

One productive link on the site is an archive of AIHA white papers on various topics, including the group's response to the proposed revision of ASHRAE Standard 62.

Electric Power Research Institute (EPRI)
<http://www.epri.com>

Gas Research Institute (GRI)

<http://www.gri.org>

These two sites provide access to institutes sponsored respectively by the electric power and the gas industries. The GRI site requires you to sign up for full access.

IEQ Video Offers Guidance on Performing Building Evaluation

A self-paced video from Chelsea Group, Ltd. (Madison, Wisconsin) provides detailed direction for IAQ professionals in how to conduct an investigation into the building environment. Available for both sale and rental, the video has an accompanying manual and sample inspection checklist.

The program focuses on the most important issues mechanics and technicians need to know to improve IAQ and help avoid liability. It also includes sections showing some common mistakes made in these investigations. The accompanying

manual reinforces the video and includes the checklist to aid in establishing a custom program for a building.

Purchase price for the video is \$325 and includes one manual. A two-week rental costs \$135 and includes one manual to keep. For more information, contact Chelsea Information Services, 6402 Odana Road, Madison, WI 53719, USA; (800) 722-9093 or (608) 288-1211, Fax: (608) 288-1272; E-mail: inviron@chelsea-grp.com.

PRACTICAL RESEARCH BRIEFS

Smoking Ban Results in Dramatic Drop in Airborne Particulates

IEQ studies in a popular sports tavern before and after an unexpected ban on smoking in public places indicated that the smoking ban resulted in a dramatic drop in respirable suspended particulates (RSPs). The results of the study give some indication of how smoking affects the indoor environment, a long-time controversial question.

The researchers in the study had been studying RSPs in the tavern over a period of three years, noting occupancy, the number of smokers, and the number of cigarettes smoked. When local authorities, with no advance warning, promulgated a total smoking ban, the researchers were able to continue their studies and measure the effect that the no-smoking policy had on IAQ.

The researchers from Stanford University and the University of Maryland reported their findings in the December 1996 issue of the *Journal of the Air & Water Management Association* (Vol. 46: 1120-1134). Wayne Ott is the lead author.

The tavern in question is a popular sports bar, which offers food cooked on its grill, as well as pizza. An entrance door opens to an alley and to a patio when weather permits. One large rectangular room — 47 ft x 48 ft — contains tables and

booths, a 20-foot bar with eight seats, and two large-screen television sets. Average attendance during the study period ranged from 10 to 75 persons. The official maximum capacity is 120 persons.

The data in the study is based on 76 visits to the bar — 26 visits before the smoking ban and 50 afterward. The follow-up visits consisted of 24 visits immediately after the smoking ban and 26 visits later in the year, matched to the dates in the pre-ban visits to obtain comparable data.

Researchers timed their visits to simulate visits made by ordinary patrons. On each visit, they:

- Periodically counted the persons present;
- Counted cigarettes actively being smoked;
- Measured successive RSP concentrations over the visit; and
- Measured outdoor RSP concentrations before and after taking indoor measurements.

When inside the establishment, the researchers placed the RSP monitor at the same location on a central table. While the monitor measured continuously, averages were taken every two minutes. To count customers and active smokers, a

researcher would walk through the tavern every seven minutes.

Results

During the time smoking was allowed, indoor RSP averaged 56.8 micrograms per cubic meter ($\mu\text{g}/\text{m}^3$) above the outdoor level. However, in the months immediately following the ban, the indoor concentration dropped to 5.9 $\mu\text{g}/\text{m}^3$ above outdoor levels. When the researchers measured concentrations during the matched visits, they found the levels averaged 12.9 $\mu\text{g}/\text{m}^3$ above outdoors. Table 2 shows the results from the matched visits, which took place approximately two years apart.

During the smoking period, researchers found the indoor RSP concentrations more than 100 $\mu\text{g}/\text{m}^3$ above outdoors nearly one-third of the time. After the ban, nearly all the indoor concentrations were less than 20 $\mu\text{g}/\text{m}^3$ above outdoors.

One interesting note is that after the smoking ban, patronage at the bar actually increased, going from a mean of 40.6 persons before the ban to 42.2 after the ban. The tobacco lobby and hospitality industry trade groups have consistently reported that smoking bans hurt business, despite numerous studies showing the opposite.

