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

HEALTH HAZARD EVALUATION DETERMINATION
REPORT NO. 73-40-116

DELCO MORAINE DIVISION
GMC CORPORATION
DAYTON, OHIO

MARCH 1974

I. TOXICITY DETERMINATION

It has been determined that antimony, asbestos, chromic acid, copper, cyanide, iron, lead, nickel, cutting oils, sodium, tin, and zinc stearate would not be expected to cause toxic effects in exposed workers of Departments 5,16,17,19,21,24,40,48 and 49 at the concentrations measured during the period of the evaluation. This determination is based upon (1) air measurements, (2) review of plant medical records, (3) medical interviews of exposed employees, and (4) available literature regarding toxicity of the substances under consideration.

II. DISTRIBUTION AND AVAILABILITY OF DETERMINATION REPORT

Copies of this Determination Report 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) Delco Moraine Division, GMC Corporation, Dayton, Ohio
b) Authorized Representative of Employees
c) U. S. Department of Labor - Region V
d) NIOSH - Region V

For the purposes of informing the approximately 1200 "affected employees" the employer will promptly "post" the Determination Report in a prominent place(s) near where exposed employees work for a period of 30 calendar days.

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 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 "fumes, dusts, acids, caustic soda, powdered metals, and asbestos linings" at the Delco Moraine Division of General Motors Corporation, Dayton, Ohio.

The request alleged that employees at the plant suffered from skin irritation, eye irritation, headaches, and sinus problems. The areas specified in the health hazard evaluation were Departments 5, 16, 17, 19, 21, 24, 40, 48 and 49.

IV. HEALTH HAZARD EVALUATION

A. Plant Process - Conditions of Use

In two of the departments surveyed (16 and 48), powdered metals are unloaded, screened, mixed, and transferred to hydraulic presses. Parts are then preformed from the alloy powder mix. The preformed parts are then sintered in furnaces to attain the desired final properties. The powder mixes in these areas were observed to have the greatest potential for exposure to the powdered metals with a lesser exposure potential for the hydraulic press operators. Substances to which these workers could be exposed are graphite, iron, copper, lead, zinc stearate, tin and nickel.

Sizing operations are performed in Department 49 but worker exposure was judged to be much less to the above substances than the exposures of powder mixers or press operators. Most potential sources of dust generation were provided with local exhaust ventilation.

Tin plating and tri-plating (lead, tin, and copper) were found to take place in Departments 24 and 40. It was also noted that a chromate dip was used in the zinc plating process performed in Department 17. The utility jobsetters were observed to have the greatest potential exposure with lesser exposure to workers doing racking and unracking work in Departments 24 and 40 or the plater operators in Department 17. Substances which are used in these areas are sodium cyanide, lead fluoroborate, copper fluoroborate, stannous fluoroborate, fluoroboric acid, copper cyanide, rochelle salt, sodium bicarbonate, sodium hydroxide, and nitric acid. The brightener dip used in Department 17 contains sodium dichromate. Local exhaust ventilation was provided on all the platers and triplaters.

Machining of cast iron parts is performed in Department 5. Workers in dry machining areas could be exposed to metal particulates, but the exposure potential was considered to be much less than in other areas. Coolants are utilized in this department and workers here have the greatest potential for contact with these cutting oils. Department 21 was observed to possibly have high noise levels, but on a return visit the machinery at which the high levels were observed had been removed from the department.

Brake shoes composed of a binder and asbestos are drilled, riveted, ground, inspected and packed in Department 19. All drilling and grinding operations in this department are provided with local exhaust ventilation. Drill operators, grinder operators, riveters, and inspectors are potentially exposed to asbestos fibers in this area.

B. Worksite Evaluation

In each area specified in the request, the jobs considered to have the greatest exposure potential were sampled using personal breathing zone sampling instruments. All persons who might be exposed could not be sampled and for this reason the person(s) believed to have the greatest exposure potential were sampled.

C. Evaluation Methods

Environmental

General: Samples for airborne particulates were collected using the appropriate filter medium held in a field monitor. Samples of particulates were obtained with a three piece closed-faced monitor, i.e. only the pin was removed from the monitor during sampling. Asbestos fiber samples were obtained with the filter contained in a two piece open-faced field monitor.

