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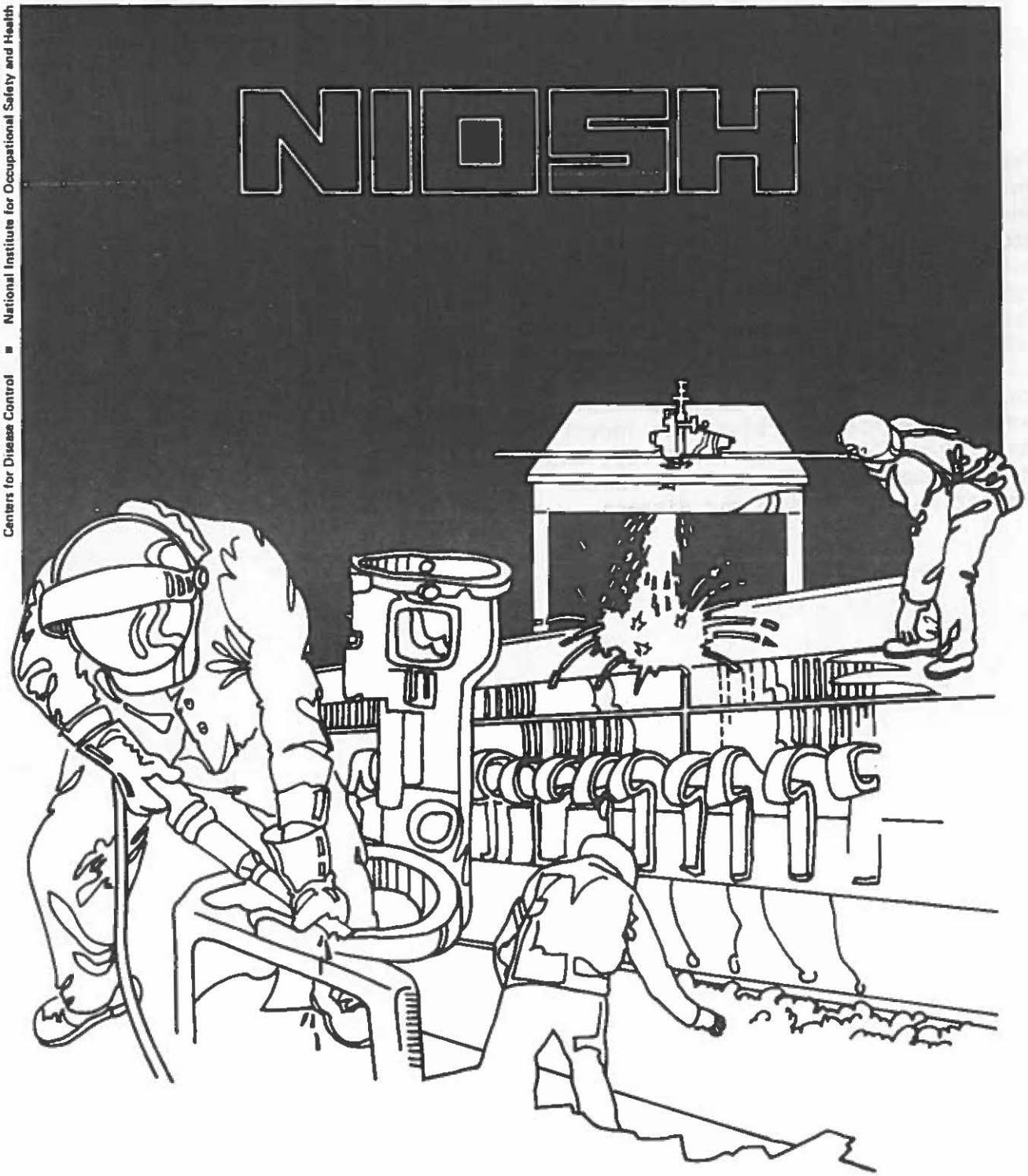
NIOSH



Health Hazard Evaluation Report

TA 80-119-1066
FEDERAL CORRECTIONAL INSTITUTION
LA TUNA, TEXAS

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 hygiene 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.

TA 80-119-1066
March 1982
FEDERAL CORRECTIONAL INSTITUTION
LA TUNA, TEXAS

NIOSH INVESTIGATOR:
Harry L. Markel, Jr.

I. SUMMARY

In September 1980, the National Institute for Occupational Safety and Health (NIOSH) received a request from the U.S. Department of Justice, Federal Prison System, to evaluate potential inmate exposures from industrial operations at the Federal Correctional Institution, La Tuna, Texas. Of primary concern were exposures in the furniture refinishing operation to isopropyl alcohol, toluene, methylene chloride, nuisance particulate matter, wood dust and iron oxide.

On December 18, 1980, a NIOSH investigator performed an environmental evaluation. Personal breathing-zone samples were collected in the applicable work areas, and ventilation measurements were made to evaluate the dust collection system in the metal furniture refinishing area.

