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AMBIENT AIR SAMPLING
AT
NAF ATSUGI, JAPAN

(8-13 AUGUST, 21-25 SEPTEMBER 1990)

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II. EXECUTIVE SUMMARY

Pacific Division Naval Facilities Engineering Command requested us to determine ambient air quality downwind from four off-base incinerators. We located an air sampling station about 300 yards NW of the incinerators and took most of our samples there. We also took samples from a helicopter flying through the incinerator plume.

Contract laboratories analyzed samples collected during two sampling periods (August 8-13, and 21-25 September, 1990). Results indicate that the ambient air around NAF Atsugi is not clean. As a point of reference, we listed pollutant concentrations along with the National Institute for Occupational Safety and Health's (NIOSH) permissible exposure limits or American Conference of Governmental Industrial Hygienists' threshold limit values in Tables 1-2b. Note that NIOSH standards are for eight hour exposure, five days per week for a healthy work force. These are not meant for continuous exposure by the general population. We provide this as a comparison only.

We detected various polycyclic aromatic organic compounds, dioxins and dibenzofurans. Most samples contain heavy metals, chromium, lead, zinc, and copper. Generally, heavy metals are present in the Atsugi air regardless of the wind direction. Organic pollutants were more wind direction dependent.

Formaldehyde and phenol were detected but their concentrations were too low to have caused the eye, nose, and respiratory discomfort experienced by base personnel.

Based on only two samples for dioxins and dibenzofurans, and on one cadmium sample, the total cancer risk estimated is 906 persons per million people. We calculated the long term cancer risk using unit risk factors established by EPA and California Department of Health Services. The calculated risk applies to a population which is exposed to these concentrations for a lifetime (70 years). EPA uses a lifetime excess cancer risk of less than one in one million as a criterion in setting toxic chemical emission standards.

Long term ambient air sampling is needed to identify the chemicals that cause the respiratory discomfort and to determine the ambient air quality. More dioxins and dibenzofurans data are needed to assess the long term health risks from these chemicals.

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IV. INTRODUCTION

In response to a request from Naval Air Facility (NAF) Atsugi, Japan[1], we collected air samples to determine the ambient air pollutant concentration between 8-13 August 1990. We sent the samples to a commercial laboratory for analysis. During sample preparation laboratory personnel destroyed some samples. To account for this loss, we collected a second set of samples between 21-25 September 1990. Due to relocation of the laboratory, we did not receive analytical results until February 1991. This is a report of the findings from samples collected during these two test periods.

V. BACKGROUND

A Japanese owned and operated industrial incinerator operation is located south of the NAF Atsugi water treatment plant. The operation includes four incinerators. These incinerators are located approximately 100 yards outside the NAF Atsugi fence. Located in a small valley, the tops of two of the four incinerator stacks are about level with the ground of the runways and golf course on base (see Figure 1). Both the runways and golf course are east-north-east of the incinerators. Besides the water treatment plant, a rifle range is in the same valley. The treatment plant is above the level of the short incinerator stacks; the rifle range is below level. Base housing area is located north-west of this water treatment plant. The other two stacks are between 10 to 15 feet above the base's ground level. During spring and summer months moderate to high south-southwest to south-southeast winds blow the incinerator plumes onto the base and into the valley containing the water treatment plant and rifle range. Under these conditions, much of NAF Atsugi is fumigated by noxious smoke. Personnel at the facility complain of eye and nose irritation, nausea, and respiratory discomfort when exposed to the smoke plume.

VI. PROCEDURES

The following procedures were used for collecting the samples.

EPA Method TO4: High volume sampler with Polyurethane Foam (PUF)

We used an Anderson Model PS-1 PUF Sampler for this method. The sampler consists of two sections - a particulate section and PUF cartridge section. A fan draws ambient air first through a 4" diameter glass fiber filter and then through a glass cylinder containing the PUF cartridge.

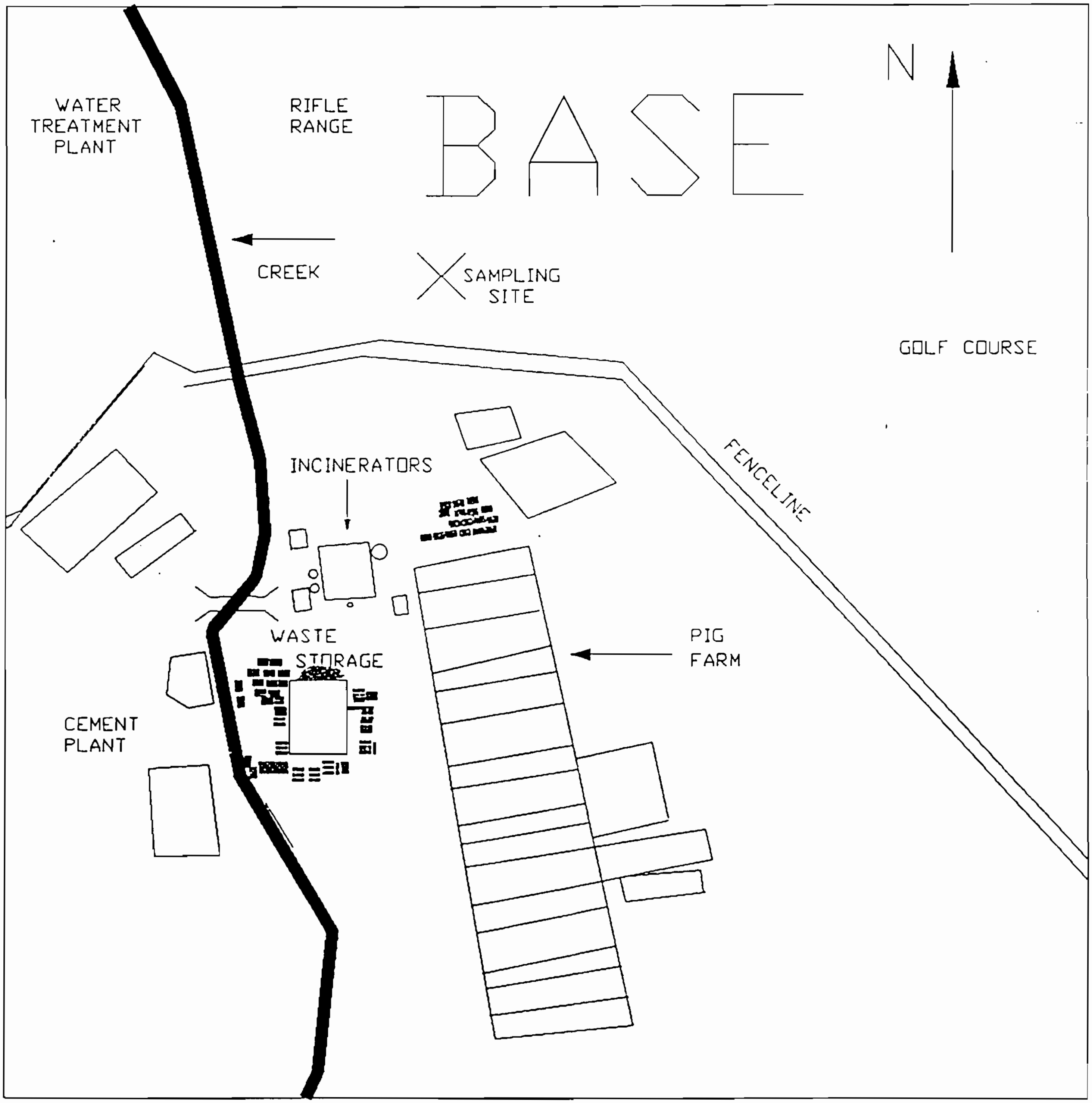


FIGURE 1. SAMPLING SITE LOCATION

We calibrated the units and operated them according to manufacturer's instruction. We tared the filters and Keystone laboratory prepared the PUF cartridges according to EPA sample preparation procedures. During sampling, we recorded ambient temperature, barometric pressure, sampler pressure drop, relative humidity, and elapsed time for each sample.

After sampling, we took the PUF assembly apart and removed the filter and PUF cartridge. We put the filter in a clean aluminum foil envelope, then a manila envelope and finally a clean, labeled polyethylene bag. We wrapped the PUF cartridge with the same aluminum foil that came with each PUF unit from the laboratory. We put the wrapped PUF cartridge in a labeled, sealable polyethylene bag. We stored the filters and PUF cartridges in a freezer after removal from the sampler and kept them in dry ice during air transport to Keystone Lab for analysis.

The laboratory provided the following analyses:

For the filters: Toxic metals - arsenic, cadmium, chromium, lead, and mercury.

For the PUFs: dioxins and dibenzofurans species; and semi-volatile organics.

Method 18: XAD-2 and Charcoal Adsorption Tube Method

We used Dupont low flow samplers to pull ambient air through the XAD-2 and charcoal tubes. We calibrated the flowrate of each sampler according to manufacturer's instructions prior to sampling. During sample collection, we recorded temperature, humidity, barometric pressure, flowrate, wind speed and direction, and elapsed time.

After sampling, we removed the adsorption tubes from the samplers, and capped both ends of the tubes. We put the tubes in labeled resealable polyethylene bags and stored them in a freezer. We kept the tubes in dry ice during air transport to Keystone Laboratory for analysis.

The laboratory provided the following analyses:

For the XAD-2 tubes: Semi-volatiles scan.
For the charcoal tubes: Volatiles scan plus ten peaks.

Method TO5: Midget Impinger Sampling

We used low flow samplers to draw air samples through midget impingers. We calibrated the sampler flowrates according to manufacturer's instructions prior to sampling. We kept the flowrates through the impingers at approximately 750 cubic centimeters per minute. During collection, we recorded sample flowrate, barometric pressure, ambient temperature, relative humidity, wind direction and average wind speed on data sheets.

We capped the impingers and stored them in the refrigerator. We kept the impingers in dry ice when transporting them to the laboratory. Keystone performed a volatile organics compound scan on each sample collected.

VII. SUMMARY of RESULTS

Tables 1a and 1b show the results for August sampling. Tables 2a and 2b show the results for September sampling. Table 3 shows the pollutant concentrations along with their corresponding cancer risk values. Concentration, permissible exposure limit, and unit risk values are in micrograms per cubic meter ($\mu g/m^3$). The wind speed values are miles per hour (mi/hr).

Table 1a. AMBIENT POLLUTANT CONCENTRATIONS AT ATSUGI
8-13 AUGUST 1990

SAMPLES	POLLUTANT	CONCENTRATION ($\mu g/m^3$)	NIOSH PEL[a] ($\mu g/m^3$)	WIND DIRECTION	WIND SPEED (mi/hr)
PUF 2	Phenol	27.2	19,000	SSE to ESE	Typhoon Winoma
	Diethyl phthalate	10.9	5,000(c)	(Sampling time: 1914 Aug 9 to 0544 Aug 10)	
	Di-n-butylphthalate	16.3	5,000		
FILTER 113	Copper	0.054	(fume) 100		
	Lead[b]	0.118	(inorganic lead compounds) 50		
	Zinc	0.476	(zinc chloride fume) 1,000		
PUF 4	Phenol	29.9	19,000	S	4
	Diethyl phthalate	108	5,000(c)	(Sampling time: 1617 Aug 11 to 1619 Aug 12)	
	Phenanthrene	41.9	(d)		
	Di-n-butyl phthalate	108	5,000		
	Fluoranthene	12.0	(d)		
FILTER 115	Chromium	0.039	100 (acid and chromates)		
	Copper	0.014	(fume) 100		
	Lead	0.021	50		
	Zinc	0.273	1,000		
PUF 5	Diethyl phthalate	16.8	5,000(c)	N to S	4
	Phenanthrene	33.7	(d)		
	Di-n-butyl phthalate	101	5,000	(Sampling time: 1746 Aug 12 to 1828 Aug 13)	
	Fluoranthene	11.2	(d)		
FILTER 116	Chromium	0.090	100		
	Copper	0.023	100		
	Mercury	0.003	50		
	Lead	0.428	50		
	Zinc	0.247	1,000		

(a) <u>NIOSH Pocket Guide to Chemical Hazards</u>. U. S. Department of Health and Human Services. June, 1990.
(b) United States National Ambient Air Quality Standards for lead is 1.5 $\mu g/m^3$.
(c) American Conference of Governmental Industrial Hygienists Threshold Limit Values[2].
(d) There is no NIOSH PEL for this compound. However, this compound is listed in the 1990 Clean Air Act Amendments as a hazardous air pollutant, or air toxic.

Table 1b. AMBIENT POLLUTANT CONCENTRATIONS AT ATSUGI
8-13 AUGUST 1990

SAMPLES	POLLUTANT	CONCENTRATION ($\mu g/m^3$)	NIOSH PEL[a] ($\mu g/m^3$)	WIND DIRECTION	WIND SPEED (mi/
XAD-A 2X	Bis(2-ethylhexyl) phthalate	6,800	5,000(b)	N (Sampling time: 1615 to 1745 Aug 12)	0-2
XAD-B 3X	Bis(2-ethylhexyl) phthalate	7,400	5,000(b)	S (Sampling time: 1644 to 1814 Aug 13)	7
XAD-C 2XH	Diethyl phthalate	1,400	5,000(b)	SSE (Sampling time: 1545 to 1601 Aug 9)	3
	Bis(2-ethylhexyl) phthalate	7,900	5,000(b)		
IMP-A	Formaldehyde	0.79	1,200	S to SW (Sampling time: 1545 Aug 10 to 0322 Aug 1	6
IMP-B	Formaldehyde	2.58	1,200	SW to S (Sampling time: 145C to 2350 Aug 11)	4
IMP-C	Formaldehyde	0.42	1,200	N (Sampling time: 233C Aug 12 to 1034 Aug 1	3

(a) NIOSH Pocket Guide to Chemical Hazards. U. S. Department of Health and Huma Service. June, 1990. Values are in microgram per cubic meter instead of millic per cubic meter.
(b) American Conference of Governmental Industrial Hygienists Threshold Limit Values[2].

Table 2a. AMBIENT POLLUTANT CONCENTRATIONS AT ATSUGI
21-25 SEPTEMBER 1990

SAMPLES	POLLUTANT	CONCENTRATION ($\mu g/m^3$)	NIOSH PEL[a] ($\mu g/m^3$)	WIND DIRECTION	WIND SPEED (mi/hr)
PUF 117	1,4-dichlorobenzene	0.196	450,000	NE	0-3
	Naphthalene	0.314	50,000	(Sampling time: 1000 Sep 21 to 1000 Sep 22)	
FILTER 117	Cadmium	0.009	(fume) 100		
	Copper	0.343	(fume) 100		
	Lead[b]	0.055	(inorganic lead compounds) 50		
	Zinc	0.229	(zinc chloride fume) 1,000		
PUF 118	1,2-Dichlorobenzene	0.109	300,000	E to NE	0 to 3
	1,4-Dichlorobenzene	0.706	450,000		
	2-Methyl naphthalene	0.212	(c)	(Sampling time: 1040 Sep 22 to 1040 Sep 23)	
	Naphthalene	0.616	50,000		
	2-Nitrophenol	0.077	(d)		
	Bis(2-ethylhexyl)-phthalate	16.0	5,000(e)		
	Di-n-butyl phthalate	0.128	5,000		
FILTER 118	Chromium	0.012	100 (acid and chromates)		
	Copper	0.904	(fume) 100		
	Lead	0.105	50		
	Zinc	0.305	1,000		
PUF 119	Naphthalene	0.238	50,000	S to NE	0 to 2
	2-Methylnaphthalene	0.212	(c)		
	1,2,3,4,6,7,8 HpCDF	1.3E-6	3.5E-6(f)		
	Total TCDF	1.4E-6	3.5E-6(f)		
	Total PeCDF	2.7E-6	3.5E-6(f)		
	Total HxCDF	2.8E-6	3.5E-6(f)		
	Total HpCDF	1.5E-6	3.5E-6(f)		
FILTER 119	Chromium	0.018	100	(Sampling time: 1330 Sep 23 to 1330 Sep 24)	
	Copper	0.296	100		
	Lead	0.708	50		
	Zinc	0.643	1,000		

Notes for Table 2a.

