EDGEWOOD
CHEMICAL BIOLOGICAL CENTER
U.S. ARMY RESEARCH, DEVELOPMENT AND ENGINEERING COMMAND

ECBC-TR-423

PROTECTION FACTOR TESTING OF THE ALLEGRO INDUSTRIES CONTINUOUS FLOW, DISPOSABLE AIR HOOD RESPIRATOR

Adam D. Seiple

ENGINEERING DIRECTORATE

December 2004

ABERDEEN PROVING GROUND, MD 21010-5424

Disclaimer

The findings in this report are not to be construed as an official Department of the Army position unless so designated by other authorizing documents.

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14. ABSTRACT
This test evaluated the performance of the Allegro supplied air disposable hood. Human subjects wore the hood into a corn oil aerosol environment where they performed exercises for simulated work. The ratio of the concentration inside the hood to outside the hood is the protection factor. The hood achieved 100% passing at a protection factor of 80,000.

15. SUBJECT TERMS

Corn oil	PF	Supplied air respirators
Protection factor	Aerosol testing	Simulant

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
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U	U	U	UL	31	19b. TELEPHONE NUMBER *(include area code)* (410) 436-2914

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EXECUTIVE SUMMARY

The work described in this report was authorized under a Test Servicing Agreement between the U.S. Army Research, Development and Engineering Command (RDECOM) and Allegro Industries. The test was to evaluate the ability of the Allegro Industries Continuous Flow Disposable Air Hood Respirator to protect the wearer from aerosolized chemical or airborne biological agents. There were two different configurations tested:

1. Tyvek Hood P/N 9911-29
2. Saran-coated Tyvek Hood P/N 9911-29S

The Protection Factor (PF) test used 15 human test subjects and had them don the equipment, enter a chamber filled with a corn oil aerosol, and perform 12 2-min exercises to stress the seal and capabilities of the equipment. The subjects all wore equipment as designated by the manufacturer. An air sample was pulled from the oral/nasal region of the hood throughout the test. The results of the test are given in PF, which is the concentration of the challenge aerosol outside the hood to the concentration of the challenge aerosol inside the hood.

All configurations had a fifth percentile of a PF > 100,000, which is the highest possible in this type of testing. All configurations also achieved 100% passing at a PF of 80,000.

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PREFACE

The work described in this report was authorized under a Task No. 0445T of Test Servicing Agreement between the U.S. Army Research, Development and Engineering Command (RDECOM) and Allegro Industries. This work was started and completed in August 2004.

The use of either trade or manufacturers' names in this report does not constitute an official endorsement of any commercial products. This report may not be cited for purposes of advertisement.

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CONTENTS

FIGURES

TABLES

PROTECTION FACTOR TESTING OF THE ALLEGRO INDUSTRIES CONTINUOUS FLOW, DISPOSABLE AIR HOOD RESPIRATOR

1. INTRODUCTION

A Testing Service Agreement (TSA) between Allegro Industries (7221 Orangewood Ave Garden Grove, CA) and the U.S. Army Edgewood Chemical Biological Center (ECBC) was set up for the Protection Factor (PF) Test Facility to provide testing services for products from Allegro. A PF test was conducted on the Allegro 9911-29 and 9911-29S supplied air hoods (SAH) to determine their ability to protect the wearer from aerosolized chemical or airborne biological agents. This test has human subjects wear the equipment into a chamber containing aerosolized corn oil. The subjects perform exercises to stress the seals of the equipment while in the chamber. The ratio of the concentration outside of the equipment to what gets inside of the equipment is known as the PF.

2. OBJECTIVE AND DESCRIPTION

The Allegro SAH is a loose fitting hood which uses a tethered line with Grade D quality supplied air. The supplied air inflates the hood creating a positive pressure in the breathing zone. The air is supplied to each of the respirators through 25 of Allegro Industries supplied air hose P/N 9101-25. The air lines are then connected to Allegro Industries "Heater/Cooler," P/N 9990, flow controller, which is worn by the test subject and connected to the respirator. These units combined are NIOSH approved Supplied Air Respirator systems under TC-19C-357.

The objective of this test was to determine the ability of the Allegro SAH system to protect the wearer from aerosolized particles. This test is designed to simulate aerosolized chemical and airborne biological agents. Although this hood system is not designed to protect the wearer from chemical or biological agents, it will give an accurate representation of how the hood system protects the wearer from airborne particles. The ability to do this was quantified as a PF. Table 1 describes the two concepts, which were tested.

Table 1. Concept Description

CONCEPT	RESPIRATOR P/N	DESCRIPTION
1	9911-29	FULLY DISPOSABLE, DOUBLE BIB, TYVEK® SAR HOOD ASSEMBLY
2	9911-29S	FULLY DISPOSABLE, DOUBLE BIB, SARAN COATED TYVEK® SAR HOOD ASSEMBLY

3. PROTECTION FACTOR TESTING

3.1 Test Facility.

Testing was conducted in Building E5604, Aberdeen Proving Grounds (Edgewood Area), MD 21010. A challenge aerosol concentration of 20 - 40 mg/m³, polydispersed corn oil aerosol, having a mass median aerodynamic diameter (MMAD) of 0.4 to 0.6 μm (the Army Standard), was generated in a 10-ft × 20-ft × 32-ft test chamber. The aerosol concentration was monitored and ensured to be in the 20 - 40 mg/m³ range by using a TSI DustTrak (TSI Incorporated, Shoreview, MN). The calibration data for the DustTrak is available in Appendix A. A TSI Scanning Mobility Particle Sizer (SMPS) is used to confirm the particle size is within the specified range. The calibration data and results of the SMPS are available in Appendix B. The test chamber challenge aerosol was generated by atomizing liquid corn oil at room temperature using a Laskin nozzle. The Laskin nozzle produced a coarse aerosol cloud, which was directed into an impaction plate to remove the larger particles and yield an aerosol in the desired size range. The concentrated aerosol from the generator was diluted with filtered ambient air to control the challenge aerosol concentration in the exposure chamber.

A 6-decade, 45° off-axis light-scattering laser photometer (Figure 1), sampling at a flow rate of 2.2 ± 0.2 L/min, was used to quantify concentration of the challenge and the in-hood corn oil aerosols. For a given particle size, the quantity of scattered light is proportional to the aerosol concentration. The photometer converted the quantity of scattered light to a voltage, which was then digitized and recorded by a microcomputer. The calibrated response of all laser photometers is shown in Appendix C. Grade D quality air was supplied to all hoods using a Kaeser Airtower 36, Figure 2. The certification and specifications of the supplied air is found in Appendix D. Figure 3 displays a schematic of the aerosol chamber configuration.

