure for these two solvents was 14% of the evaluation criteria. While using methylene chloride to clean the small paint brush, the taxidermist was exposed to about 100 ppm of methylene chloride for about 5 minutes as compared to the evaluation criteria of 500 ppm for a 15-minute exposure.

5. While using fibrous glass/resin on fish fins and tails, and putting bonding compound in fish ears, styrene exposures to three different taxidermist were all much less than 50 ppm as compared to the evaluation criteria of 100 ppm for a 15-minute exposure.

6. While transferring skulls from soaking barrels to a drying table, the taxidermist was exposed to 210 ppm of 1,1,1-trichloroethane as compared to the evaluation criteria of 350 ppm for a 15-minute exposure.

7. While removing a duck from a soaking bucket containing 97.5% methanol and blotting the duck with newspapers to dry it, the taxidermist was exposed to about 300 ppm of methanol (2-3 minute sample) as compared to the evaluation criteria of 250 ppm for a 15-minute exposure. Had the taxidermist been sampled for 15 minutes, the actual exposure would have been below the 250 ppm critera.

While using the hair dryer on the solvent soaked pheasant skins the taxidermist was exposed to toluene at a concentration @40% in excess of the short-term (15-minute) evaluation criteria. The average exposure for the 8-hour day would have been about 27 ppm as compared to the 8-hour evaluation criteria of 100 ppm. This process would rarely occur more than once a day and then not every day. Consequently, in the absence of such symptoms as narcosis or dizziness in the taxidermist, there is likely not a health effect. However, the 210 ppm air concentration is sufficiently high that some measures should be taken to reduce exposures (see Recommendations Section of this report).

With the exception of the hair dryer - pheasant skins process, the above air sample results do not indicate overexposures to solvent vapors. However, as with the dust exposures, the use of more toxic solvents or greater exposure times might lead to a health threat to the taxidermists. Also, if these processes were more continuous, not only would there be a chance for solvent vapor buildup within the shops but the evaluation criteria against which the exposures would be compared are lower for an 8-hour average daily exposure than for a short term (e.g. 15-minute) exposure (See Table 2).

Although none of the taxidermists reported overt symptomatology which could be associated with the solvent exposures, a couple of them said that solvent odors were at times quite noticeable.

C. Work Practices

In the different shops, a number of improper and less than optimum work practices were noted. These improper work practices result in increasing both airborne and direct (by ingestion or skin contact) exposures to toxic substances. Current methodology usually does not allow the measurement of exposures by skin contact or ingestion, which for some situations may be more significant than that due to inhalation. The improper work practices noted are not stated in this section of the report but are alluded to in the recommendations section under our recommendations for good work practices. In view of the hand specimen-by-specimen processes, the variety of materials and chemicals used, the duration/frequency of exposures, and that some shops are located in the owner's residence, it is felt that work practices are an important part of this study and report. Creating the habit of good work practices will carry from chemical to chemical, specimen to specimen, and process to process.

D. Bulk Sample Analyses

Altogether, 13 bulk samples of process materials were collected and analyzed. Eleven were analyzed for the presence of specific ingredients, and two were analyzed for the amounts of specific constituents.

1. Six samples of paper mache and two of fish fill were analyzed for asbestos by polarized light microscopy and dispersion staining techniques. With the exception of a "fast-setting" and a "slow setting" paper mache from one supplier, none of these samples contained asbestos. The fast mache contained 5-20% chrysotile asbestos and the slow mache contained 1-5% chrysotile asbestos. In discussion with the supplier, he indicated that he no longer puts asbestos in his paper maches.

2. A jelling hair set powder was analyzed for crystalline silica. Laboratory analysis by X-ray diffraction showed that the sample was amorphous material (probably silica). No crystalline silica was found.

3. One of the shops had a barrel of degreasing solvent of unknown composition. Analysis by gas chromatography/mass spectometry showed the sample to be mostly toluene, acetone, and isopropanol, with small amounts of trichloroethylene, 1,1,1-trichloroethane, and methylene chloride.

4. A proprietary dry preservative was analyzed to determine specific ingredients. As it was used during the survey, air sampling did not demonstrate a significant health threat.

