

BROOKHAVEN NATIONAL LABORATORY Safety & Health Services Division Standard Operating Procedure	NUMBER HP74900
	REVISION FINAL Rev1
SUBJECT: Nano-scale Material Meter Operation	DATE 07/07/10
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1.0 Purpose/Scope

The purpose of this document is to provide a link to the procedures for operating the meters used for airborne nanomaterial testing. The procedure is based and supplements on information provided in the operation and service manual.

2.0 Responsibilities

- 2.1 This procedure will be implemented through the SHSD Industrial Hygiene Group Leader. Members of the SHSD Industrial Hygiene Group, Safety & Health Services Representatives and other organizations can perform tasks in this program.
- 2.2 The persons using these meters are responsible to:
 - Ensure the integrity of the data and proper transfer to the IH Group database.
 - Maintain training for the appropriate personal protective equipment needed for areas entered.
 - Complete all required training and qualification for other hazards that may be present in areas (such as respiratory protection or radiation contamination)
 - Comply with all work planning and work permit system requirements.
 - Request and check the instrument in and out following the SHSD IH Group lab procedures.

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3.0 Definitions

Flooding: Exposure of the sensor(s) to an excessive concentration of a gaseous substance to the point that the linearity of the sensor response becomes invalid and the meter will not indicate the correct concentration.

Interferences: nanomaterials that can cause the meter to give a false response. Example, hydrogen gas causes the carbon monoxide sensor to indicate the presence of CO even when none is present.

4.0 Prerequisites none

5.0 Precautions

Hazard Determination:

- These meters may be used in areas where nanomaterial contamination may be present. These contaminants can have significant health effects and must receive a hazard evaluation by a cognizant ESH professional. These meters do not generate a hazard to the operator or occupants. The meter readings must be observed continuously when entering areas of potential hazards. The user should leave the area if the OSHA PEL or ACGIH TLV or BNL Internal Exposure Levels are exceeded.
- Using this procedure does not generate Hazardous Wastes or have negative environmental consequences.
- The test equipment design does not cause significant ergonomic concerns in routine use. These meters do not have a noise hazard.

Personal Protective Equipment

- These meters are primarily used for measuring the concentration of nanomaterials in ambient air. Personal Protective Equipment may be needed as appropriate to the task based on the anticipated and measured airborne concentrations. Eye protection is required.

Job Risk Assessment: Consult the *Job Risk Assessment* [SHSD-JRA-05](#) for the risk analysis of this operation based on the hazards and controls of this SOP.

6.0 Procedure

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- 6.1 Inspect the meter: Visually inspect the meter to ensure all parts are working, undamaged and the batteries are good. Each unit has a calibration sticker, which shows the past calibration date and the due date for the next calibration. Do Not use a meter that is out of calibration.
- 6.2 See Attachments in Section 9 or the meter Instrument Manual/ Operating Instruction for guidance on operation of the meters.
- 6.3 Record testing/measuring results on the appropriate sampling form in SHSD IH procedures, such as *Direct Reading Meter* form. Forms are available in the SHSD SOP web page in IH60500.
- 6.4 Return meter and original copy of the *Direct Reading Instrument* sampling form to the SHSD IH Laboratory. Note and mention any problems with the meter.
- 6.5 Results interpretation:
 - A competent person should write a hazard evaluation report evaluating the monitoring if it evaluated the potential for occupational exposure and indicates the status of compliance with OSHA and ACGIH Occupational Exposure Limits.
 - Ensure all forms and reports are distributed in accordance with *Reporting Personnel Exposure Monitoring Results* IH60500.

7.0 Implementation and Training

- 7.1 Using these meters is to be performed only by persons who have demonstrated competence as evidenced by experience and/or training. The qualification to use these meters is documented using Attachment to this SOP: *Job Performance Measure*.

8.0 References

None

9.0 Attachments

- 9.1 TSI 3007 CPC Meter Operation
- 9.2 *Job Performance Measure*

The only official copy is on-line at the SHSD IH Group website.
 Before using a printed copy, verify that it is current by checking the document issue date on the website.

