

Intra-Company Communication

May 26, 1961

CONFIDENTIAL

Mr. W. A. Jones, Manager
Industrial Relations Department
Engineering and Research Staff

cc E. A. Irvin, M.D.
R. T. Ross

Re: Periodic Industrial Hygiene Survey - Engineering and Research Staff

On May 11, 1961, an industrial hygiene survey was completed by Mr. R. Anderson. Ventilation, paint thinner vapors, chlorine gas, stray radiation, illumination, noise levels, carbon monoxide and mercury vapors were sampled. Also, cafeteria and sanitary facilities were observed. The results are listed on the attached data sheets.

Summary and Recommendations

1. Ventilation: With few exceptions, hood face velocities in the Scientific Laboratories and Research Building were considerably below the recommendations of the Michigan Department of Health. Air velocities through the open door areas of the hoods should be increased.

Convenient length asbestos or chain curtains would give a necessary increase in pickup air velocities under canopies in the rooms listed in the discussion.

In the Maintenance Building Woodworking Shop, ventilation should be increased on the Delta saw and extended to include the disc sander.

2. Chemicals: In-laboratory handling of chemicals appears satisfactory. However, safe use and storage of many highly toxic chemicals requires adequate ventilation in the hoods and in the storage space under the hoods.

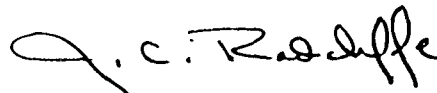
Efforts to find substitutes for benzene and carbon tetrachloride in the present control tests should be continued.

3. Paint and Solvent Vapors: The present condition is satisfactory. No recommendations.
4. Chlorine Gas: Since chlorine gas concentrations are excessive at the operator during aluminum treatment, enlarging of the canopy, without interfering with the operation, plus increased exhaust velocity is needed.
5. Stray Radiation: The present conditions are satisfactory.

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6. Illumination: Illumination at various locations throughout the Research and Engineering area was checked. Two locations with inadequate lighting are noted in the discussion. Local plant engineering should review and make specific recommendations for correction.
7. Noise Levels: Because of occasional excessive noise exposure, the operator in cell D 8 of the Dynamometer Building and the planer operator in the Maintenance Building Wood Shop should wear ear plugs or muffs when within two feet of the operating machines.
8. Carbon Monoxide: Exhaust control and air-borne carbon monoxide concentration were satisfactory in the test cells and garages throughout the area.
9. Trichlorethylene Vapors: At all degreasers concentrations were within the maximum allowable limit.
10. Mercury Vapors: Results were well below the accepted maximum.
11. Cafeterias: Warning lights or exteriorly mounted thermometers which are constantly checked by plant protection should be installed on the kitchen and branch cafeteria food refrigerators where not already installed.
12. Sanitary Facilities: With the exception of chipped paint and plaster in the womens' rest room of the Vehicle Experimental Garage, house-keeping and maintenance in the hourly personnel rest rooms were good. In the Maintenance Building flat top lockers were found with an open space between the lockers and the floor. Both of these conditions make an efficient clean-up program difficult.
13. Miscellaneous Items: The amount of air-borne carbon disulfide vapor created by the spray application of Stresscoat in the Body Engineering Building and the beryllium oxide resulting from a foundry operation were not sampled as these operations were not performed during the survey. It is recommended that plant personnel be contacted and arrangements be made so that this Section can evaluate the air-borne concentrations of these two materials.

This office would appreciate hearing within 30 days through regular channels what action is contemplated on items listed above as 1, 2, 4, 6, 7, 11, 12 and 13.



J. C. Radcliffe, Supervisor
Industrial Safety Section

Attachment

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Discussion

Ventilation: Hoods - The Michigan Department of Health recommends face velocities of 100 fpm (linear feet of air per minute) through the open door areas of hoods handling chemicals and moderately toxic materials and 125 to 200 fpm for highly toxic or radioactive material handling hoods. Two of the radioactive materials hoods and one bench top chemical exhausting hood met these requirements but the other hoods in the Scientific Laboratories and Research Building were below these minimum velocities. The measured face velocities are listed in the attached data sheets.

