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HEALTH HAZARD EVALUATION REPORT 71-13-47
HAZARD EVALUATION SERVICES BRANCH
DIVISION OF TECHNICAL SERVICES

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JULY 1973

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

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REYNOLDS METALS COMPANY
BAUXITE, ARKANSAS

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I. SUMMARY DETERMINATION

A. 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.

The National Institute for Occupational Safety and Health (NIOSH) received such a request from an authorized representative of employees regarding exposure to various dusts in operation at the Reynolds Metals Company plant in Bauxite, Arkansas.

Substances evaluated were bauxite dust, alumina dust, sinter dust, crystalline silica and fluorides. Bauxite, alumina and sinter dust are categorized as inert or nuisance dusts.

B. Federal Standards

The occupational health standards promulgated by the U.S. Department of Labor (Federal Register, Part II, §1910.93 (Tables G-1 and G-3) applicable to substances of this evaluation are as follows:

Substance	8-Hour Time-Weighted Average Concentration
Nuisance or Inert Dust (Bauxite, Alumina and Sinter Dust)	
a. Respirable Dust	5.0 mg/M3*
b. Total Dust	15.0 mg/M3
Crystalline Silica	
a. Respirable Dust	$\frac{10 \text{ mg/M}^3}{\%SiO_2 + 2}$ **
b. Total Dust	$\frac{30 \text{ mg/M}^3}{\%SiO_2 \text{mg/M}^3}$ **
Fluoride (F)	2.5 mg/M3

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* Milligrams of particulate per cubic meter of air.

** For pure crystalline silica dust samples, $\%SiO_2$ is 100, hence standards of 0.29 and 0.1 mg/M^3 apply for "total" and "respirable" fractions respectively from the above equations. For essentially crystalline-free dust samples, percent free silica is zero, and the nuisance dust levels of 15.0 and 5.0 mg/M^3 apply for "total" and "respirable" fractions respectively.

C. Environmental Evaluation

An environmental survey was conducted on March 8-9, 1972 and determinations made of exposures to substances indicated above. Twenty-seven (27) personal and eleven (11) general room air samples were obtained.

The air sample concentration levels of respirable bauxite dust ranged from 2.03 to 14.38 mg/M^3 in buildings 10A and 10B. The air concentration levels of respirable alumina dust ranged from 2.15 to 8.47 mg/M^3; of total alumina dust from 2.18 to 83.47 mg/M^3 in buildings 53, 310 and 325. Concentrations of respirable sinter dust ranged from 0.56 to 14.92 mg/M^3; for total sinter dust from 2.70 to 7.51 mg/M^3. Fluoride concentration levels ranged from 0.6 to 0.89 mg/M^3. Airborne crystalline silica was found in two samples at levels of 2.14 and 2.65 mg/M^3 - well in excess of the pure crystalline silica Federal Standard. This latter finding for silica was considered "questionable" due to possible errors caused by sample contamination in preparation for laboratory analysis. Thus, an environmental re-evaluation of the worksite, building 225E for silica was made on November 8-9, 1972.

Thirteen (13) personal and fifteen (15) general room air samples were obtained in building 225E. The air sample concentration levels of respirable crystalline silica ranged from 0.00 to 0.05 mg/M^3 and of total silica from 0.00 to 0.20 mg/M^3. Concentrations of respirable sinter dust ranged from 0.5 to 23.0 mg/M^3, for total sinter dust from 5.7 to 50.7 mg/M^3.

In summary, the results of the environmental studies conducted in March and November 1972 indicated that air sample concentration levels of bauxite dust in buildings 10A and 10B, alumina dust in buildings 310 and 325, and sinter dust in buildings 225E and 225W substantially exceeded the established Federal nuisance dust standards, fluoride and crystalline silica air sample concentration levels were, below their respective Federal standards.