Results of 38 personal breathing-zone air samples were as follows: Isopropyl alcohol [7 air samples ranging from 42-160 milligrams per cubic meter (mg/M^3)]; Toluene [7 air samples ranging from 3-8 mg/M^3]; Methylene chloride [5 air samples ranging from 73-253 mg/M^3]; Nuisance particulate matter (respirable) [8 air samples ranging from 0.4-1.6 mg/M^3]; Nuisance particulate matter (total) [8 air samples ranging from 2-82 mg/M^3]; and Iron oxide [1 sample showing a concentration of 1.0 mg/M^3]. An evaluation of the existing dust collection system at three locations along the outside wall and adjacent to the metal furniture refinishing area, showed face velocities of 75-100 feet per minute (fpm).

With the exception of three of eight (38 percent) of the nuisance particulate (total) samples, the results for all other substances were below recommended evaluation criteria.

Based on results of the evaluation, as well as the concern of health effects (cancer, dermatitis, respiratory disease), NIOSH found that a potential health hazard might exist to those persons exposed to measured concentrations of "total" wood dust. On the other hand, no evidence of a health hazard was found to exist from employee/inmate exposures to isopropyl alcohol, toluene, methylene chloride, nuisance particulate matter (respirable) and iron oxide.

Recommendations relating to this evaluation are presented in Section VII of this report.

KEY WORDS: SIC 9999 (Nonclassifiable Establishment); Isopropyl alcohol, Toluene, Methylene chloride, Nuisance particulate matter, Wood dust, Iron oxide.

II. INTRODUCTION

On September 9, 1980, NIOSH received a request from the U.S. Department of Justice, Federal Prison System, to conduct an evaluation of industrial operations at the Federal Correctional Institution, La Tuna, Texas, for purposes of determining employee/inmate exposure(s) to isopropyl alcohol, toluene, methylene chloride, nuisance particulate matter, wood dust and iron oxide.

III. BACKGROUND

The principal industrial operation at the La Tuna Federal Correctional Institution is the refinishing of "U.S. Government issue" wood/metal office furniture. In the process of stripping, sanding, painting and generally refurbishing the furniture, employees/inmates are subjected to exposures from solvents, paints, wood dust, nuisance particulate matter and welding fumes.

IV. EVALUATION DESIGN AND PROCEDURES

An industrial hygiene evaluation was performed at the correctional institution on December 18, 1980. Personal breathing-zone air samples were collected to evaluate institution employee/inmate exposure to particulate matter, iron oxide from welding fumes and isopropyl alcohol, toluene and methylene chloride contained in stripping agents. Samples were collected by using filters (both 0.8 and 5.0 micron pore size) and standard charcoal tubes, depending on the prescribed sampling/analytical method. Analytical methods utilized were gas chromatography, atomic absorption and gravimetric analysis.

With respect to existing dust collection equipment, an air velocity meter was utilized to measure face velocities at three locations along the outside wall adjacent to the metal furniture refinishing area.

V. EVALUATION CRITERIA

A. Environmental

Environmental standards and criteria considered applicable to this evaluation are shown below.

Substance	NIOSH, 8/10-hr. TWA Recommendation (mg/M^3)*	ACGIH, TLV Committee, 8-hr. TWA (mg/M^3)*	OSHA, 8-hr. TWA Standard (mg/M^3)*
Isopropyl Alcohol	984	980	980
Toluene	375	375	750[a]
Methylene Chloride	261	360	1750[b]
Nuisance Particulate (Respirable)	**	5	5
Nuisance Particulate (Total)	**	10	15

V. EVALUATION CRITERIA (continued)

Substance	NIOSH, 8/10-hr. TWA Recommendation (mg/M^3)*	ACGIH, TLV Committee, 8-hr. TWA (mg/M^3)*	OSHA, 8-hr. TWA Standard (mg/M^3)*
Wood Dust (Nonallergenic, Respirable and Total)	**	5	**
Iron Oxide	**	5	5

(a) Ceiling, 1125 mg/M^3
(b) Ceiling, 3500 mg/M^3

*Eight or ten-hour, time-weighted-average (TWA) concentrations in milligrams of substance per cubic meter of air sampled.

**No recommendation available

ACGIH - American Conference of Governmental Industrial Hygienists;
OSHA - Occupational Safety and Health Administration.

B. Toxic Effects

Isopropyl Alcohol[1,2,3]

Isopropyl alcohol is an irritant of the eyes and mucous membranes; ingestion causes central nervous system (CNS) depression, and it is expected that inhalation of high sustained concentrations will produce the same effect.

Human subjects exposed to 980 mg/M^3 for three to five minutes had mild irritation of the eyes, nose and throat; at 1960 mg/M^3 the irritation was not severe, but the majority of subjects considered the atmosphere uncomfortable. Combined skin absorption and inhalation of large amounts of isopropyl alcohol may result in coma. Some people may develop dermatitis from contact with the liquid.

