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
HE 77-108-520

CHEVROLET - TRANSMISSION PLANT #1
TOLEDO, OHIO

AUGUST 1978

I. TOXICITY DETERMINATION

A health hazard evaluation was conducted by the National Institute for Occupational Safety and Health (NIOSH) on March 21-23, 1978 at the Chevrolet Transmission Plant, #1, Toledo, Ohio. The request was concerned with employees' exposure to oil mist, and suspected cancers occurring as a result of this exposure. Personal breathing zone samples for oil mist and organic solvent vapors were obtained. Bulk samples of the two coolant fluids used were obtained for nitrosamine and polynuclear aromatic hydrocarbon (PNA) analyses. Analysis of the personal samples for oil mist indicated that exposures were below recommended criteria on the days sampled. Analysis of solvent vapors indicated the presence of benzene and toluene, however quantities measured were below recommended criteria. Analysis of the bulk samples indicated the presence of coliform contamination, PNAs and nitrosamines.

Due to the present legal status of NIOSH's right to review Company medical records, no definite conclusions regarding excess cancer risk to bar stock operators are presented. NIOSH is not able to gather enough information at this time to state whether or not there is an increased risk of cancer in this workplace.

Considering the nature of the work performed by the operators of the bar stock machines, there is little chance of exposure to coolant oils from an inhalation standpoint. However, there is a good possibility of contact dermatitis developing among susceptible individuals. Recommendations are presented in this report to prevent the occurence of such an occupationally related disease and reduce potential exposures of employees to toxic substances.

II. DISTRIBUTION AND AVAILABILITY OF DETERMINATION REPORT

Copies of this Determination Report are currently available upon request from NIOSH, Division of Technical Services, 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:

a) Chevrolet Transmission Plant #1, Toledo, Ohio
b) United Auto Workers, Local 14
c) United Auto Workers International Union
d) OSHA, Region V
e) NIOSH, Region V

For the purpose of informing the approximately 50 "affected employees" the employer shall promptly "post" for a period of 30 calendar days the Determination Report in a prominent place(s) near where exposed employees work.

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 at the Chevrolet Transmission Plant #1, Toledo, Ohio. The request was initiated when several employees expressed concern about exposure to coolant oils and alleged cancer in three employees. Originally submitted July 21, 1977, NIOSH did not officially act on the request until March 1978 due to Occupational Safety and Health Administration involvement.

IV. HEALTH HAZARD EVALUATION

A. Process Description

The bar stock area, consists of a single row of 22 bar stock machines in the middle of Plant #1. Bar stock, hollow tubes of steel of the proper inside and outside diameter, are cut into sections and shaped to specifications as components for automobile transmissions. This is an automatic feed process; the operator's job is to supervise the operation of the machine, replace worn cutting tools when necessary, and insure the parts are cut to specification. Each operator is normally responsible for two bar stock machines.

When the operation is running properly, the operator has minimal contact with the machine. The percentage of time spent in proximity to the machines and hence exposed to, or in contact with, the coolant varies

with experience. An experienced bar stock operator frequently can tell by the sound of the machine whether or not the parts are being cut properly. Occasionally it is necessary for the operator to change the cutting bits or adjust the cut. The operator is exposed to the coolant oil mist when he replaces bits and checks for proper operation. There are adjustable splash shields to block the coolant oil mist but the operators were observed to use them seldomly. Skin contact with the coolant occurs when the operator changes bits or removes finished pieces from the machine. Each cutting area is inundated with several pressurized streams of coolant. When the machine is stopped the flow is stopped but the parts and machine cavity remain dripping wet. Bits are removed by hand tools; protective gloves are not provided for this task and the operator ends up with coolant on his hands and arms and occasionally on his head and face. Cloth gloves are issued but their use is almost non-existent.

B. Evaluation Design and Methods

Personal breathing zone samples for oil mist were taken with MSA Model G* portable pumps at flow rates of 1.5 lpm (liters per minute). Glass fiber filters were used to trap the oil mist. Analysis was according to NIOSH method, #S272[1].

