

## **DETERMINING WATER CONTENT OF SILICA GEL USING THE LINDBERG FURNACE**

**Purpose** This Meteorology and Air Quality Group (MAQ) procedure describes the steps to determine the water content of silica gel to be used for the AIRNET ambient air sampling system by denaturing it in the Lindberg/Blue 1100 degrees C box furnace.

**Scope** This procedure applies to AIRNET team members assigned to denature silica gel in the Lindberg/Blue 1100 degrees C box furnace at the TA-54 "Cave" and calculate the water content of the silica gel.

**In this procedure** This procedure addresses the following major topics:

<b>Topic</b>	<b>See Page</b>
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**Signatures**

Prepared by:  _____ Alice Baumann, MAQ	Date:  <u>04/10/06</u>
Approved by:  _____ Craig Eberhart, Environmental Air Monitoring Project Leader	Date:  <u>04/13/06</u>
Approved by:  _____ Terry Morgan, QA Officer	Date:  <u>04/13/06</u>
Work authorized by:  _____ Dianne Wilburn, Acting MAQ Group Leader	Date:  <u>04/14/06</u>

04/14/06

### **CONTROLLED DOCUMENT**

This copy is uncontrolled if no red stamp is present on printed copies. Users are responsible for ensuring they work to the latest approved revision.

## General information about this procedure

**Attachments** This procedure has the following attachments:

Number	Attachment Title	No. of pages
1	Hazard Review	2

### History of revision

This table lists the revision history and effective dates of this procedure.

Revision	Date	Description Of Changes
0	06/16/05	New document.
1	4/14/06	Quick-change revision to remove reference to type of crucible material.

### Who requires training to this procedure?

The following personnel require training before implementing this procedure:

- MAQ AIRNET personnel assigned to use the furnace to denature the silica gel and/or calculate the water content

### Training method

The training method for this procedure is **mentored** training by a previously-trained individual and is documented in accordance with the procedure for training (MAQ-024).

Personnel previously trained to revision 0 do not require retraining to this revision.

Annual retraining is required and the training method will be **self-study (reading)**.

### Prerequisites

In addition to training to this procedure, the following training is also required prior to performing this procedure:

- First Aid
- Cardiopulmonary Resuscitation (CPR)

## General information, continued

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**Definitions specific to this procedure**

None.

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**References**

The following documents are referenced in this procedure:

- MAQ-024, "Personnel Training"
  - MAQ-204, "Sampling of Ambient Airborne Tritium"
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**Note**

Actions specified within this procedure, unless preceded with "should" or "may," are to be considered mandatory guidance (i.e., "shall").

## Denaturing the silica gel

**Description of process** Water content of new lots of silica gel may vary from other lots. There also may be some variation within lots. Several cans of silica gel are mixed together using the 55-gallon mixing drum then returned to the cans to be oven dried (according to “Drying the silica gel” in chapter *Preparation of silica gel cartridges* in MAQ-204, “Sampling of Ambient Airborne Tritium”). *Denaturing* heats the silica gel to an extreme temperature at which no water remains, thus allowing the calculation of the “bound” water that is in silica gel. A new determination of water content must be made with every new lot.

**Equipment needed** Collect the following supplies and equipment:

- 7 crucibles
- 2 cans of oven-dried silica gel
- “Bound Water Corrections Worksheet”, printed from AIRNET database page “Gel Bound Water Form”

**Steps to denature silica gel** To denature silica gel and determine water content, perform the following steps:

Step	Action
1	Weigh the 7 empty crucibles with their lids. High-temp marker or etched markings may be used to help identify the crucibles or their associated lids. Record the data on the “Bound Water Corrections Worksheet”.
2	Take 2 cans of oven-dried silica gel and partially fill the 7 crucibles: <ul style="list-style-type: none"> <li>• 2 crucibles from the top of 1 can</li> <li>• 2 from the top of the second can</li> <li>• 2 from ~2/3 down the first can</li> <li>• 1 from ~2/3 down the second can.</li> </ul> Record data on the “Bound Water Corrections Worksheet”.
3	Weigh each setup of crucible, lid, and silica gel and record the data on the worksheet.
4	Place the crucibles in furnace and program to heat at 1000° C for two hours. <b>WARNING: furnace becomes very hot.</b> Place warning sign in front of oven to notify others.
5	Whenever possible, remove items only after the oven has cooled. Only if necessary, use tongs to remove crucibles from hot furnace. Wear gloves and eye protection and stand back when opening hot furnace. When crucibles are cool enough to handle, weigh and record.
6	Record the silica gel lot number and can number on the worksheet.