The researchers also noted in their report that they felt the study was unique due to the

Table 2 — Comparison of RSP in Tavern During Smoking and Non-Smoking Periods

Day	Time	Smoking Period			Nonsmoking Period	
		Persons	Smokers	I-O RSP* ($\mu\text{g}/\text{m}^3$)	Persons	I-O RSP ($\mu\text{g}/\text{m}^3$)
Sunday	11:50	21.0	1.7	29.6	34.0	6.8
Thursday	17:30	25.3	1.8	38.9	23.8	1.7
Thursday	17:06	22.2	1.0	9.6	16.6	2.0
Friday	20:02	53.8	1.9	148.8	59.9	8.6
Monday	20:06	27.8	0.7	42.7	36.0	8.0
Thursday	18:10	60.4	1.9	108.3	72.0	71.8
Monday	20:19	51.2	2.2	100.4	18.0	-5.1
Thursday	18:50	56.0	1.5	131.0	55.3	5.4
Saturday	22:04	33.8	1.0	40.0	15.3	7.1
Wednesdah	19:15	50.0	0.6	28.1	48.3	18.7
Friday	19:59	66.8	0.1	11.3	73.0	19.2
Wednesday	20:20	36.0	1.8	110.2	52.0	27.5
Thursday	20:09	47.0	1.1	45.1	58.7	13.0
Friday	20:06	86.8	1.0	24.2	76.5	10.0
Saturday	20:04	37.1	0.8	21.3	78.8	15.3
Saturday	22:46	39.2	0.2	17.5	18.0	-6.3
Tuesday	19:00	41.7	2.7	124.5	31.0	10.0
Saturday	20:26	35.0	0.5	-2.0	53.7	24.4
Monday	20:02	35.5	0.9	124.5	31.0	12.1
Tuesday	20:00	32.8	0.0	23.0	39.8	-0.9
Saturday	18:20	38.5	1.6	75.0	63.5	38.6
Saturday	22:30	47.3	2.3	115.1	32.0	7.0
Wednesday	20:07	37.0	1.0	15.5	23.7	9.8
Friday	18:31	49.8	0.8	39.8	59.0	3.5
Wednesday	12:06	13.6	0.2	15.0	19.0	16.7
Monday	16:11	12.3	1.1	38.2	8.3	10.3
MEAN		40.6	1.2	56.8	42.2	12.9

* I-O RSP = Indoor RSP minus outdoor RSP

Source: Ott et al

unexpected nature of the smoking ban. Because it went into effect with little warning, they were confident that no other changes had been made to either the tavern's operation or its ventilation system.

For more information, contact Wayne Ott, Department of Statistics, Margaret Jacks Hall, Bldg. 460, Stanford University, Stanford, CA 94305, USA.

Analysis Indicates Photocatalysts Costlier than Carbon Filters

Photocatalytic oxidation of indoor contaminants, while a promising technology, may not be as economically feasible as originally thought. A researcher from the US Environmental Protection Agency (EPA) has performed a cost analysis that shows the infant technology comparing poorly to current methods, specifically granular activated carbon (GAC).

Bruce Henschel of the EPA originally compiled the analysis, showing that, based on available systems, photocatalytic systems would cost more than 10 times as much as GAC systems and would have annual costs nearly twice as high (see Table 3). Henschel told *IEQS* that he is currently revising that analysis, correcting for new developments in photocatalytic reactors, but that the new figures make the technology "even less attractive."

Henschel cautioned, however, that his analysis is based on system specifications that are available in published material. Some companies have developed systems using proprietary technology,

and that technology, if cheaper in capital costs and more efficient to operate, could change the cost analysis dramatically.

Henschel based his original projections (in Table 3) on a generic reactor configuration, a packed bed with a titanium dioxide (TiO₂) photocatalyst deposited on suitable supports, irradiated by a suitable ultraviolet (UV) source. He assumed the reactor to operate at 40°C, requiring a heat exchange configuration. He assumed that both air cleaners would be challenged with a volatile contaminant stream at 1 part per million.