Personal breathing zone samples for organic vapors were taken with Sipin portable pumps with a flow rate of 0.2 lpm. Activated charcoal was used as the collecting media. Analysis was by NIOSH method, #127[2].

Bulk samples of the two coolants, Dascool 130CT and Sunseco, used in this operation were obtained for analysis for nitrosamines and polynuclear aromatic hydrocarbons. Since these two classes of compounds are suspected cancer causing agents and the request indicated concern about cancer in some of the workers, these analyses were deemed appropriate.

During the course of the investigation, it was learned that a type of deposit was building up on one or two of the bar stock machines. Workers were concerned with coming in contact with this fatty-like buildup. A sample of this was obtained and cultured on nutrient agar to determine the presence and identification of microorganisms.

Employees were informally interviewed regarding work histories and health problems. Some of the employees mentioned as having occupational health problems were not present during the survey. These employees were mailed a confidential health questionnaire to be returned to NIOSH when completed. Also, medical release forms were obtained from these employees so that their private physicians could release their medical records for review.

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*Mention of commerical names or products does not constitute endorsement by NIOSH.

C. Evaluation Criteria

In order to evaluate a worker's exposure to substances found in the workplace, values have been derived, based on the best available information from industrial experience, human and animal toxicity studies, which refer to airborne concentrations of the substances to which it is believed that nearly all workers may be repeatedly exposed day after day without adverse effect.

Because of a wide variation of individual susceptibility, a small percentage of workers may experience discomfort from some substances at concentrations at or below the recommended level; a smaller percentage may be affected more seriously by aggravation of a pre-existing condition or by development of an occupational disease.

In this study, three sources of criteria were used: 1) NIOSH Criteria Documents; 2) recommended and proposed threshold limit values (TLVs) and their supporting documentation as set forth by the American Conference of Governmental Industrial Hygienists (ACGIH), 1977[3], and 3) Occupational Health Standards as promulgated by the U.S. Department of Labor, Occupational Safety and Health Administration (29 CFR 1910.1000)[4].

In the following discussion of the criteria used, the most current criteria (with its source) is presented along with the current OSHA standard. These criteria, with the exception of OSHA standards, are not to be used as fine lines between safe and unsafe working conditions; they should be used as guidelines in the reduction of environmental levels of contaminants to the lowest values possible. The OSHA standards are provided only as a reference to determine the state of compliance or non-compliance with Federal Regulations. The Federal standards are legal standards and enforcement is the responsibility of the U.S. Department of Labor - OSHA.

1. Oil Mist

OSHA and the ACGIH have established that no worker be exposed to greater than 5.0 mg/M^3 of mineral oil mist. This level has been established as an index of good industrial work practice rather than the prevention of injury. Industrial exposure occurs by inhalation and skin contact. A study by Ely et.al.[5] in 1970 revealed no increase in respiratory symptoms at an average concentration of 5.2 mg/M^3. Prolonged or repeated skin contact will cause irritation and dermatitis.[6]

2. Nitrosamines and Polynuclear Aromatic Hydrocarbons

Nitrosamines and polynuclear aromatic hydrocarbons (PNAs or PAHs) may or may not occur in various types of oils used in industry. There are many compositions of oils used, ranging from straight mineral oils to synthetic oils. Straight mineral oils are petroleum based oils with polar additives, germicides and pressure lubricants. Synthetic oils are transparent, water based oils with corrosion inhibitors, germicides and other

additives. Semi-synthetic oils contain petroleum products "dissolved" in water with other additives. Soluble oils are water soluble, containing mineral oil, water and other additives.

