Clayton Environmental Consultants

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newsletter

An Improved Method for Analyzing p-Dioxane and Tetrahydrofuran in Water Samples

by Paul Epstein, Ph.D.
Technical Organic Supervisor

Dioxane (not to be confused with dioxin) and tetrahydrofuran (THF) are cyclic ethers commonly used as industrial chemicals. Dioxane is used as a solvent for cellulose acetate, ethyl cellulose, resins, oils, waxes, oil and spirit dyes, and other organics. THF is used as a solvent for several polymers (particularly polyvinyl chloride), and as a reaction solvent for Grignard reactions.

Dioxane is the more toxic of the two compounds and has been listed as a carcinogen by the U.S. Environmental Protection Agency (EPA) based on the National Toxicology Program (NTP)[1] findings. This NTP listing also means that p-dioxane must be listed as a carcinogen in any Occupational Safety and Health Administration (OSHA) hazard communication determination. Clayton recently investigated an incident of groundwater contamination with p-dioxane and THF. The project required a rapid method for measuring low parts per billion (ppb) levels of dioxane and THF in drinking water.

The common methods of measuring organics in water, such as solvent extraction and concentration or purge and trap methods, cannot attain ppb limits of detection (LOD) with very water-soluble compounds, such as THF and p-dioxane. Direct injection of the contaminated water onto a GC-FID (gas chromatograph-flame ionization detection) is a viable method, but cannot attain LODs at ppb levels. Heating the purge vessel during the U.S. EPA method 8240[2] for volatiles can achieve low LODs (10 ppb) for these compounds. This method, however, has two disadvantages. It is undesirable to introduce large quantities of water vapor into the GC/MS (gas chromatograph/mass spectrometer) system and it is not cost effective.

Clayton has developed a new method that consists of adsorption of THF and p-dioxane onto charcoal followed by desorption with methanol-saturated carbon disulfide. The desorbate is then analyzed by GC-FID. (See diagram for a typical chromatogram and chromatographic conditions.) Spike recoveries in the range of 59 to 90% were obtained for p-dioxane spiked water

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Analytical Notes

Tetraethyl Lead

Both Occupational Safety and Health Administration (OSHA) and American Conference of Governmental Industrial Hygienists (ACGIH) have exposure limits for tetraethyl lead (TEL), an anti-knock additive to leaded gasoline. Both the OSHA permissible exposure limit (PEL) and the ACGIH threshold limit value (TLV) are expressed as total organo-lead and not in terms of a specific organo-lead compound. Sampling and analyses of TEL is generally carried out by the following two methods:

National Institute for Occupational Safety and Health (NIOSH) S383, Volume 4, NIOSH Manual of Analytical Methods

This method requires collection on

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PERISCOPE

OSHA Proposes a 1-PPM Benzene Limit...Second Time!

The Occupational Safety and Health Administration (OSHA) recently proposed that its permissible exposure limit for benzene be reduced from 10 parts per million (ppm) to 1 ppm, with an action level of 0.5 ppm. In 1978, after five years of discussion, OSHA set a permissible exposure limit (PEL) of 1 ppm for benzene. Following a challenge by the American Petroleum Institute, however, the U.S. Supreme Court overturned OSHA's 1-ppm limit, and the PEL remained at 10 ppm since that decision.

Benzene is a constituent in gasoline and in many common industrial solvents. It is also used as an intermediate in the production of styrene, phenols, and maleic anhydride.

The OSHA proposal calls for designating areas where the benzene concentration exceeds the PEL, measurement of employee exposures, methods of exposure control, personnel protective equipment, medical surveillance, hazard communication, and training among various other requirements. The proposed revision was based on OSHA's preliminary determination that the standard was needed to reduce the risk of leukemia and other adverse health effects of exposure to benzene.

Informal public hearings are scheduled at four locations across the country in March and April 1986. The most controversial aspect of the proposed rule is the absence of a short-term exposure limit (STEL) similar to the one in the existing standard originally developed by the American National Standards Institute (ANSI) standard [Z37.40-1969].