5. A liquid preservative was analyzed by gas chromatography/mass spectometry and shown to be a formalin solution containing formaldehyde and an alcohol.

6. A sample of white dust from African trophy hides was analyzed for arsenic by graphite furnace atomic absorption. No arsenic was detected.

The results of the bulk sample analyses, and trade name product information (some proprietary) obtained from suppliers, were used to determine potential exposures (to be air sampled for) and to identify particularly hazardous ingredients (e.g. carcinogens). The particularly hazardous ingredients are reflected in the recommendations section of this report.

VII. RECOMMENDATIONS

A. Substitution

Perhaps the best way to eliminate or reduce a chemical health hazard is to substitute a less toxic material. But, it does require an effort to

find out what is in the materials being used and whether or not the different ingredients are particularly toxic. Examples of the more toxic compounds (carcinogens) are asbestos, arsenic, formaldehyde, perchloroethylene, carbon tetrachloride, trichloroethylene, and benzene. These compounds should not be used in taxidermy shops. Cellulose or fiberglass can be substituted for asbestos; 1,1,1-trichloroethane for the more toxic chlorinated hydrocarbons such as perchloroethylene, trichloroethylene, carbon tetrachloride; etc. Sometimes it is possible to use a less toxic form such as a liquid rather than an aerosol, or a solid rather than a powder.

B. Ventilation

It is recommended that taxidermy shops have a forced draft ventilation system but it does not have to be an elaborate affair. Just an open window is usually not adequate when working with solvents to any degree. A simple and well placed exhaust fan, with an open door or window to provide make up air, would provide adequate ventilation for nearly all taxidermy shops. It is recommended that such process steps as pouring of a urethane form, spray painting, and cleaning with solvents, be done immediately in front of the exhaust fan (within a foot or two). Sometimes it is possible to work out-of-doors, where a great amount of natural dilution usually occurs.

C. Good Work Practices

1. Hands should be washed frequently in soap and water. Avoid using solvents, alkalis, and harsh abrasives to clean hands and face.

2. Avoid smoking, drinking, and eating in the work areas, as a number of process materials are flammable and inadvertant ingestion of chemicals is a possibility.

3. Good housekeeping is important for safety and health reasons and for professional appearances. Vacuuming and wet mopping is preferable to dry sweeping which may raise dusts. Chemical or solvent spills should be quickly cleaned up and the contaminated materials properly disposed of.

4. Chemicals, solvents, etc., should be stored in labeled and tightly sealed containers and should be kept out of the discovery area of children. Barrels of solvents should not be stored in the principal's residence.

5. Since flammable substances are used, a proper fire extinguisher should be kept in the workshop area.

D. Personal Protective Equipment

1. Gloves and aprons should be used to prevent solvents or other toxic materials from getting on the hands and clothing. These gloves and aprons should be inpervious to the materials being used; should be left in the work area; and should not be mixed in with the family laundry.

2. Protective goggles should be used when working with caustics, acids, and solvents.

3. Safety glasses should be worn when there is a chance for eye injury from grinding, sanding, etc.

VIII. AUTHORSHIP AND ACKNOWLEDGEMENTS

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IX. DISTRIBUTION AND AVAILABILITY OF REPORT

Copies of this report are currently available upon request from NIOSH, Division of Standards Development and Technology Transfer, Publications Dissemination Section, 4676 Columbia Parkway, Cincinnati, Ohio 45226. After 90 days, the report will be available through the National Technical Information Service (NTIS), 5285 Port Royal, Springfield, Virginia 22161. Information regarding its availability through NTIS can be obtained from the NIOSH Publications Office at the Cincinnati address. Copies of this report have been sent to:

1. Pennsylvania Taxidermy Association Members
2. Licensed Pennsylvania Taxidermy Shops
3. NIOSH, Region III
4. OSHA, Region III