Toluene[4,5,6]

Toluene is recognized to cause central nervous system (CNS) depression. Liquid splashed in the eyes of workers results in transient corneal damage and conjunctival irritation; however, complete recovery normally occurs within 48 hours. Repeated or prolonged skin contact with liquid toluene has a defatting action, causing drying, fissuring and dermatitis.

Signs and symptoms include fatigue, weakness, confusion, euphoria, dizziness, headache, dilated pupils, lacrimation, nervousness, muscular fatigue, insomnia, paresthesias of the skin and dermatitis.

Methylene Chloride[7,8,9]

Methylene Chloride is a mild central nervous system (CNS) depressant and an eye, skin and respiratory tract irritant; at extremely high concentrations it has caused liver and kidney damage in animals.

In human experiments, inhalation of 1800-3600 mg/M^3 for one to two hours has resulted in light-headedness; there was sustained elevation of carboxyhemoglobin level in several nonsmoking subjects. Liquid methylene chloride is irritating to the skin on repeated or prolonged contact. Splashed in the eye, it is painfully irritating but it is not likely to cause serious injury.

Signs and symptoms include fatigue, weakness, sleepiness, lightheadedness, numbness/tingling of the limbs, nausea and irritation of the eyes and skin from liquid splashes.

Nuisance Particulate[10]

Nuisance dusts have little adverse effects on lungs and do not produce significant organic disease or toxic effect when exposures are kept under reasonable control. The nuisance dusts have also been called "inert" (biologically) dusts, but the latter term is inappropriate to the extent that there is no dust which does not evoke some cellular response in the lungs when inhaled in sufficient amounts. However, the lung-tissue reaction caused by inhalation of nuisance dusts has the following characteristics: the architecture of the air spaces remains intact; scar tissue is not formed to a significant extent; and the tissue reaction is potentially reversible.

Excessive concentrations of nuisance dusts in the workroom air may seriously reduce visibility; may cause unpleasant deposits in the eyes, ears and nasal passages; or cause injury to the skin or mucous membranes by chemical/mechanical action per se or by the rigorous skin cleansing procedures necessary for their removal.

Wood Dust (Nonallergenic)[11,12,13]

The health effects from exposure to wood dusts are concerned with cancer, dermatitis and respiratory disease. Cases of carcinoma of the nasal cavity and accessory sinuses have been reported to occur among cabinet and chair makers and wood machinists in the furniture industry in Great Britain. The incidence of adenocarcinoma of these workers for the decade 1956 to 1965 was about 1000 times greater than that of the general male population.

The risk was found to extend, although to a lesser extent, to other furniture industry employees exposed to wood dusts. Carpenters and joiners not employed in the furniture industry appear to have no increased risk. The carcinogenic agent, believed to be derived from some constituent of hard wood, was present in the industry as early as 1920, and as recently as 1940. The types of wood involved are primarily oak, beech and mahogany,

but the following have also been implicated: Douglas fir, African walnut, elm, chestnut, African cherry, cherry, walnut, ash and plywood.

Cancers of the larynx, tonsils, tongue and lung have also been reported as arising from the inhalation of wood dust in the furniture industry.

Iron Oxide[14,15]

Inhalation of iron oxide fume or dust may cause a benign pneumoconiosis (siderosis). Iron oxide alone does not cause fibrosis in the lungs of animals, and it is probable that the same applies to humans. Exposures of six to ten years are usually required before changes recognizable by x-ray occur; the retained dust gives x-ray shadows that may be indistinguishable from fibrotic pneumoconiosis.

VI. RESULTS AND DISCUSSION

Results appearing in Tables 1, 2, 4 and 5 show that airborne concentrations of 7 isopropyl alcohol [Range: 42-160 milligrams per cubic meter (mg/M^3)], 7 toluene [Range: 3-38 mg/M^3], 5 methylene chloride [Range: 73-253 mg/M^3], 8 respirable nuisance particulate matter [Range: 0.4-1.6 mg/M^3], 8 total nuisance particulate matter [Range: 2-82 mg/M^3], and 1 iron oxide [1 mg/M^3] personal breathing-zone air samples were below either: (a) applicable NIOSH, 8-10 hour recommended levels; (b) ACGIH, TLV Committee 8-hour TWA recommended levels or (c) OSHA, 8-hour TWA/ceiling standards. On the other hand three of eight (38 percent) of the nuisance particulate matter (total) personal breathing-zone air samples exceeded that same criteria when projected as 8-hour TWA concentrations.

Face velocity measurements (75-100 feet per minute) were recorded at three locations along the outside wall adjacent to the metal furniture refinishing area.