Significant aspects of the proposed standard include:

- Initial monitoring to be completed within 60 days of the effective date or within 60 days of the introduction of benzene into the workplace. Only monitoring conducted within one year of the standard's publication date can be used to determine compliance to the standard.
- Restrictions regarding application of the standard to bulk wholesale storage

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PERISCOPE

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facilities, containers, pipe lines, work operations where the only exposure is from liquid mixture containing 0.5% (reduces to 0.1% five years after publication date of the standard) or less benzene by volume, and oil and gas drilling, production and servicing operations.

- Employee referral to a hemotologist/internist by a physician following abnormal blood test results and temporary removal of the employee. The affected employee is to be returned to an area of benzene exposure only after a physician's approval.
- Engineering and work practice controls be implemented within two years of the standard's effective date.
- Mandatory respirator qualitative and quantitative fit-testing.

EPA Turns Full Circle on Asbestos

Lee Thomas, Environmental Protection Agency (EPA) Administrator, surprised many recently when he announced that EPA will ban the manufacture, importation, and processing of asbestos products over 10 years. In February 1985, EPA announced it would *not* seek such a ban, preferring to shift the responsibility for regulating asbestos to the Occupational Safety and Health Administration (OSHA) and the Consumer Product Safety Commission. EPA received much criticism for its decision in 1985 and was accused of bending to pressures from the Office of Management and Budget (OMB).

The proposed ban, announced January 29, 1986, will initially prohibit the manufacture and importation of asbestos cement pipe products, roofing felts, flooring tiles, vinyl asbestos floor tile, and asbestos clothing. Over the next 10 years, the remaining uses of asbestos will be phased out. This ban will accelerate the already declining use of these products.

The proposed rule will also require firms that mine or import asbestos to obtain permits. This will restrict the amount of asbestos mined or imported each year.

EPA is soliciting comments on the proposal. The agency will hold hearings beginning May 14, 1986.

Formaldehyde

The Occupational Safety and Health Administration (OSHA) recently proposed to amend its existing regulation for occupational exposure to formaldehyde [29 CFR 1910.1000, Table 2-2]. Formaldehyde is one of the most commonly used chemicals in commerce. It is used as a wood fungicide, germicide, disinfectant, and a binder in wood products. It is also extensively used in the production of urea and phenol resins. In addition, formaldehyde is used in dyes, inks, paper, permanent-press clothing, and many other consumer products. In proposing the new standard, OSHA announced that the current permissible exposure limit (PEL) for formaldehyde does not adequately protect employee health. OSHA has proposed the following alternatives to the current standard, which was initially developed by the American National Standards Institute (ANSI):

- lower the existing 8-hour, time-weighted average (TWA) exposure limit to either 1 or 1.5 parts per million (ppm) from the current 3-ppm limit, and
- delete both the existing ceiling concentration limit of 5 ppm and the peak exposure limit of 10 ppm, (permitted for up to 30 minutes in an 8-hour workshift). The first alternative, however, is an amendment to the existing list (Table 2-2T) while the second alternative proposed merely replaces the current standard with an "expanded" occupational exposure standard. The second alternative includes an "action level" of either 0.5 ppm or 0.75 ppm, measured as an 8-hour, TWA. The proposed standard contains requirements for employee exposure monitoring, establishment of regulated areas (where exposures to formaldehyde may exceed the PEL), methods to control exposure, personal protective equipment, housekeeping, emergency plans, medical surveillance, hazard communication, training, and recordkeeping.

The most controversial aspect of both proposed alternatives was the lack of a short-term exposure limit (STEL).

OSHA recognized widespread support for a STEL. If a STEL is included in the final standard, the most likely level will be 5 ppm during a 15- or 30-minute. OSHA has said, however, that it would consider values higher or lower than 1 ppm.

Acting on the recommendations made by the Advisory Committee on Construction Safety and Health, OSHA is proposing a single standard for industry. OSHA, however, recognizes alternative approaches. These include:

- making a general industry standard more applicable to construction
- modifying the general standard
- developing a separate standard

The informal rulemaking hearing is scheduled to begin on April 22, 1986.

The above Periscope articles were contributed by Michael A. Coffman, C.I.H., Manager of Industrial Hygiene, and Timothy Kass, C.I.H., Senior Industrial Hygienist.

