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 NO. 78-92-571
NORTHPARK MILLWORK LTD.
COLORADO SPRINGS, COLORADO

MARCH 1979

I. TOXICITY DETERMINATION

It has been determined that the cabinet makers were exposed to potentially toxic airborne concentrations of a mixture of lacquer thinner and 1,1,1-trichloroethane (methyl chloroform). This is based on the fact that:

1) three of eight employees questioned over the two days reported experiencing headache and light-headedness and;

2) their exposure to these substances was about 80% of the short term environmental evaluation criteria and about 50% or less than the eight-hour evaluation criteria.

The employees who work on the stationary power wood working equipment (panel saw excluded) were exposed to potentially toxic concentrations of wood dust. This is based on environmental sample results which showed that four out of six samples exceeded the environmental evaluation criteria and that the average wood dust concentration was two times the evaluation criteria.

II. DISTRIBUTION AND AVAILABILITY OF DETERMINATION REPORT

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

Copies of this report have been sent to:

1. Northpark Millwork Ltd., Colorado Springs, Colorado.

2. U.S. Department of Labor, Occupational Safety and Health Administration, (OSHA) Region VIII, Denver, Colorado.

For the purpose of informing the approximately fifteen affected employees, the employer will promptly post this Determination Report in a prominent place(s), near the work area of the affected employees for a period of thirty (30) calendar days.

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 receipt of 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 National Institute for Occupational Safety and Health received such a request from a representative of the employees to determine if the wood dust, contact cement and solvents used with the contact cement are toxic as used or found in the Millwork shop.

IV. HEALTH HAZARD EVALUATION

A. Description of Process - Conditions of Use

Northpark Millwork is a custom cabinet shop. Dimensional lumber is cut to the desired size and shape by means of saws, planers, shapers, jointers and sanders. The types of wood used include solid stock, plywood veneer and particle board. The species of wood used is dependent on the customer's order. On the days of this survey, oak was the predominant species of wood being handled. The pieces are assembled into various cabinets, counters and other configurations. A considerable portion of the exterior surfaces on many of the units are covered with plastic laminates. The contact adhesive for the plastic laminates is sprayed on the cabinet surface in the area where it was assembled, and on the plastic laminate in a fixed location near the middle of the room. Excess adhesive is wiped off with lacquer thinner. Occasionally, a piece of plastic laminate has to be removed. This is accomplished by loosening the adhesive with lacquer thinner.

The employees are potentially exposed to wood dust, the solvent in the contact adhesive (1,1,1-trichloroethane) and lacquer thinner (toluene, naphtha, methyl butyl ketone, isobutyl ketone, cellosolve acetate, butyl alcohol and isopropyl alcohol).

There are approximately fifteen employees who work in this area. All are exposed to wood dust. The cabinet makers are also exposed to the contact adhesive and lacquer thinner.

B. Evaluation Design

1. General

The environmental survey was conducted on August 28 and 29, 1978.

2. Environmental Sampling

The sampling was designed to determine the wood dust and solvent 8-hour time weighted average exposure of the employees. Several 20 to 30 minute samples were collected to determine peak solvent exposures. The sampling was accomplished by placing the collecting device in the breathing zone of the worker (attached to the shirt lapel) and connecting the device to a small battery operated pump attached to the belt. There were several area samples collected for solvent vapors near where the adhesive is sprayed and the plastic laminates are installed.

3. Worker Questionnaire

A short pre and post shift questionnaire was administered to the employees by the investigators. The questionnaire involved the employees' perception of having a headache, feeling nauseated, lightheaded or dizzy, and whether he had any irritation of the eyes, nose or throat.

C. Evaluation Methods - Environmental

1. Wood Dust - the sampling method consisted of collection of the wood dust on tared vinyl metricel filters using closed face cassettes at a flow rate of 1.5 liters per minute. The filters were weighted as received by the laboratory to determine the total weight gain.

2. Organic Solvents - the sampling method consisted of collection of the organic solvents on activated charcoal sampling tubes at flow rates of 25 to 200 cc per minute. The individual organic solvent concentrations were determined using gas chromatographic techniques. (NIOSH method P & CAM 127)(1)

D. Evaluation Criteria

The environmental evaluation criteria used in this evaluation are listed in Tables 1 and 2.

