Technical Audits of the Chemical Speciation Laboratories

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US EPA ORIA-Montgomery
Before the
IMPROVE Steering Committee
September 5-6, 2007

Items to Cover

- Who / What is NAREL?
- History of QA Support from NAREL
- Audit Procedures Explained with Recent Examples

US EPA / NAREL

US EPA / OAR / ORIA / NAREL

Agreement Between ORIA and OAQPS

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Specific QA Activities

- PT Samples
  single-blind samples analyzed at different labs
- Laboratory TSA
  on-site inspection and interviews with lab staff
- Special Studies
  experimental investigations

History of QA Support

Date	*Activity*	*Link*
Nov 2000	PT samples submitted to RTI	no
Dec 2000	On-site audit at RTI	yes
Nov 2001	Special Study of quartz filter contamination	yes
Dec 2001	PT samples submitted to RTI	yes
Feb 2002	On-site audit at RTI	yes
Jun 2002	Special Study of Nylon filter extraction efficiency - autumn season	yes
Jul 2002	PT samples submitted to RTI and DRI	yes
Jan 2003	PT samples submitted to UC-Davis	yes
Feb 2003	Special Study to further examine quartz filter contamination	no
May 2003	Special Study of Nylon filter extraction efficiency - summer season	yes

History of QA Support (continued)

Date	*Activity*	*Link*
Sep 2003	On-site audit at RTI	yes
Nov 2003	PT samples submitted to RTI	yes
Jan 2005	PT samples submitted to CARB, DRI, ODEQ, RTI, and EPA-RTP	yes
Mar 2005	On-site audit at DRI	yes
Mar 2005	On-site audit at UC-Davis	no
Jul 2005	On-site audit at RTI	yes
May 2006	PT samples submitted to CARB, DRI, ODEQ, RTI, UC-Davis, and EPA-RTP	yes
May 2007	On-site audit at DRI	yes
May 2007	On-site audit at UC-Davis	yes

Example of NAREL Report

TECHNICAL MEMORANDUM

TO:	Dennis Crumpler / OAQPS
	Dr. Marc Pitchford / IMPROVE Steering Committee Chair
FROM:	Eric Boswell / NAREL
COPY:	Dr. Charles McDade / UC-Davis
AUTHOR:	Jewell Smiley / NAREL
DATE:	August 4, 2007
SUBJECT:	UC-Davis Laboratory Audit

Introduction

On May 16-17, 2007, a Technical Systems Audit (TSA) was conducted at the Crocker Nuclear Laboratory (CNL) located on the campus at the University of California in Davis, California (UC-Davis). The TSA was performed as part of the quality assurance oversight provided by the U.S. Environmental Protection Agency (EPA) for the Interagency Monitoring of Protected Visual Environments (IMPROVE) program. The Air Quality Group working at the CNL facility has been providing valuable and critical services for the IMPROVE program since the program began in 1987. More information about the program can be found at the IMPROVE web site at the following address. http://vista.cira.colostate.edu/improve

