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Q200906190006

Scientific Notebook No. 785: Air Sampling of
Soil Particles (04/11/2006 through 04/26/2006)

Standard: 20.00001
 Weight₁ is the weight @ 30s.
 Weight₂ is the weight @ 2 min

Loading Cascade Impactor for first test measurement

Filter	Location
.	B-F ⁹⁰ F-11-06 B-1
..	B-2
...	B-3
....	B-4
—	B-5
	B-6
—..	B-7
—...	B-F

4-12-06
 1st Test Measurement
 Pump Start: 10:48 End: 16:48
 Desiccation Start: 17:30 End: 9:50 (4-13-06)

The purpose of this measurement was primarily to test the equipment and to determine if a minimum detectable mass of material could be collected in 6 hours. The equipment used was the SWI Anderson Cascade Impactor, a rotameter to measure the air pressure through the impactor, and an air pump. Initially, a Honda generator was used to power the pump. However, it was not capable of powering the pump, so AC power was used.

4-11-06 90 112
After Desiccation (Desiccation Time 18.5 h)
Pre weigh standard (20g) = 20.00000
Filter Weight (g)
Sample
0.33356
0.33092
0.32945
0.33181
0.33175
0.33183
0.33278
0.33212
0.32494
0.33077

Reweigh filters after installing anti-static device
The purpose of these measurements is to determine if the Mettler scale is capable of measuring small quantities of dust on a fairly heavy filter and to determine a minimum mass load on the filter. The minimum mass load will establish the time for each measurement.

Filter #	Weight ₁ (g)	Weight ₂ (g)	Reweigh (20g)	Avg Wt (g)
1	0.33351	0.33392	0.33357	
2	0.33088	0.33089	0.33092	
3	0.32939	0.32940	0.32946	
4	0.33171	0.33171	0.33177	
5	0.33178	0.33179	0.33179	
6	0.33187	0.33187	0.33186	
7	0.33282	0.33282	0.33274	
8	0.33216	0.33216	0.33211	
9	0.32491	0.32492	0.32492	
10	0.33071	0.33074	0.33078	

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Air Sampling of Soil Particles

4-11-06

Ali bupkas (Ad)

Jane Puhon (JD)

The purpose of these measurements is to determine the particle size distributions of suspended tephra around the Sunset Crater. The first set of measurements are intended as a test of the equipment and to help develop procedures. For this first measurement, the filters are weighed before desiccation, after desiccation, and after the collection. The filters used are

the air sampler is an Anderson cascade impactor and the balance used is a Mettler Toledo balance located in room 106, Bldg 57, Model #: XP205 asset number 012005, Cal due date July 4, '06, Calibrated on Jan 4, '06.

Sample #	Weight before desiccation (g)	Aug
.	0.33346	0.33349
..	0.33077	0.33074
...	0.32936	0.32933
....	0.33170	0.33167
—	0.33175	0.33175
i	0.33172	0.33170
—..	0.33272	0.33274
—...	0.33209	0.33207
—....	0.32471	0.32487
— —	0.33075	0.33071