D. Medical Evaluation

A medical evaluation was conducted on March 8-9, 1972. Twenty-two (22) employees potentially exposed to bauxite, sinter and alumina dust, silica, and fluorides were interviewed. A few workers in the alumina bagging area noted occasional burning of the nose and most workers noted large quantities of caked alumina in their noses at the end of the workshift. Workers in the bagging area had a history of skin irritation from exposure to alumina, but the dermatitis was well controlled by the use of protective creams. No serious health hazard is thought to exist from the excessive exposure to alumina dust, but levels should be maintained below the nuisance dust standard.

None of the workers exposed to sinter dust (thought to contain trace quantities of crystalline silica) reported any respiratory problems which one would expect from exposure to silica. The development of silicosis requires exposure to silica over a period of many years. Thus, the absence of respiratory symptoms at this time does not necessarily preclude its possible development in the future if the environment produces silica air concentrations which exceed the Federal standard.

There was no evidence that the one worker exposed to fluorides in the cryolite area was experiencing any ill effects from such exposure.

E. Toxicity Determination

Based upon the results of our environmental and medical investigations, the established Federal standards and the documentation supporting the standards, it is our determination that the substances bauxite dust (buildings 10A and 10B), alumina dust (buildings 310 and 325) and sinter dust (building 225 E & W) have potentially toxic effects at the concentrations found during the evaluation; the substances, crystalline silica and fluorides are not toxic at the concentrations measured.

Engineering controls and personal medical protective measures have been recommended to management to control hazardous exposures and produce a desirable working environment for affected employees.

F. Distribution

Copies of this Summary Determination of the evaluation are available upon request from the Hazard Evaluation Services Branch, NIOSH, U.S. Post Office Building, Room 508, 5th and Walnut Streets, Cincinnati, Ohio 45202. Copies have been sent to:

a) Reynolds Metals Company

b) Authorized Representative of Employees

c) U. S. Department of Labor - Region VI

For purposes of informing the approximately sixty (60) "affected employees," 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.

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.

The National Institute for Occupational Safety and Health (NIOSH) received such a request from an authorized representative of employees regarding exposure to various dusts in operations at the Reynolds Metals Company plant in Bauxite, Arkansas.

Plant Process:

The major function at Reynolds Metals Company is the production of alumina from earth-bearing aluminum known as bauxite ore. Bauxite ore usually contains alumina, silica and trace quantities of other elements. Procedures for processing bauxite ore to obtain purified alumina consist of grinding, digesting, separating and washing the bauxite. The end product at this stage is commonly referred to as "red mud." The red mud is discharged into the sinter plant where it is further processed and finally stored in silos for future use. Dust liberated in the sinter plant is referred to as "sinter dust."

III. BACKGROUND HAZARD INFORMATION

A. Federal Standards

The occupational health standards promulgated by the U.S. Department of Labor (Federal Register, Part II, §1910.93, Tables G-1 and G-3) applicable to substances of this evaluation are as follows:

Substance	8-Hour Time-Weighted Average Concentration
Nuisance or Inert Dust (Alumina and Sinter Dust)	
a. Respirable Dust	5.0 mg/M^3 *
b. Total Dust	15.0 mg/M^3

*Milligrams of particulate per cubic meter of air.

Crystalline Silica

a. Respirable Dust $\frac{10 \text{ mg/M}^3}{\%SiO_2 + 2}$ **

b. Total Dust $\frac{30 \text{ mg/M}^3}{\%SiO_2 + 2}$

Fluoride (F) 2.5 mg/M^3

Alumina and sinter dust may be considered nuisance dusts; therefore, may be evaluated under the air concentration standards established for nuisance dust.

B. Toxic Effects

1. Bauxite and Sinter Dust

The potential risk from exposures to bauxite is mainly to aluminum oxide and silica. According to Patty[1] the primary environmental health problem encountered from aluminum ore (bauxite) is that of a nuisance dust and exposure has not produced pneumoconiosis or predisposition to lung disease. Normally free silica is not associated with the bauxite ores that can be economically used for the production of metal-grade alumina. However, it should be recognized that silica may be a contaminant at times and may reach significant amounts.