Metal Analyses

1. Air samples were obtained using a cellulose membrane filter, and the amount of metal was determined using an atomic absorption spectrophotometer.[1] This method was used to quantify the amount of lead, copper, zinc, tin, iron, antimony, sodium, and nickel collected. For hexavalent chromium analysis the air sample was obtained using a polyvinyl chloride filter. The analytical technique utilized was that of Abell and Carlberg.[2]

2. Air samples for asbestos counting were obtained using cellulose membrane filters, and individual filters were counted using a microscope equipped with phase contrast optics.

3. The concentration of graphite was measured by collecting an air sample with a silver membrane filter. The amount of graphite was determined using a carbon, hydrogen, nitrogen analyzer to determine total carbon.

Medical

Basically, the medical evaluation rests upon observations made at the time of walk-through and a review of medical records. In addition, 12 employees were interviewed at various work stations in the plating and powdered metal areas. Because of the very large number of employees,

time limitations, and the widely scattered distribution of the areas under consideration, the traditional approach of complete department wide individual interviews was not deemed feasible.

D. Evaluation Criteria

1. Toxic Effects of Substances [3,4,5,6]

The following toxic effects discussion describes the toxicological effects that may occur in workers exposed to the substances of this evaluation. These effects are described so workers will know the symptoms and health consequences of overexposure. The effects described depend upon a number of factors such as concentration, length of exposure, individual susceptibility and possibly additive or synergistic effects of two more compounds. If the combined concentrations of substances are controlled below the standards presented in this report, it is believed that these adverse health effects can be avoided.

Antimony

The toxicity of antimony by inhalation is greater than by other routes of entry. Abnormalities in blood pressure, electrocardiographic changes, and deaths from chronic thrombosis have occurred coincident with exposure to antimony trisulfide. Antimony dust and fume have been associated with radiographic lung changes. The experiences noted above occurred with air concentrations from six to eleven times the present Federal Standard. Dermatitis has been reported from exposure to antimony trioxide.

Asbestos [7]

Prolonged inhalation of asbestos fibers may result in a form of typical pulmonary fibrosis which may be accompanied by respiratory disability. A high percentage of persons exposed to asbestos will develop asbestosis if the dust concentration is excessive and it is inhaled over a prolonged period of time. Fibrosis appears first in the lower lobes of the lungs, but with continued exposure progressively involves the other lobes. There is also evidence of a greater incidence of bronchogenic cancer and mesothelioma of the pleura or peritoneum among workers in certain asbestos industries when compared with the general male population.

Chromic Acid [8]

The exposure of workers to chromic acid in electroplating operations has been reported to cause a number of adverse effects. These may include lacrimation, inflammation of the conjunctiva, nasal itch and soreness, ulceration and perforation of the nasal septum, and chronic asthmatic bronchitis. The liquid has a powerful corrosive action which may cause ulceration of exposed skin (chrome holes). Chromate industry workers also appear to have an increased incidence of bronchogenic carcinoma.

Copper

Breathing the dusts of copper salts can result in congestion of nasal mucous membranes, sometimes of the pharynx, and on occasion, ulceration with perforation of the nasal septum. Chronic exposures may result in anemia. Copper salts also may cause skin irritation producing itching eczema, and on the eye, conjunctivitis or even ulceration and turbidity of the cornea.

Cyanides

At low air concentrations the earliest symptoms of poisoning are weakness, headaches, confusion, and occasionally nausea and vomiting. At much higher concentrations a few inhalations may be followed by almost instantaneous collapse and cessation of respiration. Although chronic poisoning has been reported, it seems to be relatively rare.

Iron

Iron and insoluble iron salts are generally considered to be of relatively low orders of toxicity and are essential constituents of the human body. Excessive ingestion seldom results in toxicity since absorption from the gastrointestinal tract is normally limited to body needs. It is believed sustained exposure to pure iron oxide dust produces an essentially benign pneumoconiosis. This condition results in few, if any, symptoms and causes no disability. X-ray lung changes following long-term exposure may present problems in differential diagnosis. Soluble iron salts such as ferric chloride and sulfate are highly irritating to the respiratory tract.