Pre weigh standard (20g) = 19.99997

Post weigh standard (20g) = 19.99994

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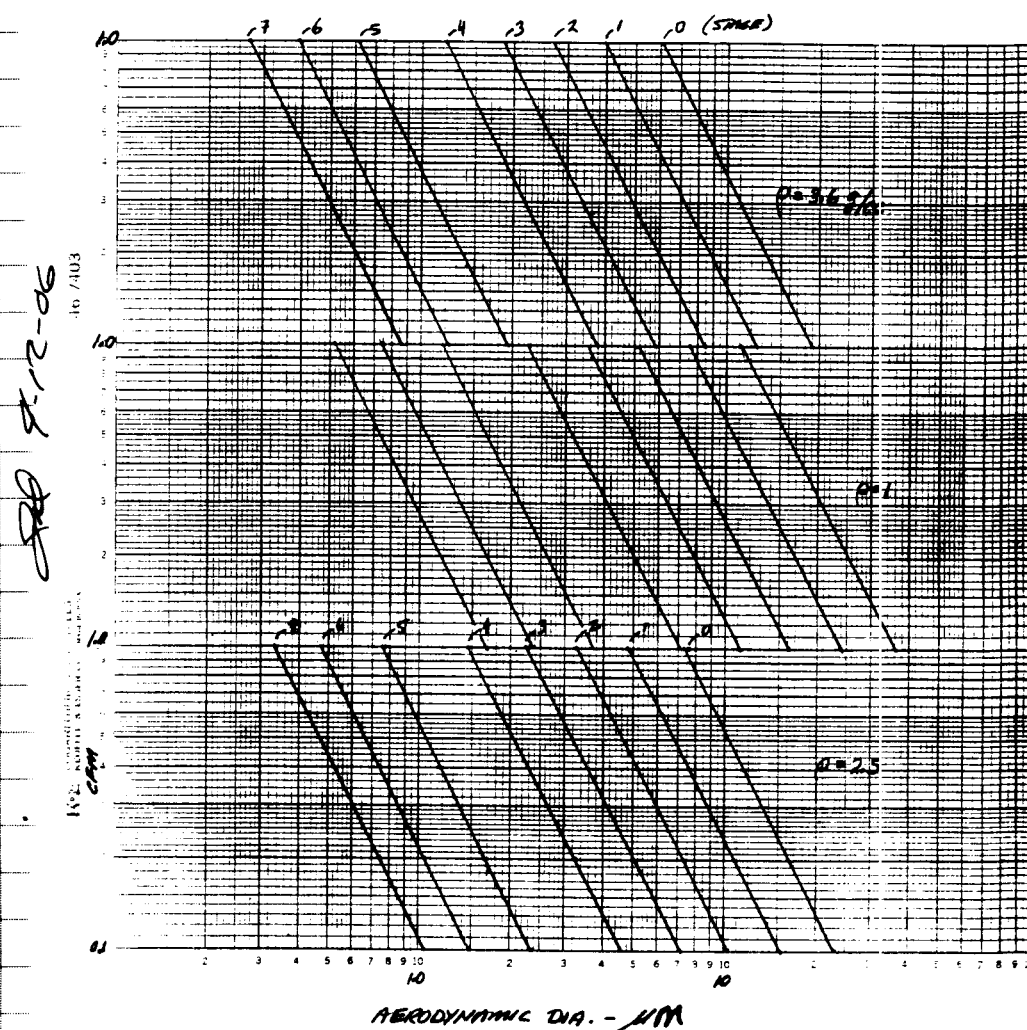
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The rotameter was set to operate at a reading of 70%, which corresponds to a flow rate of 1 acfm as shown in the following calibration curve obtained from the owner of the equipment.

SWRI Impactors

IMPACTOR D_{50} CALCULATIONS

3/14/95



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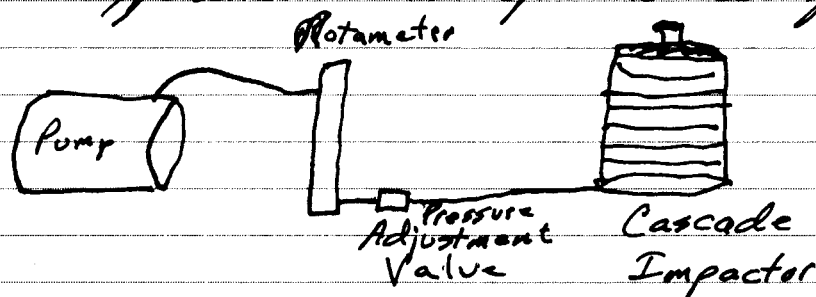
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The experimental setup was as follows:



^{ID 4-13-06}
 Operation A description of the physics of operation of the impactor will be provided later. After 6 hours of exposure, the filters were removed from the impactor and placed in a desiccator overnight.

