SURVEY REPORT

OF

GENERAL MOTORS ASSEMBLY DIVISION
NORWOOD, OHIO

DATE OF REPORT
January 19, 1978

Industry-Wide Studies Branch
Division of Surveillance, Hazard Evaluations, and Field Studies
National Institute for Occupational Safety and Health

PLACE VISITED:	General Motors Assembly Division Norwood, Ohio
DATE OF VISIT:	June 21, 1977
PERSONS CONTACTED:	Mike Owen Safety Director Patrick Frazee Corporate Industrial Hygienist Robert Osborne UAW Health and Safety Representative
PERSONS MAKING VISIT:	Paul Johnson Industrial Hygienist Dennis Roberts Physical Science Technician
REPORT WRITTEN BY:	Paul Johnson
PURPOSE:	To conduct an industrial hygiene survey to determine the type and extent of industrial exposures existing during torch brazing operations.

INTRODUCTION

A primary responsibility of NIOSH is to collect data and analyze scientific and technical information for the development of occupational health and safety standards. One area planned for future NIOSH criteria development is welding and brazing. Therefore the intent of this project is to identify occupational hazards existing during welding and brazing operations by literature research and industrial hygiene studies, and to provide information that can be used in the development of a NIOSH criteria document.

An evident deficiency as determined by a recent literature review of welding and brazing, is the identification of hazards associated with brazing and thermal spraying of non-cadmium materials such as silver, nickel, zinc, aluminum, copper, chromium, and magnesium alloys. The principal processing techniques using these materials are electric arc spraying and dip, furnace, and torch brazing operations.

HISTORY OF THE PLANT

The General Motors Assembly Division, a subsidiary of General Motors Corporation, began it Norwood Plant operation in 1920. The plant has expanded its production over the years to its now 60-acre site. There are eight major buildings which together total 2,000,500 square feet. The employee force, which totals 4800 persons, consists of 400 administrative and 4400 production workers. The primary plant responsibility is automobile assembly.

DESCRIPTION OF PROCESS

Of particular interest at this plant was the torch brazing booth near Building Column G-20-77. Here, automobile bodies were automatically conveyed through an exhaust ventilated booth at a rate of 57 per hour. As the bodies passed through the booth, various metal parts were joined by two brazers and seven inert gas (MIG) welders. This operation was conducted during two 9-hour shifts.

The brazers used brass rods (60-percent copper, 40-percent zinc) to join galvanized steel to plain steel at three separate locations on each automobile body. The total brazing time required for each body was approximately 30 seconds. Both full and half-face shields were made available to the brazers. However, such protective equipment was not properly utilized during the survey.

The MIG welders used 0.035-inch diameter copper-coated steel wire to join plain steel parts only. The total welding time required for each body was approximately 30 seconds. One welder wore a full-face shield during the evaluation while the others wore full welding type helmets.

The booth itself was equipped with a single overhead exhaust slot extending from one end of the booth to the other. The slot (4-inches wide by 55-feet long) was centered in the booth ceiling at a height of about 10 feet. Overhead make-up air supply grilles were located along both outer edges of the booth and ran parallel to the exhaust slot. Two overhead fans were positioned between the MIG welders and the brazers, and pointed in the direction of the brazers.

An automatic wire-brushing operation was located farther down the conveyor line in another section of the booth. This operation was separated from the brazing area by a silhouetted partition. The profile of the partition matched that of the automobile body and thus permitted the body to pass into the wire-brush area.

POTENTIAL HEALTH HAZARDS

Potential health hazards noted or detected in the torch brazing area are as follows:

1. Fume emitted by MIG welding operations are displaced by two 24 inch fans into the torch brazing area thus exposing the torch brazers to additional fumes and gases.
2. Hot metal particles and slag generated by the torch during the brazing process.
3. Fumes generated from the filler rods and base metals when heat is applied by the torch to melt the materials being joined.
4. Noise caused by automatic wire brushes, located at the end of the MIG welding-torch brazing booth. Torch brazing and MIG welding operations also contributed to increased noise levels.

SAMPLING AND ANALYSIS

A total of 15 air samples were collected for trace metal fume analysis (silver-Ag, copper-Cu, nickel-Ni, zinc-Zn, cadmium-Cd, iron-Fe, chromium-Cr, manganese-Mu, and magnesium-Mg). Four of these samples were collected on 25 mm diameter DM 800 filters by using a MSA Model G pump calibrated at 1.5 liters per minute. These four samples were analyzed by X-ray diffraction (P&CAM 222) for concentrations of zinc oxide. The remaining 11 samples were collected on Millipore AA, 37 mm diameter, 0.8 µm pore size filters by using a MSA Model G pump calibrated at 1.5 liters per minute. These samples were

dissolved in hot nitric acid and then diluted to 25 ml. Analysis was by atomic absorption.

The Quest Model 215 sound level meter was used for noise measurements. All levels recorded by this instrument were monitored on the A-weighted scale at various locations in the torch brazing area.