Hood exhaust velocities should be increased. Since conservation of conditioned air is a problem, consideration, other than keeping hood doors closed when not in use, might be given to replacing some hoods with flexible "spot" exhaust ventilation with provision for positioning or to converting from horizontal to vertical sliding hood doors thus allowing adjustment to the minimum open face width needed by the man using the hood.

Canopies--In the middle bay metallurgy department, the canopy does not adequately control chlorine vapors from the experimental aluminum treatment. Correction through enlarging the canopy and increasing the exhaust velocity is necessary. Pick up velocities at the source of dusts, vapors and gases were inadequately low under canopies in rooms S 3075, S 3020, S 3006, S 3006 solder room and S 2045 of the Scientific Laboratories and Research Building and in the Maintenance Building Metal Working Shop soldering area. Convenient length asbestos or chain curtains would increase these pick up velocities.

Maintenance Building Ventilation--The slot velocity on the Woodworking Shop's Delta saw was zero and the disc sander was not ventilated. Ventilation should be increased and extended in this shop.

Chemicals: In-laboratory handling of chemicals appeared satisfactory. However, highly toxic materials such as bromine, fluorine, hydrofluoric acid, thionyl chloride and hydrazine are stored in hoods or in the storage space under the hoods where there is little or no ventilation.

Efforts to find substitutes for benzene and carbon tetrachloride in the present control tests should be continued.

Paint and Solvent Vapors: The present condition is satisfactory.

Chlorine Gas: At the operator, chlorine gas concentrations were seven times the maximum allowable limit during experimental aluminum treatment. Enlarging the canopy without interfering with the operation plus increased exhaust velocity is needed.

Stray Radiation: Stray radiation was within acceptable limits at the radioactive material laboratory hoods, the X-ray diffraction units, the hospital X-ray operator's booth and the new Gammacell. Wipe-tests for radioactive material at the hood control knobs and bench top in the hot lab were negative.

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Illumination: Illumination was checked at various locations throughout the Research and Engineering Staff area. Special attention was given to the Body Engineering Building where inadequate illumination is alleged. Supplemental lighting is suggested at the visicorder and control panel in the brake test room of the Scientific Laboratories and Research Building, on the metal working shop table in the Maintenance Building and in areas of the Body Engineering Building where vernier scales must be read.

Noise Levels: We understand that ear defenders are available to employees working near test engines and compressors. Because of the high noise level, the operator in cell D 8 of the Dynamometer Building should be especially conscientious in this respect while working within two feet of the operating six cylinder truck engine. Another location where ear defenders should be worn during occasional excessive noise exposure is at the wood shop planer in the Maintenance Building. Slightly excessive constant background noise in the hospital audiometric room can be brought within the ASA standard by plugging or removing the louvers from the incoming air duct.

Carbon Monoxide: Exhaust control and air-borne carbon monoxide concentrations were satisfactory in the test cells and garages throughout the area.

Trichlorethylene Vapors: At all degreasers concentrations were within the maximum allowable limit of 100 ppm.

Mercury Vapors: At manometers and the mercury fusion pump results were well below the accepted maximum of 0.1 mg/m³.

Cafeterias: General conditions in the cafeteria kitchen were good. However, there were no warning light systems or easily visible thermometer to warn of power failure in the kitchen and branch cafeteria food refrigerators. Warning lights or exterior mounted thermometers which are constantly checked by plant protection should be installed.

Sanitary Facilities: Sanitary facilities in shop areas rather than office and engineering areas were inspected during this survey. With the exception of chipped paint and plaster in the womens' rest room of the Vehicle Experimental Garage, housekeeping and maintenance were good to excellent.

The old type flat top lockers found in the Maintenance Building are difficult to keep clean and lockers obtained in the future should have slanted tops. Open spaces between the lockers and the floor should be enclosed with sheet metal so as to eliminate the possibility of debris accumulating under the lockers.