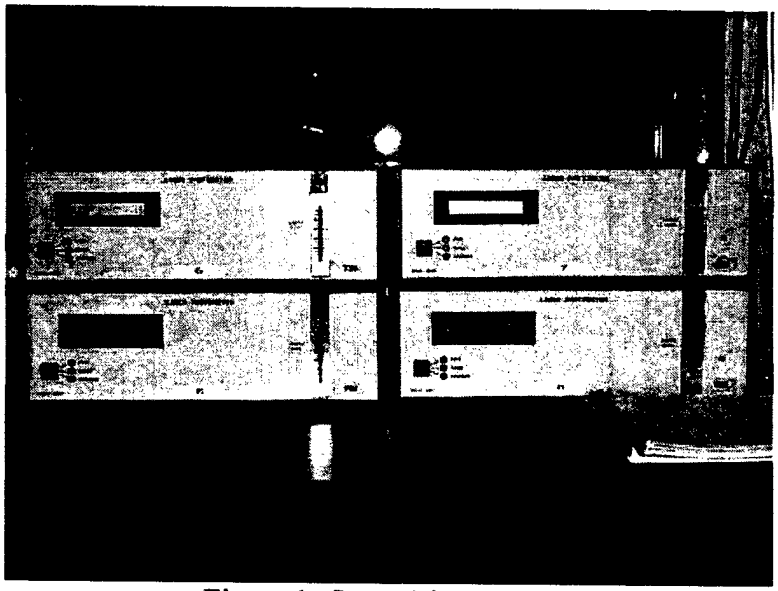

Figure 1. Laser Photometers

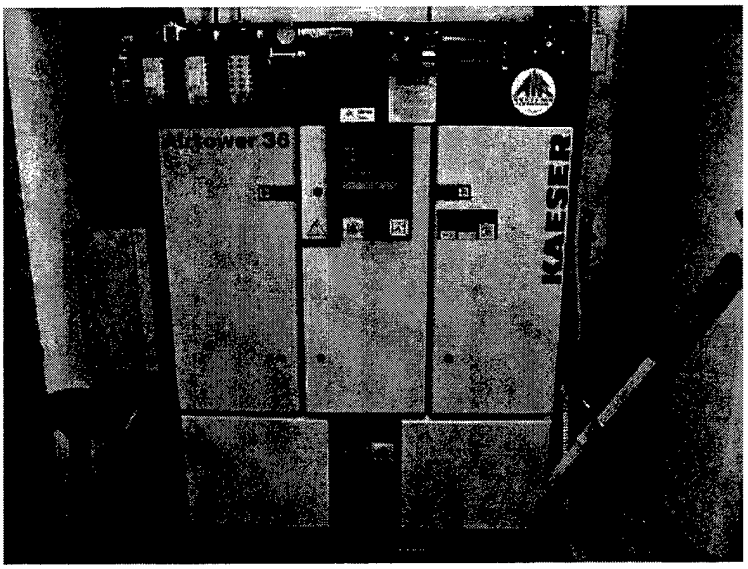

Figure 2. Kaeser Air Tower

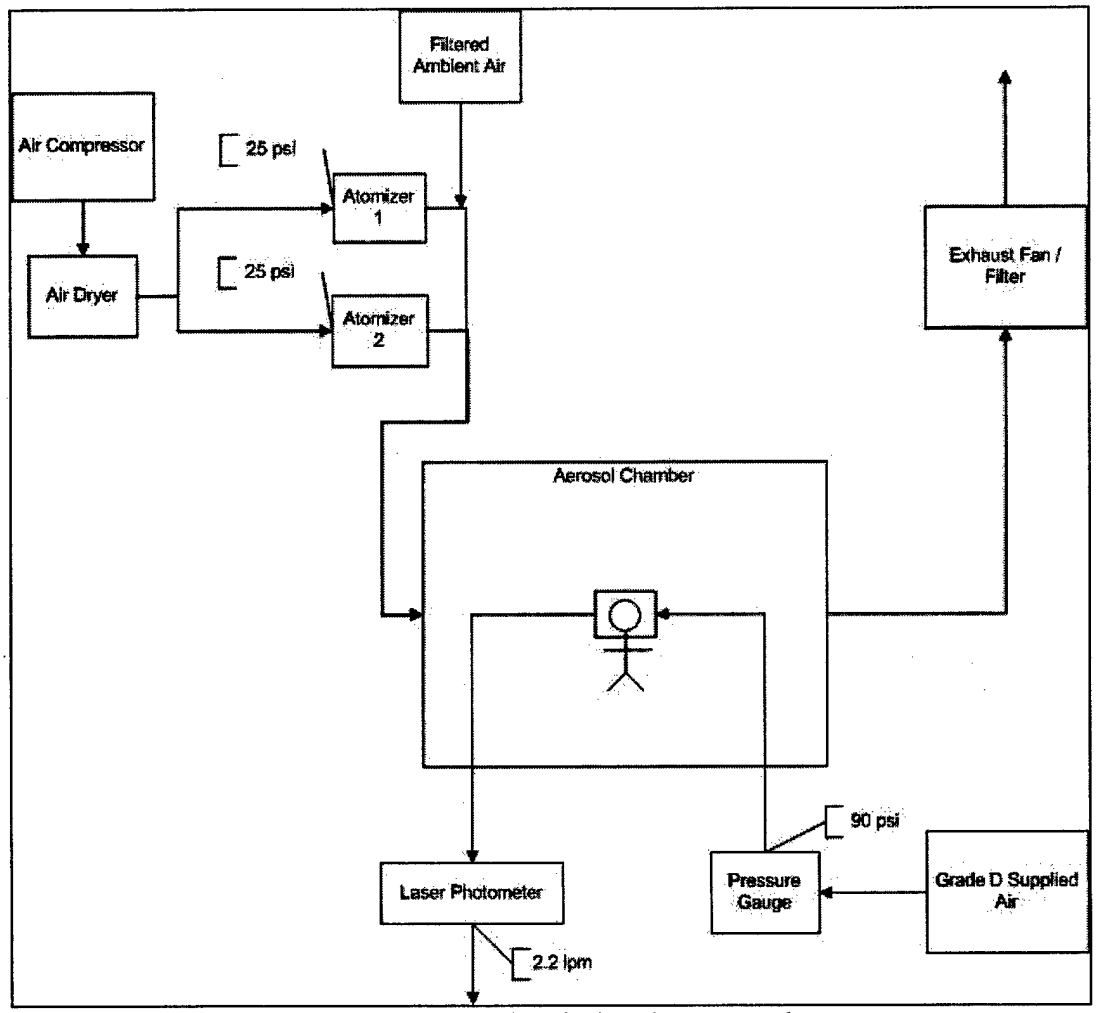

Figure 3. Schematic of Chamber Operations

3.2 Test Preparation.

The hoods were received from three different locations; Allegro Industries (Garden Grove, CA), RCL Environmental (Albany, GA), and Merck Pharmaceutical (Riverside, PA). All other related equipment and accessories were received from Allegro Industries. A total of 30 hoods were used (15 of each type), and Table 2 lists the distribution of hoods from each location. The PF Test Facility personnel punched a hole in the lower left part of the face lens. A probe was then inserted through the hole to enable sampling throughout testing. This probe had a barb on both ends. The inner barb was connected to a cannula tube, which the subject wore throughout testing. The outer barb was connected to the laser photometer. All hoods were uniquely numbered for identification purposes.