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p-Dioxane and Tetrahydrofuran

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samples at spike concentrations ranging from 10 to 500 ppb. For THF, recoveries ranged from 88 to 110% in the 9- to 90-ppb concentration range studied. Detection limits are dependent on the sample size. Typically, a 1-liter sample can be analyzed with a LOD of 5 ppb. This method can be used effectively in combination with the direct injection technique which serves as a prescreen.

We are currently conducting additional studies to determine the applicability of this methodology to other water-soluble organic compounds.

For additional information on this method, contact Paul Epstein at (313) 424-8860, or write to him at 25711 Southfield Road, Southfield, MI 48075.

(1) **Second Annual Report on Carcinogens,** NTP 81-43, December 1981, pp 131-133.

(2) **Test Methods for Evaluating Solid Waste-Physical Chemical Methods** (SCV-846 2nd Ed. 1982 — Table 1).

Chromatogram of p-Dioxane and THF at 100 ppb.

Instrument	HP5890
Detector	FID
Column	60 m DB-5 capillary
Oven	55°C
Injection Port	250°C
Detector	275°C
Head Pressure	21.5 PSIG
Injection Size	1 ui

Upcoming Clayton Breakfast Seminars

MAY THROUGH AUGUST 1986

Date	Subject	Location
April 29	RCRA	Woodbridge Hilton 120 Wood Avenue South Iselin, NJ
May 6	PCB	Hotel Sofitel 5601 W 78th Street Minneapolis, MN
May 8	PCB	Hyatt Regency Indianapolis One South Capitol Avenue Indianapolis, IN
May 13	Chemical Management in the Workplace & RCRA	Omni International 101 W. Fayette St Baltimore, MD
June 3	Asbestos Management Update	Hyatt Regency - Dallas At Reunion 300 Reunion Boulevard Dallas, TX
June 4	Chemical Management in the Workplace	Sheraton Amarillo 3100 I-40 West Amarillo, TX
June 5	Chemical Management in the Workplace	Hotel Meridien Houston 400 Dallas St. Houston, TX
June 17	Asbestos Management Update	Warwick Hotel 17th & Locust Street Philadelphia, PA
June 19	RCRA	Warwick Hotel 17th & Locust Street Philadelphia, PA
July 8	Chemical Management in the Workplace	Sheraton at Station Square 7 Station Square Drive Pittsburgh, PA
July 10	Asbestos Management Update	Waldorf Astoria 301 Park Avenue at 50th St. New York, NY
July 22	Chemical Management in the Workplace	Marriott Pavilion One Broadway St. Louis, MO
July 23	Chemical Management in the Workplace	Marriott Hotel 75 South West Temple Salt Lake City, UT
August 5	Asbestos Management Update	Seattle Sheraton & Towers 1400 Sixth Avenue Seattle, WA
August 6	Chemical Management in the Workplace	Alexis Hotel 1510 Southwest Harbor Way Portland, OR
August 7	Asbestos Management Update	Hyatt Wilshire 3515 Wilshire Blvd. Los Angeles, CA
August 19	Chemical Management in the Workplace	The Westin At Fountain Square Cincinnati, OH

The seminars begin at 9:00 a.m. with a buffet breakfast. This is followed by a slide presentation and a question-and-answer period. A panel, including Clayton staff and industry experts, will field questions from the audience. The seminars end about 11:00 a.m. There is no charge for the seminar. To reserve a place, please call or write to Karen Moehr at Clayton's Southfield office (313/424-8860).

Meet the Clayton Staff...Charlie Blake

In each issue of the Clayton Newsletter, we will introduce a member of our staff, allowing our readers to see the "other side" of Clayton's professionals. This issue, we profile Charlie Blake, Manager of Clayton's Marietta, Georgia office.

— Editor

"Clearwater-St. Pete Tower, this is Comanche 7697 Papa, declaring emergency. I have just had a complete engine failure—request clearance for emergency landing!"

"Comanche 7697, you are cleared for emergency landing, any runway, any surface."

This exchange between Charlie Blake and the airport control tower took place shortly after takeoff when the single engine in his Piper Comanche belched out a thick cloud of smoke and died. Unable to glide back to the airport, Charlie lined up the crippled aircraft parallel to the beach (staying a safe distance from the bathers in Tampa Bay), and made an unexpected (and unrehearsed) amphibious landing.