Lead (inorganic)[9]

Lead dust from all except the most insoluble compounds is readily absorbed on inhalation and to a lesser extent after ingestion. Lead poisoning may be acute or chronic. Symptoms of acute poisoning may include a burning sensation in the mouth, abdominal pain, nausea, vomiting, constipation or possibly diarrhea. Often lead poisoning in industry is of a chronic nature which starts with vague symptoms such as general ill feeling, fatigue, exhaustion, irritability, loss of appetite and weight, or abdominal discomfort. A blue discoloration of the gums may be noticed occasionally and neurologic changes are common.

Nickel

Dermatitis is the most common effect observed in humans. Nickel and its salts are not sufficiently absorbed through the skin to cause intoxication. A significant increase in cancer of the lung and nasal sinuses has occurred among refinery employees in England, Norway, and Canada. In England, this increase has been partly associated with nickel carbonyl. However, the carbonyl process was not used in refineries

in Canada and Norway. Other effects due to nickel exposure have been reported but substances in addition to nickel were present.

Sodium (as sodium hydroxide)

Caustic dusts or mists are irritating to the upper respiratory system. Prolonged exposure to higher concentrations may cause discomfort and even ulceration of nasal passages. The standard is set at a level which is believed will prevent excessive irritation.

Tin

The ingestion of small amount of tin is considered harmless as evidenced by the use of tin plate in the food canning industry. A benign pneumoconiosis, stannosis, has been reported from the inhalation of tin oxide dust. This condition results in no pulmonary disability and has only rarely been reported.

Zinc Stearate

Most of the available literature regarding occupational exposure to zinc compounds is concerned with substances other than zinc stearate. Although it has been reported that zinc stearate may cause pulmonary inflammation,[10] the ACGIH has recently recommended the nuisance dust standard for this substance.

2. Occupational Health Standards for Substances in this Evaluation

Occupational Health Standards are established at levels designed to protect the health of workers occupationally exposed to a substance on an 8-hours per day, 40 hours per week basis over a normal working lifetime. The recommended environmental standards presented for substances of this evaluation are taken from three sources:

a. Federal Standards - the standard enforced by the Department of Labor as found in the Federal Register, Vol. 37, Section 1910.93, October 18, 1972.

b. Threshold Limit Value (TLV) - the recommended limit developed by the TLV Committee of the American Conference of Governmental Industrial Hygienist (ACGIH).

c. Recommended standard from the applicable NIOSH Criteria Document.

Substance	Federal Standard	TLV (ACGIH)	NIOSH Criteria Document
	(8-Hour Time-Weighted-Average Concentration)		
Antimony	0.50 mg/M3*	0.50 mg/M3	-
Asbestos			
Effective July 7, 1972	5 fibers/cc**	5 fibers/cc	2 fibers/cc
Effective July 1, 1976	2 fibers/cc		
Chromic acid (as CrO_3)	0.10 mg/M3	0.10 mg/M3	0.05 mg/M3***
Copper (dusts & mists)	1.00 mg/M3	1.00 mg/M3	-
Cyanides, alkali (as CN)	5.00 mg/M3	5.00 mg/M3	-
Iron (as ironoxide fume)	10.00 mg/M3	10.00 mg/M3	-
Lead (inorganic)	0.20 mg/M3	0.15 mg/M3	0.15 mg/M3
Nickel	1.00 mg/M3	1.00 mg/M3	-
Sodium (as NaOH) (inorganic)	2.00 mg/M3	2.00 mg/M3	-
Zinc Stearate	-	10.00 mg/M3	-

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* Milligrams of particulate per cubic meter of air
** Standard expressed as number of fibers longer than 5μm in length per cubic centimeter of air. A ceiling of 10 fibers/cc is not to be exceeded at any time.
*** A ceiling of 0.10 mg/M3 is not to be exceeded at any time.