Table 2. Hood Sources

Location	Hood Type	Number of Hoods Tested
Allegro Industries	Tyvek Hood	10
Allegro Industries	Saran-coated Tyvek Hood	10
Merck Pharmaceutical	Tyvek Hood	2
Merck Pharmaceutical	Saran-coated Tyvek Hood	3
RCL Environmental	Tyvek Hood	3
RCL Environmental	Saran-coated Tyvek Hood	2

3.3 Test Procedure.

Fifteen civilian test subjects were used over the course of the testing. They had a few anthropometric measurements taken: height, weight, and head and neck circumference. The anthropometric data is available in Appendix E. All 15 test subjects were then acclimated to the test procedure and given subject agreements to read over and sign. The subjects were then introduced to the equipment and given a brief overview on how it works. Each subject was assigned a Tyvek suit which fit them accordingly. Four subjects were tested in the chamber at one time. The first four subjects donned the equipment according to the manufacturer's instructions. They placed the cannula tube over their head so the sample port was between their upper lip and nose (see Figure 4).

Figure 4. Subject Preparing to Enter Chamber

The belt containing the vortex cooler was donned and the hose to the hood was connected. A 10-ft silicone sampling tube was attached to the outer barb of the probe. The subjects then entered the chamber where PF Test Facility personnel attached the supplied air hoses to the vortex coolers. All air hoses were ensured to provide at least 90 psi (see Figure 5).

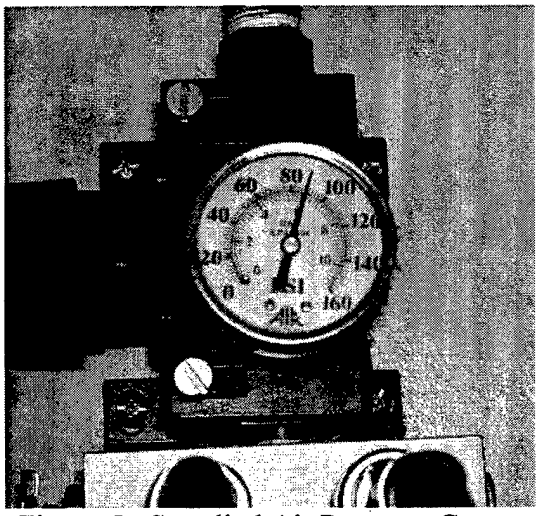

Figure 5. Supplied Air Pressure Gauge

The PF Test Facility personnel also then attached the silicone sampling tubes to Tygon® tubes, which were connected to the laser photometer located outside of the chamber. Enough time was given to purge the hood of any corn oil, which may have contaminated the hood prior to connecting the supplied air. The subjects performed the following twelve 2-min simulated workplace exercises:

1. Normal breathing, seated
2. Head side to side
3. Head up and down
4. Bend forward and touch toes
5. Raise arms above head and look up
6. Stand still, fold arms and twist torso
7. Jog in place
8. Normal breathing, seated
9. Bag clothes
10. Normal breathing, seated
11. Move 3 lb boxes from floor to ceiling
12. Normal breathing, seated

The PF Test Facility personnel located in the control room communicated the exercises to the subjects using a loudspeaker system. Figure 6 shows subjects performing the 'Bag clothes' exercise. Once all exercises were completed, the subjects disconnected their sampling lines and test personnel disconnected the supplied airlines. They then exited the chamber and removed the hoods. This was considered one trial. Each subject performed two trials in each hood type for a total of 30 data points per hood type.

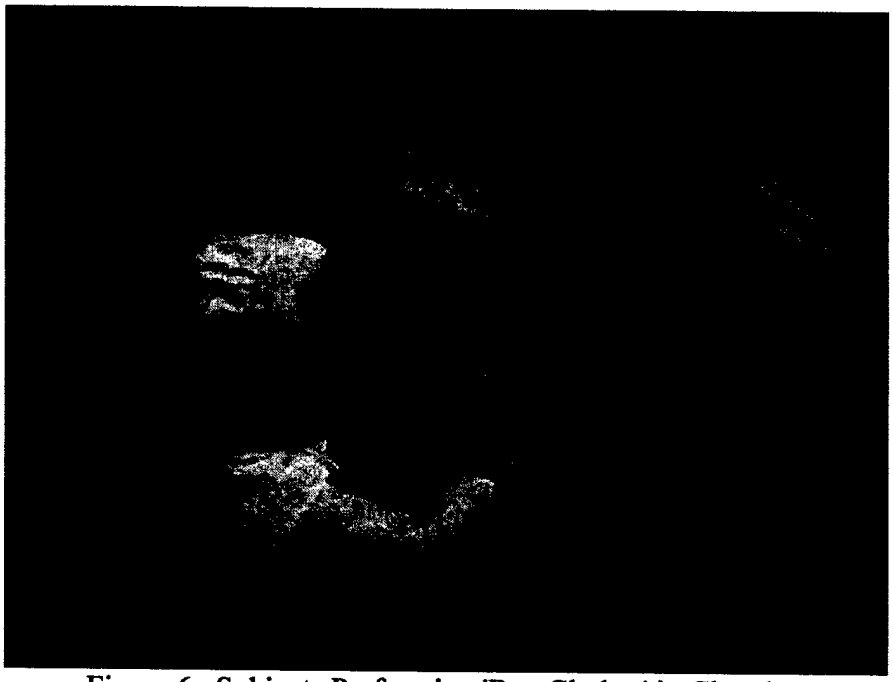

Figure 6. Subjects Performing 'Bag Clothes' in Chamber

4. DATA ANALYSIS

The hood's performance was quantified in terms of a PF. The PF was calculated by determining the ratio of the challenge aerosol concentration to the in-hood aerosol concentration as quantified by integrating the peak voltage output from the photometer over a time interval. A PF was calculated for each individual exercise (PF_i):

$$PF_i = \frac{Challenge\ Concentration}{In-hood\ Concentration}$$

Each PF_i for that trial were then used to calculate an overall PF for a volunteer (PF_o) as follows:

$$PF_o = n\left(\sum_{i=1}^{n}\frac{1}{PF_i}\right)^{-1}$$

where n is the number of exercises. The PF_o is affected most by the smallest PF_i. Under the conditions of this test and the sensitivity of the photometer, the maximum PF that can be reported is 100,000. In Appendix F, the PF_i for each trial is listed under the exercise and the PF_o is also shown.

