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. 75-103-261

ROBERTS DIESEL SERVICE
GARDEN CITY, GEORGIA

FEBRUARY 1976

I. TOXICITY DETERMINATION

Based upon results of environmental and medical investigations (which included airborne sampling, non-directed medical interviews with current workers, and medical review of the pulmonary problem of a former employee), NIOSH investigators believe that steam cleaning operations as normally performed do not present a health hazard to operators. Airborne concentrations of potentially toxic substances (sodium hydroxide and butyl cellosolve) liberated in the process from a solution of commerical general purpose steam cleaning soap (GPSCS) were measured at levels below current NIOSH and OSHA recommended standards. Since the GPSCS is highly alkaline and can produce severe skin burns, appropriate precautions are recommended in handling.

II. DISTRIBUTION AND AVAILABILITY OF DETERMINATION REPORT

Copies of this Health Hazard Evaluation Toxicity Determination Report are available upon request from the Hazard Evaluation Services Branch, NIOSH, U.S. Post Office Building, Room 508, Fifth and Walnut Streets, Cincinnati, Ohio 45202.

Copies have been sent to:

a) The Roberts Diesel Service
b) U.S. Department of Labor, Region IV
c) NIOSH - Region IV

For purposes of informing the affected employees of the determination the employer shall upon its receipt post a copy of the determination for a period of 30 calendar days at or near the work place(s) of affected employees. The employer shall take steps to insure that the posted determination is not altered, defaced, or covered by other material during such period.

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 a request from the employer, Roberts Diesel Service in Garden City, Georgia to evaluate a potential health hazard in operation of a steam cleaner. The request was prompted by the development of a lung problem by one of the employees who occasionnally operated the steam cleaner.

IV. HEALTH HAZARD EVALUATION

A. Description of Process - Conditions of Use

Roberts Diesel Service is a small service and repair shop for diesel trucks and is operated by the owner who employs three mechanics. Steam cleaning of engines and of large flat-bed refrigerated trailers has only occasionally been done (depending upon requester demand) over the last few years at this facility.

A "Malsbery Steam Cleaner" Model 150 is utilized in conjunction with a "general purpose steam cleaning soap" (GPSCS) supplied by the Savannah Brush and Chemical Company. Mineral spirits are used to fire the cleaner.

Engine or trailer cleaning jobs are accomplished in relatively short-time periods (about 10-30 minutes). In the use of the cleaner, one quart of GPSCS, obtained from a 55-gallon drum stock supply, is added manually to a 5 gallon reservoir containing water in the steam cleaner. The cleaner water pump further dilutes the reservoir supply in application at the rate of 140 gallons of water per hour. The reservoir supply usually lasts about 2 hours before recharging is necessary.

"GPSCS" is reportedly widely used in the southern United States for steam cleaning. It is an ionic and non-ionic detergent blend with alkaline building sequestriants and inhibitors. Its main ingredient is water. Cleaning agents are principally caustic soda (~3%) and butyl cellosolve (~3%). At full strength it has a PH of 13.1.

B. Evaluation Progress and Design

An observational and enyironmental survey was conducted by NIOSH industrial hygienist, Jerome P. Flesch, on June 23, 1975.

Initial discussions with the employer were completed regarding the process operations of concern. It was disclosed that a former employee had experienced a lung problem which a private physician opinioned may have been work related. The process itself, steam cleaning of engines and trailers, had been done only sporadically in the past and its need or call at the time of the survey unpredictable.

Based upon the information it was decided that a simulated steam cleaning operation would be set up and appropriate air sampling conducted to determine the degree of emissions likely to be encountered in such operations.

Some employees had reportedly operated the steam cleaner. Non-directed medical questionnaires were administered to all current workers (four).

Subsequent to the field evaluation, a NIOSH physician contacted the affected former employee and his private physicians to discuss their findings.

C. Evaluation Methods

1. Environmental

Caustic soda (sodium hydroxide): Air samples were collected on vinyl metricel (VM) 37 mm, 0.8 micron pore size, filters in closed-face cassettes using calibrated MSA Model G battery-powered pumps at an air flow rate of 2.0 liters per minute. Analyses for total sodium content was accomplished by flame emission photometry.

Butyl cellosolve: Air samples were collected in glass tubes containing activated charcoal using both battery-powered Sipin pumps at an air flow rate of 200 cubic centimeters per minute and MSA Model G pumps at 1.0 liter/minute. Analysis was accomplished according to NIOSH PCAM #127 (desorption with carbon disulfide, gas chromatography).[1]

PH: PH Analysis of the soap "GPSCS" stock and dilute solutions were accomplished by the NIOSH laboratory using a Corning Model 112 PH meter.

