Laboratory Fume Hood and Ventilation System Testing Services
Georgia Institute of Technology

Effective Date 4/27/2011

A. Purpose:

The purpose of this document is to establish the scope of work and methods to be used in performance testing all fume hoods and other forms of local exhaust ventilation on the Georgia Institute of Technology (GT) campus and also the GT Cobb County Campus.

B. Scope:

1) This document applies to 1098 fume hoods 194 elephant trunks local exhaust ventilation devices 21canopy hoods and 25 slot and plenum devices as specified in Appendix A

2) Testing is to be performed as according to the schedule outlined in Appendix A

3) This document also applies to an additional 100 exhaust ventilation devices to be specified over the course of the 12 month period of the service contract.

C. Tasks to be performed:

1) Performance testing of fume hoods and local exhaust ventilation devices as specified in section G-K of this document.

2) Reporting of fume hood performance to GT Environmental Health and Safety (EHS) as discussed in sections L of this document.

D. Contractor requirements

1) Contractor must have at least 5 years of experience in fume hood performance testing.

2) Contractor must provide proof of certification/working knowledge of GT fume hood controllers per manufacturer specifications. This includes, but is not limited to, Sureflow, Triatek, and Hood Trol II controllers.

3) Contractor is required to notify GT EHS personnel within one month of technician change so verification of manufacturer and safety certifications can be obtained.

4) Contactor is required to provide proof of safety training for all employees assigned to GT. This training must include:

   a) OSHA Hazard Communication

   b) Basic Lab Safety/Chemical Hygiene

   c) Radiation Hazard Awareness

d) Biological Materials Hazard Awareness

5) Contractor's employees must receive training by GT EHS personnel, or proof of equivalent (as determined by GT EHS) prior to working in labs.

6) All contractor's personnel will adhere to all GT rules regarding conduct, attire and personal protective equipment while in laboratories. See Appendix B for rules on appropriate apparel. Additionally, contractor's employees will wear branded shirts or jackets (or name tags) that identify them to the lab occupants as being employees of the company authorized to do fume hood performance testing

7) Personal protective equipment (PPE) to be worn in laboratories shall include safety glasses (donned at the door), and nitrile gloves. Other PPE may be required as specified by the lab.

8) Contactor will coordinate with GT EHS as to dates and times they will work in specific buildings. (See Communications, Section M, below.)

9) Variances from the procedures outlined in Section G-N (below) must be pre-authorized in writing by GT EHS.

E. Payment

1) Contactor may invoice GT for all completed work on a monthly basis, based on the percentage of the total annual performance tests completed for that month.

F. Failure to perform work as specified and as scheduled

1) Failure to perform work as specified in Sections G, H, J, K, L, M, and N unless pre authorized by GT EHS, will result in an immediate termination of the contract. Contractor will forfeit payment of all unpaid work to date.

2) Failure to complete all work as scheduled per Appendix A over two consecutive months will result in an immediate termination of the contract. Contractor will forfeit payment of all unpaid work to date.

3) Failure to report work completed by the 15th of the following month as specified in section L may, at GT EHS's discretion, result in the termination of the contract. Contractor will forfeit payment of all unpaid work to date.

G. Basic Fume Hood Testing Procedures

1) Face velocity or "pitot traverse" methods are acceptable techniques for measuring ventilation system performance.

2) Sash Positions

a) Vertical rising sashes will be tested at a height of 18 inches.

b) Horizontal sliding sashes will be opened to two sash widths and checked in the center.

c) Combination sashes will be tested with the horizontal sections closed and the vertical sash raised to18 inches.

d) Walk-in hoods (floor mounted, California style hoods) will be tested with the front sash down and the back sash raised to 8 inches above the top of the front sash.

e) Check sash operation by moving sash(es) through the full range of travel. Movement should be smooth and easy. Vertical shall hold any height without creeping up or down unless designated otherwise (see manufacturer's specifications). Contractors shall report any problems to Facilities.

3) Face Velocity Measurements

a) Face velocity will be measured using a macromanometer. When a velocity matrix (covering ~1 ft^2) is used, readings will be taken at equal distances across the face of the hood. Therefore, a 6 ft hood will require 5 readings and a 4 ft hood will require 3 readings, etc.

4) Containment Checks

a) Containment and verification of proper air flow will be checked by appropriate smoke devices as described in Scientific Equipment & Furniture Association (SEFA) 1.2.

