

# Clean Room/Flow Bench and Deionized Water Sampling and Analysis



Materials and Processes Laboratory  
Materials Test Branch, Building 4623

National Aeronautics and Space Administration  
George C. Marshall Space Flight Center  
Marshall Space Flight Center, AL 35812

Release Authority	Name	Title	Organization	Date
Office of Primary Responsibility	<i>Saith/ Gordon</i>	Materials Test Branch Chief	EM10	<i>2/4/05</i>
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Revision	Date	Originator	Description	Affected Pages
Baseline	2/4/05	Steve Whitfield	Document converted from ED36-OWI-056. Previous history retained in system as part of canceled or superseded ISO document files.	All

This document baselines the Organizational Work Instruction (OWI) for the Environmental Gas Laboratory Clean Room/Flow Bench and Deionized Water testing of samples submitted for testing in Building 4623 and for samples tested on site. Any change to this OWI shall be submitted to and approved by the Materials Test Branch Chief, EM10. Revisions may be also be submitted to the concurring organizations listed below for review and concurrence by memo. The original OWI and all changes shall be maintained by EM10.

Concurring organizations:  
 Building 4623 Test Operations Contractor  
 EM10 COTR  
 Environmental Health, AD60M

**CHECK THE MASTER LIST -- ONLY THE LATEST VERSION IS VALID**

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## 1.0 Scope

### 1.1 Scope

The scope of this Organizational Work Instruction (OWI) is twofold:

1. The periodically scheduled sampling, analysis, and reporting of analytical results of controlled environments, specifically clean rooms and flow benches, for a number of analytical parameters
2. The as-requested sampling of deionized water sources.

The analyses are performed either on site or in the Building 4623 Toxicity Laboratory at the Marshall Space Flight Center

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### 1.2 Purpose

1.2.1. Clean Rooms and Flow Benches: MSFC has many controlled environments, ranging from 100K clean rooms to Level 100 flow benches, which are used to assure cleanliness in the preparation of flight hardware. Analysis is performed on these systems to certify qualification according to MSFC-STD-246, as well as other specially requested analysis. The above analysis is typically scheduled beforehand on a master list, which includes sites sampled daily, weekly, monthly, quarterly, or yearly.

1.2.2. Deionized Water: Sampling of deionized (DI) water is performed in accordance with EPA 600/4-79-020. Analysis is typically scheduled by the requestor.

1.2.3. Data Analysis: The analytical data package is completed by gas laboratory personnel, reviewed by the gas laboratory manager, and reported to the requester in a standard format. Occasionally, verbal results are requested; hard copy results follow, by the normal reporting requirements.

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### 1.3 Applicability

This instruction applies to the Chemistry Team, Materials Test Branch, of the Materials and Processes Laboratory.

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## 2.0 Applicable Documents

*Climet CI-4102A Laser Particle Counter Operations Manual, September 1995.*

*Comark Operating Instructions for Comark C9500 Series Intrinsically Safe Pressure Meter.*

EM10-OWI-CHM-050, *Building 4623 Guidelines for General Operations.*

EM10-OWI-CHM-058. *Chemical Hygiene Plan for Building 4623.*

*Extech Instruction Manual Mode 1407112 Digital Thermometer/Anemometer.*

*Hach Sens Ion 5 Conductivity Meter Manual, Cat #51800-18, 1999.*

MPD 1840.3. *MSFC Respiratory Protection Program.*

MPR 1040.3. *MSFC Emergency Plan.*

MPR 1840.2. *MSFC Hazard Communications Program. .*

MPR 8715.1. *MSFC Safety, Health, and Environmental (SHE) Program.*

MSFC-STD-246, Revision B. *Standard Design and Operational Criteria for Controlled Environmental Areas.*

MWI 3410.1. *Personnel Certification Program.*

MWI 8621.1. *Close Call and Mishap Reporting and Investigation Program.*

*Orion Model 610 Instruction Manual, 1997.*

*Orion Model 6157 Low Maintenance Solid State pHuture Probe Instruction Manual, 1999.*



**Note:** Personnel **shall** always **refer** to most current versions of applicable documents.

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## 3.0 Definitions

### 3.1 Definitions

*AVO* – Avoid Verbal Orders. Non-routine special request sample.