Miscellaneous Items: Carbon disulfide is a highly toxic material which requires good local exhaust. At the present time this operation is performed in an exhaust ventilation room which normally does not provide sufficient control for use of material of this type. Better control would be provided by performing this operation in an exhaust ventilated booth.

The present exhaust ventilation present in the foundry operation is questionable for adequate control of beryllium oxide.

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These operations were not performed during the survey, therefore, evaluation of the quantity of air-borne contamination was not obtained. Because of the physiological effects that may result from exposure to these two materials, this Section would appreciate an arrangement for these operations to be sampled.

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Ventilation

Data Sheet #1

Engineering and Research Staff

<u>Location</u>	<u>Face Air Velocity, FPM</u>
Chemical & Physics Lab Hoods, Scientific Labs & Research	
Room S 3062, hood - northeast corner 1st hood	52
" " " " " 2nd hood	60
" " " southwest " "	69
Room S 3068, hood - east side	10-22
" " " - west side, lab. door open	50
" " " " " closed	48
Room S 3070, " east side	48
" " " west side	24
Room S 3072, " west side	62
" " " east side	60-76
Room S 3074 " east side	52
" " " west side	170
" " " (glass booth) open	0
" " " " " almost closed	95
" " " storage space under east hood	0 (H ₂ F ₂ storage area)
Room S 3079, hood, southwest corner, 1st hood	38
" " " " " 2nd hood	29
" " " " " 3rd hood	32
" " " small hood on bench top, west side	96
" " " " " " east side	112
Room S 3075, courtyard anteroom hood	70
" " " main lab hood (nitric oxide, sulfur dioxide)	35
" " " main lab hood, storage area under hood	0
" " " canopy hood, center of lab.	0
Room S 3071, hood, east side (thionyl chloride and trichloroethyl chloride)	0
" " " west side	20
Room S 3069 " east side	60
" " " west side	30-50
Room S 3061, "	85
Room S 3049, hood	55
Room S 3044, north wall hood, radioactive material	48
Room S 3044, hot lab hood, radioactive material	52
" " " hood, room adjacent to hot lab.	50
Room S 3028, physics lab hood	70
Room S 3028, potassium fluoride oven exhaust	450
Room S 3020, canopy hood	85
Room S 3006, canopy	40 (1 ft. above bench)
" " " , inside small spray booth	0-10
" " " in adjacent room (silver solder)	0- 5 (1 ft. above bench)
Room S 2071, hood, annex	60
Room S 2059, hood	45
Room S 2045, canopy, (graphite dust and heat)	0- 5 (at source)
" " " " " " "	35 (at face)
Room S 2037, Resource lab (should have hood facilities available for venting oxides of nitrogen.)	

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Ventilation (continued)

Data Sheet #2

Engineering and Research Staff

<u>Location</u>	<u>Face Air Velocity, FPM</u>
Room S 2030, Metallography lab. hood	15 (face vel.)
" " " " "	300 (slot vel.)
" " Etching lab hood (use hydrofluoric acid)	12
Room S 2010, canopy with chain curtain	65
" " canopy ventilated area - center of room	70
Carbide tip dumping, hood	75
" " " room floor sweep exhaust	450-600
Room S 2003, Experimental electrostatic spray booth	0- 45
" " 2 hoods	0
Room S 2023, radioactive materials hood, large	125
" " " " small	125
Room S 2031, nonmetallic materials	8- 12
" " natural draft-cold, Lindberg furnace	0
Room S 1008, flexible exhaust duct, welding	280-350
Scientific lab & research, #23 blue print machine	40
" " " material devel. surface grinder	200
" " " material devel. cutoff machine	40
" " " material devel. drill press	450
" " " material devel. lathe	400
" " " material devel. belt sander	300
" " " material devel. bearing lab, canopy	0- 5
" " " Metallurgy Dept., middle bay, chlorine gas canopy exhaust, at face	350
" " " at chlorine source	0- 25
Room E 3197, hood, next to door, southwest corner	5
" " " 2nd from door, " "	2-3
" " " northwest side	35
Room E 3191, Lubrication Lab., 1st hood, southwest side	60
" " " 2nd hood, southwest side	90
" " " 1st hood, northwest side	90
" " " 2nd hood, northwest side	65
" " " 3rd hood, northwest side	2- 5
Room E 2152, hood, north side	0
Room E 2158, hood over scale	100-1000
Room E 2156, paint hood	88
Room E 1155, hood, stress coat test with CS ₂	130
Room E 2205, booth	140
Room E 2205, heat treat furnace canopy	100
Maintenance Building	
Paint shop	250
Metal working shop, solder area canopy	250
" " " " " fume source	0
" " " flexible dust	100-1000
Woodworking shop, planer	200-900 (slat)
" " disc sander	no ventilation
" " Delta saw	0 (slot)