D. Evaluation Criteria

Caustic Soda (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 especially on direct contact with the skin. NIOSH in its Criteria Document[2] has recently recommended occupational exposure to sodium hydroxide

mist be controlled so that no worker is exposed at a concentration greater than 2.0 milligrams per cubic meter (mg/M3) of air for any 15 minute sampling period. The Federal Standard set by the U.S. Department of Labor (OSHA) (29 CFR 1910.93, Table G1) is 2 mg/M3 determined as an 8-hour time-weighted-average TWA daily exposure designed to protect workers exposed over a working lifetime.

2-Butoxy Ethanol (Butyl Cellosolve: Butyl Cellosolve penetrates the skin readily and toxic action from excessive skin exposure may be more likely than from vapor inhalation. The OSHA standard has been set at 50 ppm (240 mg/M3) determined as an 8-hour TWA, a level of exposure that should prevent irritation as well as systemic effects.

E. Evaluation Results and Discussion

1. Environmental Evaluation

Bulk liquid samples of the stock "GPSCS" solution were collected which the NIOSH laboratory verified to be highly alkaline: stock solution - ph of 13.59; diluted stock solution 1:1100; ph of 10.65.

Air samples were collected under simulated cleaning operations on June 23, 1975. Sampling was conducted outdoors at the rear of the facility where the "Malsbery" unit is housed. Reservoir or use solutions of GPSCS were freshly prepared in dilutions described in Section IVA. Air samplers were placed within a few feet up from ground level where the discharge nozzle of the cleaner was positioned (as in cleaning a trailer bed). Weather conditions, particularly wind vector, will influence airborne concentrations in the immediate vicinity of the operation. The samplers were located to sample directly in the steam plume as much as possible to simulate a breathing zone exposure likely to be encountered by an operator under normal conditions.

Results of four such sampling periods are summarized in Table I. Sampling periods ranged from 6 to 30 minutes. Sodium hydroxide airborne concentrations ranged from < 0.05 to 1.88 mg/M3; butyl cellosolve concentrations from < 0.05 to 1.0 mg/M3. These concentrations are below recommended levels previously described (see Evaluation Criteria).

2. Medical Evaluation

Non-directed medical questionnaires were administered to four workers currently employed. The two workers who have performed steam cleaning operations reported no health problems related to this operation. Three workers reported feeling tired during the summer months particularly from heat in the shop area (no forced ventilation).

The case of the former employee who experienced a lung problem was investigated by NIOSH physician Theodore Thoburn, M.D. Contacts were made with the two physicians who had treated this individual. Beginning in April 1975 he appeared to develop a pneumonia in his right lung with low grade fever which failed to respond well to treatment of antibiotics for a period of two weeks. Subsequently a segmental pneumonia was demonstrated on X-ray. It was felt that the clinical course was most characteristic of viral pneumonia; although a foreign body lodged in the bronchus might have given a similar picture.

The opinion of the NIOSH physician after reviewing all available information is that the individual's pulmonary problems were not related to his job exposure to cleaning agents.

F. Conclusions and Recommendations

Based upon the results of environmental and medical investigations performed, it is believed that airborne concentrations of toxic substances liberated (sodium hydroxide and butyl cellosolve) from a general purpose steam cleaning soap (GPSCS) as normally used do not present a health hazard to operators.

Since the bulk stock solution of GPSCS is highly alkaline and can cause skin burns and irritation upon direct contact, it is recommended that appropriate precautions are taken to avoid contact when handling this material (as in preparing reservoir solutions). Operators should wear chemical goggles, aprons and gloves which are impervious to caustic solutions. Dilution of the stock solution should be made in proportions recommended by the supplier since excessive concentrations of airborne contaminants (particularly sodium hydroxide) may result if "stronger" solutions are employed.

V. REFERENCE

1. NIOSH Manual of Analytical Methods; USDHEW,CDC,NIOSH, - 1974, Publ. No. 75-121

2. NIOSH Criteria for Recommended Standard...Occupational Exposure to Sodium Hydroxide. HEW Publication No. (NIOSH) 76-105, 1975.

VI. AUTHORSHIP AND ACKNOWLEDGMENTS

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TABLE 1

SUMMARY OF SIMULATED EXPOSURES TO AIRBORNE
TOXIC SUBSTANCES ON STEAM CLEANING OPERATIONS

JUNE 23, 1975

Location	Time Period	Sodium Hydroxide (mg/M^3)	Butyl Cellosolve (mg/M^3)
Area Samples Positioned Approximately 2-3 feet From Discharge Nozzle of Steam Cleaner	09:55 - 10:14	0.64	<0.05
	10:23 - 10:43	<0.05	1.0
	10:55 - 11:01	1.88	<0.05
	11:50 - 12:20	0.52	<0.05