Detectable levels of PNAs are found most often in straight oils. Detectable levels of nitrosamines - provided the right combination of ingredients - amine compounds and oxides of nitrogen are present - are found in synthetic oils. Semi-synthetics and soluble oils may contain both nitrosamines and PNAs. The oils used in this operation are soluble 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 proven."[7] The ACGIH lists nitrosamines as "Industrial Substances Suspect of Carcinogenic Potential for Man." NIOSH issued a Current Intelligence Bulletin on October 6, 1976 concerning nitrosamines in cutting fluids. Presently there are no ACGIH or NIOSH criteria for nitrosamines. There is no OSHA standard for nitrosamines in general. However N,N-dimethyl nitrosamine is listed as one of 14 carcinogens controlled by OSHA. OSHA requires a "no exposure" level to any human carcinogen.

The literature contains many references to PNAs and their carcinogenicity to man.[8] The ACGIH lists particulate PNAs as human carcinogens and recommends that no worker be exposed to greater than 0.2 mg/M^3 of PNAs which are soluble in benzene. OSHA has no standard and NIOSH does not presently address any recommendation specifically for PNAs. However, both agencies do address environmental levels of Coal Tar Products (NIOSH - Criteria Document - Occupational Exposure to Coal Tar Products[9] and OSHA standard for coal tar pitch volatiles.) Many PNAs of carcinogenic potential are derived from coal tar, coal tar pitch and creosote. NIOSH recommends that no worker be exposed to coal tar products in excess of 0.1 mg/M^3 of cyclohexane - extractable fraction. OSHA's standard for Coal Tar Pitch Volatiles is 0.2 mg/M^3 for the benzene soluble fraction.

3. Benzene and Toluene

Benzene and toluene are solvents that are similar in their toxic effect. Both can cause, on contact, a dry, scaly dermatitis. Also, they are irritating to the eyes and upper respiratory tract. However, recent studies have indicated that benzene can cause changes in the blood and bone marrow. NIOSH has concluded, based on reports of blood and chromosome changes, that exposure to benzene can cause leukemia.[10] Therefore NIOSH has recently recommended to OSHA that the exposure standard be reduced to 3.2 mg/M^3. The current OSHA standard is 31.9 mg/M^3 benzene. The NIOSH recommended criteria for toluene is 375 mg/M^3 and the OSHA standard is 752 mg/M^3.

D. Evaluation Results and Discussion

Fourteen personal air samples for oil mist were obtained. All fourteen samples were below the criteria of 5.0 mg/M^3 recommended for this study. (Table I)

Ten charcoal tube samples for organic vapors were taken. Since it was suspected that little organic vapor was generated by the machining process, two samples, one from each type of oil used, which were most likely to have significant contamination, were chosen for analysis. Initial screening indicated the presence of two compounds - benzene and toluene. Quantification of the results indicated levels of both compounds to be in the one to five microgram range. Since these high volume samples were well below the evaluation criteria for benzene (3.2 mg/M^3) and toluene (375 mg/M^3), no further analysis was performed. The exact magnitude of these data are suspect since the blank used to determine the background concentration already present on the tube revealed a benzene peak (0.0006 mg). However, this error in relation to the data will not cause a significant difference in the comparison of the data and recommended criteria. It can be stated that although workers are exposed to benzene and toluene, the degree of exposure is well below limits established by OSHA or recommended by NIOSH. Apparently there is a greater percentage of benzene and toluene in the Dascool 130CT oil than in the Sunseco oil, based on the relative analytical figures. The above environmental data is presented in Table I.

Bulk samples of the two oils used were obtained for nitrosamine and PNA analyses. The Dascool 130CT bulk was analyzed only for nitrosamines. The analysis was positive for diethanolnitrosamine in the undiluted oil (as received from the manufacturer) at the nanogram level (60 ng/ml). In the diluted oil (as used by the company) nitrosamines were undetected at the 10 nanogram level.

The bulk sample of Sunseco was analyzed for both classes of compounds. Nitrosamines were undetected at the one microgram level. The following PNAs were identified - pyrene and benzo(a)pyrene (BaP) - at the picogram level (values unreported). According to the National Academy of Sciences[11] pyrene is not carcinogenic and benzo(a)pyrene is strongly carcinogenic.