VII. RECOMMENDATIONS

1. Based on visual observations, air velocity measurements of the existing dust collection system, results of air monitoring for nuisance particulate matter and concern for the health effects from exposure to wood dusts, extended efforts should be made to reduce dust concentrations in the areas where sanding/grinding operations are conducted on wooden/metal furniture. Due to the varied operations where dust is generated, the low volume-high velocity exhaust system[16] is recommended. This system is the unique application of exhaust which uses small volumes of air at relatively high velocities to control dust from portable hand tools. Control is achieved by exhausting the air directly at the point of dust generation, using close-fitting, custom-made hoods. Capture velocities are relatively high, but the exhaust volume is low due to the small distance required. For flexibility, small diameter, light-weight plastic hoses are used with portable tools, resulting in very high duct velocities. This method allows the application of local exhaust ventilation to portable tools which otherwise would require large air volumes and large ductwork when controlled by conventional exhaust methods.

For example, portable orbital sanding machines can be fitted with a small exhaust duct surrounding the edge of the plate. A fitting can then be provided to connect this to the flexible hose or a standard domestic vaccuum cleaner. Figures 1, 2 and 3[17] illustrate a custom-made line of exhaust hoods available. In order to control the dust, high pressures are required to create high capture velocities at the dust source. The dust is conveyed at high velocities in small diameter, flexible hoses.

The dust-laden air is passed into primary and secondary cyclone collectors and through a fabric filtering unit as shown in Figure 4.[18] The fabric collector can be cleaned by a simple manual valve which admits air into the clean side of the fabric, bringing this side of the fabric to atmospheric pressure. Since the dirty side of the fabric is at a pressure far below atmospheric, this causes rapid air flow through the fabric and provides reverse cleaning.

2. Ensure that single-use, disposable-type respirators are worn by employees and/or inmates performing duties in the sanding/grinding areas.

3. Most solvents/chemicals being used in the Institution's furniture refinishing operation have an irritating effect on the skin. Frequent contact of these chemicals with the skin should be minimized by the use of appropriate personal protective equipment, such as gloves and safety glasses.

VIII. REFERENCES

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17. Ibid, pp. 5-87,5-90, 5-91.

18. Ibid, p. 5-92.

IX. AUTHORSHIP AND ACKNOWLEDGEMENTS

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X. DISTRIBUTION AND AVAILABILITY OF DETERMINATION REPORT

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

Copies of this report have been sent to:

a) U.S. Department of Justice, Federal Prison System, Washington, D.C.,
b) U.S. Department of Labor, Region VI
C) NIOSH, Region VI

For purposes of informing the various affected inmates, a copy of this report shall be posted in a prominent place, accessible to the inmates, for a period of thirty (30) calendar days.

Table 1

Isopropyl Alcohol and Toluene Concentrations

La Tuna Federal Correctional Institution
La Tuna, Texas

December 18, 1980

Sample Number	*Type of Sample	Location	Sampling Period	**Concentration (mg/M^3)	
				Isopropyl Alcohol	Toluene
IPT-1	P	Furniture Stripping--Wood	1004-1450	94	3
IPT-2	P	Furniture Stripping--Wood	1024-1344	148	5
IPT-3	P	Furniture Stripping--Wood	1015-1349	138	5
IPT-4	P	Furniture Stripping--Wood	1006-1504	82	3
IPT-5	P	Furniture Stripping--Metal	1010-1500	42	8
IPT-6	P	Furniture Stripping--Metal	1013-1344	50	3
IPT-7	P	Furniture Stripping--Wood	1000-1502	160	3
OSHA, 8 hr. TWA Standard				980	750
OSHA, Ceiling Standard				---	1125
NIOSH, 8-10 hr. TWA Recommendation				984	375
ACGIH, 8-hr. TWA Recommendation				980	375

*P - Personal
**mg/M^3 - Milligrams of substance per cubic meter of air sampled

Table 2

Methylene Chloride Concentrations

La Tuna Federal Correctional Institution
La Tuna, Texas

December 18, 1980

Sample Number	*Type of Sample	Location	Sampling Period	**Concentration (mg/M^3)
MC-1	P	Furniture Stripping--Metal	1013-1344	76
MC-2	P	Furniture Stripping--Wood	1022-1519	73
MC-3	P	Furniture Stripping--Wood	1010-1430	135
MC-4	P	Furniture Stripping--Metal	1020-1400	87
MC-5	P	Furniture Stripping--Wood	1004-1415	253

OSHA, 8-hr. TWA Standard	1750
OSHA, Ceiling Standard	3500
NIOSH, 8-10 hr. TWA Recommendation	261
ACGIH, 8-hr. TWA Recommendation	360

