

**National Personal Protective
Technology Laboratory**

**Evaluation of High-Flow Filter
Efficiency Testers for PAPP**

Policy and Standards Development Branch

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Docket 008A**

Evaluation of High-Flow Filter Efficiency Testers for PAPR

- **Project Description – Planned Activities**
 - Evaluate Air Techniques International (ATI) Model TDA-500P and TSI, Inc. (TSI) Model 3120 High-Flow Filter Efficiency Testers for use in PAPR95 and PAPR100 particulate filter efficiency level determination testing
 - Identify High-Flow Filter Efficiency Tester(s) acceptable for the required testing
 - Formulate Standard Test Procedure for Particulate Filter Efficiency Level Determination Testing for PAPR and Operating Procedure(s) for acceptable High-Flow Filter Efficiency Tester(s)



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Evaluation of High-Flow Filter Efficiency Testers for PAPR

- **Project Goals – Specific Testing for Each High-Flow Filter Efficiency Tester**
 - Verify high-flow filter efficiency testers conform to advertised specifications and PAPR Standard
 - Determine DOP aerosol loading as a function of time at flow rates ranging from 100 to 500 Lpm
 - Determine the time required to load 1000 mg of DOP aerosol
 - Determine the DOP aerosol particle size distribution at flow rates ranging from 100 to 500 Lpm
 - Identify lab technician issues



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- **Operating requirements for AT1 and TSI High-Flow Filter Efficiency Testers**
 - Additional compressed air required to accommodate higher flow rates
 - **Compressed Air Requirements:**
 - **AT1: 18 scfm at 80 psig**
 - **TSI: 25 scfm at 100 psig**

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- **Operating requirements for ATI and TSI High-Flow Filter Efficiency Testers (cont.)**
 - Vacuum pump required to overcome higher pressure drop across filter test bed and DOP discharge filter due to higher flow rates
 - **Vacuum Requirements:**
 - **ATI: 22.5 acfm at 19 inches Hg**
 - **TSI: 25 acfm at 7.5 inches Hg**

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- **Operating requirements for ATl and TSl High-Flow Filter Efficiency Testers (cont.)**
 - Higher exhausting capabilities required due to higher flow rates
 - **DOP Aerosol Exhaust Requirements:**
 - **ATl: 48 scfm**
 - **TSl: 25 scfm**
 - **ATl exhaust requirements higher than TSl due to DOP aerosol carryover venting**

Evaluation of High-Flow Filter Efficiency Testers for PAPP

- ATI TDA-500P High-Flow Filter Efficiency Tester



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- TSI 3120 High-Flow Filter Efficiency Tester



Evaluation of High-Flow Filter Efficiency Testers for PAPR

- DOP Aerosol Loading Measurements
 - Determination of DOP aerosol loadings required an enlargement of the filter test bed to approximately 8-1/2 inches in diameter:
 - Reduce the pressure drop at the higher flow rates
 - Collect sufficient DOP aerosol to obtain accurate change in weight measurements
 - Type A/E glass fiber filters, 265-mm in diameter, are being used for collection of the DOP aerosol
 - A support grid, with 1/2-inch X 1/2-inch openings and a 1/16-inch thick lattice is being used to support the filter and prevent filter blowout

Evaluation of High-Flow Filter Efficiency Testers for PAPR

- ATI TDA-500P High-Flow Filter Efficiency Tester
 - 8-1/2-inch in diameter filter test bed with support grid