Table 1

Air Sampling and Analysis Methodology

Substance	Collection Device	Flow Rate (lpm)	Duration (hrs)	Analysis	Detection Limit (ug/sample)	NIOSH Reference
Arsenic	Membrane Filter	2.5	1.6	Atomic Absorption	0.05	P&CAM 346
Inert Dusts*	Membrane Filter	2	2.4	Electrobalance	10	29.02
	Membrane Filter	9	0.2-0.9	Electrobalance		
Solvents**	150 mg Charcoal Tube	0.5-1	0.2-1.0	Gas Chromatograph	10	P&CAM 127
Methyl Ethyl Ketone	150 mg charcoal Tube	1.0	40 min.	Gas Chromatograph	10	S3
Formaldehyde	Colorimetric Indicator Tube	1.6 liter sample	2-3 min.	Directing Reading	0.5 ppm	Mfg. Data
Styrene	Colorimetric Indicator Tube	1.1 liter sample	2-3 min.	Directing Reading	50 ppm	Mfg. Data
Methanol	Colorimetric Indicator Tube	1.0 liter sample	1-2 min.	Directing Reading	100 ppm	Mfg. Data
Methylene Chloride	Colorimetric Indicator Tube	20. liter sample	2-3 min.	Directing Reading	50 ppm	Mfg. Data
1,1,1-Trichloroethane	Colorimetric Indicator Tube	0.2 liter sample	1-2 min.	Directing Reading	50 ppm	Mfg. Data

*Inert dusts (bone, paper mache, polyurethane, and dry preservative) and borax.
**Solvents included xylenes, toluene, 1,1,1-tricholorethane, acetone, trichloroethylene, methylene chloride, styrene

Table 2

Environmental Criteria

Allowable Daily Exposures for a 40-Hour Week

Substance	Evaluation Criteria Air Conc.*	Time*	Source	OSHA Standard Air Conc.*	Time*	Principal Health Effects
Arsenic	0.002	15	NIOSH	0.01	480	Dermatitis, lung and lymphatic cancer
Inert Dusts	10	480	ACGIH	15.0	480	Pulmonary effects
Acetone	250 1000	480 15	NIOSH ACGIH	1000	480	Irritation; liver, kidney, and nervous system effects
Methanol	200 250	480 15	NIOSH ACGIH	200	480	Blindness; metabolic acidosis
Methylene Chloride	75 500	480 C*	NIOSH NIOSH	500 1000	480 C	Central nervous system effects; Carbon monoxide toxicity
Methyl Ethyl Ketone	200 300	480 15	NIOSH ACGIH	200	480	Irritation; liver, kidney, and nervous system effects
Styrene	50 100	480 15	NIOSH NIOSH	100 200	480 C	Nervous system effects; irritation of eyes and respiratory system
1,1,1-Trichloroethane	350	15	NIOSH	350	480	Nervous system, liver and heart effects
Trichloroethylene	25 150	480 15	NIOSH ACGIH	100 200	480 C	Central nervous system depressant; cancer
Toluene	100 150	480 15	NIOSH ACGIH	200 300	480 C	Central nervous system depressant
Xylene	100 150	480 15	NIOSH ACGIH	100	480	Central nervous system depressant; airway irritation
Borax*	5	480	ACGIH	10	480	Acute irritation of eyes, resp. tract. Dermatitis

NOTES:
1. Air concentrations for arsenic and inert dusts are in mg/m^3; all others are in ppm.
2. Allowable exposure times are in minutes.
3. "C" designates a ceiling value not to be exceeded.
4. Borax is considered to be sodium borate-decahydrate

Table 3

Results of Air Sampling for Dusts

Date	Activity and Sample Type	Sample Time (Minutes)	Substance	Air concentration (mg/m^3)*	Calculated 8-Hour TWA* (mg/m^3)	Evaluation Criteria (mg/m^3)	Time Basis
10/25/83	Recrating African Hides for Shipment Hide Handler - Personal sample. Note Taker - Area sample.	96 96	Arsenic Arsenic	nd* nd*	- -	0.002 0.002	15-minute 15-minute
10/26/83	Dusting inside of 2 pheasant skins with borax. Personal Sample	14	Borax	21.0	0.6	5.0	8 hour-TWA
10/26/83	Sawing and sanding deer skulls. Personal sample.	53	Bone	11.3	1.2	10.0	8 hour-TWA
10/26/83	Hand mixing of paper mache and water. Personal sample.	17	Paper Mache	42.5	1.5	10.0	8 hour-TWA
10/26/83	Combined exposure for previous 3 samples since for 1 taxidermist	84			3.9	10.0	8 hour-TWA
10/27/83	Hand grinding and shaping of polyurethane forms for two fish. Personal sample.	33	Polyurethane	3.3	0.2	10.0	8 hour-TWA
10/26/83	Treating snow goose with dry preservative. Personal sample.	145	Proprietary*	1.0	0.3	10.0	8 hour-TWA

