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## Environmental Programs Directorate

### Standard Operating Procedure

for **AIRNET - DETERMINING WATER CONTENT OF  
SILICA GEL USING THE LINDBERG FURNACE**

#### APPROVAL SIGNATURES:

<b>Subject Matter Expert:</b>	<b>Organization</b>	<b>Signature</b>	<b>Date</b>
Shannon Allen	WES-EDA	Signature on File	4/2/2009
<b>Responsible Line Manager:</b>	<b>Organization</b>	<b>Signature</b>	<b>Date</b>
Craig F. Eberhart	WES-EDA	Signature on File	4/2/2009

## 1.0 PURPOSE AND SCOPE

This standard operating procedure (SOP) states the responsibilities and 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 for the Los Alamos National Laboratory (LANL) Waste and Environmental Services Division (WES). This procedure integrates the criteria of the Quality Assurance Plan for the Environmental Programs, hereinafter referred to as the Quality Assurance Plan.

All **WES participants** shall implement this procedure when 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.

## 2.0 BACKGROUND AND PRECAUTIONS

### 2.1 Background

Silica gel retains water (bound water) even above the temperatures at which it is dried for AIRNET usage. This leads to a dilution of tritium in the water extracted during distillation.

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 SOP-5144, "AIRNET - 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.

### 2.2 Precautions

- Furnace can get very hot.

## 3.0 EQUIPMENT AND TOOLS

- Assemble the following equipment: 7 crucibles, 2 cans of oven-dried silica gel and "Bound Water Corrections Worksheet", printed from AIRNET database page "Gel Bound Water Form"

## 4.0 STEP-BY-STEP PROCESS DESCRIPTION

### 4.1 Denaturing the Silica Gel

- |        |  |
|--------|--|
| Worker | <ol style="list-style-type: none"> <li>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" (Attachment 1).</li> </ol> <hr/> <ol style="list-style-type: none"> <li>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" (Attachment 1).</li> </ol> <hr/> <ol style="list-style-type: none"> <li>3. Weigh each setup of crucible, lid, and silica gel and record the data on the worksheet.</li> </ol> <hr/> <ol style="list-style-type: none"> <li>4. Place the crucibles in furnace and program to heat at 1000° C for two hours.</li> </ol> <p><b>WARNING: Furnace becomes very hot. Place a warning sign in front of oven.</b></p> |
|--------|--|

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 final weights on the "Bound Water Corrections Worksheet" (Attachment 1)
6. Record the silica gel lot number and can number on the worksheet.

## 4.2 Calculating Water Content

- Worker
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. Enter the following into the electronic Bound Water Corrections Worksheet in the database:
    - silica gel lot number being analyzed
    - silica gel can numbers
    - position of the silica gel removed from the can
    - crucible number
    - weight of the empty crucible and lid
    - weight of the un-denatured gel + lid + crucible
    - weight of the denatured gel + crucible + lid
    - gel weights
  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".

## 4.3 Records Management

- Worker
1. Records will be submitted to the Records Processing Facility according to EP-DIR-SOP-4004, Records Transmittal and Retrieval Process.

## 5.0 DEFINITIONS

N/A

## 6.0 PROCESS FLOW CHART

N/A

## 7.0 ATTACHMENTS

Attachment 1 Bound Water Corrections Worksheet

## 8.0 REVISION HISTORY

Revision No. <i>[Enter current revision number, beginning with Rev.0]</i>	Effective Date <i>[DCC inserts effective date for revision]</i>	Description of Changes <i>[List specific changes made since the previous revision]</i>
0	06/16/05	New document.
1	04/14/06	Quick-change revision to remove reference to type of crucible material.
0	4/2/2009	New document number and reformatted for WES division. Formerly ENV-MAQ-257.

**ATTACHMENT 1: BOUND WATER CORRECTIONS WORKSHEET**

<b>SOP - 5178-1</b>  <b>Date:</b> _____	<b>Bound water corrections worksheet</b>  <b>Lot #:</b> _____	Records Use Only  

Crucible Number	Can Number	Position of gel in can (relative to top or bottom)	Mass of Empty Crucible plus Lid (grams)	Pre-denatured Silica Gel plus Crucible plus Lid (grams)	Denatured Silica Gel plus Crucible plus Lid (grams)	Comments
1						
2						
3						
4						
5						
6						
7						

*Example*