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 DETERMINATION
REPORT NO. 76-22-383

STANDARD FORGINGS CORPORATION
EAST CHICAGO, INDIANA
APRIL 1977

I. TOXICITY DETERMINATION

It has been determined that employee exposures to Tectyl 506® mists and vapors are not toxic at concentrations measured in the finish line or palletizer areas. The palletizer may experience symptoms of upper respiratory or nasal irritation due to occasional peak concentration periods, but other adverse health effects from this exposure are not expected. This determination is based on personal observation, employee interviews, environmental concentration measurements, and the composition and limited use of Tectyl 506®.

Recommendations for improved ventilation in the finish line enclosure have been offered in this report in order to enhance air quality and provide for greater worker comfort.

II. DISTRIBUTION AND AVAILABILITY OF DETERMINATION REPORT

Copies of this Determination Report are 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 have been sent to:

A. Standard Forgings Corporation, East Chicago, Indiana
B. Authorized Representative of Employees, United Steel Workers, Local 1720
C. U.S. Department of Labor - Region V
D. NIOSH Regional Consultant for OSH - Region V
E. NIOSH - DTS, Information Resources and Dissemination Section

For the purposes of informing the approximately 12 "affected employees," the employer will promptly "post" the Determination Report in a prominent place where the affected employees work for a period of 30 calendar days.

® TRADENAME

III. INTRODUCTION

Section 20 (a)(6) of the occupational Safety and Health Act of 1970, 20 U.S.C. 669 (a)(6), authorizes the Secretary of Health, Education, and Welfare, following a written request by 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 (NIOSH) received such a request from an authorized representative of employees, United Steel Workers, Local 1720, regarding employee exposure to airborne mists of Tectyl 506, (a rust preventive allegedly containing 45% mineral spirits) which was contaminating workroom air on the Finish Line, Building 83, at Standard Forgings Corporation, East Chicago, Indiana.

IV. HEALTH HAZARD EVALUATION

A. Plant Process - Conditions of Use

Standard Forgings Corporation manufactures rail road freight car axles. The finish line is located in a walled-in enclosure within a much larger high bay building. (bldg. 83), Rough forged, temperature conditioned axles are passed through a wall opening, center drilled, lathe turned and finish ground to size. The finish line consists of two rough turn lathe machines, and two finish grinders; each axle is conveyed down the line with an automated lift system. The work area (approximately 150 feet long, 50 feet wide and 20 feet high) was ventilated by means of two 36" diameter, roof mounted, exhaust fans. Make up air was pulled into the enclosure from the main building through all enclosure openings. Two newly installed 36" air intake fans on the south wall provided sufficient supply air volume to reverse air through enclosure openings. Durthe winter months these supply fans were not operated. Since a 0.0005 of an inch tolerance is required of the finished axle, a 72°F ambient air temperature is maintained in the finish line enclosure.

After finish machining, the axles are inspected and rolled out a wall opening at the end of the finish line. The "palletizer" positions four axles on a rack and sprays the ends of the axles with a protective coating of Tectyl 506. Spraying takes approximately 2 minutes and an additional 6 minutes is required to load and palletize the 4 axles for shipment. No local exhaust ventilation was provided for the "palletizer", but the work station was located in the large high bay area just outside the finish line enclosure. With the average production rate at 100 axles per shift, total spraying time per shift was approximately 50 minutes. The "palletizer" wore a dust filter mask which apparently reduced nostril irritation from Tectyl 506 mist and spray.

Six to 7 men work the finish line and are, with one or two exceptions, long time employees. Average length of service for all workers in the plant is 27 years. A large reduction in the work force left only those employees with the most seniority. This reduction was required when the company discontinued its drop forging operations. Most of the long term employees had previous experience as hammersmiths. The rail road axle finish line has been in operation for about 6 years, and operates eight hours per shift, two shifts per day, five days a week.

Job Classifications include; 1 Lathe Operator, 1 Spellman, 2 Finish Grinders, 1 Inspector, 1 Palletizer and 1 Foreman.