## Calculating Water Content

**Calculate the water content** Calculate the water content by entering all data in the AIRNET database.

**Steps to enter data** To enter data and calculate the water content, perform the following steps:

Step	Action
1	From the AIRNET Main Switchboard – Field Sampling – Gel Bound Water, click on “Create new correction”. Enter silica gel lot number being analyzed into popup form.
2	Record the following data: <ul style="list-style-type: none"> <li>• silica gel lot number being analyzed</li> <li>• silica gel can numbers</li> <li>• position of the silica gel removed from the can</li> <li>• crucible number</li> <li>• weight of the empty crucible and lid</li> <li>• weight of the un-denatured gel + lid + crucible</li> <li>• weight of the denatured gel + crucible + lid</li> <li>• gel weights</li> </ul>
3	Check entries. If they are correct, click on “Perform Calculations” and click “Add to data sheet”.
4	Repeat steps 2 and 3 for all data.
5	Enter the first sample period for which the new lot will be used into “Effective PeriodID of Correction”.
6	Click on “Compute Average Correction and Load into Results Table”.
7	Print report for logbook and paste copy into AIRNET field logbook.

## Records resulting from this procedure

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### Records

The following records generated as a result of this procedure:

- Entries made on datasheet and placed in logbook

**Note:** Electronic data are stored on the network and backed up according to network backup procedures.

## HAZARD REVIEW FOR DETERMINING WATER CONTENT OF SILICA GEL USING THE LINDBERG FURNACE

Work tasks/Steps	Hazards, Concerns, and Potential accidents; Likelihood/ Severity	Controls, Preventive Measures (e.g., safety equipment, administrative controls, etc.)	Hazard Level from IMP 300-00-00 Hazard Grading Matrix
Use oven according to steps in this procedure (MAQ-257).	Thermal burns to user and others.  Moderate / occasional = Low	Read pertinent instructions and safety considerations in manual prior to use.  Place warning sign near oven to warn others that it is use.  Avoid removing items from hot oven – wait until it has cooled. Only if necessary, use tongs to remove crucibles from hot furnace. Wear gloves and eye protection and stand back when opening hot furnace. Don't touch hot surfaces!	Low

**Wastes or residual materials resulting from process**

Denatured silica gel: Dispose in normal trash.

**Emergency actions to take in event of control failure**

For all injuries, provide first aid and see that injured person is taken to Occupational Medicine (only if immediate medical attention is not required) or the hospital. Notify supervisor and group office as soon as possible.







Air Quality Group  
**PROCEDURE TRAVELER**

This form is from ESH-17-022

**Part 1 (completed by any group employee)**

Procedure number: ENV-MAQ-257 Revision: 0

Procedure title: Determining Water Content of Silica Gel using the Lindberg Furnace

Action Requested:  New procedure  Major revision of existing procedure  Deletion of existing procedure

Description of and reason for action:  Quick-change revision of existing procedure (parts 3 and 5 N/A)

The procedure refers to nickel-chromium crucibles. These crucibles are no longer available through Fisher. Remove reference to crucible material.

Signature: \_\_\_\_\_ Name (print): A. Baumann Date: 3/22/06

**Part 2 (completed by appropriate manager)**

I agree with the action requested:  Yes  No If No, enter reasons below.

If Yes, assigned preparer: \_\_\_\_\_ Affected teams, programs, groups, or individuals required to review this procedure and others who should review it (see procedure page 5):

Required reviewers: \_\_\_\_\_ Optional reviewers: \_\_\_\_\_

Signature: Craig Eberhart Name (print): Craig Eberhart Date: 4/13/2006

**Part 3 (completed by preparer or other qualified safety reviewer)**

I have evaluated, according to ESH-17-035 and LIR300-00-01.0, the risks inherent in performing this procedure and have documented them on the Hazard Control Plan form, or referred to a plan that covers this type of work.

Preparer: Aliu Baumann Name (print): Aliu Baumann Date: 3/22/06

Draft prepared and sent for formal review on: 4/3/06 Comments resolved on: 4/10/06 After comments have been resolved with each reviewer, obtain signatures of the reviewers in part 5.

**Part 4 (signed by safety officer or group leader)**

I agree that the appropriate safety-related activities and appropriate risk level were identified during the hazard evaluation:

Signature: Diane Wilbern Name (print): Diane Wilbern Date: 4/13/2006

**Part 5 (signed by required reviewers: NA for quick-change revisions)**

I attest that all my comments and concerns have been satisfactorily discussed, resolved, and/or incorporated into the final version of the procedure.

Signature: NA Name (print): \_\_\_\_\_ Date: \_\_\_\_\_

Signature: \_\_\_\_\_ Name (print): \_\_\_\_\_ Date: \_\_\_\_\_

Signature: \_\_\_\_\_ Name (print): \_\_\_\_\_ Date: \_\_\_\_\_

Signature: \_\_\_\_\_ Name (print): \_\_\_\_\_ Date: \_\_\_\_\_

Preparer: After all reviewers have signed above section, submit this form with copy of draft and final procedure to records coordinator.