(a) NIOSH Pocket Guide to Chemical Hazards. U. S. Department of Health and Human Services. June, 1990.
(b) United States National Ambient Air Quality Standard for lead is 1.5 $\mu g/m^3$.
(c) There is no NIOSH PEL for this compound. However, this compound is listed in the 1990 Clean Air Act Amendments as a hazardous air pollutant, or air toxic.
(d) There is no NIOSH PEL for this compound. Listed in EPA TSCA Inventory.
(e) American Conference of Industrial Hygienists Threshold Limit Values[2].
(f) "Noncancer Acceptable Exposure Levels (Chronic)" from Air Toxics "Hot Spots" Program, AB 2588 Risk Assessment Committee of the California Air Pollution Control Officers Association (CAPCOA). January, 1991.

Table 2b. AMBIENT POLLUTANT CONCENTRATIONS AT ATSUGI 21-25 SEPTEMBER 1990

SAMPLES	POLLUTANT	CONCENTRATION ($\mu g/m^3$)	NIOSH PEL[(a)] ($\mu g/m^3$)	WIND DIRECTION	WIND SPEED (mi/hr)
PUF 120	1,4-Dichlorobenzene	0.022	450,000	S to NW	0 to 2
	Naphthalene	0.280	50,000		
	Di-n-butyl phthalate	0.414	5,000	(Sampling time: 1630 Sep 24 to 1630 Sep 25)	
	1,2,3,4,6,7,8-HpCDD	7.0E-7	3.5E-6(b)		
	OCDD	4.5E-6	3.5E-6(b)		
	1,2,3,4,7,8-HxCDF	6.4E-7	3.5E-6(b)		
	Total TCDD	2.0E-6	3.5E-6(b)		
	Total HxCDD	7.0E-7	3.5E-6(b)		
	Total HpCDD	7.0E-7	3.5E-6(b)		
	Total TCDF	5.4E-6	3.5E-6(b)		
	Total PeCDF	2.3E-6	3.5E-6(b)		
FILTER 120	Chromium	0.022	100		
	Copper	0.396	100		
	Lead	0.221	50		
	Zinc	0.807	1,000		

Notes:

(a) NIOSH Pocket Guide to Chemical Hazards. U. S. Department of Health and Human Services. June, 1990.
(b) "Noncancer Acceptable Exposure Levels (Chronic)" from Air Toxics "Hot Spots" Program, AB 2588 Risk Assessment Committee of the California Air Pollution Control Officers Association (CAPCOA). January, 1991.

HpCDD = Heptachloro-dibenzo-p-dioxin
OCDD = Octachloro-dibenzo-dioxin
HxCDF = Hexachloro-dibenzofuran
TCDD = Tetrachloro-dibenzo-p-dioxin
HxCDD = Hexachloro-dibenzo-p-dioxin
TCDF = Tetrachloro-dibenzofuran
PeCDF = Pentachloro-dibenzofuran

Table 3. ESTIMATION OF EXCESS CANCER BURDEN FOR AUGUST AND SEPTEMBER 1990 AMBIENT SAMPLING AT NAF ATSUGI

Pollutant	Sample	Concentration[a] ($\mu g/m^3$)	Unit Risk ($\mu g/m^3$)$^{-1}$	Actual Risk	ASIL[b]
Cadmium	Filter 117	0.009	2E-2	1.08E-4	5.6E-4
Chromium	Filter 116	0.090			1.5[c]
1,4 dichloro-benzene	PUF 118	0.706	8.60E-7	6.07E-7	1500
Di-n-butyl-phthalate	PUF 120	0.414			16.7
Dioxins	PUF 120	8.6E-6[d]	38	3.27E-4	
Fluoranthene	PUF 4	0.0083	1.7E-3		
Formaldehyde	IMP-B	2.58	1.3E-5	3.35E-5	0.077
Dibenzofurans	PUF 119	9.7E-6[f]	38	3.69E-4	
Lead	Filter 119	0.708	8.0E-6	5.7E-6	
Phenanthrene	PUF 4	0.0291	1.7E-3		

TOTAL RISK[e] = 0.000906
EXCESS BURDEN PER MILLION = 906

a. These are the highest concentrations detected for both test periods. This yields a worst case scenario of the emissions impacts.
b. Acceptable Source Impact Level (ASIL) for each carcinogenic pollutant limits the risk of an additional cancer case to one in a million. Taken from: Public Hearings: Rule to Regulate Air Toxics, Washington State Department of Ecology.
c. This limit is for chromium metal.
d. This value corresponds to the sum of the dioxin components for PUF 120.
e. The total risk is the algebraic sum of individual actual risks for each pollutant.
f. This value is the sum of dibenzofuran components for PUF 119.

VIII. DISCUSSION

After the August sampling, we contracted Keystone Lab-Houston (Keystone) for the chemical analysis. Keystone subcontracted Triangle Laboratories of Houston Inc. (Triangle) for dioxins and dibenzofurans analyses. A laboratory accident during solvent extraction at Triangle destroyed our samples. Triangle agreed to reimburse us expenses for resampling. We sampled again in September 1990 and sent our samples to Keystone for analysis. We did not receive our results until February 1991 because Keystone was going through relocation and reorganization and Triangle needed to repair analytical equipment.

Since both sampling periods were short, the results can only be viewed as a snapshot of the air quality at the sampling site at the times of sampling. Only continuous multi-year sampling can provide true ambient air quality values.

Some samples from the August sampling were not reported because they were destroyed by the laboratory. Several XAD and charcoal tube samples taken during September sampling, including the ones taken in the helicopter, were not tabulated in the tables because sampling times were too short or pollutant concentrations were below detection limits.

Sampling data and laboratory analysis information are included in Appendices A and B, respectively.

Pollutants Concentration Analysis

During the August sampling the winds were mostly southerly, blowing the incinerator plumes toward our sampling site on base. During the September sampling the winds were generally northeasterly and the incinerator plumes were blowing away from our sampling site. Various chemicals and metals detected along with their respective permissible exposure limits (PELs) are presented in Tables 1a and 1b for August sampling and Tables 2a and 2b for September sampling. By comparing samples collected during S and SSE winds (Filter 113/PUF 2 and Filter 115/PUF 4 in Table 1a) and those collected during N and NE winds (Filter 117/PUF 117 and Filter 118/PUF 118 in Table 2a), there is definitely a contrast for the organics collected. Only one organic compound, di-n-butyl phthalate, is common to both sets of samples. Chromium, copper, lead, and zinc metals are common to both sets of samples. Cadmium was collected when the wind was from NE.

Since there are no national ambient air quality standards (NAAQS) for the chemicals detected except for lead, we are comparing the pollutants concentration with National Institute for Occupational Safety and Health's permissible exposure limits (PELs), and American Conference of Governmental Industrial

Hygienists' threshold limit values (TLVs). Both PEL and TLV are concentrations that must not be exceeded during any 8-hour work shift of a 40-hour workweek for a healthy adult worker.

All detected pollutant concentrations, except the ones collected on XAD samples and the dioxins and dibenzofurans values, are at least one order of magnitude less than either the PEL or TLV. There are no PEL or TLV established for dioxins and dibenzofurans. We listed the Noncancer Acceptable Exposure Levels for dioxins and dibenzofurans in Tables 2a and 2b for comparison only. The highest lead concentration detected was 0.708 $\mu g/m^3$. This is less than half the value of 1.5 $\mu g/m^3$, the NAAQS for lead. As a comparison, South Coast Air Quality Management District (Los Angeles area, California) monitoring stations data show that their ambient lead concentrations range[3] between 0.01-0.2 $\mu g/m^3$. Our sample shows the Atsugi air to be about five times higher in lead than Los Angeles, but still acceptable.

The results for the XAD samples are tabulated in Table 1b. Diethyl phthalate (1400 $\mu g/m^3$) and Bis(2-ethylhexyl) phthalate (ranges 6800 to 7900 $\mu g/m^3$) were detected in these samples. We do not know why these concentrations are so high.

Dioxins and dibenzofurans were detected in PUFs 119 and 120 and their concentrations are included in Tables 2a and 2b. Both concentrations of the OCDD (4.5 ng/m^3) and total TCDF (5.4 ng/m^3) for PUF 120 exceeded the Noncancer Acceptable Exposure Levels (NAELs) value of 3.5 ng/m^3. NAEL is discussed in the following Risk Analysis Section. Both samples were collected when the winds were calm and came from NE about 60% of the time and S and SW for about 40% of the time. During PUF 119 sampling the incinerators were shut down for about 16 hours, from about 1900, 23 September to 1045, 24 September 1990.

Risk Analysis

In this analysis, we compare the detected air pollutant levels with levels set by the health community in the United States.

Both long term and short term exposure limits are used to express the relative degree of danger to the surrounding population. For short term limits, both PEL and NAEL are listed for reference. According to the National Institute for Occupational Safety and Health (NIOSH), the PEL is an 8 hour time weighted average that is set for the average healthy adult so that no short acute effects are manifested. The NAELs are levels set by California Air Pollution Control Officers Association. To maintain an acceptable human safety, NAELs should not be exceeded for the general population. In addition to these short term limits, long term cancer risk was estimated using unit risk factors established by EPA and the California Department of

Health Services (DHS). The calculated risk applies to a population which is exposed to these concentrations for a lifetime (70 years).

Excess cancer burden is calculated using a worst case analysis. Highest concentrations measured are assumed to act on the population for a lifetime of 70 years. The unit risk factors set by DHS and EPA yielded a high excess cancer risk of 906 per one million. Concentrations of cadmium, dioxins and furans are responsible for the majority of risk. The cadmium level measured was not high but it added considerably to the risk since it is a potent carcinogen. Along with cadmium, the dioxins and furans (members of the polycyclic aromatic hydrocarbon family) are potent carcinogens and mutagens.

IX. CONCLUSIONS

All toxic compounds and metals detected in the filters and PUF units were below the PEL or TLV. XAD samples showed very high concentrations of bis(2-ethylhexyl) phthalate and diethyl phthalate. We have no explanation for these high values.

Dioxins and dibenzofurans were detected in two of the PUF samples. The concentrations of octachloro-dibenzo-dioxin and tetrachloro-dibenzofuran were higher than the risk assessment guideline established by California Air Pollution Control Officers Association. The total risk calculated was high, 906 cancer cases per million persons. EPA's acceptable risk criteria for setting toxic air emission standard is less than one cancer case per million. The actual risk should be much lower because:

(1) Most people do not live on base for 70 years;

(2) The most damaging compounds are cadmium, dioxins and dibenzofurans for their carcinogenic and mutagenic effects. Only one sample detected cadmium and two samples detected dioxins and dibenzofurans; and

(3) All these toxic pollutants probably are not present in the ambient air at the same time with the same concentrations.

With these two short sampling periods, we cannot determine which direction these toxic pollutants came from. Different winds bring different chemical compounds to the sampler. The wind direction and wind speed were not constant for any sampling period. The incinerators burn different wastes from day to day. Also, with the air operation on base, open burning and other industrial sources off-base, the pollutants could come from sources other than the incineration facility. Toxic metals are present in the air independent of wind direction.

Even though the pollutants detected are below PEL and TLV, the ambient air at Atsugi is definitely not clean. With large combination of the toxic substances in the air, it's hard to assess the actual health risk to base personnel. Two respiratory irritants, phenol and formaldehyde, were detected but their concentrations are too low to have caused the choking, eye, nose, and respiratory discomfort reported by base personnel.

X. RECOMMENDATIONS

To better understand the ambient air quality at Atsugi, we recommend:

1. Establish a fact-finding program to determine what chemical compounds in the incinerator smoke cause the eye, nose, and respiratory problems. Then, determine the health impacts.

2. Establish a long-term ambient air sampling system with at least two sampling stations, one downwind from the incinerators and one away from both the incinerators and the downwind station. This second station will be the "background" station;

3. Each station is to include samplers for each of the pollutants identified by the work recommended in Item 1.

4. Each station should include one PM-10 ambient sampler, PUF, a three gas sampler for acid gases (HCl and NO_2), wind speed and direction monitoring and recording system, and a low flow PM-10 sampler; and

5. As an option, a directional sampling mechanism to allow samplers to start when the wind is at a preset direction.

NEESA has ambient air samplers that can meet most of the above requirements. We can set up the sampling stations and train base personnel to operate equipment. Using our equipment, NAF Atsugi can start sampling sooner. We included literature of our sampling equipment in Appendix C.

We further suggest that a DoD laboratory in Japan be used for sample analyses. Due to the laboratory liability potential when analyzing highly toxic compounds and the costly equipment required, using a contract laboratory in the United States is cost prohibitive.

XI. REFERENCES

1. Phoncon COMPACNAVFACENGCOM M. Waki/NEESA (Code 111C) D. Carpenter of 19 July 1990

2. American Conference of Governmental Industrial Hygienists. 1990-1991 Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices. 1990.

3. South Coast Air Quality Management District. Air Quality Standards Compliance Report, 1990.

APPENDIX A

SAMPLING DATA

PUF DATA

SAMPLES ID	DATE	TIME HH:MM	BARO "Hg	TEMP F	HUM %	WND VEL mph	WND DIR	DEL P "H2O	FLOW RATE scfm	COMMENTS
1/112 - FIL/PUF-B	08AUG	18:14	29.31	82	76	5	S	30.30		.5-3 PNGLMM, FUMG VLY GRND,
	09AUG	:10	29.40	76		0		31.00		19:30-22:30 rain on/off
		05:30	29.43	74		2	NNE	31.00		plm-strat up, ovrcst,50' op
		18:17	29.33	76	86	3	SSE	29.00		FUMG VLY GRND, NO SMELL, GU
TOTAL TIME ***		24:03	*****	****	***	***	***	*****	****	
AVERAGE ***			29.37	77	81	3		30.33	6.4	
2/113 - FIL/PUF-F	09AUG	19:14	29.40	78			SSE	32.00		TYPHOON WINONA
		23:21	29.32	76			ESE	30.00		
	10AUG	05:44	29.19	75			ESE	33.00		SHUT DOWN EARLY
TOTAL TIME ***		10:30	*****	****	***	***	***	*****	****	
AVERAGE ***			29.30	76.3				31.67	6.5	
3/114 - FIL/PUF-A	10AUG	14:47	29.06	80		10	S	36.00		GUST 20mph
		18:53	29.10	80		3.5	SSW	32.00		GUST 4.5mph, SMELL @ HANGER
	11AUG	08:00	29.26	82		5	S	27.00		STACK 3 GREY, PLM RT @ US
		14:48	29.10	90	68	7	SW	26.00		
TOTAL TIME ***		24:01	*****	****	***	***	***	*****	****	
AVERAGE ***			29.13	83		6		30.25	6.4	
4/115 - FIL/PUF-C	11AUG	16:17	29.14	88	66	4	E	32.00		
		18:00	29.17	85		5	E	28.00		
		20:04	29.25	82		5	E	25.00		FUMIG VLY, GUST 7mph
		23:30	29.25	81		2	E	27.00		FLAMES STCK 2,3
	12AUG	11:00	29.10	92	72	4	SES	27.00		GUST 6mph, PLM STRAT UP
		16:19	29.24	82		2	N	28.00		VERY LOW WIND
TOTAL TIME ***		24:02	*****	****	***	***	***	*****	****	
AVERAGE ***			29.19	85		4		28.33	5.9	
5/116 - FIL/PUF-E	12AUG	17:46	29.32	80	80	1	N	31		PLM STRAT UP
		23:57	29.32	79		2	N	30		LITES OFF @INCIN
	13AUG	05:30	29.37	78	82	3	N	31		STILL SHUT DWN, TIRE INCIN
		14:11	29.22	88		10	S	27		INCIN #4 OFF ALL DAY
		18:28	29.27	82		5	S	27		BLACK SMOKE
TOTAL TIME ***		24:43	*****	****	***	***	S	*****	****	
AVERAGE ***			29.30	81.4		4		29.20	6.3	