*Laminar flow bench* – Laboratory ventilation bench designed to prevent particulate contamination on substances by trapping contaminants in micromesh filters.

*NASA*. Marshall Space Flight Center EM10 responsible personnel.

*Particle Counter* – Laboratory equipment designed for automated measurement of contaminant particles to determine if they are within the correct size range. Contains a pump to sample the air and a laser to determine the particle size.

*Point of Contact* – The person (or a designated representative) responsible for the sampling point. Refer to the current list of sample points to identify the Point of Contact.

*Tagging* – Provides testing results on tag cards at a designated location at each testing point so the requestor can go to a specific point to view results of the data.

*Test engineer*. The person responsible for correctly following the approved test plan for a specific test from sample receipt to test data evaluation.

*Test operator*. The person responsible for conducting the test under the guidance of the test engineer

### 3.2 Acronyms

<i>AVO</i>	Avoid Verbal Orders
<i>COB</i>	Close of Business
<i>COTR</i>	Contracting Officer's Technical Representative
<i>MSFC</i>	Marshall Space Flight Center
<i>NASA</i>	National Aeronautics and Space Administration
<i>OWI</i>	Organizational Work Instruction
<i>POC</i>	Point of Contact
<i>PPE</i>	Personal Protective Equipment
<i>ppm</i>	parts per million

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## 4.0 Instructions

### 4.1 Clean Rooms and Flow Benches

Clean room and flow bench analyses are typically performed on site. Environmental Gas Laboratory personnel **shall perform** the following procedures:

#### 4.1.1. Preparing to Conduct Sampling

- **Ensure** that equipment and batteries are fully charged before leaving Building 4623 to take samples.
- **Ensure** that all equipment is calibrated.
- **Review** weekly and monthly points on the schedule to determine the proper points to be sampled.
- No special safety equipment is required when sampling clean rooms or flow benches, unless designated by special notice. (See section 9.1 for an equipment list and Table 9.4 for details of the list.)
- **Wear** proper attire in clean rooms, in accordance with MSFC-STD-246.
- **Observe** all warning labels such as barricades, tape, or signs.
- *If a clean room requires a badge to gain access, secure authorization from MSFC Security.*



**Note:** The test requestor shall call Security and approve badge access for that specific point.

#### 4.1.2. Conducting Sampling

4.1.2.1. **Follow** the procedure detailed in the specification *MSFC-STD-246, Revision B (Standard Design and Operation Criteria for Controlled Environmental Areas)* for the analysis of temperature, particle count, relative humidity, pressure differential, and airflow. Maximum acceptable results for these parameters are listed in Table 4.1.

4.1.2.2. **Tag** the clean room or flow bench immediately after the test results have been calculated.

4.1.2.3. *If a clean room or flow bench is out of specification, contact* the test requestor within 24 hours.

#### 4.1.3. Data Recording and Reporting

4.1.3.1. **Log** points according to location and **record** pertinent information on the Clean Room and Flow Bench Report Routine Orders (Figure 7.3-2).

Clean Room Type	Class 100	Class 1,000	Class 10,000	Class 100,000
Parameter				
Particles per cubic foot 0.5	100	1,000	10,000	100,000
Particles per cubic foot 5	0	4	60	600
Relative humidity (%)	30-50	30-50	30-50	30-50
Temperature (deg F)	67-77	67-77	67-77	67-77
Pressure differential (inches water)	NA	.05	.05	.05
Air flow at filter face (ft <sup>3</sup> /min)	Not specified	Not specified	Not specified	Not specified
Air flow in room or at filter exit (ft <sup>3</sup> /min)	Not specified	Not specified	Not specified	Not specified

**Table 4.1.**  
Clean Room Parameters  
and Acceptable Results

4.1.3.2. *If the sample cannot be taken because of construction or other safety hazards, report that specific clean room or flow bench as “temporarily deactivated.”*

4.1.3.3. Results of testing shall be reported weekly to EM10.

## 4.2 Deionized Water (DI)

Environmental Gas Laboratory personnel **shall perform** the following procedures:

