

# ***DOE TEAM Initiative***

***High Tech Buildings***

***Berkeley Fume Hood***

***Aerosol Duct Sealing***

Presented by:

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U.S. Department of Energy  
**Energy Efficiency and Renewable Energy**

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# High-Performance Buildings Web Site

## High-Performance Building for High-Tech Industries

The screenshot shows a web browser window displaying the website. The title bar reads "High-Performance Buildings for High-Tech Industries - Windows Internet Explorer". The address bar shows "http://hightech.lbl.gov/". The website header features the title "High-Performance Buildings for High-Tech Industries" and a search box with "A-Team : EETD : LBNL" and "Sitemap : Contact" links. A left sidebar contains a vertical menu with items: Mission, Issues, Facilities, Technologies, Demos, Design, Events, Library, Links, Team, Advisors, Sponsors, Newsletters, Press, and What's New. The main content area includes a paragraph: "This website provides a portal to an extensive portfolio of research, development, demonstration, and deployment of energy-efficient technologies and practices for high-tech facilities such as laboratories, cleanrooms, and data centers. To learn more, please choose from among the menu items to the left." Below this is a navigation bar with "Laboratories • Cleanrooms • Data Centers". The central graphic is a collage of images and charts, including a pie chart titled "Energy Efficiency", a bar chart titled "Trends", a 3D architectural rendering, and various photos of facilities. At the bottom of the page, there is a footer with navigation links: "Home : Applications Team : Environmental Energy Technologies Division : Berkeley Lab : Sitemap : Contact : Disclaimer & Privacy Statement". The Windows taskbar at the bottom shows the Start button, several application icons, and the system tray with the time "3:39 PM".

[Click Here](#)

