

U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE  
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH  
CINCINNATI, OHIO 45202

HEALTH HAZARD EVALUATION DETERMINATION  
REPORT NO. 77-101-441

DAP DERUSTO, INC.  
TIPP CITY, OHIO

NOVEMBER 1977

I. TOXICITY DETERMINATION

It has been determined on the basis of environmental sampling that the levels of mineral spirits, xylene, toluene, cellosolve acetate, ammonia, methylene chloride, and nuisance dust did not exceed recommended criteria on an 8-hour time-weighted average concentration basis within the worksite area at the time of this evaluation, (September 2, 1977). However, results of employee interviews indicate employees are experiencing numerous symptoms which can be associated with solvent exposures. Ventilation studies revealed little air movement in several locations, some of which were locations where the use of solvents was the greatest. These areas include the add mix tank washing and to a lesser degree, the mixing area. Therefore, on the basis of employee health complaints, it is recommended that local ventilation be installed in these areas.

II. DISTRIBUTION AND AVAILABILITY OF REPORT

Copies of this Determination Report are currently available upon request from NIOSH, Division of Technical Services, Information 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) DAP Derusto, Inc., Tipp City, Ohio
- b) Authorized representatives of employees
- c) U.S. Department of Labor - Region V
- d) NIOSH - Region V

For the purpose of informing the approximately "50" affected employees, the employer shall promptly "post" for a period of 30 calendar days, the 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 (NIOSH), received such a request from an authorized representative of employees regarding employees exposure to solvents, dusts and ammonia. Reported symptoms included fatigue, headache, dizziness, nausea, eye and throat irritation, numbness in fingers and arms, breathing difficulties and an unusually high incidence of bladder infections.

### IV. HEALTH HAZARD EVALUATION

#### A. Conditions of Use

The DAP Derusto plant in Tipp City is mainly involved in the manufacture of paints and to a lesser extent with other coatings, glues and cleaners. The products are predominantly packaged in pint, quart or gallon metal containers or aerosol cans, depending on the particular product. The process begins in the compounding area where the paints or materials are mixed using high speed dispersers. The solvents and liquid resins are brought into the area via enclosed pipelines from outside underground tanks and flow directly into the mixing tanks or are added manually, depending on the solvent and quantity used. The pigments and powdered inert materials are all added manually. After the mixing is complete the paint is stored in either stationary storage tanks in the area or in large portable tanks. The portable tanks are then taken from the compounding area to the filling area. In the case of the stationary tanks, the material is pumped to the filling area via pipelines. Two basic types of operations are conducted in the filling area. The paint can be packaged in pint, quart or gallon metal containers. This process is predominantly done by machines. The correct volume of paint is dispersed into the cans, the cans are sealed with metal lids, labels are applied and the cans are placed in cardboard boxes ready for shipment. The second process involves filling aerosol cans. The material is added to the cans, the propellant injected and the can capped and packaged for shipment. After the tanks are empty they are taken back into the compounding area and washed, generally using mineral spirits. This is a manual operation with mineral spirits being taken out of a five gallon can using a smaller can. The solvent is thrown against the inside wall of the tank, which is then washed using a broom. This operation has the potential for one of the highest solvent exposure situations.

Approximately 11 employees work in the compounding area and 26 in the filling area. General ventilation is provided throughout the plant and local ventilation is provided on the aerosol line.

## B. Evaluation Methods

### 1. Environmental

An environmental-medical survey was conducted on September 1-2, 1977. On September 2, samples were collected in the compounding area for nuisance dust using VM-1 filters at a flow rate of 1.5 lpm. Personal breathing zone and area charcoal tube samples were taken in the compounding area and filling areas for mineral spirits, xylene, toluene and cellosolve acetate. Samples were collected at a flow rate of 50 cc/min and were analyzed by gas chromatographic procedures. On the aerosol line, impinger samples for ammonia were collected. Samples were collected in Nessler Reagent at a flow rate of 1 lpm and analyzed colorimetrically. Also collected on the aerosol line was a personal charcoal tube sample for methylene chloride which was analyzed by gas chromatographic procedures.

### 2. Medical

Nondirected medical questionnaires were administered to 53 employees on September 2, 1977. This number represents most, if not all, of the employees at work in the plant on that date.

## C. Evaluation Criteria

To assess the concentrations of air contaminants found in the place of employment, three primary sources of criteria were used: (1) NIOSH criteria for recommended standards for occupational exposure to substances (criteria documents); (2) recommended and proposed threshold limit values (TLV's) and their supporting documentation as set forth by the American Conference of Governmental Industrial Hygienists (ACGIH) (1976); and (3) occupational health standards as promulgated by the U.S. Department of Labor (29 CFR Part 1910.1000).

In the following tabulation of criteria appropriate values are presented with references.