B. Evaluation Design and Study Progress

An initial survey was conducted on March 31, 1976, in order to observe the finish line, interview the workers assigned, and identify potentially toxic environmental exposures associated with Tectyl 506® overspray from the palletizer work station. It was noted during this survey, that one of two overhead fans was not operating and both were covered with a heavy build up of dirt and lint. A heavy build up of "linty-dust" was evident on all air moving equipment and especially on the large man cooler fan which was located near an entrance door adjacent to the "palletizer" work station. Air was flowing through this door into the finish line area at approximately 50 feet per minute as indicated by measurements with a velometer.

Prior to the initial visit, NIOSH requested information from the supplier, Ashland Oil Inc, regarding substances used in formulation of Tectyl 506®. This product is 50% oxidized petrolatum or heavy petroleum jelly and 45% mineral spirits which serves as the carrier. A definite mineral spirits odor was noted by NIOSH investigators when spraying was in progress.

During the private employee interviews, many of the workers complained about the lack of adequate ventilation. Those interviewed made complaints such as; "hard to breath," "feel sleepy at the end of the shift," "lack of fresh air," or "bad smell from cooling oils," etc. One lathe operator was using a respirator which he had purchased on his own. At the union's request, a physician from the local area (on call to Standard Forgings) had visited the plant prior to the NIOSH initial survey. The doctor did not observe any pathology or symptons of respiratory irritation in any of the workers, but recommended that plant ventilation be improved.

It was pointed out during the initial survey exit interview with management and union representatives, that improved ventilation in the finish line area would resolve the problems identified by the workers. Workers were greatly concerned about the air quality in their area. In order to better evaluate this air quality it was decided that atmospheric sampling for mineral spirits should be accomplished. A follow up environmental survey was scheduled for Aug 17, 1976.

C. Evaluation Methods

Employee personal breathing zone, and area samples were collected on the finish line and palletizing station using vapor adsorbing charcoal tubes and low flow battery operated air sampling pumps. Area samples were collected near the axle roll out beam (1 foot south of axles being sprayed) and directly above the finish line #2 grinder skimming tank. Bulk samples of Tectyl 506® were taken directly from the spray gun for laboratory use in identification of the mineral spirits during analysis. All atmospheric samples were analyzed by gas chromatography at the Utah Bio-medical Test Laboratory in Salt Lake City.

Three of the 4 workers, wearing sampling equipment, were given non directed employee interviews, to supplement information obtained during the initial survey. These men had not been interviewed previously.

Additional air flow measurements were taken to determine the effect of two additional air supply fans that had been installed since the previous visit. All measurements indicated that make up air volume was now greater than exhaust air volume. Air flow was 300 feet per minute (FPM) at waist level through the large over head door and 50 FPM through the smaller man doors. Mineral spirits odor was not noticeable at any point inside the finish line enclosure. The positive air pressure of the finish line enclosure created by the excessive air supply provided an out flow of air through all enclosure openings, reversing the flow pattern noted during the initial survey.

D. Evaluation Criteria

There is currently no Federal standard for occupational exposure to mineral spirits. However, the American Conference for Governmental Industrial Hygienists (ACGIH) has recently recommended a Threshold Limit Value (TLV) for stoddard solvent (a substance having similar toxicological properties) of 100 parts per million (PPM) time weighted average concentration for a normal 8 hour work day.[1] Acute exposure to high concentrations of petroleum naphthas, a generic name for a group of related hydrocarbon compounds which includes mineral spirits, has been known to cause central nervous system depression in humans. Symptoms ranging from headache, nausea, vertigo, and anesthetic stupor have been reported. Vapors from these compounds can irritate mucous membranes, although none of these materials are actually strong irritants.[2]

The other major component of Tecty1 506® was an oxidized petrolatum, or petroleum jelly. Petrolatum is a mixture of purified saturated hydrocarbons. Most of the more toxic aromatic type hydrocarbons are extracted from the compound during processing. Petrolatums mainly contain a large number of saturated hydrocarbons of different chain lengths, the three most common hydrocarbon structures being, normal paraffins, (hydrocarbons with straight carbon chains), isoparaffins, (hydrocarbons with branched carbon chains), and naphthenes (mono or polycyclic saturated hydrocarbons). In general, saturated aliphatic and alicyclic hydrocarbons have a relatively low order of acute toxicity. Because of low vapor pressure, inhalation of vapors from a petrolatum compound would not be expected when used at normal room temperature. Exposure to mists can cause mucous membrane irritation and chemical pneumonitis from direct contact of the liquid or aerosol with pulmonary tissue. Frequent and prolonged contact with skin may lead to skin irritation and dermatitis.[3] A threshold limit value for this type of hydrocarbon mixture has not been established.