5. RESULTS AND DISCUSSION

Tables 3 and 4 show the analyzed results from all testing. Each table represents a configuration tested. The first column is the high end of a range of Protection Factor (PF) values, whereas the row above that value is the low end to that range. The second column lists the number of trials whose overall PF values fell within that range. The third column shows the cumulative percentage of trials tested. The fourth column shows the passing percentage at the PF listed in the first column. The passing percentage means that percent of the trials achieved at least the PF listed in the first column.

All four configurations had 100% of trials passing at a PF of 80,000.

Table 5 displays the fifth percentile for each concept. This data was calculated using the PF_i from each exercise, whereas the data above used only the overall values, PF_o. The fifth percentile shows PF values of 100,000 and above, which is the maximum possible PF attainable in this test.

Table 3. Tyvek Hood Results

PF	Frequency	Cumulative %	Pass %
0	0	0.00	100.00
10	0	0.00	100.00
20	0	0.00	100.00
50	0	0.00	100.00
100	0	0.00	100.00
500	0	0.00	100.00
1000	0	0.00	100.00
1667	0	0.00	100.00
2000	0	0.00	100.00
6667	0	0.00	100.00
10000	0	0.00	100.00
20000	0	0.00	100.00
50000	0	0.00	100.00
100000	30	100.00	N/A
Total Trials	30		

Table 4. Saran-Coated Tyvek Hood Results

PF	Frequency	Cumulative %	Pass %
0	0	0.00	100.00
10	0	0.00	100.00
20	0	0.00	100.00
50	0	0.00	100.00
100	0	0.00	100.00
500	0	0.00	100.00
1000	0	0.00	100.00
1667	0	0.00	100.00
2000	0	0.00	100.00
6667	0	0.00	100.00
10000	0	0.00	100.00
20000	0	0.00	100.00
50000	0	0.00	100.00
100000	30	100.00	N/A
Total Trials	30		

Table 5. Fifth Percentile Results

TEST & RESPIRATOR	RANGE OF PFi'S	MEDIAN PFi	5TH PERCENTILE PFi
TEST TRIAL # 1, Tyvek Hood	>100,000->100,000	>100,000	>100,000
TEST TRIAL # 2, Tyvek Hood	26,172.8->100,000	>100,000	>100,000
TEST TRIAL # 1, Saran-coated Tyvek Hood	>100,000->100,000	>100,000	>100,000
TEST TRIAL # 2, Saran-coated Tyvek Hood	>100,000->100,000	>100,000	>100,000

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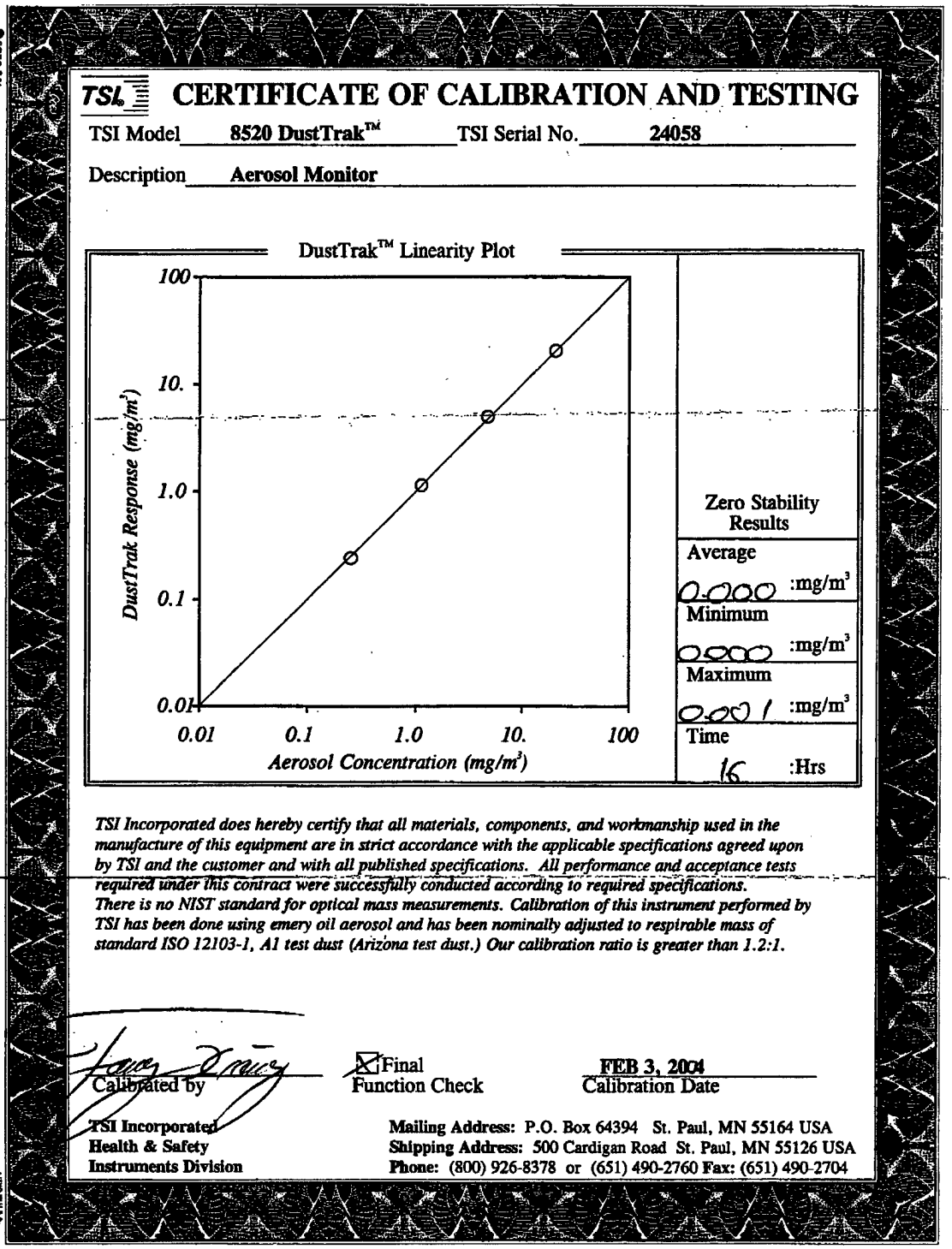
APPENDIX A

TSI DUSTTRAK CALIBRATION DATA AND RESULTS



TSI **CERTIFICATE OF CALIBRATION AND TESTING**

TSI Model **8520 DustTrak™** TSI Serial No. **24058**

Description **Aerosol Monitor**

DustTrak™ Linearity Plot

Zero Stability Results	
Average	0.000 :mg/m³
Minimum	0.000 :mg/m³
Maximum	0.001 :mg/m³
Time	16 :Hrs

TSI Incorporated does hereby certify that all materials, components, and workmanship used in the manufacture of this equipment are in strict accordance with the applicable specifications agreed upon by TSI and the customer and with all published specifications. All performance and acceptance tests required under this contract were successfully conducted according to required specifications. There is no NIST standard for optical mass measurements. Calibration of this instrument performed by TSI has been done using emery oil aerosol and has been nominally adjusted to respirable mass of standard ISO 12103-1, A1 test dust (Arizona test dust.) Our calibration ratio is greater than 1.2:1.