2. Aluminum Oxide - Alumina

Alumina was found to be highly fibrogenic in animals (2 fibers) by Stacey[2] but there are no clinical studies implicating aluminum oxide as a cause of pneumoconiosis in man. The standard was therefore set at the same level as "inert" or nuisance dust.[3]

**For pure crystalline silica dust samples, $\%SiO_2$ is 100, hence standards of 0.29 and 0.1 mg/M^3 apply for "total" and "respirable" fractions respectively from the above equations. For essentially crystalline-free dust samples, percent free silica is zero, and the nuisance dust levels of 15.0 and 5.0 mg/M^3 apply for "total" and "respirable" fractions respectively.

3. Silica

Finely divided silica (silicon dioxide-SiO_2) in the free state can cause the pneumoconiosis called silicosis. It is the most common and serious of all the pneumoconioses. The silica may be in a crystalline form such as in quartz, cristobalite and tridymite, or in a non-crystalline or amorphous form such as opal. The crystal structure of pure silica has an important influence upon tissue reaction. Among the crystalline forms, tridymite is intensely fibrogenic, cristobalite and quartz somewhat less so, and the amorphous silica only slightly fibrogenic.

The size of the silica particle is also extremely important in determining the degree of tissue reaction. The optimum size for retention deep within the lung (in the alveolar areas) is about 1 micron. However, particles larger (8-10 microns) and smaller (.1 micron) have been associated with silicosis.[9]

Many factors appear to play a role in the development of silicosis; for example, exposure to high concentrations of finely divided free crystalline silica dust, duration of exposure, the synergistic action of other ions, differences in individual susceptibility, and the presence of infections especially tuberculosis.

Silicosis may be recognized either as an acute or chronic process. The acute form (rapidly-developing silicosis) may be recognized after 8-18 months from first exposure and probably develops after massive exposure. Patients note severe shortness of breath and rapid breathing, and chest x-rays often show fibrosis with no visible typical nodulation of silicosis. Tuberculosis is often present.[4]

Chronic pulmonary silicosis is the type most often seen in industry and usually occurs only after years (sometimes 15-30 years) of exposure to silica dust. Chest x-rays will usually detect silicosis in a relatively early stage. However, an uncomplicated case may progress to an advance stage while producing only symptoms of moderate shortness of breath.[4]

The three chief complications of silicosis, which are also the most frequent cause of death, are pulmonary tuberculosis, respiratory insufficiency, and acute pulmonary infection.[5]

Prevention is extremely important since treatment is not effective for the pulmonary lesions. Insuring that levels of free silica are below the Federal Standard is the best preventative measure.

4. Fluorides

The toxic effects of fluoride have been divided into (1) acute systemic intoxication (usually by ingestion); (2) local corrosion of mucous membranes and skin; and (3) chronic bone changes, ranging from mottling of tooth enamel to crippling skeletal abnormalities.[6] Acute poisoning from inhalation of the dust or mists of fluoride salts has rarely been recorded.[7]

Fumes of fluoride can cause upper respiratory irritation.[8,9,10] In workers exposed to cryolite, Roholm noted many complaints of gastric, intestinal, circulatory, respiratory, and nervous system symptoms, as well as skin rashes and complaints related to bones, joints, and muscles. Fluoride air levels were about 11-24 mg/M^3. Collins[9] considered 2.4 mg/M^3 elevated, but Irvin[10] believed levels less than 3-4 mg/M^3 to be safe.

The present Federal Standard of 2.5 mg/M^3 should prevent the occurrence of symptoms and signs of fluoride over-exposure.

IV. HEALTH HAZARD EVALUATION

A. Initial Visit - Observational Survey

The Hurricane Creek Alumina Plant, Reynolds Metal Company, located in Bauxite, Arkansas was initially visited by NIOSH personnel on November 9, 1971 with subsequent visits on March 9-10, 1972 and November 8-9, 1972. During these periods we met with:

A walk-through survey in Buildings 10A, 10B, 53, 59, 225E, 225W, 310, and 325 where exposures to bauxite, alumina dust, silica, and/or fluorides may occur was made. The labor force in the plant is distributed among a four-shift work schedule. In the observational survey, it was concluded that the health hazard evaluation should assess exposures to "total" and "respirable" dust fractions of bauxite ore, alumina, silica, and fluoride.