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Ventilation (continued)

Data Sheet #3

Engineering and Research Staff

<u>Location</u>	<u>Face Air Velocity, FPM</u>
Body Engineering	
#1 paint booth, at sprayer	100-300
#2 paint booth, at sprayer	75-250
#3 paint booth, at sprayer	100-400
Engine Experimental Garage	
Booth, B.T.# P471803	125-225
Booth, B.T.# P471802	175-250
Booth, B.T.# P471804	200-250
Booth, jet flow test with benzene	0- 25 at source of vapors
Ford Vehicle Experimental Garage	
Floor exhaust, main aisle	600
Monoxivents	1000 (slot)
Southwest wheel aligning pit	1000
Lincoln Continental Vehicle Experimental Garage	
Wheel aligning pits	1000
Monoxivents	1000 (slot)
Engine Experimental Garage Building, Visualiner pit	1000
Wind Tunnel Garage, pit	1000
Vehicles Test Building	
South end grease pit	1000
Front end pit	No exhaust
Research Vehicles Laboratory	
Garage Visualiner pit	1000
Garage monoxivents	1000 (slot)
Engine and Electrical Building, north crib ozalid machines	150
Power House, rest room - poor exhaust, approx. 4" x 6" opening	75
Paint Shed, ammonia filling station booth	75 (at vapor source)
Body Engineering Building	
Metal shop welding booth	1000 at 4" from duct
Plastic fabricating area, sanding booth	100-125
" " " "	350 (slot)
" " " sanding machine	1000
Epoxy booth in wood shop	1000
Shaper room, at shaper exhaust	1000

*FPM means linear feet of air movement per minute at the base of hoods, booths or canopies. Exceptions are noted in parenthesis.

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Paint and Solvent Vapors

Data Sheet #4

Engineering and Research Staff

<u>Location</u>	<u>Concentrations, PPM*</u>
Scientific Labs and Research, cell 13 dynamometer test	100-450 (gasoline spillage)
Maintenance Building, paint shop, in booth	0- 50
Body Engineering, paint shop, #2 booth	0
Engine Experimental Garage, benzene jet flow test	0-100 (momentarily)
" " " carburetor test room #1	0-150
Paint Shed, general area	0- 20

*PPM means parts of paint thinner or solvent vapors per million parts of air.

The maximum allowable amounts for an eight hour exposure is 200 ppm for xylene vapors and 25 ppm for benzene.

Chlorine Gas

<u>Location</u>	<u>Results, PPM*</u>
Scientific Labs and Research, middle bay metallurgy dept:	
During aluminum melt treatment and pouring	7.0
Five to fifteen minutes after pouring	0.0

*PPM means parts of chlorine gas per million parts of air. The maximum allowable exposure is 1.0 ppm.