The fatty deposit alluded to earlier was cultured on nutrient agar. After four weeks no fungal growth was present. However, three generi of coliform bacteria were identified - Enterobacter cloacae, Escherishia coli and Klelesiella pneumoniae. Heavy growth was indicated. These three coliform bacteria, especially E. coli are indicators of fecal contamination. In their normal habitat, the colon, these bacteria will not be the cause of any disease. However, there is a remote possibility of local infection or septicemia if they are introduced into broken skin or pores and/or if a person has reduced resistance to disease. The origin of these bacteria in the oil is unclear. Direct contamination from feces would seem unlikely; indirect contamination by workers not washing their hands after using the

toilet is possible. The oil contains a bacteriacide which should eliminate this growth. Whether contamination is too great or the strength of this germicide in the diluted oil is inadequate is uncertain.

The confidential work history and health problem questionnaire administered to the workers indicated that five of seventeen had some skin problems which they felt were related to contact with the coolant oil. Two of the five indicated that their problems intensified as the end of the week approached and the coolant became older. This may be a result of the degeneration of the coolant and concurrent increased numbers of bacteria present, but is probably more related to repeated exposure to the various additives in the coolant.

Attempts were made to obtain medical records from those employees whom it was believed may be suffering from some occupational disease. Of the four present or former (two were deceased) employees in this category, medical records were obtained from three; the remaining employee refused to supply NIOSH with his consent for medical records review. The three cases reviewed by the NIOSH physician had respiratory cancer; two of three were heavy smokers. In the physician's opinion "These three cases of respiratory cancer occurring in cigarette smokers do not, in themselves, suggest the presence of an occupationally-related cancer risk among the bar stock operators. However, since there are no data available to calculate cancer incidence or mortality in this group, there is no basis for saying either that there is or that there is not such a risk at the Chevrolet Transmission Plant."[12]

At the present time, General Motors will not release Company medical records to NIOSH that in this case could be used to further evaluate any possible increased risk of cancer. NIOSH has decided at this time and in this specific case, not to pursue legally the acquisition of these medical records until a ruling is made by the Federal District Court in Dayton, Ohio in General Motors vs. Dr. J. Finklea (case number C-3-77-339). This decision is based on the belief that legal action in the State of Ohio on the same question of release of medical records is not appropriate at this time. When a final court decision is reached, NIOSH will be able to more fully evaluate future requests of this nature.

V. RECOMMENDATIONS

The following recommendations are presented in order to reduce employee exposure to oil mist and to improve working conditions in the bar stock area.

1. The operator should use the splash shields on the bar stock machines. Their purpose is to block the oil mist spray and keep it from contaminating both the employee and the surrounding area.

2. The company should supply light weight, impervious gloves with elbow length arm coverings to the bar stock operators. This will prevent contact dermatitis on the hands and forearms. The employees, in turn, should maintain the integrity of this personal protective equipment, and obtain a replacement when torn. The pH of the coolant should be monitored also. A pH of 8.5-9.0 is best for preventing dermatitis in most people. The more basic pH also reduces metal corrosion.

3. Each bar stock machine should be steam cleaned periodically and the coolant changed to prevent the growth of organisms and the accumulation of fatty deposits. This will probably enhance the cooling properties of the oil and will help eliminate employee dissatisfaction with company management.

4. The company should consult with the manufacturer of the oils used in this operation to determine if there is enough bacteriacide in the oil at the dilution rate used to effectively control the growth of bacteria.

5. Company industrial hygiene personnel should periodically monitor this operation for nitrosamines, benzene, toluene and PNAs. Periodic changing of the oils may reduce the possibility of nitrosamine formation; changing to a completely snythetic oil will eliminate the presence of PNAs. Since BaP, a carcinogen, was found, it is recommended that the switch to a completely synthetic oil be made. Water-based fluids transfer heat two-to-three times faster than oil-based fluids[13], so the switch may be beneficial in this regard. Although the use of synthetics increase the formation of nitrosamines, fluids without the precursors of nitrosamines (nitrates and amines) can be obtained.