### 4.2.1. Preparing to Conduct Sampling

- **Ensure** that all sampling equipment is available and ready for use:
  - A clean, particle-free, 500-ml glass bottle with a Teflon™ stopper in which to collect the sample for filtration and microscopic analysis
  - A clean, 100-ml beaker rinsed with DI water and dried for pH analysis
  - A clean, 250-ml glass bottle with a glass top to collect the sample for pH analysis
  - A Teflon™ rinse bottle filled with DI water and filtered until particle free
  - A clean, particle-free pair of forceps for handling filter pads.
- **Check** that batteries for both the pH and conductivity meters are charged.
- **Calibrate** pH and conductivity meters.

### 4.2.2. Conductivity Analysis

4.2.2.1. **Sample** the source, *if it is not in use. If the source is in use, obtain permission from the POC to conduct sampling.*

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4.2.2.2 **Purge** the source to be sampled for a minimum of 5 minutes.

4.2.2.3 **Fill** and **empty** the 500-ml sample bottle 3 times.

4.2.2.4 **Fill** the 500-ml sample bottle for a fourth time. **Analyze** this sample immediately for conductivity in accordance with EPA report 600/4-79-020, "Methods for Chemical Analysis of Water and Wastes," Method 120.1.

#### 4.2.3. pH Analysis

4.2.3.1 **Perform** measurement of pH under a laminar flow bench or a vacuum hood.

4.2.3.2 **Fill** both the 500-ml and 250-ml sample bottles from the sampling source 3 times, and **empty** the bottle 3 times. **Fill** both the 500-ml and 250-ml sample bottles from the sampling source for a fourth time. Take these samples to the Environmental Gas Laboratory for pH analysis and filtration in accordance with the following steps.

4.2.3.3 **Decant** 50 ml of the sample from the 250-ml glass sample bottle into the 100-ml beaker.

4.2.3.4 **Measure** the pH on the 50-ml sample in accordance with EPA report 600/4-79-020, "Methods for Chemical Analysis of Water and Wastes," Method 150.1.

#### 4.2.4. Filtration of the Deionized Water Sample

4.2.4.1 **Perform** filtration of DI water under a laminar flow bench or a vacuum hood.

4.2.4.2 **Rinse** the filter pad on the influent side of the pad with DI water from the Teflon™ rinse bottle; **place** the pad on the filtering frit.

4.2.4.3 **Clamp** the clean, particle-free filtering cup with the clean, particle-free watchglass over the filter pad.

4.2.4.4 **Rinse** the outside of the 500-ml sample bottle and stopper with DI water from the Teflon™ rinse bottle.

4.2.4.5 **Lift** the watchglass, and **decant** 250 ml of the sample into the filtering cup.

4.2.4.6 **Rinse** the underside of the watchglass with DI water from the Teflon™ rinse bottle, and **place** the watchglass over the filtering cup.

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4.2.4.7. **Rinse** the sample bottle stopper with DI water from the Teflon™ rinse bottle,, and **return** the stopper to the sample bottle.

4.2.4.8. **Filter** 250 ml of the sample through the filter pad, using a vacuum pump with the filtering glassware.

4.2.4.9. **Decant** the remaining 250-ml sample into the filtering cup. **Rinse** the inside of the sample bottle three times with DI water from the Teflon™ rinse bottle. **Add** the rinses to the filtering cup. **Rinse** the watchglas with DI water from the Teflon™ rinse bottle, and **place** the watchglass over the filtering cup.

4.2.4.10. When all of the sample has been filtered, **lift** the watchglass, and **rinse** the inside of the filtering cup three times. **Rinse** the watchglass with DI water from the Teflon™ rinse bottle, and **place** the watchglass over the filtering cup.

4.2.4.11. **Unclamp** the filtering cup after the three rinses have been filtered, and **use** clean forceps to transfer the filter pad to a clean filter pad slide. **Rinse** the underside of the cover for the filter pad slide with DI water from the Teflon™ rinse bottle, and **place** the cover over the filter pad. The filter pad is now ready for microscopic analysis.