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10.0 Documentation

Document Development and Revision Control Tracking		
Prepared By: <i>R. Selvey 10/08/09</i> <i>(signature/date on file)</i> (As IH74900)	Reviewed By / Date:	Approved By / Date: <i>(signature/date on file)</i> J. Peters 07/07/10 (As HP74900) SHSD S&H Representative Group Manager
ESH Coordinator/ Date: <i>none</i>	Work Coordinator/ Date: <i>none</i>	SHSD Manager / Date <i>none</i>
QA Representative / Date: <i>none</i>	Training Coordinator / Date: <i>none</i>	Filing Code: HP74.05
Facility Support Rep. / Date: <i>none</i>	Environ. Compliance Rep. / Date: <i>none</i>	Effective Date: 10/08/09
ISM Review - Hazard Categorization <input type="checkbox"/> High <input type="checkbox"/> Moderate <input checked="" type="checkbox"/> Low/Skill of the craft	Validation: <input type="checkbox"/> Formal Walkthrough <input type="checkbox"/> Desk Top Review <input type="checkbox"/> SME Review Name / Date:	

Revision Log
Purpose: <input type="checkbox"/> Temporary Change <input type="checkbox"/> Change in Scope <input type="checkbox"/> Periodic review <input type="checkbox"/> Clarify/enhance procedural controls Changed resulting from: <input type="checkbox"/> Environmental impacts <input type="checkbox"/> Federal, State and/or Local requirements <input type="checkbox"/> Corrective/preventive actions to non-conformances <input type="checkbox"/> none of the above Section/page and Description of change: SME Reviewer/Date: Rev1 07/07/10 Remove "intrinsically safe" passage from text in Appendix 9.1. Change document number from IH74900 to HP74900

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Attachment 9.1

TSI Model 3007 Condensation Particle Counter (CPC)

The CPC analyzer is not intrinsically safe.

This unit uses isopropyl alcohol, which is flammable. In the quantities used in this instrument, the risk of an uncontrolled fire is very small. However, refer to the [TSI MSDS](#) for handling precautions and first aid procedures.

- Always recap the alcohol fill capsule and other containers immediately to prevent absorption of moisture and the escape of fumes. Do not use any alcohol which is visibly contaminated.
- Never transport or store the CPC with the alcohol cartridge inside it. Flooding of the optics could occur.
- Never leave the cartridge cavity open longer than necessary. Use the storage cap to cover the cartridge cavity when the CPC is transported or stored.
- When the CPC is stored in the carrying case, store the cartridge in the fill capsule.
- Also, install the storage cap into the cartridge cavity to prevent dirt or lint from getting inside the CPC.



Equipment:

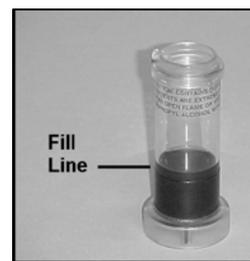
- TSI Model 3007 CPC
- Battery Holder
- Spare Batteries (6 AA)
- Carrying Case
- AC Charger
- TSI Approved Isopropyl Alcohol
- Alcohol Fill Capsule
- Alcohol Cartridge
- 30 ml alcohol bottle
- Mesh Storage Bag
- Spare wick kit,
- computer cable,
- HEPA zero filter and adaptor

1. Battery check

- a. Open the bottom panel of the meter and ensure the battery pack is installed.
- b. When using the AC adaptor the batteries are bypassed and will not charge.
- c. There is an internal battery that is not user replaceable. This battery maintains the logged data when the instrument is turned off or the batteries are being replaced.

2. Filling the Alcohol Capsule:

- a. Turn the CPC off.
- b. Open the alcohol fill capsule by twisting the storage cap counter-clockwise. Set the Storage cap down on a clean surface, with the end standing up.



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- c. Open the bottle of alcohol. Invert the bottle and insert the nozzle end into the alcohol fill capsule as far as possible to make certain that you cannot inadvertently spray alcohol anywhere except down into the capsule.
- d. Squeeze alcohol into the alcohol fill capsule until the liquid level is even with the scribed fill-line near the base. Recap the alcohol bottle.
- e. Make certain the alcohol cartridge is clean! Insert the alcohol cartridge into the alcohol fill capsule by aligning the groove with the pin and turning 1/8 turn clockwise until it locks into place.
- f. Set the alcohol fill capsule down and wait a few minutes while the wick inside the cartridge soaks up alcohol.
- g. Remove the cartridge from the capsule and gently shake it over the capsule to allow excess alcohol to drain back into the capsule. Stop when excess alcohol is no longer dripping. It is not necessary to wait until the outside surface of the alcohol cartridge is dry.