RESULTS AND DISCUSSION

Zinc Oxide

The results of the four zinc oxide samples collected (shown in Table I) ranged from 0.03 to 0.11 milligrams per cubic meter (mg/m^3). All samples were found to be well within the current OSHA standard of 5.0 mg/m^3 (Table IV).

Trace Metals

Samples analyzed for trace metals (Table II) indicate fume exposures to be within the current OSHA standards. The results for these samples are as follows:

Silver (Ag)	<.003 mg/m^3
Copper (Cu)	.005 - .018 mg/m^3
Nickel (Ni)	<.027 mg/m^3
Zinc (Zn)	.11 - 2.61 mg/m^3
Cadmium (Cd)	<.003 mg/m^3
Iron (Fe)	.05 - .37 mg/m^3
Chromium (Cr)	.003 mg/m^3
Manganese (Mn)	.009 - .010 mg/m^3
Magnesium (Mg)	.004 mg/m^3

It should be noted that Ag, Ni, and Cd concentrations were calculated by using the analytical limits of detection and the air volumes sampled.

Noise

Noise levels measured during the torch brazing operations were found to be above 90 decibels, A weighted scale, dB(A) (Table III). Only during lunch and break periods were the noise levels found to be less than 90 dB(A). The more notable levels of 101-102 dB(A) were recorded about 30 inches from the automatic wire grinders. Although grinding was an intermittent operation (on 5 seconds, then off 57 seconds) levels ranged from 98 to 99 dB(A) 8" from the brazing torch with the grinder not operating. Not only were the torch brazers subjected to increased noise, but the MIG welding operators in the adjoining area were also exposed to levels exceeding 90 dB(A).

It must be mentioned, however, that there was a 4 dB difference noted in the sound level meters used by the NIOSH and General Motors industrial hygienists with the GM sound level meter readings being lower. The instruments were calibrated prior to use and were rechecked after the noise measurements with both apparently reading accurately.

RECOMMENDATIONS

Sample analyses recorded in Tables I and II indicate fume concentrations to be below the current OSHA standards (Table IV). However, the potential for peak exposures to increased concentrations does exist. The MIG welding and brazing booth should be re-evaluated from an industrial hygiene standpoint if there are significant increases in production or changes in processing. It is recommended that the two 24" fans should be relocated or used in such a manner as to eliminate moving potential air contaminants from one section of the brazing - MIG welding booth to another. The full and half-face shields provided the brazers should be worn during all brazing operations.

Noise

Noise levels, recorded in Table III, measured in the torch brazing - MIG welding area were found exceeding 90 dB(A) which is the permissible 8-hour noise exposure established by OSHA. Since the previously mentioned noise level discrepancies existed it is recommended that a noise survey be conducted at the plant in the brazing - MIG welding booth to reassess worker exposure. If the noise levels exceed the OSHA noise standard it is recommended that a hearing conservation program be implemented. Such a program should follow the one outlined in the Criteria for a Recommended Standard, Occupational Exposure to Noise NIOSH, HSM 73-111001 and should include all brazing and welding employees.

Table I

General Motors Assembly Division
Norwood, Ohio

Results of Zinc Oxide (ZnO) Analysis
Torch Brazing and MIG Welding Tunnel

Sample No.	Time (Minutes)	General Area	Concentration of ZnO in mg/m^3
A-1	205	Left - Brazing operations (next to fan)	.11
A-2	221	Left - Brazing operations	.03
A-3	170	Left - MIG Welding Area (Fan)	.04
A-5	180	Right -MIG Welding Area	.07

Quantitative analysis for Zinc Oxide was accomplished according to the NIOSH Manual of Analytical Methods; DHEW (NIOSH) Publication No. 77-157-A, Method number P&CAM 222.

Table II

General Motors Assembly Division
Norwood, Ohio

Results of Trace Metal Analysis
Torch Brazing and MIG Welding Tunnel

Sample No.	Time (Min)	Brazing Area Sampled	Milligrams per cubic meter (mg/m3)								
			Silver	Copper	Nickel	Zinc	Cadmium	Iron	Chromium	Manganese	Magnesium
GM-1	247	Brazing Reliefman	--	--	--	--	--	--	.003	.009	.004
GM-6	165	Brazer - right side of assembly	--	--	--	--	--	--	.003	.010	.004
GM-2	188	Brazer - left side of assembly	<.001	.015	<.011	2.61	<.001	.05	--	--	--
GM-3	177	MIG Welder - left side of assembly	<.001	.012	<.011	.22	<.001	.17	--	--	--
GM-4	173	MIG Welder - right side of assembly	<.001	.013	<.011	.38	<.001	.26	--	--	--
GM-5	73	MIG Welder - right of assembly near grinder	<.003	.018	<.027	.65	<.003	.37	--	--	--
GM-7	127	MIG Welder - left of assembly near grinder	<.002	.013	<.016	.19	<.002	.18	--	--	--

Table II
(continued)