B. Environmental Evaluation (March 1972)

On March 8-9, 1972 an environmental and medical survey was conducted by Messrs. Henry Ramos, Steven K. Shama, M.D., and Harry L. Markel, Jr., NIOSH.

1. Sampling Procedures

A total of 38 (27 personal and 11 general room) air samples were obtained. Personnel air sampling equipment was used to obtain "respirable" breathing zone air samples. The sampling train consisted of an MSA Model G battery powered portable vacuum pump, a Dorr-Oliver 10 mm cyclone, a Casella flow-pulsation damper and polyvinyl chloride filters of 37 mm diameter and 0.5 microns pore size. The general room "total" dust air samples were collected at fixed locations using the sampling train described above but without the cyclone separator. Sampling rates were maintained at 1.7 liters per minute by periodically adjusting the calibrated rotometer on each MSA pump. The sampling periods ranged from 171 to 459 minutes.

2. Analytical Method and Results

The air samples were evaluated by the Division of Laboratories and Criteria Development, NIOSH, Cincinnati, Ohio. The general room "total" sinter and alumina dust concentrations ranged from 2.70 - 8.89 and 16.66 - 83.47 milligrams per cubic meter (mg/M^3) respectively, and the personal air sample concentrations for "respirable" sinter and alumina dust ranged from 0.56 - 14.92 mg/M^3 and 2.15 - 6.80 mg/M^3, respectively.

Air samples collected in Building 225E were assayed for silica content. The "total" crystalline silica concentration levels in general room samples ranged from 0.00 - 0.08 mg/M^3; personal air sample concentrations for "respirable" silica ranged from 0.00 - 2.65 mg/M^3. Fluoride dust concentrations in general and personal air samples ranged from 0.06 - 0.89 mg/M^3. A detailed description of specific air contaminant concentrations is found in Table I, Parts A, B, C, D.

3. Discussion

Excessive exposures to alumina dust reported above were found to be in part caused by leaks on chutes that transport and fill alumina bagging machines and by spills on the floor from broken bags. The employees are required to wear respirators; however, the common practice is to wear the respirator only when dust concentrations are high. Often, men not wearing respirators are exposed to transient dust storms caused by winds blowing dust into the bagging area. Additionally, some men eat lunches in the bagging area.

Airborne crystalline silica was found on two samples at levels of 2.14 and 2.65 mg/M^3 - well in excess of the pure crystalline Federal Standard. This latter finding for silica was considered "questionable" due to possible errors caused by sample contamination in preparation for laboratory analysis.

C. Medical Evaluation

1. Procedure and Method

On March 8-9, 1972 a medical evaluation as part of the hazard evaluation of the Reynolds Metals Company was made by Steven K. Shama, M.D. The alleged offending agents were aluminum hydrate, bauxite ore containing silica, and a fluoride compound, cryolite.

Twenty-two workers who were exposed to aluminum hydrate, bauxite (sinter dust) and cryolite (one worker) were interviewed and examined in an attempt to uncover symptoms and signs of upper and lower respiratory irritation and symptoms of chronic fluoride toxicity.

2. Findings

Except for one young worker who complained of shortness of breath on mild exertion (whose symptoms at the time of this report are known to have disappeared), none of the workers complained of any respiratory symptoms suggestive of acute or chronic lung disease. A few workers reported occasional mild burning of the nose and a rare nosebleed. A majority of the workers complained that at that end of the day their noses were clogged with caked aluminum hydrate and other dusts. Many workers in the bagging area with intimate exposure to aluminum hydrate reported having very rough, red, dry skin.