#### 4.2.5. Data Recording and Reduction

4.2.5.1. **Record** the results of analysis on a tag that shall be delivered to the requestor or the point of contact after the test results are obtained.

4.2.5.2. The results of analysis shall be recorded weekly on the Gases and Liquids Report Routine Orders (Figure 7.3-3), which shall be submitted to EM10.

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## 5.0 Notes

Custodians for EM10-OWI-CHM-056	
Master List and Document Control	EM10 Management Support Assistant
Alternate Document Control	EM10 Group ISO Representative
Records	Materials Test Branch ISO Representative
Calibration	Materials Test Branch Calibration Contact
Memoranda	Materials Test Branch ISO Representative

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## 6.0 Safety Precautions and Warning Notes

### 6.1 Hazards

Although the nature of clean room, flow bench, and deionized water testing does not involve any specific hazards, Environmental Gas Laboratory personnel **shall observe** the Safety Precautions listed in section 6.2.

### 6.2 Safety Precautions

Environmental Gas Laboratory personnel **shall follow these safety precautions:**

6.2.1. **Observe** normal laboratory safety rules.

6.2.2. When testing in the Building 4623 laboratory, **plan** testing so that two Environmental Gas Laboratory chemists are in the test area or that one Environmental Gas Laboratory chemist is in the test area and one other alerted person is in Building 4623 during testing. For specific personnel requirements, **refer** to section 4.7, Personnel Control (Facility Management), of EM10-OWI-CHM-050, *Building 4623 Guidelines for Test Operations*. When analyses are performed in other buildings' laboratories, **plan** testing so that at least one other alerted person in is that building during testing.

6.2.3. In accordance with Occupational Safety and Health Administration requirements, **read** the Materials Safety Data Sheets (MSDSs) for all chemicals used or encountered during testing. **Read the test material's MSDS to ensure familiarity with all safety precautions associated with the material. Verify that all Environmental Gas Laboratory personnel are aware of all highly hazardous, reactive, or toxic components of the test material.**

6.2.4. No special safety equipment is required when sampling clean rooms or flow benches, unless designated by special notice.

6.2.5. When operating Environmental Gas Laboratory equipment, **refer** to the safety section of each operator's manual, located in the Environmental Gas Laboratory.

6.2.6. **Smoking shall not be permitted** in Building 4623. The test area is generally an oxygen-enriched environment. Open flames or other high-temperature sources shall not be permitted in the testing area while enriched-oxygen conditions exist.



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6.2.7. **Verify** that no lights or sirens are on outside the Environmental Gas Laboratory before entering to ensure that the oxygen level indicated by the gauge reads between 19.5 and 23.5% oxygen.

### 6.3 Emergency Shutdown Procedure

Not applicable. The testing equipment does not have to be shut down to be considered safe in an emergency situation.

### 6.4 Accident Reporting

6.4.1. From a safe location, the *test operator* **shall immediately call 911 and shall notify** the EM10 Materials Test Branch Chief or the Environmental Gas Laboratory manager.

6.4.2. From a safe location, the notified *EM10 Materials Test Branch Chief/Environmental Gas Laboratory manager* **shall immediately report** the accident to the NASA Safety Monitor and the appropriate supervisor(s).

### 6.5 Emergency Response Plan

Emergency procedures and plans for Building 4623 are incorporated into the OWIs and are stated in MPR 1040.3. *MSFC Emergency Plan*. Plans **shall** be modified if operations change in a significant manner.

### 6.6 Mishap Reporting

“Each employee is responsible for reporting emergencies, unsafe or potentially unsafe conditions, mishaps and close calls in the workplace.<sup>1</sup>”

Environmental Gas Laboratory personnel **shall follow these safety precautions:**

**Report** all mishaps occurring in the Environmental Gas Laboratory in Building 4623 to the *EGL manager*, who shall **report** the mishap to the *area coordinator/Safety Monitor*, who shall **report** the mishap or close call in accordance with MWI 8621.1, *Close Call and Mishap/Incident Reporting and Investigation Program*. Specifically,

- For all Type A & B mishaps, *the area coordinator/Safety Monitor* shall immediately **initiate** an initial verbal report to the Center Director and S&MA Director.