Calibrated by

☒ Final Function Check

FEB 3, 2004 Calibration Date

TSI Incorporated
Health & Safety
Instruments Division

Mailing Address: P.O. Box 64394 St. Paul, MN 55164 USA
Shipping Address: 500 Cardigan Road St. Paul, MN 55126 USA
Phone: (800) 926-8378 or (651) 490-2760 **Fax:** (651) 490-2704

Figure A. DustTrak Calibration

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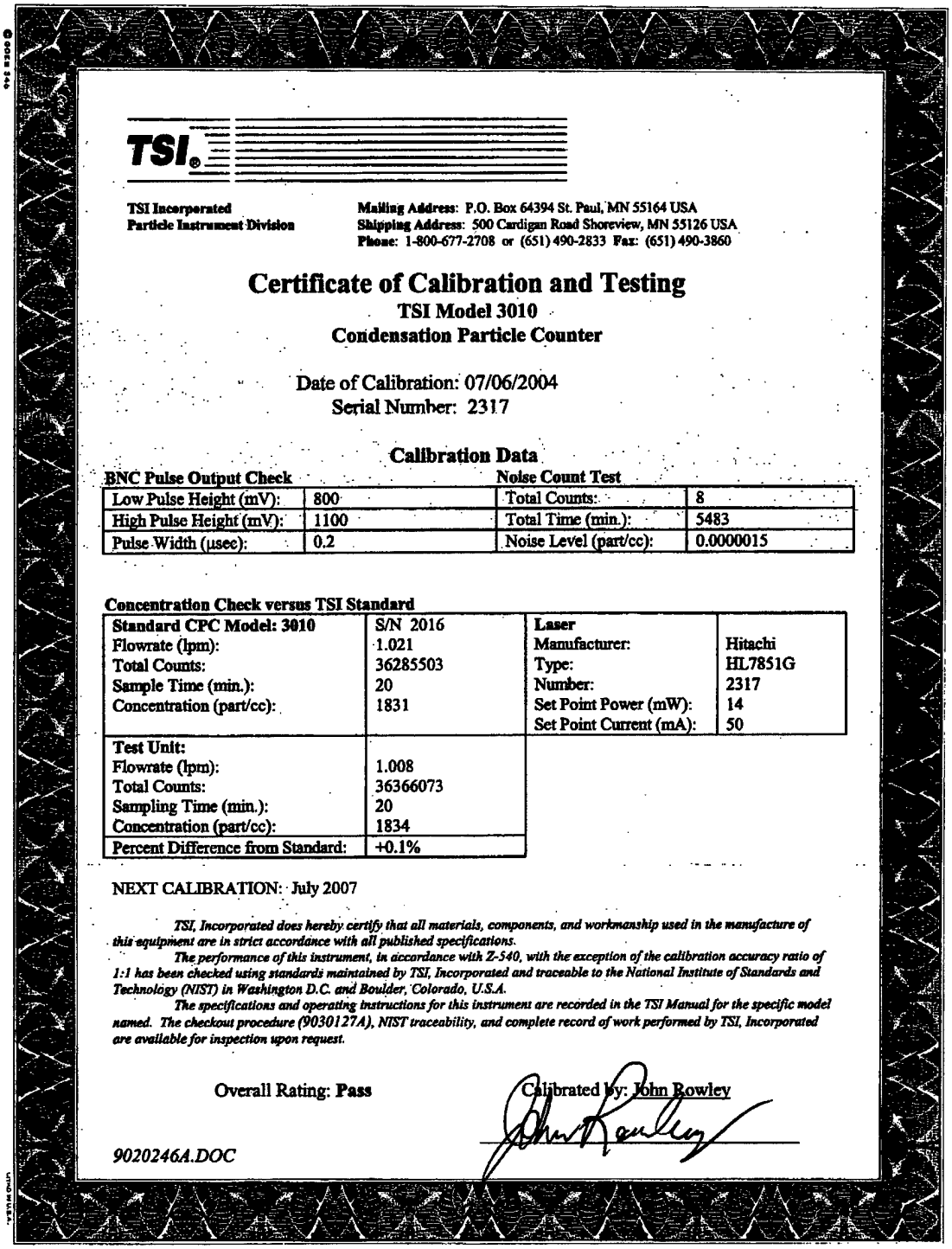
APPENDIX B

SCANNING MOBILITY PARTICLE SIZER CALIBRATION AND RESULTS



TSI.

TSI Incorporated
Particle Instrument Division

Mailing Address: P.O. Box 64394 St. Paul, MN 55164 USA
Shipping Address: 500 Cardigan Road Shoreview, MN 55126 USA
Phone: 1-800-677-2708 or (651) 490-2833 Fax: (651) 490-3860

Certificate of Calibration and Testing

TSI Model 3010
Condensation Particle Counter

Date of Calibration: 07/06/2004
Serial Number: 2317

Calibration Data

BNC Pulse Output Check		Noise Count Test	
Low Pulse Height (mV):	800	Total Counts:	8
High Pulse Height (mV):	1100	Total Time (min.):	5483
Pulse Width (μsec):	0.2	Noise Level (part/cc):	0.0000015

Concentration Check versus TSI Standard

Standard CPC Model: 3010	S/N 2016	**Laser**	
Flowrate (lpm):	1.021	Manufacturer:	Hitachi
Total Counts:	36285503	Type:	HL7851G
Sample Time (min.):	20	Number:	2317
Concentration (part/cc):	1831	Set Point Power (mW):	14
		Set Point Current (mA):	50
Test Unit:			
Flowrate (lpm):	1.008		
Total Counts:	36366073		
Sampling Time (min.):	20		
Concentration (part/cc):	1834		
Percent Difference from Standard:	+0.1%		

NEXT CALIBRATION: July 2007

TSI, Incorporated does hereby certify that all materials, components, and workmanship used in the manufacture of this equipment are in strict accordance with all published specifications.

The performance of this instrument, in accordance with Z-540, with the exception of the calibration accuracy ratio of 1:1 has been checked using standards maintained by TSI, Incorporated and traceable to the National Institute of Standards and Technology (NIST) in Washington D.C. and Boulder, Colorado, U.S.A.

The specifications and operating instructions for this instrument are recorded in the TSI Manual for the specific model named. The checkout procedure (9030127A), NIST traceability, and complete record of work performed by TSI, Incorporated are available for inspection upon request.