SAMPLES ID	DATE	TIME HH:MM	BARO "Hg	TEMP F	HUM %	WND VEL mph	WND DIR	DEL P "H2O	FLOW RATE cfm	COMMENTS
117 - FIL/PUF	21SEP	10:00	30.05	82			E	41.00		SUNNY, CLEAR, PATCHES CLOUD
	21SEP	16:00	30.05	74	61	4	E	44.00		OVERCAST
	21SEP	24:00	30.05	65	66	3	N	46.00		HEAVY SMOKE FROM STACKS. FL
	22SEP	10:00	30.10	80	57	3	NE	43.00		LIGHT HAZY SMOKE
TOTAL TIME ***		24:00	*****	****	***	***	***	*****	****	
AVERAGE ***			30.06	75.2	62	3		43.50	7.5	
118 - FIL/PUF	22SEP	10:40	30.15	80	53	3	NNE	43.00		GUST 5-6MPH
	22SEP	16:40	30.15	78	50	3	E	44.00		VERY LITTLE SMOKE
	10AUG	05:44	29.19	75	75	0	NE	47.00		SHUT DOWN EARLY
	10AUG	10:40	30.19	79	56	0	E	43.00		
TOTAL TIME ***		24:00	*****	****	***	***	***	*****	****	
AVERAGE ***			29.92	77.6				44.25	7.6	
119 - FIL/PUF	23SEP	13:30	30.19	82	54	4	SSW	44.00		MODERATE INC. ACTIVITY
	23SEP	19:30	30.19	74	73	3	S	46.00		INC. SHUT DOWN
	24SEP	06:45	30.00	71	80	2	NE	46.00		INC. STILL DOWN
	24SEP	13:30	29.96	81	60	1	VAR	41.00		LOW INC. ACTIVITY
TOTAL TIME ***		24:00	*****	****	***	***	***	*****	****	
AVERAGE ***			30.09	77		3		44.25	7.6	
120 - FIL/PUF	24SEP	16:30	29.96	81	46	2	VAR	46.00		HIGH PLUME, LOW ACTIVITY
	24SEP	22:30	29.94	71	81	0	S	48.00		HIGH PLUME, LOW ACTIVITY
	25SEP	07:15	29.96	74	90	2	N	44.00		OVERCAST, MODERATE ACTIVITY
	25SEP	16:30	30.06	82	61	1	NE	43.00		OVERCAST, HIGH ACTIVITY
TOTAL TIME ***		24:00	*****	****	***	***	***	******	****	
AVERAGE ***			29.98	77		1		45.25	7.7	

LOW FLOW DATA SHEET

Label		Day	Date	Start Time (hh:mm)	Pump No. (#)	Flow Rate (cc/m)	Elapsed Time (hh:mm)	Avg Baro Pres ("Hg)	TWA Amb Temp (°C)	Avg Rel Hum (%)	Avg Wind Dir	Avg Wind Spd (mph)
1CH	CC-F	Thur	09-Aug-90	15:45	1	1822	00:19	29.30	24	86	SSE	
1XH	XAD-H	Thur	09-Aug-90	15:45	2	1313	00:19	29.30	24	86	SSE	
2CH	CC-G	Thur	09-Aug-90	15:45	3	175	00:16	29.30	24	86	SSE	
2XH	XAD-C	Thur	09-Aug-90	15:45	4	176	00:16	29.30	24	86	SSE	
midget 1		Fri	10-Aug-90	15:45	5	750	11:37	29.20	28	75	SSW	5
midget 2		Sat	11-Aug-90	14:50	2	750	09:00	29.25	32	63	S-SSE	5
1C	CC-A	Sat	11-Aug-90	16:21	3	200	01:30	29.25	30	68	S-SSE	5
1X	XAD-F	Sat	11-Aug-90	18:00	3	200	01:30	29.25	31	68	S-SSE	5
2C	CC-B	Sat	11-Aug-90	18:07	4	200	03:00	29.25	28	68	S-SSE	5
midget 3		Sun	12-Aug-90	23:30	5	750	11:04	29.22	33	82	N-S	3
3C	CC-C	Mon	12-Aug-90	16:15	3	170	01:30	29.32	28	72	N	1
2X	XAD-A	Mon	12-Aug-90	16:15	4	170	01:30	29.32	29	72	N	1
4C	CC-D	Mon	13-Aug-90	05:43	4	170	01:30	29.37	27	82	N	3
3X	XAD-B	Mon	13-Aug-90	16:44	3	170	01:30	29.37	27	82	N	3
4CBAG	CC-E	Mon	13-Aug-90	16:30	3	170	01:30	29.27	26	82	S	3
1F	FOR-A	Mon	13-Aug-90	16:30	4	170	01:30	29.27	25	82	N	3
4XBAG	XAD-G	Mon	13-Aug-90	15:45	3	170	01:30	29.27	23	82	N	3
2F	FOR-B	Mon	13-Aug-90	15:45	4	170	01:30	29.27	24	82	N	3

LOW FLOW DATA SHEET

Label		Day	Date	Start Time (hh:mm)	Comments Observations
1CH	CC-F	Thur	09-Aug-90	15:45	helicopter-THRU PLM
1XH	XAD-H	Thur	09-Aug-90	15:45	helicopter-THRU PLM
2CH	CC-G	Thur	09-Aug-90	15:45	helicopter-THRU PLM
2XH	XAD-C	Thur	09-Aug-90	15:45	helicopter-THRU PLM
	midget 1	Fri	10-Aug-90	15:45	INSD PUF HOUSING, AFTER TYPOON, PLM VARY OVER SITE
	midget 2	Sat	11-Aug-90	14:50	UNDER PUR HOUSING, PLM FUMIG
1C	CC-A	Sat	11-Aug-90	16:21	OUTSD PUF HOUSING, PLM FUMIG
1X	XAD-F	Sat	11-Aug-90	18:00	OUTSD PUF HOUSING, PLM FUMIG
2C	CC-B	Sat	11-Aug-90	18:07	OUTSD PUF HOUSING, PLM FUMIG
	midget 3	Sun	12-Aug-90	23:30	#4 OFF, #3 ON LINE, LTL SMK, WND CHNG N TO S
3C	CC-C	Mon	12-Aug-90	16:15	#4 OFF, #3 ON LINE, LTL SMK, LTL ACTIVITY
2X	XAD-A	Mon	12-Aug-90	16:15	#4 OFF, #3 ON LINE, LTL SMK, LTL ACTIVITY
4C	CC-D	Mon	13-Aug-90	05:43	ALL OFF, LTL ACTIVITY
3X	XAD-B	Mon	13-Aug-90	16:44	ALL OFF, LTL ACTIVITY
4CBAG	CC-E	Mon	13-Aug-90	16:30	bag sample, from helo
1F	FOR-A	Mon	13-Aug-90	16:30	bag sample, from helo
4XBAG	XAD-G	Mon	13-Aug-90	15:45	bag sample, from helo
2F	FOR-B	Mon	13-Aug-90	15:45	bag sample, from helo

APPENDIX B

LABORATORY RESULTS

Houston
Monroeville
Pittsburgh

Keystone Lab-Houston
8300 Westpark
Houston, TX 77063
713-266-6800
FAX 713-974-5491

CHESTER LabNet

FAX COVER SHEET

To: DAVE COOK

Company: NEESA

Fax No: 805-982-3588
5388

From: TED OSTERMAN

Date: 2/6/91

Time: 13:05 C.S.T.

Pages: 1 (Following Cover Sheet)

Operator: [illegible]

Comments: PLEASE CALL ME UPON ARRIVAL OF THIS FAX!!!

Thanks
TO

NEESA Atsugi Ambient Air Samples

Sample	HITS	concentration	units	FINAL CONCENTRATI amount - units
PUF 2	Phenol	5	µg/PUF	27.2 µg/m³
	Diethyl Phthalate	2	"	10.9 µg/m³
	Di-n-butyl Phthalate	3	"	16.3 µg/m³
PUF 4	Phenol	5	µg/PUFF	29.9 µg/m³
	Diethyl Phthalate	18	"	108 µg/m³
	Phenanthrene	7	"	41.9 µg/m³
	Di-n-butyl Phthalate	18	"	108 µg/m³
	Fluoranthene	2	"	12.0 µg/m³
PUF 5	Diethyl Phthalate	3	µg/PUF	16.8 µg/m³
	Phenanthrene	6	"	33.7 µg/m³
	Di-n-butyl Phthalate	18	"	101 µg/m³
	Fluoranthene	2	"	11.2 µg/m³
XAD-A 2X	Bis(2-ethylhexyl)PHTH	100	µg/TUBE	6.8 mg/m³
XAD-B 3X	Bis(2-ethylhexyl)PHTH	110	µg/TUBE	7.4 mg/m³
XAD-C 2XH	Diethyl Phthalate	4	µg/TUBE	1.4 mg/m³
	Bis(2-ethylhexyl)PHTH	23	µg/TUBE	7.9 mg/m³
FILTER 113	Copper	62.4	µg/filter	0.054 µg/m³
	Lead	136.5	"	0.118 µg/m³
	Zinc	552	"	0.476 µg/m³
FILTER 115	Chromium	95.1	µg/filter	0.039 µg/m³
	Copper	34.2	"	0.014 µg/m³
	Lead	50.1	"	0.021 µg/m³
	Zinc	657	"	0.273 µg/m³
FILTER 116	Chromium	238	µg/filter	0.090 µg/m³
	Copper	60.3	"	0.023 µg/m³
	Mercury	0.74	"	0.003 µg/m³
	Lead	1130	"	0.428 µg/m³
	Zinc	654	"	0.247 µg/m³
BLANK IMP	Formaldehyde	0.2	µg	Not applicable
1I IMP-A	Formaldehyde *	0.6	µg	0.79 µg/m³
2I IMP-B	Formaldehyde *	1.2	µg	2.58 µg/m³
3I IMP-C	Formaldehyde *	0.4	µg	0.42 µg/m³

* - Values for Formaldehyde are blank corrected
PHTH - Phthalate

Revised 2/6/90

TOTAL P.02

[redacted] [redacted]

Houston
Monroeville
Pittsburgh

Keystone Lab– Houston
8300 Westpark
Houston, TX 77063
713-266-6800
FAX 713-974-5491

CHESTER LabNet

January 2,1991

Dave Cook
Naval Energy and Environmental Support Activity
Bldg. 1163 Code 111C1/Dave Cook
Port Hueneme,CA 93043-05014

Dear Dave:

Enclosed are the analytical results for the second sampling event at Atsugi NAF. As in the first sampling event, results are based upon standardized volumes of air drawn through each media.

No compounds of interest were found in the XAD analysis for semi-volatile compounds or in the charcoal tube analysis for volatile organic compounds. Blank data sheets are enclosed showing the contaminant list searched for in this work order. Blank data is also useful in assessing laboratory contamination. Much of the dioxin and dibenzofuran data are flagged with the EMPC descriptor. These values indicate that an interference was detected at the GC column retention time thereby masking the peak of interest. EMPC concentrations are used in risk assessment evaluation work where total possible dioxin and dibenzofuran is required. You may, for your purposes, decide to only use the non-EMPC concentrations.

Should any questions arise, please feel free to call me at (713)266-6800.

Sincerely,

Thomas T. Osterman
Laboratory Manager
enc/tto

Report
Prepared
for

Naval Energy and Environmental Support Activity

Bldg. 1163 Code 111C1/Cindy Ruf
Port Hueneme CA 93043-05014

Attention : DAVE COOK

by

Keystone Lab - Houston
8300 Westpark Drive
Houston, Texas 77063
(713) 266-6800

CERTIFIED BY : Thomas T. [signature]

PROJECT ID :
P.O. NUMBER :

WORK ORDER : H90-09.148
DATE RECEIVED : 29-SEP-1990

SAMPLE & ANALYSIS SUMMARY

Keystone Sample ID	Client's Sample Name	Date Collected	Sample Matrix
H90-09.148-001	BLANK PUF	21-SEP-1990	PUFF
H90-09.148-002	PUFF 117	21-SEP-1990	PUFF
H90-09.148-003	PUFF 118	22-SEP-1990	PUFF
H90-09.148-004	PUFF 119	23-SEP-1990	PUFF
H90-09.148-005	PUFF 121	25-SEP-1990	PUFF
H90-09.148-006	PUFF 122	26-SEP-1990	PUFF
H90-09.148-007	PUFF 120	24-SEP-1990	PUFF
H90-09.148-008	BLANK FILTER	21-SEP-1990	FILTER
H90-09.148-009	FILTER 117	21-SEP-1990	FILTER
H90-09.148-010	FILTER 118	21-SEP-1990	FILTER
H90-09.148-011	FILTER 119	22-SEP-1990	FILTER
H90-09.148-012	FILTER 120	24-SEP-1990	FILTER
H90-09.148-013	FILTER 121	25-SEP-1990	FILTER
H90-09.148-014	FILTER 122	26-SEP-1990	FILTER
H90-09.148-015	BLANK XAD	21-SEP-1990	TUBE
H90-09.148-016	21 XAD	21-SEP-1990	TUBE
H90-09.148-017	24 XAD	24-SEP-1990	TUBE
H90-09.148-018	27 XAD	21-SEP-1990	TUBE
H90-09.148-019	BLANK TUBE	21-SEP-1990	TUBE
H90-09.148-020	21 C	21-SEP-1990	TUBE
H90-09.148-021	24 C	24-SEP-1990	TUBE
H90-09.148-022	BLANK PUFF MS	21-SEP-1990	TUBE
H90-09.148-023	BLANK PUFF MSD	21-SEP-1990	TUBE
H90-09.148-024	BLANK SPIKE	30-SEP-1990	TUBE

Analysis ID	Parameter Description
DIOXIN_SU	Chlorinated Dioxins & Furans
EXT_8270SX	(Soil) Extraction by EPA 8270
EXT_SU	(Nonaqueous)Extraction
SV$TCL_SX	(Soil)SV (Target Compound List) plus peaks
PSOLID	Percent Solids
AG_SX	Silver (Non-aqueous)
AS_SX	Arsenic (Non-aqueous)
BE_SX	Beryllium (Non-aqueous)
CD_SX	Cadmium (Non-aqueous)
CR_SX	Chromium (Non-aqueous)
CU_SX	Copper (Non-aqueous)
HGA_SX	Digestion - Metals (Non-aqueous)
ICP_SX	Digestion - Metals (Non-Aqueous)
NI_SX	Nickel (Non-aqueous)
PB_SX	Lead (Non-aqueous)
SB_SX	Antimony (Non-aqueous)
SE_SX	Selenium (Non-aqueous)

Analysis ID	Parameter Description
TL_SX	Thallium (Non-aqueous)
ZN_SX	Zinc (Non-aqueous)
EXT_3540_S	SOXHLET EXTRACTION
VOA#TCL_SX	TCL VOA + peaks