*P - Personal
**mg/M^3 - Milligrams of substance per cubic meter of air sampled

Table 3

Total Dust Concentrations

La Tuna Federal Correctional Institution
La Tuna, Texas

December 18, 1980

Sample Number	*Type of Sample	Location	Sampling Period	**Concentration (mg/M^3)
2806	P	Wooden Furniture--Sander	1021-1521	16
2800	P	Wooden Furniture--Sander	1019-1519	10
2819	P	Wooden Furniture--Sander	1015-1520	2
2802	P	Wooden Furniture--Sander	1010-1348	82
2815	P	Metal Furniture--Grinder	1004-1525	8
2813	P	Metal Furniture--Sander	0857-1349	17
2798	P	Metal Furniture--Grinder	0900-1526	48
2812	P	Metal Furniture--Grinder	0901-1523	29

OSHA, 8-hr. TWA Standard (Nuisance)	15
ACGIH, 8-hr. TWA Recommendation (Nuisance)	10
ACGIH, 8-hr. TWA Recommendation (Wood Dust, Nonallergenic)	5

*P - Personal
**mg/M^3 - Milligrams of substance per cubic meter of air sampled

Table 4

Respirable Dust Concentrations

La Tuna Federal Correctional Institution
La Tuna, Texas

December 18, 1980

Sample Number	*Type of Sample	Location	Sampling Period	**Concentration (mg/M^3)
2805	P	Wooden Furniture--Sander	1021-1521	1.6
2803	P	Wooden Furniture--Sander	1019-1519	0.5
2808	P	Wooden Furniture--Sander	1015-1520	0.2
2797	P	Wooden Furniture--Sander	1010-1348	0.4
2799	P	Metal Furniture--Grinder	1004-1525	0.7
2814	P	Metal Furniture--Sander	0857-1349	0.8
2820	P	Metal Furniture--Grinder	0900-1526	0.8
2809	P	Metal Furniture--Grinder	0901-1523	1.3

OSHA, 8-hr. TWA Standard (Nuisance)	5.0
ACGIH, 8-hr. TWA Recommendation (Nuisance)	5.0
ACGIH, 8-hr. TWA Recommendation (Wood Dust, Nonallergenic)	5.0