5) Controller and Monitor Checks

a) The controller/monitor reading will be checked against face velocity results. If the reading is not within 10% of the face velocity result, controllers must be calibrated. Inaccurate monitors must be reported to Facilities by the contractor on the GT form or approved substitute (see Appendix D)

b) The manufacturer's specifications will be used for calibration procedures.

c) The visual indicator should be in the normal range (green) for monitors that do not have numeric readings.

d) Face velocity readings, as measured, will be recorded on a tag posted on the fume hood.

e) The emergency flow will be checked to ensure proper function (controller only).

f) High sash alarms will be checked as appropriate to ensure proper function (controller only).

i. Position sash above sash catch height (typically 18") to check that both visual and audible alarms are triggered. Move sash back to "catch" position to verify that alarms have disengaged.

6) Auxiliary Air Hoods

a) Auxiliary air hoods shall be checked as per the procedure described in ANSI/AIHA Z9.5-2003 6.3.4

7) Other Checks

a) Lights: Broken/nonfunctioning lights will be reported to Facilities via e-mail (see Appendix C).

b) Sash catches: broken or missing sash catches (to keep the sash at proper height) must be reported to Facilities by the contractor via email (see c).

c) General condition of hood: Hazardous conditions will be noted and reported to GT EHS along with any conditions which may adversely affect fume hood function. Hazardous conditions include, but are not limited to:

i. Spilled materials

ii. Excessive chemical storage (to the point of blocking flow)

iii. Large equipment blocking normal airflow

iv. Open waste containers.

d) Cross drafts: contractor should make note of possible sources of cross drafts (poorly positioned air diffusers, doorways, etc.) and report to GT EHS.

H. Pitot Traverse Measurements

1) Pitot traverse measurements will be performed per the procedures described in Industrial Ventilation (American Conference of Governmental Industrial Hygienists, Cincinnati, Ohio, 2001).

2) Static pressure measurements will be recorded.

I. Acceptable Limits

1) General Purpose laboratory fume hoods will be considered acceptable with an average face velocity of 80 lft/min to150 lft/min, optimal range being 100-120 lft/min.

2) Hoods in laboratories with carcinogens or extremely hazardous materials will be considered acceptable with an average face velocity of 120 lft/min ±10%. (EHS will communicate this information to the contractor whenever possible.)

3) Fume hood performance will not be considered acceptable if any single face velocity reading is less than 70 lft/min and will be tagged with a red and black "DANGER HOOD IS NOT WORKING! DO NOT USE!" tag. Report per Section L

4) Fume hood performance will not be considered acceptable if any single face velocity reading is greater than 150 lft/min and will be tagged with a red and black "DANGER HOOD IS NOT WORKING! DO NOT USE!" tag. Report per Section L.

5) Velocities in excess of 120 lft/min require additional testing by smoke to verify that nothing is exiting the hood.

6) Refer to Industrial Ventilation for acceptable ventilation system performance for non-laboratory hood ventilation systems and/or refer to original specifications for the installed ventilation system.

7) If a ventilation system does not perform according to criteria, a work order to repair the ventilation system shall be initiated by the contractor (see section L)

J. Other Exhaust Ventilation Systems

1) Canopy Hoods

   a) Will be checked by pitot traverse whenever possible.

   b) When a pitot traverse is not possible, a macromanometer may be used to measure air velocity at a distance of 6 inches from the duct opening.

   c) If the average of these readings has decreased more than 10% from the previous readings, then a work order shall be issued as per Section L.

2) Elephant trunks

   a) Will be checked by pitot traverse whenever possible.

   b) When this is not possible, a hot wire anemometer may be used at the aperture.

   c) If the average of these readings has decreased more than 10% from the previous readings, then a work order shall be issued as per Section L.

3) Slot and plenum

   a) Will be checked by pitot traverse whenever possible.

   b) When this is not possible, a hot wire anemometer may be used at slot center.

   c) If the average of these readings has decreased more than 10% from the previous readings, then a work order shall be issued as per Section L.

K. Periodic Testing of Fume Hoods and Local Exhaust Ventilation Devices

1) Testing shall be repeated every 6 months as per the schedule provided (See Appendix A)

2) When hoods cannot be tested because they are in use such that conducting the test would be hazardous to the contractor, or because testing would interfere with a experiment in progress, it is the contractor's responsibility to coordinate with the researcher to return and compete the testing within one week. If the contactor is still unable to complete test after making 2 attempts, the contractor is to contact GT EHS to intercede in arranging a time to complete the tests.