E. Evaluation Results and Discussion

1. Environmental

There were sixteen solvent vapor samples (12 breathing zone and 4 general area) collected. This resulted in eight 8-hour time weighted average samples. There were three short term samples collected to determine the maximum exposure during specific operations. These results are shown in Table 3. None of the samples exceeded the evaluation criteria which was based on the solvent mixture in each sample collected. The six breathing zone samples ranged from 13% to 55% of the evaluation criteria. The two area samples were 24 and 41% of the criteria. The short term samples collected during the spraying of the contact cement and when the plastic laminates were wiped off with the lacquer thinner were 77%, 83% and 84% of the short term limits.

There were 13 wood dust samples collected that resulted in twelve 8-hour time weighted average samples. The results are shown in table 4. Four were representative of the cabinet makers' exposure. The four samples had a range of 1.96 to 3.02 mg/cu m and an average concentration of 2.37 mg/cu m. These were all 60% or less than the current evaluation criteria of 5 mg/cu m. Two samples from the panel saw operator showed concentrations of 0.88 and 1.63 mg/cu m which were also less than the 5 mg/cu m evaluation criteria.

There were six 8-hour time weighted average samples collected on workers who operated the stationary power tools. The results are shown in table 4. They ranged from 1.94 to 36.1 mg/cu m with an average of 11.9 mg/cu m. This average exposure is more than two times the evaluation criteria of 5 mg/cu m. In addition, four of the six samples exceeded 5 mg/cu m. The extremely high sample of 36.1 mg/cu m was from the worker who operated the power fed rip saw most of the day. (This is typical of this process and should be controlled by local exhaust ventilation) These wood dust levels will vary from day to day due to varying usage of each piece of equipment and amount of wood processed.

The wood dust levels can be reduced by increasing the local exhaust ventilation on each piece of equipment and installing a new hood on the power fed rip saw. Table 5 shows the measured exhaust air volume and the volumes recommended in the Industrial Ventilation Manual (7). The drawing of the recommended hood design for the power fed rip saw is shown in table 6. The current hood under

the saw is inadequate due to the large opening between the hood edges and the under side of the saw. With a large opening at this point, the collection efficiency is greatly reduced.

One cabinet maker in the shop wore a respirator for use against wood dusts.

2. Worker Questionnaire

A pre and post shift questionnaire was administered by the NIOSH investigators to eight employees on August 28 and twelve on August 29. Four cabinet makers were questioned on the 28th and eight on the 29th. On August 28, none of the four reported experiencing any eye, nose or throat irritation or nausea. Two reported feeling lightheaded and dizzy, and one also had a headache. These two individuals both had short term exposures during glue spraying to 1,1,1-trichloroethane that were less than the short term recommended level. The total solvent exposures during these periods were 276 and 253 ppm (combined 1,1,1-trichloroethane and lacquer thinner). On August 29 none of the eight experienced eye or throat irritation, felt nauseated or felt lightheaded. One experienced nose irritation and one had a headache. The cabinet makers, in addition to the solvent exposure, were also exposed to wood dust.

Four employees who operated the stationary power tools were questioned on August 28 and again on the 29th. On the 28th, none of the four reported experiencing any post shift eye, nose, or throat irritation; while two stated they had headaches and felt lightheaded. One of these individuals had a very high wood dust exposure of 36 mg/cu m. On the 29th, he did not experience any post shift symptoms while his wood dust on that day was 13.7 mg/cu m. The second worker on the 28th, who had a headache and felt lightheaded, had a wood dust exposure of 5.24 mg/cu m. This individual, on the 29th, experienced nose irritation while being exposed to 2.5 mg of wood dust per cubic meter of air. Another worker on the 29th, whose wood dust exposure was 11.9 mg/cu m, experienced throat irritation. These individuals did not do any work with the contact cement or lacquer thinner, however, they work near the area where they were used. The predominant wood species handled by these individuals was oak.

