

BROOKHAVEN NATIONAL LABORATORY Safety & Health Services Division	NUMBER IH62400
	REVISION FINAL rev0
INDUSTRIAL HYGIENE GROUP Standard Operating Procedure: Field Procedure	DATE 11/22/02
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SUBJECT: Local Exhaust Ventilation Initial Evaluation	

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1.0 Purpose/Scope

This procedure provides a standardized method for conducting the initial evaluation of work areas where local exhaust ventilation (LEV) systems are used. **Evaluation of laboratory sash hoods is covered in other procedures and is not included in this document.** This procedure establishes a methodology for determining the acceptable operating parameters of the system that can be used in routine system effectiveness validation testing using IH 62410. By completing this SOP, BNL will:

- Document the initial performance of LEV systems and verify operation in accordance with design specifications
- Verify compliance of operations with applicable codes
- Develop criteria for future testing of LEVs.

Local exhaust systems are important components in worker protection engineering controls. These systems are commonly used in the chemical and nuclear field to remove harmful contaminants from the workers breathing zone and the work area. They are specialized systems that must match the source's emission pattern and dynamics.

The evaluation of a local exhaust system should follow the following steps:

- a) Initial Test: The effectiveness of the system needs to be determined to verify that the engineering controls protect the worker to levels below applicable occupational exposure limits (OEL).

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- b) Establishing operating parameters: Once the effectiveness of control of hazards is verified, measurement of the operation parameters of the system that achieve that control (such as duct velocity, capture velocity, etc.) are made. A “safety envelope” of acceptable operating parameters is set.
- c) Periodic testing: At a set interval, retest the system. Retesting is done via IH62410.

Ventilation systems should be tested upon completion of construction and before acceptance of the installation project.

Periodic validation tests (using IH62410) are to be made:

- Throughout the life of the system to ensure continuing performance. BNL’s frequency for periodic testing is:
 - **12 months** (or per manufacturer’s recommendation) when OELs are exceeded;
 - **36 months** is recommended when OELs are not exceeded and the ventilation system is not critical for worker protection.
- Whenever major modifications are made to the system
- On start-up of a system that has been dismantled, out-of-service, and reassembled, and
- When complaints of poor performance are made by operating personnel.

A new initial evaluation is needed when changes in the application of the system occur that significantly alter the value of the original evaluation (e.g. changes such as: the type of hazards, the rate of hazard generation, or mechanism of hazard generation).

HEPA filters are often placed in-line within the exhaust of these system to protect the environment from release of hazardous materials. Surveillance testing of the HEPA filter is covered by IH62300.

2.0 Responsibilities

This procedure will be implemented through the RCD Facility Support Group Leader with assistance from the SHSD Industrial Hygiene Group Leader. Personnel from the Industrial Hygiene Group will assist RCD Facility Support with the initial measurement of the effectiveness of the system if needed. The IH Group is responsible to review and approve all initial evaluations.

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3.0 Definitions

Occupational Exposure Limit (OEL): For this procedure, an OEL is an occupational employee exposure limit that triggers action regarding engineering controls. This includes OSHA Permissible Exposure Limits (PEL) & action levels and ACGIH Threshold Limit Values®.

4.0 Prerequisites

- 4.1 Prior to testing a local exhaust system, verify the calibration and operability of the test equipment.
- 4.2 Observe area postings and obtain approval to enter the test area, as required.

5.0 Precautions

5.1 **Hazard Determination:**

- 5.1.1 By its very nature, a test may be done in areas where chemicals or radiation contamination is known or suspected to be present. Exposure to these contaminants can have significant health effects. These hazards must receive a hazard evaluation by a cognizant ESH professional. This operation may involve hazardous chemical that can result in worker exposures (such as smoke tube vapor/fumes. The gases, vapors, or aerosols that the exhaust systems are used to capture could cause exposure to the tester. Appropriate measures to minimize contact with solid or liquid contaminant and inhalation of solid, liquid, vapor, or gas contaminant must be made.
- 5.1.2 Air testing meters used in this procedure do not generate in Hazardous Waste. The testing equipment does not generate a hazardous environmental emission. Smoke tubes or candles may be used, but their environmental impact is not significant. Expended smoke tubes and candles are not considered hazardous wastes. The test equipment design does not cause significant ergonomic concerns in routine use.

5.2 **Personal Protective Equipment**

- 5.2.1 Hand: Contact with aerosol liquid should be minimized as it could pose a health risk. Use of this operation in areas of known or suspected chemical or radiological contamination requires the use of disposable gloves. Exam-style,

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splash gloves are acceptable. Acceptable elastomers are: Nitrile, PVC, and Natural Rubber.