<sup>1</sup> MWI 8621.1 *Close Call and Mishap/Incident Reporting and Investigation Program*. March 27, 2000. pg. 7.

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**Note for contractor employees:** In the absence of the EGL manager and the area coordinator/Safety Monitor or other NASA employee, any employee is authorized to initiate verbal notification of the Center Director and S&MA Director immediately.



- For all mishaps and close calls, a flash report shall be generated within 4 hours of the mishap occurrence. The *employee reporting the mishap or close call* **shall notify** his/her supervisor immediately. The *employee's immediate supervisors* **shall call** 544-4357, Option 0, to generate the flash report. In addition, the *employee's immediate supervisor* **shall submit** NASA Form 1627 to S&MA within 6 calendar days. All mishaps **shall** be reported in accordance with MWI 8621.1, *Close Call and Mishap/Incident Reporting and Investigation Program*.

Mishaps or close calls that occur while performing clean room/flow bench/DI water analyses in facilities other than Building 4623 shall be reported to that facility's building manager or test engineer responsible for developing that facility's emergency procedures, in accordance with MWI 8621.1, *Close Call and Mishap/Incident Reporting and Investigation Program*. The employee reporting the mishap or close call shall also notify his/her supervisor immediately. The employee's immediate supervisor will call 544-4357, Option 0, to generate the flash report. In addition, the employee's immediate supervisor **shall submit** NASA Form 1627 to S&MA within 6 calendar days. All mishaps **shall be reported** in accordance with MWI 8621.1, *Close Call and Mishap/Incident Reporting and Investigation Program*.

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## 7.0 Attachments, Data, Reports, and Forms

### 7.1 Attachments: Procedure for Avoid Verbal Orders (AVOs)

7.1.1. Customer telephones and requests service.

7.1.2. An AVO is written, containing the following information:

- AVO number
- Requester's name
- Contract line item number
- Specifics (if applicable)
- Number of samples requested
- Sample location and identification number (if applicable)
- Contact person's name, telephone number
- Other essential information.

7.1.3. Contractor is notified of the AVO by telephone and is given a copy of the AVO.

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### 7.2 Reports

The Weekly Report contains a compilation of all sample data collected from the AVO Test Request (Form EM10-F-CHM-036, Figure 7.3-1), the Clean Room and Flow Bench Report Routine Orders (Figure 7.3-2), and the Gases and Liquids Report Routine Orders (Figure 7.3-3). (See section 8 for additional information about the Weekly Report.)

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### 7.3 Forms

7.3.1. AVO Test Request Form. Figure 7.3-1 shows a representative sample of the AVO Test Request Form.

7.3.2. Clean Room and Flow Bench Report Routine Orders. Figure 7.3-2 shows a representative sample of the Clean Room and Flow Bench Report Routine Orders form.

7.3.3. Gases and Liquids Report Routine Orders. Figure 7.3-3 shows a representative sample of the Gases and Liquids Report Routine Orders form.

7.3.4. Calibration Sheet. Figure 7.3-4 shows a representative sample of the Calibration Sheet.

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AVO # 027	Date 11-23-99	Requestor/Org/Ph Cooper/TD71/4-3544	
Contract Line Item #	Specifics if Applicable	Number of Samples	Location, Sample ID#, Specification/Procedure (if not inherent to line item #) Other essential remarks.
5		1	TS 116 Contact: Tommy Barron, LBYB, 4-1283
			① LOX line GN2 purge 50 psi max
			② ips supply line moisture, hydrocarbons - no particulates
Sampled by MSFC?		Env. Compliance Sample?	

1/05

EM10-F-CHM-068

**Figure 7.3-1.**  
AVO Test Request Form  
(sample)

Note: Representative AVO Test Request. Refer to Forms Master List for current version.