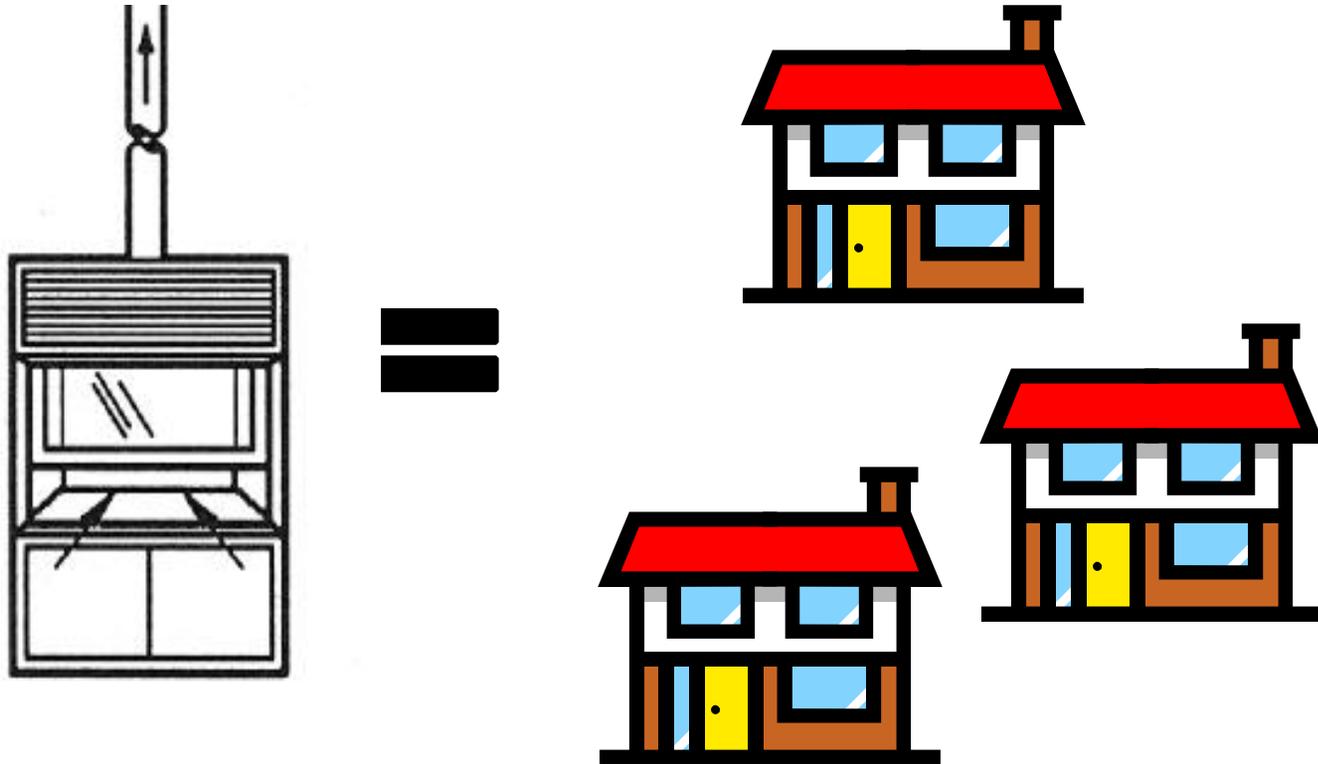
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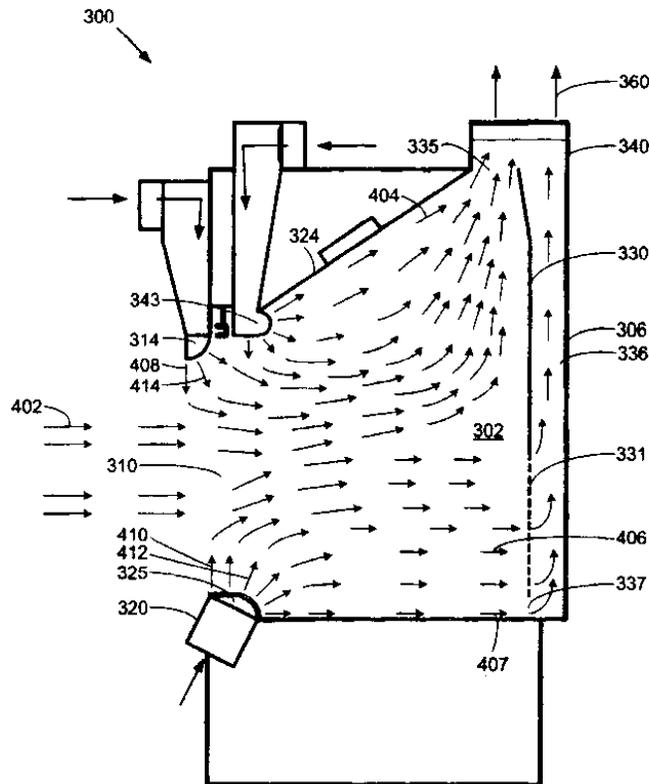
# *"Tame the Hoods..."*

