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HEALTH HAZARD EVALUATION REPORT 72-87 - 58

HAZARD EVALUATION SERVICES BRANCH

DIVISION OF TECHNICAL SERVICES

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Establishment : Shell Oil Company
Wood River, Illinois

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

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SHELL OIL COMPANY
WOOD RIVER, ILLINOIS

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1. SUMMARY DETERMINATION

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 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 regarding exposures to cutting oils and dust and fumes from metalizing via flame spraying at the Shell Oil Company Refinery at Wood River, Illinois.

NIOSH investigators conducted an evaluation of the associated operations on January 10, 1973. Fourteen employees in the machine shop, where the oils are used and the metalizing via flame spraying is performed, were interviewed regarding symptoms associated with the use of cutting oils and fumes emanating from the metalizing and machining processes. Most of the twelve machines were operated at some time during the day, as well as the metalizing process, which was demonstrated for our information and observation.

Information was furnished by the company regarding the composition of the three cutting oils in use in the machine shop and the twelve metal sprays currently in stock and available for use, as required. Based on all available information, it was determined that under the conditions which were observed, the use of cutting oils does not constitute a serious health hazard. However, since some instances of dermatitis were observed (or have occurred in the past), specific control measures have been recommended to management to obviate the potential for future exposure.

Inasmuch as dermatitis is a skin condition associated with direct chemical contact, air samples were not deemed appropriate nor necessary.

The metalizing via flame spraying is a completely enclosed and ventilated process that is operated less than five percent of the working day (if at all). The ventilation system was evaluated and proved adequate. Minor corrections were noted to improve the efficiency of the ventilation system.

Copies of this Summary Determination 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) Shell Oil Company, Wood River, Illinois
- b) Authorized Representative of Employees
- c) U.S. Department of Labor, Region V

For purposes of informing the approximately 22 "affected employees" who work in the machine shop, the employer will promptly "post" the Summary Determination in a prominent place(s) near where affected employees work for a period of 30 calendar days.

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II. 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 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.

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III. BACKGROUND HAZARD INFORMATION

A. Cutting Fluids:

Although improvements in formulations of cutting and grinding fluids have been made, occupational dermatitis can still be a problem. Oil acne and folliculitis are the most common cutaneous problems of those who work with insoluble oils. Bacteria in lubricating coolants may contribute to breakdown of the coolant, but are unrelated to outbreaks of folliculitis. The chief problem which results from exposure to soluble oils and synthetic coolants is eczematous contact dermatitis, a disease of multiple causation. These two important skin diseases, as well as several minor ones associated with exposure to lubricating coolants, can be prevented by measures designed to minimize contact and to improve personal hygiene¹.

Carbon Monoxide can be formed during combustion of the cutting oils. The occupational health standards promulgated by the U.S. Department of Labor (Federal Register, Part II, 1910.93, Table G-1) applicable to substances of this portion of the evaluation are as follows:

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|----------------------|----------------------|
| 1) Carbon Monoxide | 50 ppm** |
| 2) Oil Mist, Mineral | 5mg/M ³ * |

*mg/M³ - milligrams of substance per cubic meter of air and

as sampled by method that does not collect vapor.

**ppm - parts of vapor per million parts of contaminated air by volume at 25°C and 760 mm of HG pressure.

B. Metalizing:

The chief hazard of metalizing is that of pollution of the surrounding atmosphere with particles of the sprayed molten metal, and its seriousness will depend in large measure on the toxicity of the metal being sprayed. On any metalizing operation, the threshold limit value of the material being handled should be known, and precautions should be taken to keep the air contamination safely within that limit. The process presents fire and explosion hazards common to the handling of any fuel gas system and some probability of contaminating the surrounding atmosphere with carbon monoxide, since metalizing is normally done with a reducing flame. A further explosion hazard is present when light metals are used for spraying. The fine metal dust is collected in the ventilating system and may be explosive. There is the same hazard from visible glare as in other gas welding operations and also a hazard of burns either from the flame or from the hot metal, particularly on a large job which requires preheating for a good result. In preparation of the surface to be metalized, there are hazards of chemical burns and of inhalation of acid fumes from pickling solutions. There is also the danger of inhalation of silica during sandblasting operations. On maintenance jobs, which often are done with improvised or makeshift apparatus, special precautions should be taken against chemical splashes and inhalation of the vapor from pickling baths. Use of makeshift or improvised apparatus is likely to require more dependence on personal protective equipment than is customary and, consequently, to require closer supervision to see that the equipment is properly used².

