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16. Abstract (Limit: 200 words)

Worker exposures to coal tar pitch volatiles, fluorides, and heat were surveyed from July 10 to 14, 1972, at Martin Marietta Aluminum Company (SIC-3341) in the Dalles, Oregon. The number of employees at the company was not specified. All airborne fluoride concentrations were below 1.4 milligrams per cubic meter (mg/cu m) and all urinary fluoride concentrations were below 8 milligrams per liter. Several samples for benzene soluble material exceeded the threshold limit value of 0.2mg/cu m. Average wet bulb globe temperatures ranged from 77.9 to 84.6 degrees F. No exposure standards were included for fluoride or heat. The authors conclude that workers were exposed to significant amounts of coal tar pitch volatiles. They note that compliance with legal exposure standards should be determined from samples collected by the company and the government agency responsible for compliance enforcement.

17. Document Analysis a. Descriptors

Field-Study, Region-10, Coal-tar-pitch, Chemical-exposure, Health-survey, Metal-workers, Industrial-health, Air-sampling, Standards, Heat-exposure, Industrial-hygiene

b. Identifiers/Open-Ended Terms

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Introduction

During the week of July 10-14, 1972 a team of National Institute for Occupational Safety and Health (NIOSH) personnel visited the Martin-Marietta Aluminum Plant at The Dalles, Oregon to conduct an Industrial Hygiene Survey. NIOSH participants were: Arvin Apol, Lee Larsen, Raymond Rivera, and William Wagner.

A heat stress study was conducted during August by a research team from NIOSH, Cincinnati, Ohio, under the immediate supervision of Roger Jensen. Dr. Frank Dukes-Dobos, Chief Physiology and Ergonomics Branch of NIOSH had visited the plant during July to plan the heat stress study.

The purpose of these surveys was to determine exposure levels to coal tar pitch volitiles, fluoride, heat, or other potential health hazards. The information obtained will be used by the Division of Field Studies and Clinical Investigations as part of a broader study of the potential health hazards of various air contaminants in industry. Such studies will provide useful information for development of criteria for recommended standards documents for various toxic materials.

Occupational Safety and Health research is one of the most important functions of the National Institute for Occupational Safety and Health (NIOSH). Under provisions of the Occupational Safety and Health Act of 1970, a wide range of research projects are conducted. The Institute conducts research on effects of exposure to toxic substances and harmful physical agents and to combinations of exposures.

Survey Procedures

Fluorides:

General air samples to determine both particulate and gaseous fluorides were taken in the potroom areas. These samplers were equipped with a cassette containing an 0.8μ pore size Millipore AA filter to catch the particulates followed by a midget impinger containing distilled water to collect the gaseous fluorides. The amount of fluoride was determined with a fluoride specific electrode. Urine samples were also obtained and analyzed for fluoride.

Coal Tar Pitch Volatiles and Total Dust:

Personnel samplers were attached to some of the workers and run at 1.7 l/min. for the entire shift if possible, or until he left the work area. The total airborne fraction was collected on a combination of a glass fiber Type A filter followed by a 0.8μ pore size silver membrane filter, and then finally, a support pad. The filters were weighed before the survey and then reweighed after sampling to determine the total dust concentration. Next, the samples were sent to the Western Area Occupational Health Laboratory for a benzene soluble fraction analysis.

In the benzene soluble fraction determination the particulate material on the preweighed filters is extracted by benzene using the continuous cycling process of a Soxhlet extractor. After extraction, the solution is filtered through the original filters and the weight loss of the filters is considered to be the amount of benzene solubles.

The benzene soluble analysis is based on a method requiring weight determinations. Our experience indicates that the practical accuracy of the weight determination is to the nearest 0.1 milligram. To overcome this source of error several samples were combined to give greater accuracy.

Heat Stress:

Information obtained during the survey during August 21-25, 1972 was primarily to provide minimum background information on heat stress at the Martin-Marietta Company. This information was obtained by a group from the Physiology and Ergonomics Branch of NIOSH located at Cincinnati, Ohio.

Information related to several types of heat stress indices was obtained. Of interest for this report is the information obtained for use with the proposed criteria for a recommended standard for Occupational Exposure to Hot Environments recently recommended to the U.S. Department of Labor by the National Institute for Occupational Safety and Health (NIOSH).

