

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

HEALTH HAZARD EVALUATION DETERMINATION  
REPORT NO. 74-144-211

FILE COPY

SAFEGUARD AUTOMOTIVE COMPANY  
BALTIMORE, MARYLAND  
JULY 1975

I. TOXICITY DETERMINATION

It has been determined that employee exposures to mineral spirits and sodium hydroxide are not toxic at concentrations usually encountered by employees. Short-term potentially toxic exposures may exist during certain work procedures which require leaning directly over open containers of either mineral spirits or sodium hydroxide solution. This determination is based on results of environmental concentration measurements, interviews with employees, and observation of work practices.

Concentrations of sodium hydroxide and of mineral spirits, as determined from samples collected in the workers' breathing zones, were found to be non-toxic. Area samples, obtained directly above the vibrator where mineral spirits are added or on the tank containing sodium hydroxide solution, indicated concentrations which were significantly higher than those found in breathing zone samples. Employees would not normally encounter these higher concentrations for any but a short exposure during routine maintenance procedures. During these brief exposures, employees should be provided with appropriate protective equipment. Recommendations pertaining to protective equipment are included in the report.

II. DISTRIBUTION AND AVAILABILITY OF DETERMINATION REPORT

Copies of this Determination Report are available upon request from the Hazard Evaluation Services Branch, NIOSH, U. S. Post Office Building, Room 508, 5th and Walnut Streets, Cincinnati, Ohio 45202. Copies have been sent to:

- a) Safeguard Automotive Company, Baltimore, Maryland
- b) Authorized Representative of Employees
- c) U.S. Department of Labor - Region III
- d) NIOSH - Region III

For the purposes of informing the approximately 10 "affected employees", the employer shall promptly "post" the Determination Report in a prominent place(s) near where exposed employees work for a period of 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 a written request by an employer or authorized representative of employees, to determine whether any substance normally found in the place of employment has potentially toxic effects in such concentrations as used or found.

The National Institute for Occupational Safety and Health received such a request from an authorized representative of employees regarding exposure of employees to Oakite (containing sodium hydroxide) during the operation of a washing machine and to Odorless Mineral Spirits which is used in a vibrating machine, at Safeguard Automotive Company, Baltimore, Maryland. The request alleged that the vapors and mists from these machines caused the workers to cough and feel sick.

IV. HEALTH HAZARD EVALUATION

A. Plant Process - Conditions of Use

Safeguard Automotive Company rebuilds and reconditions automobile generators and starters. In the two processes observed, disassembled parts are cleaned in preparation for rebuilding. One process uses mineral spirits and media (abrasive stone pellets) in a vibrating machine while the other uses heated Oakite 145, a caustic detergent, to clean the parts. Disassembled generators and starters are conveyed to one or the other of these cleaning procedures. The two processes are adjacent to one another, but are not operated on the same days. Each might run 2 or 3 times per week, for an entire 8-hour shift.

The plant has been in operation since 1961, but both of these machines are relatively new. The Cincinnati washer, which operates on the same principle as a car wash and which uses Oakite 145, has been in operation approximately 1 year as of March 1975. The Rampe machine essentially vibrates the engine parts with an abrasive and mineral spirits, and has been operating since July 1973.

Three persons are normally employed to run the Rampe machine. Engine parts are placed on a conveyor belt by a feeder operator and are dropped into the "Kleen Abrader" along with abrasive stone (in pellet form) and mineral spirits. The vibrating action of this machine has a cleaning effect. Every 15 seconds, a door opens on the output side and the cleaned parts are pushed out onto a slotted conveyor. The spaces between the slots permit the abrasive stone and mineral spirits to fall through and be collected below the conveyor for recycling. The mineral spirits collect in an open trough on the floor and pass through a fabric filter before reuse. The open surface area of the trough is approximately 10 square feet.