4-13-06 ^{ID 4-13-06} Readout of Weighing of the Filter

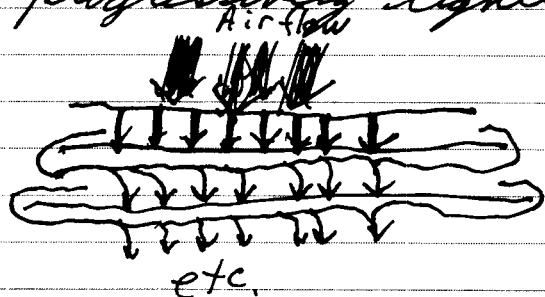
Filter	Weight(g) Standard: 19.99998 g
..	0.33371
...	0.33097
....	0.32907 ^{ID 4-13-06} 32956
.....	0.33190
—	0.33177
i	0.33179
—..	0.33272
—...	0.33210

Weights were obtained after passing the filter through the anti-static device 3 times and allowing the scale to equilibrate for 2 minutes.

J.D. 4-14-06

Cascade Impactors - Theory of Operation

A cascade impactor passes a laminar flow of air through a series of plates with holes that are progressively smaller in diameter from plate to plate. The holes in a plate act as jets and force the air (and the particles carried in the air) to flow at a high velocity, which causes the particles to increase their momentum. Heavier particles will have a higher momentum than lighter particles. An impaction surface is placed at the outlet of the jet, and particles with a momentum above a certain value (that depends on the size of the hole) will impact the surface and stick. Particles with momentum below the value will flow to the next stage. Thus, each stage collects particles that are progressively lighter and, therefore, smaller.



Schematic of Cascade Impactor

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Results of 1st measurements

Filter	Pre-W1	Pre-W2	Avg	Post-W1	delta m
1	0.33352	0.33357	0.333545	0.33371	0.000165
2	0.33089	0.33092	0.330905	0.33097	6.5E-05
3	0.3294	0.32946	0.32943	0.32956	0.00013
4	0.33171	0.33177	0.33174	0.3319	0.00016
5	0.33179	0.33179	0.33179	0.33177	-2E-05
6	0.33187	0.33186	0.331865	0.33179	-7.5E-05
7	0.33282	0.33274	0.33278	0.33272	-6E-05
8	0.33216	0.33211	0.332135	0.3321	-3.5E-05

These results show that there is a methodical error in the measurement process. After speaking with other researchers, it was suggested that the method used to prepare the filter should be changed. The new method is to dry the filters in a muffle furnace for minutes, then allow them to equilibrate to room temperature in a desiccator before weighing. Articles on the Internet indicate that the balance used was adequate for the measurements and that a ^{mass of} ~~collecting~~ 15 μg may be too much to collect.

4-17-06 JD

Pre-weigh procedure: 1 hr @ 65°C, placed ^{at 17°C} in desiccator to come to room temperature for 10 minutes.

Standard weight: 19.99988

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Filter
Sample ID

Weight (g)

4-18-06
Final Weight (g)

0.32606

0.32617

0.32446

0.32448

0.32687

0.32728 ~~0.32753~~ 4-18-06

0.32508

0.32517

0.32431

0.32470

 80 4-17-06

0.32416

0.32443

0.33038

0.33106

0.32730

0.32753

Load Impactor:

Stage Filter

B-F .

B-7 ..

B-6 ...

B-5

B-4 ---

B-3 ---

B-2 -----

B-1 ---

20g standard = 20.00000

10mg standard = 0.0002

Sampling Start Time: 10:09 AM 4-17-06

Rotameter Reading: 70% (1 actm)