The survey procedure for collecting information for use with the proposed standard consisted of determining Wet Bulb Globe Temperature (WBGT) readings in various work and rest areas. Also a time study was conducted to determine where the worker spent his time. This information enabled the researcher to calculate a time weighted average WBGT for various job categories.

Results and Discussion

Fluoride:

Values obtained from the analysis of urine for fluoride are reported in Table 1. Values above 8 mg/liter were rechecked by obtaining and analysing another urine sample. These values of samples obtained during October are reported in Table 1A. All workers had values less than 8 mg/liter either on the first or second sampling.

Air concentrations of fluoride, both gaseous and particulate fluoride are reported in Table II. These figures are well below present safe guidelines for exposure in the work environment to gaseous and particulate fluroide. However, most samples were area type samples and may not be truly representative of an individual workers exposure.

Coal Tar Pitch Volatiles:

Table III gives the values obtained for benzene soluble material (used to evaluate exposure to coal tar pitch volatiles). Table IV gives the values obtained for total particulate. It will be noted from Table III that a number of benzene soluble values exceeded the present threshold limit value for benzene soluble material of 0.2 mg/M^3.

Heat Stress:

WBGT values obtained during the survey are reported in Table V.

There is no enforcement type standard for heat stress at the present time. NIOSH has submitted criteria for a recommended standard for Occupational Exposure to Hot Environments to the U.S. Department of Labor for their consideration, but no standard has yet been issued by this agency.

The proposed standard defines a hot environmental condition to mean any combination of air temperature, humidity, radiation and wind speed that exceeds a Wet Bulb Globe Temperature (WBGT) of 79°F.

This proposed standard states that when exposure of an employee is continuous for one hour or intermittent for a period of two hours and the time weighted average WBGT exceeds 79°F for men or 76°F for women, then any one or combination of practices shall be initiated to insure that the employee's body core temperature does not exceed 100.4°F.

The information obtained was not for compliance purposes. It would have been necessary to look at several other time periods if such were the case.

The outside dry-bulb temperatures the week of the survey ranged throughout the seventies (°F). Time weighted average values may or may not be higher for an individual worker when outside temperatures are higher. Men who know their workplace usually know how to maximize time spent in the cooler spots. Therefore, the time-location data we collected may not be representative of exposures during hotter days. It is therefore recommended that the company do its own time-location studies and environmental measurements at a time when the outside temperatures are higher.

Comments and Conclusions

From the information obtained during the survey the only air contaminant greatly exceeding present threshold limit value guidelines is coal tar pitch volatiles. It should be emphasized however, that this survey was conducted to obtain information to enable NIOSH to evaluate existing guidelines and standards. NIOSH is a research agency not an enforcement organization. Therefore, an evaluation of compliance with enforcement type standards for the materials mentioned in this report should be based on samples collected by company or governmental agencies concerned with compliance type activities.

TABLE 1. FLUORIDE IN URINE DETERMINATION

Sample #	Job Title	Fluoride mg/Liter
15	Cell Operator	3.7
16	" "	2.4
10	" "	0.7*
22	" "	1.0
23	" "	6.2
11	" "	3.4
17	" "	3.1
24	" "	1.4*
12	" "	3.4
39	" "	3.9
25	" "	2.7
13	" "	6.8
52	" "	2.8
49	" "	5.6
32	" "	4.0
45	" "	6.8
58	" "	5.7
46	" "	6.0
59	" "	2.5
29	" "	2.8
42	" "	9.6
41	" "	6.1
30	" "	2.1
28	" "	7.6
53	" "	4.0
70	" "	2.2
77	" "	4.2
44	" "	2.1
75	" "	1.5*
78	" "	2.0
76	" "	3.2

*No Specific Gravity Correction

Table 1 (continued)

Sample #	Job Title	Fluoride mg/Liter
57	Cell Operator	6.2
54	" "	1.9
80	" "	3.2
43	" "	1.9
84	" "	4.3
68	" "	3.4
66	" "	3.4
72	" "	2.2
71	" "	2.0
63	" "	3.4
105	" "	2.3
86	" "	2.2
89	" "	1.3
104	" "	3.0
103	" "	1.4
95	" "	1.8
83	" "	2.5
98	" "	3.9
61	" "	3.4
81	" "	3.6
82	" "	2.1
93	" "	3.4
62	" "	3.8
91	" "	2.9
107	" "	2.1
90	" "	0.2
108	" "	0.8
109	" "	2.5