L. Reporting

1) Fume hoods with face velocities outside the parameters found in Section I that cannot be corrected by adjusting the controller require the contractor to submit a work order to Facilities within 24 hours of the test using a "Fume Hood Inspection Work Request" form or equivalent specified by GT EHS and developed in cooperation with the contractor. (See Appendix D for an acceptable example).

2) Changes in face velocity or Static Pressure (pitot traverse) of more than 10% from the previous reading that cannot be corrected by adjusting the controller require the contractor to submit a work order to Facilities within 24 hours of the test, using the Fume Hood Inspection Work Request form (see #1, above)

3) Other deficiencies, such as problems with lights or sashes, or controller/ monitor issues, etc. also require the contractor to submit a work order to Facilities within 24 hours of the test using the Fume Hood Inspection Work Request form.

4) Contractor is to cc GT EHS on all work orders to Facilities

5) Upon completion of testing scheduled for that month, contractor will provide certification results for each device tested in the form of a Monthly/Building Report (electronic and hard copies) to GT EHS no later than the 15th of the following month. The format of the report is to be specified by GT EHS and developed in cooperation with the contractor.

M. Communication

1) Contractor will determine the day and order of the buildings to be tested each month and communicate this information to GT EHS not less than 3 weeks in advance.

2) GT EHS will pre-notify labs/buildings of intent to inspect and test fume hoods no less than 2 weeks prior to start date.

3) GT EHS will provide contractor with Facilities Area Maintenance contact information for work request submission. (Appendix C)

4) Contractor is to provide GT EHS with the names and training documentation of all new personnel prior to their arrival at Georgia Tech.

N. Record Keeping/Reporting

1) Fume hood certification will be recorded on a sticker affixed to the fume hood to include date, average face velocity, and initials and company of the person performing the test at the time the test is completed.

2) Test results will be recorded in the GT EHS database (by GT EHS personnel).

O. Follow-up Procedures

1) GT EHS will do quality control checks on 10% of all hoods and local exhaust devices.

2) GT EHS will follow-up with appropriate Facilities Area Maintenance within two weeks to ascertain the status of fume hood repairs.

3) Fume hoods which have been repaired will be rechecked by GT EHS and tags will be updated/removed as appropriate.

P. References

American Conference of Governmental Industrial Hygienists, Industrial Ventilation Cincinnati, Ohio, 2001.

American National Standards Institute-American Industrial Hygiene Association, Standard Z9.5-2003 Laboratory Ventilation

National Research Council, Prudent Practices in the Laboratory, National Academy Press, Washington, DC. 1995

Scientific Equipment & Furniture Association Standard 1.2- 1996, Laboratory Fume Hoods, Recommended Practices

Appendix A: Fume Testing Schedule by Building

Building Name	Building Number	No of Fume Hoods	Schedule	Area #
Daniel Laboratory	22 & 22A	21	January/July	4
Fac. Waste Storage (HazMat)	161	5	January/July	2
Student Cntr. And Post Office	104	2	January/July	1
Knight Aerospace	101	1	January/July	4
ESM	41	5	January/July	4
Pettit MIRC	95	6	January/July	3
Weber SST1	84	4	January/July	4
Cherry Emerson Biology	66 & 66A	32	February/August	3
Mason CE	111	4	February/August	3
College of Computing	50	30	February/August	3
U.A Whitaker BME	165	18	February/August	2
Ford ES&T	147	140	March/September	2
MRDC I	135	20	March/September	1
IBB	146	68	March/September	2
IPST	129	68	March/September	1
Boggs	103	270	April/October	3
MS&E	167	160	April/October	2
Centennial Res. Building	790	3	May/November	2
CCRF I and II	801 & 802	16	May/November	
Love (MRDC II)	144	39	May/November	1
Baker Building	99	29	May/November	2
Bunger Henry	86	67	May/November	3
Neely Nuclear Research	87	3	June/December	2
MARC	126	22	June/December	1
Howey Physics	81	11	June/December	3
Van Leer Elec. & Comp. Eng.	85	3	June/December	3
Nara Food Proc. TRC	159	1	June/December	5
14th St. Engineering Center	850	29	June/December	
Totals		1077		

