HETA 87-142-1802
JUNE 1987
C. F. & I. STEEL CORPORATION
PUEBLO, COLORADO

NIOSH INVESTIGATOR:
Bobby J. Gunter, Ph.D., CIH

I. SUMMARY

On February 5, l987 the National Institute for Occupational Safety and Health (NIOSH) received a request from management at C F & I Steel Corporation to evaluate exposures to 1-1-1-trichloroethane in two large vapor degreasers in the Nail factory. Management filed this request due to complaints of the workers concerning fumes generated by the nails as they passed through the 1-1-1-trichloroethane vapor. The Nail machine takes coils of galvanized wire of varying size and automatically chops these coils into nails of various size and length. After the nails are chopped they are carried in large metal bins into the vapor degreasing area. The nails are unloaded and are passed through the vapor degreaser using a conveyor. The nails are then packed and ready to be sent to the customer.

NIOSH performed an environmental survey of the degreasing department on March l3, l987. Time weighted average (TWA) exposures were monitored for the entire workshift. All workers were interviewed.

Analysis of the environmental samples did not indicate (TWA) personnel exposures above the NIOSH recommended criteria or the OSHA standard. One of the General Room samples exceeded the Occupational Safety and Health Administration (OSHA) standard, the ACGIH TLV, and the NIOSH evaluation criteria of 1900 mg/M^3. A total of l5 air samples were collected. Six of these were breathing zone air samples; the values ranged from 4l to 399 mg/M^3. The average concentration for all six was 206 mg/M^3. Nine general room air samples were collected; the values ranged from 70 to 22l8 mg/M^3. The average concentration for all nine samples was 478 mg/M^3. Time weighted average concentrations for three personnel samples were 94, 226, and 299 mg/M^3. Time weighted average concentrations for the four general area samples was l93, ll50, 307 and 92.5 mg/M^3. Samples collected on the first part of the work shift had lower levels of l-l-1-trichloroethane than those collected on the second part of the work shift. The apparent reason for this was that much smaller nails were degreased during the last half of the shift. The greater surface area of the smaller nails was the apparent reason for the higher concentrations of 1-1-1-trichloroethane.

On the basis of the environmental data obtained during this investigation, it was determined that with the exception of one sample, a health hazard did not exist from exposures to 1-1-1-trichloroethane during the degreasing of nails. There may be a hazard if workers have to work for extended periods of time on top of the vapor degreasers. Recommendations in this report will eliminate this hazard.

KEYWORDS: Sic: 3315 Steel Wire Drawing and Steel Nails and Spikes, 1-1-1-trichloroethane

II. INTRODUCTION

On February 5, l987 an authorized representative of management of C F & I Steel, submitted a health hazard evaluation request concerning possible exposures to 1-1-1-trichloroethane in the vicinity of two vapor degreasers that are located in the nail factory. Management had previously monitored this department for 1-1-1-trichloroethane no overexposures were found. Management asked for NIOSH assistance to document employees exposure during this operation to 1-1-1- trichloroethane. NIOSH responded to this request by performing an environmental survey on March 13, l987. Plant management and a member of the union's safety committee accompanied NIOSH on the survey. Excellent participation of all the employees was in part due to interest in both management and union officials concerning health of the workers.

III. BACKGROUND

The nail factory at CF & I steel is one of the departments that is closely connected to the galvanizing department. Large rolls of galvanized steel wire are received in this department. These rolls of wire are fed into nail machines and nails are chopped from the coils. Nails vary in size from 1 inch to large l2 inch spikes. After the nails are made they are delivered by forklift truck and a large metal container to the degreasing area which is located in the rear of the nail factory. Here the nails are passed through two degreasers using 1-1-1-trichloroethane as the degreasing agent. The focus of this evaluation was to see if there was a health hazard in this area to the degreasing agent 1-1-1-trichloroethane. There are approximately six workers in this area.

IV. ENVIRONMENTAL DESIGN AND METHODS

Fifteen air samples for 1-1-1-trichloroethane were collected on organic vapor charcoal sampling tubes using vacuum pumps operated at l00 cc/minute. Samples were desorbed using carbon disulfide then they were analyzed using gas chromatography using an HP 5880A gas chromatograph equipped with a 30-meter DB-l fused silica capillary column and an FID (splitless mode). Workers were informally interviewed, with questions asked concerning exposures to 1-1-1-trichloroethane.