Occupational health standards promulgated by the U.S. Department of Labor applicable to some of the substances which make up the composition of the six metalizing wires and six metalizing powders used in the process can be found in the Federal Register, Part II, Section 1910.93, Table G-1.

IV. HEALTH HAZARD EVALUATION

A. Observational Survey:

The observational survey of the Shell Oil Company Refinery was made on January 10, 1973, by the National Institute for Occupational Safety and Health (NIOSH) representatives, Mr. Richard S. Kramkowski and Dr. Edward Shmunis. The purpose of our visit was explained to

Industrial Hygienist, and Part I of the NSN questionnaire was completed. accompanied us to the machine shop. Since the requester desired to remain confidential, he did not accompany us through the shop.

The original request mentioned skin eruptions from the use of cutting oils and obnoxious odors, causing choking. Dust from the use of spray guns also were alleged to cause difficult breathing. Incorrect blower equipment was cited as a contributing factor. The machine shop was the area in the Shell Oil Refinery to which the evaluation was directed. It employs approximately 22 people. The function of this machine shop is to provide maintenance and repair to equipment throughout the refinery. Metal spraying is only done at one end of the large building which comprises the machine shop. Many other machines typical of machine shops (lathes, drill presses, etc.) are spaced throughout the machine shop area.

The machine shop works on two shifts: a day and a late afternoon-evening shift. Of 14 individuals who were interviewed, only four had been there less than three years. The employees thus formed a stable work force of mostly mature, skilled individuals.

Repairs can involve any sized piece of equipment and a spectrum of substances from cast iron to pressed fibrous materials. Grinding or machining metals can involve either of three currently stocked cutting oils, depending on specific needs. furnished copies of material safety data sheets for two of the Shell-produced cutting oils - one, a sulfurized mineral oil plus minor amounts of fatty oil and chlorinated wax; and the other (actually a coolant), a mineral oil plus emulsifier normally used at water : oil ratios of 10:1 to 40:1. The third cutting oil is used for grinding ferrous and nonferrous materials. It is a chemical-type water soluble coolant concentrate normally used at water : oil ratios of

75-100:1 and 50-75:1. Samples from each of twelve of the machines were made available, as well as a description of use, i.e., proportions, frequency of change or replenishment, etc.

The metalizing process consists of a lathe to hold and turn the part to be metalized, and either a wire or powder oxygen-acetylene operated spray gun. The process is performed only as required, i.e., often not for days or weeks, but up to a maximum utilization of approximately two hours per week. The estimated average utilization is once per week, with the average part requiring about 10 minutes to metalize. Although the metalizing process was not scheduled for use during the week of our visit, a demonstration was arranged. The company furnished a list of spray materials in stock and the suppliers technical bulletin, stating the typical composition and typical size range of their products. The metalizing process is enclosed on three sides and the top by metal with a canvas front flap, and is exhausted by overhead and local exhaust (in line with the spray) ventilation. Some of the ventilation is recent or improved. Additional changes to improve the overhead exhaust are in progress. The operator wears ear muffs, a respirator, and safety goggles during the process. The process is automatic and requires the operator only to set it up, start it and observe for malfunctions. Air flow measurements indicated a sufficient velocity at the exhaust to effectively capture the fumes when the system is working properly.

The refinery is a large plant which has its own inplant hospital, round-the-clock nursing, and a doctor present five days a week and on call 24 hours. All employees have a pre-employment examination. People in the machine shop receive no regular monitoring after their initial examination. Since the inception of the OSHA Log, there has been only one case of dermatitis in the machine shop reported. In addition, ^{had} assembled for us an analysis of nurse visits from the machine shop for the year of 1972. The analysis indicated the majority of these were the results of trauma with 58 of the 69 reports representing abrasions, burns, contusions, foreign bodies, and lacerations. There were no reported skin infections or inflammations during this year. The management was unaware of current problems referable to the symptoms cited in the Hazard Evaluation, nor were any workmen's compensation cases related to the

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machine shop and skin problems pending to their knowledge. There was also no record of any ear, nose, and throat problems from the machine shop - neither reported through nursing visits nor appearing as respiratory conditions on the OSHA Log. Three instances of eye inflammation occurred during 1972 in this group of workmen.

