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NASA TECH BRIEF

Lewis Research Center

Improved High Volume Air Sampler

The design of conventional high volume air samplers has been improved to quantitatively separate suspended particulate matter from wind-blown "non-suspended" particulate matter.

High volume air samplers are used to collect particulate matter from the air. They generally consist of a vacuum cleaner type motor and blower connected to a filter, installed in a suitable housing. Although these air samplers are intended to collect suspended particulate matter, their construction allows the additional collection of particles that are not truly suspended (i.e., that are larger and/or heavier) under wind conditions that are often present. Generally, only the suspended particles have relevance for physiological (particularly pulmonary) effects. Therefore, it is desirable to determine the concentrations of particulate matter in the atmosphere having diameters (or more precisely aerodynamic properties) above or below a certain value. The particles generally considered most irritable to pulmonary tissue are those with diameters 10 μm ($\mu m = 10^{-6}$ meter) and less.

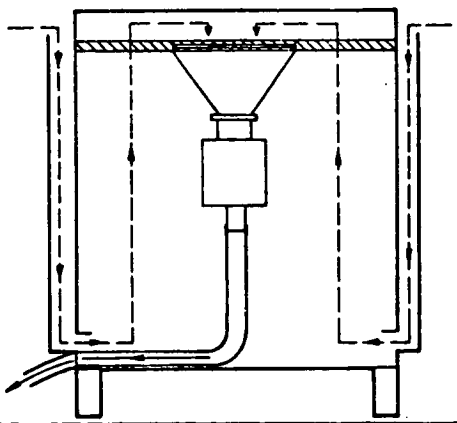
The improved air sampler under normal air flow conditions permits size separations of particles approaching 10 μm, thus allowing the number of particles both above and below 10 μm to be determined. This separation is accomplished by directing the sampled air through a cross-sectional area (plenum chamber) sufficiently large that the air velocity is reduced to the point where particles of larger size (and appropriate aerodynamic properties) will settle out.

Conventional high volume samplers do not have such a settling chamber; the air passes under a slightly depressed roof and directly onto the filter. Even low velocity winds or small gusts can carry relatively large (at least 200 μm) particles under the roof and onto the filter.

The improved air sampler (see figure) takes the air in at about the same height as conventional high volume samplers but conducts the air downward and through slots around the periphery of the unit into the relatively open interior of the high volume sampler housing, then upward around the edges of the filter holder, through the filter, and down through the blower to be discharged. The improved high volume air sampler is typically constructed with side dimensions to give cross-sectional areas, air velocities and particle separations as shown in the table.

Settling Chamber Cross Sectional Area (Square Shape)		Air Volume		Air Velocity		Maximum Particle Size Retained*
m^2	ft^2	m^3/min	ft^3/min	m/min	ft/min	μm
0.37	4	1.68	60	4.58	15	32
		1.12	40	3.05	10	26
		0.84	30	2.29	7.5	22
		0.56	20	1.53	5	20
0.58	6.25	1.68	60	2.90	9.5	31
		1.12	40	1.95	6.4	21
		0.84	30	1.46	4.8	20
		0.56	20	0.98	3.2	16
0.84	9	1.68	60	2.04	6.7	21
		1.12	40	1.37	4.5	20
		0.84	30	1.01	3.3	16
		0.56	20	0.67	2.2	12

* Based upon the gravitational settling for spheres with a specific gravity of 2.0.



Note:

No additional documentation is available. Specific technical questions, however, may be directed to:

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Reference: B74-10080

Patent Status:

NASA has decided not to apply for a patent.

Source: Robert B. King
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(LEW-11644)

Category 05