The parts are then conveyed through an enclosed cabinet in which mineral spirits are sprayed on the parts to rinse them. A take-off operator removes the cleaned parts and loads them into wire baskets. A third person oversees and maintains the continuity of the entire operation. He is also responsible for maintaining the level of mineral spirits at 300 gallons, which entails the addition of approximately 10-15 gallons per day.

The Cincinnati washer is comprised of two large, enclosed cabinets, one for steam cleaning and one for drying, through which the parts move on two 36 foot-long conveyor belts. As the engine parts move through the first cabinet, a detergent is sprayed on them. This detergent is composed of a 5% solution of Oakite 145 in water; Oakite 145 contains 35% sodium hydroxide. The solution is heated to 160°-170°F. The parts then are conveyed through a gas-fired hot air dryer to the take-off end of the process. Both cabinets are vented to the outside.

Four or five persons are usually employed at the Cincinnati washer: 2 persons at the feed end, 1 person for maintenance, and 1 or 2 persons at the take-off end. The maintenance person is responsible for replenishing the detergent with approximately 15-25 gallons per day. This is done by hand, with a bucket. Rubber gloves are required here and at the take-off end; fabric gloves are worn by the feeder operators. No other personal protective equipment is required.

#### B. Evaluation Design and Methods

Environmental investigations were performed on February 19-21, 1975 by NIOSH industrial hygienists. A preliminary observational survey was made on February 19 to identify the areas in which the alleged hazardous materials were being used.

On February 20, during the operation of the Rampe machine, employees' breathing zone and area samples were obtained for mineral spirits using personal sampling pumps and charcoal tubes. The area samples were collected directly above the Kleen Abrader where the mineral spirits are added. The environmental air samples were analyzed by gas chromatography at the NIOSH Laboratories in Salt Lake City. A bulk sample of the Odorless Mineral Spirits was qualitatively analyzed and was not found to contain any benzene.

The Cincinnati washer was in operation on February 21, and breathing zone and area samples were collected using personal sampling pumps and pre-weighed cellulose membrane (AA) filters in 3-piece filter cassettes. Total weight gain of the filters was determined gravimetrically and the concentration of sodium hydroxide was determined by atomic absorption analysis for sodium and multiplication by a constant.

Fifteen persons were identified as having worked at least one day at either of the two cleaning operations. Twelve of the fifteen were present at the plant and were given non-directed medical questionnaires to determine the presence of any work-related health problems.

Although physical agents are outside the scope of Section 20(a)(6) of the Occupational Safety and Health Act, it is NIOSH policy to report such health hazards when observed in workplaces during an investigation. On February 20, during the operation of the Rampe machine, noise levels were measured using a General Radio Model 1565 sound level meter.

#### C. Evaluation Criteria

##### 1. Environmental Standards

The Occupational Health Standard for sodium hydroxide, as promulgated by the U. S. Department of Labor (29 CFR 1910.93, Table G-1), has been set at 2 mg/M<sup>3</sup> determined as an 8-hour time-weighted average exposure. This standard is designed to protect the health and safety of workers exposed to sodium hydroxide for an 8-hour workday, 40-hour week, over a working lifetime. Because of the irritant effects of caustic mists, the ACGIH has recommended that a ceiling limit of 2 mg/M<sup>3</sup> be designated for exposure to sodium hydroxide.

There is currently no federal standard for occupational exposure to mineral spirits, which is a petroleum distillate fraction composed primarily of paraffins and naphthenes. The specific brand of mineral spirits used at Safeguard Automotive contains less than 0.1% aromatic hydrocarbons, and approximately 87% paraffins, and 13% naphthenes. The American Conference of Governmental Industrial Hygienists has recommended an equation for computing threshold limit values for petroleum distillates for which no specific TLV exists.