TABLE OF CONTENTS

Sample	HITS	concentration	units	FINAL CONCENTRAT amount - unit
PUF 117	1,4-Dichlorobenzene	30	µg/PUF	0.196 µg/m³
	Naphthalene	48	µg/PUF	0.314 µg/m³
	Total HxCDF (EMPC)	0.31	ng/PUF	0.0010 ng/m³
PUF 118	1,4-Dichlorobenzene	110	µg/PUF	0.706 µg/m³
	1,2-Dichlorobenzene	17	µg/PUF	0.109 µg/m³
	2-Nitrophenol	12	µg/PUF	0.077 µg/m³
	Naphthalene	96	µg/PUF	0.616 µg/m³
	2-Methylnaphthalene	33	µg/PUF	0.212 µg/m³
	Di-n-butyl Phthalate	20	µg/PUF	0.128 µg/m³
	Bis(2-Ethylhexyl)PHTH	2500	µg/PUF	16.0 µg/m³
PUF 119	Naphthalene	37	µg/PUF	0.238 µg/m³
	2-Methylnaphthalene	33	µg/PUF	0.212 µg/m³
	OCDD (EMPC)	0.35	ng/PUF	0.0011 ng/m³
	2,3,7,8-TCDF (EMPC)	0.80	ng/PUF	0.0025 ng/m³
	1,2,3,4,7,8-HxCDF(EMPC)	0.45	ng/PUF	0.0014 ng/m³
	1,2,3,4,6,7,8-HpCDF	0.41	ng/PUF	0.0013 ng/m³
	Total TCDD (EMPC)	0.56	ng/PUF	0.0018 ng/m³
	Total PeCDD (EMPC)	0.47	ng/PUF	0.0015 ng/m³
	Total HxCDD (EMPC)	0.29	ng/PUF	0.00093 ng/m³
	Total TCDF	0.45	ng/PUF	0.0014 ng/m³
	Total PeCDF	0.83	ng/PUF	0.0027 ng/m³
	Total HxCDF	0.88	ng/PUF	0.0028 ng/m³
	Total HpCDF	0.47	ng/PUF	0.0015 ng/m³
	Total TCDF (EMPC)	2.2	ng/PUF	0.0071 ng/m³
	Total PeCDF (EMPC)	1.1	ng/PUF	0.0035 ng/m³
	Total HxCDF (EMPC)	1.3	ng/PUF	0.0042 ng/m³
PUF 120	1,4-Dichlorobenzene	28	µg/PUF	0.179 µg/m³
	Naphthalene	44	µg/PUF	0.280 µg/m³
	Di-n-butyl Phthalate	65	µg/PUF	0.414 µg/m³
	1,2,3,4,6,7,8-HpCDD	0.22	ng/PUF	0.00070 ng/m³
	OCDD	1.4	ng/PUF	0.0045 ng/m³
	2,3,7,8-TCDF (EMPC)	0.47	ng/PUF	0.0015 ng/m³
	1,2,3,4,7,8-HxCDF	0.20	ng/PUF	0.00064 ng/m³
	Total TCDD	0.63	ng/PUF	0.0020 ng/m³
	Total PeCDD (EMPC)	0.28	ng/PUF	0.00089 ng/m³
	Total HxCDD	0.22	ng/PUF	0.00070 ng/m³
	Total HpCDD	0.22	ng/PUF	0.00070 ng/m³
	Total TCDF	1.7	ng/PUF	0.0054 ng/m³
	Total TCDF (EMPC)	2.7	ng/PUF	0.0086 ng/m³
	Total PeCDF	0.72	ng/PUF	0.0023 ng/m³
	Total PeCDF (EMPC)	0.91	ng/PUF	0.0029 ng/m³
	Total HxCDF	0.34	ng/PUF	0.0011 ng/m³
	Total HxCDF (EMPC)	0.68	ng/PUF	0.0022 ng/m³

FILTER 117 - Initial weight = 0.715 gms.

	Cadmium	26.9	µg/filter	0.009 µg/m³
	Copper	1050	"	0.343 µg/m³
	Lead	168	"	0.055 µg/m³
	Zinc	703	"	0.229 µg/m³

Sample	HITS	concentration	units	FINAL CONCENTRATION amount - units	
FILTER 118 - Initial weight = 0.709 gms.					
	Chromium	26.8	µg/filter	0.012	µg/m³
	Copper	2820	"	0.904	µg/m³
	Lead	328	"	0.105	µg/m³
	Zinc	950	"	0.305	µg/m³
FILTER 119 - Initial weight = 0.715 gms.					
	Chromium	55.0	µg/filter	0.018	µg/m³
	Copper	2200	"	0.296	µg/m³
	Lead	808	"	0.708	µg/m³
	Zinc	2000	"	0.643	µg/m³
FILTER 120 - Initial weight = 0.716 gms.					
	Chromium	70.4	µg/filter	0.022	µg/m³
	Copper	1240	"	0.395	µg/m³
	Lead	692	"	0.221	µg/m³
	Zinc	2530	"	0.807	µg/m³

PHTH = Phthalate
EMPC = Estimated Maximum Possible Concentration
HxCDF = Hexachloro-dibenzofuran
OCDD = Octachloro-dibenzo-dioxin
TCDF = Tetrachloro-dibenzofuran
HpCDF = Heptachloro-dibenzofuran
TCDD = Tetrachloro-dibenzo-p-dioxin
HxCDD = Hexachloro-dibenzo-p-dioxin
PeCDD = Pentachloro-dibenzo-p-dioxin
PeCDF = Pentachloro-dibenzofuran
HpCDD = Heptachloro-dibenzo-p-dioxin

INST ID: 4530 SAMPLE NUMBER: SBLK (PUF)/(XAD-2)

ORGANICS ANALYSIS DATA SHEET

LABORATORY NAME: KEYSTONE
LAB SAMPLE ID NO.: 90--
SAMPLE MATRIX: PUF
DATA RELEASE AUTHORIZED BY:.........

CASE NO.: ---
QC REPORT NO.: 11/02/90
CONTRACT NO.: --
DATE SAMPLE RECEIVED: ....

SEMIVOLATILES

CONCENTRATION: LOW
DATE EXTRACTED: ....
DATE ANALYZED: ....

DATAFILE: 4B09148C01
DILUTION FACTOR: ....

	COMPOUND	DETECTION LIMIT (MICROGRAMS /	AMOUNT FOUND PUF)
C315	PHENOL	10 U	
C325	BIS(2-CHLOROETHYL)ETHER	10 U	
C330	2-CHLOROPHENOL	10 U	
C335	1,3-DICHLOROBENZENE	10 U	
C340	1,4-DICHLOROBENZENE	10 U	
C345	BENZYL ALCOHOL	10 U	
C350	1,2-DICHLOROBENZENE	10 U	
C355	2-METHYLPHENOL	10 U	
C360	BIS(2-CHLOROISOPROPYL)ETHER	10 U	
C365	4-METHYLPHENOL	10 U	
C370	N-NITROSODIPROPYLAMINE	10 U	
C375	HEXACHLOROETHANE	10 U	
C410	NITROBENZENE	10 U	
C415	ISOPHORONE	10 U	
C420	2-NITROPHENOL	10 U	
C425	2,4-DIMETHYLPHENOL	10 U	
C430	BENZOIC ACID	50 U	
C435	BIS(2-CHLOROETHOXY)METHANE	10 U	
C440	2,4-DICHLOROPHENOL	10 U	
C445	1,2,4-TRICHLOROBENZENE	10 U	
C450	NAPHTHALENE	10 U	
C455	4-CHLOROANILINE	10 U	
C460	HEXACHLOROBUTADIENE	10 U	
C465	P-CHLORO-M-CRESOL	10 U	
C470	2-METHYLNAPHTHALENE	10 U	
C510	HEXACHLOROCYCLOPENTADIENE	10 U	
C515	2,4,6-TRICHLOROPHENOL	10 U	
C520	2,4,5-TRICHLOROPHENOL	50 U	
C525	2-CHLORONAPHTHALENE	10 U	
C530	2-NITROANILINE	50 U	
C535	DIMETHYL PHTHALATE	10 U	
C540	ACENAPHTHYLENE	10 U	
C545	3-NITROANILINE	50 U	
C550	ACENAPHTHENE	10 U	
C555	2,4-DINITROPHENOL	50 U	
C560	4-NITROPHENOL	50 U	
C565	DIBENZOFURAN	10 U	
C570	2,4-DINITROTOLUENE	10 U	
C543	2,6-DINITROTOLUENE	10 U	

KEYSTONE DC # ---- 8

SAMPLE NUMBER: SBLK (PUF)/(XAD-2)

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET, CONTINUED

DATAFILE: 4B09148C01

	COMPOUND	DETECTION LIMIT (MICROGRAMS /	AMOUNT FOUND PUF)
C580	DIETHYL PHTHALATE	10 U	
C585	4-CHLOROPHENYL PHENYL ETHER	10 U	
C590	FLUORENE	10 U	
C595	4-NITROANILINE	50 U	
C610	4,6-DINITRO-2-METHYLPHENOL	50 U	
C615	N-NITROSODIPHENYLAMINE	10 U	
C625	4-BROMOPHENYL PHENYL ETHER	10 U	
C630	HEXACHLOROBENZENE	10 U	
C635	PENTACHLOROPHENOL	50 U	
C640	PHENANTHRENE	10 U	
C645	ANTHRACENE	10 U	
C650	DI-N-BUTYL PHTHALATE	10 U	
C655	FLUORANTHENE	10 U	
C715	PYRENE	10 U	
C720	BUTYL BENZYL PHTHALATE	10 U	
C725	3,3'-DICHLOROBENZIDINE	20 U	
C730	BENZO(A)ANTHRACENE	10 U	
C745	BIS(2-ETHYLHEXYL)PHTHALATE	10 U	
C740	CHRYSENE	10 U	
C760	DI-N-OCTYL PHTHALATE	10 U	
C765	BENZO(B)FLUORANTHENE	10 U	
C770	BENZO(K)FLUORANTHENE	10 U	
C775	BENZO(A)PYRENE	10 U	
C780	INDENO(1,2,3-CD)PYRENE	10 U	
C785	DIBENZO(A,H)ANTHRACENE	10 U	
C790	BENZO(GHI)PERYLENE	10 U	

U = UNDETECTED AT THE LISTED DETECTION LIMIT
J = COMPOUND IS PRESENT, BUT BELOW THE LISTED DETECTION LIMIT

K E Y S T O N E   L A B   -   H O U S T O N

SAMPLE ID : H90-09.148
SAMPLE NAME: BLANK FILTER

DATE COLLECTED: XX-AUG-1990
DATE RECEIVED : XX-AUG-1990

SAMPLING POINT: QA_QC
MATRIX : PARTICLE FILTER

Component name
Silver
Arsenic
Beryllium
Cadmium
Chromium
Copper
Nickel
Lead
Antimony
Selenium
Thallium
Zinc

TRIANGLE LABORATORIES
PCDD/PCDF 8280 ANALYSIS (a)

FILE NAME....:	S000053	CLIENT ID....:	KEYSTONE	TLI NUMBER....:	2-50-1
CONCAL.......:	S000050	SAMPLE ID....:	09-143-001 BLANK		
ANALYST......:	XL	ANALYSIS DATE:	12/08/90	PROJECT NUMBER:	176-P
SAMPLE SIZE..:	1.00	SAMPLE MATRIX:	PUF	DATE RECEIVED.:	10/04/90
ICAL DATE....:	12/04/90	SAMPLE ORIGIN:	HOUSTON	DATE COLLECTED:	/ /
SPIKE FILE...:	SF82305H			SHIPMENT NO...:	1560

NAME	AMT(ng)	NUMBER	DL	EMPC	RATIO	RT	FLAGS
2378-TCDD	ND		0.07				___
12378-PeCDD	ND		0.1				___
123478-HxCDD	ND		0.10				___
123678-HxCDD	ND		0.08				___
123789-HxCDD	ND		0.09				___
1234678-HpCDD	ND		0.1				___
OCDD	ND		0.2				___
2378-TCDF	ND		0.04				___
12378-PeCDF	ND		0.07				___
23478-PeCDF	ND		0.07				___
123478-HxCDF	ND		0.07				___
123678-HxCDF	ND		0.05				___
234678-HxCDF	ND		0.05				___
123789-HxCDF	ND		0.07				___
1234678-HpCDF	ND		0.08				___
1234789-HpCDF	ND		0.1				___
OCDF	ND		0.1				___
TOTAL TCDD	ND		0.07				___
TOTAL PeCDD	ND		0.1				___
TOTAL HxCDD	ND		0.09				___
TOTAL HpCDD	ND		0.1				___
TOTAL TCDF	ND		0.04				___
TOTAL PeCDF	ND		0.07				___
TOTAL HxCDF	ND		0.06				___
TOTAL HpCDF	ND		0.10				___

INTERNAL STANDARDS RECOVERY SUMMARY

NAME	AMT (ng)	% REC.	RATIO	RT	FLAGS
13C12-2378-TCDF	43.9	87.8	0.79	19:26	___
13C12-2378-TCDD	42.3	84.6	0.77	20:13	___
13C12-HxCDD 678	40.1	80.2	1.30	32:15	___
13C12-HpCDF 678	63.8	63.8	1.08	36:29	___
13C12-OCDD	49.5	49.5	0.85	45:09	___

:______________ __/__/__:

8280_RPT rev:3.01

INST ID: 4000

KEYSTONE DC # ---- 8
SAMPLE NUMBER: VBLK

ORGANIC ANALYSIS DATA SHEET -

LABORATORY NAME: KEYSTONE ENV.
LAB SAMPLE ID NO.: 90---
SAMPLE MATRIX: CHARCOAL
DATA RELEASE AUTHORIZED BY: ....

CASE NO.: ---
INITIAL CALIBRATION DATE: ....
CONTRACT NO.: --
DATE SAMPLE RECEIVED: 10/05/90

VOLATILES

CONCENTRATION: LOW
DATE ANALYZED: 10/05/90

DATAFILE: EB1005V01A
DILUTION FACTOR: 1.00

	COMPOUND	DETECTION LIMIT (MICROGRAMS / TB)	AMOUNT FOUND
C010	CHLOROMETHANE	10 U	
C015	BROMOMETHANE	10 U	
C020	VINYL CHLORIDE	10 U	
C025	CHLOROETHANE	10 U	
C030	METHYLENE CHLORIDE	5 U	
C035	ACETONE	10 U	
C040	CARBON DISULFIDE	5 U	
C045	1,1-DICHLOROETHENE	5 U	
C050	1,1-DICHLOROETHANE	5 U	
C053	1,2-DICHLOROETHENE (TOTAL)	5 U	
C060	CHLOROFORM	5 U	
C065	1,2-DICHLOROETHANE	5 U	
C110	2-BUTANONE	10 U	
C115	1,1,1-TRICHLOROETHANE	5 U	
C120	CARBON TETRACHLORIDE	5 U	
C125	VINYL ACETATE	10 U	
C130	BROMODICHLOROMETHANE	5 U	
C140	1,2-DICHLOROPROPANE	5 U	
C143	CIS-1,3-DICHLOROPROPENE	5 U	
C150	TRICHLOROETHENE	5 U	
C155	DIBROMOCHLOROMETHANE	5 U	
C160	1,1,2-TRICHLOROETHANE	5 U	
C165	BENZENE	5 U	
C172	TRANS-1,3-DICHLOROPROPENE	5 U	
C175	2-CHLOROETHYLVINYLETHER	10 U	
C180	BROMOFORM	5 U	
C205	4-METHYL-2-PENTANONE	10 U	
C210	2-HEXANONE	10 U	
C220	TETRACHLOROETHENE	5 U	
C225	1,1,2,2-TETRACHLOROETHANE	5 U	
C230	TOLUENE	5 U	
C235	CHLOROBENZENE	5 U	
C240	ETHYLBENZENE	5 U	
C245	STYRENE	5 U	
C250	XYLENES (TOTAL)	5 U	