*P - Personal
**mg/M^3 - Milligrams of substance per cubic meter of air sampled

Table 5

Iron Oxide Concentrations

La Tuna Federal Correctional Institution
La Tune, Texas

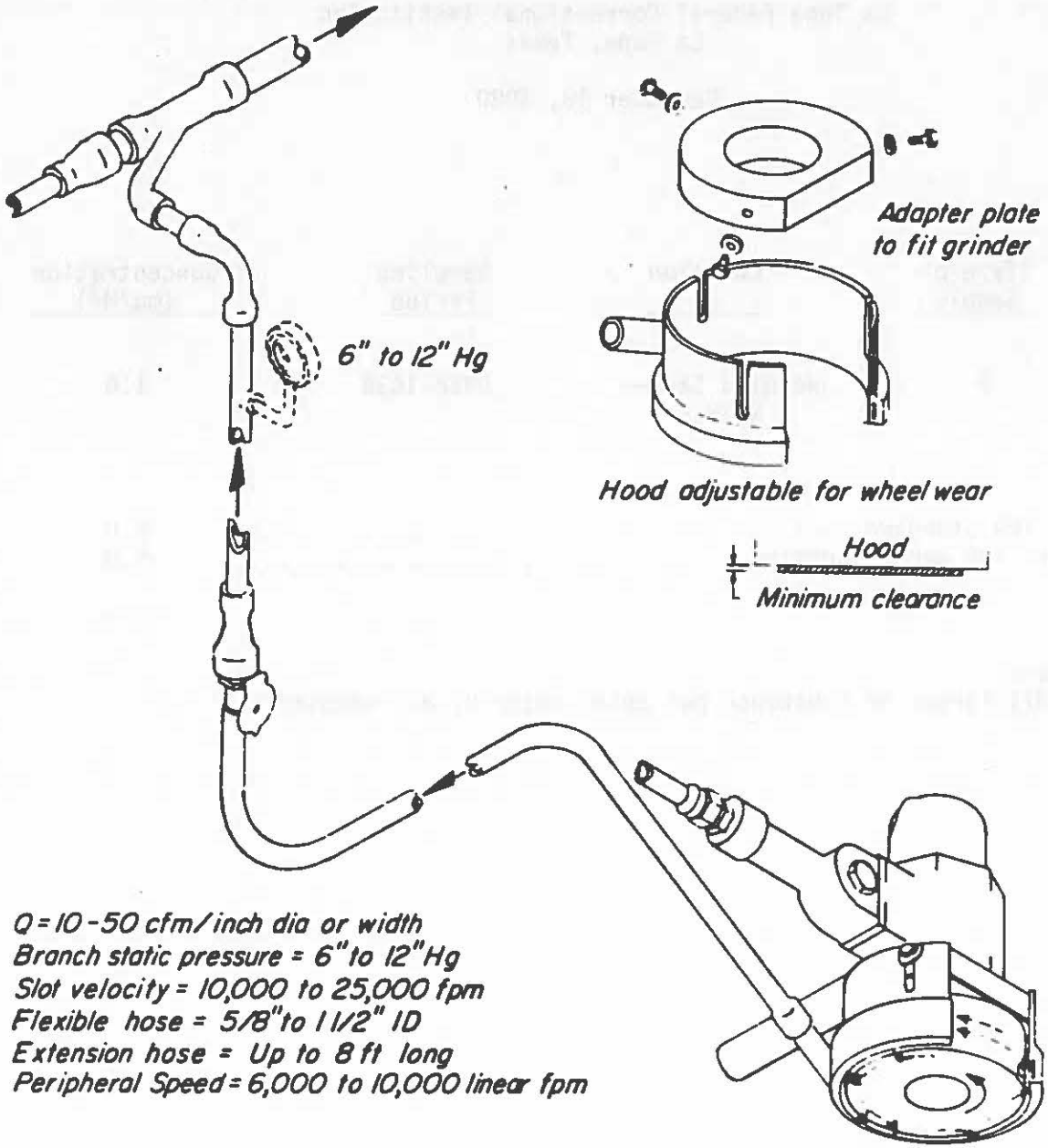
December 18, 1980

Sample Number	*Type of Sample	Location	Sampling Period	**Concentration (mg/M^3)
IO-1	P	Welding Shop--Welder	0858-1035	1.0