Contract No.: NASX-XXXXX  
Report Period: 10-15-00 through 10-22-00

Gases and Liquids Report  
Routine Orders

(Contractor)  
(Mailing Address)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Line	Item	Freq	Location	Requestor	Org.	Sample Medium	Date Sampled	Particulate 30-100U per 30 scf	Moisture ppm	Total CH4 ppm	% (v/v) O2	CO ppm	CO2 ppm	Mass Spec	Odor
4*	W	4481-AV215-250	Caudle	AD23	Air	11/15/00	Max=25 3	Max=0 0	Max=24 0.8	Max 5 0.8	19.5-23.5 21.25	Max = 10 0.1	Max = 500 255.18	500	NEG
5	SM	4708-1102P-88	Johnston	SP43	Air	11/19/00	Max=25 1	Max=0 0	Max=24 0.9	Max 5 0.9	19.5-23.5 21.26	Max = 10 <0.1	Max = 500 <0.1	500	NEG
5*	M	4670-LEVEL12-119	Strickland	TD71	GN <sub>2</sub>	11/20/00	Max=25 1	Max=0 0	Max=24 0.9	Max 5 0.9	19.5-23.5 21.26	Max = 10 <0.1	Max = 500 <0.1	500	NEG
54	Q**	4707-Fill192	Caudle	AD23	DIW	11/19/00	Max=25 1	Max=0 0	Max=24 0.9	Max 5 0.9	19.5-23.5 21.26	Max = 10 <0.1	Max = 500 <0.1	500	NEG
54	Q**	TR2796	Caudle	AD23	DIW	11/19/00	Max=25 1	Max=0 0	Max=24 0.9	Max 5 0.9	19.5-23.5 21.26	Max = 10 <0.1	Max = 500 <0.1	500	NEG

The samples listed above were tested in accordance to MSFC-PROC-404A.

\*High-pressure points unobtainable due to lack of equipment.

\*\*Feb-May-Aug-Nov

(Name)  
EGL Chemist

Report Date: 11-22-00

- 1 Enter Line Item number.
- 2 Enter frequency of order: W = weekly; M = monthly; SM = semi-monthly.
- 3 Enter location of test (building number, room number, point number).
- 4 Enter last name of requestor.
- 5 Enter organization code of requestor.
- 6 Enter atmospheric medium of sample: Air, GN<sub>2</sub>, GHe, etc.
- 7 Enter date sampling was performed.
- 8 Enter reading of particulates 30-100.
- 9 Enter reading of particulates >100.
- 10 Enter moisture reading.
- 11 Enter total hydrocarbons reading.
- 12 Enter oxygen reading.
- 13 Enter carbon monoxide reading.
- 14 Enter carbon dioxide reading.
- 15 Check scan for contaminants.
- 16 Check for presence of odor.
- 17 Enter pH value.
- 18 Enter specific resistance reading.
- 19 Enter reading of particulates 100-175.
- 20 Enter reading of particulates >175.

Figure 7.3-3.  
Gases and Liquids  
Report Routine  
Orders (sample)

Note: Representative Clean Room and Flow Bench Report. For Illustration only..

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Figure 7.3-4.  
Calibration Sheet (sample)

<b>Calibration Statement: Categories IV and V Equipment</b>	
<p><b>Calibration is required before use per MPR-8730.5.</b>          (Calibration before use for each test series and periodic testing          by the Using Line Organization)          Calibration Contacts: EM10/James Perkins, EM10/Mark Griffin</p>	
User Name: _____	
Equipment Description: _____ (attach multiple components sheets if necessary)	
Manufacturer: _____	
ECN: _____ Serial No.: _____ Model No.: _____	
Date of Calibration: _____	
Type of Software and Version: _____	
Listing of Standards Associated with Calibration: _____ _____ _____ _____	
Are standards National Institute of Standards and Technology (NIST) traceable?	<input type="checkbox"/> Y <input type="checkbox"/> N
Did calibration meet equipment manufacturer's specifications?	<input type="checkbox"/> Y <input type="checkbox"/> N
Calibration was performed by: _____	
Remarks: _____ _____ _____ _____ _____ _____ _____	
1/05	ED36-F-CHM-018

Note: Representative Calibration Sheet. Refer to Forms Master List for current version.

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## 8.0 Records

Records for the Environmental Gas Laboratory shall consist of (a) memoranda that contain test results and that are stored electronically in the Materials and Processes Technical Information System (MAPTIS) and (b) calibration records.