Recently there has been great concern regarding the possibility for formation of diethanolnitrosamines in industrial cutting oils. Historically, nitrosamines have been regarded as one of the most potent families of animal carcinogens. Although nitrosamines are suspected to be human carcinogens, their carcinogenic potential in man has not been established. Presently, the toxicity of dithanolnitrosamine is being questioned and further research is needed. There is no history of increased cancer risk for humans exposed to diethanolnitrosamine.

However, NIOSH believes it is important that suppliers and consumers be aware that synthetic cutting fluids, semi-synthetic cutting oils, and soluble cutting oils may contain nitrosamines, either as contaminants in amines, or as products from the reaction of amines (e.g. triethanolamine) with nitrite.[4]

In December, 1976, The D.A. Stuart Oil Company, supplier of the 2 cutting oils (Dascool 4515 and Dascokleen 3114) used in the lathe turning and grinding machines on the finish line, disclosed to management representatives of Standard Forgings, that Dascool 4515 contained 1.5% sodium nitrite and 12% triethanolamine. Sodium nitrite has now been removed from this Dasco Kleen 3114 reportedly contained no nitrosamines or chemicals that could form nitrosamines. The responsive corrective action by The D.A. Stuart Co. to eliminate questionable materials in its products is commendable.

E. Evaluation Results and Discussion

The gas chromatograph analysis results for environmental sampling of the finish line are presented in Table 1. Both personal and area sample concentrations are listed as milligrams of mineral spirits vapor per cubic meter of air (mg/M^3), and as parts of mineral spirits per million parts of air (PPM). Concentrations of mineral spirits ranged from a high of 6.77 PPM to levels below that which is detectable by gas chromatograph analysis (less than 0.03 PPM).

These low levels are not unexpected considering the limited spraying time required for a 100 axle per shift production rate. Sampling duration was roughly 4 hours and represents a total spraying time of approximately 25 minutes. A theoretical maximum exposure for the "palletizer" or maximum concentration for the palletizing area can be predicted by making the assumption that all collected mineral spirits vapors were generated only 25 minutes out of a total four hour sampling duration.

PALLETIZER

Sample collected in micrograms (ug) = 80
Sampling pump flow rate = 191 cc/min. (APX.)
Sample volume in 4hr. 7min. = 47.2 liters (L)
Sample volume in 25 min. = 4.8 L

$$\text{Average Concentration} = \frac{80ug}{47.2L} = 1.7ug/L = 1.7mg/M^3 \text{ or } 0.3PPM$$

$$\text{Maximum Concentration} = \frac{80ug}{4.8} = 16.7ug/L = 16.7mg/M^3 \text{ or } 3PPM$$

PALLETIZER AREA

Sample collected in micrograms (ug) = 1650
Sampling pump flow rate = 185.6 cc/min (APX)
Sample volume in 3hr.56min. = 41.69 L
Sample volume in 25min. = 4.64 L

$$\text{Average Concentration} = \frac{1650ug}{41.69L} = 39.6ug/L = 39.6mg/M^3 \text{ or } 6.77PPM$$

$$\text{Maximum Concentration} = \frac{1650ug}{4.64L} = 356ug/L = 356mg/M^3 \text{ or } 60PPM$$

F. Conclusions

Sampling results clearly indicate that the volatile mineral spirits used in Tectyl 506® did not present an environmental exposure which could be considered hazardous to the health of those working on the finish line or in the palletizing area. All environmental samples detected minimal vapor concentrations which were well below the (ACGIH) established Threshold Limit Value of 100 PPM. It is unlikely that even peak concentrations generated during spraying application would exceed 60 PPM. It is therefore reasonable to conclude that under the conditions for use of Tectyl 506®, which were observed during this survey, mineral spirits vapors are not toxic to exposed employees.