That evening, Charlie and I were to be in Milwaukee to meet with a client. Charlie, then in Tampa, was to pick me up in Detroit after making a quick stop in Atlanta for some personal business. After an anxious wait of several hours, my telephone rang. In a calm voice, Charlie told me that he'd had "an unusual flight experience" that morning and was calling from the Tampa General Hospital. He quickly added that he expected to be discharged within a couple of hours after treatment of a few minor cuts and bruises he suffered during his "unconventional landing." Charlie felt that the plane might be salvageable since it "landed" in shallow water, but the files containing project information and the pump calibration data were beyond saving. Also gone were the six MSA gravimetric pumps and a dozen specially prepared silica gel tubes he wanted to use for sampling amines.

The accident investigators complimented the pilot on his skillful emergency landing, avoiding serious injury to himself and others. The incident did not diminish Charlie's enthusiasm for aviation. He did, however, conclude that it was advantageous to have a twin-engine craft. Those of us who have flown with him since have a new appreciation for the term "redundancy."

On a typical Saturday, if he is not tinkering with his Beechcraft Baron or one of his three Porsches, Charlie can be found in Clayton's Marietta office pondering over the next week's schedule, trying to squeeze in two extra emergency "rush" asbestos projects. Soon after, he is on the phone bargaining feverishly with other Clayton managers to borrow or steal an experienced helper to staff the "emergency" jobs.

Charlie Blake has been with Clayton for over seven years. He first joined Clayton's Southfield office as a senior industrial hygienist and group leader. When the position of manager became available in Clayton's newly opened Atlanta office, Charlie eagerly volunteered for the job. Before coming to Clayton, Charlie had spent his entire working career in the south, and he always wanted to go back "home" — a remarkable transformation for a Connecticut boy.

After earning his chemical engineering degree at the Worcester Polytechnic Institute, Charlie joined the DuPont Company in Chattanooga as a process engineer, making nylon. His four-year career with DuPont was interrupted by the Viet Nam War, where Captain Blake earned a Bronze star for his service in the U.S. Army. In Viet Nam, Captain Blake's standard attire included a nylon flak jacket, which he wore on (almost) all occasions. When asked about his passion for the (DuPont) nylon jacket, he replied, "This was one product about which I could be sure of the quality control." Upon returning to DuPont, Charlie was assigned quality control responsibilities.

Shortly afterward, he joined the Aetna Insurance Company in Hartford as an industrial hygienist/laboratory chemist. Charlie talks fondly of his initiation into the industrial hygiene world by his mentor, Rudolph (Rudy) Schmidt, who apparently had most unusual ideas about laboratory instrumentation.

While reviewing x-ray diffraction results for silica analyses on one recent project, Charlie launched into a long discussion about his struggle with the colorimetric (Talvitie) method he used at Aetna. "The industrial hygiene laboratory instrumentation in those days was basic," Charlie said. Rudy Schmidt even made his own reticle (for the microscope) using a specially created spider web.

After Aetna, Charlie spent the next six years formulating, controlling, and disposing pesticides and herbicides for the Helena Chemical Company in Memphis.

I first met Charlie while performing an industrial hygiene/environmental audit at the Helena plant in Des Moines. After introducing myself to the plant manager, I asked

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Charlie Blake, Manager of Clayton's Marietta office, embarks on yet another environmental field survey.

Charlie Blake

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to talk to the process engineer to review the chemical processes and the unit operations involved. Soon after, Charlie walked in carrying a roll of drawings, sketches, and a chalk in his hand. Later in the day, I asked to talk to the company environmental engineer, since the air and water emissions appeared to be an important concern at that facility. I was ushered into Charlie's office. The second day of my survey was devoted to industrial hygiene: "Can I speak to the industrial hygienist or the safety engineer?" You guessed it, back to Charlie's office!

Welcome to the world of pesticides!

That afternoon, Charlie explained everything I always wanted to know about pesticides. Until then, I had not realized that there could be much humor in that business. Our discussion turned to toxaphene, a sticky, brownish material made from chlorination of camphene ("pine pitch," as the farmers call it).