There is a cafeteria in the refinery, but most of the machine shop people eat at tables near their work areas. There are adequate restroom and washing facilities in the machine shop. Paper towels and Calgon Pink Lotion Soap are provided. In addition, Whisk Waterless Hand Cleaner, produced by the Metalife Company of Wentzville, Missouri, is used frequently out in the shop.

There are no barrier creams dispensed although lanolin is available and several people had it near their machines.

B. Medical Investigation and Results:

A total of 14 machinists were available for interview during the day shift on the day of the investigation. Each machinist was interviewed and questioned about discomforts or illnesses since his employment as a machinist in this shop. Any individual with symptoms at the time of the interview was examined.

The average age of the employees was 42, with ages ranging from 21 to 60. The average number of years in the machine shop was 9, with the duration of employment ranging from one-third to 17 years (which was the maximum possible since the construction of the present physical plant). With respect to problems with the skin, 4 individuals in the machine shop were currently experiencing skin eruptions, 5 others had histories of skin eruptions, and the remainder had no involvement.

The first individual with a current skin problem had a history of dry, red, scaly patches on his forearms for a year. Examination showed small, discrete erythematous, scaly areas with some follicular prominence on the forearms. The man had not consulted the infirmary about these patches. The individual had a family history of eczema.

A second individual had been treated by a private physician during the last year for a rash which was occurring on his left thigh. He had not gone to the infirmary. This area was beneath

his left pants pocket and was constantly being pressed against the metal machine during the course of its operation. This individual has been treated for possible fungus infection although the area on the thigh would be an unusual place for a fungus infection to erupt. The possibility of nickel dermatitis, both from metal objects carried in his pocket and from contact with his machine, was considered the most likely cause.

A third individual with an existing dermatitis was a man who had red, scaly areas on his elbows for many years since beginning work in the machine shop. Examination disclosed red, scaly plaques on the elbows. He had not gone to the infirmary for this condition. He also contended that each summer he would develop folliculitis on his thighs although it was not present at the time of the interview.

The last individual had folliculitis on his thighs, bilaterally, which he had had for the last several months since beginning work in the machine shop, but not previously. He also had not gone to the infirmary for consultation.

Case summaries of the five individuals with previous skin eruptions, excluding one of the men cited above who also had a history of a previous eruption, are as follows: 1) one episode of dermatitis on the forearms several years ago which cleared with the nurse's help; 2) irritation of the hands due to Whisk Waterless Hand Cleaner, which cleared upon avoidance of this product; 3) episodes of dryness due to handling petroleum distillate; 4) oil folliculitis many years ago which cleared spontaneously; and 5) an individual who had a rash on his chest, neck and arms approximately one and one-half months ago. This rash took three weeks to clear and was treated by a private doctor with shots, but was not reported to the infirmary.

With respect to irritation of the eyes, throat or nose, six individuals complained of previous symptoms involving these systems, and they are summarized as follows:

- 1) This individual contended that before the last repair of the metalizer, fumes would give him a sore throat and inflame the membranes of his nose. This has improved since the last repair. He continues to have aggravation of a pre-existing sinus problem whenever he works with cast iron and fibrous pressed materials. In addition, his sinuses are aggravated

whenever trucks are repaired with the motors running inside the building.

2) This individual occasionally experiences choky sensations on an episodic basis, related to instances of open spraying of oil mist or the cleaning of parts or the use of solvents for special procedures. He mentioned there was no quick way of dispensing with these fumes in these instances when the accumulation became irritating.

3) The third instance occurred in a man who has had sinus problems during the last 10 years of his 17-year employment. These problems are worse in the winter and cause sore throats and sneezing. He has been to an ear, nose and throat specialist for this problem, but never to the nurse in the plant. The metalizer gives off fumes which seem to aggravate his sinus condition.