With regard to the cryolite process, only one man is exposed to the cryolite dust and the area in which he worked seemed to be fairly clean. He spends less than one-third of his day in the cryolite building and most of that time is spent in an office. This one worker did not have any symptoms suggestive of chronic fluoride toxicity.

3. Discussion

Since aluminum oxide or alumina can be considered an inert or nuisance dust, it can be evaluated under the Federal Standard established for nuisance dust. There is no indication that exposure to alumina at this plant produces any chronic lower respiratory disease. The occasional burning of the nose should be considered evidence of mild irritation. Alumina and sinter dust environmental concentration levels above the Federal Standard were measured in Buildings 10A, 10B, 225E, 225W, 310 and 325.

A majority of workers noted a history of skin problems probably caused by the astringent properties of alumina, but the dermatitis was well treated and prevented by a protective cream provided by the company.

With regard to the cryolite process, the worker involved retired in April, 1972, and follow-up on this employee need not be pursued since he did not have any suspicious symptoms. It is suggested that as a good occupational medical practice a baseline urine and a follow-up urine for fluorides be performed on the new worker who will be exposed to the cryolite process.

D. Follow-Up Environmental Evaluation (November 1972)

1. Sampling Procedure

The environmental re-evaluation for silica was made on November 8-9, 1972 at the Sinter Plant, Building 225E due to the concern voiced by management upon receipt of the March 1972 results. Such evaluation was conducted to preclude any erroneous conclusion in fairness to both Company and affected employees. A total of 28 air samples were collected. Thirteen (13) personal "respirable" dust fraction, seven (7) high-volume "respirable" dust fraction room samples, and eight (8) low-volume "total" dust air samples were collected. The sampling equipment used for obtaining personal air samples was described previously in this report. General room low-volume "total" dust samples were collected at fixed locations with open-face millipore filters. A Gast 1531 vacuum pump equipped with a 9.0 liter per minute critical orifice and a one-half inch steel cyclone was used to collect the high-volume "respirable fraction" dust samples.

2. Analytical Method and Results

Twenty-eight (28) samples were assayed for dust weight and silica content by the Division of Laboratories and Criteria Development, NIOSH, Cincinnati, Ohio. The colorimetric method according to Hyslop and Talvite[11] was used to determine free silica content. The sensitivity limit of the colorimetric method of analysis is 10-20 micrograms. Additionally, x-ray determinations were made on bulk material and a heavy load general room sample (4a) with the result that less than 0.01% free silica was detected on both samples. The silica content in thirteen (13) personal "respirable" air samples ranged from 0.00 - 0.05 mg/M^3 respirable sinter dust ranged from 0.05 - 2.2 mg/M^3. Silica content in seven (7) general "respirable" room samples ranged from 0.00 - 0.05 mg/M^3 and associated sinter dust ranged from 2.5 - 23.0 mg/M^3. The air sample concentration levels for silica in eight (8) samples ranged from 0.00 - 0.29 mg/M^3; for total sinter dust ranged from 5.7 - 50.7 mg/M^3. The highest air concentration levels were found in the Sinter Transfer Belt ("C" Belt), cooler floor (midway and south end), and Peck Carrier Pit (north end). The silica content per filter ranged from none detected to 114 micrograms. A detailed data survey summary of crystalline silica and sinter dust air sample concentration levels is found in Table II, Parts A and B.

3. Discussion

Crystalline silica was found in nine (9) of the twenty-eight (28) environmental air samples collected in Building 225E at levels greater than the analytical method limit sensitivity of 20 micrograms. These quantities, however, represent only trace amounts relative to the gross dust collected. Crystalline silica concentration levels in all cases were well below their respective pure crystalline silica Federal Standards.

Sinter dust concentrations levels exceeded the Federal nuisance dust standards for both "total" and "respirable" dust fractions.

E. Conclusion

Based upon the results of our environmental and medical investigations, the established Federal Standards and the documentation supporting the Standards, it is our determination that the substances alumina dust (Building 310) and sinter dust (Buildings 10A,B; 225E,W, 325) are toxic at the concentrations found during this evaluation; the substances, crystalline silica and fluorides are not toxic at the concentrations measured.