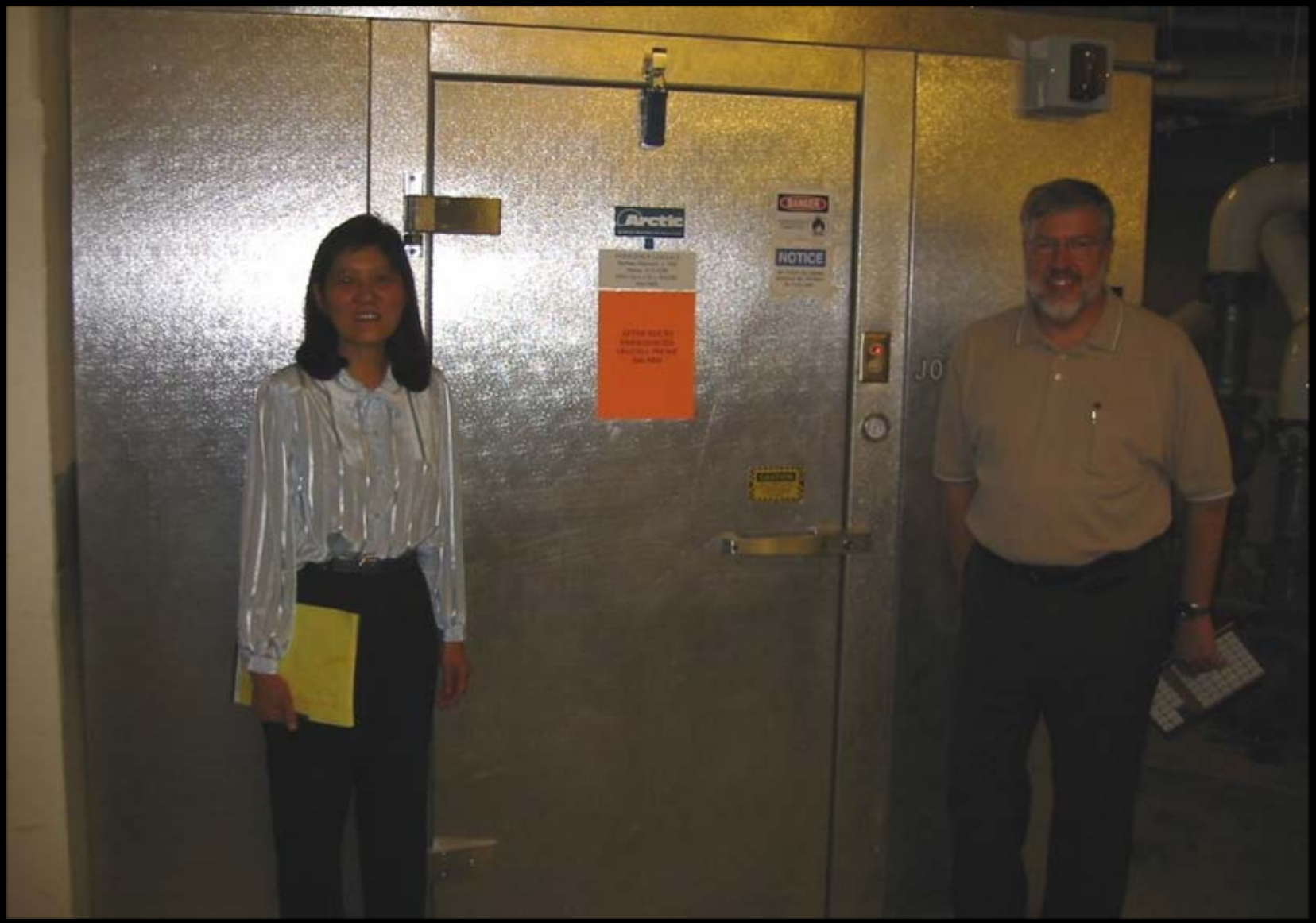
The audit was performed by Steve Taylor, Jewell Smiley, and Marc Pitchford. Steve and Jewell are

Travel to Audits - March 2005

Travel to Audits - March 2005

DRI Audit - March 2005

On-site Audit at DRI – May 2007



On-site Audit at DRI – May 2007

Leaving DRI Audit – May 2007

Leaving DRI Audit – May 2007

On-site Audit at RTI – July 2005

On-site Audit at RTI – July 2005

Preparing for an On-site Audit

- Request copy of most recent QA documents –
  laboratory SOPs, QAPP, organizational chart
- Check report from last audit and PT samples –
  select items to discuss during audit
- Prepare supplies for on-site measurements –
  standards, data loggers
- Schedule a convenient time for the audit and communicate the agenda

Historical Audit Issue

After PM has been collected onto the surface of a teflon filter, how is the gravimetric mass measurement affected by humidity?