"What accounts for the potency of this material?", I asked.

"Well, the farmers have their own interpretation of its toxicology," Charlie said. "They call toxaphene the "trappin' toxin."

"The trappin' toxin?"

"Yes, they feel the bugs die because they just get trapped in the sticky pine pitch!"

Charlie also explained to me the seasonal nature of the business. He said the timing of the pesticide spray was critical. "If you wait too long to spray bole worms, they get so big and nasty that the only way to kill them would be to drop the barrel on their heads."

It is his diversity of experience that has helped Charlie thrive in the consulting environment, tackling projects that sometimes appear to be a strange mix of science and detective work. These days, our conversation often drifts away from industrial hygiene and toward hazardous waste. Discussing a recent project where the Clayton laboratory found 1- to 2-parts per million of *1,1,1-trichloroethane in some water* samples, I asked Charlie, "Does that look serious?" "I guess it's all relative," Charlie said with a shrug. "Trichloroethane is not the same thing as toxaphene or parathion, but on the other hand I wouldn't want any 1, 1, 1 in my drinking water."

How about in the fuel tank of your Beechcraft Baron, Charlie?

Contributed by:
Jaswant Singh, Ph.D., C.I.H.
Senior Vice President

New Building Progress

Despite the cold and wet weather, foundations have been poured and construction is under way on Clayton's new $2,000,000 main office and laboratory in Novi, Michigan. The artist's drawing above depicts the design of the building.

New York City Toughens Asbestos Laws

by Kirit Vora
Manager, Edison Office

In 1958, Henry Johns started an asbestos roofing manufacturing business in his New York basement. Within a few decades, the "magic mineral" was being applied, as fireproofing, in many steel-framed skyscrapers in New York and other major cities. New York City wants to carefully control the "magic mineral" which they now believe is the cause of significant disease.

Following the state of New Jersey's footsteps in regulating asbestos, New York City recently approved amendments to its administrative code for the control of asbestos. The new law will require that renovation or demolition work, which disturbs asbestos, must be performed in accordance with procedures established by the city. Workers who handle asbestos-containing materials would have to receive proper training. All asbestos projects would require a permit from the commissioner of Department of Buildings. Moreover, it would be unlawful for any person to handle friable asbestos (in the course of performing work for compensation) without a valid asbestos-handling certificate.

Under the New York City law, an asbestos project means any form of work in which renovation or demoliton would disturb 260 linear feet or 160 square feet of asbestos material. Fees that the city may levy on asbestos work include:

- application fee for a permit $800
- *fee for issuing or renewing an asbestos-handling certificate* $100
- *fee for certifying or recertifying an asbestos investigator* $100
- *fee for approval of an asbestos removal plan* $1,000

New York has announced that within 18 months the commissioner of environmental protection will submit a report to determine if the presence of asbestos poses a risk to building occupants during "normal" day-to-day operations (when no renovation, alteration, or demolition is occurring). Other cities are developing local laws to license "asbestos handlers" and specifying requirements and restrictions on asbestos removal, renovation, and remodeling projects. The city of Philadelphia has proposed a comprehensive asbestos law similar to that of New York City.

We will report on further developments in this area in the forthcoming issue of the Clayton Newsletter. For more information on these emerging asbestos laws and regulations, please contact Kirit Vora of Clayton's Edison office at (201) 225-6040.

Analytical Notes

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XAD-2 followed by solvent desorption and analysis by gas chromatography using a photoionization detector.

OSHA-Field Operations Manual Method Requires collection on activated charcoal, preceded by a 37-mm glass fiber prefilter. The charcoal is acid-extracted and the extract analyzed by atomic adsorption spectrophotometry. Samples are collected at a flowrate of 1 liter per minute for two hours.

The NIOSH method can determine specific organo-lead compounds whereas the OSHA method determines total organo-lead without speciation.

Clayton's laboratory has performed analyses using both of these procedures. In our recent experiences, however, we have found significant interferences in determining TEL using the NIOSH method. The interferences are particularly significant in environments containing the petroleum products (due to the presence of many other organic compounds). As a result, we recommend the use of the OSHA method for determining TEL in cases where the purpose of the sampling is to determine compliance with the OSHA PEL or comparison against the ACGIH TLV.