E. Evaluation Results and Discussion

1. Environmental Results

The sample results obtained in various areas of the plant are contained in the Tables, Section VII of this report.

Powdered Metals - Areas 16 and 48 - Table I

All results for individual substances are well below the applicable environmental standards with two exceptions. One result is the copper concentration to which the powder mixer, Area 16 was exposed on October 18, 1973. The sample time was less than half a shift (3 hours and 18 minutes) but occurred during the first half of the shift when work activity is usually high. This result indicates some work activities may result in copper concentrations greater than the standard for periods of time less than a total shift. However, the second half of the shift tends to be a less active work period, and the sample result

would probably be substantially lower than the standards if this time period had also been sampled. The personal sample was removed early since the worker objected to wearing the sampling device.

The other exception is the finding of 0.14 mg/M^3 for lead which is only slightly lower than the present NIOSH Criteria Document recommended occupational health standard of 0.15 mg/M^3 for inorganic lead. This single result was obtained in the breathing zone of one of the press operators in Area 16.

Workers were questioned by NIOSH investigators concerning blood-lead testing. In Area 48 all workers questioned answered that they were receiving the tests while the press operators in Area 16 stated they were not being tested. It was later confirmed by contacting a company representative that only powder mixers in Area 16 and powder mixers, press operators, jobsetters, and inspection foremen in Area 48 are tested. Although there are only a few sample results from the two NIOSH surveys, the average exposure is higher for the Area 16 workers than for the Area 48 workers. These results show as much need to test press operators, jobsetters, and inspection foremen in Area 16 as there is to test these same job categories in Area 48.

Platers and Triplaters - Areas 24 and 40 - Table II

The sampling results for workers in these areas are far below any of the standards outlined in the report.

Platers - Area 17 - Table III

The results of samples for hexavalent chromium analysis are far below (all results less than 1 µg/M^3) any of the standards outlined in this report.

Drilling, Grinding, and Riveting Asbestos Brakeshoes - Area 19

The results of samples obtained for asbestos fiber concentration measurement ranged from <0.02 to 0.78 fibers/cc. These results are all within the present DOL standard of 5 fibers/cc as well as the more restrictive recommendation of 2 fibers/cc contained in the NIOSH Criteria Document which will become a DOL Standard on July 1, 1976.

2. Medical Findings and Discussion

The plant dispensary was noted to be very modern and attractive. Around the clock nurse coverage is maintained. A local physician spends approximately two hours daily in the facility. No daily log is kept. Summaries of reportable injuries and health problems were reviewed. Fourteen cases of chemical irritation were noted on the OSHA Form 100 dating back to 1971. However, these were scattered among ten different work areas. Only five cases originated in the areas for which evaluation was requested. Five cases of contact dermatitis were recorded; four of

hand dermatitis; and nine of various acid and caustic burns. One case of heat exhaustion and one of heat stroke was noted. One instance of ammonia inhalation was recorded. The vast majority of entries dealt with various occupational injuries. The numbers, types of conditions, and their location by area did not suggest the presence of any unusual problem when placed in the perspective of a plant of this size.

Blood lead records going back to 1967 were reviewed. In 1967-68 many elevated levels were found, so many and so consistently that an analytical error was suspected. This was later confirmed by the Medical Director. This artifact disappeared by June 1969, and since then the vast majority of levels have been well within normal levels. In 1972 one man was noted to have a level of 70 micrograms/100 g of whole blood on two occasions. This is not normally considered an elevated level among lead workers where levels of 80 micrograms/100 g of whole blood are usually regarded as the upper limit for safety. Review of the last 133 analyses performed gave the following distribution:

LEAD LEVELS	NUMBER OF INDIVIDUALS	
20 micrograms/100 g whole blood	12	
30 micrograms/100 g whole blood	63	
40 micrograms/100 g whole blood	41	
50 micrograms/100 g whole blood	17	
60+ micrograms/100 g whole blood	0	
	133	Average level 34.7 micrograms/100 g whole blood

This is a surprisingly low average for occupationally exposed workers In fact, it is very close to that reported for the average city dwelling person. These results strongly suggest that no current lead hazard exists in this facility.