5.2.2 Body:

- If contact of the body with contaminated surfaces is anticipated, a disposable suit should be used. Acceptable Chemical protective clothing (CPC) materials include: *Tyvek*®, *KleenGuard*®, and cotton. Disposable garments must be discarded as per *Hazardous Waste Management Division* instruction.
- If contact with potentially contaminated surfaces is not expected, protective clothing is optional. However, if personal clothing items become contaminated, they must be surrendered for BNL cleaning or disposal.

5.2.3 Foot:

- If contact of the feet is anticipated with contaminated surface, disposable shoe coverings, boots or booties should be used. Acceptable CPC material include: *Tyvek*®, *KleenGuard*®, and rubber.
- If contact with potentially contaminated surfaces is not expected, shoe coverings are optional. However, if personal shoes become contaminated, they must be surrendered for BNL cleaning or disposal.

5.2.4 Respiratory: Under normal use, respiratory protection is not required. If chemical or radiological levels from contamination in the area cause the OSHA, ACGIH, or DOE standards to be exceeded, respirators are required.

5.2.5 Eye: Safety Glasses with side shields are required.

6.0 Procedure

6.1 Testing Equipment

- Air contaminant sampling equipment or direct reading meter. Follow the appropriate SHSD IH SOP or RCD SOP on the operation of the meter.
- Air ventilation tester: Velometer, Anenometer, Balometer, Smoke tubes or candles, etc. Follow the appropriate SHSD IH SOP on the operation of the meter/equipment.



6.2 Pre-Testing Inspection of LEV systems

6.2.1 Verify that the exhaust ventilation system is operating.

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- 6.2.2 Inspect the exhaust system and its associated ductwork and mechanical components for any obvious signs of damage (e.g., missing or damaged seals, breached ductwork, excessive rust, or unusually loud motor noise). Notify Plant Engineering and the system owner of these conditions. Do not test if the system is not operable or not of adequate integrity.
- 6.2.3 Inspect markings and labeling on the equipment and record design specifications on the system, such as horsepower, cfm rating, model and serial number, etc.
- 6.2.4 If there are questions or concerns regarding the operation of the system, review the original design drawing, manufacturer's literature, or any other appropriate information.
- 6.3 Measurement of the controlled work place hazard
- 6.3.1 Verify that the current hazardous material generation from the operation is representative of operations that are conducted using the equipment (i.e. hazards are being generated, the system is not idle, and exposure represents the generation level that the process produces and the exhaust system is being used to eliminate).
- 6.3.2 With the ventilation system on and the source generating the hazard, follow an appropriate Industrial Hygiene SOP (in section IH75) or a Radiological Control Division SOP to measure the worker exposure to the hazardous substance. Analyze the sampling results.
- If the occupational exposure limit and action level are not exceeded (both real-time and time weighted), it will be appropriate to proceed to measure the operating parameters of the exhaust system.
 - If over exposure is measured, the operation should be halted or other protective actions taken for exposed workers.
- 6.4 Measurement of the un-controlled work place hazard
- 6.4.1 **Conduct this test only if it can be made safely without jeopardizing the health or safety of workers and testing personnel.** Turn off the exhaust system and measure the workplace concentration of the hazard in the worker and bystander breathing zones. Compare the results to the occupational exposure limits and action levels and establish the frequency of retesting. If the occupational exposure limit and action level are:
- Not exceeded (both real-time and calculated time weighted): It is appropriate to consider the exhaust system as a non-mandatory, *best*

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management practice. Recommend voluntary periodic testing, as appropriate.

- Exceeded: Use of the exhaust system is critical. Annual or more frequent validation testing is needed. Appropriate testing frequency and measurement parameters must be established and conveyed in writing to the owner(s) of the exhaust system and operation generating the hazard.

6.4.2 Trace Gas test method is a safer alternate to the operation of the hazard generating equipment without engineering controls. This method uses a tracer gas release (relatively low toxicity- such as Carbon Dioxide, or Sulfur Hexafluoride) in lieu of the hazard. While it will not measure the uncontrolled hazard exposure level, it will measure the degree of control the exhaust system is providing. To use this method, follow IH SOP 62460.