F. Summary and Conclusions

The cabinet makers were exposed to potentially toxic concentrations of a mixture of lacquer thinner and 1,1,1-trichloroethane. This is based on the fact that three of eight employees questioned over the two days reported experiencing headache and lightheadedness. Their exposure to these substances was about 80% of the short term evaluation criteria and 55% or less than the eight-hour evaluation criteria.

The employees who work on the stationary power wood working equipment (panel saw excluded) were exposed to potentially toxic concentrations of wood dust. This is based on environmental sample results which showed that four out of six samples exceeded the evaluation criteria and that the average wood dust concentration was two times the evaluation criteria.

G. Recommendations

1. Employee exposure to wood dust should be measured on a regular basis. Records should be maintained for all sampling schedules. Each employee should be able to obtain information on his own environmental exposure.

2. Local exhaust ventilation should be installed on the 10 inch Rockwell table saw.

3. The power fed rip saw needs special attention because of the high airborne wood dust concentrations to which the operator is exposed. A new hood should be constructed and installed on the saw (see table 6) and the exhaust ventilation rate increased to the rate listed in table 5.

4. The exhaust ventilation should be increased for each piece of stationary wood working equipment to the rates listed in table 5.

5. A minimum duct velocity of 3500 fpm should be maintained in all duct work.

6. All hand power sanders should be equipped with a dust collection device.

7. NIOSH approved respirators for use against wood dust should be worn by employees operating the stationary woodworking equipment.

8. NIOSH approved respirators for use against organic solvent should be worn by the workers in the immediate area during

spraying of contact adhesive and during heavy use of lacquer thinner.

9. The spraying of contact adhesive and the heavy use of lacquer thinner (stripping off plastic laminates) should be conducted in a well ventilated area or booth.

10. A respirator program that meets the requirements outlined in the OSHA standards should be instituted if respirators are used.

11. Rubber gloves should be worn when using lacquer thinner to clean up excess adhesive and when removing plastic laminates.

12. A dispenser should be used to transfer the lacquer thinner from the bulk container to the small bottles.

V. REFERENCES

1. NIOSH Manual of Analytical Methods - HEW Publication (NIOSH) 77-157 P & CAM #127.

2. Threshold Limit Values for Chemical Substances and Physical Agents in the Workroom Environment for 1978. American Conference of Governmental Industrial Hygienists (ACGIH).

3. OSHA-U.S. Department of Labor, Code of Federal Regulations Dated July 1975, Part 1910, Title 29, Chapter XVII, Subpart 2, Tables Z-1, Z-2, Z-3.

4. NIOSH Criteria for a Recommended Standard...Occupational Exposure to 1,1,1-Trichloroethane. HEW Publication (NIOSH) 76-184.

5. NIOSH Criteria for a Recommended Standard...Occupational Exposure to Ketones. HEW Publication (NIOSH) 78-173.

6. NIOSH Criteria for a Recommended Standard...Occupational Exposure to Toluene. HEW Publication (NIOSH) 73-11023.

7. Industrial Ventilation - A Manual of Recommended Practice. 15th Edition. American Conference of Governmental Industrial Hygienists.

8. NIOSH Criteria for a Recommended Standard...Occupational Exposure to Refined Petroleum Solvents. HEW Publication (NIOSH) 77-192.

VI. AUTHORSHIP AND ACKNOWLEDGMENTS

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T A B L E 1

EVALUATION CRITERIA

NORTHPARK MILLWORK LTD.
COLORADO SPRINGS, COLORADO

HHE 78-92

SUBSTANCE	TWA*
Lacquer Thinner ++	88 ppm **
1,1,1-Trichloroethane (methyl chloroform)	350 ppm ceiling concentration for any 15 minute period
Wood Dust	5 mg/cubic meter +

* TWA - 8-hour time weighted average

** PPM - parts of vapor per million parts of air.

\+ mg/m^3 milligrams per cubic meter of air.

++ The TWA criteria for the lacquer thinner was calculated using the manufacturer's composition data for this product and the evaluation criteria listed in table 2.