- h. Insert the cartridge into the CPC. DO NOT FORCE IT. Align the tab on the cartridge with the tab on the CPC.
- i. As you approach full insertion, firmly twist the cartridge clockwise about 1/8 turn. It should snap into position.
- j. Recap the alcohol fill capsule using the storage cap.
 - Always recap the alcohol fill capsule and other containers immediately to prevent absorption of moisture and the escape of fumes. Do not use any alcohol which is visibly contaminated.
 - Never transport or store the CPC with the alcohol cartridge inside it. Flooding of the optics could occur.
 - Never leave the cartridge cavity open longer than necessary. Use the storage cap to cover the cartridge cavity when the CPC is transported or stored.
 - When the CPC is stored in the carrying case, store the cartridge in the fill capsule. Also, install the storage cap into the cartridge cavity to prevent dirt or lint from getting inside the CPC.



3. Turn On and Operation

- a. The CPC can be used as a survey meter or data logger.
- b. Turn the meter on by pushing in the ON/OFF button on the front of the instrument (hold for 2-3 seconds). The instrument will go through a warm-up period of approximately 600 seconds.
- c. It will automatically begin monitoring in the survey mode. The real-time display is concentration in particles per cubic centimeter (pt/cc). The display is updated once each second.

Note: The instrument must be maintained in a *horizontal* position at all times. Tilting the instrument for prolonged periods will flood the optics and require factory servicing. A tilt error message will be displayed, a beep sound, the pump stopped and the screen blanked if the instrument is tilted for more than 4 seconds. Upon return to horizontal, the unit will reset and begin monitoring again. It may be necessary to start logging mode again.

4. **Perform Daily Zero Check:** Once per day conduct this zero check to verify normal operations.
 - a. Turn on the instrument and let it warm-up.

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- b. Attach the zero filter assembly to the inlet screen assembly.
- c. The pt/cc reading should go to zero in 5-10 seconds. Leave the filter attached for 30 seconds to ensure a stable reading.

5. Using the Keypad

- The backlight option adjusts the length of time the backlight stays on after a key is pressed or an alarm goes off. Prolonged use of the backlight may severely reduce the overall battery life.
- The keypad has four arrows and an *Enter* key to move through the menus and select items.
- The main menu has three options: **Absolute Pressure**; **Setup**; and **Log Mode 1**.
- The **Setup** mode allows review of logged data, and can be used to change date/time, log interval, backlight interval; audio function and clearing memory.
- The default values for log intervals are set at 1 second, or 1, 5, 15, and 30 minutes. The interval is a frequency and averaging period. As an example, when the interval is set to 5 minutes the reading will be recorded every 5 minutes and will be an average over the 5 minute period.
- Clearing the memory. Performing this step will erase ALL logged data files and is not reversible.
- The **Log Mode1** selection on the main menu allows selection of the logging mode (1, 2 or 3). **Log Mode 1** is the default. **Log Modes 2 & 3** are more sophisticated logging modes that require programming through the Aerosol Instrument Manager software.
- The *Enter* key will select the log mode and begin logging. The following screen will be displayed. Pressing the *Enter* key again will stop the log mode and return to survey mode.



4048		PT/CC
MIN 4032	08:32:00	
MAX 4950	09:27:00	
	98 % MEM	
LOG MODE 1	↵ TO STOP	

6. The **Log Mode** can store approximately 1000 hours of logged tests when recording at 1 minute intervals and may be separated into as many as 141 tests. Shorter logging intervals use memory more quickly.
7. **Recommended Maintenance:** The following list is the factory recommended maintenance schedule.
 - a. **Daily Zero Check** – Before each use.
 - b. Recharge the alcohol wick – Before each use
 - c. Change the alcohol wick – As needed. This should be performed by the IH Lab Manager.
 - d. Factory Calibration and Cleaning - Annually

