

DOCKET NO. 40-3453

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Atlas Minerals
Division of Atlas Corporation
P. O. Box 488
Moab, Utah

March 27, 1964

Mr. Donald A. Nussbaumer, Chief
Source and Special Nuclear Materials Branch
Division of Licensing and Regulation
United States Atomic Energy Commission
Washington 25, D. C.

Dear Mr. Nussbaumer:

In our letter to you dated April 5, 1963, reference LR-WFN 40-3453, we outlined an air sampling program which at that time appeared to be the most reliable method of determining exposures to airborne radioactive material. However, experience has proven this method frequently indicates erroneously high exposures. In areas of the mill where dry ore is processed and the airborne dust contains relatively small amounts of radioactive material good indications of gross exposures have been obtained. In the product drying and packaging area it has been difficult to evaluate the exposures indicated. We know that quantities of non-respirable material in the form of unavoidable splashes of wet yellow-cake and temporarily airborne non-respirable dry particles report in the samples. In order to obtain samples from which we can evaluate intelligently the exposures indicated, we feel that it is necessary at this time to modify and improve our air sampling program.

Since the behavior of particulate aerosols in the human respiratory system is well known and since instruments that duplicate accurately the separation of particles into respirable and non-respirable fractions are available, we feel that sufficient justification exists for the issuance of an amendment to Source Material License No. R-161 stating that the

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concentrations specified in Appendix B, Table I, 10 CFR 20, are to respirable radioactive materials.

The respirable size range of airborne material has been well established. As shown in the enclosed page from the American Conference of Governmental Industrial Hygienists Manual entitled "Air Sampling Instruments for Evaluation of Atmospheric Contaminants," a standard human curve to establish standards for respirable dust sampling was adapted under the sponsorship of the Atomic Energy Commission. Figure 5 of the enclosure shows this curve and the curve which represents the collecting characteristics of the sampler we propose to use. Also, as stated in the enclosure, samplers whose collection characteristic lies to the right of this curve satisfy the criteria specified in 10 CFR 20.

As shown in Figure 5 of the enclosure, the instrument is calibrated with particles of unit density. However, it is generally accepted that the aerodynamic size of the particles is of primary significance in evaluating airborne material. It has been established that dust particles of different density and other qualities different from those with which the instrument is calibrated will be collected according to their aerodynamic or effective size. This is exactly what happens in the human respiratory system. Therefore, samples of any particulate aerosol collected with this instrument will be separated into two fractions; respirable and non-respirable.

In areas where we feel that more exact knowledge of the exposures is required, such as the product drying and packaging area, time studies will be made to determine the number of work areas involved and the amount of time an

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individual spends in each. From these studies, time weighted average exposures will be determined using the Unico Model 30 Air Sampler with the Model 18 cyclone attachment described in the enclosure. General Air Surveys will be conducted using the same instrument without the cyclone. Non-routine breathing zone samples will be obtained with the personal lapel type samplers as in the past.

It is the desire of our company to evaluate correctly the exposure of our personnel to airborne radiation. In order to do this it is necessary to know where a hazard exists. Adequate protection cannot be made unless the exact nature of the exposure is known. By utilizing the above methods and procedures, we feel another step will be made in the direction of realistic, effective radiation protection.

Very truly yours,



R. F. Hollis
Vice President - Milling

RFH/bj

Enclosure

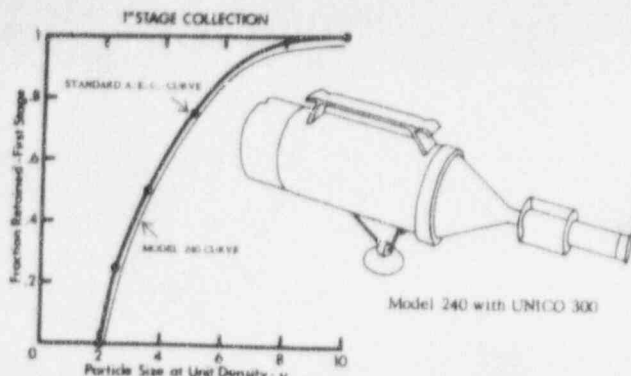


Fig. 4. Collection characteristic of Model 240 cyclone at 240 liters/min (8.5 cfm).