U = UNDETECTED AT THE LISTED DETECTION LIMIT
J = COMPOUND IS PRESENT, BUT BELOW THE LISTED DETECTION LIMIT

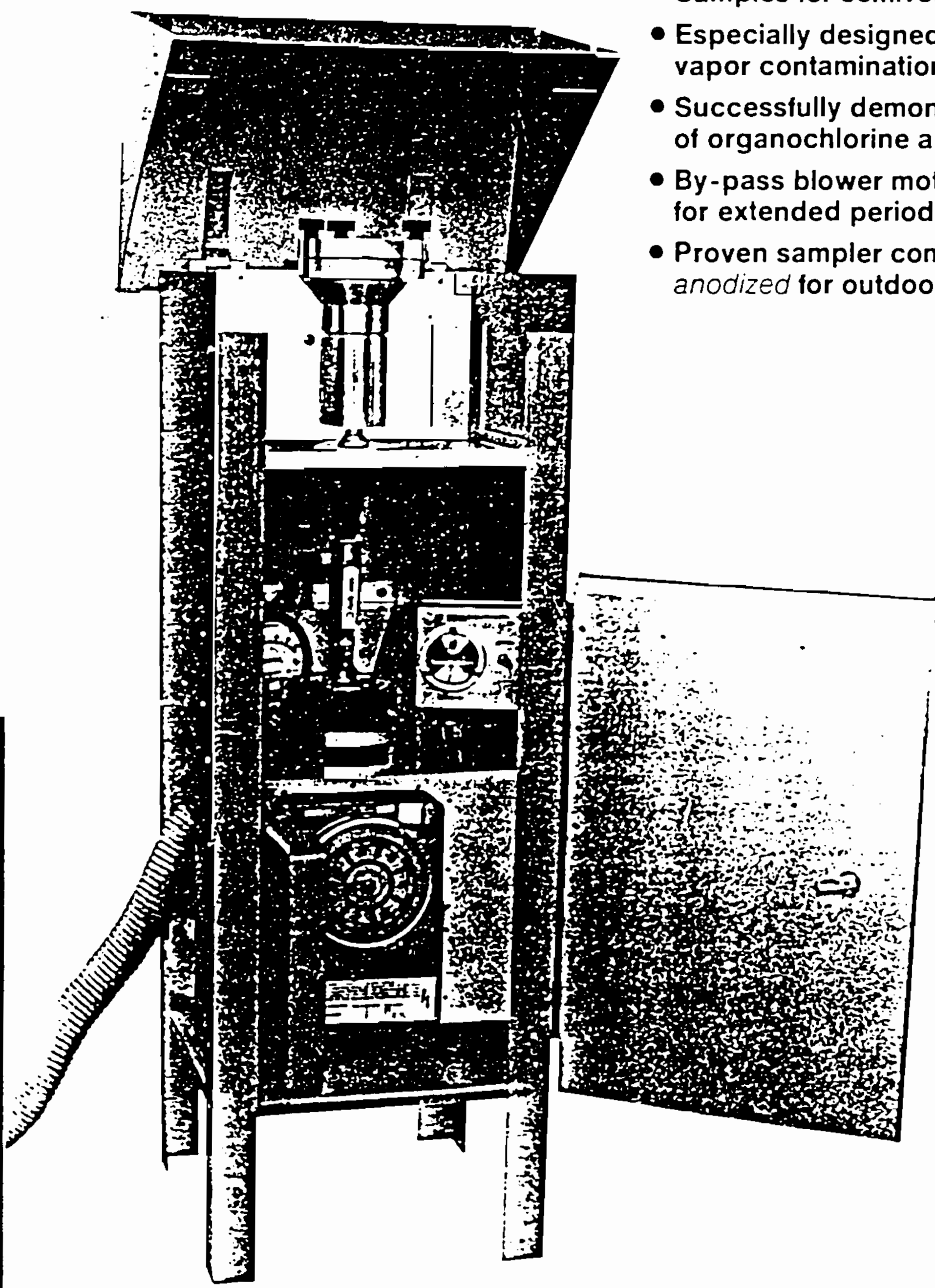
APPENDIX C

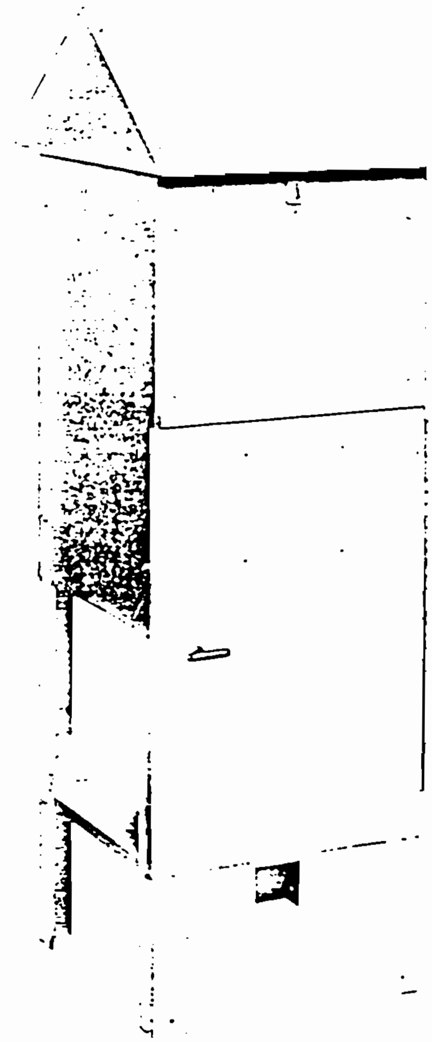
SAMPLING EQUIPMENT

MODEL PS-1 PUF SAMPLER

Pesticide Particulate and Vapor Collection System

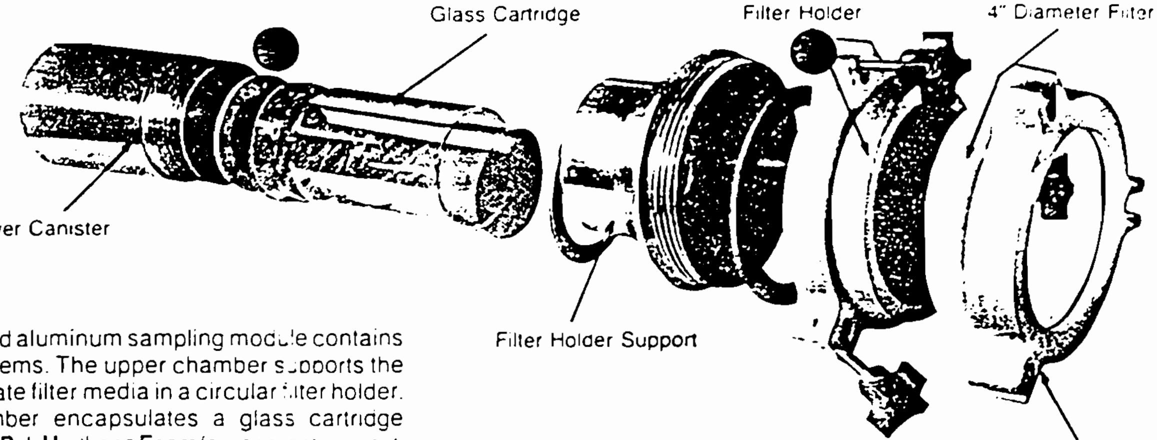
- Samples for semivolatile organic compounds.
- Especially designed for sampling airborne particulates and vapor contamination from pesticide compounds.
- Successfully demonstrated to efficiently collect a number of organochlorine and organophosphate pesticides.
- By-pass blower motor design permits continuous sampling for extended periods at rates to 280 liters per minute.
- Proven sampler components housed in aluminum shelter *anodized* for outdoor service.





The Andersen **PUF** (**P**oly**U**rethane **F**oam) Sampler is a complete air sampling system designed to simultaneously collect suspended airborne particulates as well as trap airborne pesticide vapors at flow rates up to 280 liters per minute. The Model PS-1 features the latest in technological advances for accurately measuring airborne particulates and vapors.

The Andersen **PUF** Sampler is equipped with a by-pass blower motor arranged with an independent cooling fan. This feature permits the motor to operate at low sampling flow rates for periods of long duration without motor failure from overheating.



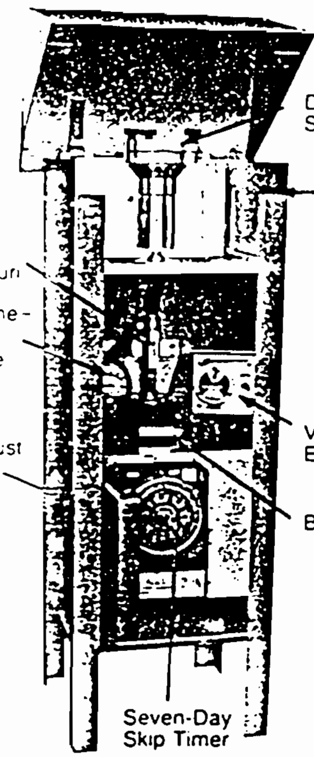
A dual chambered aluminum sampling module contains both filtering systems. The upper chamber supports the airborne particulate filter media in a circular filter holder. The lower chamber encapsulates a glass cartridge which contains the **P**oly**U**rethane **F**oam for vapor entrapment.

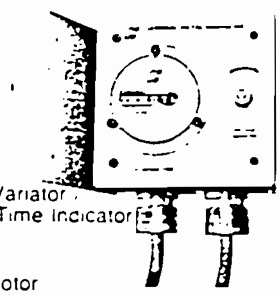
A wide variety of sorbents can be used in a manner that permits their continual use. Polyurethane foam or wet / dry granular solid media can be used individually or in combination.

The dual chambered sampling module is designed for easy access to both upper and lower media. Swing-away bolts simplify changing the 4" diameter particulate filter media. The threaded lower canister is removed with the cartridge intact for immediate exchange. Filter support screens and module components are equipped with gaskets providing a leak proof seal during the sampling process.

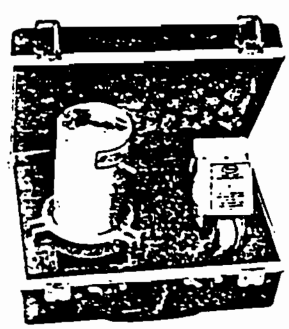
Air flow rates are infinitely variable up to 280 liters per minute. The voltage variator adjusting screw alters the blower motor speed to achieve the flow rate desired. The air flow rate is measured through the flow venturi utilizing a 0-100" Magnehelic Gage. Periodic calibration is necessary to maintain on-site sampling accuracy.

A 7-day skip timer is included as standard and permits weekly scheduling with individual settings for each day and 14 trippers to turn the sampler on and off as desired. Any day or days may be omitted. Day and night periods are distinctly marked. Other timers and timer programmers are available optionally to suit any sampling requirement.



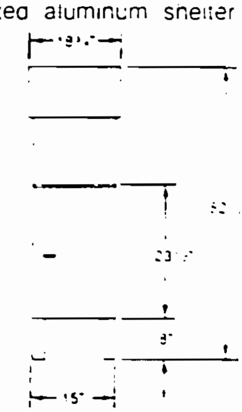


A nonresettable, elapsed time indicator verifies accumulative intermittent sampling time periods as well as total elapsed time of operation. Calibrated in tenths of a minute, the unit has a total register of 99,999.9 minutes.



Priced separately, the calibration kit includes a manometer, calibrator and calibration curve nested in a carrying case. The calibrator attaches directly to the top of the filter holder eliminating the need to disassemble the sampling unit. It affords precise calibration of the sampler and is especially recommended for calibrating the Model PS-1 **PUF** Sampler.

The Andersen Model PS-1 **PUF** Sampler is shipped completely wired and assembled, ready for operation. All components are housed within the anodized aluminum shelter for maximum protection.



SPECIFICATIONS:

Amperage-8.0

Wattage-960

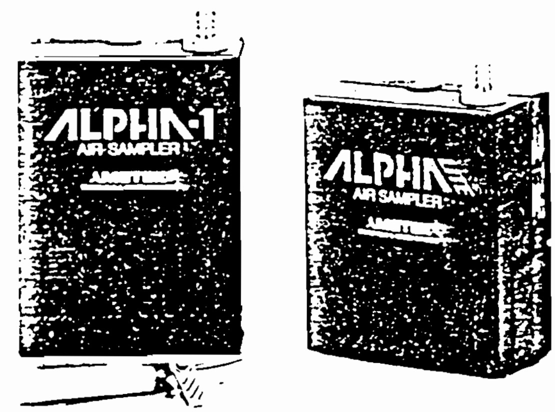
Max. Flow Rate-280 liters per minute

Power Source-115V, 1 phase, 60 Hertz (other electrical characteristics available on request)

Net Weight-65 lbs

Shipping Weight-75 lbs

Constant Flow Air Samplers



ALPHA-1 and ALPHA-LITE

DESCRIPTION

Alpha-1 and Alpha-Lite samplers are designed to be easy for operators to use. A simple needle valve calibration adjustment means that set-up time is minimized.

The large LCD readout of in-control run-time, out-of-control run-time, delay time, and TWA temperature brings you instant display of sampling information.

With the Alpha-1 and Alpha-Lite, you get easy user programmability with the push-button keypad. You can program start time, length-of-run time and out-of-control time before automatic shutoff.

For accuracy and reliability, the Alpha-1 and Alpha-Lite are the number 1 performers. True airflow sensing with the AMETEK patented flow control system assures constant flow over the entire range from 5 to 5,000 cc/min. without external devices. An easy adjustment of the flow control system provides constant flow at a guaranteed ± 5 percent.

FEATURES

- LED flow control indicator is readily visible through the lockable cover for easy check of flow status.
- Fault clock indicates run-time in the event of flow fault shutdown.
- Unique memory retention feature prevents accidental loss of data.
- For hard copy printout, the Alpha-1 and Alpha-Lite can interface with the new CPI Plus Computer/Printer interface and data logger.
- HOLD mode permits interruption of the sampling without loss of data
- Built-in charging system permits automatic recharging and even guards against overcharge with an automatic flip to trickle feature
- Built-in replaceable fluid and dust trap
- Locking, tamper-resistant cover
- One year warranty

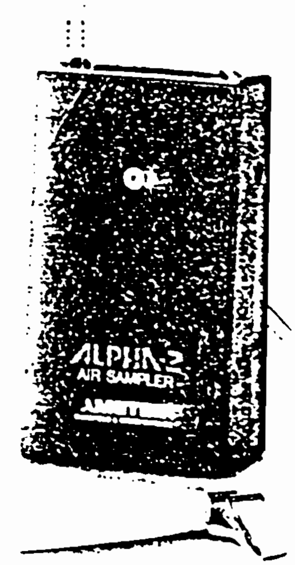
ALPHA-2 (Low-Flow)

DESCRIPTION

For true airflow sensing in a low-flow air sampling pump with a range of 5 to 200 cc/min., choose the Alpha-2. Its easy calibration means ease of use, short set-up time, and accurate results. With the AMETEK patented control system measuring actual airflow, the Alpha-2 provides constant flow within ± 5 percent over the entire range.

The Alpha-2 features a flow control indicator to provide protection of the integrity of your samples by indicating loss of flow control. The battery check light signals sufficient power for eight hours' operation.

With its record for durability, small size and light weight, the Alpha-2 offers proven performance in low-flow air sampling.



SPECIFICATIONS

Constant Flow Operating Range
5 to 5,000 cc/min.

Pressure Drop Range
55" water column maximum

Flow Control
Automatically maintained at ±5% of set point over operating range

Flow Control Indicator
If flow is restricted, an externally visible LED will blink

Battery
The Alpha-1 and Alpha-Lite may be ordered with a choice of regular or light-duty NiCd rechargeable battery packs. Depending upon the intended use, either of these may be suitable.

Sampler Controls
User programmable via a push-buttom keypad. Allows programming of:
- Start time
- Length of run time
- Tolerated restricted (low-flow) time before automatic shutoff.