6.5 Measuring Operational Parameters

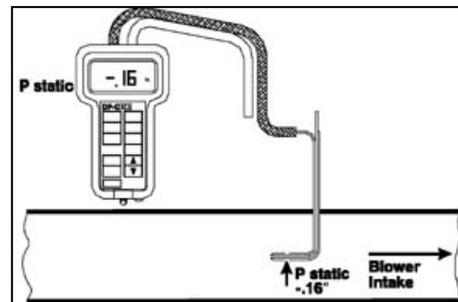
6.5.1 Make a drawing of the system (or take a digital photograph). Incorporate the photo/drawing into the *LEV System Initial Evaluation Test record*. Indicate all test locations.

6.5.2 Determine and measure appropriate operational parameter(s) for the ventilation system. Use an IH Series 62nnn SOP or RCD Facility Support SOP, if available, or follow the manufacturer's recommendation in conducting the measurement. Some acceptable operational parameters to measure include one or more of the following tests:

- Pressure in ducts: total pressure, velocity pressure, static pressure,
- Differential pressure across filters,
- Velocity: capture velocity, face velocity, duct velocity traverses,
- Smoke tube/candle plume observation,
- Tracer gas measurements.

Record the existing operational parameters on the *LEV System Initial Evaluation Test Record*.

6.5.3 Based on the degree of control of the hazards and using professional judgment, estimate the range of acceptable variation from the measured operational parameter(s). Record the acceptable range on the *LEV System*



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Initial Evaluation Test Record.

- 6.6 Based on measurement of the operating parameters; controlled and uncontrolled hazard exposure levels; and other appropriate characteristics of the system (such as frequency and duration of use) establish a *LEV System Periodic Validation Test Record* (see IH62410) that is specific to the operation and the exhaust system.
- 6.7 Record-keeping: Provide A copy of the *LEV System Initial Evaluation Test Record* to the Divisional Safety Coordinator, the Process/Operation and Exhaust system owner/management, and any other interested parties. The original test report is retained by the organization responsible for periodic testing in accordance with the BNL record keeping requirements. A copy of the record should be sent to SHSD IH lab.

7.0 Implementation and Training

- 7.1 Tests shall be performed by persons who have demonstrated the competence to satisfactorily perform the tests as evidenced by experience and training.
- 7.1.1 SHSD: Determination of qualification to use this procedure, testing of applicants, and documentation of qualification shall be set by the IH Group Leader, or designee.
- 7.1.2 RCD: Determination of qualification to use this procedure, testing of applicants, and documentation of qualification shall be set by the RCD Facility Support Group Leader, or designee.

8.0 References

- 8.1 American Conference of Governmental Industrial Hygienists (ACGIH). Industrial Ventilation: A Manual of Recommended Practice.
- 8.2 American Conference of Governmental Industrial Hygienists (ACGIH). *Guidelines for Testing Ventilation Systems*; 1991.

9.0 Attachments

- 9.1 *Local Exhaust Ventilation Initial Evaluation report*

IH62400 ATTACHMENT 9.1



LOCAL EXHAUST VENTILATION INITIAL EVALUATION

Environment, Safety & Health Directorate

System Identification

DIVISION	BUILDING	ROOM/AREA
SYSTEM DESCRIPTION		Sample This FORM is prepared uniquely for each piece of equipment
SYSTEM TYPE	MANUFACTURER	
BNL ID#	MODEL	SERIAL#
BLDG MANAGER	ESH Coordinator	OTHER CONTACT

EVALUATOR(S) NAME	SIGNATURE	TEST DATE
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System Description (Photograph or Drawing)

	<p style="margin-left: 20px;">← Sample Point A</p> <p style="margin-left: 20px;">← Sample Point B</p>
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Design Specifications

Rated Velocity:	Rated Amperes:	Other:
Rated Flow Rate (CFM):	Horsepower:	Other:



**LOCAL EXHAUST VENTILATION
INITIAL SYSTEM EVALUATION**
Environment, Safety & Health Directorate

Field Observations and Measurements- potential parameters to be evaluated

Fan Static Pressure	Duct Velocity (V)	Fan Speed
Pressure Drop across filters	Volumetric Flow Rate (Q)	Motor Speed
Smoke Tube Test	Air Temperature	Motor Amperes
Tracer Gas Test	Moisture Content of duct air	Motor Rotation

METER:	METER SN		
METER CALIB. DATE	COMMENTS		
Parameter:	Point	Acceptable Operational specification	Observed Measurement
	A		
	B		
	C		
	D		

METER:	METER SN		
METER CALIB. DATE	COMMENTS		
Parameter:	Point	Acceptable Operational specification	Observed Measurement
	A		
	B		
	C		
	D		

METER:	METER SN		
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