T A B L E 2

ENVIRONMENTAL EVALUATION CRITERIA

NORTHPARK MILLWORK LTD.
COLORADO SPRINGS, COLORADO

HHE 78-92

SUBSTANCE	RECOMMENDED ENVIRONMENTAL LIMIT	SOURCE	OSHA STANDARD	PRIMARY HEALTH EFFECTS
Butyl Alcohol	50 ppm*	ACGIH (Ref 2)	100 ppm	Eye irritation, headache, narcosis
Cellosolve Acetate (2-Ethoxyethyl Acetate)	100 ppm	OSHA (Ref 3) ACGIH (Ref 2)	100 ppm	Eye and nose irritation
Isobutyl Acetate	150 ppm	OSHA (Ref 3) ACGIH (Ref 2)	150 ppm	Irritation of eyes and respiratory passages
Isopropyl Alcohol	400 ppm	OSHA (Ref 3) ACGIH (Ref 2)	400 ppm	Narcosis, mild irritation of eyes, nose and throat
1,1,1-Trichloroethane (Methyl Chloroform)	350 ppm ceiling conc. for any 15 min. period	NIOSH (Ref 4)	350 ppm	Narcosis, eye irritation
Methyl Isobutyl Ketone	50 ppm	NIOSH (Ref 5)	100 ppm	Irritation of eye, nose, respiratory passages, headache, dizziness, nausea, narcosis
Naphtha (Petroleum)	350 mg/cu m** (approx. 100 ppm)	NIOSH (Ref 8)	500 ppm	Narcosis, dizziness, irritation of skin and mucous membranes of upper respiratory tract
toluene	100 ppm	NIOSH (Ref 6)	200 ppm	Mild eye irritation, headache, nausea, dizziness and narcosis
Wood dust	5 mg/cu m	ACGIH (Ref 2)	***	Dermatitis, respiratory disease, carcinoma of the nasal cavity and accessory sinuses; allergenic wood e.g., western red cedar may cause asthma.

* ppm - Parts of vapor per million parts of air.
** mg/cu m - milligrams per cubic meter of air.
*** OSHA does not have a specific standard for wood dust. Their nuisance dust standard of 15 mg/cu m would apply.

T A B L E 3

LACQUER THINNER AND 1,1,1-TRICHLOROETHANE (CONTACT CEMENT SOLVENT)
AIR CONCENTRATIONS

NORTHPARK MILLWORK LTD.
COLORADO SPRINGS, COLORADO

HHE 78-92

SAMPLE LOCATION	DATE	SAMPLE NUMBER	SAMPLE TIME MINS.	SAMPLE VOL. LITERS	LACQUER THINNER CONCENTRATION TWA* PPM**	1,1,1-TRI-CHLOROETHANE CONCENTRATION TWA PPM	EVALUATION + CRITERIA OF THE MIXTURE IN EACH SAMPLE PPM	TOTAL EXPOSURE PPM	RATIO-TOTAL+ EXPOSURE/ EVALUATION CRITERIA OF MIXTURE
Area sample-SE corner of room. Approx. 280 sq ft of plastic laminates were laid up nearby.	8-28-78	2	223	9.64	4	42	228	94	0.41
	8-28-78	9	180	7.66	34 > 17	120 > 77			
Area sample, approx. 4' from where plastic laminates are sprayed.	8-28-78	4	224	8.04	4	22	237	56	0.24
	8-28-78	7	170	6.49	15 > 9	79 > 47			
Cabinet maker (BZ) sprayed some contact cement; worked near the spray area.	8-28-78	1	230	10.12	7	24	208	50	0.24
	8-28-78	6	170	8.15	12 > 9	63 > 41			
Cabinet maker (BZ); he laid up approx. 280 sq ft of plastic laminates.	8-28-78	3	228	8.93	4	27	179	74	0.41
	8-28-78	8	170	7.72	50 > 24	79 > 49			
Cabinet maker (BZ); short term sample during glue spraying; (sample was during 20 mins. of Sample #8 above)	8-28-78	10	20	4.03	10	266	329++	276	0.84

(CONTINUED ON FOLLOWING PAGE)

T A B L E 3 (CONT'D)