6. The source of fecal contamination of the coolant should be investigated. Three possible sources are: 1) contaminated water used initially to dilute the coolant; 2) contamination via worker's poor personal hygiene; and 3) contaminated oil as received from the manufacturer.

7. A better working relationship should be developed between management and local union officials.

VI. REFERENCES

1. NIOSH Manual of Analytical Methods, 2nd ed. DHEW (NIOSH) Publication No. 77-157-A (April 1977).

2. Ibid.

3. "Threshold limit Values of Chemical Substances and Physical Agents in the Workroom Environment with Intended Changed for 1977", ACGIH (1977).

4. OSHA Safety and Health Standards for General Industry (29 CFR 1910). U.S. Department of Labor (Revised January 1976).

5. Ely, T.S., et. al. "A Study of Mortality, Symptoms and Respiratory Function in Humans Occupationally Exposed to Oil Mist", Journal of Occupational Medicine, Vol. 12 (July 1970).

6. "Documentation of the Threshold Limit Values for Substances in Workroom Air", 3rd ed. ACGIH (1971).

7. Current Intelligent Bulletin - Nitrosamines in Cutting Fluids, October 6, 1976.

8. See bibliography in NIOSH criteria document entitled "Occupational Exposure to Coal Tar Products" especially numbers 1, 11, 12, 14-19. DHEW (NIOSH Publication No. 78-107) (September 1977)

9. Ibid.

10. Occupational Diseases - A Guide to Their Recognition. U.S. HEW, Public Health Service, Revised Edition, June 1977.

11. "Particulate Polycyclic Organic Matter", National Adademy of Sciences, Washington, D.C. (1972).

12. Singal, Mitchell, M.D., Memorandum to Case File HE 77-108, July 21, 1978.

13. Springhorn, R.K. (ed.), Cutting and Grinding Fluids; Selection and Application; American Society of Tool and Manufacturing Engineers, Michigan, 1967.

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Table I

Personal Samples for Oil Mist and Organic Vapors
Bar Stock Area

Chevrolet - Transmission Plant #1
Toledo, Ohio

March 21-22, 1978

Job Description	Type Coolant Used	Oil Mist		Organic Vapor		
		Volume Sampled M^3*	Concentration mg/M^3**	Volume Sampled M^3	Concentration mg/M^3	
					Benzene	Toluene
BZ*Bar Stock Opr.	Dascool	0.56	0.36	0.07	N.A.***	N.A.
BZ Bar Stock Opr.	Sunseco	0.44	0.55	----	----	----
BZ Bar Stock Opr.	Sunseco	0.17	1.00	0.05	N.A.	N.A.
BZ Bar Stock Opr.	Sunseco	0.47	0.13	----	----	----
BZ Bar Stock Opr.	Sunseco	0.48	1.04	----	----	----
BZ Bar Stock Opr.	Dascool	0.66	0.33	0.08	N.A.	N.A.
BZ Bar Stock Opr.	Sunseco	0.65	0.32	0.05	N.A.	N.A.
BZ Bar Stock Opr.	Dascool	0.56	0.18	0.08	0.02	0.06
BZ Bar Stock Opr.	Sunseco	0.43	0.23	0.05	N.A.	N.A.
BZ Bar Stock Opr.	Dascool	0.56	0.07	0.03	N.A.	N.A.
BZ Bar Stock Opr.	Dascool	0.66	0.15	0.03	N.A.	N.A.
BZ Bar Stock Opr.	Dascool	0.66	0.18	0.07	N.A.	N.A.
BZ Bar Stock Opr.	Sunseco	0.65	0.35	0.09	0.007	0.009
BZ Bar Stock Opr.	Sunseco	0.64	0.23	----	----	----
Limits of Detection	0.002 mg					
Recommended Criteria			5.0		3.2	375

* Breathing Zone
** Milligrams substance per cubic meter of air sampled
*** Not analyzed