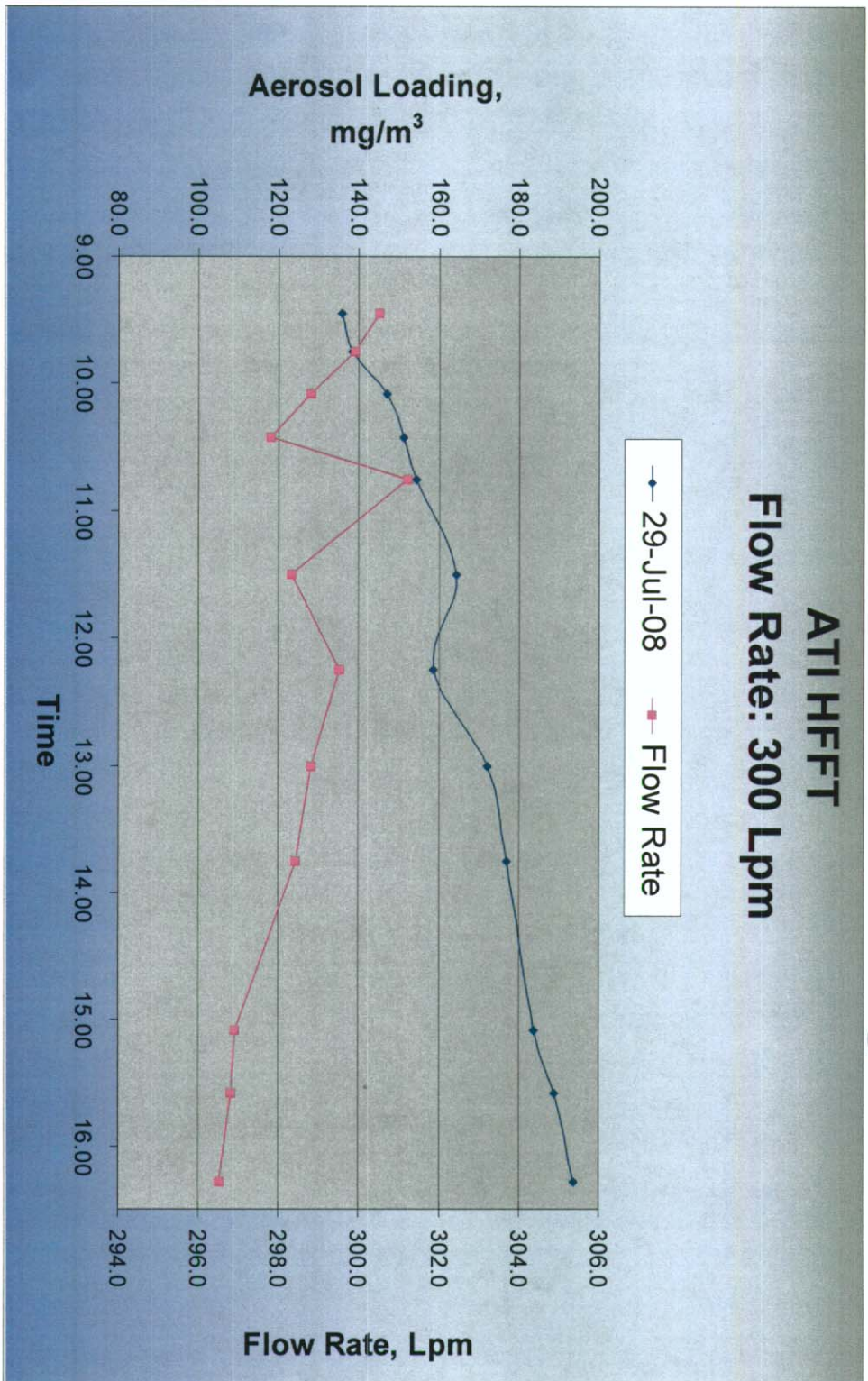


Evaluation of High-Flow Filter Efficiency Testers for PAPR

- **Flow Rate Effect on DOP Aerosol Loading**
 - Initial testing indicates DOP aerosol loading is dependent on flow rate
 - Recent testing employing a hand valve to control the flow rate resulted in an improvement in the repeatability and consistency of DOP aerosol loading measurements from run to run
 - Mass flow controllers installed in place of existing mass flow meters would improve aerosol loading stability