None of the twelve randomly interviewed employees complained of symptoms that they associated with their work, nor did they know of co-workers with such complaints. While this number of employees is very small in relation to the plant population several of the areas under investigation employed only a few men per shift.

CONCLUSIONS

Based upon the relatively limited amount of medical data it is our professional judgment that no (serious) medical hazard currently exists. The reported number of cases of dermatitis, upper respiratory tract, and eye irritation are apparently episodic and not judged to be excessive in a plant of this size.

3. Recommendations

(1) A daily log of all clinic visits should be kept. This would allow the clinical staff to much more easily identify potential or impending problem areas within the plant by providing an easily reviewed record.

(2) A plant of this size should have a full time medical director. All criteria suggest at least one full time physician is needed and many would suggest two. Since the number of cardiac and other medical emergencies can be expected to increase with the average age of career employees, a broadening of medical coverage is an increasing necessity.

(3) Workers who may be exposed to lead should follow these precautions:

a. Wash hands and face thoroughly before eating.
b. Never take food, beverages, or tobacco into the work area.
c. If ill for any reason, ALWAYS inform physician that you work with lead.
d. Comply with company policy for a semi-annual blood test to determine blood lead levels.

(4) Press operators, jobsetters, and inspection foremen who work in Area 16 should be included in the blood-lead testing program.

V. REFERENCES

1. General Procedure for Metals by Atomic Absorption, P&CAM 173, Physical and Chemical Analysis Branch, NIOSH, USDHEW, September 1973.

2. Abell, M.T. and J.R. Carlberg, A Simple Reliable Method for the Determination of Airborne Hexavalent Chromium, Amer. Ind. Hyg. Assoc. J. (In Press).

3. Documentation of the Threshold Limit Values, American Conference of Governmental Industrial Hygienists, 3rd Ed., Cincinnati, Ohio 1971.

4. Hygiene Guide Series, American Industrial Hygiene Association, 14125 Prevost, Detroit, Michigan.

5. Patty, F.A., Industrial Hygiene and Toxicology, Second Revised Edition, 3 volumes. Interscience Publishers, New York, 1967.

6. Encyclopedia of Occupational Health and Safety, International Labor Office, McGraw-Hill Book Co., New York, 1971.

7. Criteria for a Recommended Standard --- Occupational Exposure to Asbestos, U.S. Public Health Service Publ. No. HSM 72-10267, Supt. of Documents, U.S. Govt. Printing Office, Washington, D.C., 1973.

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9. Criteria for a Recommended Standard -- Occupational Exposure to Inorganic Lead, U.S. Public Health Service, Publ. No. HSM 73-11010, Supt. of Documents, U.S. Govt. Printing Office, Washington, D.C., 1972.

10. The Merck Index, 7th Ed., Rahway, New Jersey, 1960.

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VII. TABLES - Health Hazard Evaluation Determination 73-40

TABLE I - Personal Sampling Results - Areas 16 and 48

			Airborne Concentrations of Substances (mg/M^3)*						
Date Sampled	Area	Job Description	Antimony	Copper	Iron	Lead	Nickel	Tin	Zinc Stearate
Sept. 16, 1973	16	Group Leader	N.D.	<.032	0.72	.014	.019	N.D.	0.73
"	16	Powder Mixer	N.D.	<.014	0.95	.025	.008	.055	0.27
"	48	Powder Mixer 1	N.D.	<.309	4.43	.016	.020	N.D.	1.19
"	48	Powder Mixer 2	N.D.	<.087	0.73	.044	.017	N.D.	0.63
"	48	Press Operator	N.D.	<.022	0.26	.030	.018	N.D.	0.44
Oct. 18, 1973	16	Powder Mixer	<.034	1.065	2.00	.056	.016	<.017	0.20
"	16	Press Operator	<.017	.007	0.32	.046	.002	<.009	0.34
"	16	Press Operator	<.024	.004	0.25	.028	<.001	<.013	0.42
"	16	Press Operator	<.108	.027	0.08	.140	<.005	<.054	0.53
"	48	Powder Mixer 1	<.017	.025	0.84	.018	.005	<.009	0.97
"	48	Powder Mixer 2	<.017	.270	4.10	.022	.008	.075	0.83
"	48	Press Operator	<.019	.056	0.26	.053	.007	<.009	0.11
"	48	Press Operator	<.031	.010	0.72	.063	.007	<.016	0.75
Federal Standards			0.500	1.000	10.00	0.200	1.000	2.000	10.00