Sampler Data Display
Unique LCD Readout displays:
- Total accumulated in-control (±5%) run time
- Total accumulated restricted-flow time
- Delayed-start time remaining until pump start-up
- Time-weighted average air temperature.

Sampler Case
ABS Injection-molded plastic

Dimensions
ALPHA-LITE—2¼" x 4¼" x 5" (5.7 cm x 108 cm x 12.7 cm) with the light-duty battery pack
ALPHA 1—2¼" x 4¼" x 5⅞" (5.7 cm x 10.8 cm x 14.9 cm)

Weight
ALPHA-LITE—31 ounces (879 g)
ALPHA -1—38 ounces (1065 g)

Operating Temperature
0°C to 50°C

Approvals
UL' Listed
—Class I: Groups A, B, C, D
—Class II: Groups E, F, G
—Class III
MSHA 2G Safety Approval
(These approvals also apply to ALPHA-2 Samplers)

Air Bag Sampling
Hose barb provided which attaches to the exhaust port for air bag filling

Additional Features
- Controlled 14-hour battery charge cycle with an automatic flip to trickle charge. The LCD displays the time remaining to full charge by flashing "CHRG" and then the time in hours: minutes remaining. In trickle charge, the LCD displays "TRIC." Should a bad battery cell be detected, the LCD displays "CELL."
- Automatic shutdown with memory retention on low battery
- 20-minute memory retention after sampler is turned off
- HOLD key for temporary interruption of sampling without loss of accumulated in-control run time of the sample.
- Will interface with CPI Plus Computer/Printer Interface for programming or reading. Data can be printed or transferred to a computer for storage

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SPECIFICATIONS

Constant Flow Operating Range
5 to 200 cc/min.

Pressure Drop Range
25" water column maximum

Flow Control
Automatically maintained at ±5% of set point over 0 to 25 inches w.c.

Flow Control Indicator
If flow is interrupted for 15 to 45 seconds, the LED will go out, indicating lack of control. The LED is visible through the instrument case.

Flow Rate Adjustment
Accomplished by precision needle valves.

Battery
Rechargeable NiCd battery pack capable of eight-hours' operation at maximum flow and pressure. In an emergency situation, it may be replaced by a standard 4 "AA" size battery cell holder, although this will void intrinsic safety approvals.

Battery Check Indicator
An LED lights to indicate that the battery has been charged.

Sampler Controls
"On-Off" switch; flow control adjustment; bypass valve

Sampler Case
Durable injection-molded ABS plastic case with a tamper-proof cover which will limit access to controls

Dimensions
1½" x 2¹⁵⁄₁₆" x 5¼" (3.8 cm x 7.5 cm x 13.3 cm)

Weight
16 ounces (454 g)

Operating Temperature and Humidity Range
32°F to 120°F (0°C TO 49°C)
19% to 95% Relative Humidity

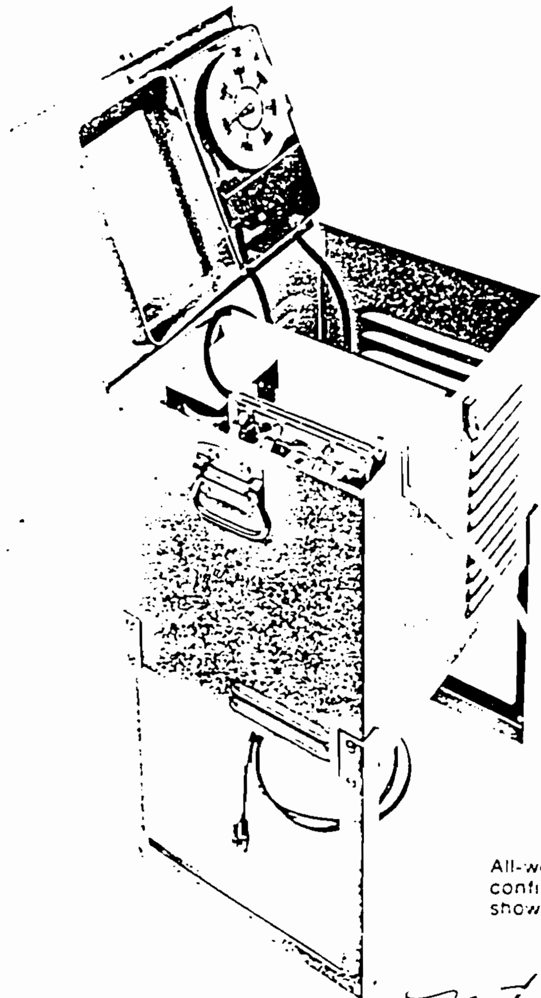
Approvals
Same as ALPHA-1 and ALPHA-LITE

Air Bag Sampling
Hose barb provided which attaches to the exhaust port for air bag filling

Reliable Accurate Control

RAC

BULLETIN 2441-1



NOTICE
SEND ALL CORRESPONDENCE AND ORDERS TO THE ATTENTION OF:
THOMAS TORTORETE

$1880 00

FIGURE 1
All-weather shelter in operating configuration (top opened to show optional timer).

versatile
3-GAS SAMPLER

designed to sample up to three different pollutant gases simultaneously, this unit features a unique thermoelectric system to assure maximum accuracy for SO_2 sampling

Note: other Price is on Back →

Features

- Meets or exceeds EPA Reference Method specifications for sampling SO_2 in ambient air
- Thermoelectric cooling-heating system maintains SO_2 reagent between 5 & 25°C for optimum sample stability at ambient temps from —25 to 50°C
- Both all-weather shelter & indoor models are portable, easy-to-operate
- All-weather unit can be equipped with timing mechanisms (optional)
- Critical orifices provide 200 ml/min flow rate (nominal) through system
- All orifices are protected by inline filters & moisture traps to prevent clogging & flow reduction
- Sampling train compartment has an adjustable heater & fan to prevent reagent freezing in non-thermo-electrically-controlled bubblers
- Bubblers & closures supplied in colors; moisture traps in natural plastic
- Modification kit is available to adapt existing **RAC 5-Gas Samplers** (outdoor models) to use thermoelectric module for SO_2 sampling

Application

The RAC 3-Gas Collecting Sampler is a wet-chemical system that will sample ambient air for any pollutant gas for which there is a suitable reagent (absorbing solution). It tests for sulfur dioxide (SO_2), nitrogen dioxide (NO_2), hydrogen sulfide (H_2S), ammonia (NH_3), aliphatic aldehydes (R-CHO), and other gases reactive to specific aqueous reagents. This system can be used virtually anywhere that line power is available to serve widely diversified gas sampling requirements.

In its basic configuration, the RAC 3-Gas system is designed to collect samples of SO_2, NO_2, and a third (optional) gas simultaneously. Modular components permit easy changes in sampling train configuration — except for the SO_2 arrangement (Station I) — to meet varying sampling needs.

Maximum SO_2 Sampling Accuracy

Tests performed by the Environmental Protection Agency (EPA) in 1975 revealed that the accuracy of established wet-chemical SO_2 sampling procedures is adversely affected by high ambient temperatures. At 50°C (122°F), for example, about 75% of the SO_2 in a collected or stored sample will be lost because of thermal instability within a 24-hour period. Sample degradation begins in the 20°C (68°F) range, with an initial loss factor of approximately 0.9% in 24 hours, and progresses at an increasing rate as the ambient temperature rises. The rate of decay increases five-fold for every 10°C increase in temperature over the range of 20 to 40°C (68 to 104°F).

The RAC 3-Gas design eliminates this problem in SO_2 sampling. It features a rugged solid-state thermoelectric (Peltier Effect) cooling-heating system (Patent Pending) that maintains the temperature of the SO_2 bubbler and reagent between 5 and 25°C (41 and 77°F) in an ambient temperature range from —25 to 50°C (—13 to 122°F). As a result, all the SO_2 collected during a sampling cycle is preserved for optimum accuracy of sample evaluation by standardized wet chemistry and spectrophotometric procedures.

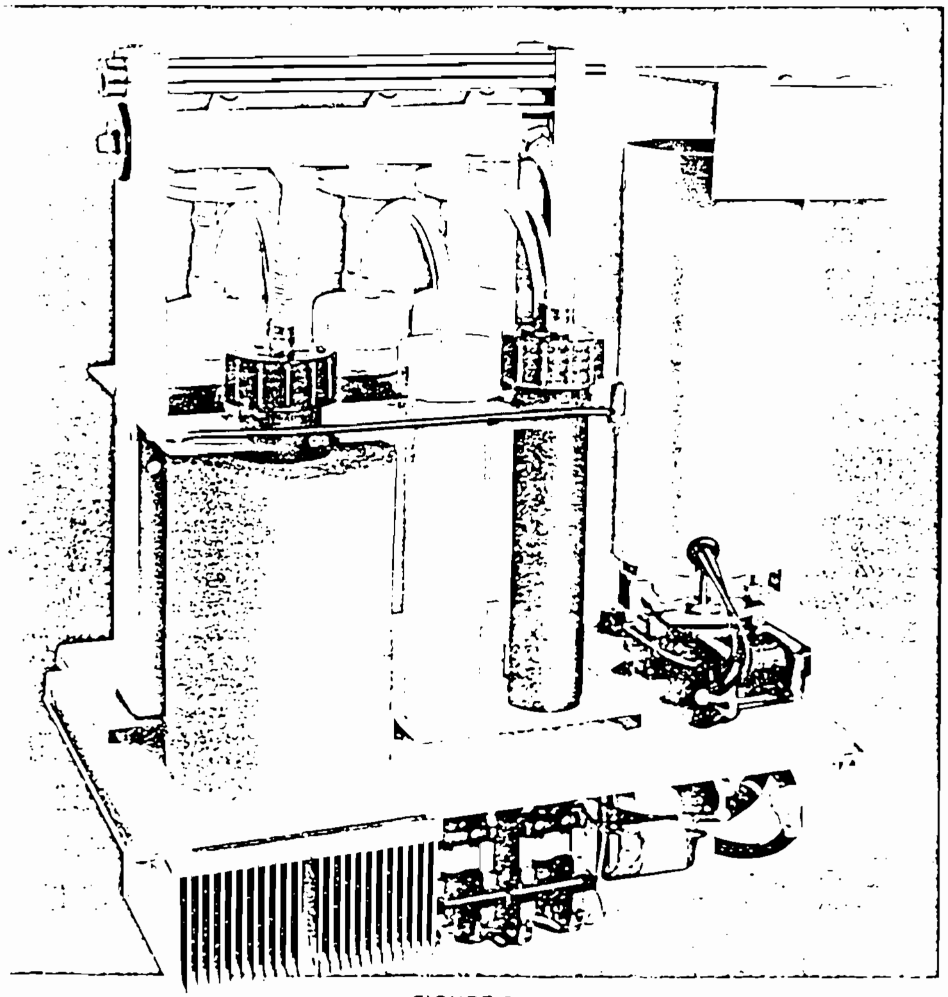


FIGURE 2

Sampling and temperature-regulating modules in operating position. Temperature of SO_2 bubbler (in insulating jacket) is controlled solely by a thermoelectric cooling-heating system. Heater and circulating fan assembly, at right, maintains temperature in insulated compartment above 16°C to prevent freezing of reagents in other bubblers during cold-weather sampling, but does not affect SO_2 bubbler.

Design

The RAC 3-Gas sampling system is supplied in a portable all-weather shelter model for outdoor use and in a smaller, lighter weight, steel case enclosed indoor model. Both are furnished complete and ready-to-operate. In addition, a modification kit is offered to adapt existing RAC 5-Gas Samplers (shelter models only) to use the new thermoelectric cooling-heating system for SO_2 sampling.

All-Weather Shelter Model

This self-contained design includes a heavy-gage steel cabinet with a hinged, lockable top member, two separate compartments, and a weather-resistant baked enamel finish. The preassembled complete sampling train, the thermoelectric system, and a thermostatically-controlled heater assembly are installed in an insulated compartment; the system's vacuum pump, vacuum gage, and electrical junction box are installed in the second compartment, which has louvers on three sides for heat dissipation. A 3-wire power cord is supplied as standard.

SAMPLING TRAIN—The RAC gas sampling train assembly includes a polypropylene inlet tube with a conical rainshield and an aluminum rack containing a 3-branch glass inlet manifold, 3 polypropylene 100 ml bubblers with interchangeable closures*, 3 polypropylene moisture-entrainment traps, 3 critical/limiting orifices, a 3-branch exhaust manifold, and all necessary connecting tubing. The sampling rack is positioned on a base module that supports the thermoelectric device for the SO_2 bubbler and the nonrelated compartment heater and blower assembly. The complete sampling module is easily removed for filling, cleaning, or change in configuration (except for the

*Threaded closures for the polypropylene bubbler tubes are a 2-hole inlet-outlet unit used for sampling operations and a solid leak-tight cap used to transport bubblers containing reagents. The 100 ml bubblers and both types of closures are supplied in red, yellow, and blue colors, one complete set in each color. Their related moisture trap units are furnished only in natural plastic.

SO_2 arrangement). The base module also is easy to remove for periodic inspection or servicing.

The bubblers in **Station I** (SO_2 sampling) and **Station III** (third gas sampling) contain orifice-type 0.4 ± 0.1 mm glass bubbler tubes. The unit in **Station II** (NO_2 sampling) has a fritted glass dispersing element (70 to 100μ).

TEMPERATURE CONTROL—The SO_2 bubbler is encased in an insulating jacket and its temperature is controlled between 5 and 25°C solely by the thermoelectric cooling-heating system. To prevent reagents in the other two bubblers from freezing during cold weather, a constant (variable) temperature above 16°C (60.8°F) is maintained in the insulated compartment by the integral heater, which does not affect the temperature of the specially insulated SO_2 bubbler.

Recently developed thermoelectric system uses a finned heat sink and blower combination for efficient heat transfer, and is protected by a thermal cutout on the heat sink as well as two fuses in the electrical circuit.

FLOW-REGULATING ORIFICES — The critical/limiting orifices are precision-bore glass tubing encased in Tygon plastic tubing. The orifices provide a 200 ml/min flow rate (approx.) to all bubblers, and are easily cleaned in small ultrasonic baths.

DETACHABLE LEGS — The all-weather shelter model has sturdy angle-iron legs that can be attached flush with the cabinet for carrying/transporting. The legs are securely attached in either the extended or retracted position by rust-resistant bolts threaded into captive nuts.

TIMING MECHANISMS — To meet a variety of sampling requirements, three different types of timing mechanisms can be supplied with the RAC 3-Gas all-weather shelter model: a 24-hour timer, a 7-day skip timer, or a 1-out-of-6 days timer. All timers are optional accessories. An elapsed time meter is also available to determine the duration of the sampling period.

Indoor Model

This unit is comprised of an insulated, louvered, steel carrying case, an external vacuum pump with gage, and a 3-wire power cord. It uses the same pump, complete sampling train, and base module as the shelter model, and provides the same versatile sampling capabilities for indoor applications. If desired, the indoor configuration can be used to sample outdoor air by passing the inlet tube and rainshield through any convenient structural opening or by connecting them to an air inlet duct. The sampling case and pump should be shielded from inclement weather conditions at all times.

Modification Kit

All-weather shelter models of the **RAC 5-Gas Collecting Sampler** can be adapted to use the thermoelectric cooling-heating system for SO_2 by means of a packaged modification kit. The kit includes a steel cabinet of modified design, a new bubbler rack and manifolds, the new solid-state thermo-electric system, and the adjustable compartment heater assembly. Since all other components of a 5-Gas Sampler can be interchanged without alteration, the kit does ***not*** include vacuum pump, bubblers, moisture traps, orifices, inlet tube and rainshield, connecting lines, or power cord. If any of these standard components are required, they can be ordered as replacement parts. The Modification Kit is CAT. #209066/115V, 209066-1/220V.