## *Fume hood Energy Consumption*



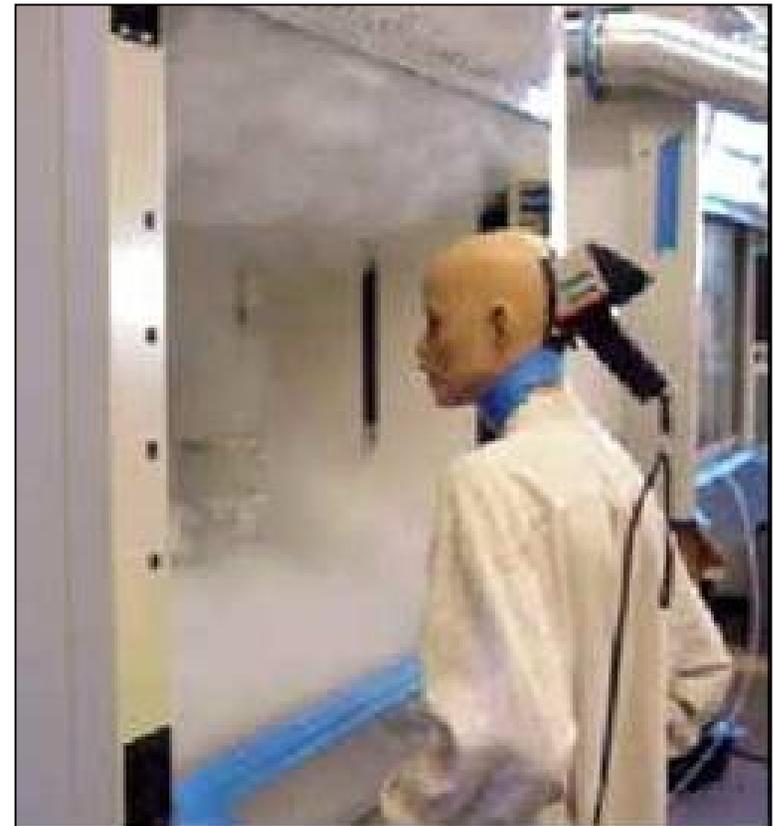
# Berkeley Hood Air Divider Technique

**Low-turbulence Intensity  
Displacement ventilation  
Push-Pull Containment**



**(Sectional view)**

U.S. Patents # 6,089,970, # 6,428,408



# Extensive Standardized Testing...

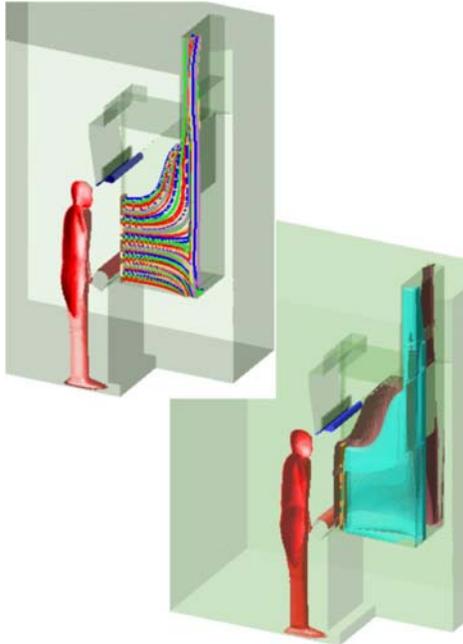
## ASHRAE 110 Testing



- ✓ **ASHRAE 110-1995 tracer gas containment**
- ✓ **Large and small volume smoke**
- ✓ **Sash-movement effect tests**
- ✓ **Dry Ice tests**
- ✓ **Different SF6 flow rates**
- ✓ **Various mannequin heights**

# Advanced, Non-standard Testing...

## CFD Analyses



- ✓ Side-by-side Equivalent Containment Tests
- ✓ Human-as-Mannequin Testing
- ✓ Cluttered hood interior
- ✓ Helium Bubbles
- ✓ Schlieren flow studies
- ✓ Envelope testing
- ✓ Expert evaluations
- ✓ New SF6 ejector designs
- ✓ Cross drafts

# Berkeley Hood: Results and Future...

- Estimated energy reductions to be 70 percent, compared to “standard” constant velocity (CV) fume hood.
- Equivalent containment performance verified with side-by-side ASHRAE 110-1995 testing and LBNL Human-as-Mannequin Testing Protocol
  - Independent testing performed by Exposure Control Technologies
- Two variances were granted by CAL/OSHA to operate the Berkeley hood at 80 FPM at its design sash-height of 18 inches.
  - Total exhaust airflow is one-half of a standard hood’s flow
  - Containment has been verified in this configuration
- ESCO Global has licensed the Berkeley hood technology
  - Commercial hood expected by January 2008

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## ***Aerosol Duct Sealing***