### 8.1 Memoranda

Memoranda containing test results shall be retained indefinitely by EM10. These memoranda shall be stored electronically in the MAPTIS database and shall be accessible by test request number or memorandum number. A weekly record of all Environmental Gas Laboratory analyses, which contains all sampling sites and the results obtained, shall be compiled by laboratory personnel and presented to the NASA COTR. This report includes Clean Room/Flow Bench and DI water test results.

### 8.2 Calibration Records

8.2.1. All equipment requiring calibration shall be in current calibration, in accordance with EM10-OWI-CHM-050, *Building 4623 Guidelines for General Operations*.

8.2.2. Form EM10-F-CHM-018, current revision (Figure 7.3-4), shall be used to document the calibration of all Category IV and Category V equipment. For each instrument used in the Environmental Gas Laboratory, a record of calibration performed shall be maintained in a notebook in close proximity to the instrument. Calibration of equipment shall be properly documented on the day of calibration.

### 8.3 Maintenance of Records

8.3.1. Memoranda less than 10 years old shall be maintained in ready-access files in MAPTIS; memoranda 10 years old or older shall be automatically transferred to historical files.

8.3.2. Calibration records shall be maintained on site for a minimum of 10 years, filed and indexed by test request number. These shall be stored in a manner that will protect them, *e.g.*, in a test folder stored in a metal file cabinet. After 10 years, calibration records shall be transferred to historical files.

8.3.3. The original test records shall be saved for a minimum of 5 years

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## 9.0 Tools, Equipment, and Materials

### 9.1 Testing Equipment

9.1.1. Climet Particle Counter: A portable on-site meter that detects contaminant particles, estimates the average particle size (in microns) in gas samples, and measures humidity. It is also used to count particles and measure humidity in clean rooms and flow benches.

9.1.2. Fisher Scientific Micromaster Microscope: A binocular microscope used for particle counts.

9.1.3. TSI Velocicalc: A portable air velocity meter with a hot wire sensor, which determines temperature, relative humidity, airflow, velocity, and pressure differential.

9.1.4. Extech Thermometer/Anemometer: An instrument used to measure temperature and the amount of airflow throughout the clean rooms and flow benches.

9.1.5. Comark Pressure Gauge: This gauge is used to determine the amount of pressure differential in clean rooms; it is not used with the flow benches.

9.1.6. Hach Sens Ion 5 Conductivity Meter: This meter is used to measure the conductivity of liquids.

9.1.7. Orion 610 pH Probe: This instrument is used to measure the pH of a solution.

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### 9.2 Required Tester Maintenance

When Gas Laboratory equipment requires repair or maintenance, **notify** the Environmental Gas Laboratory Manager.

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### 9.3 Calibration

Table 9.3 shows the calibration schedule for relevant Environmental Gas Laboratory instruments.

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### 9.4 Environmental Gas Laboratory Equipment

Table 9.4 lists the Environmental Gas Laboratory instruments.

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Instrument	Calibration Schedule		
	Before Analysis	As Required	Other
Shaw Moisture Meter		✓	
Climet Particle Counter		✓	
Fisher Microscope			Not required
TSI Velocicalc		✓	
Orion 610 pH Probe	✓		
Hach Sens Ion 5	✓		

**Table 9.3.**  
Calibration Schedule

\*Other clean room and flow bench equipment shall be calibrated once a year.

Item Description	NEMS, Model, or SN	Location	Room
Filter Holder	N/A	Bldg. 4623	102
TSI Velocicalc	-	Bldg. 4623	102
Fisher Scientific Micromaster Microscope	1962938	Bldg. 4623	102
Climet Particle Counter	1964655	Bldg. 4623	102
Climet Particle Counter	1964656	Bldg. 4623	102
Extech Thermo-Anemometer	L306023	Bldg. 4623	102
Extech Thermo-Anemometer	L721700	Bldg. 4623	102
Comark Pressure Gauge	C9051S	Bldg. 4623	102
Comark Pressure Gauge	C9051S	Bldg. 4623	102
Matheson Pressure Gauge (24)	63-3122	Bldg. 4623	102
TSI Velometer	8357	Bldg. 4623	102
Orion 610 pH Probe	002369	Bldg. 4623	102
Hach Sens Ion 5 Conductivity Meter	51975-00 CND 0167 184	Bldg. 4623	102
Thermo Orion perpHect Buffer 7.0	M650961	Bldg. 4623	102
Vaisala Temp-Humidity Sensor	T4930007	Bldg. 4623	102
Vaisala Temp-Humidity Sensor	T4510016	Bldg. 4623	102