V. EVALUATION CRITERIA

A. Environmental

As a guide to the evaluation of the hazards posed by workplace exposures, NIOSH field staff employ environmental evaluation criteria for assessment of a number of chemical and physical agents. These criteria are intended to suggest levels of exposure to which most workers may be exposed up to 10 hours per day, 40 hours per week for a working lifetime without experiencing adverse health effects. It is, however, important to note that not all workers will be protected from adverse health effects if their exposures are maintained below these levels. A small percentage may experience adverse health effects because of individual susceptibility, a pre-existing medical condition, and/or a hypersensitivity (allergy). In addition, some hazardous substances may act in combination with other workplace exposures, the general environment, or with medications or personal habits of the worker to produce health effects even if the occupational exposures are controlled at the level set by the evaluation criterion. These combined effects are often not considered in the evaluation criteria. Also, some substances are absorbed by direct

contact with the skin and mucous membranes, and thus potentially increase the overall exposure. Finally, evaluation criteria may change over the years as new information on the toxic effects of an agent become available.

The primary sources of environmental evaluation criteria for the workplace are: 1) NIOSH Criteria Documents and recommendations, 2) the American Conference of Governmental Industrial Hygienists' (ACGIH) Threshold Limit Values (TLV's), and 3) the U.S. Department of Labor (OSHA) occupational health standards. Often, the NIOSH recommendations and ACGIH TLV's are lower than the corresponding OSHA standards. Both NIOSH recommendations and ACGIH TLV's usually are based on more recent information than are the OSHA standards. The OSHA standards also may be required to take into account the feasibility of controlling exposures in various industries where the agents are used; the NIOSH-recommended standards, by contrast, are based on concerns relating to the prevention of occupational disease. In evaluating the exposure levels and the recommendations for reducing these levels found in this report, it should be noted that industry is legally required to meet those levels specified by an OSHA standard.

A time-weighted average (TWA) exposure refers to the average airborne concentration of a substance during a normal 8- to 10-hour workday. Some substances have recommended short-term exposure limits or ceiling values which are intended to supplement the TWA where there are recognized toxic effects from high short-term exposures.

Environmental Exposure Limits
Time Weighted Average (TWA)

1-1-1-trichloroethane (Methyl Chloroform)
l900 mg/M3 NIOSH, OSHA, ACGIH

B. Toxicology

1-1-1-trichloroethane- (methyl chloroform) The NIOSH recommended level for occupational exposure to methyl chloroform is a ceiling concentration of 350 ppm (1900 mg/M^3) as determined by a l5 minute sampling period[l]. This level is designed to protect the workers health and safety by preventing the adverse effects of this substance. The primary health effects from methyl chloroform include central nervous system (CNS) depression, headache, dizziness, incoordination, lightheadedness, drowsiness, generalized weakness, toxic hepatitis, nausea, vomiting, diarrhea, hypotension, bradycardia, cardiac arrhythmias, coagulopathies, skin dryness and irritation, and mucous membrane irritation. Due to the similarity between this chemical and a group of known carcinogens, NIOSH recommends care in the industrial use of this agent, though no evidence exist at the current time either in animals or humans to implicate this agent as a carcinogen[2]. The NIOSH Current Intelligence Bulletin number 48 published on March 3l, l987 "Organic Solvent Neurotoxicity" verifies the above information but does not indicate that it is a carcinogen.