Overall Rating: **Pass**

Calibrated by: John Rowley

9020246A.DOC

Figure B1. Condensation Particle Counter Calibration

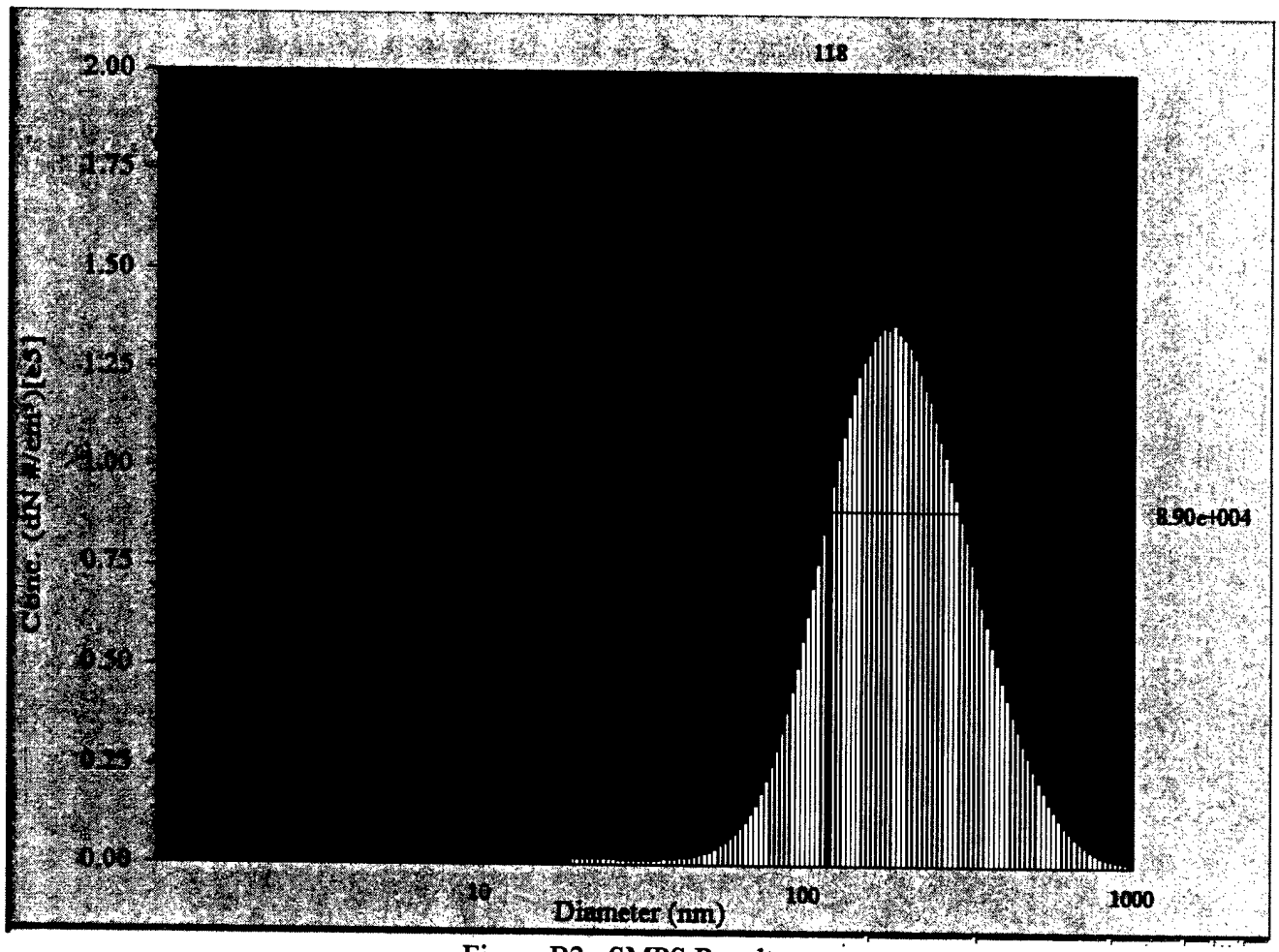


Figure B2. SMPS Results

MMAD = 0.403 μm

APPENDIX C

UNIFORMITY OF LASER PHOTOMETERS

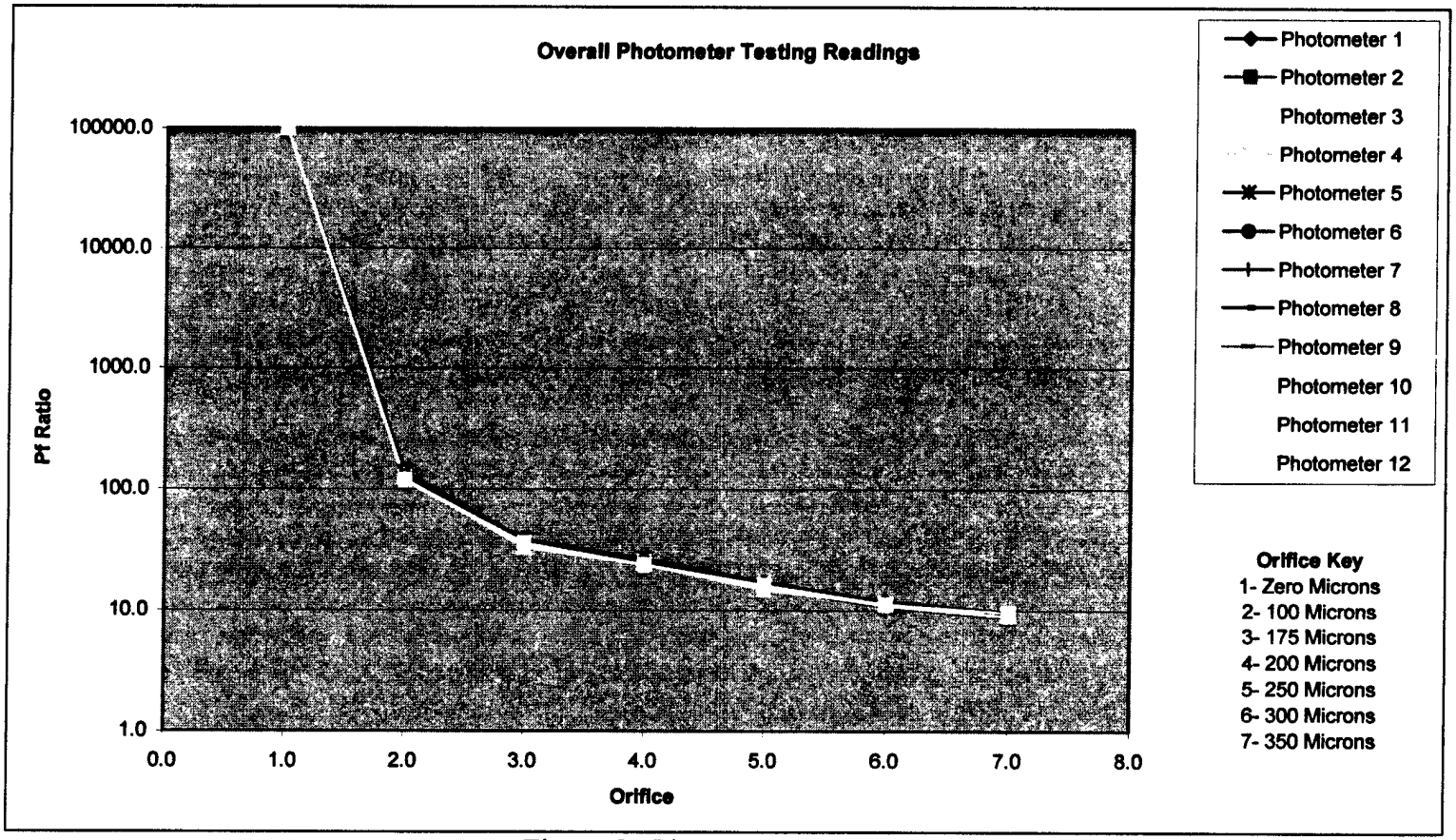


Figure C. Photometer Response

The figure above is the result of a calibrated leak test performed on all photometers. Six different size laser drilled orifices plus a HEPA filter test (zero microns) were tested on all 12 photometers. No significant difference in response between photometers was found. Only photometers 1 through 8 were used in this test.

APPENDIX D

SUPPLIED AIR QUALITY DATA

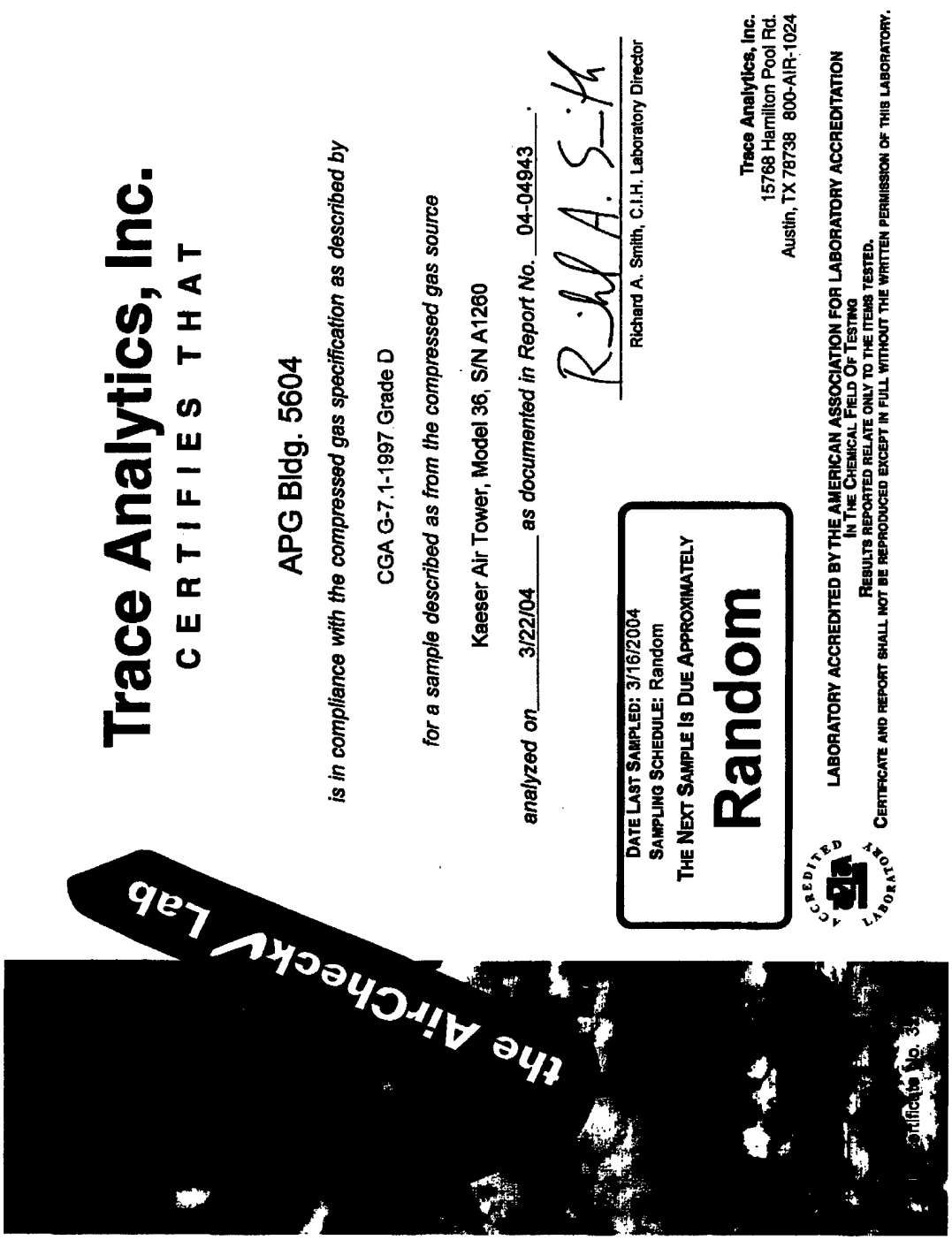


Figure D1. Supplied Air Certificate

Trace Analytics, Inc.
15768 Hamilton Pool Road • Austin, Texas 78738
Voice: 800-AIR-1024 or 512-263-0000 • Fax: 512-263-0002
E-mail: Service@AirCheckLab.com

AirCheck Report™

Customer No.: 941
Report No.: 04-04943

LBS Corp.
Mr Craig Mazzantenta
11408 Pulaski Hwy
White Marsh MD 21162