OSHA, 8 hr. TWA Standard.....	5.0
ACGIH, 8-hr. TWA Recommendation.....	5.0

*P - Personal
**mg/M^3 - Milligrams of substance per cubic meter of air sampled

Figure 1

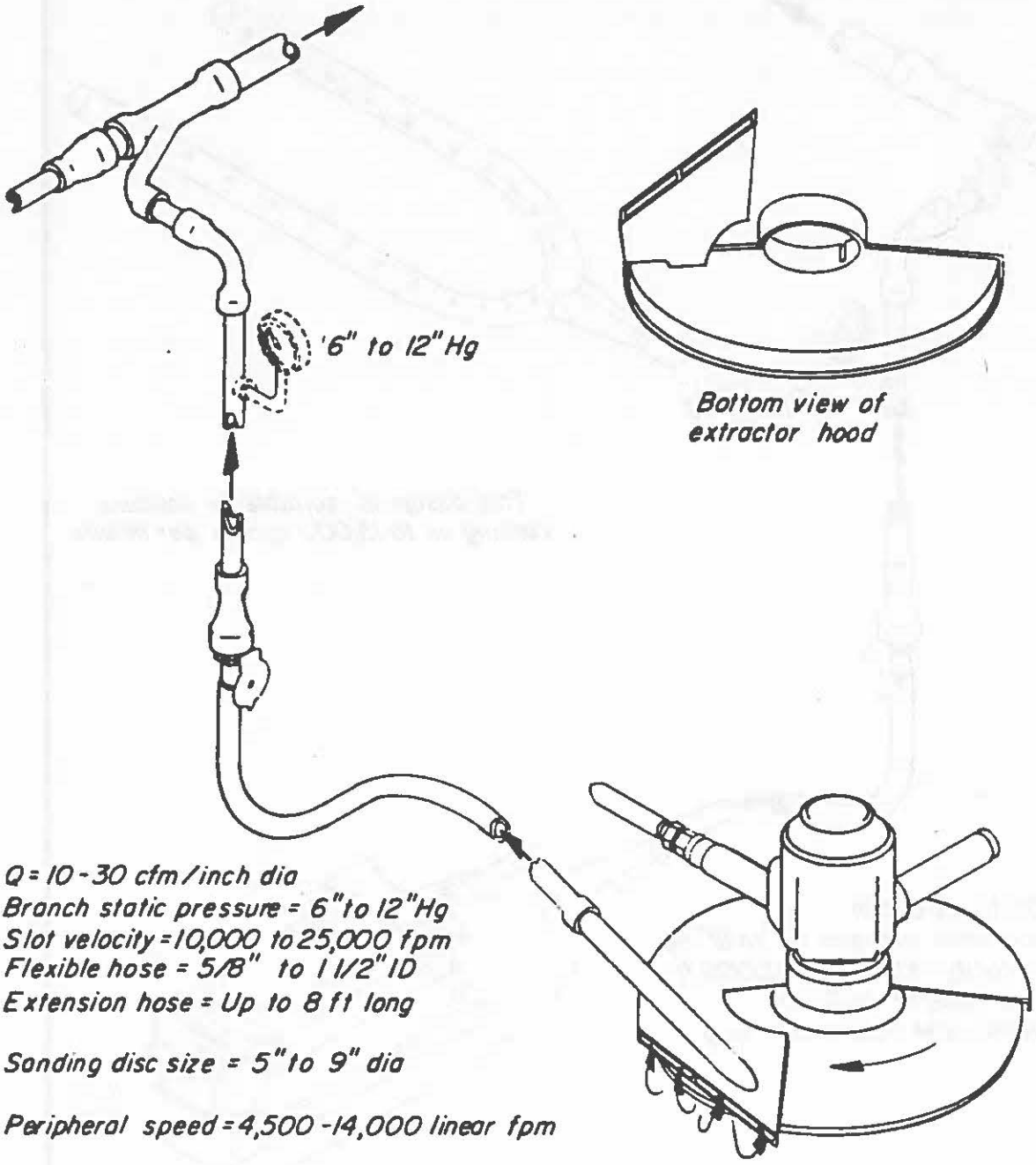


AMERICAN CONFERENCE OF
GOVERNMENTAL INDUSTRIAL HYGIENISTS

HOOD FOR CUP TYPE SURFACE
GRINDERS AND WIRE BRUSHES

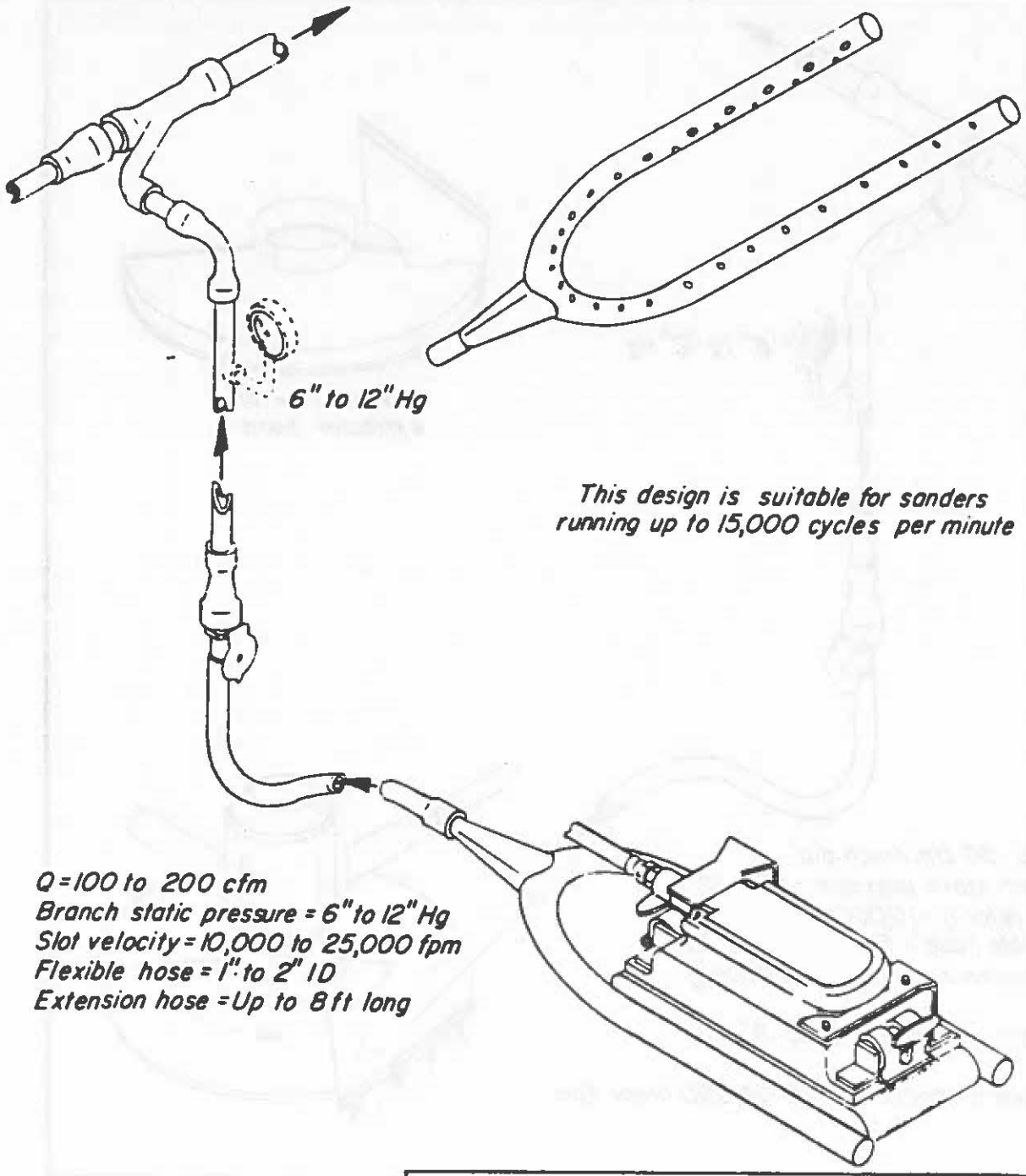
DATE 1-72 | VS-802

Figure 2



AMERICAN CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGIENISTS	
EXTRACTOR HOOD FOR DISC SANDER	
DATE 1-72	VS-805