**Table 9.4.**  
Environmental Gas Laboratory Equipment

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## 10.0 Personnel Training

The nature of work that occurs in the Environmental Gas Laboratory is complex and involves potential hazards; therefore, all activities covered by this OWI shall be performed only by credentialed Environmental Gas Laboratory personnel or under the direct supervision of personnel credentialed to do this work.

### 10.1 Credentials for Clean Room/Flow Bench Testing

Credentialed in Clean Room/Flow Bench testing requires that the candidate perform the following:

- **Train** in the following subjects:
  - General Safe Laboratory Practices
  - OSHA Hearing Conservation Training
  - Inert/Asphyxiant Gases and Liquids
  - Marshal Contractor Safety Forum Training
- **Read** the OWI thoroughly and **sign** a statement of reading and understanding the OWI. Each candidate **shall be issued** a personal copy of the OWI.
- **Pass** a written test (minimum grade of 70) covering the entire OWI (with the exception of section 4.2), administered by the test engineer. This test **shall consist** of multiple choice questions and **shall be given** as an “open OWI test.” A maximum of 1.5 hours **shall be allowed** to complete this test.

In addition to the above requirements, candidates for credentialed in Clean Room/Flow Bench Testing **shall**:

1. **Train** in the use of each instrument used for the work by the instrument’s manufacturer, a credentialed EGL person, or other qualified personnel.
2. **Demonstrate** knowledge of the tests and monitoring equipment by completing 25 successful test sets under the supervision of the test engineer or credentialed EGL personnel.
3. **Demonstrate** knowledge of the tagging procedure and the location of weekly, monthly, and other points.

### 10.2 Credentials for DI Water Testing

Credentialed in Deionized Water testing requires that the candidate perform the following:

- **Train** in the following subjects:
  - General Safe Laboratory Practices
  - OSHA Hearing Conservation Training
  - Inert/Asphyxiant Gases and Liquids
  - Marshal Contractor Safety Forum Training

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- **Read** the OWI thoroughly, and **sign** a statement of reading and understanding the OWI. Each candidate **shall be issued** a personal copy of the OWI.
- **Pass** a written test (minimum grade of 70) covering the entire OWI (with the exception of section 4.1), administered by the test engineer. This test **shall consist** of multiple choice questions and **shall be given** as an “open OWI test.” A maximum of 1 hour **shall be allowed** to complete this test.

In addition to the above requirements, candidates for credentialling in Deionized Water testing **shall**:

1. **Train** in the use of each instrument used for the work by the instrument’s manufacturer, a credentialled EGL person, or other qualified personnel.
2. **Demonstrate** knowledge of the tests and monitoring equipment by completing 5 successful test sets under the supervision of the test engineer or credentialled EGL personnel.
3. **Demonstrate** knowledge of the tagging procedure and the location of the DI water points.

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### 10.3 Recredentialling

After 2 years, credentials **shall expire**, and recredenitalling **shall be required**. Recredenitalling **shall be granted** automatically *if there has been no break in service over 6 months and if the candidate has been performing duties in the credentialled area continuously. If a break in service has occurred for over 6 months*, the candidate **shall repeat** the entire credenitalling process, including testing.

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<b>EMERGENCY PHONE NUMBERS</b>	
<b>Emergency.....</b>	<b>911</b>
<b>Medical Center.....</b>	<b>4-2390</b>
<b>Industrial Safety.....</b>	<b>4-0046</b>
<b>Chemical Spills.....</b>	<b>4-4357</b>
<b>Safety Monitor Building 4623.....</b>	<b>5-0358</b>