Table 1 (continued)

Sample #	Job Title	Fluoride mg/Liter
7	Stud Puller	1.6
1	" "	1.7
8	" "	1.9
9	" "	2.2
40	" "	3.9
48	" "	3.2
47	" "	1.8
19	" "	5.5
31	" "	3.1
37	" "	3.9
85	" "	2.6
74	" "	2.7
69	" "	4.3
94	" "	0.7
87	" "	1.2
100	" "	2.4
102	" "	1.0
99	" "	1.1
92	" "	1.7
21	Alloy Tapper	3.2
55	Alloy Man	1.7
110	" "	3.1
2	Tapper	4.4
3	"	7.2*
4	"	3.4
36	"	6.8
18	"	1.6
56	"	2.5
26	"	1.0
111	"	1.2
51	Briquett Driver	1.7
67	" "	1.7
106	" "	1.6

Table 1 (continued)

Sample #	Job Title	Fluoride mg/Liter
6	Transfer Driver	3.5
20	" "	1.7
101	" "	1.0
88	" "	4.0
60	" "	19.0
14	Foreman (Pot Line)	3.9
33	"	5.1
50	"	3.7
38	"	4.3
27	"	1.1
73	"	2.7
65	"	2.7
5	Cruce Room	2.1
35	" "	4.5
97	" "	1.8
79	Summer Relief	3.0
96	Extra Man	2.4
64	" "	1.3

TABLE 1A

FLUORIDE IN URINE DETERMINATIONS

(Recheck of "high values" from samples collected during July)

SAMPLE NUMBER	JOB TITLE	FLUORIDE MG/LITER
1	Cellman	5.5
2	Tapper	0.4
3	Cell Control	1.9
4	Tapper	3.3
5	Cellman	1.2
6	Cellman	5.1
7	Cellman	2.5
8**	Stud Puller	0.9
9	Cellman	1.3
10**	Stud Puller	4.7
11	Cellman	2.5
12	Tapper	2.5
13	Cellman	3.6
14	Cellman	5.1
15	Cellman	6.7
16	Cellman	0.8
17	(?)	3.6
18	Cellman	2.0
19**	(?)	6.5
20	Cellman	3.2

** <15 ml sample

TABLE 1A

FLUORIDE IN URINE DETERMINATIONS
(Recheck of "high values" from samples collected during July)

SAMPLE NUMBER	JOB TITLE	FLUORIDE MG/LITER
1	Cellman	5.5
2	Tapper	0.4
3	Cell Control	1.9
4	Tapper	3.3
5	Cellman	1.2
6	Cellman	5.1
7	Cellman	2.5
8**	Stud Puller	0.9
9	Cellman	1.3
10**	Stud Puller	4.7
11	Cellman	2.5
12	Tapper	2.5
13	Cellman	3.6
14	Cellman	5.1
15	Cellman	6.7
16	Cellman	0.8
17	(?)	3.6
18	Cellman	2.0
19**	(?)	6.5
20	Cellman	3.2

** <15 ml sample

TABLE 2. FLUORIDE IN AIR CONCENTRATIONS

Date	Location	Sample Number	Time	mg of F/M^3 Soluable	Insoluable	HF	Total Fluoride mg/M^3	Comments
'11/72	Room E	48	200-	0.24	0.01	--	0.36	Sweeping ore into bath, riding on ore truck
		MI-I	302	--	--	0.11	0.36	Adding Alumina (worn by LBL)
'11/72	A and B Lines	F64	154-	0.07	1.5	--	0.22	(Sampler worn by WL)
		MI-2	338	--	---	< 0.01	0.22	
'11/72	Room C; near cell 20; outside wall area sample	35	200-	0.14	0.10	--	0.28	
		MI-3	350	--	--	0.04	0.28	
'12/72	Room C; near cell 20; outside wall area sample	40	607-	0.10	0.06	--	0.25	
		MI-19	927	---	--	0.09	0.25	
'12/72	Tapper in Room E	47	615-	0.34	0.12	--	0.91	Sampler worn by Ind. Hyg.
		MI-18	715	--	--	0.45	0.91	
'12/72	Room A; at voltage control box near cell 22	49	0645-	0.11	< 0.01	--	0.19	Area sample
		MI-17	940	--	--	0.07	0.19	
'12/72	Tapper in Room C	39	915-	0.25	0.15	--	0.41	Sampler worn by Ind. Hyg.
		MI-14	1025	--	--	0.01	0.41	
'12/72	Stud puller (pulling in Room C)	50	0925-	0.14	0.02	--	0.44	Sampler worn by Ind. Hyg.
		MI-5	1150	--	--	0.28	0.44	
'12/72	In crane cab used for pulling studs	46	0952-	0.12	0.02	--	0.15	
		MI-6	1150	--	--	0.01	0.15	