V. RECOMMENDATIONS

1. Good housekeeping practices should be implemented to decrease excessive exposures to aluminum dust. It is impossible to have an effective health program, unless maintenance housekeeping is good and employees are informed of the need for these measures.

2. Leaks on chutes that transport alumina should be sealed and malfunctioning bagging machines that spew alumina into the work room should be repaired. Efforts should be made to decrease dust exposure to workers working in the bagging areas who are exposed to aluminum hydrate.

3. Feasible engineering controls for reducing dust exposures should be instituted. In the interim, Bureau of Mine approved dust respirators should be worn continuously during bagging operation. The respirator should not be removed immediately after the operation ceases as small dust particles are airborne for an indefinite time period.

4. Workers should not eat in the bagging area.

5. For good occupational practice the worker involved in the cryolite process should be given a baseline urine test for fluorides and also a follow-up urine for fluorides to determine his exposure to fluoride.

6. It is good occupational medical practice to provide yearly chest x-rays for workers exposed to potentially harmful airborne agents. It is strongly recommended that all men potentially exposed to silica be given chest x-rays at this time and yearly thereafter, and that all men exposed to dusty environments, in general, be given yearly chest x-rays.

VI. REFERENCES

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TABLE I

Summary of Air Sample Results at Reynolds Metals Company
Bauxite, Arkansas

March 8-9, 1972

A. Alumina Dust Concentration Data (mg/M3*)				Alumina Concentration	
Sample No.	Location	Type	Time (min.)	Respirable	Total
126	310	P**	392	6.80	
131	310	P	394	5.93	
17A	310	GR***	285		83.47
145	310	P	332	3.98	
150	53	P	355	3.48	
14A	53	P	355	2.15	
25A	310	GR	310		16.66
FEDERAL STANDARD				5.0	15.0

B. Sinter Dust concentration Data (mg/M3*)				Sinter Dust Concentration	
Sample No.	Location	Type	Time (min.)	Respirable	Total
.28	325	P	280	8.47	
129	225W	P	318	5.65	
130	225E	P	355	14.92	
132	225E	P	355	4.64	
133	10A	P	323	9.98	
135	10A	P	447	14.38	
18A	325	GR	459		2.18
16A	325	GR	464		3.93
134	59	GR	171		6.19
20A	225E	GR	360		2.70
139	325	P	453	5.18	
136	225E	P	417	0.81	
137	225W	P	413	0.56	
140	225E	P	430	1.16	
141	10A	P	419	2.03	
142	10B	P	407	12.25	
21A	325	GR	430		2.82
23A	325	GR	430		8.89
24A	225E		406		7.51
FEDERAL STANDARD				5.0	15.0

*Milligram of particulate in air per cubic meter.
**P-Personal samples were all "respirable" type breathing zone air samples.
***GR-General room samples were all "total dust" air samples taken at fixed locations.

TABLE I - Continued

C. Fluoride Dust Concentration Data (mg/M³)

Sample No.	Location	Type	Sample Time (min.)	Fluoride Concentration mg/M³
128	325	P	280	0.89
18A	325	GR	459	0.48
139	325	P	453	0.06
21A	325	GR	430	0.51
23A	325	GR	430	0.89
FEDERAL STANDARD				2.5

D. Crystalline Silica Concentration Data (mg/M³)

Sample No.	Location	Type	Sample Time (min.)	SiO_2 (µg/filter)*	SiO_2 Concentration Respirable	SiO_2 Concentration Total
129	225W	P	318	32	0.06	
130	225E	P	355	1597	2.65 **	
132	225E	P	355	1290	2.14 **	
20A	225E	GR	360	nd		0.00
136	225E	P	417	nd	0.00	
137	225W	P	413	nd	0.00	
140	225E	P	430	nd	0.00	
24A	225E	GR	406	7		0.01
27A	225E(pit)	GR	202	115		0.08
FEDERAL STANDARD					0.1	0.29