<u>Substances</u>	<u>Permissible Exposures</u> (8-hour Time Weighted Average)
1 Toluene	100 ppm
2 Xylene	100 ppm
3 Nuisance Dust	10 mg/M <sup>3</sup>
4 Methylene Chloride	75 ppm
5 Ammonia	50 ppm*
6 Mineral Spirits	800 mg/M <sup>3</sup>

\*Ceiling value - concentration that should not be exceeded.

- 1 Reference: The NIOSH 1973 criteria document, the 1976 ACGIH TLV and the current Occupational Safety and Health Administration (OSHA) standard.
- 2 Reference: The NIOSH 1975 criteria document, the 1976 ACGIH TLV and current OSHA standard.
- 3 Reference: The 1976 ACGIH TLV. The current OSHA standard is 15 mg/M<sup>3</sup>.
- 4 Reference: The NIOSH 1976 criteria document. The 1976 ACGIH TLV is 220 ppm and the current OSHA standard is 500 ppm.
- 5 Reference: The NIOSH 1974 criteria document, the 1976 ACGIH TLV and current OSHA standard.
- 6 Reference: Calculated value. Currently there is no federal standard for occupational exposure to mineral spirits. Mineral spirits are a petroleum distillate fraction composed primarily of paraffins and naphthenes. ACGIH has recommended an equation for computing threshold limit values for petroleum distillates for which no specific TLV's are listed.

$$\text{TLV} = \frac{100}{\frac{\% \text{ A1}}{3.6 (200 - \text{B.P.}^\circ\text{C}) + 20} + \frac{\% \text{ Ar}}{1.3 (200 - \text{B.P.}^\circ\text{C}) + 10}} \text{ ppm}$$

where % A1 = aliphatic components

% Ar = aromatic components

B.P. = mean boiling point in degrees centigrade

The specific brand of mineral spirits used at DAP Derusto contains 7% aromatics and has a mean boiling point of 315<sup>o</sup>F. The calculated TLV is then approximately 800 mg/M<sup>3</sup>.

The NIOSH criteria document on Refined Petroleum Solvents recommends that no employee be exposed to a typical mineral spirit in concentrations greater than 350 mg/M<sup>3</sup>. A typical mineral spirit is defined as being composed of 80-86% saturated hydrocarbons, 1% olefins and 13-19% aromatics. Due to the aromatic content of the mineral spirit used at DAP, the 800 mg/M<sup>3</sup> criteria is considered to apply.

#### D. Evaluation Results and Discussion

The results of the filter samples collected for nuisance dust in the compounding area are given in Table 1. Results range from non-detected to 1.2 mg/M<sup>3</sup>. All results are well below the 10 mg/M<sup>3</sup> standard for nuisance dust. Table 2 contains the results of the charcoal tube samples collected

for mineral spirits, xylene, toluene and cellosolve acetate. A review of the results show all measured concentrations are below levels believed to cause adverse health effects. Even when considering the additive effects of the various solvents present, measured levels are all less than a calculated exposure limit for a mixture of these substances. Low concentrations of ammonia and methylene chloride were also measured on the aerosol line. Results are listed in Tables 3 and 4.

Table 5 lists the symptoms or health complaints reported by employees who were interviewed on September 2, 1977. Of the 53 employees who were interviewed, 15 employees (28%) reported no health problems. (Most of the individuals reporting no health complaints worked in the warehouse.) The most frequently reported complaints were nausea, headaches and dizziness or lightheadedness.

One or more of these symptoms were reported by 25% of the individuals interviewed. Such symptoms are consistent with those observed as a result of solvent exposure, although environmental measurements indicated no excessive solvent levels. Although integrated environmental measurements for solvents were low, ventilation measurements revealed several areas where almost no air movement was occurring. These observations were made using smoke tubes. Stagnant areas were particularly noted in the add mix area and tank washing area. These were also the areas where the highest solvent concentrations were measured.

The presence of symptoms without the apparent presence of excessive solvent levels may be explained in the following manner. Employees may be exposed to high solvent levels for brief periods of time. The remainder of their workday may be spent in areas where solvent levels are very low. As a result, the TWA exposures are below the recommended criteria. However, during the employees high exposure times, levels of solvents may be great enough to produce the reported symptoms. Therefore, based on the lack of air movement and the number of employee complaints, additional ventilation appears advisable. It is recommended that local ventilation be installed in the add mix area, for tank washing and, of secondary importance, in the mixing area.

The ventilation system at DAP Derusto appears to rely heavily on the "number of air changes per hour" concept. It must be understood that ventilation requirements based on room volume alone has no validity. Calculations of the required rate of air change can only be made on the basis of material balance for the contaminants under question. Air change rate must be based on site and rate of generation of the contaminants. In the design of industrial ventilation, "number of air changes" rarely has valid application. The term is useful when applied to situations such as meeting rooms or offices but rarely to industrial processes. DAP should reevaluate their ventilation system with the sites of generation of contaminants and local ventilation controls in mind.