*Notes:
1. "mg/m^3" means milligrams of substance per cubic meter of air
2. TWA means time weighted average
3. The proprietary dry preservative can be considered a nuisance dust except for a trace amount of arsenic (about 5 ppm by weight). The resultant arsenic exposure would be than 1% of the evaluation criteria.
4. "nd" means not detected at laboratory limit of quantitation.

Table 4

Results of Air Sampling for Solvent Vapors

Date	Activity and Sample Type	Sample Time (min.)	Substance	Air Concentration (ppm)	Evaluation Criteria (ppm)	Evaluation Criteria Time Basis (min.)
10/25/83	Using air brush (acrylic lacquer and thinner) to touch up bear skin. Personal sample.	40	Xylenes	9.4	150	10
			Toluene	2.9	150	10
			Acetone	35	1000	15
			Methylene Chloride	12	500	15
			Methyl Ethyl Ketone	1.5	300	15
			Combined Exposure (15% of allowable)			
10/26/83	Using air brush (acrylic lacquer and thinner) to touch up a deer head and a duck display. Personal sample.	40	Xylenes	0.4	150	10
			Toluene	26	150	10
			1,1,1-Trichloroethane	0.9	450	15
			Acetone	6.1	1000	15
			Trichloroethylene	0.3	150	15
			Methylene Chloride	3.1	500	15
			Combined Exposure (19% of allowable)			
	Area sample about 3' from taxidermist	40	Xylenes	0.1		
			Toluene	17		
			1,1,1-Trichloroethane	0.2		
			Acetone	3.9		
			Trichloroethylene	0.2		
			Methylene Chloride	1.5		
11/26/83	Using hand held hair dryer on two pheasant skins which had been soaked in solvent. Personal sample.	62	Xylenes	0.3	150	10
			Toluene	210	150	10
			1,1,1-Trichloroethane	1.1	450	15
			Acetone	45	1000	15
			Trichloroethylene	3	150	15
			Methylene Chloride	23	500	15
			Combined Exposure (154% of allowable)			
	Area sample about 3' from taxidermist.	62	Xylenes	0.4		
			Toluene	280		
			1,1,1-Trichloroethane	1.2		
			Acetone	13		
			Trichloroethylene	3.1		
			Methylene Chloride	23		
11/27/83	Using small brush and methylene chloride to smooth polyester resin fill in two fish. Personal sample.	34	Toluene	0.2	150	10
			Methylene Chloride	26	500	10
			Styrene	9.0	100	15
			Combined exposure (14% of allowable)			
	Using methylene chloride to clean small paint brush. Breathing zone sample.	3	Methylene Chloride	100	500	15

Table 4 (continued)

Results of Air Sampling for Solvent Vapors

Date	Activity and Sample Type	Sample Time (min.)	Substance	Air Concentration (ppm)	Evaluation Criteria (ppm)	Evaluation Criteria Time Basis (min.)
10/27/83	Using fiberglass reinforced resin on fish fins and tails. Breathing zone samples.	3	Styrene	<50	100	15
		3	Styrene	<50	100	15
		3	Styrene	<50	100	15
10/26/83	Putting bonding compound in deer ears. Personal sample.	9	Styrene	5	100	15
10/27/83	Putting bonding compound in deer ears. Breathing zone sample.	2-3	Styrene	<50	100	15
11/25/83	Transferring skulls from soaking buckets to drying table. Personal sample.	29	1,1,1-Trichloroethane	210	350	15
11/25/83	Removing duck from soaking bucket containing 97.5% methanol. Breathing zone sample.	2-3	Methanol	300**	250	15

* "ppm" means parts per million parts of air (by volume).
** Had the taxidermist been sampled for 15 minutes, the actual exposure would have been below the 250 ppm criteria.

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