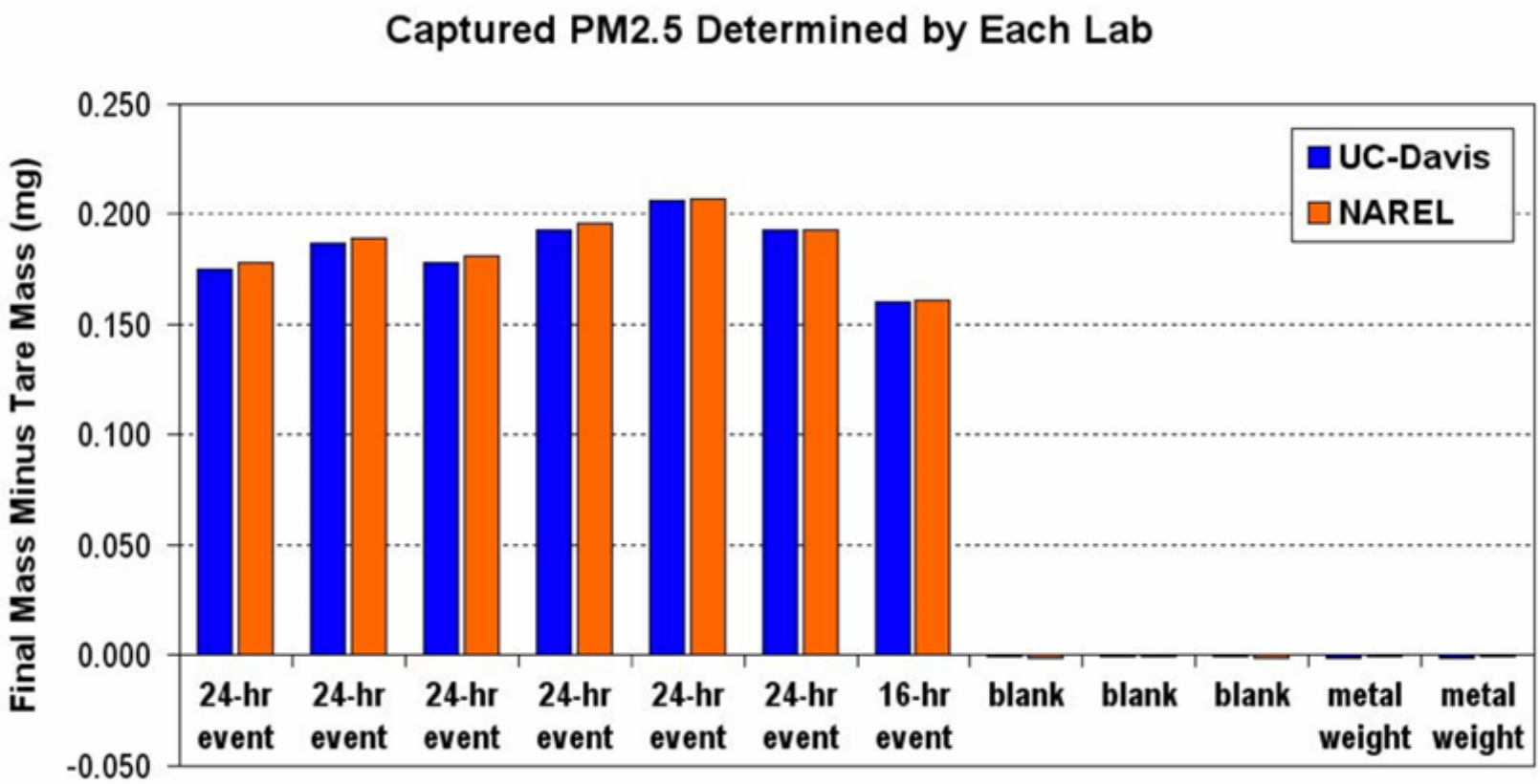
UC-Davis Audit – May 2005

Report Finding #4: Filters are not equilibrated for at least 24-hours within a weighing chamber with good control of temperature, humidity, and dust.

Comment: UC-Davis has provided evidence that filters equilibrate to constant mass within ten minutes [see Table 3]. The audit team has not seen evidence to dispute their findings. The weighing laboratory personnel began their analysis of a gravimetric PE sample set during this TSA while the audit team was present. The final results, which were excellent, are included in this report [see Figure 2, Figure 3, and Table 4].