Date Received: Mon, March 22, 2004
Date Analyzed: Mon, March 22, 2004
Date Reported: Tue, March 23, 2004
Sampled By: Stephen Tress
Date Sampled: Tue, March 16, 2004
Air Source ID: Kaeser Air Tower, Model 36, S/N A1260

Sampled for APG Bldg. 5604

Results vs CGA G-7.1-1997 Grade D Gas Quality Specification

Limiting Characteristic		Concentration			QC Results, %*	
		Source	Ambient	Specification	Accuracy	Precision
Oxygen, Volume %		20.5	20.8	19.5-23.5	100	0.0
Nitrogen / Argon, Volume %		77.9 / 0.9	78.3 / 0.9	N/A - N/A	100	0.0
Carbon Monoxide (CO), ppmv		<0.3	3.5	10	100	0.7
Carbon Dioxide (CO_2), ppmv		441	612	1000	100	0.2
Water (H_2O), ppmv/Dewpoint, °F		14.0 / -73	N/A	24/-65 (W)	100	0.4
Total Volatile Hydrocarbon Content (TVHC)	TVHC (excluding CH_4), ppmv	3.7	24.5	N/A	100	0.4
	Methane (CH_4), ppmv	1.9	2.2	N/A	100	0.1
	TVHC (excluding CH_4), ppmv	1.8	22.3	N/A	N/A	N/A
Oil (condensed) & Particulate, mg/m³		<0.06	N/A	5	100	0.1
Odor (provided by customer)		None/Slight	N/A	None/Slight	N/A	N/A
Other		N/A	N/A	N/A	N/A	N/A

This sample COMPLIES with the above referenced specification.