Table 2 (Continued)

Date	Location	Sample Number	Time	mg of F/M^3 Soluable	Insoluable	HF	Total Fluoride mg/M^3	Comments
'/13/72	Cell Operator	33	440-	0.30	0.04	--	1.34	Sampler worn by worker
		MI-21	655	--	--	1.0	1.34	
'/13/72	Cell Operator	43	441-	0.21	0.32	--	0.74	Sampler worn by worker
		MI-22	717	--	--	0.21	0.74	
'/13/72	Cell Operator	42	443-	0.21	0.01	--	0.54	(water in tube) Sampler worn by worker
		MI-23	610	--	--	0.32	0.54	
'/13/72	Room B; near cell 47 at sidewalk	45	705-	0.07	0.01	--	0.13	Area sample
		MI-30	1010	--	--	0.05	0.13	
'/13/72	A Room; near cell 51 at sidewalk	32	725-	0.05	< 0.01	--	0.08	Area sample
		MI-31	1006	--	--	0.02	0.08	
'/13/72	A Room; near cell 17 sidewalk	20	746-	0.16	< 0.01	--	0.41	Area sample
		MI-40	1007	--	--	0.24	0.41	

Table III. AIR CONCENTRATIONS OF BENZENE SOLUBLE MATERIAL

Field Number	Description	Composite Volume m^3	Composite Benzene Solubles mg/m^3
1.	Composite of 4 field samples Stud Pullers 7-11-72	2.810	1.9
2.	Composite of 3 field samples Tappers 7-11-72	1.878	0.59
3.	Composite of 5 field samples Cell Operators 7-11-72	3.232	0.41
4.	Composite of 5 field samples Cell Operators 7-12-72	4.374	0.40
5.	Composite of 3 field samples Tappers 7-12-72	2.576	0.47
6.	Composite of 4 field samples Stud Pullers 7-12-72	3.248	1.9
7.	Composite of 3 field samples Lunch Room 7-12-72	1.980	< 0.1
8.	Composite of 4 field samples Stud Pullers 7-13-72	3.302	2.0
9.	Composite of 7 field samples Cell Operators 7-13-72	5.724	0.40
10.	Composite of 3 field samples Tappers 7-13-72	2.540	0.15
11.	Composite of 2 field samples Briquet Drivers 7-11, 7-12, 7-13-72	1.658	< 0.1

Table III (Continued)

Field Number	Description	Composite Volume m^3	Composite Benzene Solubles mg/m^3
f93	Transfer Driver 7-12-72	0.888	0.41
12.	Composite of 5 field samples Rammers 7-11-72	4.530	0.41
f69	Fork Lift Operator 7-11-72	0.920	< 0.1
13.	Composite of 6 field samples Rammers 7-12-72	4.560	0.44
14.	Composite of 2 field samples Mixerman 7-12-72	1.599	< 0.1
f99	Crusher Man 7-12-72	0.756	2.1
15.	Composite of 2 field samples Jack Riser 7-12-72	1.420	0.28
16.	Composite of 3 field samples Stud Pullers	2.244	1.8
	Composite of 5 monitors (Consisting of 1 silver membrane filter and 1 fiberglas filter each)		(0.6 mg)
	Composite of 3 filters as described above		(0.3 mg)