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Table 1

DAP Derusto, Inc.  
Tipp City, Ohio

September 2, 1977

## Nuisance Dust

<u>Sample Location</u>	<u>Sample Number</u>	<u>Sampling Period</u>	<u>Sample Volume</u> (liters)	<u>Nuisance Dust</u> (mg/M <sup>3</sup> )
Compounder A	V3186	07:45-15:37	708	0.5
Compounder B	V1162	07:48-15:32	696	1.2
Compounder C	V1329	07:57-15:41	696	0.2
Compounder D	V1385	08:00-15:40	690	0.2
Compounder E	V1156	08:00-15:35	670	N.D.*
Compounder F	V1271	10:12-15:45	499	0.3

\*N.D. - Not detected

Table 2

DAP Derusto, Inc.  
Tipp City, Ohio

September 2, 1977

<u>Sample Location</u>	<u>Sample Number</u>	<u>Sampling Period</u>	<u>Sample Volume</u> (liters)	<u>Mineral Spirits</u> (mg/M <sup>3</sup> )	<u>Toluene</u> (ppm)	<u>Xylene</u> (ppm)	<u>Cellosolve Acetate</u> (mg/M <sup>3</sup> )
Compounder A	CT-1	07:45-11:55	12.6	71	10	0.7	N.D.
	CT-16	12:30-15:37	9.6	31	9	1.0	2.0
Compounder B	CT-2	07:48-11:50	11.2	53	10	0.6	N.D.
	CT-17	12:25-15:42	8.9	22	23	0.8	N.D.
Compounder C	CT-3	07:57-12:00	11.6	43	4	0.6	N.D.
	CT-18	12:35-15:41	9.3	43	7	0.7	N.D.
Compounder D	CT-4	08:00-12:00	13.4	74	6	0.7	N.D.
	CT-19	12:30-15:40	11.6	112	32	1.8	2.6
Compounder E	CT-15	08:08-11:55	10.7	84	19	1.1	N.D.
	CT-20	12:27-15:35	8.3	108	44	1.4	N.D.
Paint Mixer	CT-5	08:10-11:55	12.3	32	4	0.6	N.D.
Tank Washer	CT-6	07:52-11:55	11.4	70	11	1.0	N.D.
	CT-29	12:30-15:30	8.5	129	55	1.9	N.D.
Add Maker	CT-7	08:05-12:00	12.5	40	11	2.2	N.D.
	CT-30	12:25-15:35	8.9	45	10	2.1	2.3
Compounder F	CT-25	12:35-15:35	10.3	58	18	1.4	N.D.
Filler Operator, Line 2	CT-8	08:15-11:50	9.6	73	27	1.2	N.D.
	CT-21	12:40-15:30	7.7	78	33	1.5	5.2
Area Above Gluer	CT-9	08:17-12:25	11.2	44	6	0.8	N.D.
	CT-22	12:25-15:30	8.9	34	9	0.8	N.D.
Maintenance Man	CT-10	08:20-11:55	10.4	9	4	0.2	N.D.
	CT-23	12:30-15:35	8.3	24	5	0.6	N.D.
Filler Operator, Line 4	CT-11	08:26-11:55	10.0	10	2	N.D.	N.D.
	CT-24	12:40-15:30	8.8	11	5	N.D.	N.D.
Area Sample in Compounding	CT-13	08:50-12:20	12.6	16	5	0.6	N.D.
	CT-26	12:20-15:40	12.0	58	10	1.0	N.D.
Area Sample Add Mixing	CT-27	12:20-14:45	2.7	37	12	2.6	N.D.
	CT-32	12:20-15:33	8.6	93	19	1.9	N.D.



Table 3

DAP Derusto, Inc.  
Tipp City, Ohio

September 2, 1977

Aerosol Line

<u>Sample Location</u>	<u>Sample Number</u>	<u>Sampling Period</u>	<u>Sample Volume (liters)</u>	<u>Ammonia (ppm)</u>
Above filling head	N-1	11:05-14:55	230	4.3
Beside filling head	N-2	11:05-14:55	230	1.2

Table 4

DAP Derusto, Inc.  
Tipp City, Ohio

September 2, 1977

Aerosol Line

<u>Sample Location</u>	<u>Sample Number</u>	<u>Sampling Period</u>	<u>Sample Volume (liters)</u>	<u>Methylene Chloride (ppm)</u>
Aerosol line filling	12	08:43-10:40	6.6	29

Table 5

DAP Derusto, Inc.  
Tipp City, Ohio

September 2, 1977

Reported Symptoms by History

<u>Symptoms</u>	<u>Number of People Reporting Symptom*</u>
Headaches	13
Nausea	15
Dizziness or lightheadedness	15
Skin irritation or rash	6
Eye irritation	3
Fatigue	3
Weakness	1
Bladder infections	2
<u>Chest tightness</u>	<u>1</u>

\*Some individuals reported more than one symptom.  
53 individuals interviewed.