Sampling End Time: 10:13 AM 4-18-06

Rotameter Reading: 68%

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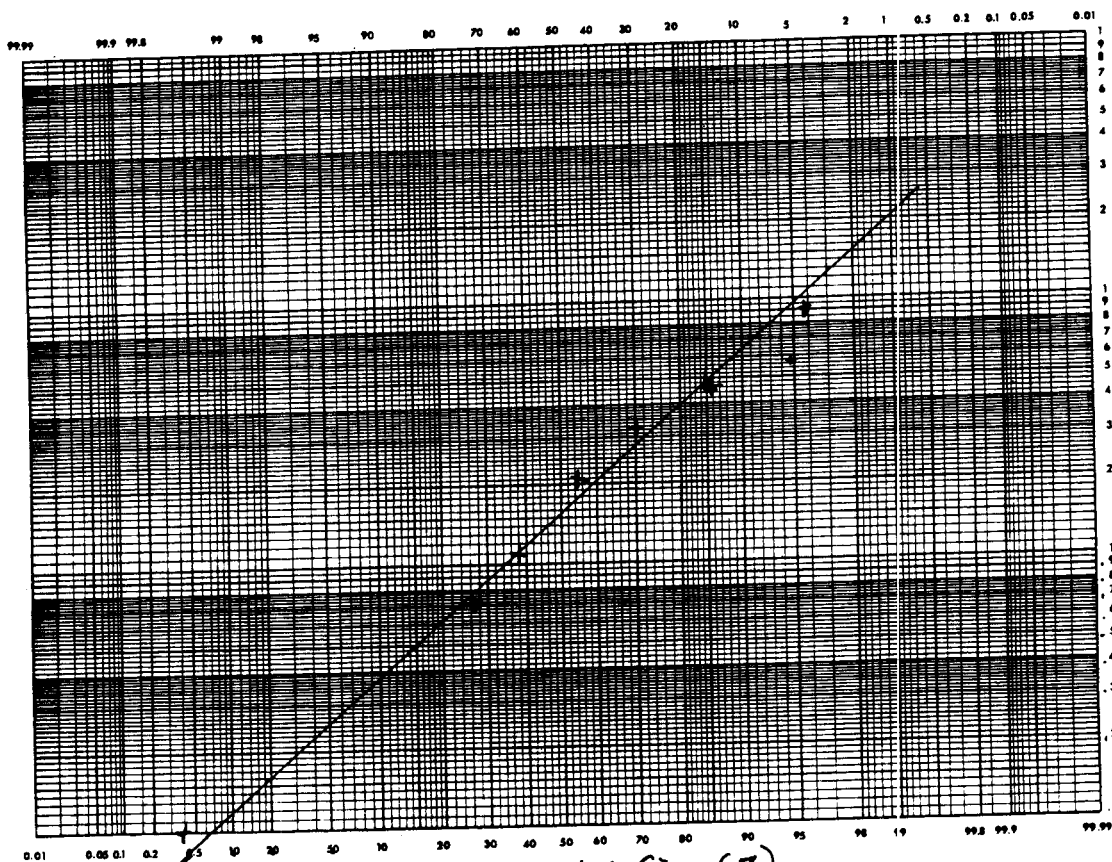
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4-19-06

JAD

Filter	Pre-W	Post-W	delta m	ECD (um)	%<size	cum m %<size
1	0.32606	0.32617	0.00011	9	0.044	0.956
2	0.32446	0.32448	2E-05	5.8	0.008	0.948
3	0.3273	0.32753	0.00023	4.7	0.092	0.856
4	0.32508	0.32547	0.00039	3.3	0.156	0.7
5	0.32431	0.3247	0.00039	2.1	0.156	0.544
6	0.32687	0.32728	0.00041	1.1	0.164	0.38
9	0.32416	0.32443	0.00027	0.7	0.108	0.272
10	0.33038	0.33106	0.00068	0.4	0.272	0
total =			0.0025			



$$\sigma_g = \frac{84.13\% \text{ diam}}{50\% \text{ diam}} = \frac{4.8}{1.6} = 3.0$$

$$\sigma_g = \frac{50\% \text{ diam}}{15.87\% \text{ diam}} = \frac{1.6}{0.52} = 3.1$$

$$\mu_g = 1.6 \mu\text{m}$$

essentially equal

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4-26-06 JE
Test of generator: 6 hours with no Impactor
until gas ran out

Side by Side Measurements - Respicon & Cascade Impactor
Oven: 55°C two hours

Filter W_i 4-27-06 JE
.
0.32521
..
0.32700
...
0.32783
90 4-27-06
....
0.32436
—
0.32861
—
0.32426
—
0.32638
X
0.32643
X—
0.32422

Respicon

Filter W_i
F1 0.01214
F2 0.02011
E1 0.01436
F44 0.01614
F45 0.01486
E25 0.01489

Standard (20mg) = 0.01001 g
Standard (20g) = 19.99997

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~~Informal Travel to Honolulu End of Jan~~
~~92 1-24-09 after Pres. Day~~

6/10/09

Final entry
- notebook closed

J. Wintuk
Manager, PA Group

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