UC-Davis Audit Report – March 2005

Figure 2



UC-Davis Audit Report – March 2005

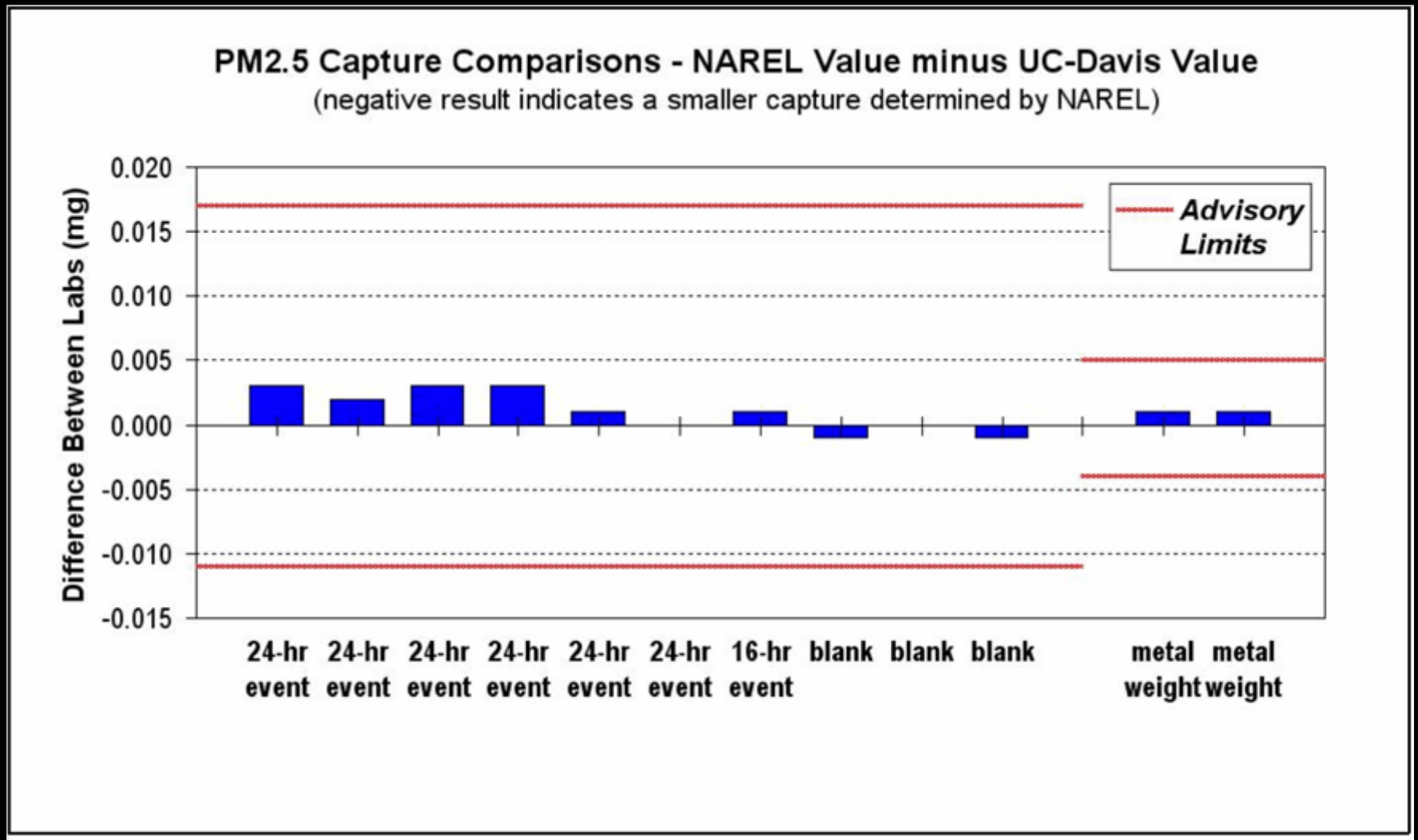
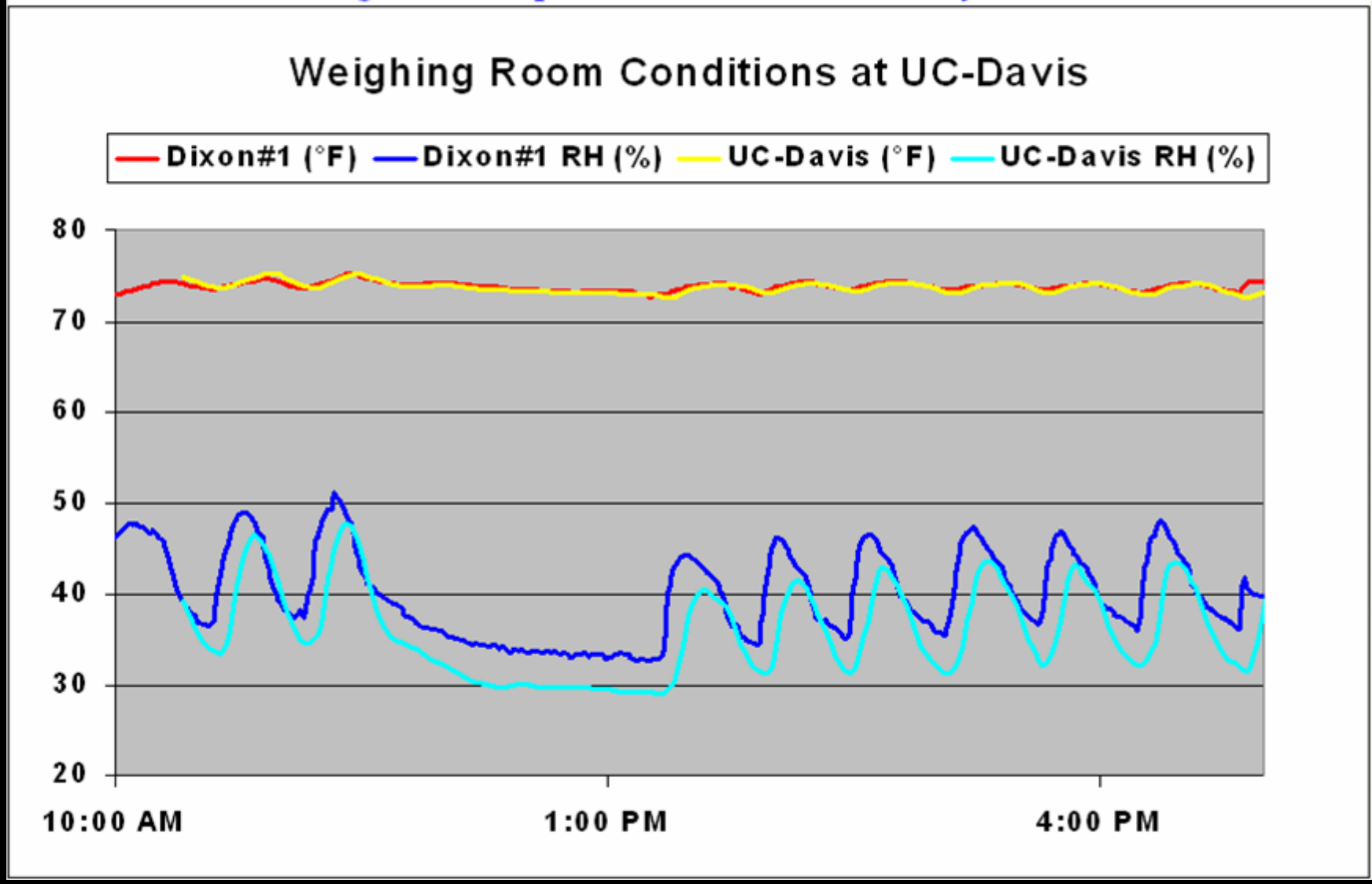