4) The fourth man experiences eye watering, coughing and headaches attributed to smoky conditions. These symptoms occur about 12 times a year, on a sporadic basis. Sometimes the irritating fumes originate outside in the acid area. Another initiating circumstance is the use of heavy cutting oil on large pieces of machinery which produces an irritating black smoke.

5) The fifth person notes burning of the eyes when heavy cutting oil is used on large pieces of machinery. This individual also complained of acid fumes from the outside, particularly if a spill has occurred.

6) The last instance of sinus aggravation concerned a man with pre-existing sinus problems which are aggravated by working in the machine shop. He has been to a doctor because of these problems since his employment although he has not been to the plant nurse. He attributes his symptoms to smoky conditions and the lack of adequate ventilation for ridding the area of smoky conditions. This individual also has a history of asthma.

It is of interest that the two individuals who actually do the metalizing did not complain of fumes during metalizing as much as some of the others who are positioned around the metalizer.

Ten of the 14 workers interviewed were not aware of the availability of aprons or sleeves for protection although they were

familiar with the availability of gloves when they can be used without hazard.

V. SUMMARY AND CONCLUSIONS

There were four instances of dermatitis seen on the day of the investigation. It is felt that in each case, there was probably a relationship to employment in the machine shop. It appeared in each case to be an individualized problem with a procedure or substance probably exercising its cutaneous effect because of work practice deficiency.

For instance, the individual with folliculitis needs to change his clothing frequently, but is not aware of this necessity and its pathophysiological relationship to his eruption. Similarly, the man with the eruption on his elbows also has to protect this area from contact with a host of substances which are irritating stimuli for his elbow eruptions. Either long sleeves or stockinette tubing could be used to protect him as long as it was changed frequently. The man with the discrete eczematous patches on his forearms probably has not been advised of how his job, which is a new one requiring frequent washings, can dry out his skin and that more frequent use of lanolin or similar lotions would be advisable.

Lastly, the man with possible nickel allergy may need to be ultimately tested for this entity. We spoke with him and explained the possible relationship to carrying metal objects in his left pants pocket or even leaning against the metal side of his machine. If nickel allergy exists, it would be prudent to change his work position so that his thigh is not constantly leaning against the machine at that point, or to pad his machine's exterior with a nonmetal surface. These four individuals had not presented themselves to the company clinic for help.

On occasion, several individuals, some of whom have a prior history of sinus problems, have been aggravated by smoky conditions or by the collection of irritating vapors. The majority of these people correlated the aggravation of their sinus problems, burning throats, watery eyes and/or headaches with the machining of large pieces requiring heavy petroleum cutting oils. They have pointed out that an exhaust system to rapidly dispel irritating collections does not exist. They also have mentioned that occasionally the opening of doors and windows brings in aggravating smells from an acid pit area nearby, particularly if spills occur. No smoky conditions or strong vapors were present at

the time of our visit.

Fumes from the metal spraying apparatus also have been alleged as a causative factor in some of the sinus aggravation, although these fumes were also not present at the time of the visit. Previous defects in the ventilation system had been modified and additional changes were recommended to improve the operating efficiency.

VI. RECOMMENDATIONS

1. The installation of a local exhaust mechanism for those machines which accommodate large parts.
2. A leak in the duct of the overhead exhaust of the metal spraying apparatus was observed at the time of our visit, and this should be remedied.
3. The canvas front flap on the metalizing booth is to be, and should be, changed to prevent unnecessary escape of fumes and dust to other areas of the shop.
4. The workers should be instructed to attend the company clinic at the first sign of a developing skin problem.
5. The workers should be made aware of the availability of aprons, gloves and sleeves, and other protective devices, such as barrier creams, and they should be instructed as to their proper use.
6. Good work practices should be emphasized at all times by the employer and employees to avoid possible contact with irritating substances. This includes frequent changes of work clothing, especially when working with cutting oils.

VII. REFERENCES

1. Key, M.M.; Ritter, E.J.; Arndt, K.A.: American Industrial Hygiene Association Journal, Volume 27, September - October, 1966, Page 423.
2. Data Sheet 357 (Revised); National Safety Council, 425 North Michigan Avenue, Chicago, Illinois 60611.