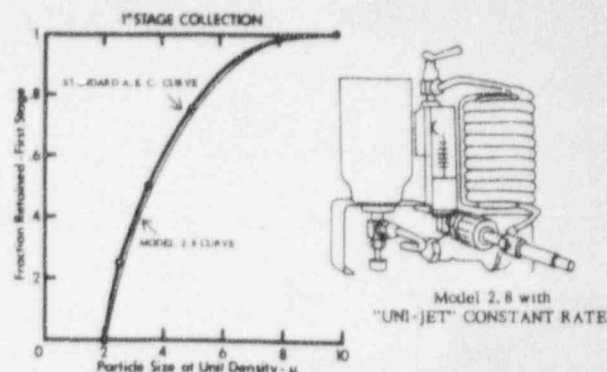


Fig. 6. Collection characteristic of Model 2.8 cyclone at 2.8 liters/min.

used with the Unico Model 300 Sampler at 240 liters per minute (8.5 cfm). This is the flow that the Model 300 will draw through the cyclone and a 4-inch diameter Whatman #41 filter in series.

SOURCE

Union Industrial Equipment Corporation, Port Chester, New York Model 240 - \$44.50, Model 18 - \$37.50, Model 2.8 - \$20.50. All models include cyclone and filter holder.

OPERATING INSTRUCTIONS

A. Sample Collection

1. Place clean filter in filter holder.
2. Place clean polyethylene cap over bottom of cyclone collector.
3. Attach outlet end of cyclone to inlet of filter head.
4. Attach back end of filter holder to inlet of air sampler.
5. Collect sample at prescribed flow rate:
 - a) Model 2.8: 2.8 liters per minute (0.10 cubic feet per minute)

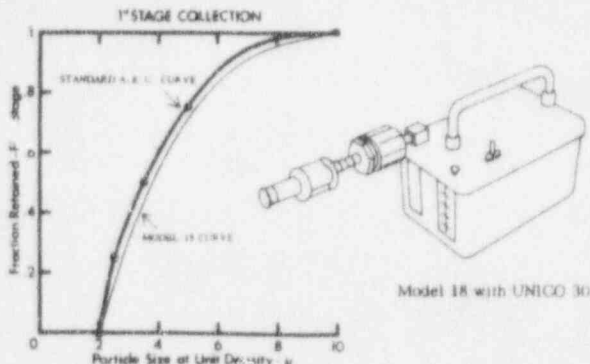


Fig. 5. Collection characteristic of Model 18 cyclone at 18 liters/min.

- b) Model 18: 18 liters per minute (0.65 cubic feet per minute)
- c) Model 240: 240 liters per minute (8.5 cubic feet per minute)
6. Place filter in clean sample envelope for submission to analytical laboratory.
7. If the concentrations of both fractions of the sample are required, place in clean sample container for analysis. If only the "respirable" dust concentration is required, the cyclone may be reused without cleaning it out.

B. Cleaning Cyclones

The particles collected in the cyclone stage tend to adhere strongly to the inner walls. Therefore, cleaning must be thorough. Depending on the material to be removed, and the equipment available, cleaning may be adequately performed by the following procedures:

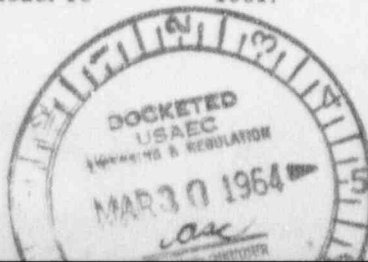
1. Dissolution of the sample with suitable acid, base, or solvent.
2. Thorough washing of walls using a rubber tipped stirring rod.
3. Agitation in an ultra-sonic bath.