Total Dust and Graphite Samples Obtained October 18, 1973
Area 16 - General Area - Total Dust - 0.4 mg/M^3 and 0.22 mg/M^3 graphite
Area 48 - Powder Mixer 1 - Total Dust - 1.5 mg/M^3 and 0.8 mg/M^3 graphite
Powder Mixer 2 - Total Dust - 3.4 mg/M^3 and 1.2 mg/M^3 graphite

* Milligrams of particulate per cubic meter of air at 25°C and 760 mm Hg pressure

TABLE II - Personal Sampling Results - Areas 24 and 40

			Airborne Concentration of Substances (mg/M^3)*						
Date Sampled	Area	Job Description	Antimony	Copper	Iron	Lead	Nickel	Tin	Zinc
Sept. 14, 1973	24-40	Plater Loader	N.D.	.016	N.D.	.016	N.D.	N.D.	.010
"	24-40	Plater Racker	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
"	24-40	Utility Jobsetter	N.D.	.013	N.D.	.013	N.D.	N.D.	.056
Oct. 18, 1973	24-40	Plater Racker	<.023	.007	.014	.038	<.001	.011	.003
"	24-40	Plater Racker	<.022	.005	.011	.007	.003	.011	.002
"	24-40	Utility Jobsetter	<.043	.016	.026	.018	<.005	<.022	.005
Federal Standards			0.500						

Sodium Samples Obtained September 14, 1973

Plater Loader, No. 2 Triplate	Sodium not detected
Utility Jobsetter	Sodium not detected
Plater Racker	Sodium - .038 mg/M^3

Cyanide Sample Obtained October 18, 1973

Utility Jobsetter	Cyanide - 0.12 mg/M^3

* Milligrams of particulate per cubic meter of air at 25°C and 760 mm Hg pressure

TABLE III - Personal Sampling Results - Area 17

Date Sampled	Area	Job Description	Conc. Hexavalent Chromium ($\mu g/M^3$)*
9/14/73	17	Plater Operator	0.24
"	17	Plater Operator	0.13
"	17	Jobsetter	0.18
"	17	Plater Operator	0.01
Federal Standard			100.00

* Micrograms of particulate per cubic meter of air at 25°C and 760 mm Hg pressure

TABLES - Health Hazard Evaluation Determination 73-40

TABLE IV - Personal Sampling Results for Asbestos Fibers - Area 19

Area	Location	Job Description	Conc Fibers/cc*
Service	No. 3 Line	Grinder Operator	0.08
Service	No. 4 Line	Grinder Operator	0.38
Drill Section	-	Drill Operator	0.08
Drill Section	-	Drill Operator	0.06
Drill Section	No. 2 Line	Drill Operator	<0.02
Drill Section	No. 7 Line	Drill Operator	0.09
Assembly	No. 3 Line	Grinder Operator	0.07
Assembly	No. 5 Line	Grinder Operator	0.14
Assembly	No. 2 Line	Grinder Operator	0.02
Assembly	No. 3 Line	Grinder Operator	0.09
Assembly	No. 5 Line	Grinder Operator	0.78
Assembly	No. 6 Line	Grinder Operator	0.12
Assembly	No. 3 Line	Grinder Operator	<0.01
Assembly	No. 6 Line	Grinder Operator	0.03
Assembly	No. 3 Line	Back Riveter	0.27
Assembly	No. 5 Line	Middle Riveter	0.17
Assembly	No. 6 Line	Back Riveter	0.36
Assembly	No. 2 Line	Inspector	0.43
Assembly	No. 5 Line	Inspector	0.02
Federal Standard			5,00

* Concentration of fibers longer than 5 µm in length per cubic centimeter of air