Operation

NOTE: When sampling for SO_2, a membrane-type particulate filter should NOT be used between the air inlet tube and manifold because it may absorb a major portion of the SO_2 in the sample stream.

In operation, the vacuum pump draws ambient air in through the conical rainshield and inlet tube. (Rainshield is inverted to prevent precipitation from entering the sampling train.) The inlet manifold divides the air stream into equal volumes that flow through Teflon tubing to the bubblers. Each bubbler has a 2-hole cap with a standard glass bubbler tube, either constricted or fritted, on the inlet port (see details under SAMPLING TRAIN). The sample air passes through these tubes into 50 ml of reagent contained in each bubbler.

After bubbling through the reagent, the air exhausts through Tygon tubing connected to the outlet port in the cap. Each sample stream then passes through another polypropylene bubbler containing silica gel followed by a membrane filter. This dual-trap arrangement protects the critical orifices from moisture or other entrainments, and helps to maintain continuous full-flow operation for optimum sampling efficiency. The scrubbed air streams then flow through the critical orifices to the exhaust manifold and are discharged through the pump. ***NOTE:** The membrane filters and the moisture traps should be replaced/charged periodically in accordance with the procedures being used.*

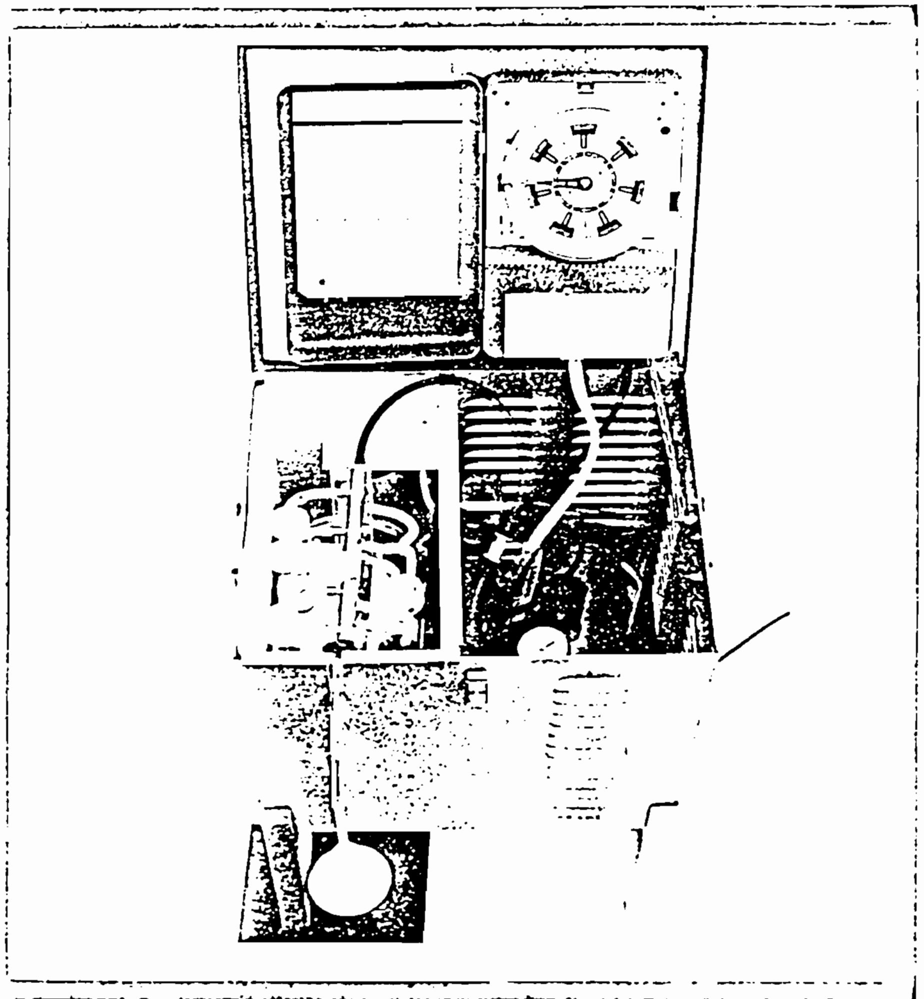


FIGURE 3

Arrangement of 3-Gas system components in all-weather shelter. A 24-hour or 1-out-of-6 days timer mechanism can be used in place of the 7-day timer shown. Timers and elapsed time meters are optional.

In this instrument, contaminate gas samples contact only polypropylene, Teflon, or glass before entering the absorbing reagents. This design concept provides for optimum sample collection. All materials in contact with the sample stream are widely recognized for their noncontaminating characteristics when used in probes for a broad range of air pollutants.

After a sampling cycle is completed, the sampling train assembly is removed from the shelter (or carrying case). The reagent tubes are removed from the rack, and the 2-hole closures are replaced with solid, leak-tight, threaded caps. These then are taken to a laboratory for analysis of contents according to appropriate procedures. Tubes containing thermally unstable gas samples, such as SO_2, should be transported in refrigerated containers.

Specifications

Vacuum Pump
1/6 hp, 1.8 cfm free flow, 29" Hg vac. continuous duty, overload protection

Electrical
SHELTER MODEL:
Std: 115 volts, 60 Hz, 3.7 amp
Opt: 220 volts, 50/60 Hz, 1.9 amp
INDOOR MODEL:
Std: 115 volts, 60 Hz, 1.9 amp
Opt: 220 volts, 50/60 Hz, 1.0 amp

Dimensions
SHELTER MODEL:
69.9 cm (27½") H x 45.7 cm (18") W x 35.7 cm (14⅛") D w/legs extended; 39.2 cm (15⅜") H w/legs raised.
INDOOR MODEL:
39.2 cm (15⅜") H x 33.7 cm (13¼") W x 21 cm (8¼") D

Weights
SHELTER MODEL:
15 kg (33 lb) including pump (without timer installed)
INDOOR MODEL:
10.9 kg (24 lb) without pump

VACUUM PUMP:	2.7 kg (6 lb)
24-HOUR TIMER:	1.4 kg (3 lb)
7-DAY TIMER:	2.7 kg (6 lb)

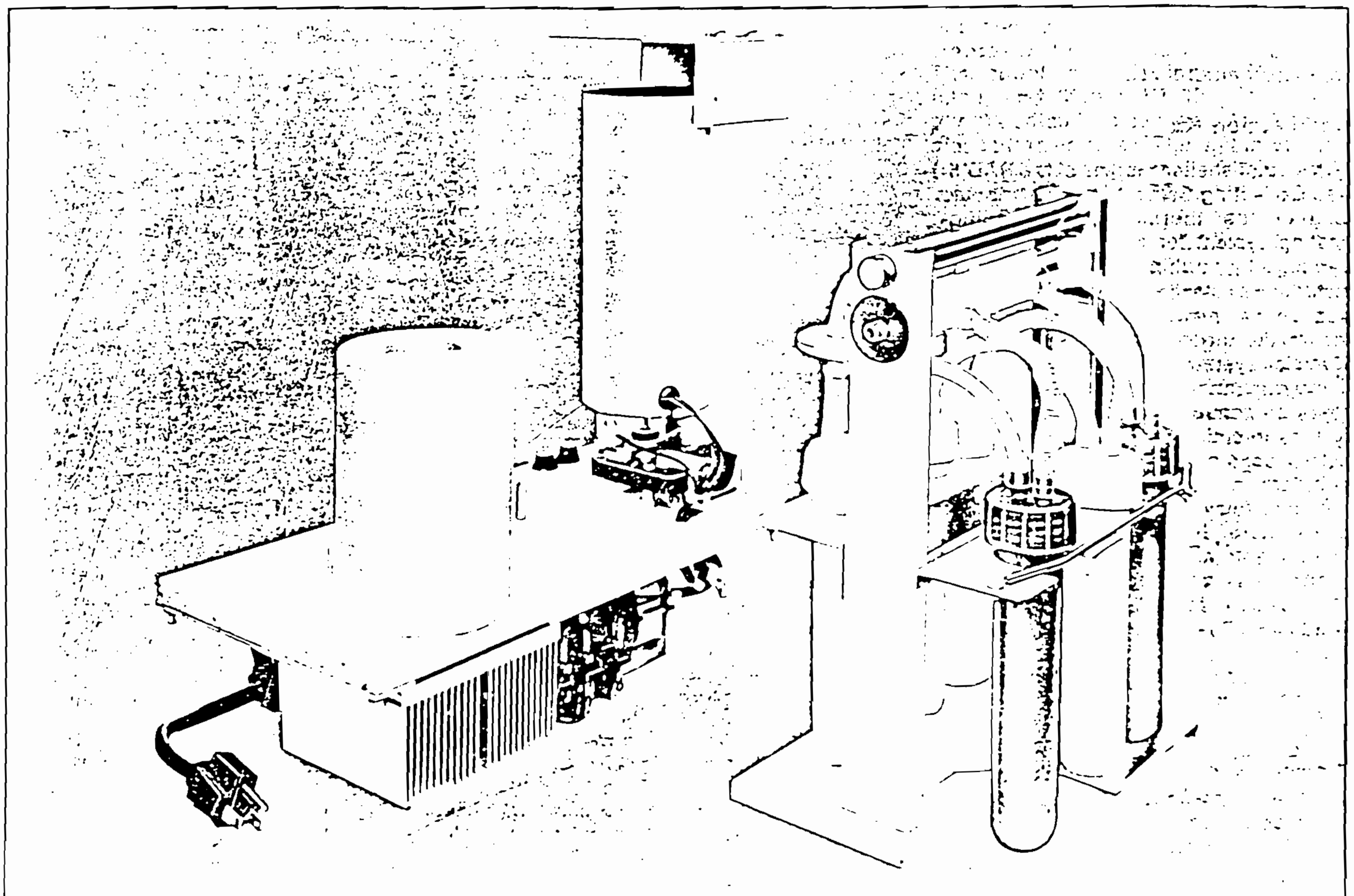


FIGURE 4
Sampling train assembly is easily disconnected and removed from shelter (or carrying case) for filling and cleaning. Base module also is removable for periodic inspection or servicing.

#209092
$750.00 Ea

$320.00

[illegible]

Both the all-weather shelter and indoor models of the RAC 3-Gas Collecting Sampler are shipped complete and ready-to-operate. The specific models include the components listed in the **Design** section of this bulletin. In addition, a pack of critical/limiting orifices (3) and a pack of membrane filters and backup discs (3 each) are supplied with each instrument.

Specify the model, voltage, and power line frequency desired—plus any optional timer mechanism — by full name and catalog number. Unit prices and catalog numbers for the individual system components are furnished on separate sheets.

(only one Type)
A Replacement Pump
If needed is.
#991578
$575.00

3-Gas Sampler, All-Weather Shelter Model, Complete:

With GLASS Orifice:	209068 115v.	
	209097 220v	
For NEEDLE Orifice:	209069 115v.	
	209093 220v	

3-Gas Sampler, Indoor Model, Complete:

With GLASS Orifice:	209071 115v
	209071-1 220v
For NEEDLE Orifice:	209072 115v.
	209072-1 220v

24 Hr. Timer:	992424 115v.
	209047 220v
7 Day Timer:	992425 115v.
	992408 220v

[illegible]

Research Appliance Company Division manufactures and supplies a wide range of precision instruments and systems designed for sampling, monitoring environmental air pollution. Write for descriptive literature, indicating the types of products on which information is desired.

Bubblers #994013
3.50 Ea

Trap #994064
2.50 Ea

NOTICE
SEND ALL CORRESPONDENCE AND ORDERS TO THE ATTENTION OF:
THOMAS TORTORETE

RESEARCH APPLIANCE COMPANY DIVISION
ANDERSEN SAMPLERS, INC.
4215 WENDELL DR., ATLANTA, GA 30336
TOLL FREE 800-241-6898 • 404-691-1910

VOLUMETRIC FLOW CONTROLLED

PM 10 High Volume Sampling Systems

MODEL GUV-15H VOLUMETRIC FLOW CONTROLLED PM10 SYSTEM

GMW's GUV-15H PM10 Size Selective High Volume Samplers are ideal total systems for accurate sampling of PM10 particles. The system consists of the G1200 Size Selective Inlet mounted on the basic hi-vol sampler and includes the G360 Volumetric Flow Controller, G302 Digital Timer, G105 Pressure Transducer Flow Recorder with pen point and 100 charts, and the G3000 Filter Cartridge.

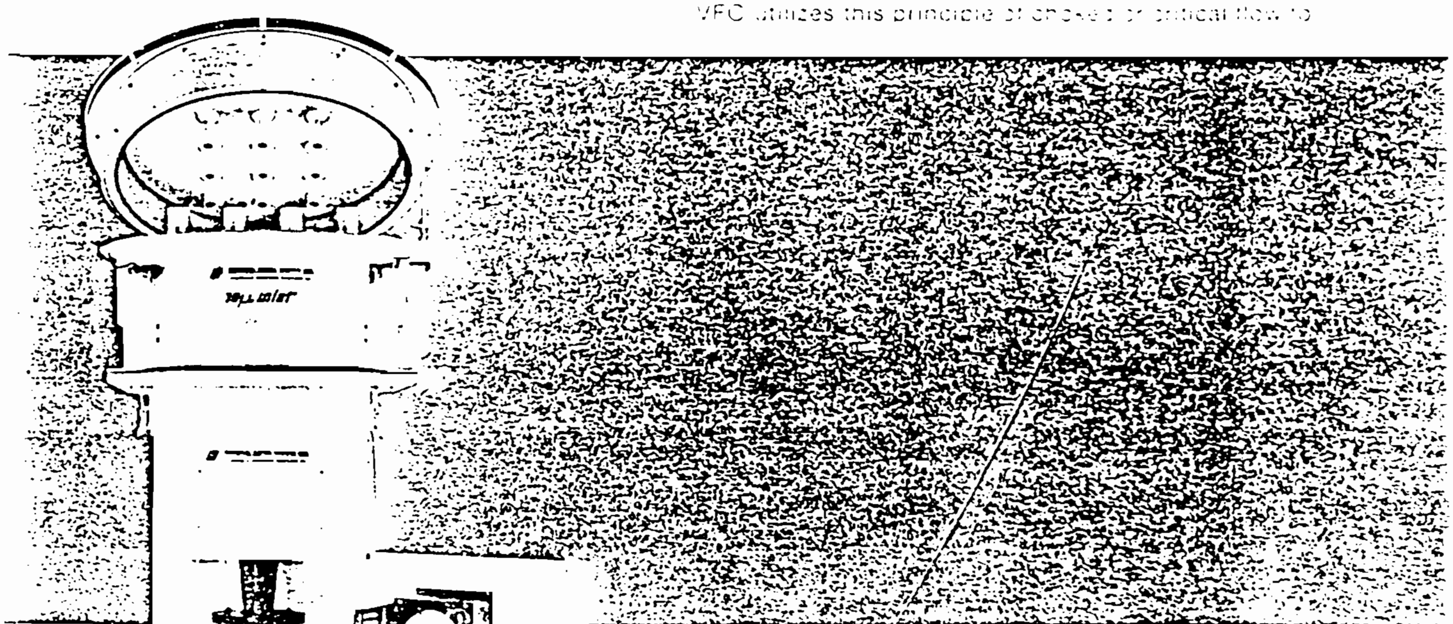
MODEL GUV-16H VOLUMETRIC FLOW CONTROLLED PM10 SYSTEM

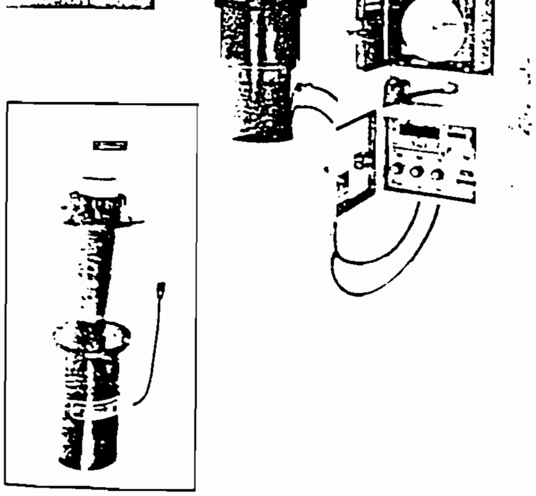
The Model GUV-16H replaces the G302 Digital Timer with the G70ET Seven-Day Mechanical Timer Elapsed Time Indicator.