It is possible that the "palletizer" may experience upper respiratory irritation or discomfort from occasional inhalation of suspended mists of Tectyl 506 during peak concentration periods. However, based on the limited duration and frequency of these exposures it is highly unlikely that workers would suffer adverse health effects if the conditions observed during this survey are maintained.

G. Recommendations

1. The finish line enclosure should be ventilated with fresh supply air in sufficient quantity to create a relative positive air pressure in relation to its surrounding areas. In this way mists and vapor from the palletizing area would not drift into the finish line area, and other unpleasant odors would be reduced or eliminated. This could be accomplished by ducting air supply for the air recirculating gas heaters to a source of fresh air, outside the enclosure. Air quality directly above the enclosure, inside the main building (bldg. 83), is probably adequate to provide the air supply needed, as long as the enclosure ceiling exhaust fans are turned off with intakes louvered shut. Benefits derived from a 100% fresh air supply to heaters may be offset somewhat by the higher consumptions of natural gas necessary to maintain the required 72°F air temperature. It is possible that some other ratio of fresh air to recirculated air would provide a more realistic approach. These recommendations apply to winter time operations only. Overhead exhaust fans and wall mounted supply fans should be used when warm weather permits.

2. Any type of air purifying filter mask or respirator which is acceptable to the "palletizer" and reduces or prevents nasal or upper respiratory irritation should be provided simply as a precaution. There is no restriction in using a respirator not approved by NIOSH in an area where respirators are not required.

V. REFERENCES

1. Threshold Limit Values for Chemical Substances and Physical Agents in the Workroom Envoronment with Intended Changes for 1976, American Conference of Governmental Industrial Hygienists.

2. Hamilton A, and Hardy, H: Industrial Toxicology, Third Edition, Publishing Science Group Inc. (1974) P. 264

3. Patty, Frank A., Industrial Hygiene and Toxicology, Volume II, Second Edition, (1967) P. 1201

4. NIOSH Current Intelligence Bulletin, nitrosamines in Cutting Fluids, October, 1976.

5. NIOSH Technical Information Publication, A Guide to Industrial Respiratory Protection, NIOSH Pub 76-189 (1976) Pg 53.

VI. AUTHORSHIP AND ACKNOWLEDGEMENTS

Report prepared by:

Stanley A. Salisbury
Asst. Regional Industrial Hygienist
Region V, Chicago, Illinois

Originating Office:

Jerome P. Flesch, Acting Chief
Hazard Evaluation and Technical
Assistance Branch
Cincinnati, Ohio

Acknowledgements

Environmental Evaluation:

Charles H. Borcherding
Regional Industrial Hygienist
Region V, Chicago Illinois

Richard S. Kramkowski
Regional Consultant
Region V, Chicago Illinois

Laboratory Analysis

Utah Biomedical Test Lab.
Salt Lake City, Utah

Table 1

Results of Environmental Sampling for Mineral Spirits

Standard Forgings Corporation
East Chicago, Indiana
Aug 17, 1976

Job Title/Location	Sampling Period	Concentration mg/M3	PPM *
"Palletizer"	0928am - 1:35pm	1.7	0.3
Area - Below axle roll-out beam at palletizer area	09:45am - 1:41pm	39.6	6.77
Area - above #2 grinder	09:41am - 1:38pm	<0.2	0.03
Skimming Tank			
Finish Inspector	09:34am - 1.39pm	0.4	0.07
Grinder Operator	09:36am - 10:53pm 11:47am - 1:37pm	<0.3 (TWA)	0.05 (TWA)
Axle Turner	09:30am - 1:34pm	<0.2	0.03
Blank	———	<0.01mg**	
Blank	———	<0.01mg**	

* Computed from mg/M^3 Value using approximate molecular weight for mineral spirit (139) at std barometric pressure and 25°C (77° F) ambient temp.

** Detection Limit = 0.01mg/sample
TWA = Time weighted Average