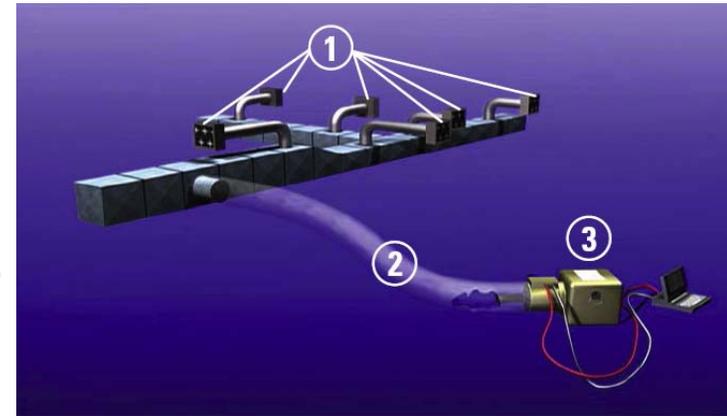


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# Aerosol ductwork sealing

## Benefits and features...

- Seals holes up to 3/8" across
- Vinyl polymer is safe
- No lingering odors or off-gassing
- Does not coat ductwork
- Cleaning ductwork not required before sealing
- Cleaning after sealing generally does not hurt seals
- Sealant remains rubbery
- Lasts >10 years