VI. RESULTS AND DISCUSSION

On March l3, l987 and environmental investigation with employee interviews was performed at the nail factory located at the CF & I Steel Corporation in Pueblo, Colorado. Fifteen air samples were collected. Six of these samples were breathing zone air samples values ranged from 4l to 399 mg/M^3 with an average of 206 mg/M^3. These six samples represented three (TWA) exposures of 94, 226, and 299 mg/M^3. Nine additional general room air samples were collected. Values ranged from 70 to 22l8 mg/M^3 with an average concentration of 447 mg/M^3. These nine samples represented 5 (TWA) exposures of l93, ll50, 307, 422, and 93 mg/M^3. One of the general room samples exceeded the evaluation criteria. This was due to its placement which was very near to the nails as they left the degreaser. None of the breathing zone samples exceeded the evaluation criteria. There is a very large volume of nails processed through the 1-1-1-trichloroethane vapor and caution should be taken that the degreasers are working properly. For example all cooling coils on the degreaser should be working and the nails should only be run through the vapor. There are higher 1-1-1-trichloroethane exposures during the processing of the small nails. All concentrations were higher on the second series of samples when the smaller nails were being degreased. Brief interviews with the workers only showed an interest in why the exposures seemed to be higher during the processing of the smaller nails. None of the workers appeared to have medical problems they thought were due to their work environment.

VII. CONCLUSIONS

Review of the environmental data, employee interviews, and observations made during this survey indicate that there may be a potential hazard to maintenance workers that have to repair parts on top of the vapor degreaser.

This was verified by the one elevated level of 1-1-1-trichloroethane found on the general room air sample that was collected on top of the degreaser. If workers must work for long periods on top of the degreasers they should wear respiratory protection.

VIII. RECOMMENDATIONS

1. Respiratory protection should be provided if workers are working for extended time periods on top of the vapor degreasers.

2. Eating, drinking and smoking should not be permitted in the work areas.

3. Employees should be briefed on the toxicology of 1-1-1-trichloroethane.

IX. REFERENCES

1. NIOSH Manual of Analytical Methods, Second Edition, National Institute for Occupational Safety and Health, D.H.E.W. Publication No. 77-157A., Volumne 1

2. American Conference of Governmental Industrial Hygienists, Threshold Limit Values for Chemical Substances and Physical Agents in the Workroom Environment with Intended Changes for 1980.

X. AUTHORSHIP AND ACKNOWLEDGEMENTS

Report Prepared By: Bobby J. Gunter, Ph.D., CIH
Regional Industrial Hygienist
NIOSH - Denver Region
Denver, Colorado

Originating Office: Hazard Evaluation & Technical
Assistance Branch (HETAB)
Division of Surveillance,
Hazard Evaluations, & Field Studies (DSHEFS)
NIOSH, Cincinnati, Ohio

Report Typed By: Marile F. DiGiacomo
Secretary
NIOSH - Denver Region
Denver, Colorado

XI. DISTRIBUTION AND AVAILABILITY

Copies of this report are currently available upon request from NIOSH, Division of Standards Development and Technology Transfer, 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. CF & I Steel Corporation.
2. U.S. Department of Labor/OSHA, Region VIII
3. NIOSH - Denver Region
4. Colorado Department of Health.

For the purpose of informing affected employees, a copy of this report shall be posted in a prominent place accessible to the employees for a period of 30 calendar days.

Table 1

Breathing Zone and General Room Air Concentrations of
1-1-1-trichloroethane at
CF & I Steel Corporation
in Pueblo, Colorado
March 13, 1987

Employee #	Job Description	Exposure Time	mg/M^3 1-1-1-tri.	TWA Tri.
1	Recorder	6:53a - 10:46a	41	
		10:47a - 2:00p	147	94
2	Packer	6:53a - 10:50a	54	
		10:50a - 2:00p	399	226
3	Packer #2	7:04a - 10:43a	261	
		10:45a - 2:00p	336	299
4	Packer #2 Gen/room	7:09a - 10:48a	154	
		10:48a - 2:00p	231	193
5	Packer #1 Gen/room	7:10a - 10:53a	82	
		10:55a - 2:00p	2218	1150
6	Top of Packer #1/gen/rm	7:11a - 10:58a	307	307
7	Top of Packer #2/gen/rm	7:15a - 10:53a	123	
		10:53a - 2:00p	721	422
8	Side of Packer #2/gen/rm	7:15a - 10:59a	70	
		10:59a - 2:00p	115	92.5
Evaluation Criteria			1900	1900

Laboratory Limit of Detection mg/sample 0.007
TWA - Time Weighted Average
mg/M^3 - millligrams per cubic meter