Figure 3

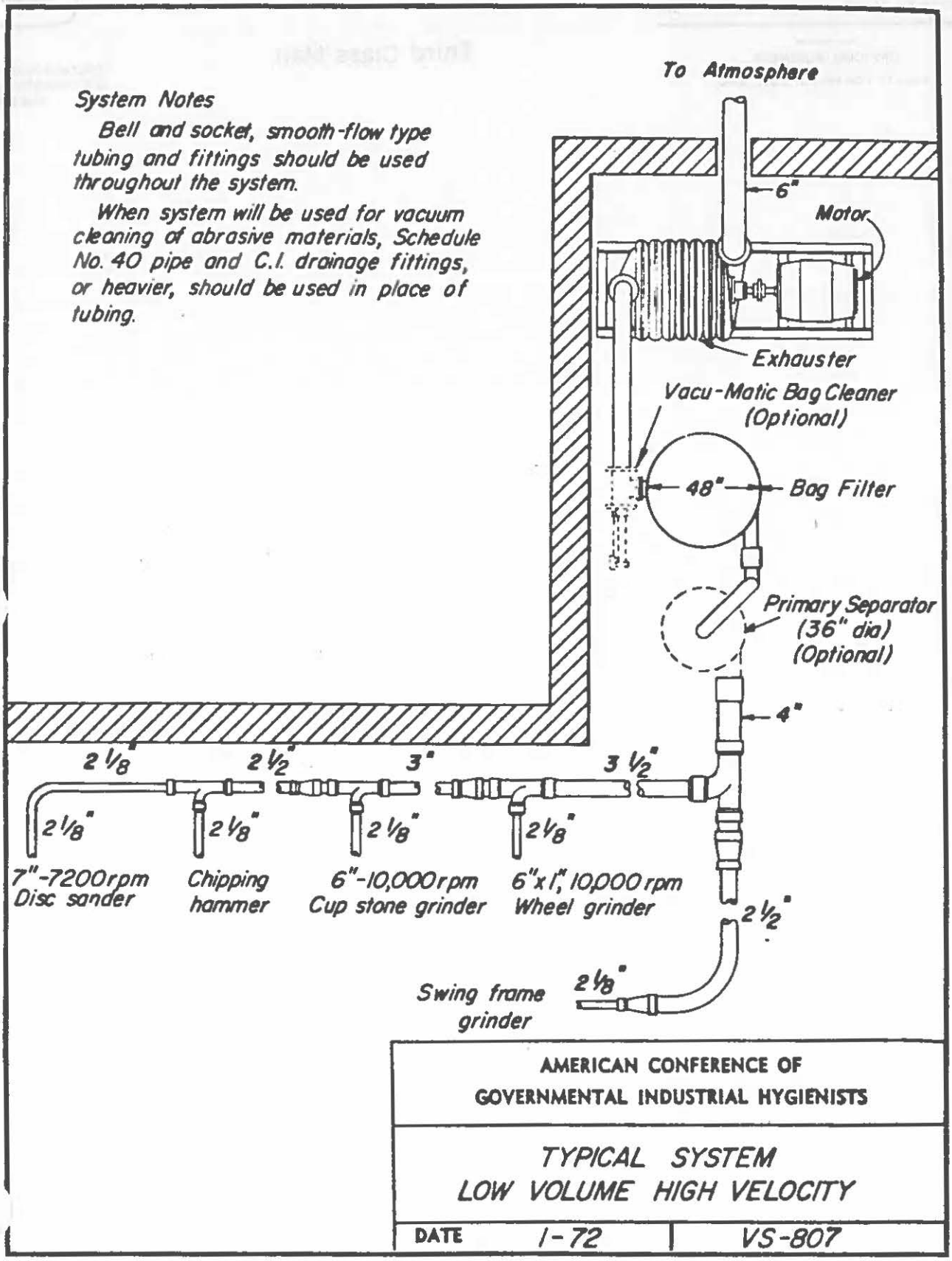


AMERICAN CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGIENISTS

EXTRACTOR TOOL FOR VIBRATORY SANDER

DATE	1-72	VS-806

Figure 4


System Notes
Bell and socket, smooth-flow type tubing and fittings should be used throughout the system.
When system will be used for vacuum cleaning of abrasive materials, Schedule No. 40 pipe and C.I. drainage fittings, or heavier, should be used in place of tubing.
To Atmosphere
6"
Motor
Exhauster
Vacu-Matic Bag Cleaner (Optional)
48"
Bag Filter
Primary Separator (36" dia) (Optional)
4"
2 1/8"
2 1/2"
3"
3 1/2"
2 1/8"
2 1/8"
2 1/8"
2 1/8"
7"-7200rpm Disc sander
Chipping hammer
6"-10,000rpm Cup stone grinder
6"x1", 10,000 rpm Wheel grinder
2 1/2"
Swing frame grinder
2 1/8"
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TYPICAL SYSTEM
LOW VOLUME HIGH VELOCITY
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