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Measurement Principles

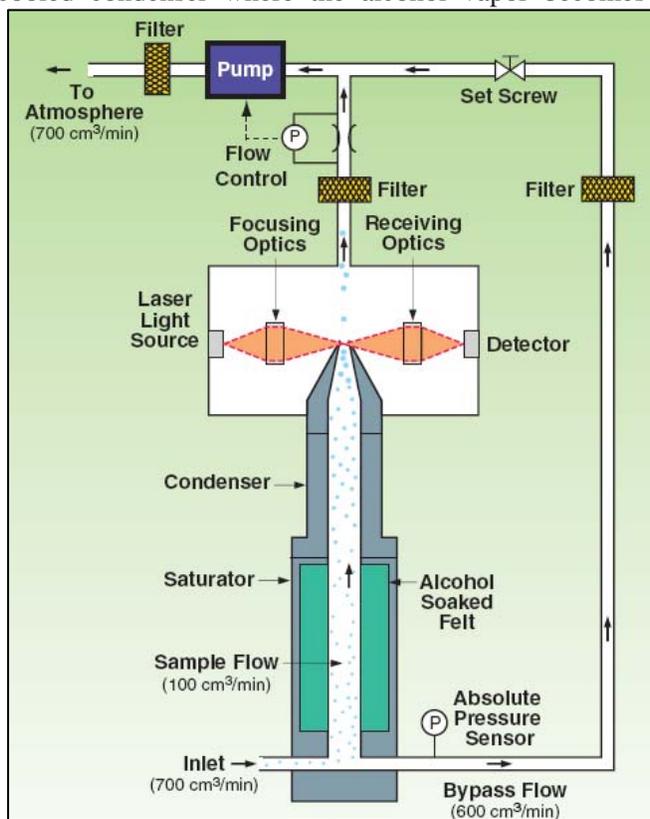
Laminar-flow Condensation Particulate Counters (CPCs) operate by drawing an aerosol sample continuously through a heated saturator, in which alcohol is vaporized and diffuses into the sample stream. Together, the aerosol sample and alcohol vapor pass into a cooled condenser where the alcohol vapor becomes supersaturated and ready to condense. Particles present in the sample stream serve as condensation sites for the alcohol vapor. Once condensation begins, particles grow quickly into larger alcohol droplets and pass through an optical detector where they are counted easily.

Particle size range is 0.01 to >1 micrometer (10 to 1000 nanometers) and the concentration range is 0 to 100,000 particles per cubic centimeter (pt/cc) with +/- 20% accuracy. Temperature range for use is 50 to 95° F. Battery life is reported to be approximately 5 hours of continuous use with 6 hours per fill of the alcohol.

The unit can be used in either the survey mode or logging mode. Logged data is downloaded to a computer using TSI's *Aerosol Instrument Manager Software*. Readings are in pt/cc and the unit is non-discriminatory for particular materials counting all particles passing through the detector.

A battery pack provides power for daily use. The system includes a separate charger/power supply which allows the analyzer to be powered from an ac supply. This allows the unit to be left in the logging mode for extended periods of time (multiple days).

The meter uses high purity isopropyl alcohol and must remain horizontal (display facing up) during use or damage can occur to the unit. During transport the alcohol must be removed from the unit to prevent leakage and damage to the optics inside the unit.



**Operation of Nanoscale Material Measuring Meters
Job Performance Measure (JPM) Completion Certificate**

Candidate's Name	Life Number:
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Knowledge of the Principles of IAQ Investigations

Criteria	Qualifying Standard	Unsatisfactory	Recovered	Satisfactory
Hazard Determination	Understands the content of the hazard determination, risk assessment, and PPE for the meter use			
Sampling Equipment	Knows where equipment described in the procedure is located and how to properly sign it out.			
Procedure Content	Knows the calibration requirements for meter use, data analysis process, and the location of sampling forms.			
Meter Operation-TSI 3007 CPC	<input type="checkbox"/> Demonstrates the proper way to set up, turn on, change settings, store data, and retrieve data from the meter.			
Meter Operation-	<input type="checkbox"/> Demonstrates the proper way to set up, turn on, change settings, store data, and retrieve data from the meter.			
Meter Operation-	<input type="checkbox"/> Demonstrates the proper way to set up, turn on, change settings, store data, and retrieve data from the meter.			

Employee: I accept the responsibility for performing this task as demonstrated within this JPM and the corresponding SOP.

Candidate Signature:	Date:
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Evaluator: I certify the candidate has satisfactorily performed each of the above listed steps and is capable of performing the task unsupervised.

Evaluator Signature:	Date:
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