Henschel told *IEQS* that his revised figures eliminate the heat exchanger, but even this doesn't lower the comparative figures. Henschel said he made his assumptions as optimistic as possible in the case of the photocatalytic reactor, but his conclusion for the future of the technology are that developers must:

- Demonstrate improved catalysts offering faster reaction rates and longer lifetimes; and

Table 3 — Cost Comparison of GAC vs. Photocatalytic Oxidation (Cost per 1,000 cfm)

Equipment Costs		
Item	Activated Carbon (US \$)	Photocatalytic (US \$)
Reactor (excluding carbon or catalyst)	530	3,300
Initial carbon/catalyst charge	240	3,400
Duct heater and controls	—	600
Air-to-air heat exchanger	—	2,600
Enlarged central air handler	40	150
Additional ducting, elbows, dampers, etc.	370	2,000
Total Installed Costs	1,180	12,050
Annual Costs		
Operating: electricity (increased HVAC cooling load and fan static pressure, power for catalytic reactor)	50	1,150
Maintenance: regeneration of catalyst, replacement of UV bulbs, replacement of carbon	2,170	1,150
Capital charges: catalyst depreciation; equipment depreciation, interest, taxes, and insurance	190	2,350
Total Annual Costs	2,410	4,650

Source: Bruce Henschel, US EPA

- Develop improved reactor designs that provide greater exposed catalyst surface per unit volume, improved catalyst irradiation, and reduced pressure drop.

Henschel is still working on his revised figures and plans to present them at a conference, *Engineering Solutions to Indoor Air Quality Problems*, which will be sponsored jointly by the EPA and the Air & Waste Management Association, July 21-23 in Research Triangle Park, North Carolina.

For more information on the cost comparison, contact Bruce Henschel, US EPA, Research Triangle Park, NC 27711, USA; (919) 541-4112, E-mail: bhenschel@engineer.aeerl.epa.gov.

For more information on the upcoming conference, contact Registrar, Air & Waste Management Association; (412) 232-3445 or (412) 232-3444, ext. 3142.

NEWS AND ANALYSIS

1981 IAQ Complaints Lead to Senator's Request for Investigation

A US senator has requested an investigation into illnesses that occupants in a federal building claim came from an indoor air exposure in 1981. Senator Lauch Faircloth (R-NC) made the request in a letter to officials at the National Institute of Environmental Health Sciences (NIEHS).

Some employees who worked at the agency's building in Research Triangle Park, North Carolina, shortly after it opened in 1981, are complaining of ongoing health problems, which they blame on the IEQ conditions at the facility. Several people — 15 of 25 who worked in one area — have since developed various diseases, including cancers, heart problems, and respiratory conditions.

Scott Merkle, currently chief of health and safety at the facility, told *IEQS* that the complaints are apparently related to conditions that existed when the building opened in April 1981. At that time, tests revealed elevated formaldehyde concentrations that officials traced to particleboard furniture and bookcases. He said the levels decreased and by 1983 no formaldehyde concentrations were detectable. NIEHS officials say they're unaware of any connection between formaldehyde exposure, especially a transient exposure,

and many of the diseases reported by the employees — leukemia, melanoma, and other forms of cancer.

Merkle said the agency hadn't tried to evaluate the specific symptoms or clusters because officials don't have access to employees' medical records. At any rate, Merkle told *IEQS*, most studies involving formaldehyde presume a long-term lifetime exposure. Also, he said, the passage of time and a wide variety of other personal habits could confound any attempt to link exposure to current ailments.

According to media reports, the current concern began when one former employee recently developed melanoma. She began contacting other people who worked in the area and discovered the array of illnesses. When she submitted the information to NIEHS officials, they denied any link between the 16-year-old exposure and the illnesses. The former employee then took the matter to Sen. Faircloth.

For more information, contact Scott Merkle, NIEHS, P.O. Box 12233, Research Triangle Park, NC 27615, USA; (919) 541-7933.

Sweden Considers Need for Removing PCBs from Buildings

Swedish researchers have found that polychlorinated biphenyls (PCBs) are leaking into air and soil from sealants used on the outside of older houses built from prefabricated concrete parts. Several thousand buildings may need to be systematically decontaminated, says the Swedish environment agency (Naturvårdsverket), which together with Stockholm's municipal environment

administration had commissioned an investigation.

PCBs were used as an additive in sealants from the 1950s until 1972, when they were phased out. Some sealants contained up to 20% PCBs. Thus far, it was considered sufficient to separate sealants during renovations to prevent them from ending up among nonhazardous construction waste. The new findings suggest, however, that