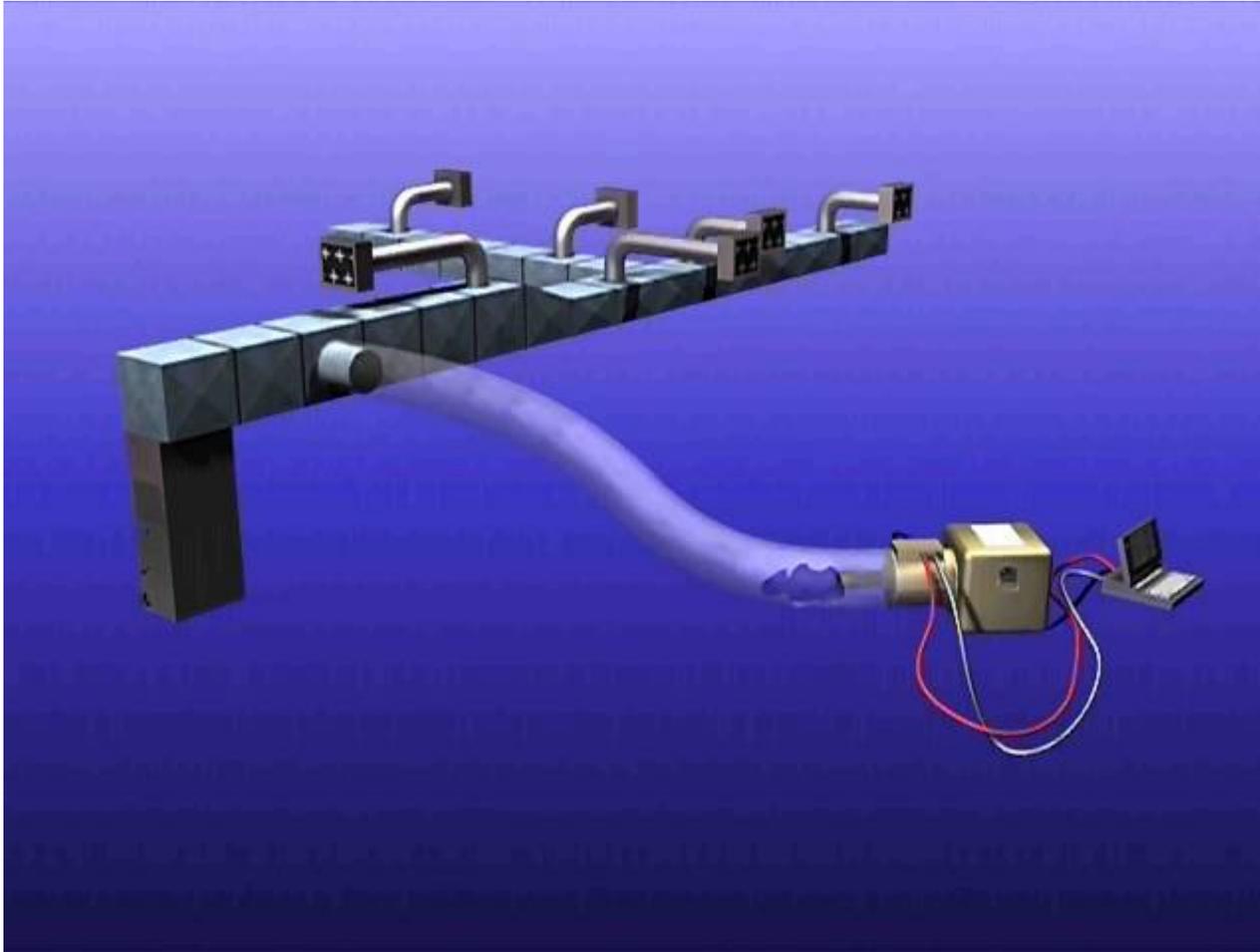


# Aerosol wand in operation...

Sealant spray pattern from injection wand



# Aerosol sealing apparatus in action...



# Aerosol Sealing Results

## Buildup of polymer sealant



# Recent aerosol duct sealing results...

Building	Fan Flow [cfm]	Initial Leakage [%]	Fraction Sealed	Notes
#1	69,000	19%	87%	4 Floors, 6 coils/floor
#2	93,000	36%	78%	2 Floors, 3 Loops, Hot/Cold/Lab Make-Up 1-2 inject/loop, 2 Fans
	22,000	27%	85%	80 grilles on 2 Floors, single point injection
#3	N/A	3000 cfm <sup>25</sup>	93%	Shower/Toilet Exhaust
#4	14,000	19%	87%	Dorm Room Supply, Return was chase with large penetrations
#5	46,200	19%	92%	Downstream Leakage Only, Slot diffusers, Sealed w/Fan On, 3 flrs
	10,000	10%	90%	No Pre-Qualification
#6	16,610	15%	92%	Blew thru terminal system-power induction boxes, pneumatic line connected to pitot inlet
#7	10995	1% - 23%	87%	No Pre-Qualification
#8	8,200	19%	85%	Found undocumented take-offs, 11 stories, penthouse inject

# Aerosol Sealing Results at LBNL...

Section (Bldg 70)	Date	Pre-seal cfm25	2-min cfm25	Final cfm25	Post-Seal cfm25	Inj Time minutes	% sealed
3rd Floor Annex Return	11/6/2005	30.7		15.6	14.5	27	53%
3rd Floor Annex Supply	11/6/2005	721	722	835	804	37	-12%
2nd Floor Annex Supply	11/16/2005	403	543	31	30.6	35	92%
1st Floor Corridor	11/20/2005	2373		134	135	171	94%
2nd Floor Corridor	11/30/2005	2805		717	919	240	67%
1st Floor Cold	12/3/2005	3087	1777.2	796	851	189	72%
2nd Floor Cold	12/4/2005	2007	1361.7	262	309	137	85%
1st Floor hot	12/10/2005	1040			273	138	74%
2nd Floor Hot	12/11/2005	1318			346	119	74%
Exhaust	12/23/2005	2277			335	319	85%
Total		15310			3198	1349	79%
Assuming avg leak press of 0.5" H2O		40212			8400		
%Leak at avg leak press of 0.5" H2O		35%			7%		
To keep the same total flow into zones, should be able to reduce fan flow to							80681
%reduction in fan flow							30%
%reduction in fan power							65%

**>12% electrical savings in first month!**

# For More Information



<http://ateam.lbl.gov>

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