TLV	100	ppm
% Al 3.6 (200-B.P. <sup>o</sup> C.) + 20	+	% Ar 1.3 (200-B.P. <sup>o</sup> C.) + 10

% Al = % aliphatic

% Ar = % aromatic

B.P. = boiling point in degrees centigrade

Assuming the mid-point of the range of boiling points to be 175<sup>o</sup> for mineral spirits, the TLV would be approximately 670 mg/M<sup>3</sup>.

## 2. Toxicologic Effects

### a. Mineral Spirits

Acute exposures to high concentrations of petroleum naphthas, a generic name for a group of related compounds including mineral spirits, have been known to produce central nervous system depression. Effects ranging from headache, nausea, inebriation, and stupor to anesthesia and coma have been reported following single acute exposures. Irritation of the skin and mucous membranes of the respiratory tract and eyes have also been associated with prolonged or repeated exposure to petroleum naphthas.<sup>1,2</sup>

Chronic toxicity of the petroleum naphthas has not definitely been established. Reports of toxicologic effects of mineral spirits on humans or animals exposed to concentrations in the range of the federal standard are absent from the literature. The manufacturer of Odorless Mineral Spirits as supplied to Safeguard Automotive, recommends a TLV of 300 ppm, which they base on their own unpublished animal experiments.

### b. Sodium Hydroxide

Sodium hydroxide is a strong alkali capable of producing irritation of the mucous membranes and respiratory tract and tissue destruction in higher concentrations. The current standard was designed to prevent excessive irritation.<sup>3,4,5,6</sup>

## E. Evaluation Results and Discussion

### 1. Environmental

Breathing zone and area samples for mineral spirits were analyzed by gas chromatography. The results of these analyses are shown in Table 1. Concentrations of mineral spirits ranged from 16 to 756 mg/M<sup>3</sup> in breathing zone samples. The take-off operator had the highest exposure on the day of the survey, and the feeder had the lowest exposure. The time-weighted average exposure of the take-off operator approximated the TLV for mineral spirits of 670 mg/M<sup>3</sup>, as calculated by the ACGIH recommended equation. The concentrations of mineral spirits ranged from 884 to 6184 mg/M<sup>3</sup> in area samples. These were taken directly above the Kleen Abrader where mineral spirits are added and therefore represent the maximum concentrations attainable. Employees are not usually exposed to these higher concentrations, however, it is possible that the person responsible for maintenance and supervision might occasionally lean over the Kleen Abrader.

Environmental air samples collected during the operation of the Cincinnati washer were analyzed for sodium hydroxide and the results are presented in Table 2. Sodium hydroxide concentrations were found to range from

0.01 to 0.12 mg/M<sup>3</sup> in breathing zone samples and from 0.06 to 0.30 in area samples. All environmental sodium hydroxide concentrations were well below the recommended criteria. The ventilation for the Cincinnati washer seems to be adequate; however when the tank cover is opened to replenish or check the level of Oakite solution, the operator could be exposed to concentrations higher than those reported.

The sound level readings as measured on February 20 are reported in Table 3. Noise levels ranged from 84-88 dbA at the feeder station to 94-99 dbA to the left of the Kleen Abrader. The average sound level reading at the Rampe machine was approximately 92 dbA.

## 2. Medical

Review of the employee interview responses by NIOSH physicians revealed evidence of transient irritation of the mucous membrane of the eyes, nose, and throat as well as transient headaches in several of the employees working at or around the Rampe machine and Cincinnati washer. In most cases the occurrence of these symptoms coincided with maintenance activities, including checking the levels of liquids in the tanks or replenishing the supply of mineral spirits or Oakite. This would suggest that a potentially toxic situation may exist for short periods of time during routine operation of the machines. Interviews did not suggest any evidence of chronic disease related to work at these machines.