Improved Dioxin/ Furan Sampler

Measurement of polychlorinated dibenzodioxins (PCDD) and polychlorinated dibenzofurans (PCDF) has become increasingly important because of their high toxicities and their frequent presence in residues from polychlorinated biphenyl (PCB)-related fires or PCB fluids that have undergone "over-heating." The limits of detection (LOD) in air required for these compounds are extremely low [1 to 2 picograms (pg) per cubic meter]. The instrumental LODs for PCDD and PCDF are in the 10-50 pg range for low resolution quadrupole mass spectrometers. Conventional industrial hygiene sampling devices collect samples at flowrates in the 0.2-2 liters per minute (L/min) range. This would necessitate an unusually long sampling period to achieve the sample size of 70-120 cubic meters required to reach the detection limits necessary for these compounds. To achieve the low LOD, the New York State Department of Health[1] designed a sampler capable of drawing up to 10-20 L/min of sample. This sampler was used at the Binghampton office building in the aftermath of a PCB fire. The sampler consisted of an aluminum glass fiber filter holder followed by a silica gel cartridge in a Teflon housing.

Modifications of the sampler, particularly the use of the fritted disc, enabled us to collect large volume samples (within a reasonable 2-3 day period) without experiencing excessive pressure drop.

The modified sampler (shown in figure) consists of all Teflon 47-mm glass fiber filter holder in series with a glass cartridge fitted with a fritted disc backplate and containing 10-20 grams of pre-extracted and activated silica gel adsorbent. The Teflon filter holder is lighter in weight and less likely to be reactive (than steel or aluminum) if the sampler is used for other organics. The filter/adsorbent design allows separate particulate and vapor measurements to be conducted. Changing the adsorbent to Florisil, XAD, or charcoal allows the sampler to be used for measuring other organics at very low detection limits.

NOTE: The complete sampling assembly for PCDD and PCDF is available from Clayton. For additional information on the availability of this sampler and sampling instructions, please contact Paul Epstein at (313) 424-8860 or write to him at: 25711 Southfield Road, Southfield, Michigan 48075.

[1] Chemical and Biological Investigations of a Transformer Accident at Binghamton, N.Y., P.W. O'Keefe et al., Environmental Health Perspectives 60, May 1985, pp 201-209.

The above analytical notes were compiled by Robert Lieckfield, C.I.H., Manager of the Southfield laboratory, and Paul Epstein, Ph.D., Technical Organic Supervisor.

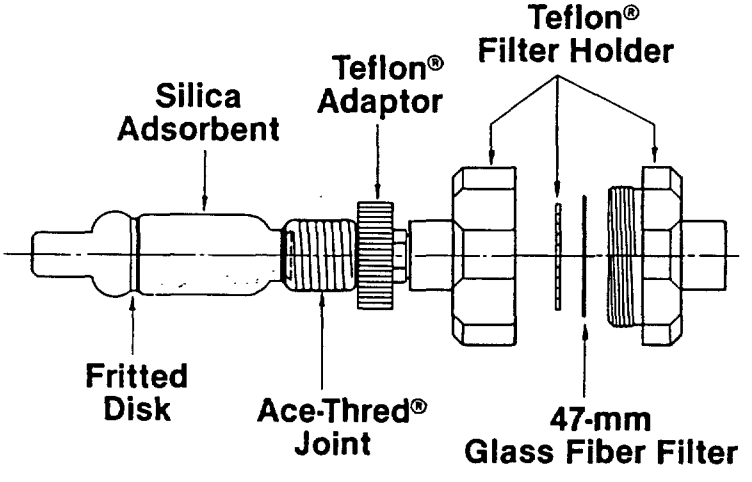

Figure. PCDD/PCDF Sampler

Research on Venturi Scrubber Design Parameters

by S. Viswanathan, Ph.D.,
A.W. Gnyp, Ph.D.,
and C.C. St. Pierre, Ph.D.
Windsor Office

Clayton Environmental Consultants is involved in the evaluation and design of dry and wet gas cleaning devices. When fundamental design parameters are not available in the published literature, the Clayton staff has conducted studies in association with the Department of Chemical Engineering at the University of Windsor. For some time the cooperative efforts have focused on the assessment of performance characteristics of Pease-Anthony Venturi scrubbers, which are effective in removing particulate matter from moving gas streams. These gas cleaning devices are popular because they offer significant advantages, including lower initial costs for comparable collection efficiencies, small floor area requirements, no internal moving parts, and capabilities for the safe handling of wet corrosive gases.