LACQUER THINNER AND 1,1,1-TRICHLOROETHANE (CONTACT CEMENT SOLVENT)
AIR CONCENTRATIONS

NORTHPARK MILLWORK LTD.
COLORADO SPRINGS, COLORADO

HHE 78-92

SAMPLE LOCATION	DATE	SAMPLE NUMBER	SAMPLE TIME MINS.	SAMPLE VOL. LITERS	LACQUER THINNER CONCENTRATION TWA* PPM**	1,1,1-TRICHLOROETHANE CONCENTRATION TWA PPM	EVALUATION CRITERIA OF THE MIXTURE IN EACH SAMPLE PPM	TOTAL EXPOSURE PPM	RATIO-TOTAL EXPOSURE/ EVALUATION CRITERIA OF MIXTURE
Cabinet maker (BZ)-short term sample during glue spraying.	8-28-78	11	20	3.71	9	244	329++	253	0.77
Cabinet maker (BZ)-short term sample during clean up with lacquer thinner.	8-28-78	5	30	6.57	103	16	143++	119	0.83
Cabinet maker (BZ)-laid up some plastic laminates during the day.	8-29-78	13	234	9.87	26	52	140	77	0.55
	8-29-78	17	175	7.16	58 > 39	19 > 38			
Cabinet maker (BZ)-laid up some plastic laminates during the day	8-29-78	14	223	8.40	8	74	246	59	0.24
	8-29-78	18	172	6.45	9 > 8	22 > 51			
Cabinet maker (BZ)-laid up some plastic laminates during the day.	8-29-78	16	232	11.17	5	33	238	31	0.13
	8-29-78	20	179	7.97	4 > 5	16 > 26			
Cabinet maker (BZ)-worked in the area but did not do any work with plastic laminates.	8-29-78	15	232	10.09	8	77	263	63	0.24
	8-29-78	19	172	7.88	6 > 7	28 > 56			

* TWA - Time Weighted Average
** PPM - Parts of vapor per million parts of air.

\+ When there are 2 or more substances present that have similar health effects, the exposure levels are combined and an equivalent permissible exposure level determined. When the ratio of the total exposure/the evaluation criteria exceeds 1.0, the evaluation criteria was exceeded.

++ The Short Term Exposure Limits are considered the maximum exposure to which workers can be exposed for a period up to 15 minutes. The ACGIH recommends this to be 1.5 times the 8-hour limit when the threshold limit values are between 10 and 100 ppm. For 1,1,1-trichloroethane, the short term exposure limit is 350 ppm.

T A B L E 4

RESULTS OF WOOD DUST SAMPLES

NORTHPARK MILLWORK LTD.
COLORADO SPRINGS, COLORADO

HHE 78-92

SAMPLE LOCATION +	DATE	SAMPLE NUMBER	SAMPLE TIME MINS.	SAMPLE VOL. LITERS	TWA* mg/cu m **	
Cabinet maker	8-28-78	908	430	645	3.02	
" "	8-29-78	903	443	665	2.36	
" "	8-29-78	950	336	504	1.96	
" "	8-29-78	892	437	656	2.15	
Panel Saw operator	8-28-78	949	427	641	1.63	
" " "	8-29-78	953	440	660	0.88	
Employee operated power fed rip saw and planer	8-28-78	902	235	252	50.1	> 36.1++
	8-28-78	893	195	293	24.1	
" "	8-29-78	904	440	660	13.7	
" "	8-29-78	940	429	644	2.50	
Employee operated sander, shaper, saws, planer	8-28-78	942	425	638	1.94	
" "	8-28-78	918	423	635	5.24	
" "	8-29-78	946	432	648	11.9	

\+ All samples were breathing zone samples.

++ Sample 902 was the first half of the shift and 893 was the second half of the shift. 36.1 is the full shift time weighted average.