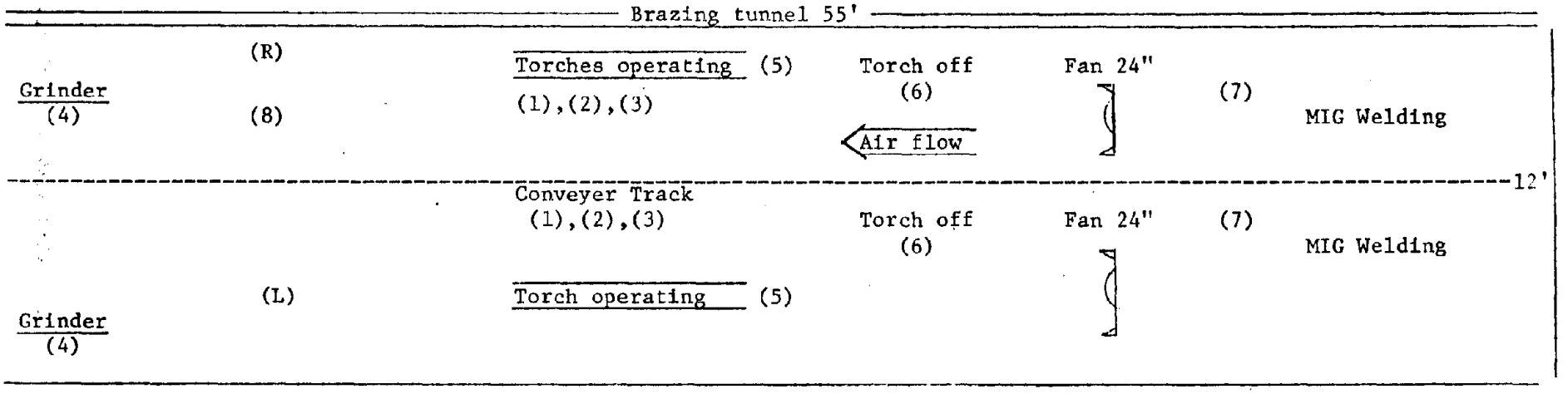
Sample No.	Time (Min)	Brazing Area Sampled	Milligrams per cubic meter (mg/m^3)								
			Silver	Copper	Nickel	Zinc	Cadmium	Iron	Chromium	Manganese	Magnesium
GM-8	160	Brazer - right of assembly	<.001	.005	<.012	.68	<.001	.05	--	--	--
GM-9	90	Brazer - left of assembly near grinder	<.002	.010	<.022	.31	<.002	.21	--	--	--
GM-10	93	Brazer - right of assembly near grinder	<.002	.012	<.021	.11	<.002	.16	--	--	--

Quantitative analysis for trace metals was accomplished according to the NIOSH Manual of Analytical Methods; DHEW (NIOSH) Publication No. 77-157-A.

Table III

General Motors Assembly Division
Norwood, Ohio

Results of Noise Survey



Location - Decription	dB(A)
(1) Right & Left of conveyor track	R-95/L-90
(2) Right & Left of conveyor track 2 ft from torch	R-99/L-95
(3) Right & Left of conveyor track	R-91/L-89
(4) 30" from grinder operation on 5 sec./off 57 sec.	R-102/L-101
(5) Right & Left of conveyor 8" from torch operator (grinder not operating)	R-99/L-89
(6) Right & Left of conveyor next to fan	R-92/L-92
(7) Right & Left of conveyor behind fan	R-94/L-96
(8) Right of conveyor between brazers	R-92

Table IV

Eight-Hour Time-Weighted Exposure Standards

Agency	Milligrams per cubic meters (mg/m3)								
	Silver	Copper fume	Nickel	Cadmium fume	Iron Oxide fume	Chromium	Manganese	Magnesium Oxide fume	Zinc Oxide fume
OSHA (1)	0.01	0.1	1.0	0.1	10.0	1.0	5.0 (ceiling)	15.0	5.0
NIOSH Recommended (2,3,4,5)	--	--	.0015	0.04	--	Cr(VI) .025	--	--	5.0

1. Occupational Safety and Health Administration (OSHA) General Industry Standards, Part 1910, Title 29 of the Code of Federal Regulations dated July 1, 1975, 1910.1000(b), Table Z-1&2.
2. Criteria for a Recommended Standard, Occupational Exposure to Inorganic Nickel DHEW (NIOSH) Publication No. 77-164.
3. Criteria for a Recommended Standard, Occupational Exposure to Chromium VI, HEW Publication No. (NIOSH) 76-129.
4. Criteria for a Recommended Standard, Occupational Exposure to Cadmium, HEW Publication No. (NIOSH) 76-192.
5. Criteria for a Recommended Standard, Occupational Exposure to Zinc Oxide, HEW Publication No. (NIOSH) 76-104.

Table V

Permissible Noise Exposures

Duration per day, hour	Sound level dBA slow response
8	90
6	92
4	95
3	97
2	100
1½	102
1	105
½	110
¼ or less	115

Occupational Safety and Health Administration (OSHA) General Industry Standards, Part 1910, Title 29, Code of Federal Regulations dated July 1, 1975, 1910.95, Table G-16.