

The Arizona Border Study

*An Extension of the
Arizona National Human Exposure Assessment Survey (NHEXAS) Study
Sponsored by the Environmental Health Workgroup of the Border XXI Program*

Quality Systems and Implementation Plan for Human Exposure Assessment

The University of Arizona
Tucson, Arizona 85721

Cooperative Agreement CR 824719

Standard Operating Procedure

SOP-UA-L-7.1

Title: Harvard PM Impactor Calibration and Leak Testing

Source: The University of Arizona

U.S. Environmental Protection Agency
Office of Research and Development
Human Exposure & Atmospheric Sciences Division
Exposure & Dose Research Branch

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Title: HARVARD PM IMPACTOR CALIBRATION AND LEAK TESTING

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APPROVALS

☒ Full SOP ☐ Working SOP #pages 6

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Harvard PM Impactor Calibration and Leak Testing

1.0 Purpose and Applicability

This SOP describes the procedures to be followed during the periodic calibration and leak testing of Harvard particulate matter (PM) impactor units. This procedure applies directly to the calibration and leak testing of Harvard particulate matter (PM) impactor units used for the EPA NHEXAS and EPA Border projects of the University of Arizona/Battelle/Illinois Institute of Technology consortia, as well as future "Health in the Environment" investigations..

2.0 Definitions

- 2.1 Impactor Units = metal housing for the PM filters, attached to the Black Boxes, which control the flow of air into and through the PM filters.
- 2.2 PM = Particulate matter
- 2.3 Pressure "T" = a metal "T" connector with three one-foot lengths of tubing connected that is used to insert the magnehelic gage in the calibration line next to the flow damper. One of the tubes connected to the bar of the "T" has an adjustable clamp on it.
- 2.4 SOP = Standard Operating Procedure

3.0 References

- 3.1 Turner, William. Manual for the Indoor Sampler (Draft dated 10/7/85), Section 3.5, Harvard School of Public Health, Boston, Mass., 1985.

4.0 Discussion

This procedure is primarily derived from the operating instructions that accompanied the Harvard PM samplers. The leak check of the impactor units was added to provide a check on the flow integrity of the impactors following modification of their bases to accept circular filter holders. The test is accomplished by inducing a negative pressure in a closed impactor system and monitoring any pressure increase in a positive sense.

5.0 Responsibilities

- 5.1 The Project Director will be responsible for:
 - 5.1.1 Final review and approval of this procedure.
- 5.2 The Project Lab Supervisor will be responsible for:
 - 5.2.1 Insuring SOP procedures are followed by the Project Lab.
 - 5.2.2 Notifying the appropriate technicians with needed repairs. In cases when the item can not be fixed in house, Project Field Coordinator will generate the appropriate

paperwork, notify the appropriate vendor or company, and ship the dysfunctional item.

5.3 The Project Lab Staff will be responsible for:

- 5.3.1 Knowing and following the procedures described in this SOP.
- 5.3.2 Recording the information as directed in this SOP.
- 5.3.3 Notifying the Project Lab Supervisor with down equipment and repair supplies needed (where applicable).
- 5.3.4 Providing the Project Lab Supervisor with down equipment label and isolating the down equipment into the down equipment area.
- 5.3.5 Insuring proper labeling techniques of down equipment.
- 5.3.6 Repairing the item (where applicable) in a timely matter.

6.0 Equipment and Materials

6.1 Equipment

- 6.1.1 Flow damper array
- 6.1.2 Impactor Units, 2.5 μm orifice (silver)
- 6.1.3 Impactor Units, 10.0 μm orifice (red)
- 6.1.4 Magnehelic gage with 100 inches H_2O range
- 6.1.5 Modified indicator tube hand pump
- 6.1.6 Pressure "T" with clamp
- 6.1.7 Rubber stopper, #7

7.0 Procedure

7.1 Preparation

- 7.1.1 PM Impactor and work area set-up
 - A. Wipe down work area.
 - B. Assemble impactors to be tested.
 - C. Fill in the impactor head and base numbers along with the date and the technician's initials on the "Impactor Service Log" (figure 1).

7.2 Procedures

- 7.2.1 Leak test of impactor units
 - A. Leak test the modified indicator tube hand pump and damper array by connecting it through flow damper to low pressure port of magnehelic gage.
 - B. Withdraw pump plunger to induce a pressure of -80 " H_2O " in the damper array (several pump strokes may be required). Observe magnehelic to insure that pressure stabilizes and remains constant over one minute.
 - C. Remove top of impactor and insert #7 rubber stopper to form an air-tight seal.

- D. Insert a circular filter holder with filter into impactor base.
- E. Connect modified indicator tube hand pump to one side of pressure "T".
- F. Connect other side of pressure "T" to the base of the impactor.
- G. Connect the base of the pressure "T" to the low pressure port of the magnehelic gage.
- H. Adjust slide on plunger of hand pump so that pump stroke will induce a pressure of -80 ± 5 inches of mercury when plunger is fully withdrawn (NOTE: Required pump stroke will be extremely short).
- I. Induce a pressure of -80 ± 5 inches of mercury in system and observe that, following stabilization, pressure remains constant for a period of one minute.
- J. Inspect and repair any impactor that fails to pass the leak test. If repair cannot be accomplished immediately, a tag indicating test failure (figure 2) will be affixed to the impactor and it will be removed from service until repaired.
- K. Record pass or fail on the "Impactor Service Log" and actions taken in the case of test failure.
- L. Repeat steps 7.2.1; C through K for each impactor to be leak tested.

7.3 Quality Control

7.3.1 Tolerance limits

- A. Constant pressure is defined as a decrease of no more than 2 inches of mercury from a stabilized reading of at least -75 inches of mercury over a period of one minute.

7.3.2 Detection limits

- A. The magnehelic gage will be read to within ± 1 inch of Hg.

7.3.3 Corrective Actions

- A. If the modified hand pump fails to hold a stable negative pressure, the piston "O" ring should be greased with stop cock grease.
- B. If an impactor fails to hold a stable negative pressure, check the #7 rubber stopper to ensure a tight seal; then retest.
- C. If an impactor fails to hold a stable negative pressure, the rubber gasket in the impactor base should be cleaned or replaced as necessary. Look for excess glue on the gasket as a possible source of air leakage. Also inspect for correct installation of the filter in the filter holder and of the holder in the base.

8.0 Records

8.1 Data Collected by this Procedure

- 8.1.1 The results of the impactor testing will be recorded on the "Impactor Service Log"(figure 1, L-7.0-1.0).

8.2 Location of Forms

- 8.2.1 The "Impactor Service Log" will be kept in the weight room next to the work area where the testing is undertaken.
- 8.2.2 "Damaged Equipment Report" (figure 2, L-7.0-2.0) will be stored in the front pocket of the "Impactor Service Log" notebook.

Figure 1. Impactor Service Log

IMPACTOR SERVICE LOG

[illegible]

Figure 2 Damaged Equipment Report

DAMAGED EQUIPMENT REPORT	
Equipment ID#:	_____
Type of Equipment:	_____
Date of Report:	_____ Tech Initials: _____ month day year
Type of problem:	_____ _____ _____
Reported to: <input type="checkbox"/> area supervisor / project coordinator	
Equipment part of: <input type="checkbox"/> Field <input type="checkbox"/> lab <input type="checkbox"/> data process	
<input type="checkbox"/> Analysis <input type="checkbox"/> other: _____	
(copy to Section Coordinator & attach tag to equipment)	

FORM UA-G2.0-1.0

L-7.0-2.0