CALIBRATION

Figures 4, 5, and 6 show the calibration curves for these samplers. They were obtained by microscopic size analyses as described in Reference 1.

REFERENCES

1. Lippmann, M. and Harris, W. B.: Size-Selective Samplers for Estimating "Respirable" Dust Concentrations, Health Physics, Vol. 7 (1961).
2. Section 20.103, Chapter 10, Code of The Federal Register, Part 20 as revised January 1, 1961.



"RESPIRABLE" DUST SAMPLERS
(Union Industrial Equipment Corp.)



Fig. 1. Model 240. Assembled unit attaches to the inlet of the Unico Model 300 light-weight high-volume sampler. The individual components are shown in exploded view. The filter is 4 inches in diameter.



Fig. 2. Exploded view of Model 18. The filter is 2.4 cm (15/16 inch) in diameter.

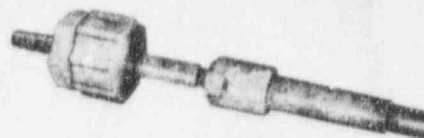


Fig. 3. Assembly view of Model 2.8. The filter is 2.4 cm (15/16 inch) in diameter.

USES

The "Respirable" Dust Samplers in Figures 1, 2, and 3 are two-stage particle collectors which simulate the collection characteristics of the human lung. They divide the sample, as it collects, into upper and lower respiratory fractions. By doing so, they make more rational interpretations of air concentration data possible.

OPERATING PRINCIPLES

The first stage collectors are miniature cyclones or centrifugal collectors. The aerosol enters the cyclones tangentially. Large particles, such as those which deposit in the upper respiratory passages, have considerable inertia and tend to travel in straight lines. They depart from the curving air streamlines, strike the walls of the cyclone, and are collected. Small particles, such as those which penetrate to the lower respiratory passages, pass through the cyclone stage, and are collected by the second stage, which is a high efficiency filter.

PHYSICAL DESCRIPTION

Cyclone Stage - Model	240	18	2.8
Weight - ounces	4.0	0.8	0.5
Height - inches	5 3/4	2 7/8	3 7/8
Nominal Diameter - inches	1	0.5	0.4
Maximum Diameter - inches	2	1	3/4

The Models 240 and 18 cyclones are constructed of 0.030 inch thick stainless steel tubing and sheet. The individual parts are silver soldered together. The Model 2.8 cyclone is injection molded nylon. All three are rugged and corrosion resistant.

In addition to the cyclones, the complete Models 2.8 and 18 samplers have 2.4 cm nylon

filter heads as shown in Figures 2 and 3. These filter heads are described in Section B-2 of this manual.

The complete Model 240 sampler in Figure 1 has a polyethylene funnel adaptor, and a 4-inch diameter filter ring which attach to the inlet of the Unico 300 high-volume sampler described in Section B-1 of this manual.

PERFORMANCE DATA

The collection efficiency of the cyclone collectors is strongly dependent on flow rate. Thus, a cyclone's retention matches the human retention at one characteristic flow rate only. The collection efficiency curves of the cyclones, at their chosen flow rates, are shown in Figures 4, 5, and 6. The standard human curve used was adapted by a conference sponsored by the Atomic Energy Commission to establish standards for respirable dust sampling.⁽¹⁾ Samplers whose collection characteristic lies to the right of this curve satisfy the criteria established by the Atomic Energy Commission regulations in 10 CFR, Part 20.⁽²⁾

The Model 2.8 sampler is designed to be used with the Unico CR Uni-Jet Sampler at 2.8 liters per minute.

The Model 18 sampler is designated to be used with the Unico Model 30 Sampler at 18 liters per minute.

The Model 240 sampler is designed to be

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Ltr. req. amendment to lic. R-161 so that it states that the concentrations specified in Appendix B, Table 1, 10CFR20, are to be respirable radioactive materials..... <u>Included</u> ; Figure 5 - Air Sampling Instruments		REFERRED TO	DATE	RECEIVED BY
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