MODEL G360 VOLUMETRIC FLOW CONTROLLER

The Volumetric Flow Controller (VFC) is a dimensional venturi device used to control gas flow. When applied to a high volume air sampler, this flow control principle incorporates a smooth-wall venturi orifice that gradually opens to a recovery section. Vacuum is provided by a motor downstream of the venturi. Over 95% of the energy lost in differential pressures across the restricting orifice is recovered in this design.

Flow control is accomplished by [illegible] or restricting, and thus accelerating the air flow through the venturi. At some point in the flow stream the air velocity will equal the acoustic velocity (or speed of sound) and critical flow will be achieved [illegible] downstream changes are small [illegible] the venturi including the flow rate [illegible] determined by upstream conditions. This condition is [illegible] and is a distinctive characteristic of [illegible] VFCs. The GMW VFC utilizes this principle of choked or critical flow to





maintain a constant actual flow rate of 40 cfm (1.13 m³/min) over a sample period. Since critical flow through the venturi is not greatly affected by changes in filter loading, ambient temperature or barometric pressure, a stable volumetric flow rate is maintained as long as power is provided to the sampler.

The orifice used in this system can also be described as a well documented Critical Venturi Meter (CVM). Basically, a CVM is a specially machined nozzle or restriction device designed to react to a specific pressure ratio expressed in absolute terms. When air reaches the speed of sound in the throat (smallest diameter) of the CVM, a sound-pressure barrier is set up that won't allow more air through under the existing temperature and pressure conditions. This is the "critical flow" point of the meter, thus the name Critical Venturi Meter. Simply put, the GMW Volumetric Flow Controller regulates flow at a constant but unadjustable rate without any moving parts or electronic components.

PM10 SIZE-SELECTIVE
Sampling Inlets

The Model G1200 High Volume PM10 SSI samples suspended particles in the air at 40 ACFM (1.13 ACMM) through the circumferential inlet. The symmetrical design insures wind-direction insensitivity, and the inlet design and internal configuration makes the collection efficiency independent of wind speed from 0 to 36 kilometers per hour. The particles are then accelerated through nine circular acceleration nozzles. By virtue of their larger momentum, particles greater than 10 micron aerodynamic diameter impact onto a greased impaction shim. The PM10 particles smaller than 10 microns are carried vertically upward by the air flow and down sixteen vent tubes to the 8 x 10-inch quartz-fiber filter, where they are collected. The large particles settle out in the impaction chamber on the collection shim and are removed/cleaned during prescribed maintenance periods.

MODEL G1200

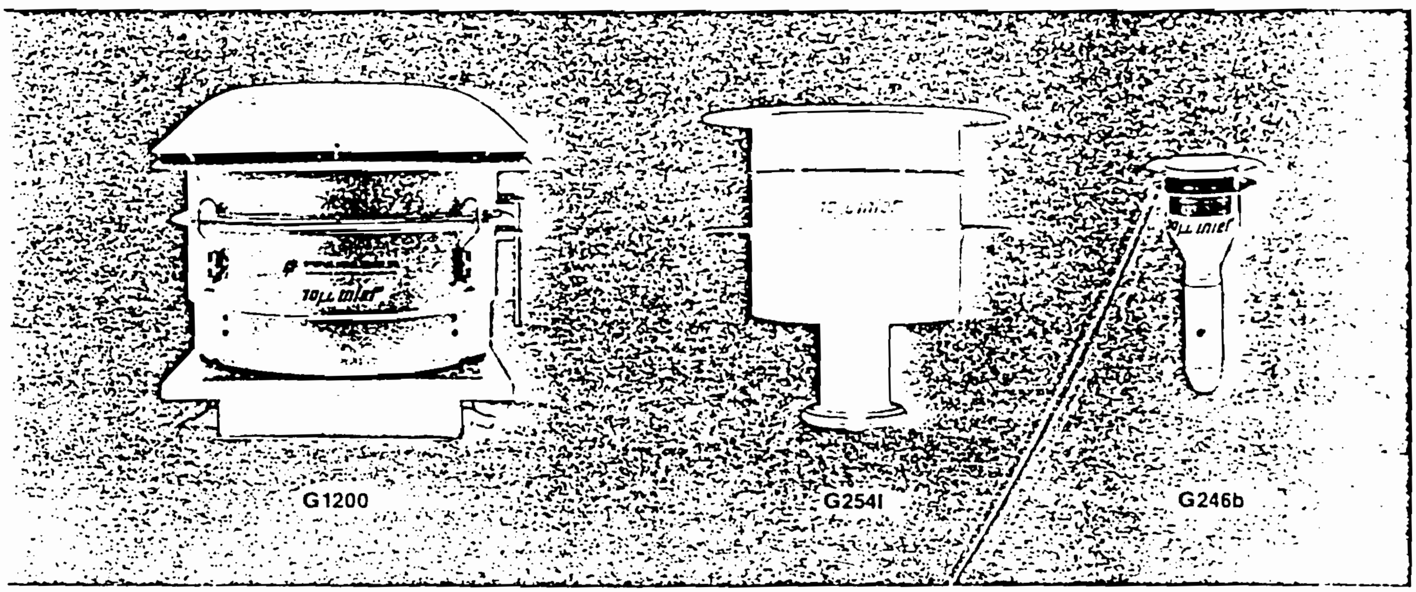
For high volume sampling systems that operate at a set flow rate of 40 ACFM (1.13 ACMM). This Inlet is adaptable to all GMW hi-vol systems.

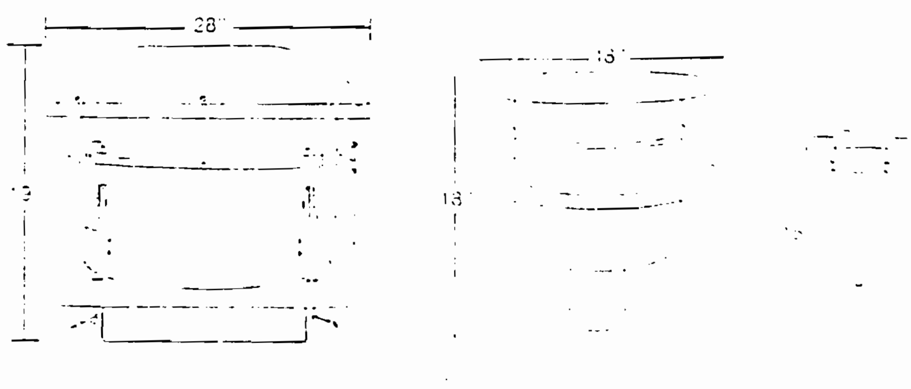
MODEL G254I

For intermediate flow rate sampling systems — the inlet operates at a flow rate of 4 ACFM.

MODEL G246b

For adaptation to dichotomous sampling systems, the inlet operates at a flow rate of 16.7 ALPM (1 ACMH).





Model G1200 EPA Federal Reference Method Designation Number RFPS-1287-063

Net Weight – 50 lbs   Net Weight – 19 lbs   Net Weight – 7 lbs

Series 100
Wind Sensors

Description

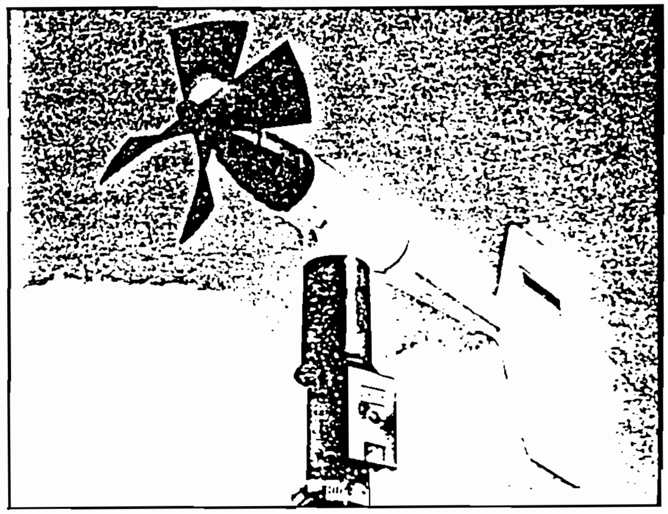
The **Series 100 Professional Wind Sensors** provide reliable information about wind speed and wind direction even in harsh environments. Originally developed for ocean data buoy use, the Series 100 sensors are well suited for a wide variety of wind measuring applications. Simplicity and lightweight corrosion resistant construction were principal design considerations. Slip rings and brushes have been eliminated resulting in improved reliability with lower cost. Extensive use of modern thermoplastic materials improves resistance to corrosion from sea-air environments and from atmospheric pollutants.

The instrument mounts on standard 1 inch pipe -outside diameter 34 mm (1.34 in.). An orientation ring is supplied for maintaining wind direction orientation when the instrument is removed for maintenance.

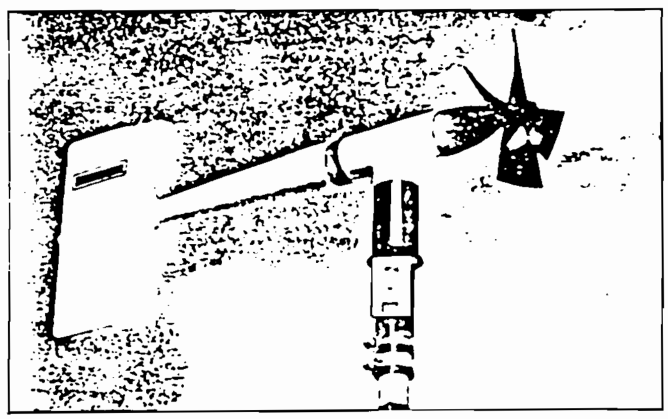
All transducer leads terminate in a junction box on the mounting post for convenience in making sensor cable connections. Four conductor cable is required.

The Model 220-100 General Purpose Wind Sensor can be used with indicators, recorders, data loggers, or personal computers to fulfill a wide range of wind measuring or complete weather station requirements. It's sensitivity satisfies general purpose requirements for wind monitoring.

* The **Model 220-101 Air Quality Wind Sensor,** like the model described above, satisfies the general purpose wind monitoring requirements and has added sensitivity for tracking lower wind movement. This sensor meets most U.S. Government Agency guidelines for wind monitoring, such as:



220-100 Wind Sensor



220-101 Air Quality Wind Sensor

1. U.S. Environmental Protection Agency EPA-450/4-80-012 Ambient Monitoring Guidelines for Prevention of Significant Deterioration (PSD) EPA-600/9-81-020 On-Site Meteorological Instrumentation Requirements to Characterize Diffusion from Point Sources
2. U.S. Nuclear Regulatory Commission NRC Regulatory Guide 1.23 Meteorological Programs in Support of Nuclear Power Plants

DATALYNX
P.O. Box 240 • Grass Valley, CA 95945 • (916) 477-5226 FAX (916) 477-8339

Series 200 Wind Sensors

Specifications:

Model 220-200

Range:

Wind speed: 0-50 m/s (112 mph)
Gust survival: 60 m/s (134 mph)
Azimuth: 360 degrees mechanical, 355 degrees electrical (5 degrees open)

Threshold:*

Cup anemometer: 1.1 m/s (2.5 mph)
Windvane: 1.3 m/s (2.9 mph) at 10 degree displacement, 1.9 m/s (4.2 mph) at 5 degree displacement

Dynamic Response:*

Cup wheel distance constant (63% recovery): 2.3 m (7.5 ft.)
Vane delay distance (50% recovery): 0.5 m (1.6 ft.)
Damping ratio: 0.2

Signal Output

Wind speed: magnetically induced AC voltage/1 pulse per revolution. 1800 rpm (30 Hz) = 22.8 m/s (51.0 mph)
Azimuth: analog DC voltage from conductive plastic potentiometer - resistance 10k, linearity 0.5%, life expectancy 20 million revolutions

Power Required:

Potentiometer excitation 2 to 15 VDC regulated
Sensor interface circuit 5 to 15 VDC unregulated
Line driver circuit 12 to 30 VDC unregulated (depending upon line and load resistance)

Dimensions

Overall height: 32 cm (12.6 in.)
Crossarm length: 28 cm (11.0 in.) between instrument centers
Vane length: 22 cm (8.7 in.)
Cupwheel: 12 cm (4.7 in.) diameter
Mounting: 34 mm (1.34 in.) diameter (standard 1 inch pipe) mounting brackets fit ¾" pipe thread

Weight:

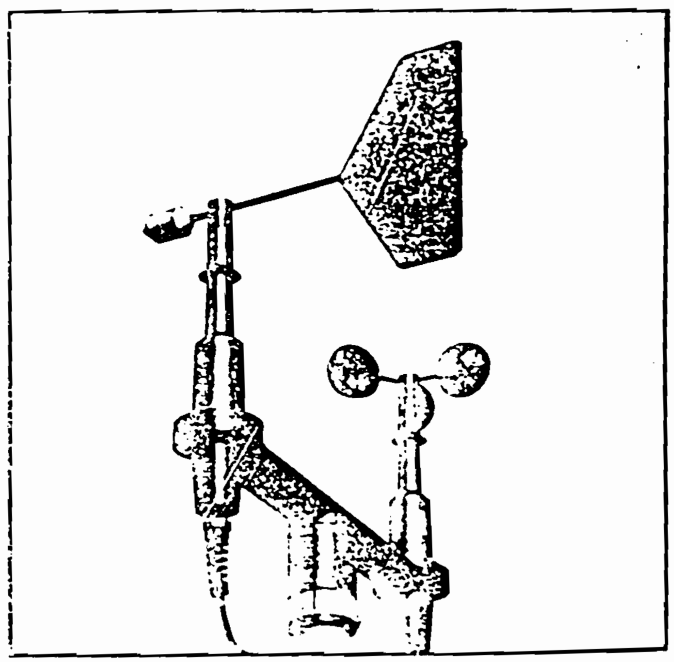
Sensor weight: Anemometer 0.2 kg (0.5 lbs.)
Vane 0.4 kg (1 lb.)
Anemometer and Vane 0.7 kg (1.6 lbs.)
Shipping weight: 1.3 kg (3 lbs.) approx.

*Nominal values - determined in accordance with ASTM standard procedures.

Description

The **Series 200 Wind Sensors** are moderately priced quality sensors designed for general purpose wind measurements. Thermoplastic construction provides excellent corrosion resistance and low sensor weight. These sensors are easy to maintain and inexpensive to repair or replace. Series 200 sensors are available as a complete set to measure both wind velocity and wind direction, or separately with mounting brackets instead of a crossarm.

The three-cup anemometer produces an AC sine wave voltage proportional to wind speed. Wind direction is measured by a balanced vane coupled to a 10k ohm conductive plastic potentiometer. With a constant excitation voltage applied to the potentiometer, output is proportional to wind direction. Series 200 sensors are provided with 10 feet of cable.



Model 220-200

Ordering Information

Model 220-200	Series 200 Wind Sensor Set with 10' cable
Model 220-220	Series 200 Anemometer with 10' cable
Model 220-230	Series 200 Wind Vane with 10' cable
Model 220-211	Wind speed translator (specify outputs), mast mount
Model 220-212	Wind speed direction translator (specify outputs), mast mount
Model 220-991	Sensor cable, per foot
Model 220-992	Line driver amplifier