* TWA - Time Weighted Average

** mg/cu m - milligrams of substance per cubic meter of air.

T A B L E 5

EXHAUST VENTILATION FOR WOODWORKING EQUIPMENT

NORTHPARK MILLWORK LTD.
COLORADO SPRINGS, COLORADO

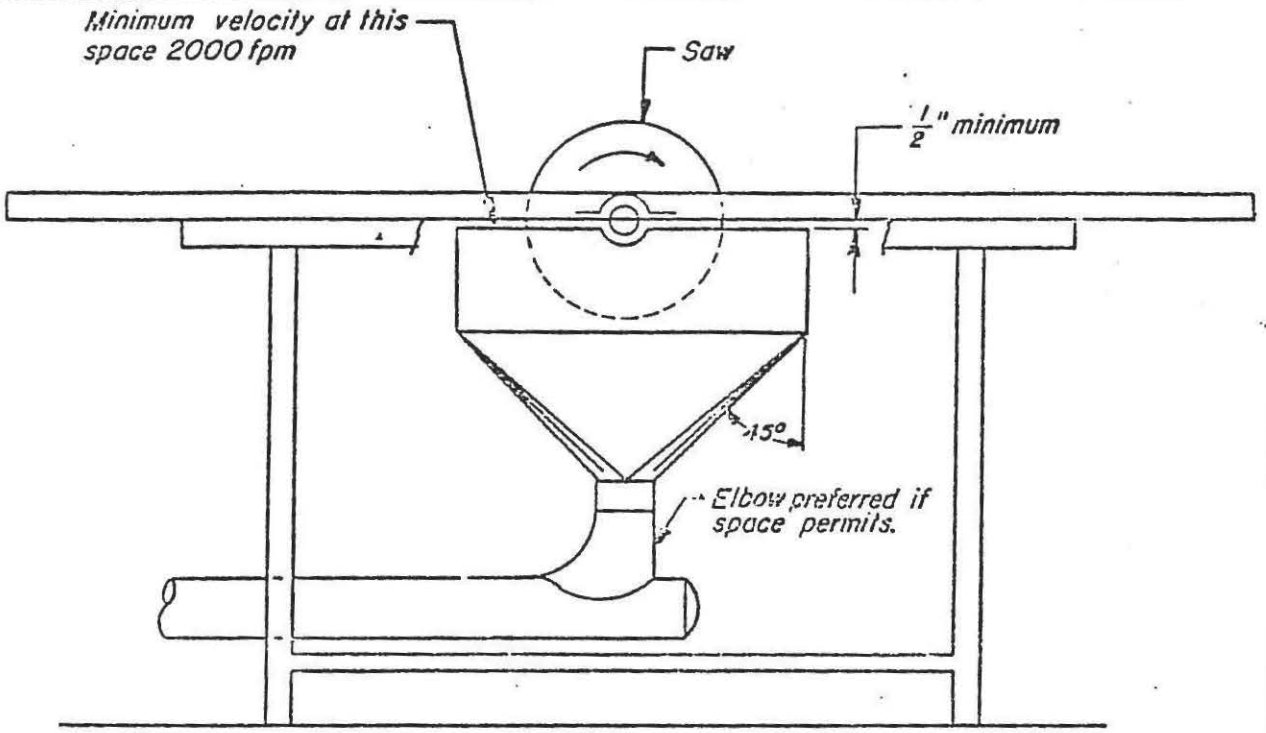
HHE 78-92

EQUIPMENT	APPROX. MEASURED CFM	APPROX. RECOMMENDED CFM *
32" drum (belt) sander	440	600
Shaper	350	400
Single Planer	745	1100
Jointer	440	440
Self-fed table rip saw	95	440 bottom 350 top > 790 total
Swing Saw	95	350
Belt Sander	210	350
Dado (on Panel Frame)	95	440
Automatic Panel Saw	260	350
Radial Arm Saw	260	450
Table Saw	No Exhaust Vent	350

* From the Industrial Ventilation Manual (Ref 7)

T A B L E 6

HOOD DESIGN FOR TABLE SAW
NORTHPARK MILLWORK LTD.
COLORADO SPRINGS, COLORADO
HHE 78-92



Table, rip, mitre and variety saws.

Saw diameter, inches	Exhaust volume, cfm
Up to 16 incl.	350
over 16 to 24 incl.	440
over 24	550
variety with dado	550

Duct velocity = 3500 fpm
Entry loss = 1.0 slot VP + 0.25 duct VP

AMERICAN CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGIENISTS

TABLE SAW

DATE	1-68	VS-708