Stray Radiation

<u>Location</u>	<u>Stray X-radiation, Mr/Hr*</u>
Scientific Labs and Research	
Room 3044, hot lab hood	0
" " " " storage vault	0-2.5
" " radioactive materials hood	0
Room 1026, 5 KV Norelco X-ray diffraction	0
" " , 45 KV Norelco X-ray diffraction	1.5-20 (2" from source)
" " " " " "	0.5 (no shield)
" " " " " "	0 (with shield)
Room 3049, G.E. 40 KV XRD ⁴ X-ray diffraction	0.1
" " Phillips X-ray diffraction	0.1
Hospital X-ray unit, chest X-ray (in booth)	0.1
" " " " " (outside door)	0.1
" " " lumbar spine	0
" " " foot X-ray	0.1
Room S 2023, radioactive waste, in barrels	0
Room S 1076, gamma cell, 2" from front	2.5
" " " " 2" from rear and sides	1
" " " " at drawer with collar open	4
" " " " 3' from cell	0-1

*Mr/Hr means milliroentgens of stray x-radiation per hour.

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Radioactive Source Lab Wipe-Tests

Data Sheet #5

Engineering and Research Staff

<u>Location</u>	<u>Radiation in CPM*</u>
Scientific Labs and Research	
Room 3044, hot test lab, hood control knobs	0
" " " " " inside hood	0
" " " " " table top	0
" " " " " at vaults	0
" " " " " hood window	0
" " main lab hood window	0
" " " " inside hood	0

*CPM means counts per minute above the background count of 50 cpm on our Tracerlab laboratory monitor.

<u>Illumination</u>	<u>Reading in Foot-Candles</u>
Scientific Labs and Research	
Middle bay, metallurgy	35-50
Room E 3197, Fisher isotherm controls	30-35
Room E 1155, at desk	30-35
Brake dynamometer room, Visicorder	28
Brake dynamometer room, at brake test	30
Brake dynamometer room, at control panel	12-15
Dynamometer Building, Mr. Patterson's office, at desk	30-35
" " " " secretary's desk	28-32
" " dynamometer test engineering desks	70
" " Mr. Gass' office, at desk	30
" " Mr. Rhode's office, at desk	28-50
" " Operations office, central desk	38
Maintenance Building, paint shop, inside paint booth	45
" " metal working shop, solder table	8-10
" " metal working shop, bench top	50
Ford Vehicle Experimental Garage, general area	20-40
" " " " Visualiner pit without supplementary lighting	5-10
Lincoln Continental Experimental Garage, Visualiner pit without supplemental lighting	5-10
Lincoln Continental Experimental Garage, general area	20-40
Engine Experimental Garage Building, Visualiner pit, without supplemental lighting	8
Wind Tunnel Garage, pits without supplemental lighting	5-10
Vehicles Test Building, grease pit	5-10
Vehicles Test Building, front end pit	5-10
Vehicles Test Building, general area	20-40
Research Vehicles Laboratory, garage Visualiner pit	5-10

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Illumination (continued)

Data Sheet #6

Engineering and Research Staff

<u>Location</u>	<u>Reading in Foot-Candles</u>
Body Engineering	
Metal shop men's rest room	35
Metal shop locker room	30
Wood shop men's rest room	15-20
Vibration test equipment meter, bay S 29	35-45
S 23	45
O 27 Reliance control panel	50
K 36 prototype assembly	45
H 36	62
G 36	40-42
H 33, reading fine vernier scale	42
H 27, working inside car body	2
H 25, body build up	20-45
K 23, hood and fender build up	30-40
F 21, bench 14 B	85
F 22, bench 12 B	90
F 22, bench 11 B	90
F 23, bench A 3	65-80
F 25, bench 7 B	90
F 25, layout table	50-80
F 27, bench B 1	90
F 28, bench area	5-70
F 27, checking table	60
Machine shop, at table	85
" " at lathe	350 (supplemental lighting)
" " #1 shaper	55-80
" " #2 shaper	35-70
" " milling machine	50-300
" " surface grinder	55
C 25, bench 4 C	85
C 25	70-75
C 24, bench 6 C	80
C 24, bench 7 C	85
C 24, bench 8 C	85
C 23, bench 4 A	90
C 21, bench 13 C	90
C 21, bench 14 C	85
Metal shop, Kirksite welding booth	40-60
Paint shop, general area	60-85
Plastic fabricating sanding booth	10-20
Engine and Electrical Engineering Building, n. blue print	
crib	70
Power House, general area	10-120
" " control panel	10-15
" " rest room	15
Paint Shed	10-120