A recently completed study by Clayton examined the correlation of film flow on the walls of Pease-Anthony Venturi scrubbers. Previous investigations had shown that a fraction of injected liquid will flow on the walls as a film instead of being atomized by the high velocity gas stream in the throat. As a result, accurate predictions of pressure drops and collection efficiencies were difficult, if not impossible. Without reliable film-flow data, optimized scrubber designs could not be achieved.

Experiments were conducted with the pilot plant size Venturi shown in Figure 1. Liquid flowing on the walls was extracted through porous sintered metal plates, positioned on adjacent walls at three axial locations. A range of gas and liquid flowrates normally encountered with industrial size units was examined. The empirical correlation,

$$F = 0.0122/[(L/G)\,(R_0/d_0)]^{1.7}V_G^{1.29}$$

illustrated in Figure 2 is useful for predicting the film flow on the walls for

$$4.0 \times 10^{-4} \leq L/G \leq 1.9 \times 10^{-3} \frac{m^3 \text{ of liquid}}{M^3 \text{ of air}}$$

$$2.1 \leq d_0 \leq 3.9 \text{ mm}$$

$$40 \leq V_G \leq 80 \text{ m/s}$$

where F = fraction of total injected water flowing as a film
L/G = liquid to gas ratio, m^3 of liquid/m^3 of air
d_0 = nozzle diameter, m
V_G = gas throat velocity, ms
R_0 = half the Venturi throat, M

This newly developed film-flow correlation provides a means of estimating film-flow rates in commercial Venturi units where measurement is not practical.

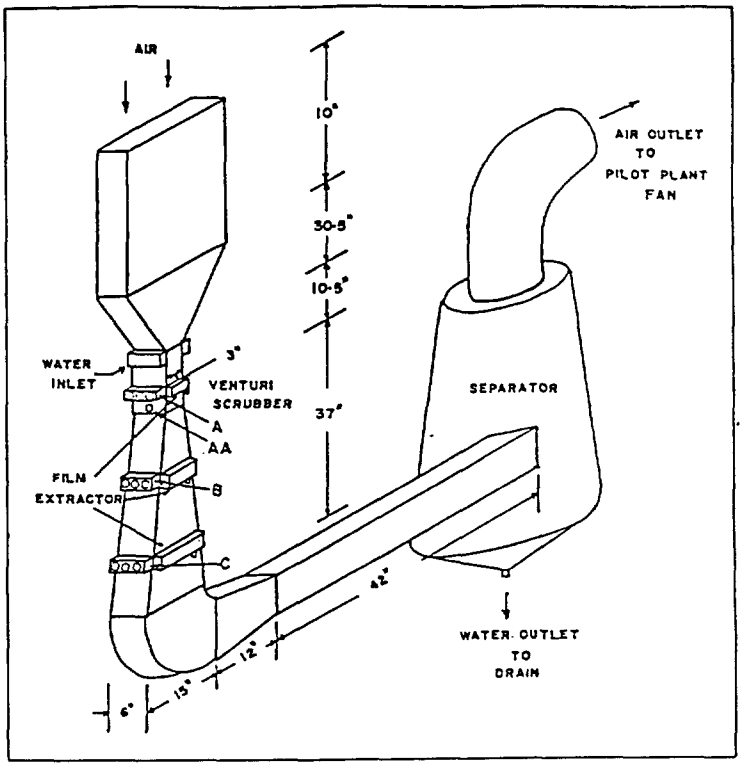

Figure 1.