Figure 3

Weighing Room at UC-Davis (2005)

Figure 1. Temperature and Relative Humidity Data



Experiment Performed at NAREL

1) Test filters were loaded with PM2.5 at NAREL.
2) Filters were placed into zip lock bags before bringing them into the lab.
3) Each filter was weighed several times at 35% RH.
4) Each filter was weighed several times at 60% RH.
5) Each filter was weighed again at 35% RH.
6) Chamber temperature was held constant at 70 °F.
7) Exposure time to chamber humidity was recorded before each measurement.

Description of the Test Filters

- ✓ Six 25-mm teflon filters

2 replicates from 68-hour collection event

2 replicates from 24-hour collection event

2 blank filters

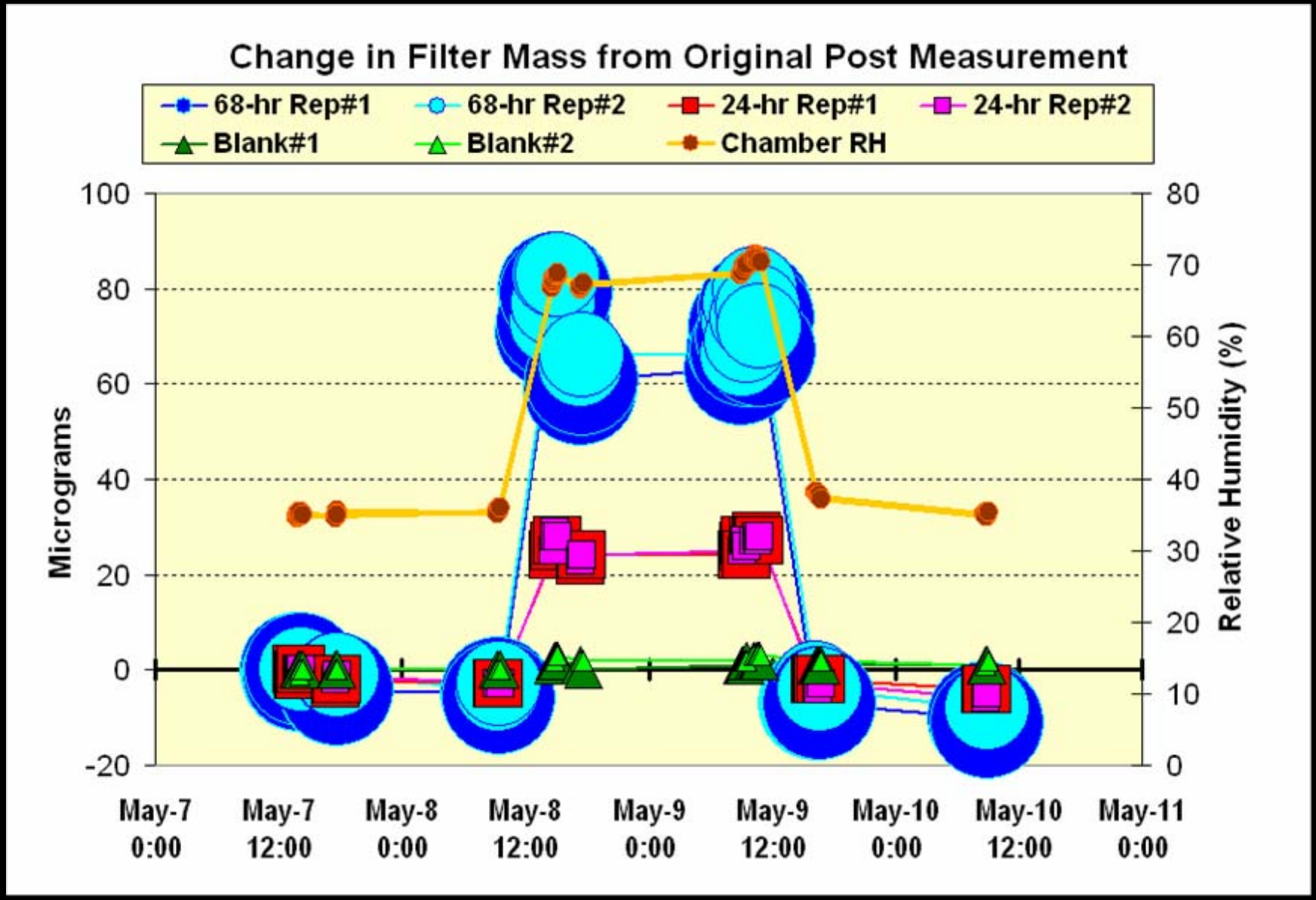
- ✓ Only one type of filter and one kind of air was tested.