## F. Conclusions and Recommendations

Based upon analyses of air samples and employee interviews, it has been determined that concentrations of mineral spirits or sodium hydroxide as normally encountered are not toxic to employees. Some potentially toxic exposures may occur when certain routine maintenance procedures are performed and personal protective equipment should be provided and used during these intermittent operations. A Mine Safety Appliances organic vapor canister (part number 448974) with a full facepiece (either part number 95940 or 96680) has been approved by NIOSH for use in atmospheres containing dusts or mists as well as organic vapors. (Approval number TC-14G-87). This would be suitable for use during intermittent exposures to either sodium hydroxide or mineral spirits. Employees should be given instruction on the use of respirators, cleaning of respirators, and how to test for leakage.

Gloves which are impervious and resistant to sodium hydroxide and mineral spirits (such as neoprene or polyvinyl chloride) should be worn.

In addition, emergency eye wash and safety showers should be made available within close proximity of the two machines.

V. REFERENCES

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Table 1

RESULTS OF ENVIRONMENTAL SAMPLING FOR MINERAL SPIRITS AT RAMPE MACHINE  
 February 20, 1975

Job Title	Sampling Period	Concentration (mg/M <sup>3</sup> )	TWA* (mg/M <sup>3</sup> )
Feeder	7:53 - 9:45 am	16	43
	9:45 - 11:50 am	52	
	1:00 - 3:25 pm	56	
Maintenance/ Supervision	7:50 - 9:45 am	137	188
	9:45 - 11:50 am	126	
	1:00 - 3:25 pm	283	
Take-off	7:55 - 9:45 am	469	594
	9:46 - 11:50 am	756	
	1:00 - 3:25 pm	551	
Area - at Kleen Abrader	8:25 - 9:45 am	884	3967
	10:00 - 11:50 am	3148	
	1:00 - 3:25 pm	6184	
Blind Blanks		15	3967
		25	

$$*TWA = \frac{(C_1 T_1 + C_2 T_2 + C_3 T_3)}{T_1 + T_2 + T_3}$$

TWA = time-weighted average concentration

C = concentration

T - time (min.)

Table 2

## RESULTS OF ENVIRONMENTAL SAMPLING FOR SODIUM HYDROXIDE AT CINCINNATI WASHER

February 21, 1975

<u>Job Title</u>	<u>Sampling Period</u>	<u>Concentration</u> (mg/M <sup>3</sup> )	<u>TWA*</u> (mg/M <sup>3</sup> )
Feeder 1	7:33 - 11:39	.08	.08
	12:40 - 3:10	.09	
Feeder 2	7:45 - 11:39	.07	.05
	12:40 - 3:18	.01	
Maintenance/ Supervision	7:40 - 11:40	.06	.05
	12:42 - 3:18	.02	
Take-off	7:41 - 11:39	.10	.11
	12:42 - 3:17	.12	
Area - at Supply Tank	7:53 - 9:40	.12	.13
	7:53 - 9:40	.13	
	9:40 - 11:39	.07	
	9:40 - 11:39	.09	
	12:44 - 3:17	.30	
	12:44 - 3:17	.06	

$$*TWA = \frac{(C_1T_1 + C_2T_2 + C_3T_3)}{T_1 + T_2 + T_3}$$

TWA = time-weighted average concentration

C = concentration

T = time

Table 3

## RESULTS OF SOUND LEVEL MEASUREMENTS AT RAMPE MACHINE

February 20, 1975

<u>Location</u>	<u>Sound Level dbA (slow)</u>	
	<u>range</u>	<u>average</u>
Feeder station	84-88	86
Kleen Abrader-right side	91-95	93
Kleen Abrader-left side	94-99	96 1/2
3 feet from Kleen Abrader	90-94	92
7 feet from Kleen Abrader	89-94	91 1/2
Beginning of spray cabinet	94-97	95 1/2
Take-off station	86-89	87 1/2

NIOSH and the TLV Committee of the ACGIH have recommended the following exposure limits for noise:

<u>Duration per day, hours</u>	<u>Sound level dbA (slow)</u>
8	85
4	90
2	95
1	100
1/2	105
1/4	100
1/8	115