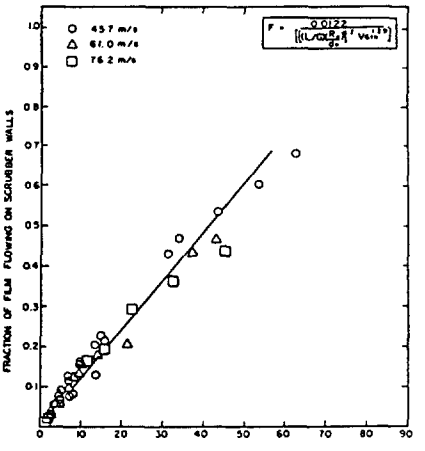

Figure 2. $\dfrac{1}{[(L/G)(R_o/d_o)]^{1.7}V_{Gin}^{1.29}}$

Editor's Note:
The Clayton Newsletter is distributed to over 15,000 engineers, industrial hygienists, and risk managers. All readers are encouraged to submit articles, case histories or past work experiences to be published in our newsletter. Please contact the Editor at Clayton's Southfield office for further information.

New Seminar

This spring, Clayton will introduce a new breakfast seminar dealing with the Resource Conservation and Recovery Act (RCRA) Hazardous and Solid Waste Amendments of November 8, 1984: RCRA II. Clayton's new RCRA seminar will highlight the impact of new regulations on waste classification and disposal procedures, management of underground storage tanks, small quantity generators, handling the disposal and burning of waste oil, delisting petitions, waste minimization, and the requirements placed on operators of disposal sites. With focus on the financial and liability implications of the amendments, the program will provide practical guidelines for coping with the new regulations.

Clayton News Briefs

New Staff

The Southfield laboratory welcomes the following people: **John Cullen**, Senior Laboratory Technician; **Tom DeLisle**, Chemical Technologist; **Susan Schiffert**, Chemical Technologist; **Colette Wiley**, Chemical Technologist; and **Deborah Woolnough**, Environmental Chemist.

Staff News

Frank Bastian of Clayton's Edison office became certified in the comprehensive practice of industrial hygiene earning the title of Certified Industrial Hygienist.

Bonnie Zeman of Clayton's Atlanta office was recently promoted to Administrative Manager.

Lab Notes

Clayton was awarded a four-year contract to perform analysis for industrial hygiene, hazardous waste, and water samples for the U.S. Air Force.

Presentations

Fred Wilt of Clayton's Los Angeles office, spoke to the California Cast Metal Association in San Francisco on December 10 and in Los Angeles on December 12. The topic was Federal and State Hazard Communication Standards/Right-to-Know.

Paul Epstein, Technical Supervisor of Clayton's Southfield Organic laboratory, addressed the Michigan Chapter of the Air Pollution Control Association (APCA) on PCB Fire Incident/Regulation on November 6, 1985.

Frederick Cooper, Manager of Air Quality Services in Southfield, acted as session moderator and technical program chairman at the Michigan Chapter APCA autumn meeting on November 6, 1985.

James Bolger, Southfield's Manager of Waste Management Services, lectured at the December 11 Boston Regional Meeting of the American Society of Safety Engineers on the subject of L.U.S.T. (Leaking Underground Storage Tanks).

Charles Blake, Manager of Clayton's Atlanta office, spoke to the Greenville Chamber of Commerce in Greenville, South Carolina on January 15 on "Health Aspects of Right-to-Know."

Dr. Jaswant Singh, Clayton's Senior Vice President/Technical Director, addressed the Houston Section of the American Industrial Hygiene Association (AIHA) on "Managing PCB Risks" on January 23.

Stack Sampling Course

Clayton Environmental Consultants, Ltd., in cooperation with the Department of Chemical Engineering, University of Windsor, is again offering its popular "The Windsor Stack Sampling Course," at the following locations:

Date	Location
April 28 - May 1	Windsor, Ontario
June 2 - 5	Montreal, Quebec
July 16 - 17	Vancouver, British Columbia

Engineers, chemists, and technicians from industry and government will benefit from the practical and theoretical information presented in this course as required to plan, execute, and report on a stack sampling program.

Emphasis will be placed on the development of sound sampling procedures for gaseous and particulate pollutants, and the use of those procedures to comply with current and proposed Canadian federal and provincial air pollution regulations and codes.

The course is comprised of lectures, practical problem-solving sessions, and the sampling of an actual operating stack.

For further information, please contact Dr. Shekar Viswanathan at the Windsor office at (519) 255-9797.