All Samples were corrected for a blank of 0.1 mg per filter

Table III. AIR CONCENTRATIONS OF BENZENE SOLUBLE MATERIAL

Field Number	Sample Description	Sampling Period	Benzene Solubles mg/m^3
f94	(Sequential Samples 7-11 to 7-14 C Room near Cell 20 at sidewall)	9:50 - 1:50 PM 7-11-72	0.22
f90	" " " " " "	1:50 - 5:50	< 0.1
f71	" " " " " "	5:50 - 9:50	< 0.1
f72	" " " " " "	9:50 - 1:50 AM 7-12-72	< 0.1
f68	" " " " " "	1:50 - 5:50	< 0.1
f88	" " " " " "	5:50 - 9:50	< 0.1
f86	" " " " " "	9:50 - 1:50 PM	0.27
f95	" " " " " "	1:50 - 5:50	< 0.1
f62	" " " " " "	5:50 - 9:50	< 0.1
f98	" " " " " "	9:50 - 5:50 AM 7-13-72	0.17
f96	" " " " " "	5:50 - 1:50 PM	< 0.1
f65	" " " " " "	1:50 - 9:50	0.18
f84	" " " " " "	10:45 - 2:45 AM 7-14-72	< 0.1
f91	" " " " " "	2:45 - 6:45	< 0.1
f58	(Area Samples - Room B near Cell 12 sidewall)		0.37
f87	(Area Samples - Room C near Cell 13 sidewall)		0.13
f34	(Area Samples - Room D near Cell 14 sidewall)		< 0.1
f16	(Area Samples - Room B near Cell 44 sidewall)		< 0.1

NOTE: The area and sequential samples were taken at the outside wall of the potroom and are not considered to be representative of an individual workers exposure. It was not practical to obtain area samples in the center of the building locations. There is better ventilation at the outside wall location where a good portion of the wall at the workers level is open to the outside atmosphere.

TABLE IV - Air Concentrations of Total Particulate

Job Description	Total Particulate mg/m^3	Composite Benzene Soluble mg/m^3
Stud Pullers		1.9
Filter 49	7.2	
29	9.6	
44	5.9	
45	9.4	
Tappers		0.59
Filter 47	21.4	
20	1.7	
	3.9	
Cell Operators		0.41
Filter 36	6.8	
46	2.2	
10	3.7	
42	2.3	
32	7.2	
Cell Operators		0.40
Filter 11	6.2	
7	2.4	
33	5.9	
23	10.4	
5	0.9	
Stud Pullers		1.9
Filter 8	6.1	
37	6.2	
19	4.9	
13	6.2	
Lunch Room		0.1
Filter 54	.8	
59	.4	
80	1.1	

TABLE IV - Continued

Job Description	Total Particulate mg/m^3	Composite Benzene Soluble mg/m^3
Stud Pullers		2.0
Filter 57	4.1	
81	7.8	
9	6.2	
52	3.9	
Cell Operators		0.40
Filter 76	5.4	
79	4.7	
50	9.1	
78	1.7	
56	5.0	
51	12.4	
38	0.6	
Tappers		0.15
Filter 83	1.3	
82	2.8	
55	3.3	
Briquet Drivers		<0.1
Filter 18	1.3	
41	1.5	
Transfer Driver		0.41
Filter 93	3.3	
Rammers		0.41
Filter 60	2.2	
61	3.2	
74	3.7	
63	3.7	
75	3.0	

TABLE IV - Continued

Job Description	Total Particulate mg/m^3	Composite Benzene Soluble mg/m^3
Fork Lift Operator		<0.1
Filter 69	2.4	
Rammers		0.44
Filter 66	3.9	
67	2.8	
70	4.5	
73	--	
85	2.0	
97	2.7	
Mixerman		<0.1
Filter 100	2.5	
89	0.9	
Crusher Operator		2.1
Filter 99	11.5	
Jack Risers		0.28
Filter 15	0.6	
14	1.6	
Tappers		0.47
Filter 21	0.0	
3	2.8	
4	7.3	
Stud Pullers		1.8
Filter 28	1.4	
40	6.2	
27	7.2	

TABLE IV - Continued

Job Description	Total Particulate mg/m^3	Composite Benzene Soluble mg/m^3
Crusher Grinder Operator	42.4*	--
Lead Man and Scale Operator	42.7*	--

*These samples contained less than 1% free silica. No U.S. Department of Labor Standard has been issued for coke dust. A standard for coal dust is 2.4 mg/M^3. A standard has also been issued for inert or nuisance dust. This value is 5 mg/M^3.

TABLE V - Average Wet Bulb Globe Temperature Values

Job	Average WBGT	Time Period
Stud Pullers	78.4	8:38 - 10:38 a.m.
" "	77.9	10:38 - 11:53 a.m.
" "	78.7	1:00 - 3:00 p.m.
Cell Operators	84.6	8:03 - 10:06 a.m.
" "	80.8	10:06 - 11:05 a.m.
" "	80.0	1:23 - 3:34 p.m.