Customer Comments

TNRO ATCES (W) Dew point is expressed in °F at one atmosphere pressure absolute.

*Accuracy relates observed to expected results (100% is complete agreement) Precision relates to reproducibility (0.0% is complete agreement)

Analytical Test Methods				Media Sample Numbers	
	Gases & Vapors	CAT-A-01	Gas Chromatography/Mass Spectrometry		Source Bottle: 719651
	Oil & Particulate	CAT-A-03	Analytical Gravimetry		Source Filter: 115440
	Particle Size	CAT-A-04	Optical Microscopy		Ambient Bottle: 407379

Accredited Since 1991 By
American Association for Laboratory Accreditation
A2LA Certificate No. 322.01
Accredited In The Chemical Field of Testing

Richard A. Smith, C.I.H., Laboratory Director

Figure D2. Supplied Air Data

APPENDIX E

ANTHROPOMETRIC DATA

Table E. Anthropometric Data

Subject	Sex	Height (in)	Weight (lb)	Neck Circ. (mm)	Head Circ. (mm)
1	M	72	200	385	590
2	M	70	160	388	574
3	F	63	135	320	540
4	F	64	120	310	540
5	M	67	160	392	559
6	F	67	143	325	555
7	F	70	145	320	535
8	M	71	184	395	560
9	F	58	95	315	545
10	M	72	165	377	580
11	M	67	180	400	575
12	M	71	205	395	550
13	F	67	120	315	514
14	F	66	155	345	560
15	F	64	140	350	540

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APPENDIX F

RAW PROTECTION FACTOR DATA

Table F1. Tyvek Hood Trials 1 and 2

DATE	MASK	SUBJECT	CONCEPT	TRIAL	PFo	EXRCS1	EXRCS2	EXRCS3	EXRCS4	EXRCS5	EXRCS6	EXRCS7	EXRCS8	EXRCS9	EXRCS10	EXRCS11	EXRCS12
8/9/2004	TA-1	1	1	1	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0
8/9/2004	TA-2	2	1	1	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0
8/10/2004	TA-3	3	1	1	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0
8/9/2004	TA-4	4	1	1	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0
8/9/2004	TA-5	5	1	1	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0
8/9/2004	TA-6	6	1	1	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0
8/9/2004	TA-7	7	1	1	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0
8/9/2004	TA-8	8	1	1	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0
8/9/2004	TA-9	9	1	1	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0
8/10/2004	TA-10	10	1	1	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0
8/10/2004	TM-11	11	1	1	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0
8/10/2004	TM-12	12	1	1	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0
8/10/2004	TR-13	13	1	1	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0
8/12/2004	TR-14	14	1	1	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0
8/12/2004	TR-15	15	1	1	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0

DATE	MASK	SUBJECT	CONCEPT	TRIAL	PFo	EXRCS1	EXRCS2	EXRCS3	EXRCS4	EXRCS5	EXRCS6	EXRCS7	EXRCS8	EXRCS9	EXRCS10	EXRCS11	EXRCS12
8/9/2004	TA-1	1	1	2	80967.5	>100000.0	>100000.0	>100000.0	26172.8	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0
8/9/2004	TA-2	2	1	2	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0
8/10/2004	TA-3	3	1	2	99637.3	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	95814.5
8/9/2004	TA-4	4	1	2	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0
8/9/2004	TA-5	5	1	2	93546.2	54708.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0
8/9/2004	TA-6	6	1	2	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0
8/9/2004	TA-7	7	1	2	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0
8/9/2004	TA-8	8	1	2	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0
8/9/2004	TA-9	9	1	2	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0
8/10/2004	TA-10	10	1	2	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0
8/10/2004	TM-11	11	1	2	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0
8/10/2004	TM-12	12	1	2	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0
8/10/2004	TR-13	13	1	2	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0
8/12/2004	TR-14	14	1	2	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0
8/12/2004	TR-15	15	1	2	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0

Key:
Mask: AB-X
A = Type of hood (Tyvek or Saran coated Tyvek)
B = Origin of hood (Allegro, Merck or RCL)
X = Sequence number of hood

Table F2. Saran-Coated Tyvek Hood Trials 1 and 2

DATE	MASK	SUBJECT	CONCEPT	TRIAL	PFo	EXRCS1	EXRCS2	EXRCS3	EXRCS4	EXRCS5	EXRCS6	EXRCS7	EXRCS8	EXRCS9	EXRCS10	EXRCS11	EXRCS12
8/9/2004	SA-1	1	2	1	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0
8/10/2004	SA-2	2	2	1	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0
8/12/2004	SA-3	3	2	1	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0
8/10/2004	SA-4	4	2	1	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0
8/10/2004	SA-5	5	2	1	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0
8/10/2004	SA-6	6	2	1	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0
8/10/2004	SA-7	7	2	1	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0
8/10/2004	SA-8	8	2	1	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0
8/19/2004	SA-9	9	2	1	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0
8/10/2004	SA-10	10	2	1	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0
8/12/2004	SM-11	11	2	1	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0
8/12/2004	SM-12	12	2	1	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0
8/12/2004	SM-13	13	2	1	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0
8/19/2004	SR-14	14	2	1	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0
8/19/2004	SR-15	15	2	1	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0

DATE	MASK	SUBJECT	CONCEPT	TRIAL	PFo	EXRCS1	EXRCS2	EXRCS3	EXRCS4	EXRCS5	EXRCS6	EXRCS7	EXRCS8	EXRCS9	EXRCS10	EXRCS11	EXRCS12
8/10/2004	SA-1	1	2	2	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0
8/10/2004	SA-2	2	2	2	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0
8/12/2004	SA-3	3	2	2	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0
8/10/2004	SA-4	4	2	2	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0
8/10/2004	SA-5	5	2	2	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0
8/10/2004	SA-6	6	2	2	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0
8/10/2004	SA-7	7	2	2	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0
8/10/2004	SA-8	8	2	2	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0
8/19/2004	SA-9	9	2	2	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0
8/10/2004	SA-10	10	2	2	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0
8/12/2004	SM-11	11	2	2	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0
8/12/2004	SM-12	12	2	2	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0
8/12/2004	SM-13	13	2	2	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0
8/19/2004	SR-14	14	2	2	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0
8/19/2004	SR-15	15	2	2	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0	>100000.0

Key:
Mask: AB-X
A = Type of hood (Tyvek or Saran coated Tyvek)
B = Origin of hood (Allegro, Merck or RCL)
X = Sequence number of hood