Speciation Air Samplers at NAREL

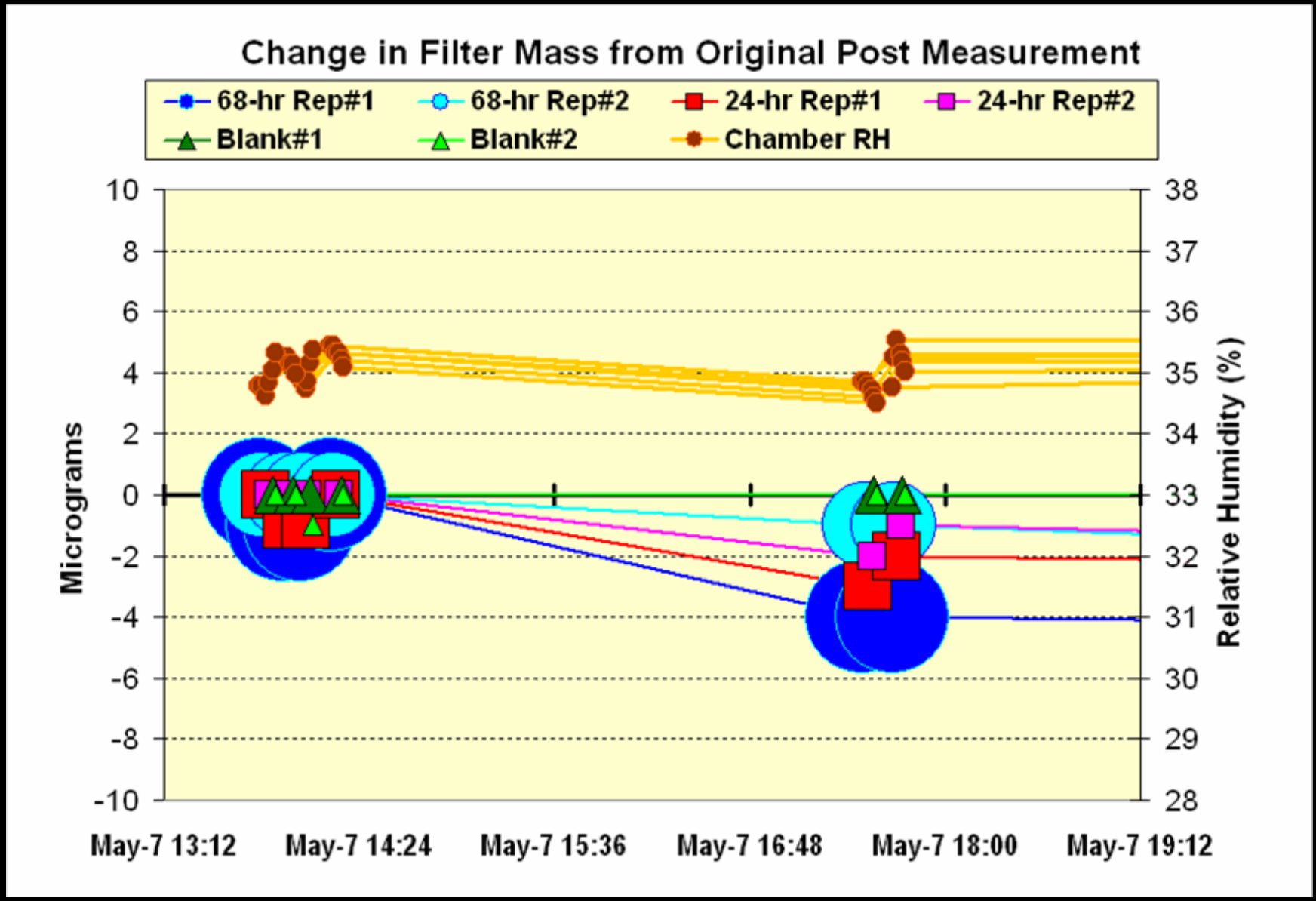
Weighing Chamber at NAREL

Weighing Chamber at NAREL

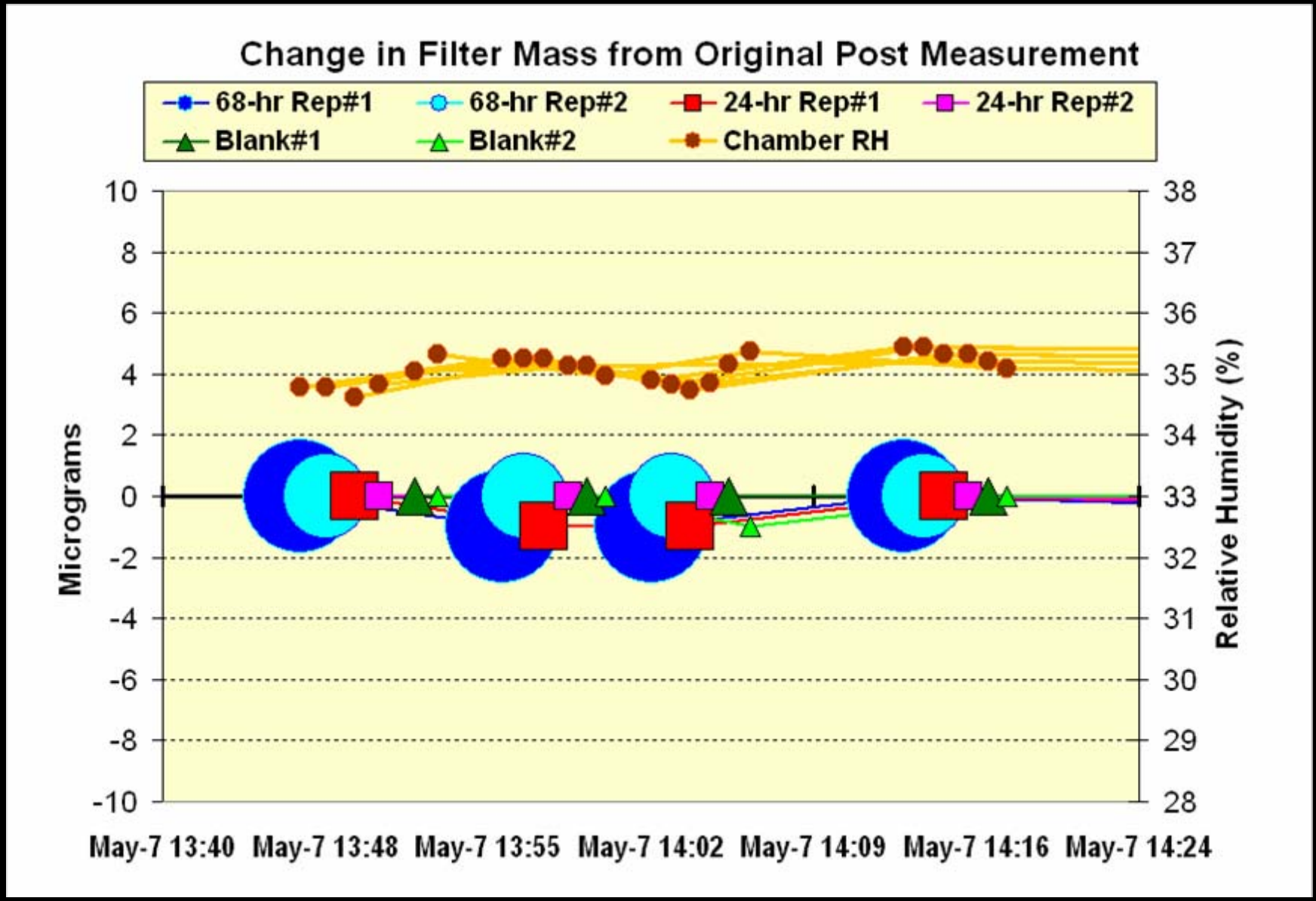
Gravimetric Mass and Humidity



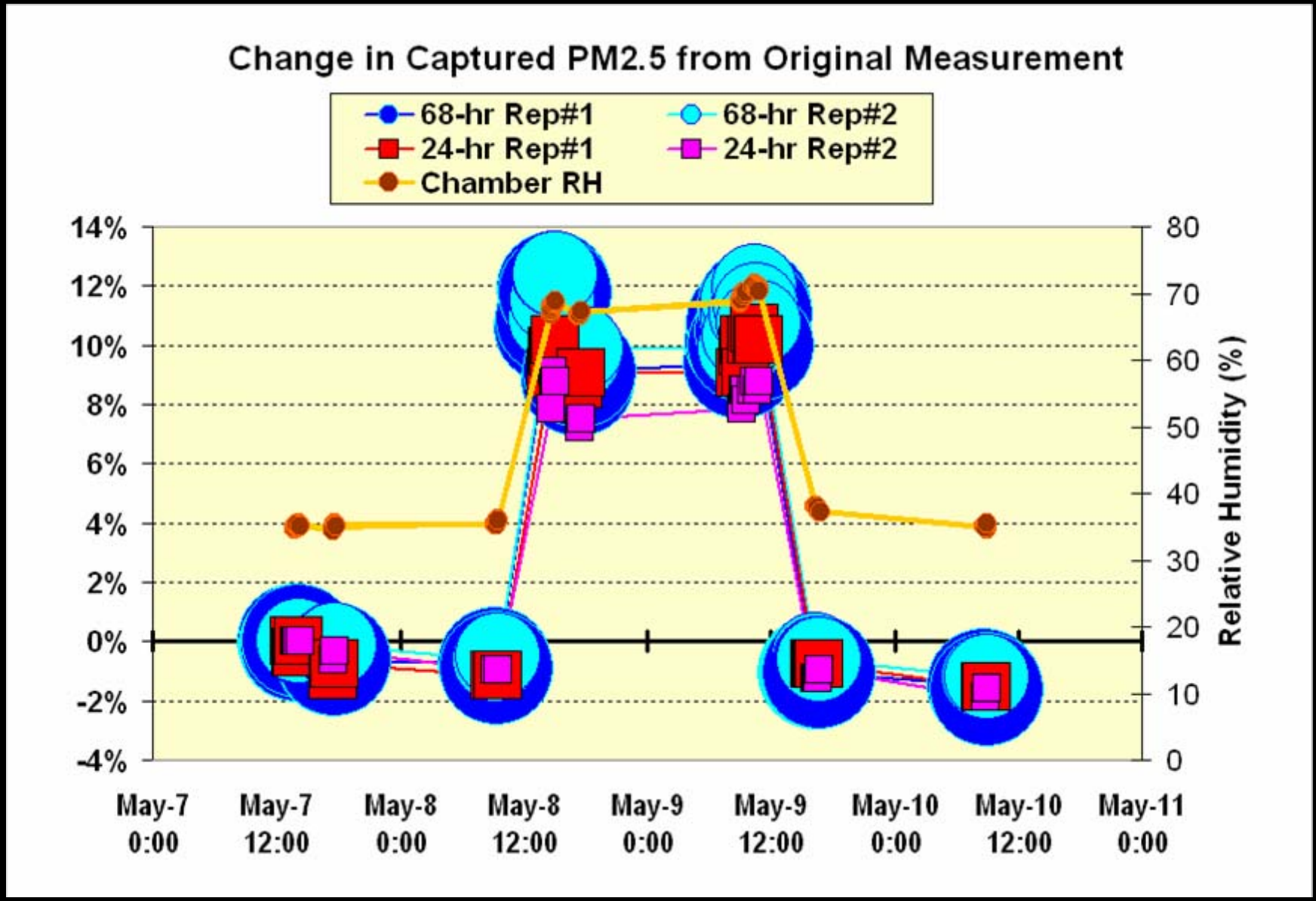
Gravimetric Mass and Humidity



Gravimetric Mass and Humidity



Gravimetric Mass and Humidity



What did we learn?

- The mass measurement can be affected by humidity, and the kinetics are fast for 25-mm IMPROVE filters.
- Changes in mass seem to be reversible.

UC-Davis Audit – March 2007

Report Finding #2: Currently blank filters are weighed more than once to generate precision data, but loaded filters are not routinely weighed more than once. This audit has demonstrated that large swings in humidity occur inside the weighing room which could affect loaded filters more than blank filters. This is a potential problem that was identified during the last EPA audit.

Recommendation: A small percentage of loaded filters should be weighed more than once to generate new precision data. The repeat measurement should not be made immediately but it should not be delayed for more than a few hours. NAREL has observed loaded filters to gradually lose mass over time possibly due to the vapor pressure of the captured semi-volatile components of the PM.

Questions?