*Micrograms, µg, per filter
nd-None Detected
**Questionable Data (see text)

TABLE II

Summary of Air Sample Results at Reynolds Metals Company
Building 225E
Bauxite, Arkansas
November 8-9, 1972

A. "Respirable Dust" Air Concentration Data (mg/M^3)

Location	Sample No.	Type	Sample Time (min.)	SiO_2 (µg/filter)	SiO_2 (mg/M^3)	Sinter Dust (mg/M^3)
Peck Carrier Pit (North End)						
	15	P	304	14	0.03	2.2
	12	P	301	ND	--	0.6
	16	P	280	24	0.05	1.3
	2A	GR	275	15	0.00	2.5
	6A	GR	344	14	0.00	3.4
	21	P	242	ND	--	1.6
	22	P	240	23	0.00	0.5
er Floor (Midway and South End)						
	3A	GR	253	114	0.05	21.9
	5A	GR	247	15	0.01	5.7
	4A	GR	240	x-ray	--	23.0
	7A	GR	365	54	0.02	15.9
	8A	GR	116	11	0.01	7.9
Burner Floor (Kiln No. 3)						
	13	P	326	13	0.02	2.1
	14	P	326	10	0.02	0.5
	18	P	501	26	0.03	1.1
	11	P	301	ND	--	0.8
	20	P	399	ND	--	0.9
	23	P	398	28	0.04	2.0
	26	P	386	ND	--	0.6
Sinter Transfer Belt (C Belt)						
	25	P	414	ND	--	0.8
FEDERAL STANDARD					0.10	5.0

TABLE II

Summary of Air Sample Results at Reynolds Metals Company
Building 225E
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A. "Respirable Dust" Air Concentration Data (mg/M^3)

Location	Sample No.	Type	Sample Time (min.)	SiO_2 (µg/filter)	SiO_2 (mg/M^3)	Sinter Dust (mg/M^3)
Peck Carrier Pit (North End)						
	15	P	304	14	0.03	2.2
	12	P	301	ND	--	0.6
	16	P	280	24	0.05	1.3
	2A	GR	275	15	0.00	2.5
	6A	GR	344	14	0.00	3.4
	21	P	242	ND	--	1.6
	22	P	240	23	0.00	0.5
er Floor (Midway and South End)						
	3A	GR	253	114	0.05	21.9
	5A	GR	247	15	0.01	5.7
	4A	GR	240	x-ray	--	23.0
	7A	GR	365	54	0.02	15.9
	8A	GR	116	11	0.01	7.9
Burner Floor (Kiln No. 3)						
	13	P	326	13	0.02	2.1
	14	P	326	10	0.02	0.5
	18	P	501	26	0.03	1.1
	11	P	301	ND	--	0.8
	20	P	399	ND	--	0.9
	23	P	398	28	0.04	2.0
	26	P	386	ND	--	0.6
Sinter Transfer Belt (C Belt)						
	25	P	414	ND	--	0.8
FEDERAL STANDARD					0.10	5.0

TABLE II - Continued

B. "Total" Dust Air Concentration Data

Location	Sample No.	Type	Sample Time (min.)	SiO_2 (µg/filter)	SiO_2 (mg/M^3)	Sinter Dust (mg/M^3)
Peck Carrier Pit (North End)						
	None					
Cooler Floor (Midway and South End)						
	2A	GR	343	13	0.02	14.6
Burner Floor (Kiln No. 3)						
	1	GR	307	20	0.04	12.9
	7	GR	383	ND	--	5.7
Sinter Transfer Belt (C Belt)						
	4	GR	248	5	0.01	13.1
	5	GR	259	90	0.20	50.7
	8	GR	377	18	0.03	17.5
	9	GR	395	29	0.04	39.3
	10	GR	370	42	0.06	40.4
FEDERAL STANDARD					0.29	15.0