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Noise Levels

Data Sheet #7

Engineering and Research Staff

<u>Location</u>	<u>Over-</u> <u>all</u>	<u>Frequencies in Cycles per Second</u>								
		<u>20</u> <u>75</u>	<u>75</u> <u>150</u>	<u>150</u> <u>300</u>	<u>300</u> <u>600</u>	<u>600</u> <u>1200</u>	<u>1200</u> <u>2400</u>	<u>2400</u> <u>4800</u>	<u>4800</u> <u>9600</u>	
Scientific Labs & Research										
Cell #3, dynamometer room	86-90									
Cell #5, " "	90-94									
Cell 12 B, " "	83									
Cell 12 A, " "	84									
Cell 10 A, " "	78-83									
Dynamometer Building										
Cell 16 C, dynamometer room	89(at control panel)									
Cell 16 C, " "	94-96(1ft.from engine)									
Components room, air conditioning										
compressor	90-92(intermittently)									
" " "	100 (momentarily)									
Cell D 19	74(at control panel)									
Cell D 19	93-97(2ft. from engines)									
Cell D 8 at operator	94-96	75	77	90	88	92	90	85	81	
Cell D 8 at engine	104	82	79	99	95	96	96	94	90	
Cell D 13, cardinal	88									
Hospital audiometric room	60	59	49	39	43	35	31	24	19	
Hospital audiometric room with										
air duct louvers removed:	59	58	47	38	38	31	27	22	17	
Maintenance Building										
Paint shop booth	98	89	93	86	93	87	85	80	74	
Metal shop grinding	80-100									
Wood shop, planer	95-108	89	97	90-98	98-108	98-106	98-106	91	80	
Power House, near compressors	104									
Ford Tentative Goal		110	102	96	94	94	94	94	94	
ASA Standard		40	40	40	40	47	57	62	67	

Note: All noise levels are in decibels

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Carbon Monoxide

Data Sheet #8

Engineering and Research Staff

<u>Location</u>	<u>Results, PPM*</u>
Scientific Labs and Research	
Middle bay metallurgy department	0-25
Dynamometer cell #3	Less than 10
Dynamometer cell #5	Less than 10
Dynamometer Building	
Dynamometer cell #16C	Less than 10
Dynamometer cell #19D	Less than 10
Dynamometer cell #8 D	Less than 10
Lincoln Continental Vehicles Experimental Garage	20
Scientific Labs and Research, Room S 2010	Less than 10
Screen room	Less than 10
Starter test room	Less than 10
Transportation garage washmobile	Less than 10
Wind tunnel garage	Less than 10
Vehicles Test Building	Less than 10

*PPM means parts of carbon monoxide per million parts of air.

The maximum allowable limit is 100 ppm for a daily eight hour exposure.

Trichlorethylene Vapors

<u>Location</u>	<u>Results, PPM*</u>
Scientific Labs and Research	
Bearing lab degreaser	0-20
Garage, degreaser	150(momentarily)
Garage, degreaser	25-80(on stand)
Garage, degreaser	10(on floor)
Ford Vehicle Experimental Garage, degreaser	5
Vehicles Test Building, degreaser	50
Experimental Engine machine shop, degreaser	25
Experimental Engine inspection area, degreaser	25
Body Engineering, paint shop degreaser	5
Dynamometer Building, degreaser, La 17	5

*PPM means parts of trichlorethylene vapors per million parts of air.

The maximum allowable concentration is 100 ppm for an eight hour day or 200 ppm for short exposure.

Mercury Vapors

<u>Location</u>	<u>Results, Mg/M³*</u>
Scientific Labs & Research	
Garage, manometer spillage	Less than .02
Room S 1026, Mercury Vacuum fusion	Less than .02

*Mg/M³ means milligrams of mercury vapor per cubic meter of air.
The maximum allowable limit is 0.1 Mg/M³.

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