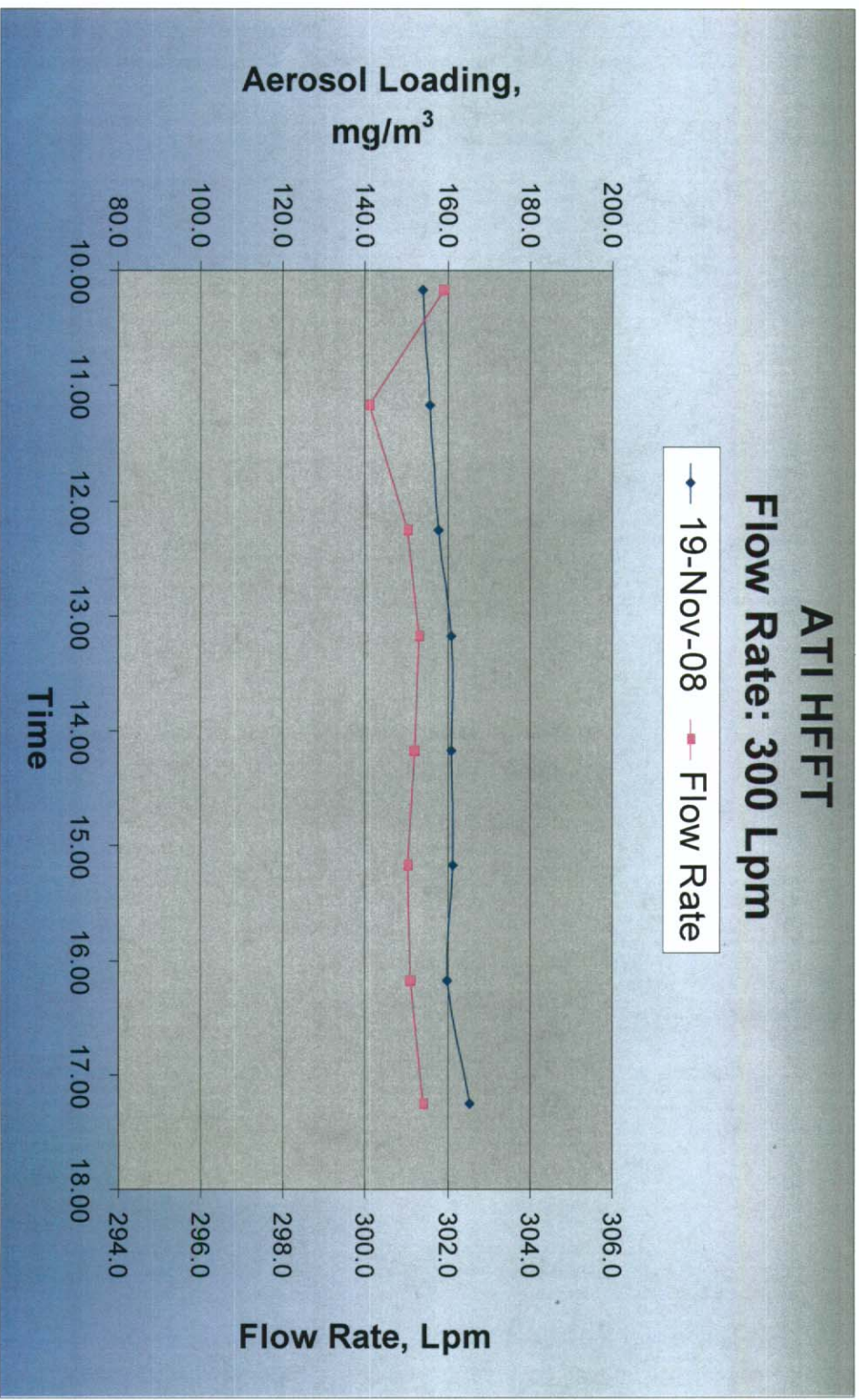
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- Flow Rate Effect on DOP Aerosol Loading – No Flow Control



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- Flow Rate Effect on DOP Aerosol Loading – Flow Control



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- Vacuum Pump Noise Generation
 - With the vacuum pump close coupled to high-flow filter efficiency tester, noise level in test lab is high
 - Vacuum pump should be located remotely for commercial models
 - Vacuum pump noise may be mitigated by sizing the vacuum pump to final PAPR standard gas flow rate requirements and the PAPR test application

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- Waste Gas Venting
 - Higher flow rates result in higher waste gas flow rates that need to be exhausted from the test area through a controlled ventilation system such as a ventilated hood
 - ATI and TSI High-Flow Filter Efficiency Tester aerosol carrier gas is filtered upstream of vacuum pump to remove DOP before venting
 - ATI High-Flow Filter Efficiency Tester requires secondary exhaust to balance excess DOP aerosol generation from aerosol generator vent, resulting in higher waste gas venting requirements
 - TSI High-Flow Filter Efficiency Tester vents directly from aerosol generator



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