Appendix B: Appropriate Lab Attire

Personal attire while in the laboratory plays a major role in determining the level of risk of exposure to hazardous agents and of physical injury. Appropriate clothing provides an extra layer of protection against spills and splashes of hazardous materials. Appropriate clothing covers the torso, legs, and feet. Therefore, the following practices shall be adhered to in Georgia Tech wet bench laboratories:

Allowed	Not Allowed	Explanation
Hair must be kept away from the eyes. Long hair must be tied back. Hair longer than 6 inches from the nape of the neck must also pinned up (Use of hair nets or hats is acceptable)	Hair must not impede vision, come in contact with the work, or open flames.	Hair can impede vision. Long hair can fall onto the lab bench/come in contact with chemicals or biologicals. Long hair is also a hazard around rotating equipment and open flames such as Bunsen burners or alcohol burners.
Ties and scarves that do not hang loose outside a the lab coat	Neckwear such as ties and scarves that hang loose	Dangling neckwear may come in contact with chemicals, biologicals or open flames. These also are a hazard around rotating equipment.
Baseball caps and other headgear as long as they are kept far enough back on the head so that vision is not impaired and also do not interfere with protective eyewear.	Caps worn low over the eyes so as to impede vision	Avoiding accidents means staying aware of one's surroundings at all times. Unimpeded visual observation is key in this regard.
	Use of iPods, MP3 players, or other electronic devices with head-phones is not allowed in laboratories and is highly discouraged in laboratory buildings.	Laboratorians must be aware of their surroundings at all times which includes being able to hear alarms, sirens, run away reactions, and other people calling for help.
Shirts/tops that cover upper torso	Cropped shirts, plunging necklines, spaghetti straps, or ripped shirts.	Layered clothing is a safety asset in that it provides an extra layer of protection against spills and splashes.

Allowed	Not Allowed	Explanation
Clothing that accommodates lab coat use.	Loose or flowing tops with wide/bell sleeves; outerwear s/a coats or shawls that make it difficult to don a lab coat.	Wearing this type of clothing makes it difficult/uncomfortable to wear a lab coat: The wearer may be tempted to do without the lab coat. Loose sleeves may also be dragged across the bench becoming contaminated and are a hazard around rotating equipment and open flames.
Long pants that cover the wearer to the ankle	Ripped jeans, shorts, capris, or skirts.	Chemicals splash up after they hit the floor; likewise shattered glass bounces up and can inflict injury on unprotected skin. Persons who must wear skirts due to personal considerations should speak with their supervisors to determine an appropriate strategy for addressing this rule.
Completely enclosed shoes that cover the instep of the foot: preferably, of leather which can be wiped clean.	Sandals, open toe, open back, or open weave shoes; shoes with holes in the top or sides; No Birkenstocks, Mary Janes, cloth shoes, or Crocs.	Shoes need to protect the wearer from chemicals, hot liquids, and shattered glass. Cloth shoes can absorb chemicals or hot liquids and hold them against the skin until they can be removed.

Other Recommendations Regarding Lab Clothing Choices:

Recommendation	Explanation
Choose clothing made of natural fibers, especially cotton whenever possible	Natural fibers are more fire resistant than synthetic fibers
Avoid wearing pantyhose	Fire and some chemicals may cause the nylon to melt to the skin increasing risk of serious injury
Keep a change of clothes, including shoes, in a desk drawer	After an exposure, the victim will not be allowed to re-don contaminated clothing and will need something to wear home.

Appendix C
Facilities Maintenance Contact Information

Area #	Contact Information	Facilities Area Manager
Area 1	Sandra Garvin Customerserv1@facilities.gatech.edu	Rodd Hineman
Area 2	Annette Clifford Customerserv2@facilities.gatech.edu	Bill Halabi
Area 3	David Ta Customerserv3@facilities.gatech.edu	Ronnie Croy
Area 4	JoAnn Pittman Customerserv4@facilities.gatech.edu	Tony Blalock
Area 5	Sonia Rosa Customerserv5@facilities.gatech.edu	Garry Lockerman

Appendix D
Fume Hood Inspection Work Request (Example)

Georgia Institute of Technology
Environmental Health & Safety

FUME HOOD INSPECTION WORK REQUEST

Building: FORD ES&T

Building No: 147

Room	Hood ID	PI	Date Inspected	Avg. Face Velocity lft/min	Comments	Recommendations
FORD ES&T	A		30-Jan-09			

Total Number of Hoods = **0**

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Appendix E
Equipment Details

This information to be made available electronically.